

ROOCS/42 NA-POL

UNITED STATES  
DEPARTMENT OF THE INTERIOR  
NATIONAL PARK SERVICE  
ROCKY MOUNTAIN NATIONAL PARK  
ESTES PARK, COLO.

October 27, 1942

Dr. Francois E. Matthes,  
Chairman, Committee on Glaciers,  
U. S. Geological Survey,  
Washington, D. C.

Dear Dr. Matthes:

Enclosed is a copy of the 1942 report on Andrews  
and Tyndall glaciers in Rocky Mountain National Park.

In general, the survey indicates increment of the  
glaciers, following a year of extremely heavy winter  
precipitation and relatively low temperatures. The  
photographs in the plates will be helpful in estimating  
the condition of these small glaciers.

The writer is leaving the National Park Service  
in the immediate future to enter the U. S. Naval Reserve,  
so that it will fall into other hands to handle the measure-  
ments in 1943, barring unanticipated early end of the war.  
A complete record of all annual surveys is being left on  
hand in this office, so that my successor can continue  
this work. No doubt you will receive a report for 1943  
from that person sometime next fall.

Yours very truly,

*H. Raymond Gregg*  
H. Raymond Gregg  
Associate Park Naturalist

Includes 15 plates.



*ROCPS/42/MA - P24*

GLACIER SURVEY

ROCKY MOUNTAIN NATIONAL PARK

1942

H.R. Gregg  
Park Naturalist

1942 GLACIER STUDIES  
ROCKY MOUNTAIN NATIONAL PARK

Annual (with exception of 1936, both glaciers; and 1941, Tyndall Glacier) measurements of glaciers have been made in Rocky Mountain National Park since 1932. Prior to that time, sporadic recorded observations and measurements as well as rate of motion studies were made or undertaken. The present report fits into the series initiated in 1932.

In 1942, both Andrews and Tyndall glaciers were visited and photographed; regular measurement data was secured at both points.

DATE

September 16, 1942

WEATHER

Clear, somewhat windy. Drifting clouds from the west rose by noon, forming fairly heavy cloudbanks in the west, less extensive, but considerable toward eastern horizon, broken and moving rapidly overhead. By mid-afternoon, the cloudbank in the west produced overshadowing of most of the range above 9,000 feet; in later afternoon, clouds cleared somewhat without storming. No precipitation occurred during the day in the course of the glacier trip. High wind, estimated at 40 miles per hour or more was encountered on the continental divide, particularly fresh at the heads of the gorges.

PARTY

The party was composed of Mr. C. S. Ziegler, of Chicago, Illinois, and Mr. Robert Weeks, of Birmingham, Alabama, with Park Naturalist Raymond Gregg of Rocky Mountain National Park.

ANDREWS GLACIER

Although the photographs which illustrate the report are misleading due to clean appearance in 1941 when new snow "cleaned up" the glacier, Andrews Glacier was in "healthier" condition in 1942 than was the case in the preceding year. The series of plates give a good impression of this body of ice from a number of angles. Comparable points are identified.

Measurement was made along two lines of measurement used in previous surveys. Simple tapeline measurement along groundlope was taken in each case, directly to the nearest connected ice, which could be distinguished as part of the glacier proper.

As indicated, there was positive advance or increment. On the measurement along the line from Station X; at the south shore of the lakelet below the glacier, the point of nearest ice in the glacier proper was 155' 8" distant from Station X'. This compares with a measurement of 212' 5" along the same line in 1941, an apparent advance of 56' 9".

From Station X'', at the north side of the glacier front, a measurement of 49' 1" from the station to nearest ice, was obtained. This compares with 54' 3" along approximately the same line in 1941, or an apparent advance on the north front of the glacier of 5' 2". In terms of relation of frontal position to the general shrinkage or increment of the glacier, this figure probably is more diagnostic than the one obtained at the south front, measured from Station X'. The ice is somewhat thinner and flatter at the south edge, and the overlay, protected by the walls of the gorge, causes more marked fluctuations of the frontal position from year to year.

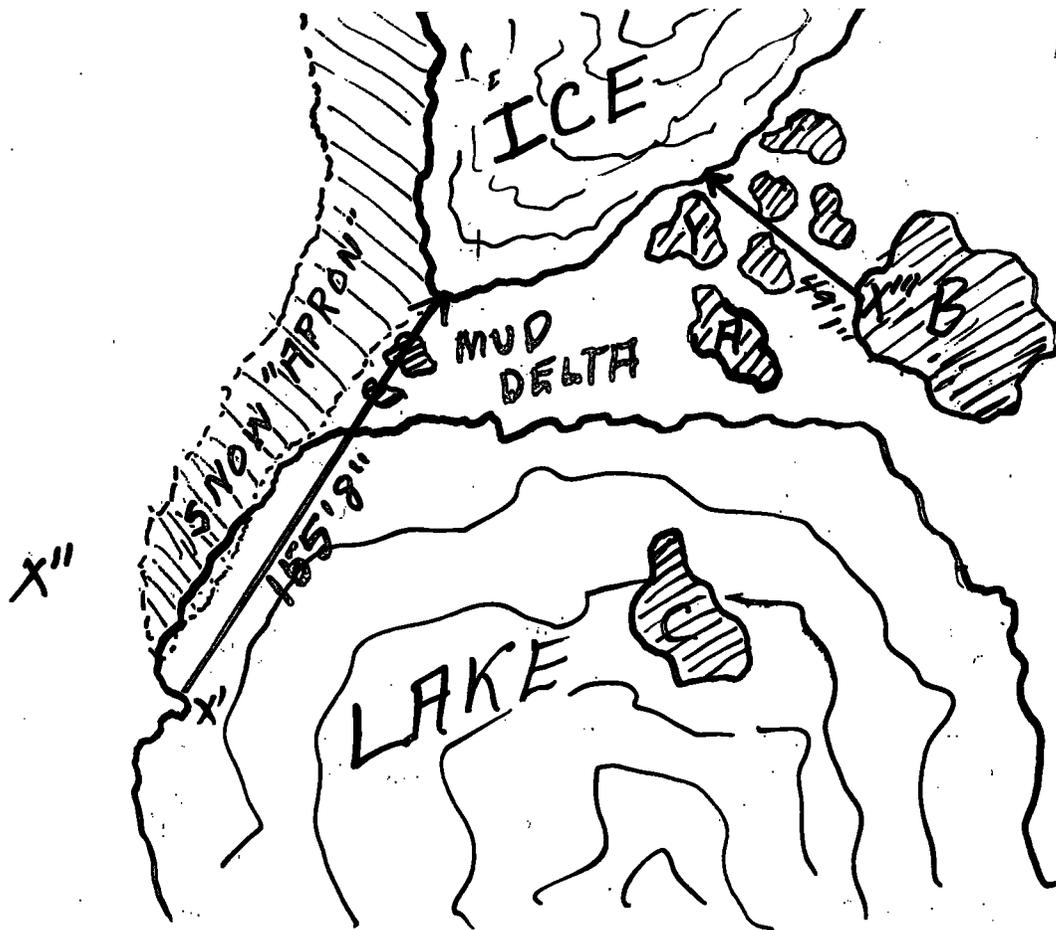
In 1942, the "ice apron", or snowbank surviving overwinter, along the southwest shore of the lake, and blending into the glacier front at its south edge, was as extensive as it has been since the writer began measurements in 1937; and apparently about as great as it has been since 1932.

The mud delta in front of the glacier increases rapidly, and it is conceivable that within ten or fifteen years the sediment will make it possible to walk on dry ground to the rock indicated as "C" on the plates looking toward the glacier, thus setting up a point from which direct line measurements can be made, eliminating the variable factor of the present system of measuring.

Since the reports of 1940 and 1941 used the Station X'' figure for citing recession or advance, it is used here, and the Andrews Glacier is here reported as having advanced 5' 2".

TABLE OF COMPARATIVE MEASUREMENTS

Station X' to Nearest Ice			Station X'' to Nearest Ice		
1942	155'	8"	1942	- 49'	1"
1941	212'	5"	1941	- 54'	3"
1940	170'	(est.)	1940	- 16'	9"
1939	92'		1939	23'	
1938	52'	5"	1938	46'	11"
1937	96'	10"	1937	No measurement	
1936	66'				
1934	139'				
1933	58'	10"			
1932	49'	7"			
Apparent Advance, 1941-42:			Apparent Advance, 1941-42:		
<u>56' 9"</u>			<u>5' 2"</u>		



SKETCH OF ANDREWS GLACIER

Rocks identified by letters used for corresponding rocks appearing in photographs on Plates I-VI

GENERAL NOTES, ANDREWS

In 1942, the snow "apron" or over-winter icebank west of stations X' and X'', at the southwest corner of the lake, was continuous with the body of the glacier at the front. The easternmost point reached by the continuous "apron" was only 9' 3".

Plate VB introduces a view directly toward the measured point from Station X', and gives a readily determinable line of measurement to use each year, by reference to the skyline crag showing prominently in the picture. Measurement is by extended taping line directly across the water to nearest ice along this line.

Measurement from Station X''' to ice is generally south-westerly from the marked station on Rock "R". Due to the high location of the station on the rock (a point not far from waist height above the ice when the station was established in 1938) the line of measurement to the north edge of the ice front is not along a rising groundslope toward the ice, but even dipping to the point measured from the elevation of the station.

TYNDALL GLACIER

At Tyndall Glacier, the measurement obtained in 1942 is about as useful as that of previous years--and no more accurate, as related to the actual condition of the glacier.

It is evident from the photographs that there was an increment in Tyndall Glacier, both in the bulk of the glacier and in the persistence of overlay of snow. The bergschrunds normally opening at the head of the glacier were negligible in 1942. The south "wing" was much greater than in either 1940 or 1941 (in which latter year no photographs were made, but observations were made by the party). The snow overlay at the front, normally debris-strewn, made determination of true ice position impossible. In fact, evidence of shifting of what would ordinarily be stable boulders in the recessional terminal ridge in front of the glacier may evidence continued dissipation of buried ice under this ridge, which probably is in part accumulation of slide material that originally came into position resting on a base of ice.

For the reasons described above, the measurement figures are not particularly valuable, but they are tabulated here for reference. Snow forming a "snout" ahead of the steep-pitching, banded ice, extended quite to the paint-marks indicating Station X', from which photographs are made and measurements taken. This gives a reading of 0, ostensibly the most advanced position of the glacier since measurements were initiated in 1932. Other measurement was not made.

Measurement tables for the annual proximity of "ice" to Station X' is here presented:

1942	0'	0"
1940	56	0"
1939	105'	4"
1938	82'	4"
1937	201'	11"
1935	38'	6"
1934	72'	5"
1933	63'	4"
1932	30'	3"

Apparent Advance 1940-42:  
56' 0"

Series of photographs are presented in Plates IX to XV, to illustrate conditions at Tyndall Glacier.

As a matter of note, the 1943 survey party should take along white paint and brush to re-mark the stations at Tyndall Glacier, due to weathering reducing them beyond more than a year or two of continued usefulness unless retouched.

No sketch is included for Tyndall Glacier, since it would add nothing to the picture presented by the photographs.

METEOROLOGICAL DATA

As in preceding glacier reports, the data are collected for the east slope through the Estes Park Cooperative Observer station; and the Grand Lake Ranger Station Cooperative Observer station; in addition, an average figure is determined and presented. Comparison is made with the averages for the corresponding period in the glacier year 1940-41.

<u>MONTH</u>	<u>STATION OR AVERAGE</u>	<u>TEMPERATURE AND PRECIPITATION</u>		<u>SNOW</u>	<u>TOTAL</u>
		<u>MEAN TEMPERATURE</u>	<u>DEPTH</u>	<u>IN. PRECIP.</u>	<u>PRECIPITATION</u>
<u>1941</u>					<i>(Snow &amp; rain)</i>
October	G.L. ( <i>Grand Lake</i> )	46.8	2"	.70	1.35
	E.P. ( <i>Estes Park</i> )	43.7	1"	.09	1.71
	Av.	44.5	1½"	.39	1.53
November	G.L.	21.7	14"	1.30	1.30
	E.P.	34.9	6½"	.41	.41
	Av.	28.3	10½"	.85	.85
December	G.L.	16.3	11"	.60	.60
	E.P.	30.1	3 ¾"	.20	.20
	Av.	24.7	7 ¾"	.40	.40
<u>1942</u>					
January	G.L.	10.9	18"	1.10	1.10
	E.P.	24.4	8"	.42	.42
	Av.	17.6	13"	.75	.75
February	G.L.	12.5	26"	1.60	1.60
	E.P.	17.6	29½"	1.49	2.49
	Av.	15.1	27 ¾"	1.55	1.55
March	G.L.	22.1	17"	1.15	1.15
	E.P.	26.8	11½"	.76	.76
	Av.	24.4	14½"	.95	.95
April	G.L.	37.7	43"	3.88	3.88
	E.P.	40.4	47"	3.69	3.69
	Av.	39.0	45"	3.77	3.77
May	G.L.	44.2			.90
	E.P.	44.6	18"	1.42	1.42
	Av.	44.4	8"	.71	1.16
June	G.L.	49.9			1.10
	E.P.	52.2			1.75
	Av.	51.1			1.42
July	G.L.	55.2			2.40
	E.P.	61.4			1.98
	Av.	58.2			2.19
August	G.L.	53.8			.75
	E.P.	60.4			.88
	Av.	57.1			.81
September	G.L.	46.9			.58
	E.P.	51.4	4"	.90	1.68
	Av.	47.9	2"	.45	1.12
For Glacier Year 1941-42	G.L.	34.8	131"	10.30	16.66
	E.P.	40.5	123½"	9.33	16.58
	Av.	37.6	127 1/8"	9.84	16.62

Comparative Data

1940-41	G.L.	35.5	97 $\frac{1}{4}$ "	9.89	19.41
	E.P.	42.5	71 $\frac{1}{4}$ "	5.81	17.86
	Av.	39.0	84 $\frac{1}{2}$ "	7.85	18.63
1939-40	Av.	40.2	73 $\frac{1}{8}$ "	6.33	12.84
1938-39	Av.	36.9	97 $\frac{1}{4}$ "	7.60	13.10
1937-38	Av.	39.4	115 $\frac{1}{5}$ "	11.56	21.86
1936-37	Av.	37.5	93.19"	6.65	17.22
1935-36	*	40.7	80.00"	7.11	18.16

\* 1935-36 computed for Estes Park only, prior to establishment of Grand Lake station.

END

Appended: Plates I to XV

*Mit*

PLATES I to XV



ANDREWS GLACIER

Looking west across lakelet at foot of the glacier, showing comparative appearance, 1941 and 1942.

Above, 1941

Below, 1942

Identified points assist visualizing changes in the position of the ice front.





ANDREWS GLACIER

Left: 1941

Below: 1942

View of south edge of glacier, with identified points marked, showing comparative appearance 1941 and 1942.

Comparison must take into account the new snow on edges of glacier in 1941.





LOOKING SOUTH ACROSS THE FRONTAL AREA OF ANDREWS GLACIER

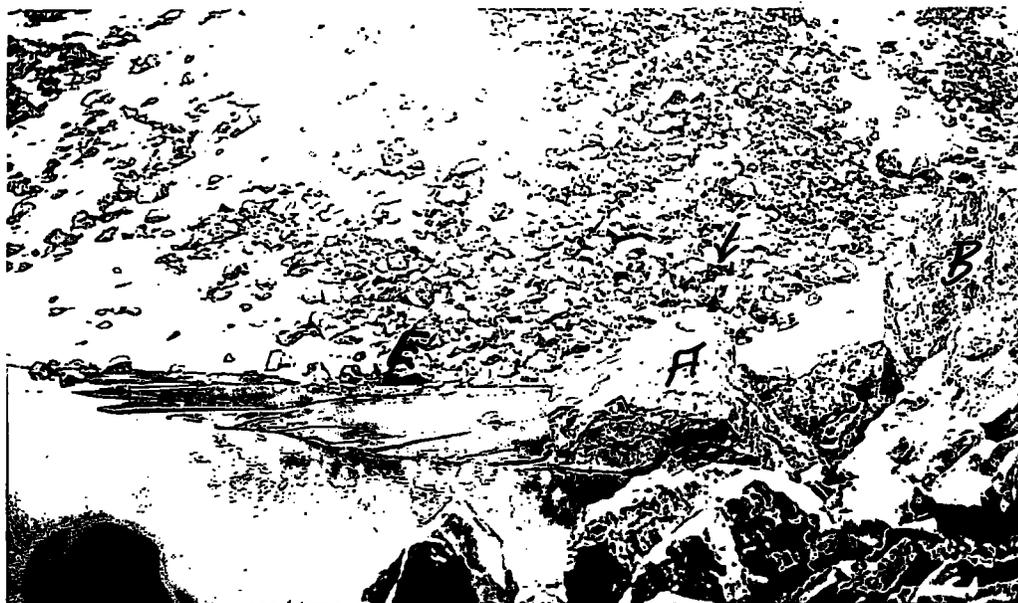
Comparable points are identified. Note the greatly increased volume of the flanking snow "apron" along the south shore of the lake. This is the most extensive bank to survive the summer season at least since 1937 when the present personnel began the annual measurements.

Above: 1941

Below: 1942



Plate III A

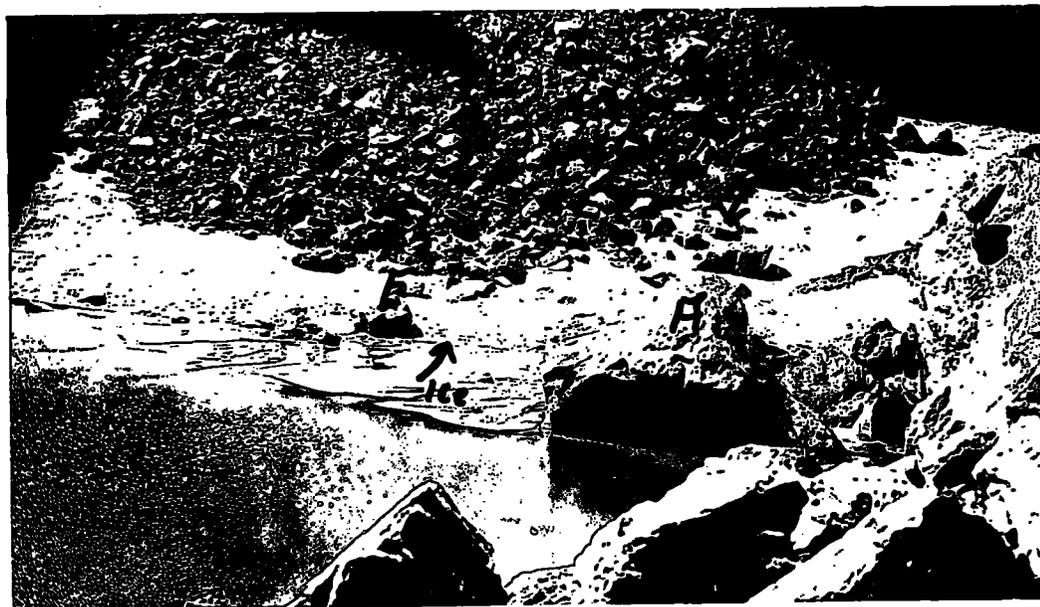


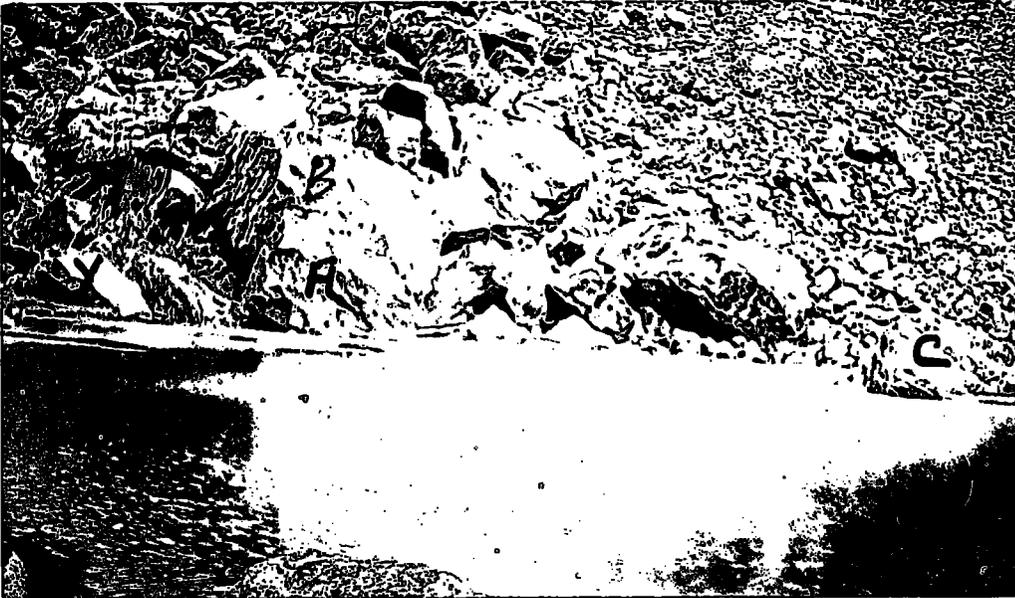
CLOSER VIEW OF FRONTAL AREA  
ANDREWS GLACIER

Above: 1941

Below: 1942

Comparable points are identified, using same symbols as in Plate IIIA, where same points appear. Note the joining of the main body of the glacier at its south front with the snow "apron" along the south shore of the lakelet. Arrow indicates point selected for tapeline measurement from Station X'.





ANDREWS GLACIER

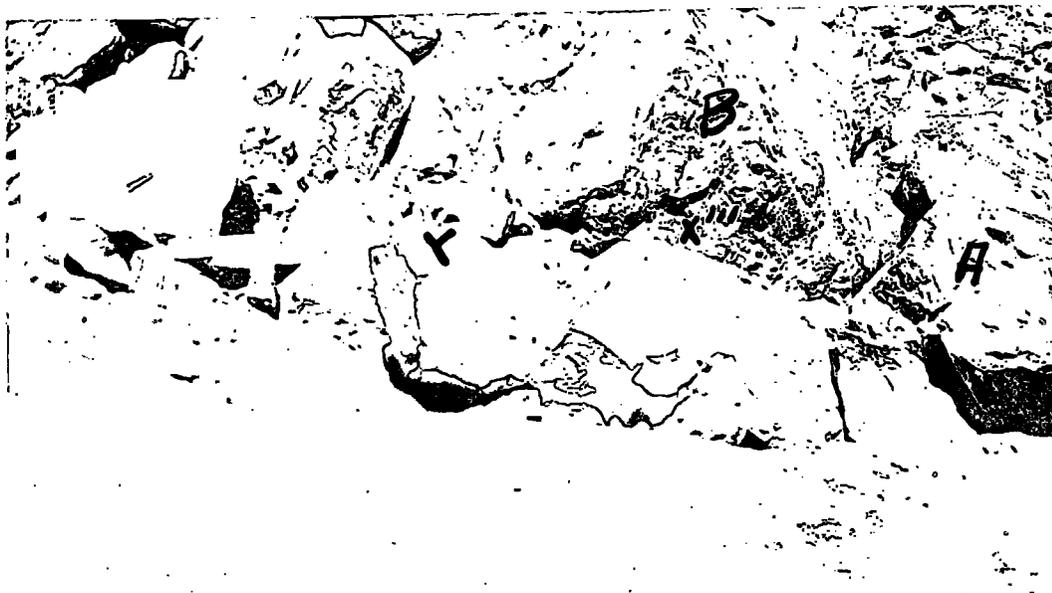
Northerly from Station X' to north edge of frontal area of the glacier. Relation of ice front to Rock C is indicated in each case by arrow at left edge of photograph.

Above: 1941

Below: 1942



PLATE IV B



Closeup looking north at front of Andrews Glacier

This is closely comparable to the lower photo in Plate IIIB of the 1941 glacier report, which latter item shows the condition from this point in 1940.

Plate IV B



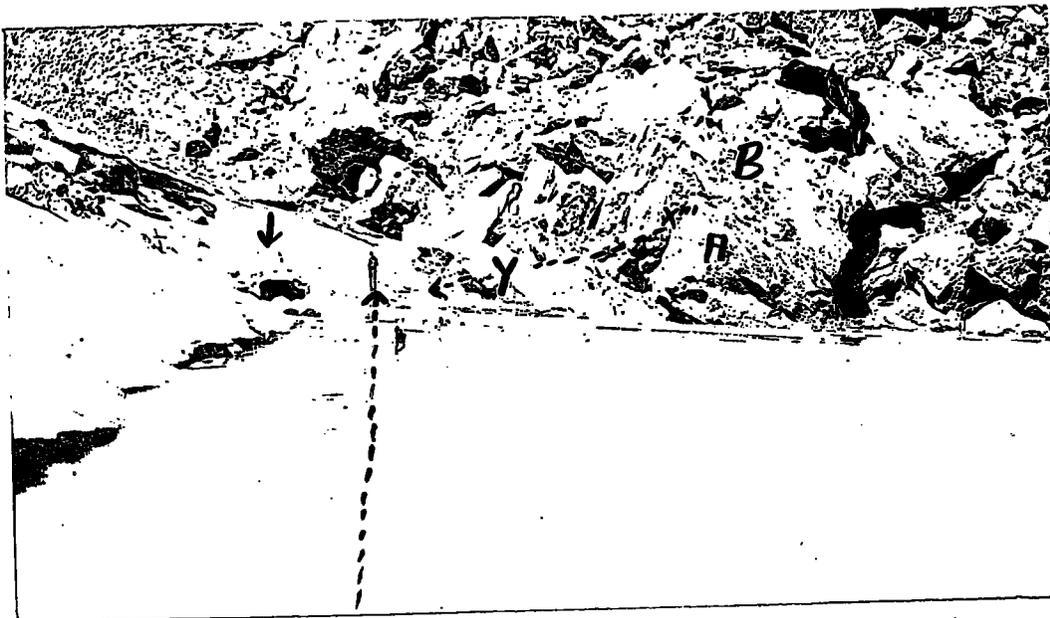
ANDREWS GLACIER

Above: 1941

Below: 1942

Looking from the angle of station X' along the line of measurement, to the ice front. Comparable points are identified. Outline in above photograph necessary to bring out relation of rocks and glacier ice, due to poor photograph.

Note that ice cone marked by arrow in 1941 photograph did not develop in 1942, at least not sufficiently to be noticeable.



X' Plate V A

## PLATE V B



ANDREWS GLACIER

Looking northwesterly along line of measurement to give comparative position for photograph and measurement in future surveys. Picture made from rock on which Station X' is established, at south shore of lakelet. Taping line is stretched across water to point of nearest ice along this line. Crag on skyline aids exact alignment.

Plate VB



ANDREWS GLACIER

Above: 1941

Below: 1942

Looking down over snout of glacier on mud delta and lakelet. Note evident increment of delta with reference to rock identified as "D" in both photographs. This comparison is even more striking by reference to better photograph made in 1940, appearing as lower item in Plate VI of the 1941 glacier report.

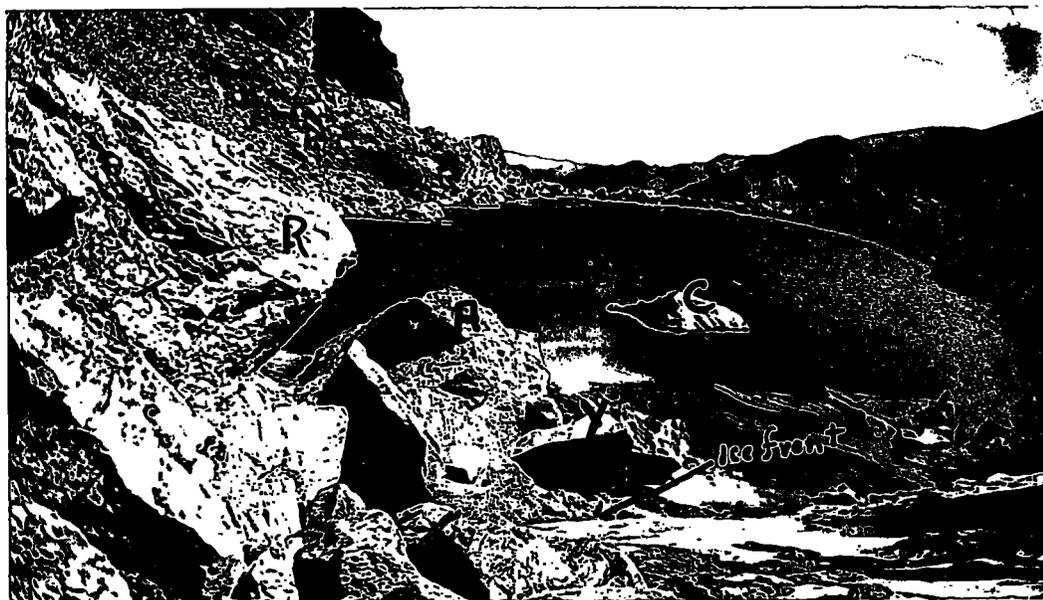




PLATE VII.

ANDREWS GLACIER

Looking up the glacier from near the ice front.

Left: 1940 photo      Lower: 1942 photo  
(no comparable shot possible in 1941 due to cloudiness)

1942 photograph evidently made a bit higher up the glacier but conditions reflected are easily comparable by reference to the pointed crag on the right skyline.





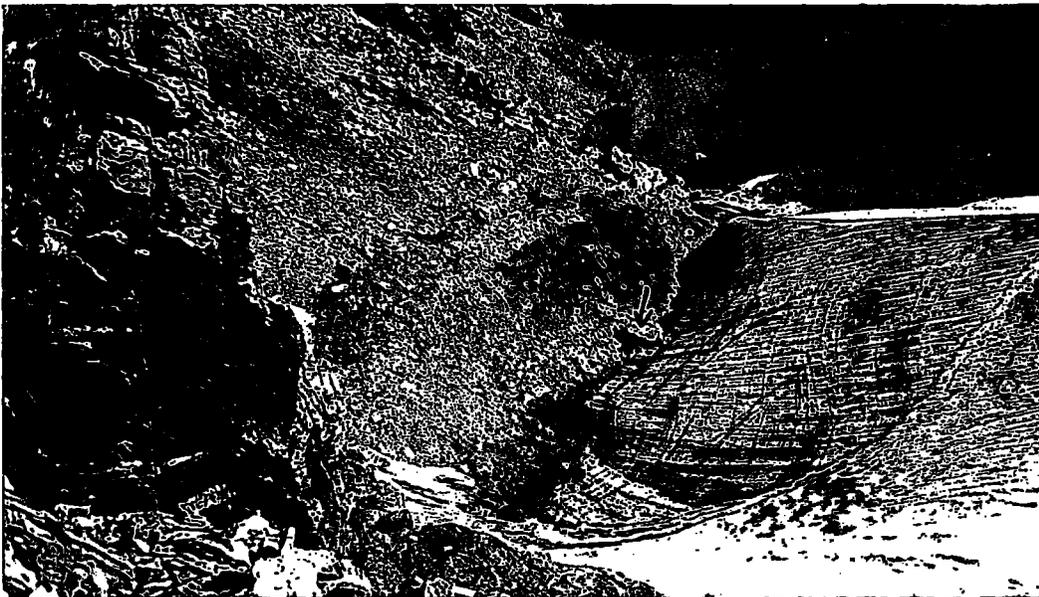
Andrews Glacier

Upper: 1940

Lower: 1942

(No comparable shot possible in 1941 due to lowering clouds covering glacier)

Looking down from headwall showing north edge with nivation ridge or "moraine". It is of interest to note the close similarity of conditions in 1940 and 1942



*Plate VIII*

PLATE IX



TYNDALL GLACIER

Above: 1940

Below: 1942

(No photos possible in 1941 due to prevailing storm)

Looking southwesterly from Flattop side across bergschrund area. Dissipation of snow overlay in 1940 contrasts with condition in 1942 when the bergschrund is barely rifted and accretion bands hardly visible. Comparable points are identified to aid in visualizing changes from 1940 to 1942.





## TYNDALL GLACIER

Above: 1940

Below: 1941

(No photos available in 1941 due to prevailing storm)  
 Looking on glacier from headwall showing front of ice and basin behind recession ridge. Note the heavy accumulation of snow in the basin, covering the ice front adding to difficulty of obtaining a satisfactory measurement. Points are identified to assist in comparing the photographs.



Plate X







TYNDALL GLACIER

Above: 1940

Below: 1942

(No photo possible in 1941)

Looking southerly from lateral ridge north of the glacier front. Points indicated assist in comparison of the larger extent of visible snow and ice in 1942. 1942 photo made from lower, or farther east on the north ridge than 1940 picture.





TYNDALL GLACIER

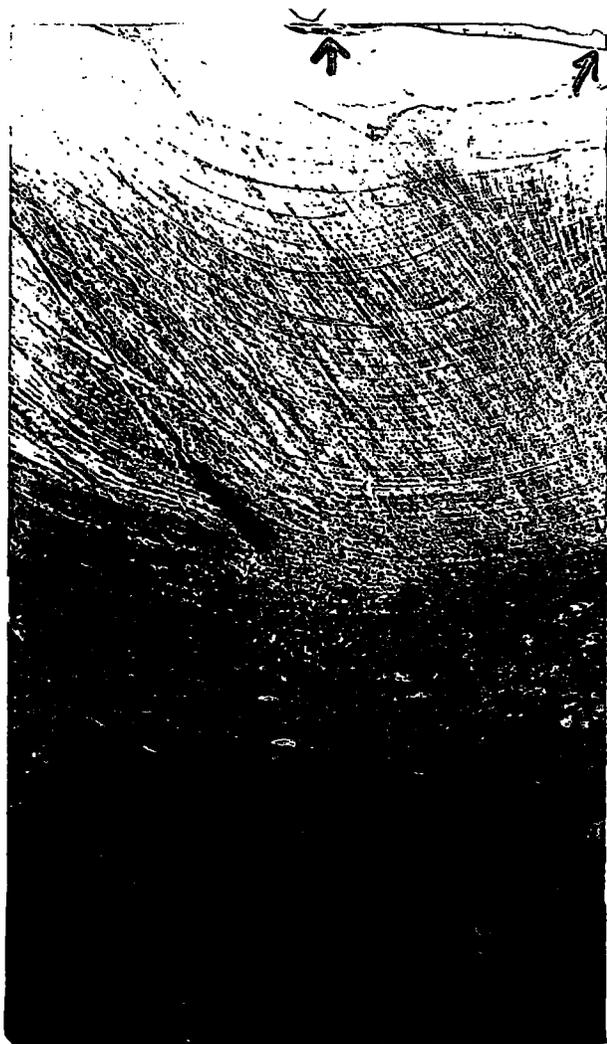
Left: 1940

Lower: 1942

(No photo possible in 1941)

Looking westerly up south edge of glacier toward headwall, with distinctive points to give comparison of shrinkage or increase along this edge of the glacier. This part of the ice body is shaded much of the day.





TYNDALL GLACIER

Left: 1940 Right: 1942  
(No photo possible in 1941)

Looking almost directly westward from Station X' over main body of the glacier. The field covered joins to the northward the field of the photographs in Plate XIV

