RECENT CHANGES *in* HOOD'S GLACIERS

Another Report on This Long-Range Study by the Club's Research Committee

By KENNETH N. PHILLIPS

"THE Ice Age was not only fascinating, but a very fertile field for scientific research—by far the most fertile left in the world, I think." So writes Admiral Richard E. Byrd, in the account of his second trip to explore Antarctica. Probably few Mazamas will ever have the chilly privilege of exploring from Little America. Fortunately, however, we do have in our own back yard a small vestige of the Ice Age—the glaciers of Mount Hood. These relatively small ice tongues have held the interest of Mazamas since the organization of the club in 1894, and particularly of their Research committee since its inception in 1925. Since these glaciers are materially affected by climatic variations, it seems worth while, as a matter of record, to present the data available as to the known changes in their size or appearance.

Much of this information has been gathered by the Mazamas, chiefly through their Research Committee, which has endeavored to obtain data on the more accessible ice streams, through field surveys, written descriptions, and photographic records. Some historical accounts by competent observers are also available, notably the photographs of the snouts of Eliot, Newton Clark, and White River Glaciers made in 1901 by Dr. H. F. Reid. For comparison with these pictures and for future studies, photographs of the lower portions of all the glaciers on the mountain were obtained by the committee on September 25, 1935. At that time, the snow of the preceding winter had melted, and no new snow had fallen to obscure the lines of the ice, while the warm, dry summer had caused a general recession of the glaciers to high levels, thus making an ideal condition for this work.

In passing it may be noted that any measurements of glacier positions are subject to certain handicaps which must result in a rather low order of accuracy. Climatic conditions are seldom ideal, and the rugged topography is not conducive to accuracy. The greatest uncertainty, however, lies in the determination of the point which marks the end of the active glacier, which may be masked by snow or morainal matter. Also, it is at times necessary to distinguish between the living glacier and stagment blocks of old ice. Results must be viewed in the light of difficulties encountered. In general, the committee has assumed the end of the glacier to be the point at which a glacial stream emerges.

WHITE RIVER GLACIER — This glacier (fig. 2), at the head of White River, was described in 1871 by Arnold Hague[1] as follows: "The crater (of Mt. Hood) is nearly one-half a mile wide from east to west. The White River Glacier heads on the eastern side of the crater and extends in a southeasterly direction. It is barely a quarter of a mile wide at the head, and about 2 miles long, extending 500 feet below the line of timber upon the side of the mountain. Near the top of the crater a broad transverse crevasse cuts entirely across the glacier. Further down transverse crevasses are of frequent occurrences. Marginal crevasses, ice caves, and caverns occur."

In the annual Mazama for 1905, Dr. Reid gives an excellent description of the glacier at the time of his visit, June 2, 1901. Reid selected a point on the west side of the creek and "about 500 yards" below the ice, from which he took a photograph of the glacier for future reference. Unfortunately, a heavy snow cover, combined with the absence of distinguishing fixed features, makes it difficult now to use this photo to locate the position of the terminus as it was in 1901.

In the National Geographic Magazine for July, 1908, A. H. Sylvester describes an ice cave caused by a fumarole just east of Crater Rock, and states that from 1905 to 1907 it appeared to be increasing in size. "Last summer (1907) the old fumarole had so developed that White River Glacier is now cut in two at this point, and its bed for 150 feet along its course, is exposed." (It seems significant that this nivasection, or beheading of the glacier, is not mentioned by earlier writers. It may

1 American Journal of Science, 3d Series, Vol 1, 1871, p. 165.

have been due to decreased snowfall, rather to greater melting from the head of the fumaroles.)

In the summer and fall of 1934, a stone shelter building was erected in the trough between Crater Rock and Steel Cliff, at a point which fits Sylvester's description of the separating line in 1907. It is at the east end of a small, moraine-shaped ridge which acts as a dam, holding back melted snow-water to form a small pond each summer. Sylvester apparently believed that the glacier was continuous over this point, as he said[1]: "The glaciers (White River and Zigzag) then extended back to the north rim, as they still do." Also, in the Mazama for 1905, Dr. Reid said (as of 1901): "White River Glacier has . . . its reservoir . . . in the crater of Mount Hood." Certainly it has not been continuous here in recent years; in fact, it may now be considered as having its head in a *neve* field beginning about 200 feet south of the hut. The crater *neve* does not now feed the glacier.

About 400 yards south of the shelter cabin, and probably 500 feet lower in elevation, the glacier has now melted down deep into a narrow canyon, and the surface has been so covered with talus from Steel Cliff that the glacier appears to be interrupted for 400 feet or more. However, it is very likely that the ice continues under this talus covering.

On August 17, 1935, the committee, guided by Dr. Reid's photograph of 1901, located his reference point on the west side of the canyon below the glacier. A cairn was built over a large jointed boulder to identify the spot. The terminus of the glacier was estimated to be 2,500 feet distant. This estimate, with Dr. Reid's estimate of 1901, indicates a recession of the terminal face of about 1,000 feet in 34 years. Admitting this to be a rough approximation, it is nevertheless the best available. Its position in 1871, if "500 feet below the line of timber growth," would be at least 4,000 feet below its present ending. Such a great recession in these 64 years seems improbable, in view of its slower retreat since 1901.

NEWTON CLARK GLACIER—This fan-shaped ice field, which ends in a steep ice fall at the head of a rock cliff on the east side of Mount Hood, is apparently slowly receding. Comparison of the photographs of July 25, 1901, and September 25, 1935 (figs. 6-7), shows a thinning of the ice wall, and a definite retreat, during the 34-year interval. The amount of recession has not been measured on the ground; but an estimate of 300 feet is probably of the right order of magnitude.

ELIOT GLACIER—The Research committee established a base line just below the terminus, on September 13, 1925. Observations since that date have shown the following changes in position, considering the point where the creek issues from the ice as being the terminus, and measuring all distances on the slope of the creek bed:

Date	Distance above base line, feet	Advance (+) or Recession (–) feet
Sept. 13, 1925	50 (scaled from map)	
Oct. 31, 1926	Not noted	− 3 approx.
Aug. 26, 1928	Not noted	−35 approx.
Sept. 27, 1931	97	− 9 approx.
Sept. 24, 1932	95	+ 2
Sept. 23, 1933	73	+22
Oct. 14, 1934	113	−40
Sept 15, 1935	123	−10
Oct. 19, 1935	135	−12

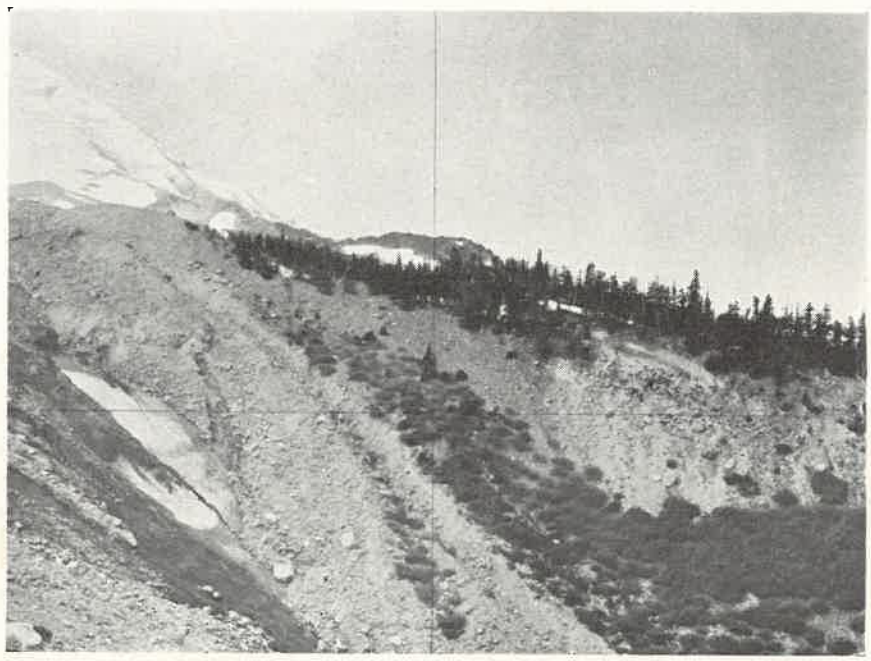
The recession of 12 feet from September 15 to October 19, 1935 is worthy of note. Both readings were double-checked to insure against

The unnamed inter-glacier discovered from air by Mazama researchers. See page 50. (Gilardi Photo)

1 Sylvester, A. H., National Geographic Magazine, July, 1908.

Above (Figure 2)—White River Glacier on southeast slope, photographed from 8,400 feet on September 25, 1935, by L. J. Bailey. Palmer Glacier lies (upper left) beyond White River.

Lower (Figure 3)—Reid Glacier, west side, as seen by research committee. Note the great wall of south moraine. (Bailey Photo)



Above (Figure 4)—End of Eliot Glacier July 23, 1901 from photo by Dr. H. F. Reid. (Eliot Creek not shown.) It emerges just below lower end of centre vertical line.

Lower (Figure 5)—Eliot Glacier, September 15, 1935 from same spot as Reid's picture above. (Phillips Photo)

error. After October 13 the temperature was below freezing, and the terminus was protected by a light snow cover; so practically all of this change must have occurred in four weeks.

On July 23, 1901, Dr. Reid obtained photographs of the terminus of Eliot Glacier (fig. 5). Unfortunately, these do not show the stream issuing from under the ice at the extreme ending; but its location was nevertheless closely determinable. Measurements on September 15, 1935, showed the 1901 position to be 240 feet downstream from the base line, and indicated about 360 feet recession from 1901 to 1935 (fig. 6). The glacier appears

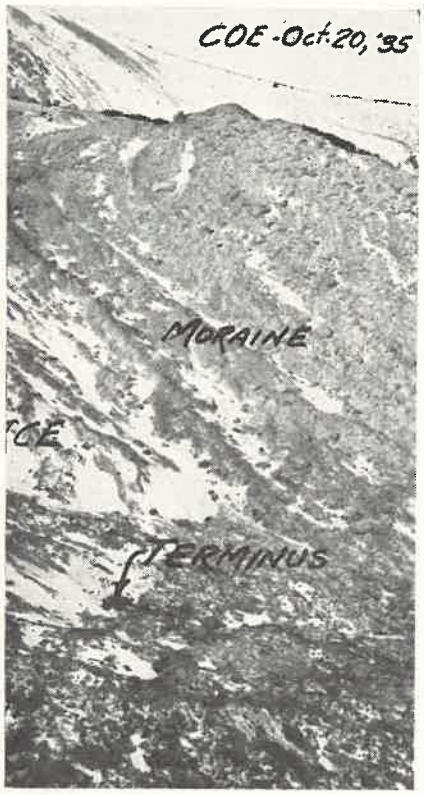
Above (Figure 6)—End of Newton Clark Glacier July 25, 1901. Photo by Dr. H. F. Reid.

Below (Figure 7)—Newton Clark from 8,400 feet September 25, 1935. Notice how glacier has receded from cliff where it terminated in 1901. (Bailey Photo for Mazamas)

to be thinner in 1935 than in 1901; but no quantitative value can be set on this ablation.

COE GLACIER—A base line was established by the Research committee on August 26, 1928, using yellow paint marks on large rocks on the lateral moraines, just below the terminus. Subsequent visits determined changes in position as follows:

Date	Distance above base line, feet	Advance (+) or Recession (–) feet
Aug. 11, 1929	−10	0
Sept. 27, 1931	+33	−43
Sept. 24, 1932	52	−19
Sept. 22, 1934	76	−24
Oct. 20, 1935	61	+15



Coe Glacier, October 20, 1935, from large boulder on east moraine marked "1935" with orange paint. (Phillips Photo)

UNNAMED INTERGLACIER—A field of ice lying on the northwest slope of the mountain, down to about 6,500 feet in elevation, is separated from Ladd Glacier by two ridges (lateral moraines), and from Sandy by a sharp rock ridge. It has well developed crevasses, moraines, and other features that mark it as an independent glacier. This ice stream might fittingly serve to perpetuate the name of some early explorer or mountain lover—say a Mazama member. The aerial photograph of September 25, 1935, shows a change that is readily discerned by comparison with the quadrangle map (survey of 1924). In 1924, the terminus was 400 feet lower than that of Ladd, and almost due west from Ladd; it is now southwest of the snout of Ladd, and at least as high in elevation.

LADD GLACIER—A base line was established by the Research committee on August 28, 1927, just below the terminus, from which the following changes were noted:

Date	Distance above base line, feet	Advance (+) or Recession (–) feet
Aug. 28, 1927	0 (snowdrift)	–
Aug. 11, 1929	30 (snowdrift)	−30?
Sept. 27, 1931	15 (ice)	+15?
Sept. 25, 1932	27 (ice)	−12
Oct. 20, 1935	15 (snowdrift)	+12?

The terminus of Ladd Glacier is always difficult to locate accurately, because of its morainal covering. In three of the five visits in recent years, the end of the ice could not be positively identified, owing to drifts of snow. Observations here indicate only that this ice stream is practically in a state of equilibrium.

SANDY, REID, AND ZIGZAG GLACIERS—No quantitative data are available on these ice fields. Their positions as shown in the aerial photographs of September 25, 1935 probably represent a condition of ablation that has seldom been exceeded. Reid Glacier (fig. 3) definitely shows the results of malnutrition, or excessive melting, since 1923, at which time the ice streams almost coalesced below the central nunatak. (See photograph facing p. 36 in Mazama, 1923.)

CONCLUSION — Most of the glaciers of Mount Hood, in company with the vast majority of glaciers in the northern hemisphere, are receding and being depleted in their lower portions (dissipators) faster than they are fed from the upper *neve* fields (accumulators). However, the changes are so slow, in comparison with the span of human life, that only the most careful observers will be able to note any material changes in the course of a lifetime. Still, a relatively slight change in climatic conditions might precipitate a more rapid retreat, or, on the other hand, cause a material advance. The observations made to date should not be considered as final, but as a foundation upon which to build a structure of facts, independent of fickle memory or nebulous tradition.