

CRATER LAKE NATIONAL PARK

PROVISIONAL MANUAL
OF INFORMATION

COMPILED BY MEMBERS
OF THE
RANGER-NATURALIST STAFF
1934

THIS BULLETIN PRODUCED WITH ASSISTANCE
OF PERSONNEL PROVIDED THROUGH S. E. L. A.

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MANUAL OF INFORMATION

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THE RANGER-NATURALIST STAFF OF 1934

has endeavored to carry on the good work of

PARK NATURALIST D. S. LIBBEY

Crater Lake National Park, now on administrative furlough to Washington D. C. as Supervisor, E. C. W., National Parks and Monuments.

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R. HENDERSON, PROGRAMS

E. G. MOLL, AESTHETIC INTERPRETATION

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C. R. SWARTZLOW, GEOLOGY

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NOTE: This material was compiled in the field, during the press of summer work and without access to complete reference sources. At some future time more adequate citations and acknowledgements will be added.

I

THE MAGNITUDE OF MOUNT MAZAMA

WARREN D. SMITH

THE MAGNITUDE OF THE MOUNTAIN
WARREN D. SMITH

- A. - Introduction.
- B. - Detailed geological notes for observations at Rim Stations on Rim Drive. (In Manual of Operation-1934).
- C. - Technical discussion of theories concerning the destruction of Mt. Mazama.

As fine as are the views of the Crater wall and the observations for close study of the internal structure of the mountain at short range, the magnitude of Mt. Mazama and the complete story of what happened here can only be adequately grasped from the rim of the great Crater. This is true because one must take positions (offered only by the "Rim Drive") where he can see both the inside of the Crater and its back slopes at the same time, and it is essential that he get this perspective from various angles such as are offered at successive stations on this trip. Furthermore, the full magnitude of the size, forces and heights can only be comprehended when one correlates observations made within the Crater, those on the rim, and certain data obtained far out on the lowest slopes of the old mountain, i.e; one must take in the full sweep of the whole park and even beyond its boundary.

To the layman the panorama presents a bewildering complexity of landscape features that usually overwhelm and overawe. It is the geologists task to bring out of this welter of physical phenomena some orderly arrangement of facts and interpret this scene so that the casual visitor may see some semblance of order in the chaos before him. This has been done very excellently in the exhibits and views at Sinnott Memorial, but even there one cannot see the outer limits of the mountain. It will be recalled by those who visited the Memorial first for orientation that the views and exhibits take up the story of Crater Lake in the following order:

- I - The Building of the Mountain.
- II - The Origin of the Crater.
- III -The Formation of the Lake.
- IV - The Aesthetic Features Resulting from the Foregoing.

This is the logical treatment of the story at Crater Lake, and we do not need to repeat this treatment here. Rather we shall discuss certain critical aspects of the subject that present themselves to one standing upon the rim with a wide vista of both the inner and outer features in full view. These essential points are the following:

1. The back slopes of the mountain.
 - a. Their extent.
 - b. The angle of slope.
 - c. The character of the surface.
2. The Crater.
 - a. Shape, size, and height of Crater Walls.
 - b. Slopes of Walls, weathering etc.
 - c. The composition of the Crater Walls.
 - d. Special features: glacial valleys, etc.
3. The relation of Mt. Mazama to the Cascade Plateau and other volcanic peaks in the Cascade Chain.

1. The backslopes of the mountain:

From what one sees on the Rim Drive, one should be thoroughly impressed by the magnitude of Mt. Mazama, as its lower slopes deploy over almost the entire park of approximately 250 square miles and debris from its many periods of explosive activity extend far beyond the park boundaries. In fact this debris can be traced for at least one hundred miles from Crater Lake, with the presumption (not so easily proved) of many times this distance, without unduly taxing the possibilities of the situation.

The angle of the backslopes of the mountain next catch the geological eye. If these are continued not merely on the same angle, but following the sine curve which volcanic mountains of the explosive type i.e. conical shaped, tend to follow, or which

they approach as a limit, the former mountain that rose above the present Crater must have been approximately 14,000-15,000 feet in height. This point was long ago ably brought out by the late J. S. Diller in his monograph (Prof. Paper No. 3, U. S.G.S.)

The character of these backslopes is a very critical aspect of this whole subject and one about which considerable controversy has centered. From most points on the Rim one is struck by the relatively clean backslopes of the old mountain; i.e., general absence of accumulations of large-sized debris, volcanic bombs, and displaced fragments of the disrupted mountain mass. However if one observes carefully the great accumulations of pumice on Llaio Rock and the new road cuts made by the B. P. R. he will readily be convinced that this material has poured a veneer over the older surfaces which completely masks the true conditions.

From these especial characteristics of the mountain, extent, slopes, and character of surface, we get definite data from which we can reproduce rather faithfully the size, height, and destruction of the mountain.

2. When we turn next to the Crater itself we get further contributions to the final solution of our problem.

The shape of the Crater is in itself not so critical except it is fairly symmetrical and about that expected of the mountain periphery at an elevation of 7000-8000 feet. Of course, subsequent erosion, controlled by salients of hard rocks (dikes) and re-entrants in softer materials, and by jointing, has changed this shape somewhat. In one aspect the shape is significant - it points to a very regular breaking up of the old mountain; i.e., the collapse or the explosion was either fairly straight down or up and not sideways. Of course there has been some retreat of the original crater walls, which would result in widening and lengthening of the crater.

The size of the crater is impressive but, to the geologist, not exceptional, as much larger craters are on record. The height of the crater walls likewise do not unduly tax the geological imagination.

However, the slopes and state of weathering of the Crater Walls do intrigue the geologist, and these, coupled with the composition of the walls, are of profound significance. First

of all, the slopes are exceedingly steep but only as steep as the angle of repose of dominantly fragmental material will permit; second, the material in the crater wall is over 50 percent fragmental, and third, it shows no recent fusion and is relatively little weathered. Conclusions to be drawn from these observations will be made in Part C. of this discussion.

Especial features, such as glacial valley cross sections, dikes, joints, slides, Wizard Island, (a minor episode in the final chapter of the geological story), all can be seen and studied from the Rim Stations and have their place in any connected account of what has taken place in this locality.

Before leaving this phase of the discussion one must not fail to call attention to the generally upturned edges of the beds and flows as seen in the Crater Wall. There are exceptions-notably Diller's famous "backflow" in Cleetwood Cove. On Hillman there is a very definite upturning of the lava flows which demands explanation. This peak is far more significant to some geologists than the so-called "backflow" which can be and should be accounted for in quite other ways than the current explanation. These points again will be amplified in the technical discussion to follow.

3. The relation of Mt. Mazama to the Cascade Plateau and the other volcanoes in the Cascade Chain.

When one takes in the full perspective of that part of the Cascades visible from the rim, or from some higher point like Mt. Scott (and not possible from within the crater or from Wizard Island), he gets certain definite and interesting points well in mind. One of them is that Mt. Mazama got much of its original height from the fact that it was built upon a general platform in itself some 6000 feet above its base. Second, Mt. Mazama was located along a definite line, an original line of weakness, perhaps a great fissure in the platform. And third, Mt. Mazama has had a history not unlike others in the Cascades except in the accident that its explosion (or collapse) was rather more symmetrical. Mt. Thielsen immediately to the northeast, which could not possibly have collapsed, shows very clearly what has been and will be the normal sequence of events in this region. Furthermore, from the advanced stage of erosion found on Thielsen it is clear that it was wrecked or partly wrecked by explosion before the catastrophe occurred that overtook Mt. Mazama.

C. Technical discussion of theories concerning the
Destruction of Mt. Mazama.

In view of the very definite trend of opinion among some observers away from the older and hitherto generally accepted "collapse" theory for the origin of Crater Lake it might be of interest to some to have some discussion of certain critical points bearing upon explosion vs. collapse. Especially is this important in the light of recent observations in the field during the current season. (1934).

The points that appear to be critical are the following:

1. The distribution, character, and amount of erupted material.
 2. The so-called "backflow" of Diller in Cleetwood Cove.
 3. The shape and character of the Crater itself.
 4. The absence of molten material which ought to have issued at some lower elevation if the mountain had collapsed and the superstructure been engulfed.
 5. The mechanics of the problem.
1. The distribution, character, and amount of erupted material.

While no detailed areal mapping of the fragmental material in the vicinity of the mountain has been made by anyone it is manifest to even the casual observer that pumice and other fragmental material is widespread in this area and extends at least a hundred miles to the east and about the same distance north and south of Crater Lake. In Sand, Annie Creek and others radiating from the Crater we find this pyroclastic material to a depth of about 200'; even on the Rogue River twenty miles west of the center of the eruption this same kind of deposit, at least 100' by actual measurement, is exposed by the stream and has buried the former forest growing there. Since other volcanoes in this region have been in violent eruptions it is not possible to be certain at this time as to what amount of this material came from Mt. Mazama. Mt. Thielson, for instance, has erupted explosively, and as near as one can judge from the field examination of the material there is little or no difference between the fragments from the two volcanoes.

Of course, if one presupposes an eruption of Krakatoan magnitude we would not need (nor could we expect) to find all the ejecta within range of the Park. Some of it undoubtedly was carried by lofty wind currents to distances of a thousand miles or more. With the prevailing winds from the S. W. for nine months of the year we would expect and do find the bulk of this deposit to the east of Crater Lake.

Much has been made the absence of large fragments, bombs, blocks, and other debris on the backslopes of Crater Lake. The alleged cleanness of these slopes is only apparent. As a matter of fact, field observations, especially in recent road cuts (which were not available to Diller) show great quantities of such material covered over, veneered and completely masked by a heavy accumulation of pumice.

An especial point has been made by Diller that the finer explosive material about the rim is of different composition from that making up the bulk of the mountain; i.e., there ought to be more andesitic fragments than appear on the surface. In reply to this point it should be pointed out that much of the later lavas were dacite, in the upperflows, and this would seem to indicate that the older andesitic fragments would be covered over by the more acid type of material.

2. Diller's "Backflow" (Cleatwood Cove).

A close examination of this flow of lava from the foot, on the flow itself and from above indicates, to the writer at least, that faulting and slumping have played a part in giving this flow its present position. Moreover, even if this were a genuine backflow, it would not necessarily prove collapse for the whole mountain. During an explosion it would be inconceivable that parts of the rim did not sag and even turn inward. We would expect to have some sagging of the rim as a result of either kind of action.

3. The shape and character of the Crater itself.

Crater Lake crater has been called a caldera, because of its general likeness to the caldera of Kilauea. In the opinion of the writer (who has visited Kilauea and walked across its congealed surface from the rim to the pit of Halemaumau) there is only a most superficial resemblance between the two.

The caldera of Kilauea is a veritable slag-pot, with fused material everywhere and evidences of peripheral faulting on all sides. Furthermore, Kilauea is only a hole in the side of Mauna Loa and not a mountain in itself. Its entire history has been quite different from that of Crater Lake.

On the other hand, the Crater (and this is the correct term to use) of Crater Lake is a typical explosion orifice, (with which type the writer is quite familiar). There is no peripheral faulting visible and no fusion within the crater. Furthermore, nearly everywhere, but notably on Hillman Peak, the ends of flows are turned upward or tend to turn upward. The high percentage of fragmental material within the rim and the subsequent explosive history indicated by the appearance of three later cones would appear to be convincing evidence that subsidence could not have taken place on the scale maintained by Diller.

We should bear in mind, of course, in all fairness, that the crater has been considerably modified by subsequent erosion and that old walls have been cut back so the present walls might conceivably present quite a different appearance from the former ones with all the old fused material removed.

Still another point should not be overlooked, namely the configuration of the bottom of the crater. As far as we can judge from the present soundings, the bottom of the crater does not have the configuration one would expect from subsidence; that is, the basin seems to be like one from which material had been scooped out rather than one into which more debris had fallen. In other words its configuration is not irregular enough and such modifications of its contours as we do find are due to explosive extrusions, viz. to three later cones.

4. The absence of molten material which should have issued at some lower point if this mountain was engulfed.

Diller, true scientist that he was, admitted this very vital evidence as being completely lacking, at the time of his work. Since this time no flow has been discovered, such as one finds on the lower slopes of Mauna Loa and Kilauea, anywhere around within reasonable range of Crater Lake and in the opinion of the writer it never will be located, since it probably does not exist.

5. The mechanics of the problem.

When the dominant forces of volcanic regions are acting outward, to suppose that the whole mountain or 17 cubic miles of it collapsed seems to be mechanically unsound, especially when that mountain's entire previous history has been that of extrusion.

Again, why should this mountain do something which no other volcano on the Pacific Rim, as far as we know, has ever done. Why should this mountain break the rule of volcanoes of this type?

The present writer knows of no volcano of the Pacific type which has collapsed. In fact he knows of no mountain of any kind that has been engulfed.

If the writer had not been familiar with the history of Taal volcano in Luzon, where he witnessed an explosive eruption and subsequent formation of a crater lake, comparable in every way to Crater Lake except in size, he might be willing to entertain such an unusual hypothesis as that of engulfment as perhaps a possibility, perhaps, though not as a probability.

In view of the above considerations and others, which we have not sufficient space to elaborate, the theory of collapse and engulfment seems not only untenable, but fantastic.

Bibliography

CRATER LAKE-

Diller, Joseph Silas. Crater Lake.
Nat. Geog. Mag. 8:33-48, 1897.

Diller, Joseph Silas,
Did Crater Lake, Oregon, originate by a volcanic sub-
sidence or an explosive eruption?
Jour. Geol. 31:226-227, April-May, 1923.

Diller, Joseph Silas,
Geologic History of Crater Lake, Crater Lake National
Park. U.S. Dept. of the Interior, 1912.

Diller, Joseph Silas, and Patton, H. B.
Geology and petrography of Crater Lake National Park.
U.S.G.S. Prof. Pap. 3, 1902.

Diller, Joseph Silas,
Geology of Crater Lake.
Mazama 1:161-170, 1896-7.

Dutton, C. E.
Crater Lake, Rogue River, Willamette and McKenzie
valleys. Science 7:179-82, 1886.

Dutton, C. E.
Crater Lake and head of Willamette.
U.S.G.S. An. Rpt. 8, pt. 1:156-67, 1889.

Moore, Bernard N.
Deposits of Possible Mue's Ardente
Origin in the Crater Lake Region.
Jour. Geol. vol. XLII, No. 4, May-June, 1934.

Smith, W. D.
Reconsideration of Geological Dogma.
Pan-American Geologist, Sept., 1930,
Crater Lake Reg., pp. 95-98.

OREGON CAVES-

Winchell, Alexander Newton.
Petrology and mineral resources of Jackson and Josephine

counties, Oregon.
Min. Res. Ore., Ore, Bur. Min. and Geol. 1, No. 5:35, 1914.

Marble Halls of Oregon,
Standard Oil Bulletin, 11:4-9, June, 1923.

Williams, Ira A.
Oregon Caves; remarkable "marble halls" of Josephine county,
Oregon.
Nat. Hist., 20:397-405, 1920.

(This paper was prepared by Ranger Naturalist Warren D. Smith,
under the direction of Warren G. Moody, Acting Park Naturalist,
1934.)

II

THE LAKE (PHYSICAL CHARACTERISTICS)

HUGH H. WAESCHE

THE LAKE (PHYSICAL CHARACTERISTICS)
HUGH H. WAESCHE

Area:

Area of Lake including Wizard Island - 21.30 square miles.
Drainage area (Crater) - 27.48.
Drainage area of Rim - 7.06 square miles.
Area of water surface only - 20.42 square miles.

Bed:

Approximately a plain several miles in extent.
Two submerged cones supplementing Wizard Island 450 and 825 feet below water level respectively.

Composed of fragmental materials, pumice dust, diatom remains, and talus materials along slopes. Also lava and ash in vicinity of Wizard and submerged cones.

One third of Lake Bed is 100 feet below level of Klamath Marsh, no evidence of volcanic heat at bottom.

Color:

Blue, due to purity of water and great depth. Depth prevents light from being reflected from bottom, hence there is a black background increasing depth of blue tint.

White light made up of primary colors as in rainbow. These are refracted by pure Lake water. Blue light refracted more than others, which seem to be more readily absorbed. Halo of colors produced around white objects below water level by refraction with blue always at top.

Refraction, absorption, and diffusion of light all play a part in producing blue color. Light blue and green along shallow portions of rim due to less refraction, absorption, and diffusion as well as color of background of Lake bed which is yellow to brown.

Crater Lake water in a container produces no color effects. Compares with pure water.

Depth of Water:

Greatest: at point 2.00 miles in line from Phantom Ship to Palisade Point - in 1908, 1996 feet. Allowing for stretch of sounding wire the depth would be slightly over 2,000 feet.

Least: 0.39 miles S. E. of Wizard Island - 93 feet.

Average: About 1500 feet.

Reported by Major C.E. Dutton as the deepest body of fresh water in the United States. (1886) J.S. Diller, U.S.G.S.P.P. #3.

Dimensions:

Average diameter of Rim - 5.7 miles.

Greatest width of Rim (from point S.W. of Wizard Island to Grotto Cove) - 6.37 miles.

Greatest width of Lake (at same) - 6.02 miles.

Least width of Rim (Dutton Cliff to Llao Rock) - 5.13 miles.

Least width of Lake (at same) - 4.54 miles.

Greatest width of Lake at:

Garfield Peak (Eagle Point) - 5.02 miles.

Head of Lake Trail 5.72 miles.

Kerr Notch 5.02 miles.

Llao Rock 5.82 miles.

Palisade Point 5.42 miles.

Pumice Point 5.72 miles.

Rugged Crest 5.72 miles.

Sentinel Rock 5.02 miles.

The Watchman 5.82 miles.

Greatest width of Wizard Island - 1.00 miles.

Least width of Wizard Island - 0.59 miles.

Width of Channel, Phantom Ship and Mainland - 1,050 feet.

Width of Skell Channel - 300 feet.

Distances (air line):

From Head of Lake Trail to:

Boat Landing on Wizard Island - 1.57 miles.

Cleetwood Cove - 5.72 miles.

Crater of Wizard Island - 1.87 miles.

Phantom Ship - 2.55 miles.

Wineglass 5.72 miles.

Sinnott Memorial to:

Crater Wizard Island	1.97 miles.
Devils Backbone	3.35 miles.
Discovery Point	1.00 miles.
Llao Rock	4.24 miles.
Phantom Ship	2.46 miles.
The Watchman	2.76 miles.

The Watchman (Summit) to:

Skell Channel	0.54 miles.
To Wizard Island	0.70 miles.
To Crater of Wizard Island	1.35 miles.
To Wineglass	6.16 miles.

Wizard Island from foot of Lake Trail:	1.52 miles.
Wizard Island to Sentinel Rock	3.79 miles.
Phantom Ship to Kerr Notch	0.98 miles.

Elevation above Lake:

Greatest (Hillman) Peak	1979 feet.
Least (Kerr Notch)	523 feet.
Applegate Peak	1958 feet.
Cloud Cap	1773 feet.
Crater Lake Lodge	899 feet.
Dyar Rock	1703 feet.
Garfield Peak	1883 feet.
Head of Lake Trail	850 feet.
Hillman Peak	1979 feet.
Kerr Notch	523 feet.
Llao Rock	1869 feet.
Phantom Ship	162 feet.
Pumice Point	762 feet.
Rugged Crest	873 feet.
Sentinel Rock	1223 feet.
Sinnott Memorial	800 feet.
Sun Notch	938 feet.
Skell Head	1073 feet.
The Watchman	1848 feet.
Wizard Island	763 feet.

Elevations of Points along Rim of Lake above sea level:

Applegate Peak	8135 feet.
Crater Lake	6177 feet in 1908.
Crater Lake Lodge	7076 feet.

Cloud Cap	7950 feet.
Devils Backbone	7400 feet.
Discovery Point	7200 feet.
Dutton Cliff	8150 feet.
Dyar Rock	7880 feet.
Garfield Peak	8060 feet.
Head of Lake Trail	7050 feet.
Hillman Peak	8156 feet.
Kerr Notch	6700 feet.
Llao Rock	8043 feet.
Palisade Point	6850 feet.
Pumice Point	6900 feet.
Sentinel Rock	7400 feet.
Sinnott Memorial	7000 feet.
Shell Head	7250 feet.
Sun Notch	7115 feet.
The Watchman	8025 feet.
Winglass	6750 feet.

Meteorology:

Average annual precipitation:	70 inches.
Average annual evaporation from lake:	55 inches.
Evaporation (14th Annual Weather Report):	43 inches.
Average annual snow fall:	40-55 feet.
Snow fall at Government camp winter of 1932 (more at Min):	73.3 feet.
Maximum temperature at Government Camp (1931-32) Sept. 15, 1932	86°
Minimum (same) Jan. 13	8°
Maximum for 1932 - 3, Aug.13, 1933	89°
Minimum (same) Feb. 9	13°
Evaporation on Lake:	.0125 ft. per day,
ten inches of snowfall: one inch of precipitation (approximately).	

Most of precipitation in form of snow.
 Crater Lake does not freeze in winter except around edges.
 This is due to roughness of surface caused by high winds
 and great depth.
 Temperature of water below 300 feet is constant at 39°.
 Radiation and conduction of the heat from the 39° water
 below to the cooler water above should retard its freezing.
 The lake should not freeze until the temperature of the upper
 300 feet is lowered to the 39° point. The high specific

heat of water is such that freezing of a body of water as large as the upper 300 feet of Crater Lake would be unlikely to occur with temperatures such as are reached at Crater Lake.

In the winter of 1924 the Lake was frozen over for two days, being the only case on record. However, Dr. E. I. Applegate suspects that the Lake was frozen at times during the winter of 1897 and 1898 when the temperature at Fort Klamath reached a low of -42° . Much snow drifts over the rim of the lake in winter, greatly increasing the catchment area. Prevailing winds are southerly and south-westerly in winter when most of the snow falls.

Snow line on S. W. portion of rim is from 5 to 12 feet. Snow line on Wizard Island is 12 feet, as determined by lichens on trees.

Source of Water:

No visible inlet on large scale. Sixty-three small streams flow into Lake probably derived from melting snow on or within rim. They supply 10.754 cubic ft. per sec. or 929,145.6 cu. ft. per day. Water derived from rain and snow. Is fresh because of its youth and because of lack of inflowing streams with high mineral content. Seepage decreases soluble salt content as does lack of solution of Lake water on its basin. Rain water and snow, which are the source materials, are as pure as distilled water.

Fate of water:

Evaporation - in summer	0.0125 feet per day.
Seepage about $\frac{1}{4}$ evaporation or	0.003 feet per day.
Lake level sinks in summer	0.0155 feet per day.

Numerous springs issue from points below lake level around lake area. An example of this is Boundary Springs on the North Boundary of the Park. It is undoubtedly derived by underground seepage or channels from Crater Lake. Numerous Springs along a fault from Modoc Point by Ft. Klamath toward Crater Lake may account for a large amount of seepage. Porous beds of agglomerate in the walls and basin of Crater Lake would offer a means of passage for water to lower levels on the mountain slopes of the immediate vicinity. There are no outlets directly visible.

Temperature of the Lake:

Aug. 1933 and August 1934 J. S. Brode reports temperatures as high as 62° beyond 100 feet from shore. Between 45° and 50° at and near the surface usual temperature. Constant at 39° below 300 feet.

Variation of Level: 2 & 3.

Has a seasonal variation of from 2 to 3 feet with lowest point reached in early fall. High stage comes in early May. Lowest point in 1901 reached about October 1. High and low points vary from year to year with the seasons. Change so gradual that beach levels not highly developed. High water usually marked by white line on rocks caused by a small crustacean (*Daphnia pulex pulicai*)¹ In summer water level of lake sinks, an average of-- 0.0155 feet per day. Elevation of Lake level in August 1908, was (W. G. Steel)² -- 6177 feet. In August 1910 (highest recorded)² 6177.2 feet. Greatest variation between 1910 and 1934 is-- 12.9 feet².

Lowest point recorded to date (1934) when the above variation of 12.9 was reached². Apparently the lake level is slowly receding at the rate of less than 0.55 foot per year.

Change of water level during summer of 1934 (C. H. Simpson)

Levels reported:

June, 15	3.9 feet.
July, 10	3.7 feet.
August, 13	3.1 feet.
August, 20	2.9 feet.

18 years of comparative drought in this region may easily account for shrinkage.

Lake level receded 0.8 feet for 2 months or an average during the summer of 1934, of 0.0133 feet per day.

References:

1. U. S. G. S. Professional Paper #3, 1902 by J. S. Diller and H. B. Patton.
2. Records by W. G. Steel and Chief Ranger kept in Chief Ranger's office, Crater Lake, Oregon.
3. See Chief Ranger's File under monthly report to Superintendent, Jan. 5, 1931 - Ward P. Webber to Mr. E. C.

Solinsky.

(This paper was prepared by Ranger-Naturalist H. H. Waesche under the direction of Warren G. Moody, Acting Park Naturalist, 1934).

III

THE LEGENDS OF CRATER LAKE

W. CRAIG THOMAS

THE LEGENDS OF CRATER LAKE
(Arranged by W. Craig Thomas)

The Peace Moon

At the time of the peace moon, in the year of the beginning, the Klamaths and the Modocs and all other tribes dwelt together in friendship and it was a time of gifts and plenty and the taking in marriage. The animals roamed the earth without fear of each other under their own gods, and spoke together. Also the gods came to the land of the Klamaths and walked with them and were with them in the hunting, and the feasting, and rejoiced with them.

Now it chanced that during the passage of that moon, when the gods had come to the meadows of the Klamaths, the tribes were ruled by a mighty chieftain, whose name may not be spoken. 1.

Courageously this chief sought to bear himself with propriety before his guests, but his heart was heavy that no son had been sent who might profit by his years and his station and inherit his place after him. And yet because his heart was like a stone within his breast, the gods took pity on him and in due time there came to that lodge a daughter to comfort and care for the old chief.

Now this chief was very old and very wise and he knew that even the gods can make mistakes, so he caused the child to be trained in all those things which are befitting a brave of the tribe, and bade her deport herself as a youth among the other youths, so that the gods should remedy their error, and that the young chief might be found inferior to none.

And Kequella-Tyee-Tihowitt, who was named Liao, and was the god of the "down-below", was with her father and the maiden in her father's house. And the god of the down-below became inflamed with her fairness, which was as of a youth, and by her eyes which were as of a fawn, and he sought her of her father saying:

"With me she shall suffer no want nor shall there be danger to frighten her; but shall descend with me into the center of the earth and there abide with me forever."

Indian Legends - W. C. Thomas

Then a great fear arose within the breast of the chief as he listened to these promises, for he dreaded the wrath of the gods. But the knowledge remained within him that she was in truth his son who was to profit by his years and his substance and so could be the wife of none.

So a great rage possessed Lla-o when his desire was denied him and no reason given for the denial; but because it was in the time of the peace moon he must contain his wrath with amity in the land of the Klamaths.

Yet each time he regarded the maiden, his love for her burned through the shadows of his eyes, and each time he beheld her father, his hate tightened his sinews as the gut of a newstrung bow.

He hated also, Skell, who was the ruler of all things on the surface of the earth, and whose servants and children were the bear, the fox, and the eagle, the coyote, the dove, and the antelope. For Skell had noticed in the hunt one whose fleetness was that of the antelope, and whose grace was that of the wind-swayed flowers; and he sought out the lad and questioned him. And as the boy spoke, the god thought he beheld the beauty which precedes the sunrise and listened to the voice of the water whispering to the wild rice. Thus he observed her to be a woman, and he also demanded her of her father. And only then in his despair, did the aged chief tell the god of all things above, the answer he had made Lla-o, and Skell laughed aloud.

"Justly are you known as a great chief", he said. "For had Lla-o taken your child, she would have vanished from the top of the world, to serve unending days in darkness and among those monstrous things which are of Lla-o. But with me, she shall be forever where the Shadow's winds but soften the sun. And her children shall play with the young of the fox and the bear and the antelope and be as they are, the messengers of that god who rules all things above the earth."

Even more than the wrath of Lla-o, the father feared the wrath of Skell; yet he made answer as he must, that this child of mankind might not be the wife of any. Yet because he trusted Skell with the trust of his own hand, he told Skell of his prayers and his offerings to the gods and of their sending him a daughter who was to become a son and must remain a son forever. And after he had listened Skell departed without anger and spied upon Lla-o,

and defeated the inflamed god who sought to abduct the maiden into his own land of fires and monsters and darkness.

Therefore Lla-O hated Skell, even more than the father but it was still the time of the peace moon and he was helpless, and must contain his anger for the Klamaths.

The War Begins

In the year of the beginning, the lands of Lla-O below the world; but at a certain place they were above the world also, and in this place the fires that are always below burst out above; where there are great holes of fire and great mountains. And there are devils in those mountains which take any shape they choose. It is the land of evil spirits, of swift winds, of horrid echoes and the thick, yellow water-smoke which in the year of the beginning, breathed death to any living things within its folds.

Thence departed Lla-O at the waning of the peace moon with bitterness and hatred in his heart against his fellow Skell and against the chieftain of the Klamath people. But he could not spread the awful water-smoke upon the valley because of his desire for the maiden who dwelt there with her father.

So he wrapped the water-smoke about his shoulders that he should no longer see the valley and them dwelling there he hated, and he sat upon a great stone where the mountains sprawled around him and waited for the passing of many years that the fears of Skell might be abated.

Thereafter, he spied upon Skell through the leaves of the ground oak, which is poisonous to any excepting the evil powers and their kind. He observed how Skell directed the sunlight where best to ripen the valleys and the huckleberries (2) that grew upon the mountains, and now he shielded the doe from the path of the panther, and the young coyote from the fangs of the wolf.

Thus envy was added to the temper which curdled in the heart of Lla-O and from the height of a great cliff he cast

a molten stone which arched the skies with fire and smote Skell upon the back of his head and he died.

Thus he killed Skell and while the antelope and the bear and the eagle were afar, creatures of Lla-O sprang through the earth and got the heart from the body of Skell.

High was the pride of Lla-O because of what had befallen and so that all the valley things might know that he was now Skookum Lla-O, which means a great many or more than one, he caused a messenger to descend into the valleys and meadows of the Klamaths and proclaim to all things living there that he was their god thenceforth, and to render him obedience. And this messenger came to the fountain whence Skell had drunk and charged all the faithful of Skell who were there assembled that they abandon their wailing and repair to the throne rock of Lla-O which overtopped all other mountains and there join their new peers, which would be the creatures of Lla-O and join in the games of rejoicing for the overthrow of Skell.

Mid-day shone upon the topmost leaf of the lodge-pole pine when the messenger had fulfilled his mission, but the sun had passed below the western hills ere any man turned his head. And when he looked, the spot, where the messenger had stood, was empty, and no man had witnessed his departure. And when the Voice spoke, each thought it the voice of his neighbor. The antelope believed he listened to the bear, and the eagle to the fox, but the coyote, who was craftiest of them all, believed he heard the echoes of far thunder and he was guided thereby.

And he told the owl, who could see in the night, to search all and make sure the messenger of Lla-O had indeed departed. Then flew the owl through the woods and through the paths of the woods and found him gone.

Then spake the coyote, "We who have lost our god, are as children who have lost their father. But shall we like children cry in a circle nor seek a remedy for that which may be restored? For it had been spoken that the heart of Skell shall live although it be possessed by the enemy, and returned to the body, the body shall live and be renewed in all strength and spirit out of the hands of Lla-O and the hands of all other evil ones who disdain it."

Then again the owl arose and flew three times around the spring to make certain no eavesdropper had heard the speech

of the coyote, and each member of the council arose in silence and departed from his place, and each as he departed turned his face for a breath toward the westward whence come and go all spirits.

Now it is a fact, that the god of the up-above, Sneth, who is the most beneficent of all the gods, sees all that befalls beneath the skies. It is he who sends the nourishing rains, and the sunlight and the clouds which beget the rains, and he also it is who sends the snows, although no man understands his reason therefor. Thus from his place in the heavens, he perceived the flight of the missile which was cast by Lla-O and marked its flight. Greatly he wondered that one god should assail another and he was perplexed; for he had loved Skell and had often sought council with him. And in the end, he came to despise Lla-O and to distrust him; and he prepared whirlwinds, and lightnings and thunderbolts against Lla-O, for this god was a prophet who foresaw many things.

The Eruption

Thus came discord upon the world and the first cleavage between gods and men. And it distressed Lla-O when he saw what he had done, but none can consort with evil powers and avoid their poisons. Demons were his cohort, nor could he endure the doubt within him that if mortals and their kind might refuse his commandments, was he longer a god. Even his own people shrank from his presence and marked how he sat, day after day, gnawing his knuckles as an old dog a bone, and flashing the lightnings from his eyes over the skies of the Klamaths.

So after a time, he dispatched a new messenger to the people of the valleys and the chieftain of those peoples stating that if, before the end of the third day the maiden were delivered to him, the Klamath nation should become invulnerable and none would dare oppose them. But if his demand be again refused, he would bring against them all the agencies of his lower world; that the earth should open and swallow up thier houses and the houses of their fellows; and that the heavens should rain stones and fire; and the

yellow water-smoke should come down into the valleys and the funeral dirge be ended, only when there lived no more to chant.

Thus Lla-O sent three days of terror and despair upon the Klamaths, for the maiden was the heart of every man and each would have died to save her from Lla-O if such saving could have been done. And the maiden herself had called them together, for they were as her brothers, and she told them that she should be cast into the trap of Lla-O for the salvation of her people. But they restrained her with thongs about her wrists and about her feet, within her father's house.

So descended the sun upon the third day, nor did it vanish as before, but withdrew itself at the horizon with an amazing cloud of light. Then the people of the valleys who knew that infernal things were about to appear, cast themselves to the ground, and each covered his face that he might not witness the approaching spectre of death.

Thrice the ground beneath their bodies bellied and sank again, until the trees broke their branches against another and great rocks bounded down the mountainsides, driven from their places by what occurred. Then while the whole world seemed to groan aloud with intolerable rupture, and with such a sound as had never before been heard, the throne rock of Lla-O burst upward and outward, and great objects and smaller fell through the air, bearing with them the very stars of the heavens.

Full seven days no sun was seen and there was no way to tell this day from another, and there was no light save the glare of the flaming mountains, and every day of those seven days the yellow water-smoke took toll in agony from those that could not live. And this was the time of fire and torture and rapine in the land, until Tlama, greatest of all the gods, arose in anger and demanded of Lla-O that these things must cease.

But Lla-O had gone mad with the bloodshed and the tumult and he asked of Tlama whether these men had not affronted him, refused his commandments, and was it untrue that the subjects of Skell had tricked him out of his vengeance beneath his very hand. And Tlama knew that Lla-O spake the truth, but he also knew that the fault was with Lla-O, for he had fallen enamored of a mortal woman in defiance of all the gods and continued his quest of her against their wills.

Then again Lla-O demanded of Tlama whether men could prevail against the gods unless they possessed the knowledge of heaven (3) which was a dreadful thing, for then they would match wits against them and there would be neither gods nor men.

So Tlama listened to Lla-O and believed; and he consented that the four wise men of the Klamaths who were also the priests and the doctors and the chiefs of the people (4), should be delivered to Lla-O, to the end that the supremacy of heaven should continue over all things of the earth and that all conflict should be ended thenceforth and forever between them.

The Plan of the Coyote

The children of Skell, in silent groups of two and three, quitted the valleys at the break of day, to assemble far within the lands of Lla-O where the great, frowning rock scowled at its shadow flung across the hills. That was a land of bitter soils and scarce waters, of thin weeds and knotted forests; and the cliffs of that land were banded as a blanket with this color and that.

Now the people of Skell found it strange that although they had come as had been bidden, none was there to greet them and none moved among those hemlocks which were before the great rock. Therefore, after a time, the people of Skell desired protection from the high sun under those trees, but when the eagle sought to alight he fell to the ground with a great shout, for the tree gobbled like a turkey which is like the laughter of evil ones, and sprang out from beneath him. And a noble buck sprang high in the air, for one of the trees had reached out from behind and grabbed his tail, which is the trick of a monster. This being wore the shape of a scorpion and its laughter was like the rustle of a squirrel among dried leaves. Thus it came about that the coyote, who was craftiest of all, knew in truth all these trees to be evil powers. He remembered the messenger of Lla-O who had vanished at the spring, and gave thanks to the spirit of Skell that all there had spoken with silence.

Silently, then, he warned all who were with him to draw together at a distance; then some looked at the heavens and

some looked at the ground, but none of them looked at the creatures of Lla-O who danced around them and stamped upon the ground and laughed until the mountains rang.

But Lla-O had commanded his people to make a peace with the people of Skell, so after they had laughed their fill, they led the way to a feast which had been prepared within the shadow of a mighty cliff. But Lla-O who spied upon them saw that none would eat of the meat for it was the flesh of the valley, and none would break of the acorn bread, for it was shortened with the fat of their fellows.

And Lla-O grew red with anger and demanded that the heart of Skell be brought before them that they might learn who now was God. And when the heart was come, one of the creatures whose shape was that of a scorpion (5) cast it with derision into the air, and another whose shape was that of a fish, leaped up and down crying, "Catch, brother, catch."

Then the coyote, who was craftiest of all, spake to the fox in the silent language; but aloud he laughed in scorn. "How puny a cast for so great a claw," he mocked. "Even the Coney who pants to lift a strawberry, could throw as far!"

"Aye?" cried the fish, who had caught the heart, "and could he cast as far as this?" Then springing up, he loosed a hurl that spun the treasure high and far.

Again laughed the coyote, more harshly than before. "A woman's throw", he sneered, "The elk could strike with his cloven hoof full thrice the distance."

Then up from his rock sprang the god of all things down below and cried in a great voice, "Could Skell himself have cast as far as this?" And bending himself like a bow, he made a mighty hurl which sped the heart high into the air and far into the valley below. And all stood breathless in the presence of such a throw and watched it with outstanding eyes.

Thus they saw the fox, who had waited where the coyote had bade him wait, spring into the air and catch the heart in its flight, and turn toward the valley of the Klamaths.

For the space of five pulses, each froze as he stood, at this audacity, then chaos and tumult burst forth in the land

of Lla-O. Spurring howl with oath, the multitude bore down upon the slowerfooted fox, intent to rend him. But through the horde sped the antelope, who caught the treasure from the gasping fox and leaped before the pursuers, fleeteter than the flight of an arrow. Like the throb of drums were the feet of the followers, but like the rattle of hail were the hoofs of the deer. Marsh whistled the wind in the ears of the chase, but the branches bent after the antelope as he passed, and his shadow only broke the surface of the flowing stream.

But one who took the shape of a shadow sprang at the leaping heels and would have hamstrung them; but the eagle taloned the heart to himself, and with whistling wings swept above the clouds and vanished from the sight of all.

Then again tumult and contention broke out among the people of Lla-O: one saying do this thing, and another do that; until quiet ensued at length, and the voice of the dove (6) was heard over the land (7). And thus all knew that the heart was again with Skell, and fled like mad-men upward into the hills of horror and disturbance from which they had sprung.

The Decision of the Gods

Now this decision regarding the medicine men was a bitter thing to Tlama, for he loved all his subjects. And after great thought, he summoned the God of the up above and held council with him, and he placed the four who had been chosen in that custody and ordained that they be guarded apart from the Klamaths and that none be allowed to approach them.

For these men possessed the art to exorcise evil spirits and to heal the sick and to foresee the future and also to engage in many other things of which the gods had taught them. Such knowledge must depart with them, nor be given to any who should remain.

And when the night was come, he gave each of these ancients a torch and bade them follow him, and he journeyed across the face of the lands and between the forests toward the place of Lla-O and the fates which awaited them.

Thus they went forward in contentment, for they had held council with one another and had agreed that it was right that they should go. For, as they said, they were aged men whose lives were finished in their bodies and whose children had departed in the ways of life, as had been the custom since the beginning.

And they who remained in the valleys watched the torches as they went up the face of the mountains into the land of Lla-O; and each knew that not one of them would return.

So with them departed the secrets of the gods, and no man may say what befell them. That they should burn forever in the bowels of the earth was the punishment of Lla-O. He had opened a great hole in the top of the earth, which he had lined with fires that he might behold them writhing forever.

But Snaith who was the most benign of all the gods, had been hidden here to assemble all his waters, and all his snows, and all his rains; and the greatest of all the gods released these waters within the caverns of Lla-O and the fires thereof were quenched. Thus they remain unto this day.

The rocks still stand here in a great hollow ring, as Lla-O placed them; and between them lie the waters of Snaith; but what may lie beneath the waters no man knows. It is forbidden that man may look on the face of these waters lest he see what is hidden beneath. And the fires of Lla-O are surely vanquished, for these waters are very cold.

Therefore, when there is neither sun nor moon, nor any other way to see, the young men of the Klamaths steal silently and alone, downward to the edge of these waters, that they may once immerse themselves and depart, silently and singly as they came. For the still waters impart a strength and a valor which none other can withstand, and it contains, among other things, the knowledge of the lands and the forests and all that abide in them.

The Decision of Lla-O

Lla-O, brooding over the defeat at the hands of Skell's people became bitter with the review of his wrongs. Power had

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been his, yet at the height of his control, the people of his vanquished enemy had risen against him and had defeated him through strategy.

Thus he resolved to challenge Skell to a test of prowess and strength. And he set out for the land and the house of Skell.

Skell was out hunting, rejoicing in his renewed vigor and his restored life. But Lla-O waited in the house of his enemy until his return.

In face of the challenge, Skell hesitated. He did not want to wrestle, since Skell was not so strong as Lla-O, nor did he care to test his strength against the frenzied hatred of Lla-O.

But his people desired that he rid them of the menace of Lla-O's power, and rather than be branded cowardly by the gods and their peoples he consented to the bout.

So great however was the strength of Lla-O in his madness, that Skell was caught by the wrists and borne on Lla-O's back toward the hole of the fires in the mountain. And Lla-O taunted Skell as they went, with the fate from which there was no escape, that had been prepared.

"You are to be quartered," said Lla-O "And the people of Lla-O wait beneath the great rock for the feast of Skell's flesh which is to be thrown to them."

Skell pondered a moment and knew that it was to be done as was spoken, lest something shift the power from his enemy to him.

Then he asked that one arm be freed. "A louse is biting me," he said, "and I must scratch."

Lla-O shook the mountains with his laughter. "Why do you worry about a little thing like that," he said, "When in a few minutes you are to be thrown to my children?"

Yet Skell insisted that his last wish be granted. And when he had one of his arms free, he drew forth his great knife and cut Lla-O's head from his body. Great was the tumult in the fire mountain; as the rocks lifted and groaned and sides of the mountain shook. Yet the people of Lla-O thought it was

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but the triumphant return of the god of the down-below, and waited anxiously for the feast that had been promised them. And Skell sent a false message that it was Skell who had been killed and that the people of Lla-O should gather beneath the scowling cliff for the banquet.

Then on the rock which had been his throne, Lla-O was quartered and the blood drenched the cliffs around the chasm with red, and as each quarter was thrown over the people of Lla-O tore it asunder and swallowed it with great shouts of joy. Thus was the body of Lla-O destroyed. But when the head of Lla-O was thrown into the pit, his people recognized the familiar face and would not touch it. Today it lies where it fell within the lake, and strangers call it Wizard Island, yet those who know speak of it as the head of the vanquished Lla-O.

The stones within the chasm ceased their groaning with the destruction of Lla-O's body, and the fires died in great clouds of smoke, and all became dark and still. And the bereaved people of Lla-O gathered around the edge of the silent abyss, and shed their tears for the fate of Lla-O. And their tears fell within the dark pit. Today, the tears shine as clear and silent as they fell from the people of Lla-O, but we know them as Crater Lake.

Sources and Footnotes

- (1) The Klamath Indians might not speak of their own dead, although they frequently spoke of vanquished enemies. Due to such religious practices, it was extremely difficult to obtain their legends from them. For that matter the number of legends was obviously limited by their beliefs.
.....Mrs. DeFault
- (2) There is reason to believe that the huckleberry had special significance for the Klamaths. Long treks were accomplished during the season of their ripening. They were probably among the extremely few sweets that the Indians had.
.....Count, Mrs. DeFault
- (3) Heaven, as a place, was completely unknown among the Klamaths, since their religion did not include such an expectancy. The term is used here only as a substitute for a term which is not included in our language.
.....Count, Mrs. DeFault from Colvig
- (4) Medicine men, as such, were unknown among the Indians of the Klamath region. But the chiefs, who really had little more than social position and wealth, rather than actual political power, held vaguely the positions of doctors and wisemen to some extent.
.....Steel, Count
- (5) In Steel's account, the scorpion is changed to that of a weasel who was recognized as Lla-O's brother. The coyote and the weasel both have figured prominently in the folklore of many western tribes. Other than the change from Mrs. DeFault's scorpion to Judge Steel's weasel, the legend is unchanged.
.....Thomas
- (6) The Indians say that a dove, though near, still sounds as though it were a long distance away. Steel in his account, says for that reason the people of Lla-O gave up the chase.
.....Thomas
- (7) Note the songs of Solomon, 11, 12.
.....Count, Mrs. DeFault

- (8) This part of the legend is written up from earlier accounts by Judge Steel, who procured his information from the chief of the Klamaths through an interpreter. Judge Steel's personal account of the difficulty encountered in bribing the chief is of extreme interest from the standpoint of typical Indian reticence. A number of newminted dollars changed hands from Judge Steel to the interpreter before the chief could bring himself to tell the legends.

It is interesting to note that the history of the Indians in this region may easily have included the last eruptions of Wizard Island. The legend with its description of the seven days of death and destruction would seem to bear out the fact that many of the Indians were killed in the eruption of the volcano.

Mrs. DeFault, born Susie Brown, was a Klamath Indian girl, educated in the Indian schools. She married a French-Canadian and I understand lived in Europe for some time. From her cosmopolitan viewpoint she has given us much of the material as it is written up today. Dr. Applegate has been kind enough to give us this brief sketch of her life. At the present time, August, 1934, she is living somewhere in California.

Judge Steel, through his early contacts with the Indians, has given us much material that otherwise would have been lost to us.

Earl Count, during his period as assistant to the Park Naturalist, was able to procure much information for us through interpreters and the older Indians; and also has given us some of the ethnological background of the Klamath Indians.

(This paper was prepared by Ranger-Naturalist W. C. Thomas under the direction of Warren G. Moody, Acting Park Naturalist - 1934)

IV

HISTORY OF CRATER LAKE IN BRIEF

R. P. ANDREWS

History of Crater Lake - R. P. Andrews

HISTORY OF CRATER LAKE IN BRIEF

R. P. ANDREWS

1853 - John Wesley Hillman and a group of prospectors discovered the lake and named it Deep Blue Lake.

(Cf. Steel Points, Vol. I, No. 2, January 1907)

1862 - Chauncey Nye and party of prospectors, unaware of the previous discovery, accidentally visited the lake, Oct. 21.

1865 - Soldiers from Fort Klamath, while on hunting expedition, visited the lake and named it Lake Majesty.

1869 - Jim Sutton, accompanied by David Linn and family of Jacksonville visited the lake and named it Crater Lake. The same year William Gladstone Steel, as a schoolboy, read a newspaper article telling of the discovery and determined to visit the lake.

1873 - J. S. Diller, geologist, and Everett Hayden of the U. S. Geological Survey visited the lake.

1884 - First photograph, a daguerreotype, taken of Crater Lake by Peter Britt.

1885 - First visit by William Gladstone Steel. Mr. Steel suggested that a national park be established and a petition was sent to President Cleveland.

(Cf Steel Points, Vol. I, No. 2, January 1907)

1886 - A presidential proclamation withdrawing ten townships (including Crater Lake) was issued. Lake surveyed and sounded by U. S. Geological Survey.

(Cf Report C. E. Dutton to Chief, U.S.G.S., July 1, 1887)

1888 - First fish planted in Crater Lake by William Gladstone Steel.

1896 - The Mazamas, mountaineering club from Portland, visited Crater Lake and christened the ancestral mountain, of which only the caldera remains Mt. Mazama.

History of Crater Lake - R. P. Andrews

1902 - Crater Lake National Park created by congressional action and approved by President Theodore Roosevelt. First superintendent W. F. Arant, appointed.

1907 - First automobile driven to rim of Crater Lake by Charles True of Medford. The Wocus, first boat for public service, placed on the lake.

1912 - First congressional appropriation passed for developing a highway system in the park. Crater Lake Lodge, the oldest structure now existing in the Rim area, was built - visitors, 5235.

1916 - National Park Service Act passed October 25.

1919 - Rim Road around Crater Lake completed. Visitors 16,645.

1925 - Plaque in honor of John Wesley Hillman, the discoverer, placed at Discovery Point. Visitors 65,018.

1926 - Utility area and residence development at Government Camp started. Mount Scott fire Lookout constructed. Naturalist activity inaugurated by Dr. Loye Miller. Visitors 86,019.

1927 - Crater Lake Ski Club organized and first annual ski races held.

1928 - Crater Wall Trail completed. Housekeeping cabins and cafeteria constructed. Visitors 113,323.

1930 - Park roads cleared of snow by snowplow, hastening access to the Lake by two to three months. Visitors 157,693.

1931 - Beginning of new standard-grade Rim Road. Sinnott Memorial and museum completed and dedicated. Visitors 170,284.

1932 - The Watchman Observation Station completed. A combined fire lookout and museum on top of the Watchman. Also a donation by W. G. Steel of a collection of photographs of the pioneers identified with the discovery and development of Crater Lake National Park.

History of Crater Lake - R. P. Andrews

References:

Oregon Out of Doors - Crater Lake

Vol. 1, No. 2, 1922

Steel Points, Vol. I, No. 2, January 1907

Report of Capt C. E. Dutton to Chief, U.S.G.S., July 1, 1887

(This paper was prepared by Ranger-Naturalist R. P. Andrews under the direction of Warren G. Moody, Acting Park Naturalist, 1934)

V

ANNOTATED LIST OF THE VERTEBRATES OF CRATER LAKE

BERRY CAMPBELL

List of Vertebrates - B. Campbell

ANNOTATED LIST OF THE VERTEBRATES OF CRATER LAKE PARK

BERRY CAMPBELL

AMPHIBIANS

1. Water dog, Western Newt. Triton torosus

This species is common under the rocks at the shore of the lake and also in Copeland Creek in the Western part of the Park. They seem to be entirely aquatic here, though in Southern California there is a well defined terrestrial stage. They differ from those of the south also in being more highly colored.

2. Long Toed Salamander - Ambystoma macrodactylum

This species is abundant in springy places throughout the park and also along the shore of the lake. Larvae are abundant in the Beaver Ponds on Copeland Creek.

3. True's Frog - Ascaphus truei

This unusual frog is fairly common in Bybee Creek several miles above the park boundary. I first found it with the aid of a flashlight, late in the evening. They were all sitting upon logs or stones just out of water. In the daytime they spend their hours on the bottom of the deeper pools, apparently never coming to the surface. They are of great interest to zoologists, because they are the only representatives in this country of an Asian family.

4. Northwestern Toad - Bufo boreas boreas

This toad is found throughout the park. It is fairly abundant in the Crater on Wizard Island. I have seen their eggs in the lake in early July. The species is quite independent of the lake and streams except during the breeding season. They hop around at night catching insects, at which time they are most often seen.

List of Vertebrates - B. Campbell.

5. Pacific Tree Toad - Hyla regilla

At Twin Springs, in the northwest section of the park, these tree toads are quite abundant. I am told by Ranger-Naturalist Stanley Brode that this species is to be found in the lake. This species has a very loud voice and in the Spring it sings in choruses. Like other members of the tree-toad family, it has pads on the tips of its toes which enables it to stick to a smooth surface, such as glass, with no trouble. In spite of its name, this species is practically never found in trees. It has an interesting ability to change its color, according to its environment, from brilliant green to tan.

6. Spotted Frog - Rana pretiosa pretiosa

This species is found in abundance in all the streams in the park also in the lake. It is found only in the vicinity of water, from which it strays sometimes as much as one hundred yards at night.

REPTILES

7. Garter Snake - Thamnophis sirtalis infernalis

This snake is abundant about the Beaver ponds on Copeland Creek and moderately so on the shores of the lake and Wizard Island. It is the only snake as yet reported from the Park.

8. Alligator Lizard - Gerrhonotus sp.

Ranger-Naturalist Stanley Brode says that one was collected last year somewhere on the lake shore.

9. Horned Toad - Phrynosoma sp.

I saw a specimen of this species which had been caught by the CCC boys of Wineglass Camp in the woods several miles down on the motorway which leaves the Wineglass and goes toward the north boundary.

List of Vertebrates - B. Campbell.

BIRDS

10. (I have included in the bird list those species which have been reported by previous naturalists. Dr. Loye Miller recorded seventy three species, E. U. Humuth three, and D. S. Libbey, one, but apparently no record was kept of who recorded what bird. In the following list, I have indicated in every case those birds which I have observed myself. It is evident that the bird list is far from complete. I have had indications that there have been loons, grebes, many different species of ducks, and geese on the lake. Duck Hawks, several species of owls, several species of sparrows, vireos, and warblers have yet to be recorded from here, though they are almost undoubtedly present.)

11. California Gull - Larus californicus.

Reported as being seen occasionally on the lake. I have seen several Gulls, but they were juveniles and I was unable to identify them.

12. Canvas Back Duck - Aristonetta valisneria.

Reported as an occasional migrant.

13. Barrow Golden-eye Duck - Glaucionetta islandica

Reported as a rare breeder.

14. Black Crowned Night Heron - Nycticorax nycticorax hoacfli.

I saw one of these birds fly along the shore of Wizard Island early in July (1934)

15. Spotted Sandpiper - Actitis macularia.

This bird is a common breeder on the shores of the lake. As one walks along the shore, they fly to some vantage point on a boulder and give their whistling "peetweet". For some unknown reason, they never stand still but bob up and down.

16. Solitary Sandpiper - Tringa solitaria cinnamomea.

There is a record of this bird having been seen in Munson Valley.

List of Vertebrates - B. Campbell.

17. Killdeer - Oxyechus vociferus vociferus

This reported to be an occasional visitor to Wizard Island.

18. Sierra Grouse - Dendragapus fuliginosus sierrae

This bird is a common resident in the park.

19. Cooper's Hawk - Accipiter cooperi.

This bird is a rare resident in the forests. I have not seen this species.

20. Sharpshinned Hawk- Accipiter velox velox.

Several times during the middle of August (1934) I saw these birds fly by the Sinnott Memorial. The habits of this and the preceding hawk are similar. Their method of catching their prey, chipmunks and birds, is to fly at high speed around the ridges of the inside of the crater and pounce upon anything on the other side. They often fly silently through the trees and catch birds on the wing.

21. Western Red-tail Hawk - Buteo borealis calurus

This is a summer resident in the park and is the commonest of the large hawks. This hawk is one of the soaring type and lives nearly exclusively on small mammals. I found a nesting pair near the motorways at the head of the Castle Creek drainage.

22. Marsh Hawk - Circus hudsonius.

This is reported to be a rare bird at the rim. I have observed it twice, once at the rim camp and once at Sentinel Point. It is a common species at Fort Klamath.

23. Swainson Hawk - Buteo swainsoni.

This is one of species of soaring hawks to be seen in the park. It is not as common as is the Western Redtail.

List of Vertebrates - B. Campbell.

24. Golden Eagle - Aquila chyscoetos.

This species is recorded from Garfield Peak. I have seen none.

25. Bald Eagle - Haliaeetus leucocephalus leucocephalus.

A breeding pair has been seen several years on Wizard Island. This year I saw one of these birds frequently along the shore below Applegate Peak but was unable to locate any nest.

26. Sparrow Hawk - Falco sparverius sparverius.

This trim little hawk is abundant throughout the park, wherever there are open spaces. I saw them commonly on the rim.

27. Prairie falcon - Falco mexicanus.

Recorded as breeding on Llao rock. I have seen none.

28. Pigeon Hawk - Falco columbarius bendirei.

There were two records of this bird on the old list. I saw one from the Sinnott Memorial, August 17, 1934.

29. Horned Owl - Bubo virginianus subsp.

This owl is a common resident of the park. I have seen it at the beginning of the Discovery Point trail and at Twin Springs and I have heard its call in Sun Notch and Crater Peak.

30. Spotted Owl - Strix occidentalis occidentalis.

I have heard this Owl call on Copeland Creek about the first of July this year (1934)

31. Kingfisher - Ceryle alcyon caurina.

This recorded from Wizard Island.

List of Vertebrates - B. Campbell.

32. Hairy Woodpecker - Dryobates villosus orius.

This bird is common throughout the park but I noticed that none were to be seen on the rim until the summer was about half over.

33. white-headed Woodpecker - Dryobates albolarvatus albolarvatus.

This species was recorded in the transition zone of the southern edge of the park by Mr. Evans, the ECW wildlife expert, 1934.

34. Arctic Three-toed Woodpecker - Picoides arcticus.

Recorded as fairly abundant in Munson Valley. Mr. Evans has so observed it at the Government Headquarters.

35. Williamson Sapsucker - Sphyrapicus thyroideus.

I believe this bird to be fairly abundant down off of the rim. I have collected it at Pole Creek. This species is peculiar in that the female bears little resemblance to the male and was at first described as a distinct species. This extreme sexual dimorphism is rather unusual in Woodpeckers. The name Sapsucker is derived from the fact that it lives on the sap and cambium of the trees. It drills a series of small holes in the bark and then goes over them and licks out the pitch with its bristly tongue.

36. Red-breasted Sapsucker - Sphyrapicus varius ruber.

This bird seems to be fairly uncommon hereabouts. I have seen it only once, at Arant Point. There were no previous records.

37. Northern Pileated Woodpecker - Ceophloeus pileatus picinus.

This may be adjudged a rare bird at Crater Lake. I have not seen it nor has Mr. Evans. Its workings, however, are quite evident on fallen logs and stumps. These may be recognized by their enormous size, being many times as large as the workings of other woodpeckers.

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38. Red-shafted Flicker - Colaptes cafer collaris.

This woodpecker is common throughout the park. Its call may often be heard from the parapet of the Sinnott Memorial.

39. Pacific Nighthawk - Chordeiles virginianus hesperis.

This bird is commonly seen about the park. I have seen several at Skiddoo Lake, some along the west boundary, and a number of them over the rim camp. The half buzzing half whistling call is distinctive. Often in their gyrations, they drop a long distance and then brake themselves with rigidly held wings. This produces a loud whirring or booming noise that is often heard early in the evening. They roost and nest on the ground and when doing so are quite invisible because of their protective coloration. They live entirely upon insects which they catch on the wing.

40. Rufous Hummingbird - Selasphorus rufus.

This bird is a common summer resident in the higher portions of the park, at least. The Garfield Peak Trail between the first and second switchbacks fairly swarms with them in early July. They are attracted by the flowers, particularly the Phacelia. This species is one of the first to leave the park. About the 25th of July this year they suddenly left to go south.

41. Calliope Hummingbird - Stellula calliope.

This species is fairly abundant lower down in the park. I have seen them in the meadows.

42. Olive-sided Flycatcher - Nuttallornis borealis.

In the spring, the call of this bird may be heard constantly from inside the rim. The species is also abundant on Wizard Island. Their call is very distinctive and sounds like "What-peeves-you?"

43. Western Wood Pewee - Myiochanes richardsoni richardsoni.

This bird is reported as fairly common in the park. ..

List of Vertebrates - B. Campbell.

I have seen few, but suspect that they are quite common in the lower elevations. I found them extremely abundant at Agency Lake.

44. Western Flycatcher - Empidonax difficilis difficilis.

This bird is especially abundant inside the rim, but its call is to be heard nearly anywhere in the park. It is to be distinguished from the other small Flycatchers by its note - a sharp, high "pee-ist."

45. Wright Flycatcher - Empidonax wrighti.

This is reported as fairly common in forested areas. I have identified it positively only once, near Bald Top Mountain.

46. Steller's Jay - Cyanocitta stelleri subsp.

In the early part of the summer this bird was abundant in the Transition and Canadian forests but absent on the rim. Towards the latter part of August, however, they appeared up on the rim and became quite numerous. Like most other members of the jay tribe, they are both noisy and gregarious.

47. Oregon Jay - Perisoreus obscurus obscurus.

These curious birds are found most often in the Hudsonian zone, in the Hemlock forests. They are rather quiet for Jays, and seldom indulge in raucous scoldings as to both Steller's Jay and the Clarke Nutcracker. Still, when occasion demands, the woods resound to their shrill call. The young may easily be told from their elders by their dark color. They lack the white markings on the head.

48. American Raven - Corvus Corax sinuatus.

Nearly all summer long Ravens could be seen or heard from the Sinnott Memorial. A pair of them nested somewhere on the cliffs - probably over near Hillman Peak - and from the middle of the summer on the whole family of five or six would be seen sitting in a dead tree somewhere inside the rim. Once I rushed out of the Information Bureau to see the flock of hawks which was soaring over the lake only to find that it was the Raven family out for an airing.

List of Vertebrates - B. Campbell.

49. Clarke Nutcracker - Nucifraga Columbiana.

This bird is very common at the rim camp and in all the higher country of the park. It seems to be especially partial to the areas where the white-barked pine is in abundance. In such places they will collect in sizeable flocks and keep up a continual racket. They are very easily recognized by means of their long heavy beaks and the white markings on their wings and tail. They are often to be seen at the drinking fountains along the rim walk.

50. California Jay - Aphelocoma californica subsp.

There is one late summer record of this bird.

51. Western Meadowlark - Sturnella neglecta.

Shortly after six P. M., September 19, 1934, I saw three of these birds in the meadow behind the lodge.

52. Western Evening Grosbeak - Hesperiphona vespertina brooksi.

This is reported as an occasional summer visitant. It was, according to reports, abundant on the rim in 1927. I have seen none of this species.

53. Cassin's Purple Finch - Carpodacus cassini.

This bird is very abundant on the rim and on Wizard Island. Its song is one of the finest to be heard in the park.

54. Red Crossbill - Loxia curvirostra bendirei.

Reported from the park, but I have seen none.

55. Hepburn Rosy Finch - Leucosticte taphracotis littoralis.

This bird is reported as common on snow banks. Possibly because there has been so little snow this year, I have seen none of this species.

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56. Pine Siskin - Spinus pinus pinus.

Pine Siskins are abundant on the rim and often attract attention as they fly around with their plaintive little call.

57. White Crowned Sparrow - Zonotrichia leucophrys leucophrys.

There is one record of this bird from Munson valley. I have neither seen nor heard any.

58. Western Chipping Sparrow - Spizella passerina arizonae.

This is one of the commonest of the summer birds. They are abundant along the rim walk during the latter part of the summer when the young ones have grown up. In June, their monosyllabic song may often be heard in the camp ground.

59. Thurber's or Sierra Junco - Junco oreganus thurberi.

This is a common summer resident and may be seen at all times along the rim. It is also distributed throughout the park - mainly in meadows. I have seen it on Wizard Island.

60. Lincoln's Sparrow - Melospiza lincolni lincolni.

Very common throughout the park in the willow thickets along the streams. I have caught them in mouse traps in Munson Valley. Their song resembles that of the song sparrow quite closely.

61. Fox Sparrow - Passerella iliaca subsp.

I saw one of these birds on the rim walk August 11, 1934. Later on, in September, I found them a common migrant along streams.

62. Green-tailed Towhee - Oberholseria chlorura.

These appeared this year during the last week in August. They are most often seen at the head of the lake trail.

63. Black-headed Grosbeak - Hedymeles melanocephalus melanocephalus.

This is reported as a late summer migrant. I have seen none.

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64. Lazuli Bunting - Passerina amoena.

This is fairly abundant in the meadows. I have found them along Bybee, Castle, and Copeland Creeks. They persist in singing from the very tiptop of the largest dead tree about.

65. Western Tanager - Piranga ludoviciana.

These birds are common summer visitors throughout the park. For some reason or other I have seen none since the middle of August.

66. Violet Green Swallow - Tachycineta thalassina lepida.

This is reported as a common summer resident - I saw none.

67. Cedar Waxwing - Bombycilla cedrorum.

I saw a juvenile of this species at the head of the lake trail September 1, 1934. It was feeding on the Red-berried Elder.

68. Cassin Vireo - Vireo solitarius cassinii.

This is reported as a late summer migrant. I saw none.

69. Calaveras Warbler - Vermivora ruficapilla ridgwayi.

This is reported as a late summer migrant along streams. I have not seen it.

70. Audubon Warbler - Dendroica auduboni auduboni.

This is a very common summer resident throughout the park. They outnumber the other resident warblers ten to one, I believe. Because of their conspicuous markings, they are particularly useful for tourist instruction. Any bird with five spots of yellow is an Audubon Warbler, and it is some satisfaction to a beginning student to be able to identify a warbler. On Grey back ridge, I have seen them in large numbers flycatching

List of Vertebrates - B. Campbell.

in the open from the old stumps and from rocks. In Southern California, where they are an abundant winter resident, they feed this way nearly exclusively, and it is interesting to note them doing this here in the fall before they migrate.

71. Black-throated Gray Warbler - Dendroica nigrescens.

Though this has been reported from the rim, I have failed to find any. It would be quite unusual to find the bird breeding in this high life zone.

72. Hermit Warbler - Dendroica occidentalis.

This is reported as a rare resident and a common migrant. I saw none before the migration season, but Mr. Evans reported seeing several. I have seen them here during migration, and agree that they are a common migrant.

73. McGillivray Warbler - Oporornis tolmiei.

This is listed as a common summer migrant. I found it at Twin Springs in the northwestern portion of the park and at Godfrey Glenn.

74. Pileolated Warbler - Wilsonia pusilla pileolata.

A male in full plumage killed itself by flying into the window at the Sinnott Memorial in August. It was probably a migrant.

75. Northern Water Ouzel - Cinclus mexicanus unicolor.

This is a common resident along the streams. I have also seen them on the lake shore.

76. Dipper, Water Ouzel - Cinclus mexicanus.

In many of the streams in the park, this gray chunky bird may be seen as it flies along the streams or teeters on a rock in the Cascades. It is not unusual to see them wading about, half submerged, in the swiftest waters. I have seen these birds at Boundary Spring and at Twin Spring and even on the shore of the lake. Apparently they are resident in this area the year around.

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77. Rock Wren - Salpinctes obsoletus obsoletus.

This bird breeds commonly on the rocky cliffs near the rim, particularly along the Garfield Peak Trail. It is curious that its song should resemble that of a Mockingbird very closely.

78. Seattle Wren - Thryomanes bewicki calophonus.

This is reported as a late summer migrant.

79. Western House Wren - Troglodytes aedon parkmani.

Reported as rare.

80. Western Winter Wren - Nannus hiemalis pacificus.

Reported as fairly common in woods. I saw one at Boundary Spring.

81. Sierra Creeper - Certhia familiaris zelotes.

This I have found to be fairly abundant in the Hemlock forests. Its strange habits make it one of the most interesting of birds. It is curious to note that while this bird and the Nuthatches obtain their living in the same way, namely by picking tiny insects from crevices in the bark, their mode of progression is quite different. The Nuthatch clings to the bark with its feet and is able to climb upwards or downwards with impunity. The Creeper, on the other hand, relies upon its woodpecker-like tail for support and consequently can climb upwards only.

82. Slender-billed Nuthatch - Sitta carolinensis aculeata.

I have found this bird only once, on Grayback ridge a short distance below the East Entrance Road. It is reported as a rare resident.

83. Red-breasted Nuthatch - Sitta canadensis.

This bird is very common throughout the park. I have seen it frequently in the White-barked pines on the summit of Garfield Peak.

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84. Pygmy Nuthatch - Sitta Pygmaea "pygmaea"

This bird is rare in the park. I have seen only one flock. That was on Grayback Ridge.

85. Bailey Mountain Chickadee - Penthestes gambeli baileyi.

This is a common resident throughout the park. They have three characteristic calls. One is a chattering "Chickadee" Another is a long drawn out plaintive whistle which sounds like "here, Phoebe". The third is a bubbling little song.

86. Western Golden-crowned Kinglet - Regulus satrapa olivaceus.

This is a common summer resident throughout the park. It is most conspicuous in a forest of young trees, for then it comes down low enough to be seen. In the mature forest, it is always at the tree-tops and noticeable only because of its quiet little call.

87. Western Ruby-crowned Kinglet - Corthylio calendula cineraceus.

This is reported as rare at low elevations.

88. Townsend Solitaire - Myadestes townsendi.

I have found this to be moderately abundant in the Hemlock Forests away from the rim.

89. Russet-backed Thrush - Hylocichla ustulata ustulata.

This bird is a common summer resident along the streams in the Western portion of the park. It is nearly always in Willow thickets.

90. Sierra Hermit Thrush - Hylocichla guttata sequoiensis.

This is a common summer resident in the dense forest. It is seldom seen, but often heard. When seen, they are usually on the ground, or if singing, in a low tree or on a stump.

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91. Varied Thrush - Ixoreus naevius subsp.

This is a rare summer resident. Early in July I have heard one at the spring about a mile down the Old Pioneer Trail.

92. Western Robin - Turdus migratorius propinquus.

This is a common summer resident throughout the park.

93. Mountain Bluebird - Sialia currucoides.

This is common in the open places about the rim and further down wherever there are burnt over areas.

MAMMALS

I have taken Stanley G. Jewetts list, the original of which may be found in the files, and enlarged it in those matters which I believe to be of particular interest to the naturalist staff.

94. Alpine Mole - Scapanus latimanus alpinus.

This animal was known first from Crater Lake. "It is fairly common but nowhere abundant. To be looked for in the Lodgepole Pine timber where there is a good growth of squaw grass".

95. Gibbs Mole - Neurotrichus gibbsi gibbsi.

"This is the miniature edition of the common mole, in appearance being half mole and half shrew. Found about woody places and under decaying logs and vegetation."

96. Wandering Shrew - Sorex vagrans vagrans.

This tiny animal is probably abundant over the entire area. I have found it abundant in Munson Valley in the runways of the Giant Meadow mice.

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97. Water Shrew - Sorex palustris navigator.

An interesting animal found along the streams of the park. It is abundant in Munson valley. The species is aquatic and are seen only in or at the edge of the water. They usually swim beneath the surface. Their close pelage and large bristly hindfeet are adaptations and specializations for such an existence.

98. Large Brown Bat - Eptesicus fuscus fuscus.

Has been reported from the park.

99. Silver-haired Bat - Lasionycteris noctivagrans.

Has been reported from the park.

100. Black Bear - Euarctos americanus americanus.

Common throughout the park.

101. Raccoon - Procyon lotor pacifica.

Reported this year from the Government Camp area by the Chief Auditor.

102. Pacific Marten - Mustela caurina caurina.

"During the early days of few trappers, Crater Lake was within the area of greatest abundance of this species. Has been trapped out considerably but is believed to be holding its own at the present time." It has been seen this year (1934) at the Watchman Lookout, on the Lake Trail, at Annie Spring, and on Garfield Peak.

103. Mountain Weasel - Mustela arizonensis.

Found commonly throughout the park. Seen at rim and government headquarters this year.

104. Pacific Mink - Mustela vison energumenos.

Formerly common on all streams in the park.

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105. Little Spotted Skunk - Spilogade phenax latifrons.

Reported by Jewett as occurring at the West entrance of the Park.

106. Large Striped Skunk - Mephitis occidentalis subsp.

Probably to be found in the transition zone east of the divide.

107. Badger - Taxidea taxus neglecta.

Moderately common over the entire park area. It digs out ground squirrels, gophers, and other small rodents.

108. Red Fox - Vulpes cascadenis.

Formerly common in the Crater Lake Area, now much scarcer.

109. Coyote - Canis lestes.

Common throughout the park. I have heard them at Skiddoo Lake. Mr. Evans saw one near Union Peak.

110. Timber Wolf - Canis gigas.

Formerly common in the Rogue River watershed, possibly occasional in the park.

111. Mountain Lion, Cougar - Felis oregonensis oregonensis.

Formerly common in the entire area but now restricted to a few localities, possibly invading the park at times.

112. Bobcat - Lynx fasciatus.

Possibly occurs in the park.

113. Marmot - Marmota flaviventris flaviventris.

This is abundant throughout the higher elevations in the park.

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114. Golden Mantled Ground Squirrel - Callaspermophilus chryso-
sodeirus chrysoideirus.

This Ground Squirrel is ubiquitous throughout.

115. Allen Chipmunk - Eutamias townsendi senex.

This is the larger, more darkly colored of the two chipmunks. Its range within the park is not known, though it is probably extensive.

116. Klamath Chipmunk - Eutamias amoenus amoenus.

This is the smaller, brightly colored Chipmunk which is found throughout the park area. It is commonly seen on the rim.

117. Cascade Pine Squirrel - Sciurus douglassi cascadenis.

"This is the common pine squirrel throughout the park area". Its habit of scolding and chattering at intruders that walk through the forest makes it conspicuous. In this habit it resembles the Eastern Red Squirrel. Its food supply is largely the nuts from the coniferous trees. I have watched one out on the branches of a tall Hemlock tree biting off the cones. With a single nip it would sever the stem and the cone would fall to the ground to be picked up later and either eaten or stored. Their work may be seen near the top of Garfield Peak where they eat the White Barked Pine and leave a pile of scales. This differs considerably from the work of the Clarke Nutcracker which leaves the core of the cone intact with the pockets for seeds showing plainly.

118. Alpine Flying Squirrel - Glaucomys sabinus fuliginosus.

"This is the species usually encountered in the lodgepole thickets along the Cascade Range". This and the following subspecies are very nocturnal in habit, and for this reason are seldom observed. They live in holes in the trees and may be occasionally frightened out in the daytime by pounding on the base of the tree.

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119. Klamath Flying Squirrel - Glaucomys sabinus klamathensis.

"Found on the east base of the mountains and should be looked for in the Yellow Pine timber on the east boundaries of the park."

120. Pocket Gopher - Thomomys mazama mazama.

Very common throughout the park where it may be noted by means of the mounds of dirt which are thrown out of their burrows. Their ecological function in plowing up the soil is not to be passed by lightly. Darwin's earthworms were not nearly so efficient as these burrowers. They are solitary animals and remain entirely beneath the ground at nearly all times, venturing part way out of their burrows only occasionally to pull down plants and leaves. In their cheeks they have fur-lined pouches in which they carry food. I have found them with these pockets stuffed with roots. They do not hibernate in the winter but tunnel ceaselessly beneath the snow. In the spring, when the snows melt, cylinders of earth may often be seen lying on the surface of the ground. These are the result of their filling up old burrows in the snow with earth from a deeper burrow. To keep weasels and other undesirable visitors out of their homes, they always plug up the openings with soil and pebbles.

121. Beaver - Castor canadensis pacificus.

This is quite common on the Western boundary of park. I have observed extensive workings on Copeland Creek and understand that they are to be found on Red Blanket Creek and Castle Creek. The residents here believe that they are distinguished from the regular Beaver by their habits of making their dens in burrows in the banks, but the distinction is not a valid one. I have seen a typical lodge on Copeland Creek. The workings which I have seen have been on Lodgepole Pines.

122. Gambel White-footed Mouse - Peromyscus maniculatus gambeli.

This is ubiquitous in the park and is to be found in every habitat from moist boggy places to talus slopes and deep woods. It is particularly abundant and harmful about the lodgings.

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123. Western Wood Rat - Neotoma cinerea occidentalis.

"This is the common pack rat of the talus slopes and which invades cabins and outbuildings whenever they can gain entrance".

124. Red-Backed Mouse - Evotomys mazama.

This interesting mouse, first known from Crater Lake Park, is found in the forest - especially the Shasta Red Fir forest in the Cascades. I have found them in Munson Valley.

125. Long Tailed Meadow Mouse - Microtus mordax sierrae.

Found about streams and moist places and has a longer tail than most meadow mice. It does not make conspicuous runways but wanders at will where it can find food.

126. Giant Meadow Mouse - Microtus richardsoni arviculoides.

"This is the largest of any of the meadow mice found in the Cascades where they live in grassy meadows along streams or in springy places on the mountain slopes. Fully adult specimens are almost as large as the pocket Gophers inhabiting that region. They make conspicuous runways about their homes, and can be easily found by locating these runways and noting the cut sections of grass where they have been feeding".

This species is very common in Munson Valley.

127. Baird Meadow Mouse - Microtus bairdi.

"Not so common as the other meadow mice and much the smallest of the group. Found in moist meadows and on the drier grassy slopes. They make conspicuous runways on their feeding grounds."

128. Alpine Phenacomys - Phenacomys intermedius intermedius.

This small grayish and chunkily built mouse lives principally in the heather meadows and damp, grassy alpine flats,

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129. Aplodontia - Mountain Beaver - Aplodontia rufa.

This is an animal of the mountain springs and meadows. It makes large burrows, and like the Cony, cuts grass to store. I, myself, have not found them in the park, but some were taken by A. Brazier Howell a number of years ago.

130. Mountain Jumping Mouse - Zapus montanus.

This mouse, which was known first from Crater Lake Park, is one of the most interesting mice in the region. It is of a yellowish brown color with an extremely long and conspicuous tail. The hind legs are greatly developed and specialized for jumping. It is found in the patches of tall grass in the moist places. I have found them at the spring along the road above government camp and in the Munson Valley.

131. Porcupine - Erethizon epixanthum epixanthum.

Moderately common throughout the park. It lives principally on the inner bark of trees. It does not hibernate but is active all winter.

132. Cony - Ochotona princeps brunnescens.

Very common on rock slides about the rim and near the shore of the lake. The high pitched squeak is characteristic. They are not nocturnal as are most rodents but are most active in the daytime.

133. Snowshoe Rabbit - Lepus washingtonii klamathensis.

Very rare or absent in the park. Found near Fort Klamath.

134. Columbian Black-tailed Deer - Odocoileus columbianus.

"This is the common deer throughout the Cascade Range and westward to the Pacific slope. It is replaced on the east by the Mule Deer". The deer seen during the summer are a rich brownish red in color. This color is lost with the

List of Vertebrates - E. Campbell.

change to winter pelage when the deer take on a bluish grey cast. This species is not resident in the park but migrates down into the Rogue River drainage during the winter where the weather is less severe. Thus they are exposed to hunting and their number depleted. The exact effects of this are not known.

135. Mule Deer - Odocoileus hemionus hemionus.

This species has been reported by Merriam as straying into the Mount Scott district. It is essentially arid country form.

136. White-tailed Deer - Odocoileus leucurus.

This species is said to range into the park on rare occasions.

137. American Elk or Wapiti- Cervus canadensis canadensis.

The native Elk in this region, the Western Wapiti, Cervus canadensis occidentalis, was extinct or nearly so in 1915 when a herd of 15 animals from Wyoming was brought in and liberated at Fort Klamath. Whether this herd thrived or not and whether the few that come into the southern boundary of the park belong to this imported race or the native one is not known, but it is probable that they are the Rocky Mountain form. While none have been sighted this year, the tracks of a small band have been seen by Mr. Evans in the Yellow Pine belt in the southeast corner of the park.

138. Antelope; Prong Buck - Antilocapra americana americana.

"Formerly antelope ranged over the Klamath basin and at least up to the early '90's', occasionally small bunches invaded the area now embraced within the park at least into Pumice Prairie between Crater Lake and Diamond Lake".

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REFERENCES

Anthony, H. E., Field Book of North American Mammals 1928
American Ornithologists Check List of North American Birds, 1931

(This paper was prepared by Ranger-Naturalist, Berry Campbell under the direction of Warren G. Moody, Acting Park Naturalist, 1934.)

VI

SOME NOTEWORTHY PLANTS PECULIAR
TO THE CRATER LAKE REGION

ELMER I. APPLGATE

Noteworthy Plants of Crater Lake - Elmer I. Applegate

SOME NOTEWORTHY PLANTS PECULIAR TO THE CRATER LAKE REGION

ELMER I. APPLIFICATE

The season of 1896 was an eventful one for Crater Lake. During the month of August the Mazama mountain climbing organization held its annual encampment here, during which time Mt. Mazama was named. It is of especial interest to botanists to note that the first plant collections of the region were made at this time. Those taking part in this pioneer work included Frederick V. Coville and John B. Lieberg of the U. S. Department of Agriculture, Washington, D. C.; Martin W. Gorman, a well known botanist of Portland, Oregon, and myself, then a student of botany at Stanford University. Small collections were also made by Dr. C. Hart Merriam, chief, and Vernon Bailey, chief field naturalist of the U. S. Biological Survey. The following year Dr. Coville and myself, while making an investigation of the flora of the Cascade Mountains, added other plants to the Crater Lake list. Among the noteworthy plants found during the two seasons, the following are of most interest. All of these were until then unknown to science, and furthermore most of them are peculiar to the region. A partial list of the August vegetation of Crater Lake by Dr. Coville was published in the Mazama annual of the year, being the first plant list of the area to appear in print.

Ribes erythrocarpum Coville & Lieberg. Crater Lake Currant. This trailing currant is perhaps the most abundant shrub in the Park, being found everywhere in the coniferous forests from the base of Mt. Mazama up to the rim. Many of the hemlock slopes are fairly matted with it. The disc-shaped flowers are copper-colored and the fruit a bright red. Without the boundary of the Park, I have collected the species at various times in the vicinity of Rabbit Ears and Huckleberry Mountain to the west, and eastward on Yamsay and Gearhart Mountains on the headwaters of Sprague and Williamson Rivers.

Botrichium pumicola Coville. Crater Lake Grape Fern. This extremely rare plant was first collected by Coville & Applegate on the bald pumice summit of Llao Rock over which the collectors passed with a pack-train August 5, 1897. Fortunately for the perpetuation of the species, its small size and pretentive coloration renders it very difficult to find. In 1902

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Dr. Coville found it on the pumice slope of Cloudcap. The two stations are the only ones known. Perhaps more extended and careful search will reward the collector.

As Dr. Coville records in the original publication of the species "In common with all its associate plants, it has conspicuous protective modifications which enables it to endure the summer drought to which it is subjected."

Collomia mazama Coville & Lieberg. Mazama Collomia. The type of this very distinct member of the Phlox family was collected by Coville & Lieberg on August 15, 1896, the locality being in the vicinity of the "Lower Camp Ground" on the upper waters of Castle Creek. One may be rewarded with the sight of this beautiful flower by hiking down the "Pioneer Trail" up which its discoverers came in a four-horse farm wagon. I also made collections of it on the same date. It is rather common along streams on the west slope of Mt. Mazama down to the western limits of the Park, southward from Boundary Spring. I have also found it in the region of the Rabbit Ears and on Huckleberry Mountain. The color of the flower matches well with that of Crater Lake, thus adding to the appropriateness of these specific names.

Cardamine belidifolia pachyphylla Coville & Lieberg. Crater Lake or Thick-leaved Bitter Cress. On the steep pumice and cinder slopes, such as those of the Watchman, Hillman and Red Cone, is to be found this fine little crucifer, its long root system being in keeping with its name, and enabling it better to anchor itself and to reach down for sufficient moisture to carry it over the dry season. The type station is on the west slope of the Watchman where it was found by Coville & Lieberg. It also occurs in similar situations on Mt. Shasta and Lassen Peak.

Arenaria pumicola Coville & Lieberg. Mazama or Crater Lake Sandwort. The generic name is from the Latin arena meaning sand. This low, matted plant with small white flowers is common on the open pumice slopes about the rim where the type specimens were collected by Coville & Lieberg August 13, 1896. This is another Crater Lake type not confined to the region, for it was found by Lemmon in northern California in 1875.

Ranunculus gormanii Greene. Gorman's Buttercup. This delicate little buttercup was named by Dr. E. L. Greene in honor of Mr. Gorman who found the type material at a spring on Castle Crest and on moist banks at the head of Annie Creek, August, 1896. Over a week earlier I collected it at the spring first named. It is

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quite common along the stream in Castle Crest Garden, as well as on the waters of Castle Creek. The single flowers are borne on slender prostrate stems.

Eucephalus covillei Green. Coville's Aster. This name was given by Dr. Greene, and in honor of Dr. Coville who collected the type specimens at Pole Bridge. This is one of the most abundant and attractive plants found in the Park. Flowering comparatively late in the season, its large purplish flowers lend much to the color of the pumice slopes, especially about the rim. Most botanists include the genus in that of Aster.

Castilleja applegatei Fernald. Applegate's Paintbrush. Named by Dr. M. L. Fernald at Gray Herbarium, Harvard University, based upon a collection made by myself, August, 1896. The exact station is the very top of Mt. Scott, the highest point in the Park. This highly colored paint-brush was a part of the first plant collection made on Mt. Scott. My brother and I made the trip across the lake from the Mazama encampment by boat. We found our way up the crater wall a little distance south of the Wine Glass, thence to and up the mountain without trail. The night was spent on the summit amidst the paint-brushes and in close proximity to a big snow-drift. This last with a cold north wind did not add to the comfort of the blanketless night. The return trip across the lake was made the following night, the occasion being enlivened by a thunder storm and high wind which threatened to swamp the small home made boat with its five passengers. One of these, by the way, was Dr. Barton W. Evermann of the U. S. Bureau of Fisheries. The thunder reverberations and vivid flashes of lightening among the crags of the crater wall were indeed most spectacular. The expedition ended with the final climb out of the crater in midnight darkness with practically no trail. Thirty-seven years later the collector again visited the type locality of the paint-brush under very different circumstances -- by auto from Klamath Falls to the base of the mountain, thence by excellent trail to the summit, where was found a lookout station on the very spot where the night was spent so long ago; and just in time to enjoy the mid-day hospitality of the ranger in charge. A large collection of the paintbrush was made for distribution to the principal herbaria of the world.

(This paper was prepared by Ranger-Naturalist Elmer I. Applegate under the direction of Warren G. Moody, Acting Park Naturalist, 1934)