the glacier surface and assures that the advance will continue at least one or two more seasons.

The adjoining Roosevelt Glacier has advanced to a series of lava cliffs formerly 500 to 700 feet removed from the Roosevelt terminus. Enormous ice avalanches, due to séracs being pushed over the lava cliffs, were enjoyed at a comfortable distance by the September observing party from the vantage point of Bastille Ridge to the east of both the Coleman and Roosevelt Glaciers. The observing party while on Bastille Ridge laid out a photogrammetric base line 662.1 feet in length, did the necessary control surveying, and made stereoscopic pairs of photographs of the entire glacier system, using the University of Washington's T.A.F. photo-theodolite. These pairs of photographs are now in Munich, Germany, where Dr. Ing. Walther Hofmann is constructing a detailed topographic map of the area from them. Such a map will be used with future data to calculate changes in ice volume of the glacier.

The advance of the Coleman and Roosevelt Glaciers may indicate something worthy of much more than passing interest on the part of mountaineers. Last summer R. Hubley[1] found that many glaciers in the North Cascades and in the Olympics are advancing. Some, particularly in the Glacier Peak area, are advancing as spectacularly as the Coleman. This widespread increase in glacial activity indicates that the trend toward a warmer and drier climate, which has been world-wide since the latter part of the 19th century, has been reversed in the northwestern United States. How long the reversal will continue, how severe it will become, and how extensive it will be can only be determined as observers the world over continue to make observations of glacial activity.

KERMIT B. BENGSTON

AN ACTIVE GLACIER IN NEVADA

Some years ago I ran across an article in the "Fifth Annual Report of the United States Geological Survey, 1883-84," entitled: "Permanent Ice on the Mountains of the Great Basin." It described a body of ice on Jeff Davis Peak, now known as Wheeler Peak, in eastern Nevada. Illustrating the article was a fine engraving of the mountain's impressive north cirque, showing the upper two-thirds of the ice body, but the lower portion was hidden by an intervening ridge.

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[1]Hubley, R. C., Journal of Glaciology, In Press, 1956, "Glaciers of the Washington Cascade and Olympic Mountains; Their Present Activity and Its Relation to Local Climatic Trends."

The report describes the climate as arid and the country desertlike throughout, and states that "A region more unfavorable for the formation of glaciers could scarcely be found; yet, as shown by the observations of Mr. William Eimbeck, of the United States Coast Survey, there is a body of ice on Jeff Davis Peak, one of the highest mountains in the Great Basin, that approaches the condition of a glacier . . ." Mr. Eimbeck saw the ice mass in August, 1883, and his notes record that it was then about 1,500 feet in length, with an average width of 200 feet. "The surface of the ice was without fissures or moraines," he wrote, "yet evidently possessed a definite structure as indicated by different tints and shades of bluish green. . . . Nothing resembling a moraine could be seen near the foot of the ice, but ancient moraines occur about a mile down the canyon, which record the lower limit of the ice stream which formerly flowed from the same cirque, that shelters the present ice body."

Albert Marshall of Three Rivers, California, and I met August 29, 1955, and spent five days knapsacking in the sub-alpine and alpine country at the head of Lehman Creek, climbed Wheeler Peak (13,061 feet) August 31, and entered the cirque September 1. Although the precipitous walls and jagged rim of the cirque are the most prominent features of the landscape, we found that we could not see its floor from any point outside. Nor did we note signs of ice, except for two small patches wedged in crevices high up on the cirque walls. We were particularly surprised that even Wheeler's north ridge and summit gave no views into the cirque whatever. However, just below the top, the lower part of the fresh moraine, with its pointed snout, is visible. The surface clearly shows a series of crescentic, down-curving bows, resembling flow lines, apparently the result of alternating bands of thicker and thinner material. Then, by working down the extremely rotten and dangerous slope east of the summit, we were able to see a small section of the cirque's walls and floor. There, at last, we found that the ice body described by Mr. Eimbeck 72 years before, not only still existed, but that its surface was broken by what appeared to be a bergschrund, a secondary bergschrund and, below these, five parallel crevasses.

Reaching the cirque next day proved to be an arduous scramble over loose detrital and morainal rock piles in an unbelievable state of instability. And, as usual, we did not even get a glimpse of the cirque until we laboriously passed the cliff-like portals and were within it. Then, we were immediately struck by the awesome and spectacular nature of the place. It bears a remarkable resemblance to the east face of Longs Peak, and rivals that famed Colorado cirque in size and grandeur. The walls rise in precipitous cliffs, 1,500 to 2,000 feet, and Wheeler Peak soars impressively in an

almost perpendicular unbroken rock face. Our surmise from the quick preview of the day before was confirmed. There, before us, cradled in this gigantic rock basin lay an active glacier. Névé, bergschrunds, crevasses, and a moraine in the process of being formed were readily apparent.

Greatest activity is centered on the east, or true right, side. Here a double ice tongue, divided at its lower end by a rock island, slants steeply up an angle in the cirque wall, and extends about two-thirds of the way to the top. Near the lower part of the more easterly section a prominent bergschrund (that seen from Wheeler's summit) cuts completely across the ice from the rock island to the true right margin. This bergschrund is well developed, is apparently from five to ten feet wide, and bows slightly upward at the center. Below it is a secondary bergschrund, equally wide, but extending from the true right margin less than half way across the ice tongue. On the ice apron below where the tongue joins the main ice body on the floor of the cirque, are five crevasses, one above the other. Although these were the crevasses seen the day before from near Wheeler's summit, from the cirque's entrance they are hidden by a large mound of fresh moraine, described below.

The west section of the ice tongue appears slightly less active, but shows a bergschrund cutting completely across it in a straight line, narrower than the first and at a higher elevation. A third bergschrund, to the west, parallels the upper margin of the main ice body against the cliffs, and is only a few feet below it. Here the glacier shows a slower rate of motion and has moved but a short distance from the cliffs, leaving a narrow fringe of névé clinging to them. Further west, directly under the summit of Wheeler Peak, ice presumably underlies the heavy mantle of moraine. Thus the whole upper end of the cirque probably contains ice, but in the west section it is apparently now stagnant.

The before-mentioned moraine tongue, which terminates in a point about a half mile down the cirque, possibly also may be underlain with ice. However, if so, it, too, is stagnant, for the moraine's outlines have the rounded appearance of stability and a few green patches of arctic willow are growing on its sides. But perhaps the glacier's most notable feature is a great mound of unstable moraine, about 100 feet high, that rises sharply, 500 to 600 feet behind the snout. This has every appearance of being the active front of the glacier, which in recent years has been advancing and pushing forward over the surface of the older moraine. Its front and sides break sharply into steep-pitched slopes down which rocks, stone and dirt appear to have been cascading. Although surprising, such indications of recent advance are in line with several glaciers in California's Sierra Ne-

vada and the Pacific Northwest. They show that a slight oscillation of climate favorable to snow storage and glacial increase has occurred during the past 15 years.

A considerable stream drains the glacier, but the floor of the cirque is so heavily burdened with loose rock that the water flows beneath the surface for more than two miles down the canyon. Although we heard it at several points we were unable to check it for degree of milkiness and glacial silt. In fact, the amount of rock, stones, and dirt falling from the loose quartzite cliffs is enormous, and far beyond the power of the glacier to transport. Even the open ice was so discolored by the constant cascades of rock material that its surface was difficult to distinguish from the adjacent cliffs. Anyone who examines the upper glacier will do so at considerable risk. To us it looked as dangerous a death trap as we had ever seen in the mountains.

The glacier is roughly triangular, its base being the upper end against the cirque cliffs and its sides coming to a point at the moraine snout. It is small, and its greatest dimension probably does not exceed 2,000 feet. But it is of more than usual interest, since it is probably the only true glacier in the entire Great Basin. WELDON F. HEALD