

ROCKY MOUNTAIN NATIONAL PARK

NATURALIST OFFICE

1953 GLACIER MEASUREMENT REPORT

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The annual glacier measurement trip was made on August 28, 1953 by six members of the naturalist staff and sixty Park visitors. The party was under the direction of Seasonal Park Naturalist J. Herbert Heger, assisted by Ranger-naturalist Richard G. Reidleman. Ranger-naturalists Hornbein and Beck aided in the measurement of the glaciers, while naturalists Slater and Kingery conducted the rather large visitor group on the hike. It is of interest that all members of the "dude party" succeeded in making the entire trip. In past years a few disenchanted individuals have usually turned back at Emerald Lake Overlook, but it is a tribute to this year's contingent that the hike was made in good time, with no laggards in the crowd to retard the progress of the party.

Mr. Beck (a graduate geologist at the University of Colorado) participated in the glacier measurement as a scientific observer. He assisted Mr. Heger in the measurement of Tyndall and Andrews Glaciers, and is to make an analysis of the scientific value of the present methods that are used. These methods include both actual linear measurements from the snouts of the glaciers to previously established stations and photographs of the glaciers' configuration from these stations. The photographs are excellent visual aids for establishing any changes in configuration of the glaciers, but Mr.

Beck's preliminary investigation of the linear measurements seems to indicate that they are of little value in determining whether there has been any advance or retreat of the front of the glaciers. Mr. Beck will submit a more detailed analysis of these measurements in the near future, which will be used to supplement the annual glacier report.

TYNDALL GLACIER

The measurement group left the Bear Lake Parking Area at 6:15 a.m. Heger and Beck approached Tyndall Glacier by the usual Flattop route, while Hornbein and Beidleman reached the base of Tyndall Glacier by ascending Tyndall Gorge. Slater and Kingery left the parking area at 7:00 a.m. with the visitor group. In hiking up the Flattop trail they met cold weather and strong winds throughout most of the ascent.

By the time the measurement group met at the base of Tyndall Glacier at 8:45 a.m. the fog had lifted, alleviating the traditional problem of inspecting a glacier that is barely visible, and the usual procedure of measuring and photographing the glacier was accomplished. Hornbein and Beidleman placed stakes across the glacier face, a new feature undertaken this year in an effort to detect and possibly to measure movement of the glacier.

The usual problems of measuring Tyndall Glacier presented themselves. In making comparisons from the 1952 to 1953 data, the supposed snout of the glacier in 1952 was 54' to Station X and 50' to Station X'. In 1953 the distance from the assumed snout to Station X was 60' and to X', 90'. However, the nearest ice to X' was 36'. It

is our opinion that the snout was more accurately determined this year since there was a definite ice cave about six feet high at the point of measurement (nearest glacier ice). This probably indicates that we have been reasonably correct in the past in selecting the true snout.

Perhaps the most interesting feature of the change in Tyndall Glacier this year is that on the southeast end, just a few feet from Station P-2, large ice caves have been formed in the past year. Some of these caves were at least 15' high and went back about 30' under the ice. At the front of these ice caves some large rocks showed fresh fractures, with several "landmark" rocks being completely changed by such break-up. However, since Station P-2 is far up on the moraine, we doubt that any movement of this location has taken place.

Our previous opinions that the terminus of Tyndall Glacier lies beneath the morainal debris tended to be confirmed by observation of what was evidently glacier ice, covered by such rock material. This was most noticeable at the southeastern tip of the glacier. Although some of the rock fragment overburden was relatively fresh talus, much of it appeared weathered and had definite morainal characteristics. Near Station X this effect was also somewhat noticeable, although less distinctly.

By and large it appeared that the glacier had much less contemporary snow and presented more ice surface than at any time in the past few years.

In order to more accurately determine the yearly rate of movement of Tyndall Glacier, Mr. Hornbein and Mr. Beidleman established six

metal stakes in the surface of the glacier. They climbed approximately one-third of the way up the north side of Tyndall Glacier and inserted a piton in a bedrock promontory at the northern edge of the glacier. Mr. Beidleman then determined a level line of sight from this piton to a large glacial erratic lying on a bedrock promontory on the south side of the glacier. While Mr. Beidleman remained at the piton on the north side, Mr. Hornbein traveled across the surface of the glacier along the level line of sight and inserted the six metal stakes at approximately equal intervals. The establishment of these six metal stakes along a level line should enable the measurement party to accurately ascertain the yearly rate of advance, and the differential rates of advance between the center and the edges of Tyndall Glacier.

CONCLUSIONS--Tyndall Glacier. Retreat and loss of volume of the ice on Tyndall Glacier appears to be considerable. On the north side of the glacier the rocks have been greatly broken up, possibly as the result of removal of their support by melting of the ice. Much ice has melted back, making it possible to climb directly out of the canyon; in previous years it was necessary to backtrack around the north edge. Also, at the southeast end of the base of the glacier there has been considerable breaking away not only of small rocks but also of large boulders, some of which must be at least ten to fifteen feet in diameter. At this point the interesting ice caves were also found. Mr. Black observed that this ice was not just a roof overhang, but that the ice curved back underneath these rocks, partially substantiating our belief that the glacial ice may go under the moraine.

ANDREWS GLACIER

The usual measurements were made to points X' and X''' from an assumed snout. The distance from the assumed snout to X' was 167', and 46' from the assumed snout to X'''. In both cases there was considerable loss from last year's measurements. For 1952 the distance from the snout to X' was 142' and from X''' to the snout 81'. Because the three measurement points (X', the assumed snout and X''') were almost in a straight line, selection of the snout is rather arbitrary. This doubtless accounts for the shorter distance to X''' this year than last. X' was completely out of the water, indicating that the lake was lower than usual. In obtaining the photograph of X' (Plate 3) the usual approach is by wading through the lake. However, this year the delta was high enough to permit the photographer to avoid wading through the water. As the pictures show, the finger-like ice mass that goes from the assumed snout to X' has melted back at least half-way. Comparisons of the pictures for the last two years clearly depict that this regression was considerable.

It was also noted that the upper south side of Andrews Glacier evidenced many crevasses. Next year proper equipment should be taken in order to measure the depth of these crevasses. Some of them were about three feet in width, and were estimated to be about 60' in depth. They were first seen on a naturalist-conducted glacier trip this season on August 3, at which time the crevasses were located at the extreme southwest edge of the glacier. On August 28, 1953 they extended all along the south edge, including the section of the glacier where

visitors often slide. It was assumed that these crevasses may have been snow-covered in previous years.

CONCLUSIONS--Andrews Glacier. Even though the measurements lack precision, the photographs indicate that there has been considerable change in volume of Andrews Glacier. The base of the glacier has retreated considerably, and crevasses have been opened on the southwest side. Possibly last winter's weather had an effect. Unusually light snow fell through the colder months, with the heavier snows occurring late in the season. These late spring snows, now melted away, permit observation of more true glacier ice than at any time during the past several seasons.

TABLE I

WEATHER STATISTICS

July 1952 through June 1953

Month	<u>TEMPERATURES</u>		No. of Days 32° or Less	<u>PRECIPITATION</u>
	Mean Maximum	Mean Minimum		Total
<u>Estes Park</u>				
July 1952	79.1	43.4	0	.98
August 1952	77.8	44.8	0	.66
September 1952	73.7	35.7	10	.20
October 1952	65.4	24.8	26	.08
November 1952	42.4	14.3	27	1.04
December 1952	39.3	18.3	30	.22
January 1953	56.6	27.2	20	.40
February 1953	39.5	16.0	23	.43
March 1953	48.8	23.2	29	1.20
April 1953	48.9	22.6	26	1.65
May 1953	51.5	31.2	17	2.13
June 1953	74.8	41.4	0	.64
Aver. Means '51-52--56.8	28.6		Total--208 days	Total--9.63"

<u>Grand Lake</u>				
July 1952	74.2	34.6	12	2.66
August 1952	70.7	35.6	8	3.11
September 1952	71.2	27.2	26	1.13
October 1952	62.6	17.8	31	Traces
November 1952	36.7	4.8	30	1.15
December 1952	30.1	-0.5	31	1.28
January 1953	34.7	9.6	31	1.92
February 1953	32.1	-0.5	28	.86
March 1953	40.5	11.1	31	1.60
April 1953	43.6	15.6	30	1.53
May 1953	54.2	23.7	29	1.82
June 1953	70.7	31.4	18	1.00
Aver. Means '51-52--51.8	17.5		Total--305 days	Total--18.06"

TABLE II

Tyndall Glacier

<u>Year</u>	<u>Station X' to "ice"</u>
1932	30' 8"
1933	63' 4"
1934	72' 5"
1935	38' 6"
1936	No measurements
1937	196' 9"
1938	62' 4"
1939	105' 4"
1940	56' 0"
1941	No measurements
1942	At ice
1943	No measurements
1944	56' 3"
1945	54' 4"
1946	112' 11"
1947	5' to ice
1948	180' to possible "glacier ice"
	260' to "foot of glacier"
	(adjusted from an erroneous measurement from Station X, not X')
1949	106'

Remarks: (1) Station X, used in 1948, was 300' from "nearest glacier ice". In 1949 a line from this station measured but 126'. (2) It is apparent from above table that measurements at Tyndall Glacier are highly erratic, with much variation in observer's judgement of actual glacier terminus.

	<u>Station X</u> (Same as 1948)	<u>Station X'</u>
1950	94'	110'
1951	about 3"	10'
1952	54'	50'
1953	60'	90'
		(Nearest ice to X' was 36')

TABLE III

Andrews Glacier

<u>Year</u>	<u>X' to "Glacier Front"</u>	<u>X''' to "Glacier Front"</u>
1932	48' 7"	
1933	58' 10"	
1934	139' 0"	
1935	66' 0"	
1936	No measurements	(Station established in 1938)
1937	96' 10"	
1938	32' 3"	48' 11"
1939	92' 0"	23' 0"
1940	170' (est.)	16' 9"
1941	212' 5"	54' 3"
1942	155' 8"	49' 1"
1943	No measurements	No measurements
1944	253' 0"	79' 2"
1945	210' 6"	65' 7"
1946	224' 9"	60' 8"
1947	201' 9"	66' 0"
1948	210' 0"	56' 0"
1949	164' 0"	64' 0"
1950	194' 0"	68' 0"
1951	165' 0"	63' 0"
1952	142' 0"	81' 0"
1953	167' 0"	46' 0"

Remarks: Judgement of the field party as to "nearest glacier ice" varies; this doubtless explains the erratic figures.

TABLE IV

SNOW DEPTHS AND WATER CONTENT FOR PARK

Dates	1953		1952		1951		Mean		Mean No. of Years
	Snow D.	H ₂ O	Snow D.	H ₂ O	Snow D.	H ₂ O	Snow D.	H ₂ O	
#116 Copeland Lake (Alt. 8,600')									
Jan. 31	11.40	2.60	23.60	6.80	30.30	6.40	22.24	5.22	5
Feb. 28	18.30	4.80	24.27	7.73	24.20	7.50	20.27	5.89	5
Mar. 31	13.45	3.27	30.80	9.80	24.70	7.82	22.12	7.03	5
Apr. 30	5.54	2.27	10.30	4.90	13.55	4.91	6.57	2.68	5
#41 Wild Basin (Alt. 10,000')									
Jan. 31	28.10	6.30	48.00	16.25	54.30	15.70	32.99	8.41	15
Feb. 28	40.50	10.75	53.46	19.12	54.12	18.25	40.66	11.03	16
Mar. 31	45.08	13.13	66.10	24.50	61.54	21.62	46.80	14.45	16
Apr. 30	39.88	15.04	56.38	24.42	59.33	22.42	40.82	14.84	16
#115 Deer Ridge (Alt. 9,050')									
Jan. 31	13.50	2.50	23.10	6.50	23.80	4.30	20.9	4.70	5
Feb. 28	17.50	4.20	22.20	6.50	27.20	7.30	22.16	6.00	5
Mar. 31	11.14	3.36	28.90	8.50	30.86	8.90	25.82	6.73	5
Apr. 30	10.57	3.78	14.40	5.00	23.20	7.40	12.37	3.86	5
#95 Hidden Valley (Alt. 9,550')									
Jan. 31	27.50	5.30	43.20	12.30	40.30	9.00	31.12	7.01	13
Feb. 28	32.00	8.00	45.20	13.60	45.60	12.50	37.70	8.27	13
Mar. 31	31.93	9.36	55.20	17.00	51.50	15.57	43.25	12.30	13
Apr. 30	41.28	13.64	52.60	17.70	55.50	18.30	45.03	13.77	13
#127 Grand Lake (Alt. 8,600')									
Jan. 31	30.00	4.92	42.95	10.91	35.91	6.83	34.03	7.05	5
Feb. 28	27.90	6.33	46.58	13.00	36.48	8.87	34.78	8.65	5
Mar. 31	27.58	5.92	52.25	16.08	37.25	10.45	37.28	9.98	5
Apr. 30	12.30	3.80	21.38	9.17	22.25	5.83	17.10	5.80	4
#64 North Inlet (Alt. 9,000')									
Jan. 31	30.08	6.18	44.00	12.40	21.10	6.70	24.89	5.82	15
Feb. 28	—	—	34.02	10.24	34.85	9.40	30.86	7.62	16
Mar. 31	28.00	8.45	53.10	17.85	38.50	11.25	33.47	9.89	16
Apr. 30	22.75	7.60	35.20	14.25	27.80	7.70	23.43	7.69	16
#12 Phantom Valley (Alt. 9,038')									
Jan. 31	30.06	6.65	42.53	11.93	35.56	9.37	26.54	6.07	17
Feb. 28	32.75	9.25	50.25	14.78	42.75	12.62	33.56	8.68	17
Mar. 31	29.03	8.18	57.50	19.03	43.68	16.00	34.89	10.31	17
Apr. 30	19.50	7.31	27.75	11.72	31.89	11.21	18.57	6.71	16
#65 Lake Irene (Alt. 10,600')									
Jan. 31	—	—	72.28	20.07	57.21	17.77	49.12	13.36	15
Feb. 28	56.35	18.42	71.78	26.50	70.35	23.14	59.57	18.18	16
Mar. 31	53.75	20.43	82.42	30.78	79.92	30.21	65.96	22.15	16
Apr. 30	59.89	23.07	62.07	28.25	84.31	34.50	69.66	24.52	15



Thorn Point P-3
Tyndall Glacier. Bergschrund area at head of the glacier,
from Flattop Mountain. August 30, 1952



Same view as above. August 28, 1953

PLATE 1. Tyndall Glacier.



1952—from Point P-1, Tyndall
Glacier. General view of the
glacier from the north.



1953—Same view as above.

PLATE 2. Tyndall Glacier



1952—Tyndall Glacier. Recessional moraine, base of Tyndall Glacier, showing X and X'.



1953—Recessional moraine, base of Tyndall Glacier, taken from above snout. Notice rock on ice in foreground.

PLATE 3. Tyndall Glacier



Recessional moraine, base of Tyndall Glacier. Taken from
snout. Notice Station X and X'. August 28, 1953

PLATE 4. Tyndall Glacier.



August 30, 1952. Taken
from P2 looking north.

Same view as above did not turn out in 1953.

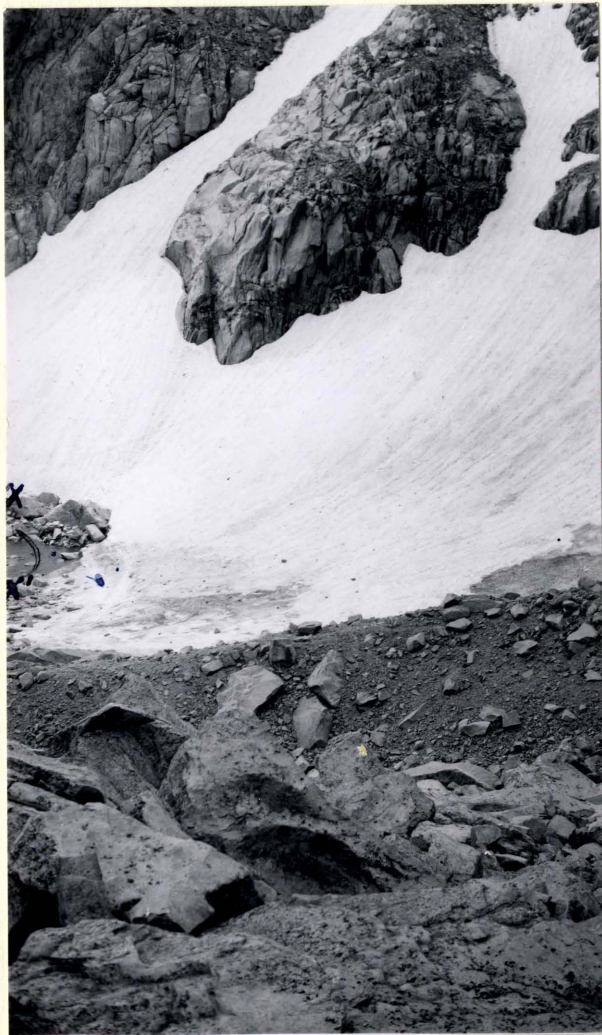
PLATE 5. Tyndall Glacier.



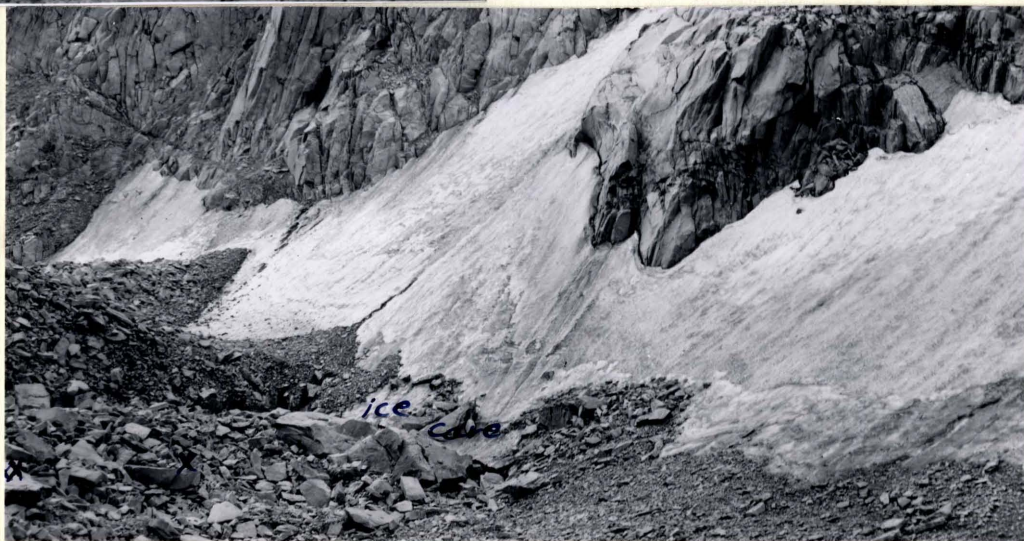
View from Point X to ice.
August 30, 1952

Same view as above did not turn out in 1953.

PLATE 6. Tyndall Glacier



1952--View from P-1 looking south,
showing ice, X and X'.



1953--Base of Tyndall Glacier from P-1.
Note X, X' and ice cave location.

PLATE 7. Tyndall Glacier



Andrews Glacier. General view, looking west across lake.
August 30, 1952



Andrews Glacier. General view, as in figure above.
August 28, 1953

PLATE 8. Andrews Glacier.



1952—Andrews Glacier. Figure "S" stands for location of snout.



1953—Andrews Glacier. Notice that figure at X' is standing in water. Also, notice lower left finger of glacier and compare with the photo above. Note crevasses that have developed.

PLATE 9. Andrews Glacier



1952—Andrews Glacier. Looking from snout toward X^{III}.

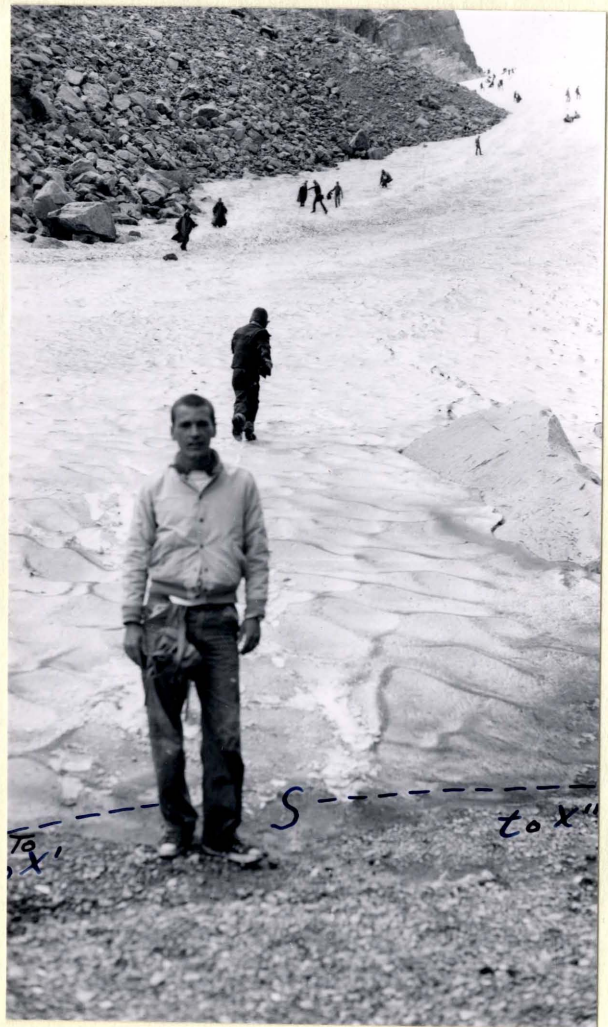


1953—Andrews Glacier. Same view as above.

PLATE 10. Andrews Glacier.



1952—Andrews Glacier. Looking from chosen snout to X'.



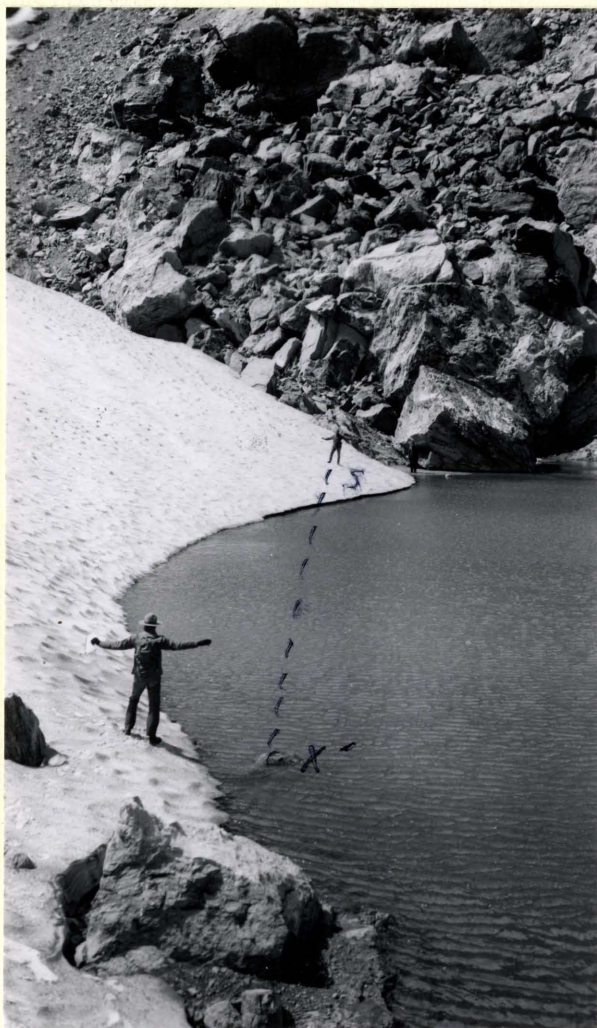
1953—looking up glacier
"snout" from delta.



Andrews Glacier. View south, showing delta, lake shore
and snout of the glacier. August 30, 1952



Andrews Glacier. Approx-
imately same view as above.
August 28, 1953



1952--Andrews Glacier. View along
line of measurement from point X'.

1953--Same view as above.

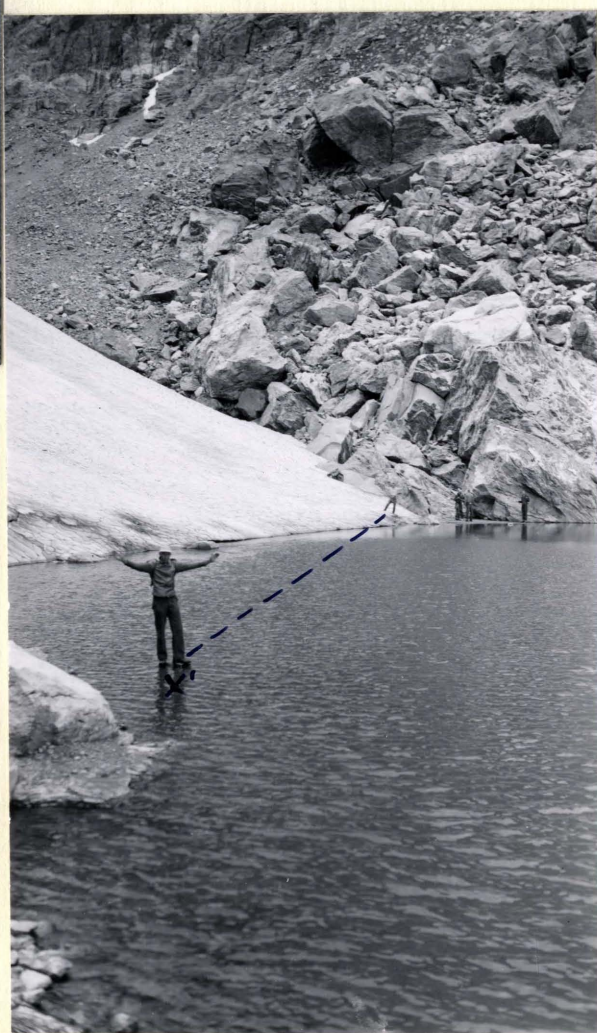
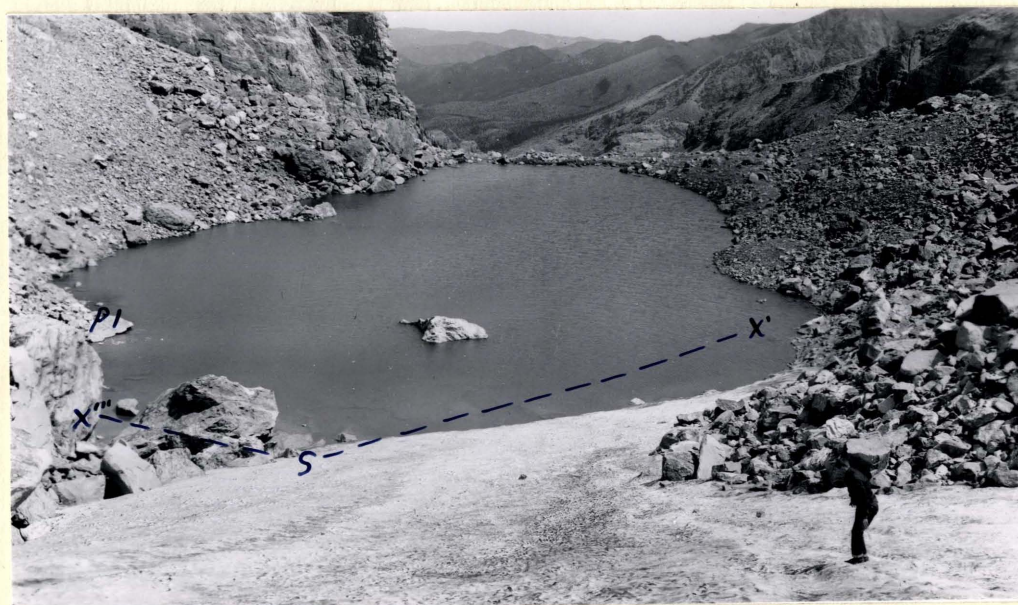


PLATE 13. Andrews Glacier



Andrews Glacier. View down the glacier toward delta and
across the glacier pool. August 30, 1952



Andrews Glacier. Same view as above.
August 28, 1953

PLATE 14. Andrews Glacier