

THE ORIGIN OF COPELAND LAKE BASIN IN ROCKY MOUNTAIN NATIONAL PARK, COLORADO

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Copeland Lake has been for many years a landmark at the entrance to the Wild Basin region in Rocky Mountain National Park. It lies near the lower end of the huge compound glaciated valley drained by the North St. Vrain River and is within a few hundred feet of the South St. Vrain highway which leads to the park from the south (Figure 1).

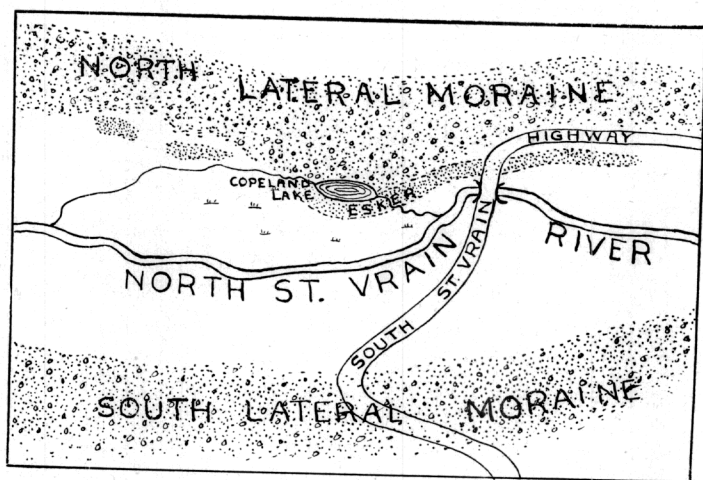


FIG. 1. Sketch map to show location of Copeland Lake and its relationship to the esker and lateral moraines.

RECENT HISTORY

Originally Copeland Lake occupied the lower part of an oval basin, without inlet or outlet, extending a quarter of a mile from east to west and half that distance from north to south. The water level fluctuated with the seasons, and forests of yellow pine clothed the surrounding ridges. Several years ago some water from the North St. Vrain River was diverted into the western end of the basin so that the level of the lake was raised to within ten or fifteen feet of the crest of the ridges which enclose the basin. In the spring the waters overflowed the rim at

the southeast and a shallow wooden flume was constructed to fill the notch, preventing erosion at that point and also carrying off the surplus water.

In June of 1929 the flume became undermined by seepage and the whole rim went out, the entire ridge being trenched to the bottom of the basin in a few minutes as the waters swept an outlet forty to fifty feet deep, three hundred feet across, and more than a hundred feet through (Figure 2).

ORIGIN OF THE BASIN

The oval basin of Copeland Lake lies in the southern edge of the massive north lateral moraine deposited by the Wild Basin Glacier during the late Pleistocene. This basin appears to be a simple kettle, judging from its position in the moraine, bounded on the north by the inner and lowermost of the compound lateral ridges making up the north moraine (Copeland) and on the south by a curving ridge of similar height and appearance. Actually, the basin is more complex.

The section made by the outlet through the ridge enclosing the basin at the southeast shows nearly forty feet of stratified sand and silt, gravel, and thin layers of till. Inspection of the rim of the basin shows abundant erratic boulders on the north and west inner slopes but none on the south and east, merely a trace of a sandy and pebbly beach. The northern side of the basin is bounded by a ridge of true drift which is part of the lateral moraine, but the southern and eastern sides are enclosed by an esker which formed a loop in its course along the main valley, curving so as to touch the moraine at two points and enclose the oval basin of Copeland Lake.

Early in the retreat of the Wild Basin glacier from its farthest advance a mile east of the lake site, a large block of ice may have been stranded against the southern side of the lateral moraine. It became partly buried in debris, but the hollow once established as it melted was maintained. As the glacier melted westward a cave, or re-entrant, in the margin became the debouchure of waters within the ice, and the debris carried by the escaping stream was dropped in a continuously lengthening ridge, or esker, whose course was generally at right angles to that of the ice front. The esker was built around the eastern and southern sides of the stranded ice block.

Retreat of the glacier was interrupted by several readvancements, as evidenced by thin layers of till and gravel interbedded with fine stratified sands and silts. It appears that first the glacier deposited a thin layer of ground moraine. As it retreated fluvio-glacial material

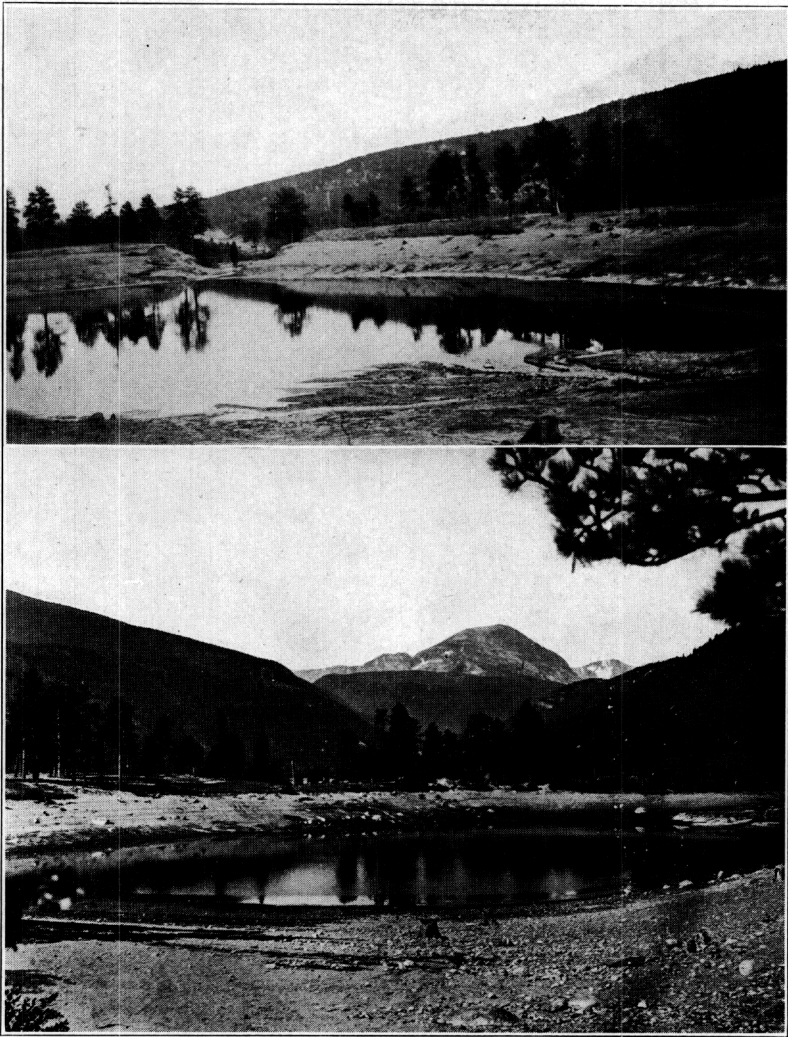


FIG. 2. *Above.* View of Copeland Lake basin from near the inlet. The ridge on the skyline is the south lateral moraine about a mile away, the outlet of the basin shows as a v-shaped cut through the esker ridge, and the small delta built by the artificial inlet is in the foreground. The strand line of the greater lake created by the artificial inlet shows near the crest of the esker in the middle distance.

Below. View of Copeland Lake basin from the east end, north of the outlet created by the flood of June, 1929. Note the boulders of the moraine bounding the basin show in the lower right-hand corner, where they merge with the sand of the esker shown in the lower left-hand corner. Note the many stumps of trees which were killed by raising the water level when the artificial inlet was made. On the right and left show the lateral moraines of the glaciated valley, with Copeland Mountain in the distance. The view is up the North St. Vrain, looking towards the head of the Wild Basin region.

was concentrated into a ridge, so that the course of the esker was determined by the piling up of several feet of stratified sand. The ice margin readvanced and left a thin layer of till over the outlines of the esker without destroying it, and then again melted back, pouring over it a thick layer of sand and silt. During the next advance of the glacier the esker was covered with a thick layer of coarse gravel and boulders. Following this, melting waters of the glacier as it retreated concentrated more than fifteen feet of sand and silt on the esker, and finally the waning ice coated the esker with a thin layer of gravel. Apparently none of the advances of the ice had sufficient force to destroy the esker, and each retreat emphasized its bulk by fresh additions of sand and silt.

In general the beds of the esker dip ten to fifteen degrees towards the basin of Copeland Lake. This suggests that the waters poured off the esker slope towards the depression created as the ice block melted, or it may be that the dips result from the slumping towards the basin as the supporting ice block vanished.

There are remnants of esker structures west of Copeland Lake basin and in line with it, not far from the north lateral moraine. From their location it appears that there may have been a chain of depressions together with their attendant lakes, but much of the evidence has been obliterated by floods of the North St. Vrain River. It appears that such depressions were formerly more or less connected in series with Copeland Lake basin and of similar origin.