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Glacier NATIONAL PARK

FILE NO.

ANNUAL REPORT OF GLACIER MEASUREMENTS FOR 1944
GLACIER NATIONAL PARK, MONTANA

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Submitted by
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cc: F. E. Matthes, U. S. G. S.
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The Director
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General and Weather

Snowfall during the winter of 1943-44 totaled 46.2 inches at Belton (Park Headquarters) or about 40% of the 30 year average of 117 inches. Annual precipitation was also well below normal for the year, while the annual mean temperature was well above the 30 year average. The lowest recorded temperature for the year was -6°.

In last year's report submitted by Park Naturalist Walker, mention was made of his expectation of finding the glaciers either holding their own or showing a slight advance as a result of the particularly severe winter. Measurements, however, indicated a continued recession which prompted the statement that seasonal weather variations are not reflected in the front of the glacier the following year.

It is the present writers contention that seasonal weather variations are reflected in the fronts of the small cirque glaciers found in this area. It is, of course, doubtful whether any one particularly severe winter could result in a definite advance of the ice front during the present cycle of rapid decline but the amount of such decline would be greatly lessened.

Certainly, as indicated by this year's measurements, a particularly light winter results in a greater amount of recession, other factors being considered.

The writer particularly wishes to acknowledge the assistance and cooperation of Mr. Arthur Johnson, Hydraulic Engineer of the Tacoma office of the U. S. Geological Survey, who participated in this years glacier measuring expedition and who has expressed his willingness and desire to assist in making more detailed studies in future years. Recommendations and plans for future work are given at the end of this report.

MEASUREMENT DATA

Sperry Glacier

This glacier was measured and photographed on September 4, 1944. Measurements taken from the 1943 red point markers to the ice front showed an average recession of 51 feet. The Park Naturalist was assisted by Mr. Arthur Johnson and Mr. C. S. Heidel, Hydraulic Engineers, U. S. Geological Survey, Chief Ranger B. R. Finch and Ben Beatty.

Jackson (Blackfoot) Glacier

Measurements and photographs were made on September 5, 1944. The lowermost and most easterly lobe of this glacier, where measurements have been taken in the past, shows evidence of rapid disintegration and is quite similar in appearance and action to the measuring station on the east lobe of the Lyell Glacier in the Yosemite High Sierra.

As indicated in the accompanying photographs, the front is melting back in an irregular manner, probably due to the protection afforded by the easterly cirque wall. Measurements of recession varied from zero next to the cirque wall to 108 feet at the furthermost measuring point. A medial point in line with the large marked boulder located in 1943 showed a recession of 56 feet, which was taken as average. Movement of the boulder was computed by triangulation as 30 feet for the year.

In addition to Mr. Johnson and the Park Naturalist, Chief Ranger Finch, Ranger Clem Harner and Ben Beatty assisted in measuring this glacier.

Grinnell Glacier

This glacier was measured and photographed on September 6, 1944. Five measuring points were found and the amount of recession varied between 51 feet maximum and a minimum of 32 feet. Average recession was found to be 40 feet. We were unable to locate the reference points used in marking the location of the large boulder which was found to have moved 50 feet the previous year. Numerous small lakes of melt water adjacent to the ice front may account for our inability to locate the reference points.

The Park Naturalist was accompanied by Mr. Arthur Johnson, District Ranger Raymond W. McIntyre, Jack Emmert, Jr., and Ben Beatty.

Agassiz Glacier

This glacier was visited and photographed on September 8, 1944. Unfortunately, no member of the present park staff was familiar with the route taken by former parties in negotiating the heavy brush covered area separating the cirque basin from the Boulder Pass trail. After fighting brush for more than three hours, our party found themselves high up on a spur of Mt. Peabody and the lateness of the hour prevented working down to the glacier. By use of field glasses and comparison with photographs taken in 1943, we estimated the recession to be approximately 80 feet.

The party included Mr. Johnson, Ben Beatty and the Park Naturalist.

Photo #1 SPERRY GLACIER Johnson Photo

View looking NE showing main portion of ice front. Note amount of recession from the recent terminal moraines at left center.

Photo #2 SPERRY GLACIER Johnson Photo

Easternmost lobe where measurements were taken. M. N. Beatty and son Ben shown taking measurements, which indicate a recession of 51 feet for the year.

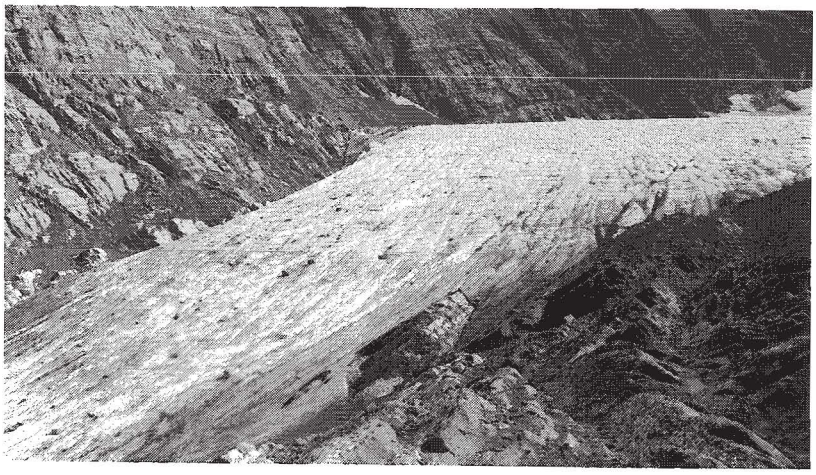

Photo #3 SPERRY GLACIER 1944 Johnson Photo

Remaining portion of east lobe from a point slightly west of measuring station. Note thinness of ice as indicated by exposed bedrock.

Photo #4 SPERRY GLACIER 1943 Walker Photo

View along rock ridge used in marking ice fronts in recent years. Rock ducks mark location of receding front. Comparison with photo #3 above shows extent of melting and shrinkage of tongue.

Photo #5 JACKSON GLACIER 1942 Walker Photo

Snout of glacier as it appeared two years ago. Note water channels.

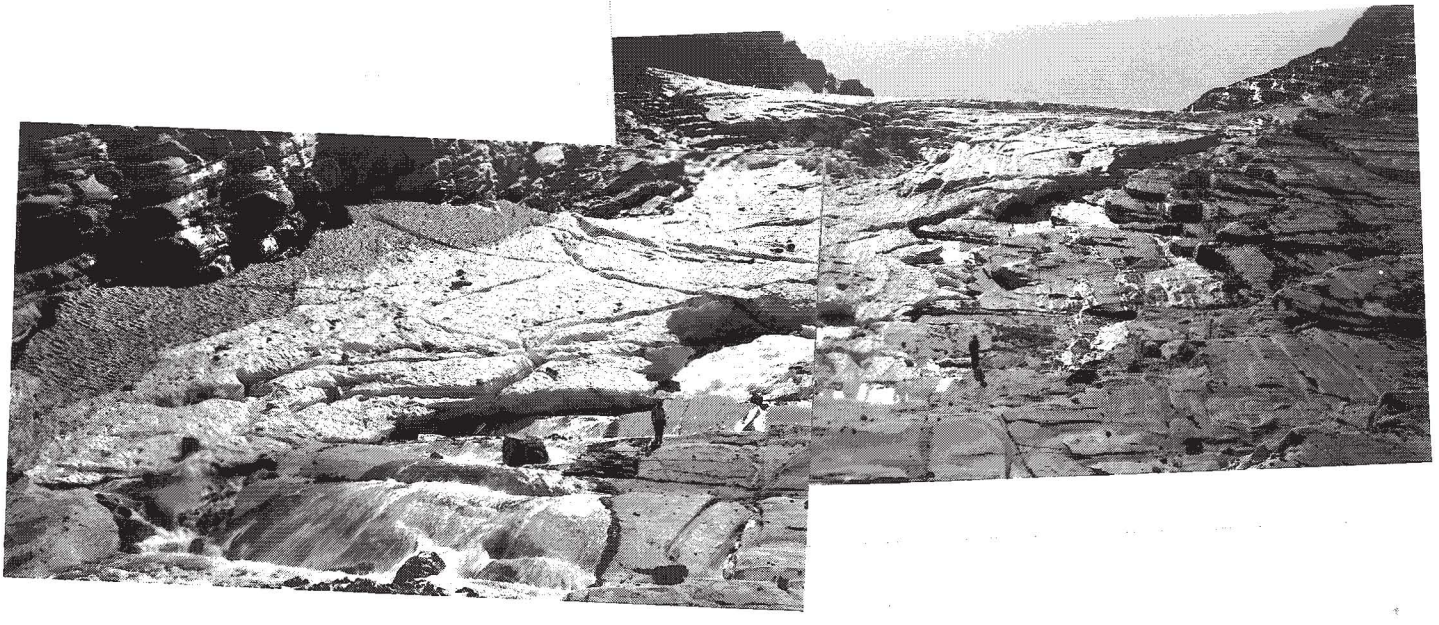

Photo #6 JACKSON GLACIER 1944 Johnson Photo

Note how ice front has changed in two years. Bulk of ice is protected by cirque wall on left. A new snout is developing top of slope. The two men are standing on 1943 line of ice front.

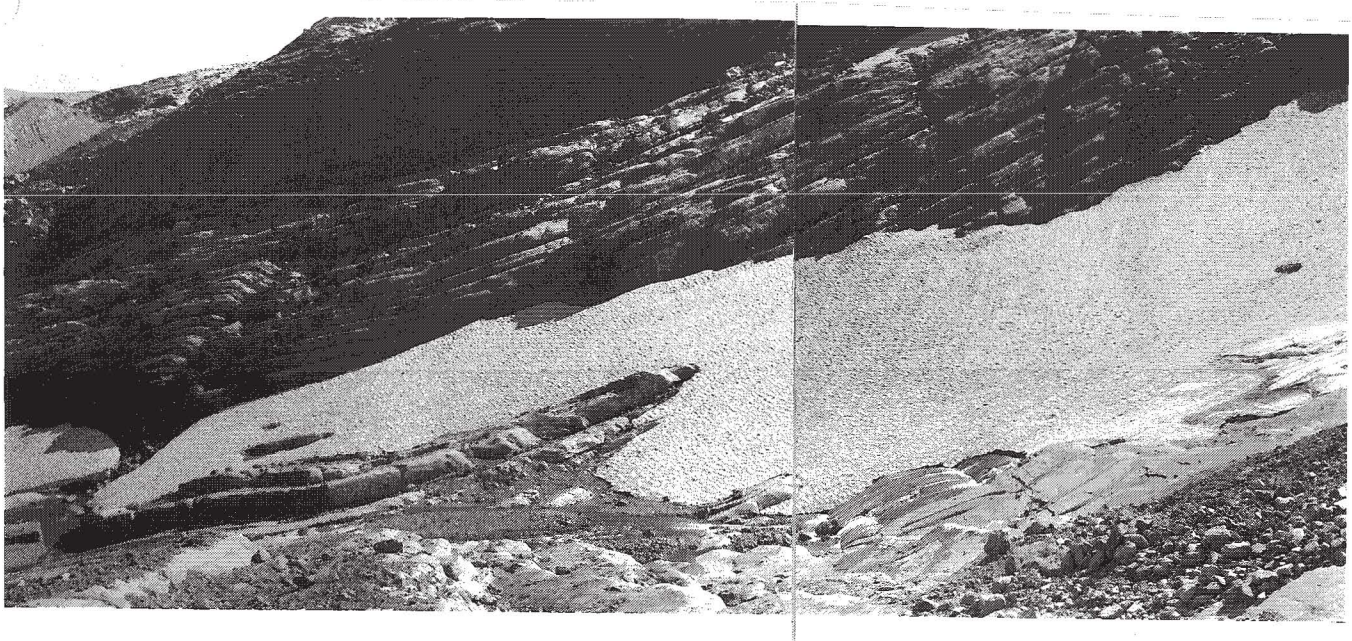

Photo #7 JACKSON GLACIER 1943 Walker Photo

East cirque wall showing heavy snow accumulation covering glacier ice which made measuring difficult.

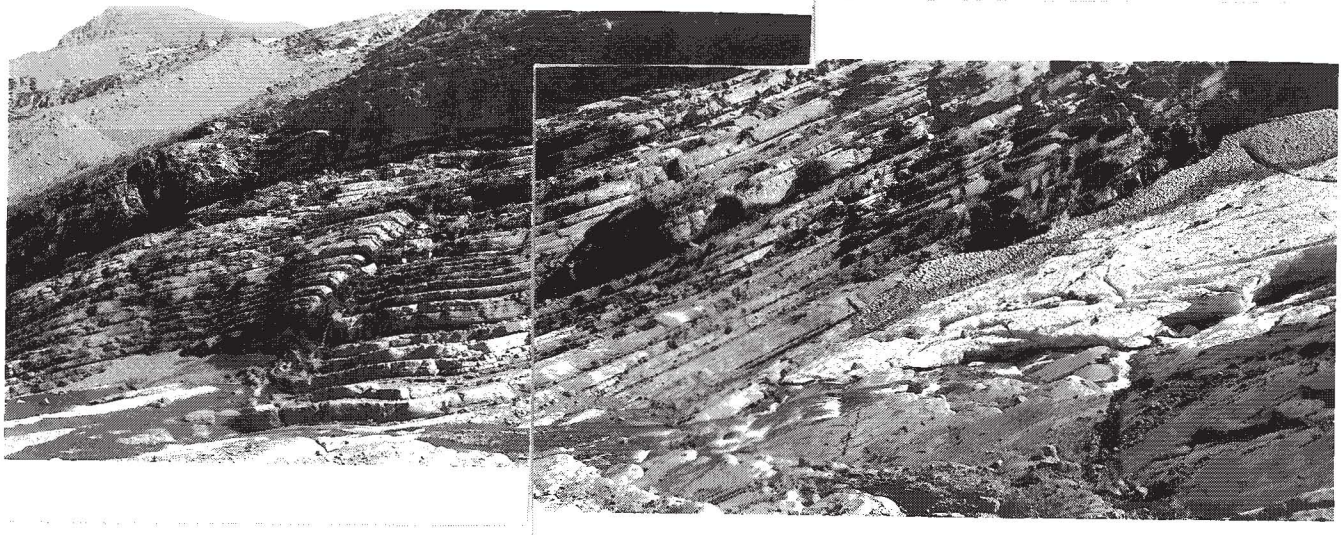

Photo #8 JACKSON GLACIER 1944 Johnson Photo

Much of the disappearance of snow and ice can be attributed to the light winter of 1943-44 and the warm spring of 1944.

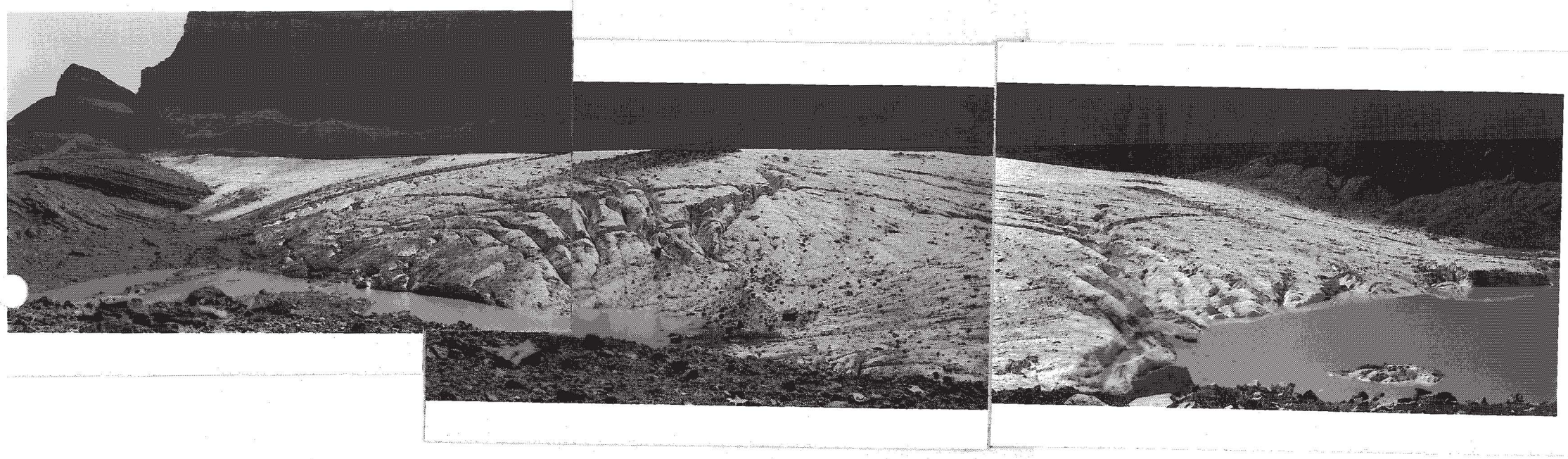

Photo #9 GRINNELL GLACIER Johnson Photos

Panoramic view of the greater portion of the glacier showing extent of melt-water lakelets. Measurements were confined to a relative short portion of the entire front. Average recession for six measuring points was 40 feet.

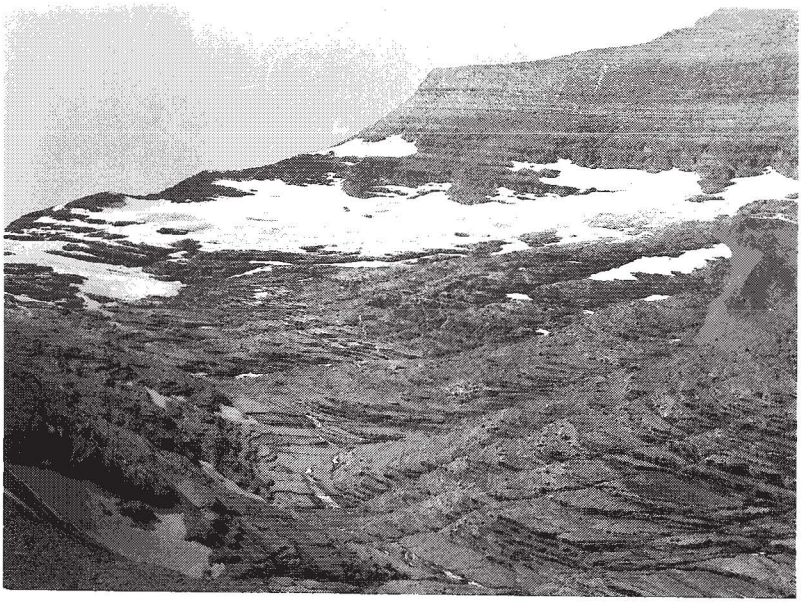

Photo #10 AGASSIZ GLACIER 1943 Walker Photo

Ten years ago almost this entire basin was occupied by the glacier. Measurements were made on the left hand lobe, now entirely separated from the upper firn field.

Photo #11 AGASSIZ GLACIER 1944 Johnson Photo

Difficult terrain and the lateness of the hour prevented our reaching the glacier. By means of field glasses and comparison with photographs taken the previous year, we estimated the recession for the year to be about 80 feet.

SUMMARY OF GLACIER RECESSION MEASUREMENTS, GLACIER NATIONAL PARK

Agassiz Glacier:	Date of Visit	Recession in Feet	Total Recession in Feet
	1932, Aug. 28	Markers set	
	1933	Not visited	
	1934, Sept. 28	75	75
	1935, Aug. 28	79	154
	1936, Sept. 3	465	619
	1937	Not visited	
	1938, Sept. 28	35	654
	1939	Not visited	
	1940	Not visited	
	1941	Not visited	
	1942, Sept. 9	2,276	2,930
	1943, Sept. 8	20	2,950
	1944, Sept. 8	80 (est.)	3,030

Jackson Glacier: (Blackfoot)	Date of Visit	Recession in Feet	Total Recession in Feet
	1932, Aug. 23	Markers set	
	1933, Sept. 4	-64	-64
	1934, Aug. 26	10	-54
	1935, Aug. 23	-8	-62
	1936, Sept. 17	104	42
	1937, Sept. 21	28	70
	1938	Not visited	
	1939, Sept. 21	69	139
	1940, Sept. 8	63	202
	1941, Sept. 8	150	352
	1942, Sept. 8	0	352
	1943, Sept. 15	15	367
	1944, Sept. 5	56	423

SUMMARY OF GLACIER RECESSION MEASUREMENTS, GLACIER NATIONAL PARK

Sperry Glacier:	Date of Visit	Recession in Feet	Total Recession in Feet
	1931, Oct. 11	Markers set	
	1932,	Advanced 1931-32	
	1933	No data	
	1934	No data	
	1935, Sept. 9	Markers set at new location	
	1936, Sept. 18	97	97
	1937, Sept. 17	29	126
	1938	Not visited	
	1939, Sept. 10	281	407
	1940, Aug. 29	33	440
	1941, Sept. 4	45	485
	1942, Sept. 4	21	506
	1943, Sept. 13	21	527
	1944, Sept. 4	51	578

Grinnell Glacier	Date of Visit	Recession in Feet	Total Recession in Feet
	1932, Oct. 6	Markers set	
	1933, Sept. 14	0	0
	1934, Oct. 5	54	54
	1935, Sept. 22	43	97
	1936, Sept. 20	64	161
	1937, Oct. 25	4	165
	1938, Oct. 6	76	241
	1939, Sept. 19	34	275
	1940, Sept. 10	71	346
	1941, Sept. 9	105	451
	1942, Sept. 7	-	451
	1943, Sept. 2	10	461
	1944, Sept. 6	40	501

Conclusions and Recommendations

The present method of measuring ice fronts is far from satisfactory. In the case of the Sperry and Jackson Glaciers, measurements have seemingly been made on but one small lobe, in each instance the lowermost as to elevation. These lobes, as shown in photographs #2, 3 and 6, are receding more rapidly than the rest of the ice front, due mainly to the steeper gradiant and thinness of the ice.

Measurements of the Grinnell Glacier have been made at a number of points along the front and consequently give a fairly accurate picture of the recession. The chief difficulty here is the extent of the melt-water lakelets along the front, as shown in photograph #9. The shifting of these lakelets from year to year due to the flatness of the basin makes tape measurements from the same points each year impossible.

No base lines have been established for measuring any of the above mentioned glaciers, the procedure being to paint the year on exposed rock surfaces at the ice front and measure back to the previous years mark. Although an attempt was made to keep these yearly marks in a straight line, the terrain did not always permit it. For this reason, measurements along a fixed course at right angles to a base line would permit far greater accuracy.

Contour maps were made of these glaciers in the order named in 1937, 1938 and 1939 by Dr. James Dyson of Colgate University. At the time it was planned to remap each glacier at five year intervals, but this plan was necessarily abandoned due to the war.

We had hoped to make use of these maps for tying in this years fronts but unfortunately, no control points were indicated by which the map and the ground could be coordinated. A number of small rock cairns were found which are believed to represent some of the control points used in mapping but data concerning them will probably not be available until after the war, as Dr. Dyson is now serving in the armed forces.

It is the writer's belief, based on the similarity of the cirque glaciers of both Yosemite and Glacier, that the ideal method of measuring would be to use a plane table and map the various glacier fronts each year. This would show the relative position of the ice fronts each year in graphic form and would probably entail but little additional time and work, once permanent control points were established.

Mr. Arthur Johnson, who assisted on this years measuring expedition, is of the same opinion and has volunteered to cooperate in carrying on such a project if his schedule and bureau permits.

This procedure, while highly desirable for the Sperry, Jackson and Grinnell Glaciers, could probably not be carried out on a yearly basis in connection with Agassiz Glacier, due to its remoteness and difficulty of access. This famous glacier, which was once the largest in the park, has shrunk so rapidly in the past few years, that a long scale mapping operation is hardly warranted.

It will be highly essential to establish a number of permanent locations at each glacier for taking photographs so that comparisons can easily be made from year to year. In this connection, we hope to secure either a wide angle lens or panoramic camera so that more inclusive views can be obtained.

M. E. Beatty

M. E. Beatty,
Park Naturalist.