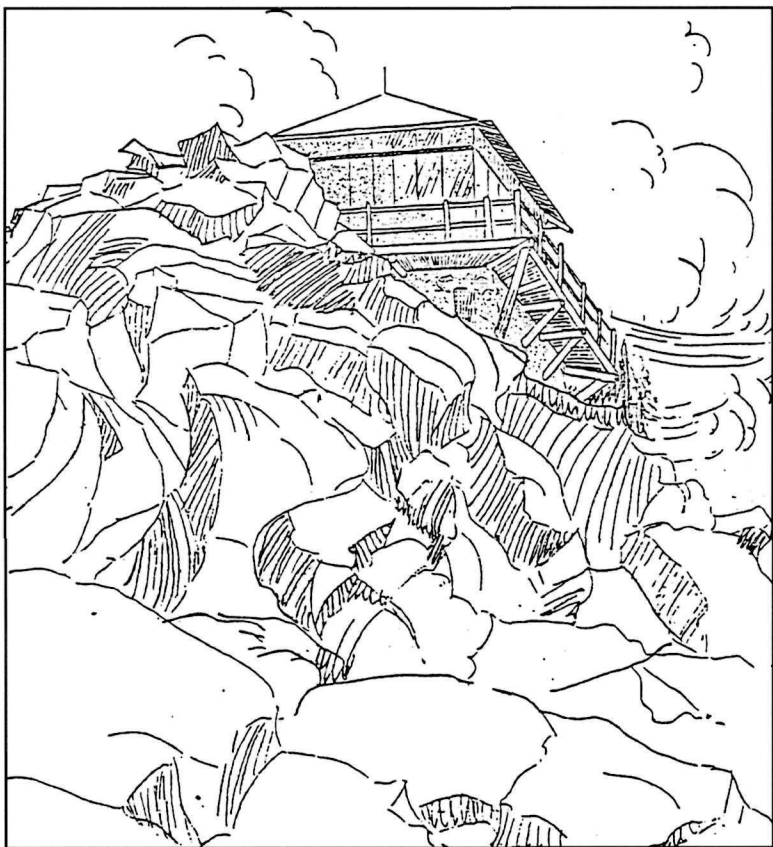


Nature
Notes

from

Crater
Lake



Above: The Watchman Lookout as depicted in the July 1933 Nature Notes from Crater Lake.

Front cover: Sno-Go opening the area in front of Crater Lake Lodge, 1947. National Park Service photo.

NATURE NOTES FROM CRATER LAKE

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History Association



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Crater Lake National Park



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History Association

Introduction

This is the 50th issue of *Nature Notes from Crater Lake*, a milestone that took 70 years to reach. Publication began in 1928, but ceased twice, with the longest hiatus being for three decades after 1961. A symposium held in 1992 brought about the current revival of this serial and it has appeared every year since then.

The first issues of *Nature Notes* were mimeographed by park staff and appeared between one and three times each summer for the first ten years of publication. The present format and restriction to an annual volume started in 1950. National Park Service naturalists at that time wanted to economize on effort, but not at the cost of sacrificing the qualities which made *Nature Notes* a popular and inexpensive sales item. The background of contributors has since broadened to include employees working in other fields besides interpretation, in addition to long time friends of the park.

Volunteers came to the aid of this year's volume with articles that underline the importance of observation. They are simply the latest in a long line of individuals who believe in the importance of an educational program at Crater Lake National Park. Two other volunteers, Jamie Halperin and Randall Payne, deserve special recognition, as they have put back issues of *Nature Notes* on the park's web site (<http://www.nps.gov/crla>) last winter.

The Crater Lake Natural History Association encourages the reprinting of articles that appear in *Nature Notes* so long as credit is given to the authors and the association. CLNHA sponsors this publication as part of its commitment to assist the educational and resource management programs of the National Park Service. Please join them in this effort by becoming a member of CLNHA, and receive a 15 percent discount on all sales items. A list of these items can be obtained from the Business Manager, Crater Lake Natural History Association, P. O. Box 157, Crater Lake OR 97604.

Stephen R. Mark, Editor

Understanding the Bimodal Eruptions of Mount Mazama

By Brandon L. Browne

Crater Lake partially fills a caldera within what was once Mount Mazama, one of the greatest volcanoes in the Cascade Range. Around 7,700 years ago it awoke with great fury and power. Roughly 13 cubic miles of magma erupted from the volcano, covering 500,000 square miles to the north and northeast. This eruption is considered by many volcanologists to be the most violent and devastating that the world has seen in the past 10,000 years.

This climactic eruption occurred in two phases. The first was a “single vent phase” in which ash and pumice were erupted from a single vent forming an eruptive cloud estimated to be 25 miles high. This disturbance emptied the uppermost levels of the chamber beneath Mazama, leaving it weak and unstable. As the eruption continued, it drained the chamber underlying the mountain so that Mazama began to collapse inward. This brought on the “ring vent phase,” whereby the remaining magma was pushed out of the mountain along the multiple areas where the upper volcano was cracking and falling. This occurred along circular ring fractures which is now where most of Rim Drive is located. This sequence of events brought about formation of a caldera, much of which we see today.

Perhaps the most unusual aspect of the climactic eruption is that it exhibited two distinct chemistries. The purpose of this article is to describe some field examples of those chemistries, because their appearance from the same volcano during one eruption is rare. Those examples should also help to illuminate how long differentiated magma compositions have characterized what we see around Crater Lake.

Volcanoes are commonly classified by their composition and their structure. Mount Mazama is an *andesitic stratovolcano*. Andesite is the most common lava type found at the volcano, and you can get a great look at andesite along West Rim Drive around the Watchman. The mountain's structure was that of a sharp faced or angular peak, making it a stratovolcano. (Mounts Hood, Rainier, and Shasta are all stratovolcanoes as well). Mount Mazama is believed to have been a cluster of several overlapping volcanoes that began erupting at least 420,000 years ago. With each new eruption, more and more bulk to the mountain would be added. The Crater Lake volcanic system consisted of three main components: 1) several peaks like Phantom cone, Hillman peak, and Mount Scott that piled on one another to form a conglomerate main cone, which the lake partially fills at present; 2) about twenty smaller volcanoes called cinder cones located

within the caldera and on its perimeter (of which Wizard Island is one of the more recognized examples); and 3) volcanic domes, the only ones of which are now beneath the water line. All three of these surface structure groups are believed to have been fed by a large magma chamber. Figure 1 illustrates the locality of that chamber in relation to the volcano.

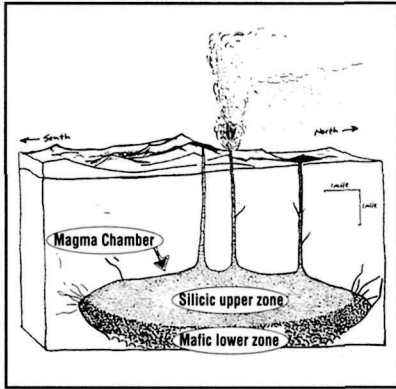


Figure 1. This is an illustration that modifies a figure drawn by C.R. Bacon of the US Geological Survey. It shows how the chamber may have been layered into these two main zones during the time of the climactic eruption. Notice that the lighter, more silicic magma floats above the heavier, mafic magma. The magma chamber is less than four miles from the surface, and it is in the general shape of a lens.

Each type of volcano is usually made up of a specific type of lava. This is due to different lavas having characteristics which result in distinct types of volcanoes. A few characteristics like viscosity, temperature, and water content vary widely when you look at different types of lavas. These variations that are observed in lavas play an important role in the way that the molten rock will eventually behave when they reach the surface. For example, if you were to drop cookie dough on one side of a plate, and pancake batter on the other side, they would behave differently. This is mainly because the thick and pasty cookie dough has much higher viscosity than does the runny pancake batter. When the dough and batter “cool” and harden, you would see two different shapes (one flat and one tall).

The cookie dough would be analogous to “silicic” lavas, while the pancake batter would be called “mafic” lavas. Silicic lavas usually build stratovolcanoes and domes, and mafic lavas make up the large and broad shield volcanoes and cinder cones. Figure 2a shows how lavas are broken-up into specific classes based mainly on compositional changes in the silica and oxygen.

Figure 2a. There are six main lava and ash types that are found in the Cascade Range. These types are classified as to the amount of silica they contain. Rhyolites have a high amount of silica, while basalts are at the low end of the scale. Lava and ash types (such as numbers 2, 3, 4, and 5) are intermediate.

It is important to realize that the majority of volcanoes in the Cascade Range, as well as those around the world, are composed of closely related lavas and other eruptive material. In other words, it is uncommon for

volcanoes to display material of one composition as well as large amounts of a completely different type. There is commonly some diversity in the lavas and ash in most eruptions, but their compositions are usually very similar to one another as shown in figure 2b.

Figure 2b. After most eruptions in the Cascades, field samples would show that a range of different lava and ash types (shown in Figure 2a) were deposited. The samples collected would be randomly dispersed among the various types, with their distribution similar to the above figure, so that no clumping of samples were evident in any group.

At Crater Lake, the volcanic system exhibits a pattern where there are only two very distinct groups of eruptive material (figure 2c). This is called a bimodal system. In the climactic eruption of the Crater Lake volcanic system, materials of two distinct compositions were erupted almost right after the other. In the first phase, an enormous (up to 30 miles high) eruptive cloud was produced. This sent large amounts of ash and pumice into the atmosphere and was eventually deposited in an area of nearly 500,000 square miles.

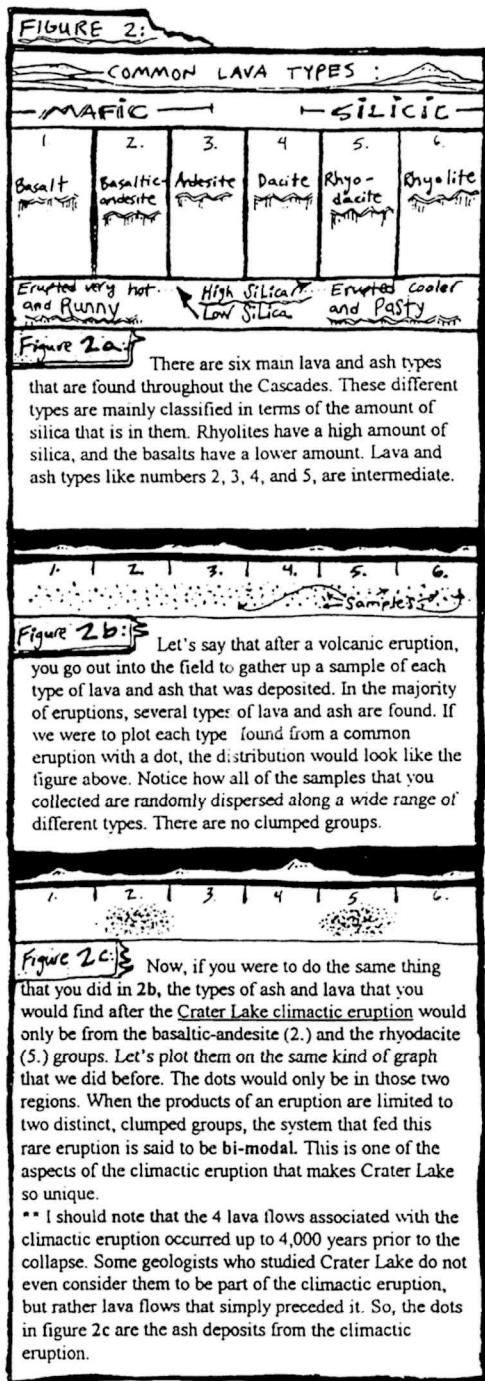


Figure 2c. The types of ash and lava evident after the climactic eruption on Mount Mazama were concentrated in the basaltic-andesite (#2) and the rhyodacite (#5) groups. When the products of an eruption are limited to two distinct groups, the system that fed it is said to be bi-modal.

As the eruption continued, the cloud grew so large and heavy that the released gases could not hold it all up and some parts fell back down on the volcano. These super hot flows of ash and rock (called pyroclastic flows) rushed down the flanks of Mount Mazama, and deposited pumice with such heat and pressure that the pumice was compressed and welded. A deposit of welded pumice brought about the Wineglass Formation. This is the long orange colored deposit of ash and pumice that stretches from Llao Rock to Red Cloud on the north and east side of the inner caldera wall. It is illustrated in figure 3.

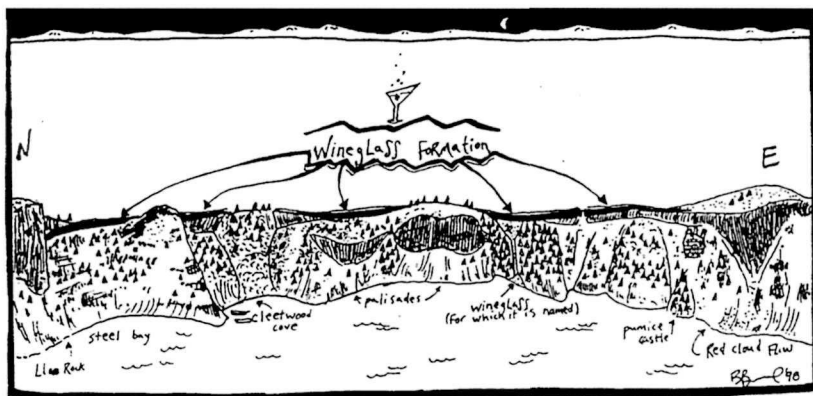


Figure 3. The Wineglass Formation (indicated by a thick black line) stretches from Llao Rock on the north side of the caldera wall to Red Cloud flow on the east side. It resulted from a pyroclastic flow in the first phase of the climactic eruption. The formation is best seen by hiking about 1/8 mile down the Cleetwood Trail, where a huge orange-colored ash flow tuff is evident. Tuff is a name given to ash when it is deposited so hot that it partially melts and recrystallizes, forming a hardened mass. Look closely at the tuff and you should see narrow lens-shaped pieces which are squished pumice from the hot flow.

Both the airfall ash and pumice and the pyroclastic flows forming the Wineglass were from the single vent phase. The single vent phase of the climactic eruption drained a large portion of the magma chamber, which left the volcano without a sturdy foundation. As it began to collapse inward, the force of the volcano was so great that it pushed the remaining contents in the magma chamber out along the fractures and cracks that the volcano

produced as it broke inward. This activity sent out even larger pyroclastic flows than did the first phase. These rushed past the flanks and out into the once glaciated valleys and deposited rhyodacite and andesite. It is significant that all of the deposits from the first phase are high silica rhyodacite, while the pyroclastic deposits from the second (or ring vent) phase of that eruption began with rhyodacite but ended with basaltic-andesite. There were no intermediate or transitional compositions during the two phases of this eruption.

It is highly improbable that a magma chamber would show two very different types of chemistries unless the compositions were separated from each other into layers within the magma chamber. Layered magma chambers are not uncommon and, in fact, they are thought to be quite ordinary. Most of the time, however, these chambers exhibit a spectrum of layered compositions—not just two main ones like Mount Mazama. How one of these layered magma chambers forms requires some knowledge of the magmas themselves. Rhyolites, rhyodacites, and dacites are considered to be high in silica, explosive, and extremely viscous—hence the categorization “silicic”. Basalts, basaltic-andesites, and andesites are considered to be lower in silica, less viscous, erupted at higher temperatures (less than 1200 degrees Centigrade), more dense than the silicic types, and are classified as “mafic” magma. If we could, hypothetically, pour these two opposite types into a big bowl, the less dense silicic type would rise above the more dense mafic type. The same thing, in essence, happens in a magma chamber where the less dense silica-rich magma rides upon the mafic type in the general shape of a lens.

A layered, lens-shaped magma chamber is believed to have existed beneath Mazama when it catastrophically erupted about 7,700 years ago. The most impressive surface manifestation of the chamber can be seen at the Pinnacles, which are found in the once glaciated valleys of Wheeler and Sand Creeks just south of Lost Creek Campground. During the second phase of the climactic eruption, pyroclastic flows rushed down these valleys and filled them. These violent flows may have rushed for miles with speeds over 100 mph and then suddenly terminated. In stopping so abruptly, the flows trapped large amounts of hot gases at the lower levels. As these gases rose toward the surface, they heated the ash and pumice so that they partially melted and recrystallized. This recrystallization process changed the soft ash into a hardened material. The hardened ash and pumice formed around the path of the escaping gas and began to act as a chimney. Over time, streams flowed through these pumice and ash filled valleys. This left the resistant pinnacles standing and eroded the softer, unaltered ash. When you look at these pinnacles, you are actually seeing the subsurface structure that escaping volcanic gases created.

By observing closely, you will see that the upper regions of the

pinnacles are darker mafic material, and the lower regions are lighter silicic material. Notice how sharp the contact is between the two (shown in figure 4). Remember how the upper silicic magma rests upon the denser mafic magma in the magma chamber. When erupted, this material would be in reversed sequence (just like if we were to erupt an “n”, it would land as a “u”). That sharp contact shows just how unmixed these compositions actually were, as if they were separated from each other in the chamber by a giant wall that disallowed any mixing to occur. The single vent phase had already removed a large portion of the chamber’s upper level, which was high silica rhyodacite. When the volcano began to collapse in on itself and erupt in the ring vent phase, the remaining rhyodacite was pushed out, as well as the underlying basaltic-andesite zone (you may wish to consult Figure 1 again to see the general structure of the magma chamber). When both of these layers erupted, the clouds of gas and ash were violently deposited in these valleys with the rhyodacite on the bottom, and the basaltic-andesite above it.

Figure 4. Distinct layers in the ash flow deposits at the Pinnacles. The “A” layer is rhyodacite that was extruded at the start of the ring vent phase, and the “B” layer of basaltic-andesite followed it. Note the sharp contrast between the two layers, and how resistant the pinnacles are to the stream erosion that has taken place since Mazama’s climactic eruption.



As stated previously, the intermingling of silicic and mafic magma is the most important piece of evidence that the chamber feeding the mountain during the climactic eruption was layered with a lens of mostly gaseous, silicic magmas separated from the dense basaltic material beneath it. This evidence is only representative of the climactic eruption, and it is worth asking whether the chamber was becoming bimodal before that time. If so, when? Fortunately

the rocks at Williams Crater can help to answer that question.

Williams Crater, once known as Forgotten Crater, is named after Howel Williams who wrote the *Geology of Crater Lake National Park*. Published in 1942, the work is considered a classic—even though Williams did not have the benefit of modern dating techniques. His interpretation of the park's geology has been modified only slightly in the past half century by Charles Bacon of the U.S. Geological Survey. It is therefore fitting that this namesake feature represents a very crucial and critical aspect in understanding the volcanic system which created Crater Lake.

Williams Crater is roughly between 22,000 and 30,000 years old, and is located about one kilometer west of Hillman Peak. It is a basaltic cone that is aligned on a fissure (a linear crack in the earth's crust) that is radiating outward from the rim. Unlike any other cones in the park, there are bands and inclusions of intermediate and silicic pieces in the basaltic lavas and the volcanic bombs that surround the cone of Williams Crater. These pieces of higher silica lava were most likely entrapped in the magma as blobs and crystal mush prior to being erupted from the basaltic cone. Some high silica magma was eventually made in the chamber and began to separate from the mafic magmas. The higher silica lava found its way up this particular vent to the west and was erupted as entrapments or inclusions in the basalt, due to this cone being close enough to Mount Mazama. Other cinder cones in the park, such as Crater Peak and Red Cone for example, were too far away from the growing chamber for this to occur. The Williams Crater complex, in other words, shows that there was some development of differentiated magma compositions in the chamber beneath Mount Mazama at least 30,000 years ago. It is uncertain whether these inclusions offer sufficient evidence of a bimodal system extending that far back in time, but they do give us some information about when this separation may have begun to take place. Many geologists believe that separation between these compositions continues into the present, but it is also worth asking about the characteristics of volcanic activity since the climactic eruption.

On the bottom of Crater Lake, the Dacite Dome to the east of Wizard Island is made of high silica dacite. Prior to its eruption, however, the formation of Merriam Cone took place just south of Cleetwood Cove from lower silica basaltic-andesite. Once again, two different compositions in the same general vicinity. This contrast beneath the lake is not really enough evidence to conclude that the Crater Lake volcanic system is still bimodal, but samples around the park appear to suggest it still has that capability. 🏠

Victor Rock and Victor View

By Steve Mark

Throughout the summer a number of visitors come to the information desk at Park Headquarters asking about the best place to see Crater Lake. These people have convinced themselves that they have only an hour or so to spare in the park, and then want to be on their way to somewhere else. I routinely dodge this type of query, if only because they have not yet seen the lake. This makes it impossible to communicate where around the rim a person could best appreciate that wonderful combination of color, geological features, and subalpine vegetation which has prompted more than one person to describe Crater Lake as the most beautiful thing they have ever seen in nature.

For those who are so short on time, and wish to limit their experience to one which involves little or no contemplation, any lake viewpoint between Park Headquarters and the North Junction will do. Motorists soon find that more than one stopping point allows them to stay in their vehicle and still see Crater Lake. They will, however, find it difficult to appreciate their surroundings without a good guidebook at the very least.

The Mazamas, a mountaineering club based in Portland, published the first booklet aimed at enhancing visitor enjoyment of Crater Lake in 1897. It had limited availability, so the government began to print pamphlets and maps with some explanation of the park's geology. These devices still fell short, it seemed, of allowing the non-scientist to fully comprehend what lay before them. Trained naturalists began lecturing and guiding the public in Crater Lake National Park during the summer of 1926, but the question of how to best convey the park story remained. After some study, park officials decided to focus most of their educational program at Rim Village because

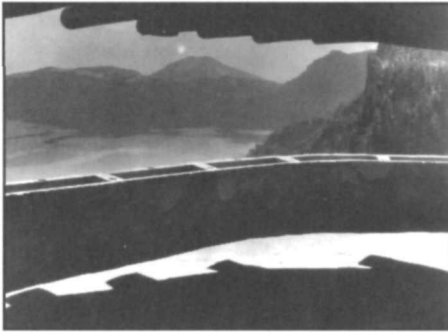


Visitor near Victor View in the late 1930s.

of its proximity to what had long been the most popular viewpoint at Crater Lake.

Named in honor of a historian who visited the lake in 1872, Victor Rock appears to be precariously perched some 900 feet above the water. The Sinnott Memorial was situated over this viewpoint in 1930, so that naturalists might give a brief orientation talk from an open-air parapet on a regular basis throughout the summer. Certainly no classroom, nor any other facility situated away from the rim, can equal the Sinnott Memorial as a venue to both see and hear about Crater Lake for the first time. It continues to function as an observation station aimed at enticing visitors to explore the park, in the hope that what they experience here will fuel an ongoing fascination with the forces which continue to shape the earth.

To broaden the introduction given by naturalists in the Sinnott Memorial, park officials initiated an educational boat tour of Crater Lake in 1931. That year they also began a project which was to widen and realign



The Sinnott memorial's parapet as it appeared in 1933.

Rim Drive. In addition to making the road safer, designers focused on showing motorists many important park features. In order to accomplish both goals, masonry walls and the resulting series of observation stations were built to blend into their surroundings. Just as the Sinnott Memorial is virtually invisible from the surface of Crater Lake, the Rim Drive is intended to facilitate contemplation of the lake, cliffs, and forest by

minimizing road scars that can be seen at a distance. Far from being the cookie cutter pull outs which often characterize modern road design, each of the observation stations was intended to help visitors see the park in different ways—as anyone who has been to such divergent stops as Discovery Point, Grotto Cove, Skell Head, and Kerr Notch will attest.

The East Rim Drive in particular remains much as its designers left it, while also being largely free of the noise and crowds which often dominate the through route from Rim Village to the North Junction. With the notable exception of the Cleetwood Cove parking area (where people have gathered almost every summer day since 1960 for hikes down to the lake and a boat tour), visitors who pause along this 24 mile road segment should have few distractions—especially if they are inclined to walk even a short distance. In nominating a favorite stop along this stretch of road, my choice is based on the following subjective combination of factors. These include the predominance of quiet, an opportunity to hike, the attractive contrast of subalpine

vegetation with open slopes, authentic examples of stone masonry from the 1930s (original work can be identified from mortar joints which feature some lichen growing on them), and, of course, the sublime drama of Crater Lake.

With those criteria in mind, my choice is a place known as Victor View. It does not appear on some maps, though the name became official in 1945. The park superintendent at that time found very few people who could identify the rock named for Mrs. Victor, even though thousands of visitors came to the Sinnott Memorial each summer. Victor View is an observation station located between Cloud Cap and Kerr Notch, but has not been signed as such. Neither is the trail which leads from pavement to Sentinel Rock, where people who are afraid of heights or inclined toward vertigo should not venture. A stand of mountain hemlock (*Tsuga mertensiana*) act as a screen so that many visitors stopping at the road overlook do not notice the trail, but it can be seen immediately opposite the masonry wall. After winding through the trees, this path emerges on a spine composed largely of pumice “gravel” so that it is roughly a hundred yards to the terminus at Sentinel Rock.

Such a vantage point certainly fills the few human visitors it receives with a sense of how privileged they are to stand where only the birds seem to light. A number of other places around the rim (Dutton Cliff, Dyar Rock,



Grotto Cove Overlook in 1968.

Hillman Peak, to name a few) may equal Victor View depending on what a person wishes to experience in conjunction with Crater Lake. Judgments attached to any of these places are, of course, relative to the person involved but any of them can render the urgency of reaching other destinations outside the park meaningless for a couple of hours. It should come as no surprise, therefore, that if I have to respond to questions about the “best” place to see Crater Lake, the answer will be “as far from your car as possible.” 🏠

Pumice Fields and a Sense of Landscape Wonder

By Ron Mastrogiuseppe

Coniferous forest which surrounds the caldera embracing Crater Lake is broken by curious openings called pumice fields, especially around the rim. Many of the pumice fields are spacious and provide grand vistas of the Cascade Range, but they are also windows into the landscape's past. The climactic eruption 7,700 years ago instantly erased biota firmly rooted upon the slopes of ancient Mount Mazama. Pioneering lifeforms of the pre-Mazama biota surviving in neighboring refugia eventually migrated upslope and colonized suitable habitats, but the eruption's power restricted the availability of these habitats.

Despite dry and sunny summer weather enjoyed by human visitors, the growing season of the pumice fields is abbreviated by extremes of temperature and moisture. Topographic features create frost pockets in swales, along lower slopes, and in crater depressions atop cinder cones. This allows snow to drift and accumulate, so that it sometimes persists through the growing season. Upland habitats, especially those with rocky outcrops, are devoid of snowpack early in the summer but are subject to dry winds—as are south- and west-facing slopes. Surface temperatures are normally intensified by high summer sun, but reduced by reflective qualities of the light-colored pumice. Air temperatures near the ground may change significantly over a 24 hour period, with a chance for frost even in summer.



Hypothesized appearance of Mazama at the beginning of its climactic eruption.

Pumice soils, having been pulverized by volcanic eruption, are very porous. This allows large quantities of water to infiltrate and percolate deeply, but largely robs the surface of moisture.

The volcanic landscape of Mount Mazama represents a mosaic of habitat types, and the pumice fields have resisted encroachment by individual trees and shrubs for centuries. The tree species best suited for pioneering this seemingly inhospitable habitat appears to be whitebark pine (*Pinus albicaulis*). This species even assumes the role of pioneer in

the fractured obsidian flow of Paulina Peak at Newberry Caldera southeast of Bend. Similarly, much of the caldera's rim edge around Crater Lake is fringed with whitebark pine as though planted in a row single file. It is this edge habitat, which is swept free of deep snow, that harbors a longer growing season than adjacent pumice fields extending downslope from the rim. This is also where the Clark's nutcracker (*Nucifraga columbiana*) caches seeds from whitebark pines, thereby insuring some regeneration.

There are some "tree islands" within the pumice fields generally featuring a single whitebark pine perhaps established a few centuries earlier. These trees may be situated on churned soil where a Mazama pocket gopher, *Thomomys mazama*, created a mound within the shelter of a rock. During the growth of a "mother tree," local microclimate changes to favor the establishment of herbaceous and shrub species in addition to subalpine fir (*Abies lasiocarpa*) or mountain hemlock (*Tsuga*

mertensiana) sheltered by the whitebark's canopy. It is common to find that the original "mother tree" has died, but still is surrounded by younger trees which prevent the snag from falling. In an environment marked by harsh growing conditions, chances for survival are enhanced by development of individual saplings in aggregations or clumps with grafted roots.¹

Given the potential number of species available for colonizing pumice fields, however, it is a mystery why additional lifeforms have not yet invaded. Each year, and especially when there is a prolific seed cone crop, the pumice fields are recipients of myriad seeds and propagules. Yet this annual "rain" of seed seems unable to bring additional numbers of species. The total number of plant species found within the Pumice Desert, for



A pumice field near Union Peak in 1936 (top) and forty years later (bottom).



example, is only fourteen.² Other pumice fields are likely similar in species diversity. When compared to the park total of some 700, this gives meaning to the term *depauperate flora*—one lacking in species richness.

The shape of pumice fields can change over time when surrounding forest borders (usually dominated by lodgepole pine, *Pinus contorta*) respond to favorable conditions. Conifer encroachment, as documented in repeat photography, began during the drought episode of the 1930s. During that decade growing seasons expanded by roughly one month as the result of warmer temperatures and reduced snowpack.³ This pattern of encroachment is not unique to the Crater Lake region, having been observed throughout the subalpine zone of the Cascade Range. Perhaps similar phenomena will be kickstarted by the years of drought (which extended from 1976-77 until the early 1990s) since these changes are believed to be driven by climatic, rather than *climactic*, events. 🏠



Whitebark pine on the rim of Crater Lake.

Notes

- ¹ Fire seems to have little effect on this habitat. Lightning may strike individual stems within the tree islands, but fuels beyond them are too scant to carry a surface fire for any distance. It should not be a surprise, then, that evidence of historic fire is almost always absent from pumice fields.
- ² See Ruth Monical and Stephen P. Cross, Mammals of the Pumice Desert, *Nature Notes from Crater Lake* 23 (1992), pp. 17-18.
- ³ The exception to this interpretation was the winter of 1932-33, when a record snowfall of more than 700 inches occurred.

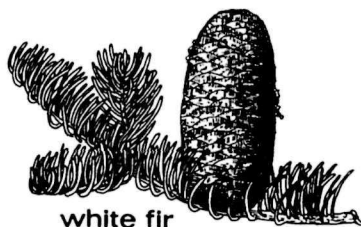
The True Firs of Crater Lake National Park: A Closer Look

By Eugene L. Parker

Four of the nine species of true fir (*Abies*) in the United States are native to Crater Lake National Park. Of these, two have been incorrectly identified by some foresters and botanists. There has been no such problem for two other Crater Lake firs: subalpine fir (*A. lasiocarpa*), and Pacific silver fir (*A. amabilis*). The problem, rather, has been with trees called “white fir” and “Shasta red fir.”

White fir

The term “white fir” has been broadly used to include two identified varieties; Rocky Mountain (“typical”) white fir (*A. concolor* v. *concolor*), and the Sierran white fir (*A. concolor* v. *lowiana*). The Crater Lake tree is Sierran white fir. This is the park’s lower elevation fir, best seen and appreciated from Highway 62 viewpoints overlooking Castle Creek Canyon toward Medford and along Highway 62 in the “panhandle” toward Klamath Falls.



As is the case along the Cascade Range from central Oregon to the Siskiyou, west slope white firs (especially at lower elevations) integrate with grand fir (*A. grandis*). Some white firs, just inside the park’s western boundary, show this trend, especially by the coloring of outer bark texture. Outer bark on grand fir, as seen in cross section, has alternating layers of dark brown and violet, while that of both varieties of white fir have softer corky layers of brown and tan. Crown formation, seed cone, and leaf characters are used for separating the two white fir varieties (see Table I).

This species of fir at Crater Lake is best identified as “Sierran” white fir, since some observers may appreciate the varietal distinctions. The Rocky Mountain variety is popularly cultivated as an ornamental throughout much of the northern United States, and is recognized initially by its silvery-blue crown color which resembles that of blue spruce (*Picea pungens*).

The natural distribution of Rocky Mountain white fir is from the Wasatch and Uinta Mountains south and eastward through Utah, Colorado, New Mexico, Arizona, eastern Nevada, southeastern California and northern Mexico. Sierran white fir is native to east-central and southwestern Oregon, western Nevada, and in California south to the Tehachapi and San Bernardino Mountains where the two varieties join their ranges and blend morphologically.

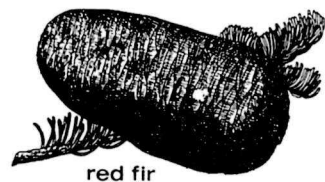
Table I
The Basic Differences

	Rocky Mountain White Fir	Sierran White Fir
NEEDLES	◆ No basal twist (spiral). ◆ Neatly arranged, of uniform lengths. ◆ Stomate coloring bluish over entire surface. ◆ Acutely pointed. ◆ Curved or sickle-shaped. ◆ Thickened to flat four-angled cross-section, esp. on outward portion.	◆ Strong basal twist. ◆ Uneven lengths and disorderly arrangement. ◆ Stomates in wide white bands, but with bright green margins and lower midrib. ◆ Apex blunt or with irregular notch. ◆ Upper side grooved or channeled full-length, the longest leaves of any Crater Lake true fir.
CONE BRACTS	◆ Rounded or slightly heart-shaped with indistinct point; short; hidden.	◆ Heart-shaped or flattened with distinct point, also shorter than 1/2 of scale.
CROWN FORMATION	◆ Limb angle basically upturned (ascending).	◆ Basically horizontal, sometimes ascending later on outer portion.

Red Fir

The terms “Shasta red fir” or “Shasta fir” have been used to identify a species of *Abies* which occurs at higher elevation in the park ever since 1939, when botanist Elmer Applegate wrote that he did not recognize noble fir (*A. procera*) in the southern Oregon Cascades. His opinion has since had wide influence with foresters, so that the term “Shasta fir” has been used in numerous publications. They have continued to list both Shasta red fir (*A. magnifica* v. *shastensis*) and “typical” or “California” red fir (*A. magnifica* v. *magnifica*) in southern Oregon.

The type-locality for the variety *shastensis* is Mount Shasta; for var. *magnifica* it is the south central Sierra Nevada. Despite the widely-held perception that “typical” red fir is native to Oregon, this variety has not been verified by specimen documentation north of Mount Lassen, where both red fir varieties occur together. The two red fir varieties are morpho-



red fir

logically separated by a key seed cone characteristic, that of cone bract length (see Table II). Variety *shastensis* has bracts (with reduced points) which are exerted beyond the cone scale. In var. *magnifica* the bracts are shorter, becoming totally hidden within the closed seed cones.



Shasta red fir

Some foresters have reasoned that "Shasta fir" is the product of introgression between "typical" red fir with hidden bracts, and noble fir with conspicuously-bracted cones. They have established hypothetical boundaries for such "Shasta fir," with the northern boundary at 44 degrees North

Latitude (McKenzie Pass) and the southern boundary in the vicinity of the 41st parallel in northwestern California. This creates a "transition zone" for the "Shasta fir" population, whereby Crater Lake National Park falls inside this zone.

It should be emphasized that noble fir and red fir are closely related, and that studies show them to be highly variable relative to species distinctions based on chemistry, phenology, and morphology. The smooth "Shasta fir" transition zone becomes geographically problematic when the exclusive occurrence of bracted "Shasta" red fir at the southern end of the "typical" red fir habitat is taken into account.

A number of botanists, meanwhile, have recognized noble fir as extending south into northwestern California. The most clearly defined morphological division between noble fir and red fir populations seems to be the Klamath River Basin. The extent of this division (through leaves, cones, progeny development and seedling cotyledon count), is unmatched at any other location in the Cascade Range or Sierra Nevada, greatly exceeding any differences apparent at the "Shasta fir transition zone" boundaries. Although this "Klamath division" follows the southwesterly course of the river to the coast, noble fir has been verified in the Klamath Mountains south of the river. Its absolute southern limit is not yet established, though noble fir-like cones have been collected as far south as Mendocino County (see Table II).

Noble fir and Crater Lake

There is a compelling argument for applying what has been learned about the true geographic range of noble fir within Crater Lake National Park. Even though the bark of some trees in the park resembles the red firs of the Lassen-Shasta region, and occasional phenotypes have cones with rather short Shasta-like bracts, the trees in the Crater Lake



noble fir

Table II
Noble Fir and Red Fir

Common Characteristics

Leaves flattened four-angle cross-section (rhomboid), blunt or acute, bent at base like a “hockey-stick,” stomatiferous above and below.

Cones large, upright, cylindrical or tapered; light olive-green to dark purplish-brown.

Mature outer bark interior layers of dark brown and deep violet.

	Noble Fir	Red Fir
LEAVES	◆ Variable length groove on adaxial (upper) surface, esp. in basal area on sterile branches. ◆ Groove fades and is replaced by keel (ridge) on outer section or absent in upper crown.	◆ No groove on adaxial surface except on occasional seedlings and small saplings.
CONES	◆ Bracts variably shaped ◆ Strongly pointed and well-exserted. ◆ Usually reflexed downward to cover most or at least 1/2 of cone surface.	◆ Shorter than scales (typical) ◆ Or slightly exserted (var. <i>shastensis</i>) ◆ Sometimes reflexed upward or downward, covering less than 1/2 of cone surface.
BARK	◆ Thin to medium thickness. ◆ Ridges nearly vertical, much-thickened at base of very old trees, esp. at higher elevations.	◆ Thick and rough on old trees on lower trunk ◆ zig-zag or irregular chained pattern.

vicinity should be interpreted as noble fir. My argument, in summary form, is as follows:

1. The established botanical keys for noble fir and red fir identify the common fir north of the Klamath River as noble fir, or at least as a morphological variant of noble fir.
2. The name “Shasta red fir” has been borrowed from its original application to the short-bracted red firs of California, and given blanket application to firs in Oregon south of McKenzie Pass.
3. The hypothesis that “Shasta fir” in southern Oregon is a “hybrid swarm” or introgressed “transition population” has been weakened by a study which found no evidence of more genetic variability in the so called transition zone than elsewhere.

4. Noble fir and red fir are both variable in cone and leaf morphology, and in oleoresin properties (noble fir to a greater degree than red fir). Variability in noble fir is more noticeable in southern Oregon, but variability north of McKenzie Pass has been calibrated, with some of the most extensive differences in resins found near the Columbia River.
5. Early botanists named the common southern Oregon species noble fir. It was only later that the awareness of occasional cone and leaf variations suggested relationship to the California firs. This resulted in polarized opinions that have fueled a long-term controversy. Subsequent interpretation of “typical” or “pure” noble fir has produced an arbitrary “north-of-the-McKenzie-theory” which holds that the firs south of that point should not be identified as *A. procera*. The primary authors of this hypothesis, however, have recently concluded that the classic taxonomic characteristics (cone and leaf morphology) of southern Oregon populations suggested a close relationship to noble fir.

Recognition of the natural variations in noble fir will restore the term “Shasta fir” to its area of origin and intended application. The Lassen-Shasta region has trees with thicker, rougher and more reddish bark than those in southern Oregon. These firs also have larger cones with only partially-exserted or completely hidden bracts, as well as foliage that is anatomically distinguishable from noble fir. 🏠



Cones are one of the most commonly used ways to identify trees. The Douglas-fir is not a true fir, as its hyphenated name indicates.

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Clearing the Way

By Steve Mark

There are still some people who are surprised to learn that Crater Lake can be seen at any time of the year. Much of this misperception is due to visitors focusing on the North Entrance and associating its closure each year with the park being shut for the winter.

Since opening the North Entrance each year signifies the start of peak visitation, the casual observer might wonder why virtually all park facilities are situated on the south side of the caldera. One reason is that very little surface water exists on the north side of Crater Lake despite the prodigious snowfall. Efforts to develop a water supply were frustrated in the 1960s when contractors drilled wells at Cleetwood Cove and the North Entrance but netted nothing but air. A steep ascent from Pumice Desert to the North Junction, coupled with the difficulties of fighting prevailing wind from the southwest, make consistent plowing of the north road exceedingly difficult. Clearing the route leading to Rim Village from Annie Spring and Highway 62 is, by comparison, much easier.

Most visitors come to Crater Lake only during the summer months and are oblivious to the complexities associated with snow removal. Many of them see only a few outward manifestations of winter, such as snow tunnels attached to buildings at Park Headquarters. The size and number of plows operated by park crews are usually out of sight by this time, along with the multitude of snow poles which line certain roads for most of the year.



Rotary snow plow used in the late 1930s.

Prior to 1930, when the first rotary snow plow arrived at Crater Lake, opening any road to the rim each spring required a large crew armed with shovels. They began by chopping through most of the previous winter's snowpack to reach the road surface, which was often under many feet of snow even in June. Warm weather and the high sun angle of late spring might eventually allow for cars to reach Rim Village in early July, but the park's operating season was effectively reduced to three months or less. With machines which could throw snow away from the road surface, and then above surrounding banks of ten feet or more, it became possible to keep a few roads open throughout the year.



Skiers at Rim Village in 1957.

As might be expected, rotary snow plows gave winter use in the park a decided shot in the arm. Such use had amounted to virtually nil before that time except for the occasional venturesome skier coming from Fort Klamath, the closest permanent settlement. Improving economic conditions by the late 1930s gave rise to increased travel and an associated demand for winter sports. No permanent facilities for downhill skiing were ever constructed, but Crater Lake was listed as Oregon's second biggest winter sports area (behind Mount Hood) in 1940. That status has to be understood in the context that most leases for development of areas on Forest Service land, such as on Mount Bachelor near Bend, were not issued until the explosion in leisure travel had occurred after World War II.

Wartime restrictions on travel meant closure for Crater Lake National Park from 1942 to 1945. When the park reopened, there was uncertainty concerning whether to provide downhill skiing facilities. National Park Service planners studied several locations such as Applegate Peak, Arant Point, and the west side of Munson Ridge in 1948, but concluded that any new development aimed at downhill skiing carried far more long-term costs than benefits. They recognized, however, that existing use (visitors wanting to see the lake in winter, as well as cross country skiing and snowshoeing) as justification for keeping the park open all year round. This has occurred over the past 50 years by plowing snow as it accumulated on roughly 25 miles of park roads.

Those visitors and employees who utilize the access provided by the snow plows have the opportunity to enjoy the beauty brought to the rim of



Roadside snow depth.

Crater Lake by each seasonal change. During the long winter, the snow accentuates glassy blue or steel grey of Crater Lake depending on clear or cloudy conditions. Visitors often note the snowdrifts, especially where the wind puts vast deposits in some places (upwards of 60 feet at the Watchman) but scours bare spots in others.

As the snowpack begins to recede in May, the patches of bare ground

slowly widen and eventually become host to a variety of plants and animals. Flower displays herald the arrival of spring sometime in late June, though the peak bloom will not be reached until the first week of August. At that time motorists and hikers alike are quick to note bright colors and ask for the names of certain wildflowers.

The summer heat usually melts even the most persistent patches of snow by mid August so that all roads and trails in the park are open. This is when the ubiquitous Newberry knotweed (*Polygonum newberryi*) turns from green to red in the vast pumice fields along the rim drive. Fortunate visitors may also find that yellow-bellied marmots (*Marmota flaviventris*) and pikas (*Ochotona princeps*) show themselves on talus slopes or even near the road.

Sometime during the first half of September, the first crisp air indicates the onset of autumn. By the end of the month, the leaves of shrubs such as mountain ash (*Sorbus sitchensis*) have turned color in a matter of only several days. They provide memorable splashes of red and yellow to those visitors lucky enough to be in the park at that time, and perhaps portend a few weeks of Indian Summer. On October 20th, however, there is a 50 percent chance of the first significant snowfall—one which will close most roads and the North Entrance. When that storm arrives, it heralds the onset of winter and the prospect of nearly nine months with snow on the ground. This is also when the snow plows return to clear the way to the rim of Crater Lake. ❄️

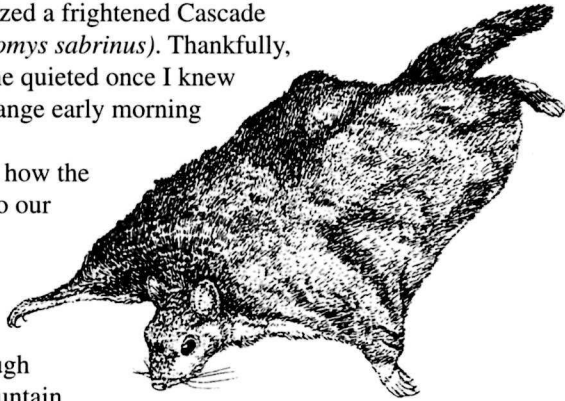
A Furry Encounter of the Close Kind

By Larry B. Smith

It was an unusually quiet morning. Most of the previous winter's snowpack had melted by the time summer began to reach its mid point. My family slept as I descended the stairs of a stone house at Park Headquarters to begin preparing for another day of assisting visitors. Little did I realize my first assistance that day would be to a rarely seen forest animal who had shown up, unannounced, for breakfast. As my foot touched the bare floor, a shiver went through my spine when a scrambling sound came from the kitchen. I realized then that I was not alone.

Upon tip toeing into the kitchen, I spotted a streaking ball of fur clamber up the kitchen cabinets. It headed for the early morning light of the window above the sink, apparently expecting to gain its freedom. The glass, however, stopped the creature's hurried retreat. After realizing there was no escape, the animal then turned to face me. At that moment I saw its huge eyes, ones I will never forget. As I looked at the frightened animal, I recognized a frightened Cascade flying squirrel (*Glaucomys sabrinus*). Thankfully, the tingling in my spine quieted once I knew the source of those strange early morning noises.

I now wondered how the squirrel gained entry to our house. This nocturnal explorer, I then surmised, fell down our chimney while swinging from the bough of an overhanging mountain



hemlock (*Tsuga mertensiana*). As it cowered on the kitchen window sill, I examined the squirrel. Brownish-gray fur, somewhat wispy, covered a diminutive body. It had a short, rounded nose and huge, unblinking eyes. The latter were obviously "better to see you with, my dear" at night.

Word of our furry visitor spread quickly among park staff, resulting in a steady stream of visitors parading through our house for the greater part of the day, all wanting to take a peek at one of nature's most secretive and elusive creatures. The squirrel never seemed to blink all day, nor show any sign of sleeping. It never attempted to leave the safety of its narrow perch near the window. With darkness approaching, however, it was time to return the squirrel to the old growth forest. As we held the door open, the furry

bundle began to stir and was soon scampering into the darkness.

That was 1973....

Almost 25 years later, while driving to Rim Village in March, I spotted what looked like a tiny Russian winter fur cap with ear flap lying in the middle of the road. As I pulled to a stop to pick up what I thought was a discarded piece of protective clothing about a half mile above Park Headquarters, I realized it was not at all what I had imagined. The brownish-gray “hat” was quivering and its “flaps” were rhythmically moving in and out. It was then I realized that I had found some type of small squirrel hunkered down on the packed snow. A bushy tail was thrust full length under its body and extended enough to cover a tiny face. What I witnessed, of course, amounted to survival behavior designed to keep the animal from freezing. As I hurriedly climbed out of my vehicle to take a photograph, the squirrel’s tail fell away from its face. This motion revealed its eyes, the same ones I remembered seeing in 1973!

As I approached the little ball of quivering fur, it suddenly darted for the top of my rear tire. This provided a nice level for a photo or two, but I wondered why it was not hibernating at this time of year. By gently rocking my vehicle back and forth after taking some pictures, I was able to frighten the squirrel from my tire and off it ran. As the flying squirrel was lost from view, I could only wonder about the hardships it faced during the next three months of winter. As I contemplated the danger posed by Pacific marten (*Martes caurina*) who prowl daily for small mammals, I could only hope that the flying squirrel might find the relative safety of a stone house—just as his ancestor did so long ago.... 

Huckleberries

By Steve Mark

Delicious wild fruit has never been cited as the primary, or even a secondary, reason for why people come to Crater Lake. Few of them know that the park contains four species of huckleberries, and are aware of the lone exception to rules prohibiting collection of plant material in Crater Lake National Park. Each person is allowed one quart of huckleberries per day for personal use, largely because picking does not appear to interfere with perpetuating the host shrub. Bears will forage for ripe huckleberries (as I found out one afternoon in the Sky Lakes Wilderness south of Crater Lake), but this inclination has yet to bring them into conflict with human visitors to the park.

All four huckleberry species are in the genus *Vaccinium*, which belongs to the *Ericaceae* (heath) family. This group of plants is distributed worldwide and contains roughly 3,300 species in 103 genera. Most thrive, as the family name suggests, on uncultivated land with inferior drainage. This is usually where the soil is poor, often coarse, and sometimes acidic.

The swamp huckleberry, *V. occidentale*, likes the western border of the park where it forms dense thickets along streams. It is also known as the westernbog blueberry, since western North American “huckleberries” are really blueberries. (True huckleberries are classed in the genus *Gaylussachia*, a group much more prevalent in Europe than in the United States). In any event, this plant yields tasty bluish-black berries which usually ripen by early August. They can be had in easily accessible areas such as Boundary Spring, Sphagnum Bog, and Red Blanket Creek.

Bluish-black berries can also be seen on the dwarf or mat huckleberry, *V. caespitosum*. These shrubs are less than a foot high, with most only a few inches off the ground. They are found in many places around the park, but are probably most evident in the Castle Crest Wildflower Garden, Vidae Falls, Annie Spring, and Wheeler Creek.

The broom huckleberry, *V. scoparium*, is also known as grouseberry. Some North American Indian groups call it fireberry due to the color of the fruits. This plant possesses bright red berries which are edible and sweet, though usually too small for picking in any quantity. Being the most drought-tolerant species in the genus, it is abundant in lodgepole (*Pinus contorta*) and mountain hemlock (*Tsuga mertensiana*) forests throughout the park.

What is certain to be the most sought-after member of the genus, *V. membranaceum*, goes by several common names. It is variously known as the big, thinleaf, or mountain huckleberry, as well as *Ewam* to speakers of



Upper left:
Westernbog blueberry
(Swamp huckleberry),
Vaccinium occidentale.

Upper right:
Big whortleberry
(Thinleaf huckleberry),
V. membranaceum.

Lower left:
Dwarf blueberry
(Mat huckleberry),
V. caespitosum.

Lower right:
Grouse whortleberry
(Broom huckleberry),
V. scoparium.

the Klamath language. This shrub, which is between two and five feet in height, appears as widely branched bushes containing thin leaves that usually measure over an inch long. Its berries are reddish- to purplish-black when they ripen during the first half of August. There are patches southwest of Park Headquarters, but most pickers go to an old burn area on Huckleberry Mountain (*Ewamcan* in Klamath) in the Rogue River National Forest where more sunlight has enhanced flowering and fruiting.

A visit to Huckleberry Mountain can be combined with a trip to see Crater Lake because it is located less than three miles west of the park boundary. Follow posted signs from the snowpark located on Highway 62 to a primitive campground situated within the huckleberry patches. The bushes cover a relatively broad area, so you will have plenty of options for where to spend a couple of hours picking berries. After a couple of afternoons there last August, I remembered that Henry David Thoreau once quoted Pliny in describing huckleberries, *In minimis Natura praestat*, Nature excels in the least things. Anyone who has tasted the fruit from Huckleberry Mountain will agree, especially if they are fortunate enough to savor it in pie, jam, or pancakes! 🏠

The author would like to thank Joy Mastrogiuseppe for reviewing this article and her suggestions.

A Natural History of My Refugium: Seven Summers in Crater Lake National Park¹

By John K. Simmons

It was 6 a.m. and cloudy on the gray spring morning when we flew from Ashland's airport in a small four-passenger plane. We rose above the clouds at 5,000 feet and in short order headed east into the breaking dawn. The sky grew lighter and ever so colorful as the sun began to rise. Within a half hour I could see the gray stillness of Crater Lake as the dawn's light bounced down the caldera walls. I always knew Wizard Island was supposed to be a nearly perfect cinder cone, but as we circled high above the lake, we were able to see just how perfectly it *was* shaped because the snow traces radiated down along its slopes, just like the spokes of a wheel. By 7:00 we landed back in Ashland, where the town was just awakening to another gray, dreary morning. But we were not drowsy and feeling under a burden of dark clouds, having just experienced a sunrise flight over Crater Lake!

I enjoyed many days hiking and camping during my employment at the park. We discovered many differing habitats, and even climbed Mount Thielson, the peak that towers over Diamond Lake. Though we came to expect golden mantled ground squirrels (*Citellus lateralis*) along the rim of Crater Lake,² we were surprised to see one at the very top of Thielson, begging for a handout!

Anywhere I went within the park, I would be greeted by some form of wildlife. Once, while walking along the base of a talus slope near Park Headquarters, I came across a doe and her fawn. In their attempt to avoid me, they could not run away because of the big, blocky boulders they had to cross. So they just walked away. One animal often heard, but rarely seen, is the pika (*Ochotona princeps*). I often heard them along the caldera walls as I hiked down the Cleetwood trail to the lake's edge. The first one I ever saw was also the only one that I was able to photograph! It is these little lagamorphs that I miss on my treks in Olympic National Park since they never populated the isolated Olympic Peninsula.

I have had the unique opportunity to "talk" with some of the spotted owls (*Strix occidentalis caurina*) living within the boundaries of Crater



Golden mantled ground squirrel.

Lake National Park. During my first year as a ranger, I read through the preliminary reports of spotted owl surveys conducted in the park in 1976. Since I had been involved with a spotted owl survey for the Forest Service prior to working at Crater Lake, I was eager to help with work in the park. Even though it was late in the summer of 1977, we were able to locate the owls seen the year before and find a couple of new locations. More surveys followed the next year, along with some predictions for where these birds might be found in the future. Not until 1992 were more in depth surveys conducted, but they found owls in the predicted locations!³

One of my favorite places to visit is Anderson Falls. Not many visitors know about it, or how to get there, because there are no formal trails leading to this spectacular feature.⁴ One can almost melt into the scenery there, where wildflowers wave at your knees. Upon the cliff above these falls are onions (*Allium validum*) that grow nearly up to your waist! And are they ever tasty...and strong! I admit that I ate a couple, and then progressed to taste those powerful bulbs the rest of that day and even through breakfast the next day!

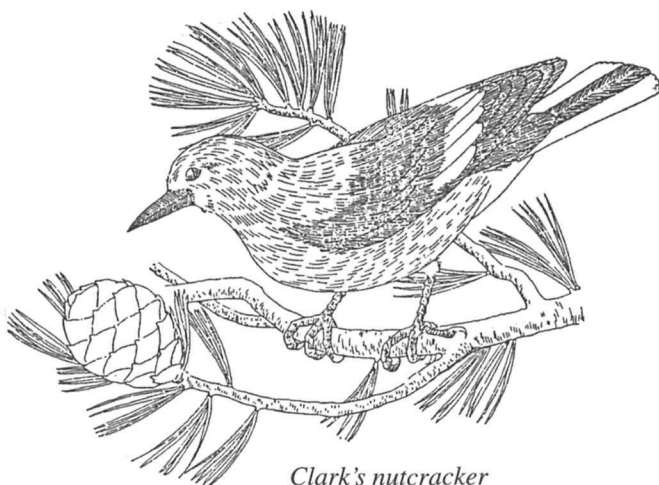
A fellow employee and I once got trapped in a hail storm near Anderson Falls. We found refuge in a small cave along the cliff, but knew that we had to get back to Rim Village. After running back to Rim Drive, a visitor picked us up and took us to the lodge. There were quite a line of cars headed down the mountain, since those visitors did not want to stay around to weather the storm. Very shortly after we reached the lodge, however, the rain stopped. We were the only ones left on the rim, it seemed, and then the clouds began to lift. As if we were the only ones who were meant to see, a rainbow formed and arched low over the lake. It moved across the water to the other side as the storm clouds headed eastward, and washed the rim wall with its colors.



Wild onion

Crater Lake itself seems to have many colors, textures, and moods that change frequently. Though the lake seems to be ever constant, staying the same year after year, one has only to spend a day along its edge to know differently. Some visitors stay for only an hour or two, and of course fail to appreciate the subtle and dramatic changes that take place.

The water is not blue, nor gray, but is crystal clear. Sunlight penetrates the water, some of which is reflected, but most is refracted or bent by the water molecules in the lake. White light from the sun is a blend of all visible wavelengths and penetrates Crater Lake's surface. Most of the reds and yellows are absorbed in the first few feet of water. The greens that are often seen along the lake's edge and



Clark's nutcracker

around Wizard Island reach down further, but become absorbed at relatively shallow depth. Blues reach the deepest, with these wavelengths being scattered and bent. Much of that blue light is reflected toward us. This provides that deep blue as we gaze at the lake. The color of Crater Lake at any one time is influenced by the intensity of sunlight, cloud cover, and suspended particles in the water.

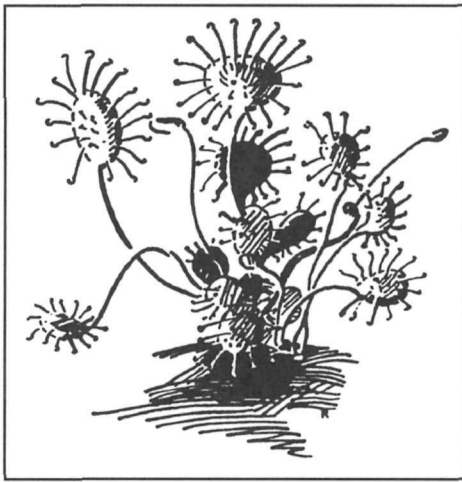
Sometimes the clouds pour into the caldera, much like water from the spout of a pitcher, reminding one of the witches cauldron in Shakespeare's *Macbeth*. The differences in air pressure and temperatures between the caldera and surrounding mountain slopes, often cause clouds to rise or descend. On one occasion, when the clouds poured into the caldera, they descended along the lake surface but left the rim walls and Wizard Island's conical peak poking out of the blanket. Although park employees knew this was a rare event, some visitors were puzzled and subsequently complained because they came to see the lake, not a bunch of clouds! If only they could understand how special this event was, they might have joined in the excitement.

Along much of the rim you can observe the survival struggle of whitebark pine (*Pinus albicaulis*). Their growth is limited by the slope, aspect, direction and strength of winds or storms, availability of water, and the Clark's nutcracker (*Nucifraga columbiana*). The resinous cones are sealed to protect the seeds from most predators, but the Clark's nutcracker (as its name implies) can break open these cones. It is as though this bird has just the right tool to pick the lock on this safe of seeds. They cache the seeds for their winter food supply, which is usually located along a ridge top where winter winds scour the snow. The bird does not always find its caches, so this eventually results in another crop of whitebark pines! Orinthologists believe that the tree and bird co-evolved, for the tree depends upon the bird to plant its seeds.

Ernest G. Moll, in his collection of poems about Crater Lake, wrote of the whitebark pine:

*On this torn ridge he rooted, proud and free,
Battling the wild earth-forces for control;
Life granted not his dream of beauty, so he,
Majestically dying, reached his goal.*

Crater Lake is also where I began to learn many of my wildflowers. The glacier lillies (*Erythronium grandiflorum*) that sprout along the Rim Drive are one of the first flowers to come up through the snow in early summer. Adorning the south facing and drier talus rock slopes are the pasque flowers



Sundew

(*Anemone occidentalis*). As the flowers fade, the stems grow high above the rocks, pushing the pom pom-like seedheads into the wind. This allows seeds to be dispersed more easily.

Sphagnum Bog, a marshy area along the western boundary of the park, hosts several insectivorous plants such as two species of sundew (*Drosera anglica* and *D. rotundifolia*) and the butterwort (*Pinguicula vulgaris*).⁵ Tiny insects get stuck on the surface of their leaves or

showy parts and are “digested” right there. This gives the plants a source of nitrogen, a substance not found in high supply around boggy areas. I hiked out there to find the sundews and photograph them, but not until later did I realize I had butterworts among the sundews in my pictures! A somewhat similar area is Thousand Springs, an area south of Sphagnum Bog, where I found the aster fleabane (*Erigeron peregrinus* var. *callianthemus*), arrowleaf groundsel (*Senecio triangularis*), and two species of bog orchids (*Habenaria dilatata* and *H. stricta*).

Beargrass (*Xerophyllum tenax*) was not to be found in Crater Lake National Park, or so I had read in a wildflower book.⁶ Being rather curious about this plant, I asked Ron Mastrogioseppe. He answered that it had recently been located, but would not say where. Over the course of that summer, though, Ron gave me two hints about its location. One was “pre-Mazama landscape” and the other was “refugium.” I had heard of a refuge, but not refugium. The latter word appeared in a geologist’s dictionary, with

the definition being “a place that had been protected in some way from a climactic event.”

After some study, I approached Ron with some possibilities for where beargrass might be found. He smiled and sent me out to locate the plants in early September. In an area only 40 feet or so square, along a small rocky ridge, I found some withered stalks!⁷ Charlie Bacon, whose work has substantially changed our understanding of the park’s geological story, told me later that there were no refugia—that is to say, protected areas within what is now the park when Mazama’s climactic eruption took place 7,700 years ago.⁸ He figured that birds had deposited the seeds. Even so, it is fascinating to consider the possibility of such a refugium.

Although the park may not have been a refuge for life at the time of the big eruption, it certainly is now. When things become too hectic, I return for a visit to Crater Lake and it rejuvenates me. Crater Lake seems like home after spending seven summers of my life there, a place where one can relax and feel like they belong. That feeling has persisted for two decades in Crater Lake National Park, my refugium. 🏠

Notes

- ¹ Edited from an interpretive slide program presented at a symposium entitled *Crater Lake National Park: Still Beautiful at 90*, on May 16, 1992.
- ² See Roger Brandt’s article on this topic in the 1993 volume of *Nature Notes from Crater Lake*.
- ³ See Lori Stonum’s article on spotted owl survey in the 1993 issue of *Nature Notes*.
- ⁴ It is, however, less than a half mile from the East Rim Drive.
- ⁵ More detail about Sphagnum Bog can be found in the article by Jean Danielson and Steve Mark which appeared in the 1994 volume of *Nature Notes*.
- ⁶ See Elizabeth L. Horn, *Wildflowers I: The Cascades*. Beaverton: The Touchstone Press, 1972 (p. 58).
- ⁷ This occurred in 1978. See Mastrogiuseppe’s article on pp. 12-14 in the 1994 issue of *Nature Notes*.
- ⁸ New evidence refutes Bacon’s position, but more study of Sphagnum Bog is needed.

Illustrations

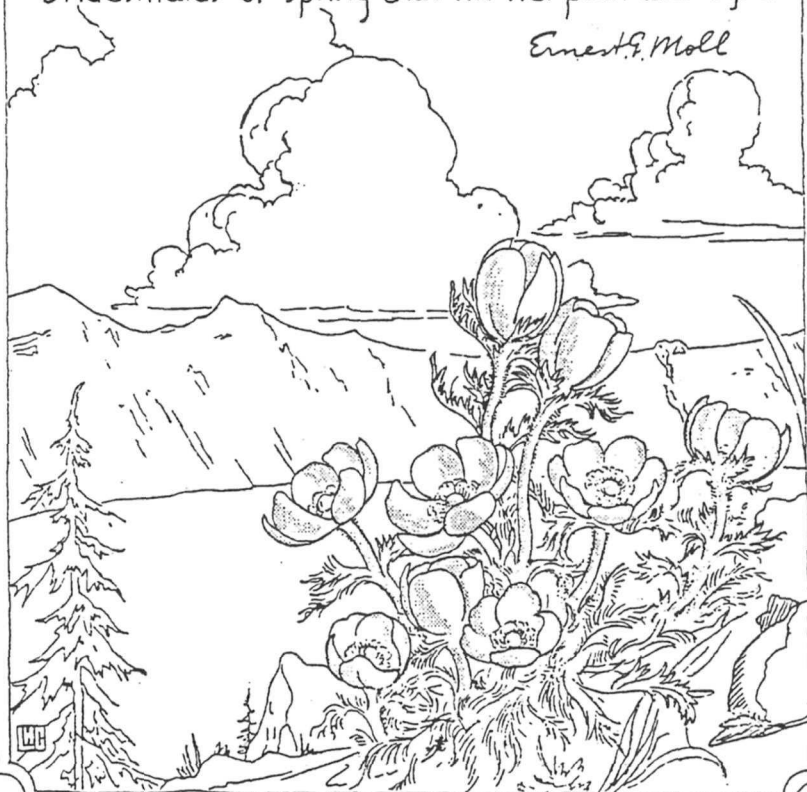
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- p. 38 Drawing by L. Howard Crawford, *Nature Notes from Crater Lake*, 7:3, September 1934.

WESTERN WINDFLOWERS

★ ANEMONES ★

Before the hills are confident with flowers,
Columbine, paint-brush, phlox - the bees' delight -
Come these, as silent as the silent hours,
Bridesmaids of Spring that fill her path with light.

Ernest F. Moll



About the Authors

Brandon Browne served as a volunteer-in-parks during 1997 and is presently studying geology at Oregon State University in Corvallis.

Ron Mastrogiuseppe is a forest ecologist who has monitored pumice fields and other phenomena in Crater Lake National Park since 1964.

Steve Mark has worked as park historian at Crater Lake and Oregon Caves since 1988.

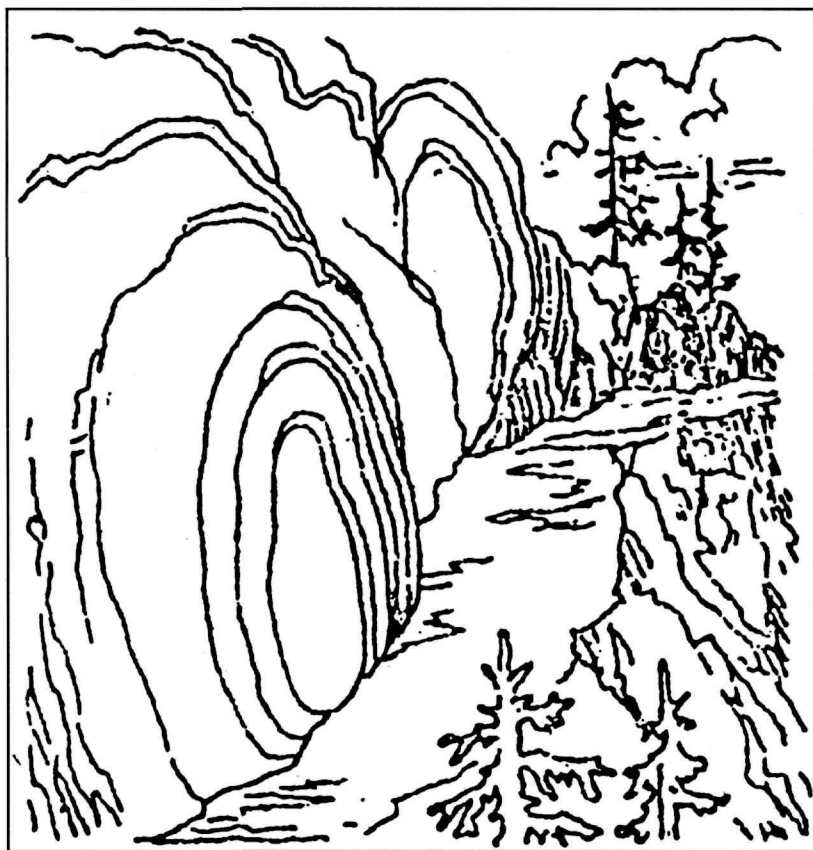
Gene Parker made numerous contributions to the study of botany in southwestern Oregon before his death in 1996. He will be remembered for specializing in true firs, an interest which became the catalyst for several important discoveries in Crater Lake National Park.

John Simmons began his career as a park naturalist at Crater Lake and is presently stationed at Canyonlands National Park.

Larry Smith teaches school in Jacksonville, Oregon, and volunteers with the Friends of Crater Lake National Park. He worked as a seasonal employee in the park between 1961 and 1985.



This issue of Nature Notes is dedicated to the memory of Richard M. "Dick" Brown, who passed away on May 31, 1998. His career spanned the years from 1952 to 1970 at Crater Lake, where he had stints as assistant park naturalist, chief park naturalist, and then research biologist. Trained as a plant taxonomist, he combined academic rigor with a gift for interpreting to the public, thereby inspiring two generations of NPS employees who were privileged enough to know him. 🏠



Above: Example of “spheroidal weathering” along the Garfield Peak Trail, Nature Notes from Crater Lake, 7:2, August 1934.

Back cover: Superintendent Dave Canfield and a new entrance sign, 1936. NPS photo by George Grant.

Nature Notes from Crater Lake, 1998

National Park Service
Crater Lake National Park

Crater Lake Natural
History Association

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