GLACIERS

in

ROCKY MOUNTAIN NATIONAL PARK

Published by the Rocky Mountain Nature Association,
Estes Park, Colorado

The Rocky Mountain Nature Association is a non-profit educational society organized to assist the interpretive program of Rocky Mountain National Park. The Association sells informational publications and slides at Moraine Park Visitor Center and at the Alpine Visitor Center. Publications may be obtained by mail from the above address.

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COVER: TAYLOR GLACIER FROM LOCH VALE
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INTRODUCTION

Few landscape features of the Rocky Mountain National Park attract as much visitor interest as the glaciers. Glaciers are products of cold climates and although Colorado is justly famous for being cool and green, it is too far south and lacks the heavy snowfall which causes glaciers to become well developed today.

You must visit Mount Rainier or Glacier National Parks to see the few sizeable glaciers remaining within our country's continental borders, and go to Alaska or Greenland to see North America's best. A few thousand years ago the situation was quite different. About 25,000 years ago, we had some big glaciers in what is now Rocky Mountain National Park. Their evidences are certainly excellent examples of past glacial work, if the modern glaciers themselves are not.

THE STORY BEGINS . . .

Perhaps about a million years ago or so. Although this seems remote by human standards, it was only yesterday when you consider the vast sweep of geological time.

By the time the present Front Range had attained its present general development, the present pattern of river valleys and drainage systems was also established. For a variety of reasons (many still rather obscure), North America underwent an Ice Age, and thousands of square miles of Canada and the northeastern United States were completely buried beneath a great ice cap. Look at modern Greenland today and you will see a comparable situation.

These great ice caps never extended into Colorado. Our Ice Age experience was not one of complete burial beneath ice; instead each mountain valley above 9,000 feet altitude, in what is now Rocky Mountain National Park, filled up with thick, slow moving rivers of ice. The glaciers began in the highest slopes — up near the present Divide — and extended down the river-cut valleys to altitudes of about 9,000 feet. They didn't reach as far as Estes Park, or at least we don't think they did, nor into the present Big Thompson Canyon. They definitely never reached the plains. Even then they were restricted to the higher mountain regions and almost always were contained within an already-existing river-cut valley or canyon.

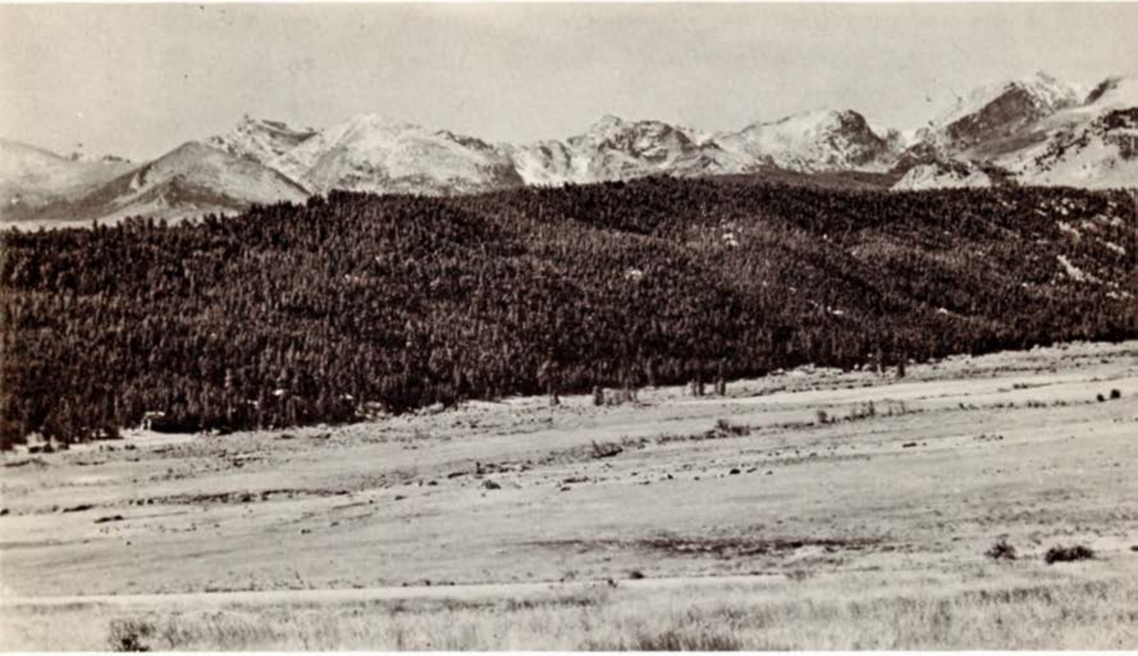
GLACIERS MADE DELUXE EXCAVATIONS

Grinding their way down these originally twisting canyons, the glaciers scooped the bottoms out deeper, removed most of the many shoulders and other obstructions responsible for their original twisting pattern and, after melting away, left them characteristically broad, steep-walled but straight and open.

If you compare the broad valley above Fall River Lodge to the tortuously twisting river-cut Big Thompson Canyon, you can see how the glaciers worked.

In the high country the glaciers did a lot of landscape changing. They quarried out originally broad valley-heads into great pit-like cirques. They cut into the sides of rounded mountains and produced great cliffs instead — like the cliffs of Hallett Peak and the famous East Face of Longs Peak. They scooped out depressions in the hard crystalline bedrock, which today are filled by lakes, such as Sky Pond and the Gorge Lakes. Altogether, then, most of the rugged beauty of our high country is due to the work of these now-vanished glaciers. The view south from the Rock Cut on Trail Ridge Road is a view of the intricate sculpture accomplished by several mountain glaciers on what was originally a group of broad, rolling upland hills.

The rock which was quarried out in the high country wasn't crushed to dust up there; most of it was carried into the lower country by the glaciers. Some of it was carried on top of the ice, like a conveyor belt. Some was enclosed within the ice. Some was actually pushed along in front of the advancing glacier front. It was all eventually dumped, either along the glacier's sides, underneath the ice on the bottom, or at the glacier's terminus. As you look at them today, these deposits are called moraines, usually noticeable as long, symmetrical forested ridges. Often the moraines served as natural dams, producing lakes. Most of our mountain meadows were once such lakes. Bear, Haiyaha and Grand Lakes are examples of such processes, but are still bodies of water. Bierstadt Lake has an interesting history. It occupies the sag formed by the piling up of two huge moraines which paralleled each other and more or less merged. Nearly all of our lakes, then, owe their existence to the Ice Age glaciers.



SOUTH LATERAL MORAINE IN MORAINE PARK, A PRODUCT OF THE GREAT ICE AGE

DO GLACIERS "MOVE"?

Much curiosity has been expressed about the "Movement" of a glacier. Many jokes — almost of Ice-Age antiquity — are told about glaciers "going back for more rocks." The movement of a glacier is roughly comparable to the slow spreading out of a mass of warm tar, or of wax. The moving takes place within the glacier itself, and is necessarily very slow — so slow that you are scarcely ever able to see it.

As ice temperatures approach the melting point, the rate of movement increases — hence, movement is at a maximum during the summer and early autumn. Friction along the bottom and sides of a glacier holds back the edges; most rapid movement of a glacier is, therefore, largely in the center. Some glaciers in Switzerland show movement of two feet per day; some in Greenland have been "clocked" at over fifty feet per day. Usually the rate is closer to fifty feet per year.

Glaciers in Rocky Mountain National Park have not been timed recently, but early work indicates the average movement of our local glaciers is about three feet per year. It is quite possible they are almost stagnant in these modern days.

One way to test the movement of a glacier is to drive a series of stakes across the glacier in a perfectly straight line. If you return to the same spot a couple of years later and if there is movement, the "stake fence" will have moved out of its straight line, usually with the stakes in mid-glacier having shifted downhill a few feet. It is hard to conceive of such slow motion accomplishing the amount of work for which we credit it, but just consider that even these slow movements, taking place over a period of perhaps a hundred thousand years, can move a great amount of rock.

Our modern glaciers are sometimes called pathetic remnants of the king-size glaciers of the past. But, even though they are small, they are interesting destinations for hikers. You can see only two — Andrews and Tyndall — at close hand without an exhausting hike. None of them are approached closely by a developed trail.

Let us study a little more closely a few of the glaciers found in Rocky Mountain National Park.

ANDREWS GLACIER . . .

Is located at an altitude of about 12,500 feet at the head of Andrews Gorge. It drains easterly through Loch Vale into Glacier Creek. About ¼ mile in length and perhaps 1/10 mile wide, it has a northeast exposure. It was named by Abner Sprague, an early settler and mountaineer, for Ed B. Andrews, husband of his wife's sister, and a well-known local amateur naturalist. The glacier terminates just short of a small lake, Andrews Tarn, which has the milky appearance typical of waters directly below glaciers. Pulverized rock, ground up by the glacier's abrasive action, is held in suspension in such lakes and adjacent streams creating so-called "glacial milk". This is one of two glaciers that ranger-naturalists "measure" annually. Their work indicates that the ice has become greatly reduced in volume since the mid-1930's.

How To Reach It — If you are a seasoned hiker, you can easily reach this glacier by following dim "fisherman tracks" up Andrews Gorge from the Loch, to which a well-developed trail leads, about six miles from the Glacier Gorge

ANDREWS GLACIER

parking area on the Bear Lake Road. It is a fairly short all-day hike. Many hikers take the Andrews Glacier in stride, descending it on the return from a hike to Tyndall Glacier via Flattop Mountain.

TYNDALL GLACIER . . .

Is located at an altitude of about 12,300 feet. It is at the head of Tyndall Gorge and drains easterly through Emerald and Dream Lakes into Glacier Creek. About ½ mile long and possibly ⅓ mile wide, it was named for Dr. John Tyndall, a noted nineteenth century scientist who visited the West in the 1870's, and after whom a 14,000 foot peak in California's Sierra Nevada is also named. It has a northeast exposure and is quite steep in gradient. Ranger-naturalists check this glacier and Andrews Glacier annually to detect movement and relative advance or retreat of the ice front. It presents great difficulties

TYNDALL GLACIER

to these men because of the likelihood that the actual terminus is buried beneath talus and morainal debris at its foot. The bergschrund — "split" area at its head between rock cliff and ice cliff — is an impressive sight.

How To Reach It — The most accessible glacier in the Park, to reach it, you need merely to ascend the Flattop Mountain trail, which begins at Bear Lake, and hike across Flattop Mountain toward the western slope, some five miles from Bear Lake. From the rim of Tyndall Gorge, the glacier will appear before you in great majesty. It clings to the cliff face as though reluctant to finally melt away. If you drive to Bear Lake, you see Tyndall Glacier on the skyline between Hallett Peak and Flattop Mountain. It is probably the most photographed of the Park's present-day glaciers. *A word of caution* —Descent into Tyndall Gorge can be very hazardous. Make the trip only by one of the known routes and it would be better if you are in the company of an experienced guide.

SPRAGUE GLACIER

SPRAGUE GLACIER . . .

Is located at an altitude of about 12,700 feet. This glacier faces northeast at the head of Spruce Canyon. It drains through Spruce Canyon into the Thompson River. It is about 4/10 mile long and possibly 3/10 mile wide. A characteristic feature is the "calving" off of ice, at the glacier's base, into the lake at its foot. It was named for Abner Sprague who, with his parents, settled in Moraine Park in 1875. Sprague called attention to the curious features of this glacier before 1900, and local residents applied his name to it.

How To Reach It — Do not try to reach this glacier unless you are with trained guides. One of the more isolated features of the Park, no trails lead anywhere near this glacier, but seasoned hikers can get close views by ascending the slopes up Spruce Canyon to Rainbow Lake. This is a rugged trip, about six miles through timber, across the creek dozens of times, and up hill all the way. Follow the regular Fern Lake trail from Moraine Park, but leave it near the Pool. It is also possible to reach an overlook point, from which the glacier is well seen, by hiking up a rather poor trail above Tonahutu Creek from the Grand Lake side.

ROWE GLACIER IN 1889, PHOTOGRAPHED BY CHAPIN

ROWE GLACIER . . .

Is located at an altitude of about 13,200 feet, on the north slope of Hague's Peak. Rowe Glacier drains into the North Fork of the Thompson River. It is about 1/4 mile long and possibly 4/10 mile in width. It was originally called Mummy Glacier, but was re-named Hallett's Glacier by Chapin in 1887 after the same climbing companion for whom he named Hallett Peak. To avoid confusion with the peak, the National Park Service re-named the glacier in 1932 in honor of Israel Rowe who discovered the glacier while bear hunting in 1880. This glacier has diminished so much in volume since 1890 that it is questionable whether this vestigial ice body can still be called a glacier. (See the comparative photographs above.)

How To Reach It — Do not try to hike to this glacier unless you are with local guides or you have asked a park ranger about the route. Two routes are in use. The usual one is to follow the marked trail to Lawn Lake and then to cross up and over the divide near the top of Hague's Peak, to the glacier.

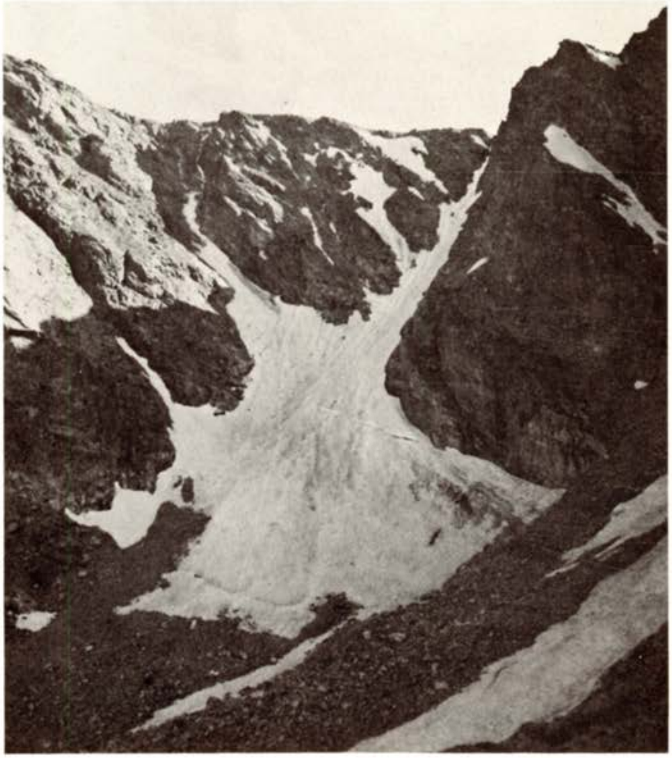
Another approach is from Lost Lake, reached by trail up the North Fork. From there you can make a rather grueling hike to the Glacier. You can also ride a horse within a mile or so of this glacier.

ROWE GLACIER IN 1956 TAKEN DURING PARK GLACIER SURVEY

TAYLOR GLACIER . . .

Is located at an altitude of about 12,700 feet at the head of Loch Vale Gorge, facing north, a mile or so west of Taylor Peak. About 6/10 mile long and 3/10 mile wide, it is an extremely steep mass of ice — a true cliff glacier. It is visible for many miles — as from Moraine Park — as a hook-shaped mass of white ice and snow. Often great gashes appear on its face — the marks left by avalanches and rock falls of the previous spring. It was named by Abner Sprague, a famous local settler, for A. A. Taylor, who was head of a normal school in Kansas and who spent a summer in Estes Park in the early 1890's.

How To Reach It — A familiar, well-marked trail leads from Glacier Gorge parking area on the Bear Lake Road to the Loch. The trail is about three miles long. From the Loch, you must locate the dim fisherman's tracks which lead south to Lake of Glass and Sky Pond. You can make a rather difficult passage through the brush and over innumerable boulders to the base of this glacier, another three miles from the Loch. This trip is very awkward if you do not make it with a guide or with someone who has found his way



TAYLOR GLACIER

there before. You can get quite a satisfactory distant view of this glacier from the Loch itself. Most newcomers should find this view adequate, but if you feel impelled to get right next to a glacier, you should continue on to Andrews Glacier instead of trying Taylor.

OTHER ICE BODIES

The five glaciers just described are not the only bodies of glacial ice in Rocky Mountain National Park. There are at least ten (perhaps more) ice bodies scattered through the Park located on the steep headwalls of glacial cirques (glacier head basins) formed during the Ice Age. Most of these cirques

ICE BODY ON MT. IDA ABOVE GORGE LAKES

are situated along the steeper east face of the main crest of the Front Range and therefore east of the Continental Divide. The ice bodies are of stagnant ice (no movement) and may not be recognizable as ice even in summer, as late-lasting snowbanks usually keep them covered until summer's end or early autumn.

RECENT GLACIATION

These present-day ice bodies, including the five small glaciers or glacierets, are presumably small retreating remnants of glaciers formed here during a minor glacial period much more recent than the Ice Age, beginning only about 800 years ago (Gannett Peak Stage). Glaciers existed in these same cirques during another minor glacial period between about 1800 to 1000 B.C. (Temple Lake Stage). The moraines of glacial debris deposited by the glaciers of these two recent glacial periods are very conspicuous features of the landscape today in the cirques below the remnant ice bodies. Indeed, these moraines are so fresh looking and unstabilized that little or no vegetation is growing upon them.

MORAINE OF MOST RECENT GLACIATION DIRECTLY BELOW TYNDALL GLACIER

ROCK GLACIERS

Some geologists believe that a few of the large complex moraines below the ice bodies are actually "rock glaciers". Rock glaciers, common in the San Juan Range of Colorado, are great masses of rock debris in which ice forms between the rock fragments (interstitial ice). The ice, being plastic and creating reduced friction, enables the rock mass with its great weight to slide down the slope very slowly. With this movement the rock debris is warped into roughly parallel but curved ridges pointing downhill. Rock glaciers may appear very similar to moraines. In many cases glacial moraines of the recent glacial periods (since 1800 B.C.) may have since converted to rock glaciers. An authority on rock glaciers has identified at least one in Rocky Mountain National Park just below Tyndall Glacier, and there may be others.

SOME GLACIER TERMINOLOGY

Some terms, in common usage in glaciated regions, are often unfamiliar to our visitors. They are listed, with explanations, below.

Cirque—(pronounced s-e-r-k). Great natural amphitheatres at the head of each glaciated mountain, where our glaciers got their start. Chasm Lake, at the foot of the East Face of Longs Peak, is in our biggest cirque, but Iceberg Lake on Trail Ridge occupies a typical, although much smaller cirque.

Crevasses—Fractures in the ice of a glacier, usually caused by movement over an irregularity by the glacier. Dangerous to an alpine climber because they may open up for a hundred feet or more.

Cyclopean Staircase—Intermittently flat and steep canyon gradient, due to differential glacial erosion. Hikers to Sky Pond, for example, traverse such a "staircase"—first a flat meadow or lakeshore is traversed, then a cliff must be climbed in order to reach the next meadow or lake basin.

Glacier — A mass of ice which moves, or shows evidence of having been moving in the recent past. The movement is due to gravity and weight of the ice. Usually an ice field must be about 100 feet thick before its weight prompts movement.

Hanging Valley—A tributary valley to a main canyon, but perched above it. Normally, streams join on a level, but scooping out of the main canyon bottom by a glacier left the tributary river "hanging" above the main canyon bed. Roaring River is our best local example of this landscape form.

Horn Peaks — Glaciers sculpture rounded mountains into steep-sided ones by taking great "bites" out of each slope. When this has occurred all around the peak, a "matterhorn" peak develops. Many such needle-like peaks can be seen in Rocky Mountain National Park.

Ice Field—A mass of ice or **neve'** which is of insufficient thickness to move. If it should move, it becomes a glacier by definition. Most of the white "flecks" on our mountains are ice fields.

Moraines—These are heaps, piles or ridges of unsorted rock debris, which were originally piled up by glaciers as they ground their way down our valleys during the Ice Age. Moraines are common everywhere in the Park above 9,000' altitude. They often have lakes behind them (as Bear Lake) or are long embankments, covered by forests (as in Moraine Park).

Neve'—(pronounced n-e-v-a-y). When snow piles up to some depth, the snowflakes change into more resistant globular grains of ice. This material is **neve'** and under pressure it becomes ice. This is how glaciers begin—snow to neve' to ice.

Paternoster Lakes—A string of glacial lakes, occupying basins scooped out by now-vanished glaciers. They (on a map, at least) resemble beads on a string, hence the name. The Gorge Lakes, in a sense, are in this category.

Peneplain—Not restricted to glaciated regions, but to be found in mountains everywhere. These are remnants of an early "plain" surface, the uplift of which has produced "fresh" mountains. In a sense, a fossil landscape, such remnants are well preserved atop Trail Ridge, on Flattop Mountain and elsewhere, where glaciers have "bitten" into them making the sheer cliffs which "top out" on a flattish, rolling surface.

Tarn Lakes—Lakes which occupy a glacial cirque (not those merely dammed up by moraines). Chasm Lake and Iceberg Lake are good examples.


THE LOCATION OF THE GLACIERS
AND MOST OF THE ICE BODIES
IN
ROCKY MOUNTAIN NATIONAL PARK
GLACIER
ICE BODY
MUMMY RANGE
Rowe Glacier
Hagues Pk. 13,560
Mummy Mtn. 13,425
Crystal Lake
Fairchild Mtn.
Lawn Lake
Ypsilon Mtn. 13,514
Ypsilon Lake
Fall River Pass 11,796
Mt. Chiquita
Mt. Chapin
Bighorn Mtn. 11,463
Iceberg L.
TRAIL RIDGE ROAD
Sundance Mt.
Rainbow Curve
DEER RIDGE JCT.
Deer Mtn. 10,013
Mt. Ida 12,880
Gorge Lakes
Mt. Julian 12,928
CONTINENTAL DIVIDE
Stones Peak
Sprague Glacier
Hourglass Lake
Rainbow Lake
Moraine Park
Odessa Lake
BEAR LAKE
Snowdrift Pk.
Flattop Mtn 12,324
Tyndall Glacier
Hallett Peak 12,713
Dream L.
Lake Haiyaha
Bench Lake
Andrews Glacier
Loch Vale
N
LONGS PEAK 14,256
Taylor Pk. 13,153
Taylor Glacier
Black L.
Lake Nokoni
McHenry Peak 13,327
Storm Pk 13,326
Lake Nanita
Chiefs Head
Andrews Peak 12,565
Mt. Alice 13,310
Mt. Meeker 13,911