

'CLOCKING' A ZERMATT GLACIER.

BY A. C. MORRISON-BELL.

IT is always hard to realise that a glacier—that great solid mass of frozen stolidity—is continually and relentlessly on the move, but this of course is well known even to the casual tourist, and that this movement can be quite easily recognised by allowing the glacier to show off its paces. The extent of this movement at some familiar spot on one of the Zermatt glaciers interested me much when there in 1918, and I accordingly resolved to make a few (quite amateurish) observations, and to trust to coming back one day to check the result.

Accordingly, at the end of August of that year with Fridolin Kronig and Heinrich, his son, I set out one morning for the Bétemps hut, having decided that the Grenz Glacier would be a very convenient one to experiment on. After bolting a hasty lunch at the hut, we scrambled down the moraine on to the glacier. I had better here explain that what I intended to do was to erect a straight line of rock cairns at 100 mètres interval right across this glacier from the Monte Rosa side to the far side on the Breithorn Massif, to leave them for a year or two to the tender mercies of their icy host, and then to come back and see what had happened. As a matter of fact, this plan had to be somewhat modified, as it was a bigger job than we had bargained for, and eventually we only completed a line of 630 mètres in length, but this turned out to be quite long enough to provide some very interesting, and, I must confess, to me, startling data. Let me here at once say that I approached the question in complete ignorance of the nature and habits of glaciers, unfortunately never having read a book about them, an omission I shall certainly retrieve, and merely with the curiosity of the average tourist, so that these notes cannot claim to have the slightest scientific value. To continue the narrative of our operations on the glacier; a large flat boulder on an ice-table determined the starting point of the line 'A,' and a small cairn was speedily built on the centre of this boulder, in which a wooden post, about 5 feet long, was duly planted. Writing from memory, I should say this point 'A' was about 80 to 100 yards from the moraine.

Seven cairns marked A to G were built exactly 100 mètres apart, and between them, every 25 mètres, a large flat stone, with a little one on top, was placed, the distances being accurately measured and re-measured with the rope. The last thing was to check with a Zeiss glass that the posts, built in the cairns, were in exact alignment. The eighth, or farthest cairn 'H,' was erected only 30 mètres instead of 100 beyond 'G,' or 630 metres from the starting post, as this particular point on the glacier was the 'skyline' from the hut at the time, and any further cairn would not have been visible. The idea of carrying the line as originally intended right across the glacier had to be abandoned, as it would have taken at least two more days to complete it. Rocks had to be dragged (with a sledge belonging to the hut) hundreds of mètres across the rough sloping glacier, and though we worked till late at night, and all the next day, and Heinrich performed prodigious feats in rock-lifting, etc., we realised that cairn 'H' was the last we could possibly erect in the time at our disposal.

At the near end of the line, about 40 mètres N.N.W. of the hut, two 'sighting posts' to mark permanently the direction of the original 1918 line were set up. These were built firmly into large cairns which we hoped were solid enough to withstand all tinkering from stray visitors to the hut. As a last check before we left, we assured ourselves with the Zeiss that the two 'sighting posts' and all the eight posts were in exact alignment. It certainly never occurred to us that in less than forty-eight hours this hard-won alignment would have gone.

In August, 1920, I was again at Zermatt, and naturally made some inquiries about the cairns. Nobody that I asked had seen them, and they had apparently disappeared, snowed under, I supposed, by the immense fall of snow that must take place up there. The object of the posts was at least to show their tips, I hoped, out of the covering layers of snow. However, when I got to the hut I was much cheered by a note in the visitors' book written by an American gentleman, who, being stormbound for two days at the hut, and noticing my note of 1918, had spent his time roaming about on the glacier, and had actually found four of the eight original cairns, and three of the posts. There was not much time to explore that afternoon, but I determined to make a day of it later on and to begin the search for the cairns by working backwards from 'G' and 'H' towards the hut, as these

two could be located without any difficulty. This plan of working backwards towards the hut succeeded well. A few days later, with a friend from Zermatt, the Rev. P. Lancaster, and with a large party of enthusiastic Americans who joined us at his invitation—the party included a surveyor with instruments of precision—we made a bee-line up the glacier for cairn 'H' and from there, working backwards towards the hut, the search began. Not only was every cairn located and rebuilt where necessary, not only was every post except two discovered and replaced, but to my great surprise every one of these intervening flat stones was identified, each with its little stone still on its back, just as it had been placed two years ago. Each successive find was announced by a young American on ahead with a loud shout, and our party of about twenty straggling across the glacier gave the impression of a tremendous game of hunt-the-thimble. On getting off the glacier and up to the Bétemps hut we found that the two sighting posts had gone; they had evidently been too much for the fidgety fingers of the tourists who visit the hut in such numbers. The posts had been worked out of their sockets in the cairns and had disappeared, though the cairns themselves were bulky enough to have withstood these attentions. However, I had provided for this contretemps by bringing up two fresh posts which had been specially prepared with strong cross-pieces nailed on to the bottom, and these were duly built in to much reinforced cairns, averaging, I suppose, about a ton apiece. It is fairly certain that no direct pull will get them out.

And now came the proof of the experiment. It was very easy, marching out over the glacier, directed on a straight line by an observer at the 'sighting posts' and accurately counting the paces to get to the exact spot, or certainly to within a very few feet of it, where cairn 'H' was originally built in 1918. It was then only necessary, of course, to pace down from this spot to its new position to find out how far this part of the glacier had travelled. And how much was it? On this alignment no less than 831 yards. This figure tallied very closely with some calculations the American surveyor made with the help of his instruments and the Siegfried map. In other words, cairn 'H' had moved on an average nearly one yard in every two days. Measurements to other cairns showed that 'H' was the outside of the circle, and moving the fastest. 'C' had moved 226 yards from its 1918 spot, and 'A,' the right-hand post of the line, about 120.

Two points occur to me. What happens to all the snow

that must fall up there? The basic idea of sticking posts in the cairns had been that perhaps their tips might just sufficiently peer out of the snow to indicate where the cairns lay concealed below. So far from this being the case, every flat stone was actually there just as exposed as it was when placed there two years ago, though surely many feet of snow must have fallen in the meantime. Would they be ever visible in winter? Surely not, for some of the snow must lie till well into late spring or later. But by August, apparently, the glacier surface becomes the same as it was two years previously, without even a quarter-inch added to it as far as I could see, judging by these stones. Supposing you left a handkerchief on the glacier, and it was not blown away by the wind, how many years would it be before it got covered up? The cairns will travel down till they end by toppling over into one of those rivulets that seem, according to the Siegfried map, to be permanently there. One of these rivulets was very big and broad last year, a regular brook, and it had to be crossed by planks. This is the first obstacle, as things are at present, to be encountered. Poor 'H' is heading towards it at a fearful rate and will certainly get swallowed up in another ten years or so, always provided that no fresh stream opens up on the glacier higher up. 'C' and the others are pushing along more leisurely and will certainly survive impetuous 'H,' while 'A' may quite possibly see us all out.

But it would be interesting, now that it seems that these cairns do not intend to play hide-and-seek with us but can always be picked up by a little searching, to keep an eye on them a few years longer, and may I appeal, therefore, to anyone who happens to find himself stormbound at the Bétemps hut, with time hanging heavily on his hands, to just take a cast round over the glacier and see how these old gentlemen are getting on? It may be necessary to build up a cairn a bit, and, if it is still there or thereabouts, to replace the stick. To find out at any time the distance the cairns have travelled it will only be necessary to pace down to them from a point on the original line, and the direction of the latter is shown by the 'sighting posts' near the Bétemps hut. As an additional check, the original 1918 line bears 270° magnetic N. from the sighting-post cairns. Even if the sighting posts themselves have again been removed—and as I said above I have tried to make this operation a little more difficult—the cairns into which they were embedded will always be there to mark the spot, so that all necessary data are available. To any who are blessed with plenty of energy, may I

suggest that they might add some more material to some of the cairns so that they become visible to the naked eye from the Bétemps hut, or to a telescope from the Gorner Grat? To scientists and to all those long familiar with glacial phenomena, I fear all this will appear very childish and vain, and an apology perhaps is really due to them; to us others who look at a glacier merely with the amateur's eye of interested curiosity, the sight of these helpless cairns being majestically carried along to their doom in the icy grip of destiny raises a spectacle of weird fascination, which it is not exactly easy to describe, but which I shall put forward to readers of the ALPINE JOURNAL as my excuse for having penned these incomplete notes.

THE CHASM, BUCHAILLE ETIVE, GLENCOE.

THE following notes were made during an ascent last Easter with my wife and Mr. R. F. Stobart. Left Kingshouse Inn 4.30 A.M., April 13, 1920.

Pitches.	Remarks.	Elevation (by Aneroid).
1	Entered chasm 6.15 A.M., 3 chockstones above one another. Wet. Easy.	1150 ft.
2	30 ft. Very wet. Climbed on right of chockstone. Moderately difficult.	1240 „
3)	Big cave pitches turned on right wall. Steep, loose, and heathery. Moderately difficult.	1300 „
4)		1380 „
5	8.45 A.M. 60 ft. of treacherous, slabby rock (red). Moderately difficult. Stretch of snow to next pitch. Huge schrund. Branch gully running up on left.	1420 „
6	9.15. Wet. Easy. Snow.	1520 „
7	9.50. 100 ft. of rotten rock, climbed by chimney on right. Moderately difficult. Breakfast 10.20. Steep snow to next pitch. Branch gullies leading out right and left.	1600 „
8	100 ft. Climbed on right of waterfall. Very bad landing. Severe.	1800 „
9	Small cave pitch, turned on right wall (looking up). Easy. Stretch of snow to next pitch.	
10	Combined tactics necessary to get on to smooth right wall. Severe. Stretch of snow. Branch gully on right to gap below pinnacle on 'Four Days' Ridge.'	2100 „