

GLACIERS OF THE ROCKIES AND SELKIRKS

By A. P. Coleman.

The traveler going westwards from the Canadian prairie finds the way blocked by a grim wall of cliffs rising 7,000 or 8,000 ft. above the sea and justifying the name of the "Rockies" given to our greatest chain of mountains. Toward the end of the summer these desolate precipices are snowless and except for a glimpse of white peaks through some pass there is scarcely a suggestion of the glacier region within. Then the train enters the "Gap" and before long the summits around show fields or patches of midsummer snow; and as one draws nearer to the heart of the Rockies there is blue ice to be seen clinging to the cliffs or reaching as glaciers down into the wooded valleys, and one is thrilled with the wild charm of alpine scenery.

However, engineers are strict utilitarians and always choose the lowest pass for a railway, so that the passenger in the observation car catches only tantalizing glimpses of the wonders and beauties of the ice world a few miles away and a few thousand feet above the valley. One must stop at some place like Lake Louise in the southern Rockies or Tete Jaune in the north or Glacier in the Selkirks to come into real contact with snow fields and glaciers. What a joy it is to get rid of the hot and dusty everyday world of cities for a while and come close to Nature in one of her wildest moods! It is not only the mountaineer who feels the seduction of the cool, clean solitudes where glaciers are born and do their wonderful work. Every healthy man or woman must yield to the delight of living in these inspiring surroundings.

It is worth while to put on warm strong clothes and hobnailed shoes and fill your lungs with mountain air in a scramble up to the snow fields to see how the glacial machinery works, machinery which some thousands of years ago shaped almost the whole surface of Canada, doing its work on the plains as well as the mountains and leaving it the splendid land of lakes and rivers and fertile prairies and rolling hills which it is to-day.

Snowline.—To reach the snows generally means some miles of walking and climbing, often, at first, through forest covered slopes, where the outside world is lost. Then the trees begin to thin and grow stunted, revealing between the trunks blue valleys with a lake or two and far off cliffs and mountains. At last the trees cease at 7,500 ft. and you are at timberline. Here the three Rocky Mountain heathers spread soft thick carpets between stiff bushes only a few feet high but with trunks a foot through, so buffeted have they been by the storms of centuries. The rows of dwarfed spruces leaning back against some rock ledge give fine shelter for the mountain goats, wisps of whose white wool cling to the stubborn branches.

Then come cliffs and rocky slopes and grassy or sedgy uplands (the true Alps as the word is used in Switzerland) where mountain sheep or goats pasture and wild flowers grow by the million, blue ones such as lupines, gentians, fox-gloves and forget-me-nots; yellow ones such as adder-tongues, columbines and a multitude of starry composite flowers; the red or orange Indian paint brush; and white flowers innumerable. You have reached the edge of the snow rapidly melting on a July day under a sun that is hot even on high mountains. The plants just freed from their winter covering are all bursting into bloom together, bees are humming, butterflies lazily flutter past and a humming bird poises over a blossom; for it is spring at these altitudes and

there is a whole season's work to be done, seeds ripened and all, before autumn comes in September with its snowstorms burying all under the white silence of a nine-months winter again.

It is a thrilling experience to set foot at last on midsummer snow sweeping upwards gleaming toward the higher summits, snow that never entirely melts and that is so dazzling in the July sunlight that one needs dark or colored glasses to avoid snow blindness if the tramp is to be a long one.

We have no special word in English for these perpetual snow fields and so the French term *neve* is commonly used. Snowline is not nearly so definite as timberline and varies with latitude, exposure and snowfall. In the eastern Rockies of Alberta, where only a few feet fall in winter, the line is scarcely below 9,000 ft.; while in the western Selkirks, which catch the full brunt of the Pacific winds laden with moisture and have a snowfall of 40 or 50 ft. in a year, snowline is depressed almost to timberline, about 7,500 ft. This accounts for the bareness of the eastern Rockies as compared with the splendid Alpine features of the Selkirk range, which is the lower of the two.

While one gazes entranced at the array of lakes and valleys, of snowfields and dark cliffs, the wind rises and mountains to the west put on a cap of cloud. This grows and darkens and presently a mantle of mist sweeps up with the wind, the sun is dimmed and in a few minutes the wide world is shut out by a blizzard. We must make our way down to lower levels where sleet whitens the closing flowers, and then through a belt of rain swept hillside into the valley where the sun may still be shining hotly.

Since snow falls every month in the year on the *neve* fields and never melts away one might expect the mountains, especially the Selkirks, to grow as snowheaps into the sky; but of course this does not take place. Under the increasing load of snow the lower beds are compressed into ice; so that the *neve*, beginning as loose or hard drifted snow above passes downwards into ice banded with blue and white layers, the whole sometimes hundreds of feet in thickness.

The snow accumulates only on the gentler slopes or in the higher valleys. On cliffs it cannot lodge but piles up on the *neve* beneath; and on steep slopes it may lie for a time but now and then, especially toward spring, it breaks loose and thunders down into the valley as an avalanche.

The Motion of Glaciers.—The final disposal of the snowfield, turned to ice in its lower parts, comes by a slow creep downwards. That the *neve* is actually in motion can be seen by following the slope of snow to its upper edge against some mountain wall where a "*bergschrund*" generally yawns between the snowfield and the cliff. This may be several feet wide and may go down many feet to obscure depths. No amount of snow can fill the chasm permanently, though it may be bridged with fresh snow for a time, making a risky passage for the climber.

The *neve* is always pulling away from the rocks at its upper border, and its general motion follows the direction of the lowest depression beneath, finally extending below snowline as a tongue of ice which reaches down into the valley until it is melted by the increasing warmth of the lower levels. Thus a glacier is born. Unless whitened by recent storms the glacier is bare of snow in summer with a rough uneven surface of a dirty