

prove a shorter route from Chamouni to Courmayeur than the Col de Miage. The actual distance is certainly less, and a night at the Grands Mulets or Pierre Pointue, with the splendid view from the Dome, is surely more interesting than the long land journey which intervenes between Chamouni and the Col de Miage. Be that as it may, it is certainly the highest, and in my mind the most magnificent, pass in the chain of Mont Blanc.

COL DES GRANDES JORASSES. By ARTHUR MILMAN, M.A.

ποιήν τι δεῖ ἄς γόνυ χλωρόν.

A desire having been expressed by many members of the Alpine Club, that some further and more minute information might be given respecting an attempt which was made in the autumn of last year by a party consisting of Messrs. Alfred Wills, his brother A. Winkler Wills, F. Taylor, and the writer of this paper, with two guides and two porters, to force a way over from Chamouni into Italy, by the Glacier de L'échaud and the Col des Grandes Jorasses, I have drawn up the following short narrative of the expedition.

It will, however, I fear, be more than usually difficult to convey an adequate idea of that strange region of snow and ice, in the wild recesses of which we worked a devious and toilsome way. For though during a large portion of the one-and-twenty hours that we were on foot, we were climbing over a vast waste of glacier, that had till then, I believe, been quite unexplored; yet being, as it is, distinctly visible from many of those points of view which are most commonly visited from Chamouni, it is known, so to say, by sight to the majority of alpine tourists. And for that, among other reasons, there would seem to be neither need or occasion for any of those descriptive digressions upon the general features of the district and topographical details which sometimes serve to eke out a scanty material.

On Monday, the 5th of September—having once before been driven back by a tempest of snow, and sleet, and rain—we crossed over from the Vallée des Fonds to Chamouni, by the Col d'Anterne and Brévent, with the intention of spending a few days there, and of making some excursions—new excursions, if that were possible—among the neighbouring glaciers. We hoped also that, as we were ultimately bound for Courmayeur and the Italian valleys, we might be able to discover some

variation upon the routes by which the Val Ferrex is usually approached. The first suggestion that such object might be obtained by aiming at an indentation or notch in the huge continuous chain of the Grandes Jorasses which lies between that mountain and an offshoot or projecting buttress of it, marked on Mr. Reilly's admirable plan as the 'Dôme des Grandes Jorasses,' came, I think, from M. Loppé, the eminent Genevese artist. Few persons are more intimately acquainted with the whole range of Mont Blanc than he; and we were of course very glad to discuss the possible route with so competent an authority. He told us that he had several times, from the Pierre Berenger and other points, very carefully examined the whole course of the Glacier de Léchaud, and the final gigantic wall of ice which connects it with the culminating ridge. He thought that though the task would undoubtedly be both laborious and difficult, yet still it might be possible to attain this ridge. Whether a descent upon the southern side would be practicable was, of course, a matter of the merest conjecture. The rocks upon that further side might, as was afterwards found to be the case, fall in a sheer precipice; or, though very steep, they might perhaps be similar to those above Mont Fréty on the Col du Géant; or it was possible—as M. Loppé thought, probable—that a stream of ice might flow down from the watersheds towards the south, corresponding to and connected with that on the northern declivity. In either of the latter contingencies the descent might not be altogether impracticable. At any rate, the attempt was worth making. Successful or unsuccessful, no grander object for a long day's climb in the mountains could be imagined. And in truth no one can look for long at this narrow gap or gate which is pierced through the perpendicular wall of the Grandes Jorasses without, if the *furor montanus*, or mountain madness, is upon him, being seized with an infinite longing to scale those mighty precipices, to attain that mysterious summit, to look down thence upon the fair valleys of the south.

At about two o'clock, then, on the morning of Thursday, September 8, the party whom I have already named assembled in front of the little inn on the Montanvert. The two guides were Michel Payot, of Les Mossons, and Claude Gurlie, *dit Belle Humeur*, of Vallon, near Samoëns; the porters, Frédéric Payot, brother to Michel, and Edouard Cupelin. These two last, I am bound to say, though in rank inferior, were in all the essential qualities of guides—perseverance, steadiness, cheerfulness—as we had abundant opportunity of testing in the course of the day, quite equal to the other two, and they will,

I believe, before the coming season, have passed their examination and obtained their full certificates as guides.

At intervals during the night loud blasts of wind had come wailing down the glacier. But now the air was still and quiet. Not a leaf would have stirred, if leaves there had been to stir. There was every promise of a glorious day.

After a few minutes' delay, we passed in single file along the narrow path which leads down to the Mer de Glace. One bearing a lantern, that inevitable concomitant of an early start, was of course in the front. There came a moment, at a later period of our journey, when its flickering light was of such essential service to us that I will say nothing now to its disparagement. But every alpine traveller knows what it is to walk by the light of one solitary candle along a narrow, rugged track; how the bright illumination plays over your face, and leaves your feet in utter darkness; how it dances, like a Will o' the wisp, high up on the mountain-side, and everywhere, except where it is wanted; how it involves you in a continual entanglement with the shadows of your companions, or with your own.

There had been a sharp frost early in the night, and we found the ice hard and crisp, slippery too, as is not uncommonly the case with ice, but otherwise in excellent condition for walking. We followed the direction which is usually taken by persons who visit the Jardin, until we came to the junction of the Glaciers of Talèfre and L'échaud. Then we held straight on, rising gradually as we pursued our way up the stream of the latter. During the first few hours of our walk there was little to require especial mention. The enchantment of the rising morn it were vain to dilate upon. It seemed to approach not gradually, but by successive bounds. Sudden flashes of brightness appeared to thrill across the valley; pale shivering rays of light to permeate the darkened atmosphere. And then, all at once, it was full daylight; though not for many hours did the sun itself mount over the eastern boundaries, and pierce with its glancing beams the depths of the ice-bound hollows.

At about six o'clock we reached the head of that portion of the Glacier de L'échaud which is seen from the Montanvert. Here we turned sharp to the right, and faced the great ice-fall and menacing séracs of the main stream of that glacier. Here also we first came upon entirely new ground—were able to examine our proposed route in its full extent, and to observe the nature of the difficulties which we should have to encounter and overcome. From its source under the highest rocks of the .Grandes Jorasses, and in the fields of snow which are accumu-

lated in the angle between those rocks and the Periades, the fall of the Glacier de Léchaud is singularly abrupt and broken. Measured by actual distance the way seemed short and plain enough; measured by eyes that had had some experience of glacier travelling it looked long, and hard, and doubtful. Even those of us, however, who were least disposed to under-estimate the labour and time which would be required in order to reach the upper snow-slopes, fell far short of the mark when they began to predict the hour of our arrival on the col.

The first question that demanded an immediate decision was, as to the line by which we might best make our way through the intricate masses of the very steep séracs, at the base of which our consultation was now being held. There was, as usual, a threefold choice. We might make for either side of the glacier, where the séracs on the whole seemed to be rather less formidable, or we might mount directly from the point on which we were standing, up through the very centre of the glacier, trusting to fortune and the instinct of our guides to find bridges over the crevasses or a means of circumventing them. The *via media* was adopted. Its difficulties and uncertainties were at least obvious, while the unseen obstacles on the right or left might have proved insuperable. We were soon entangled in a perfect wilderness of crevasses. Sometimes a snow bridge was found that gave a precarious access to the solid intervals of ice between them. Sometimes we had to walk for many hundreds of yards along their edges until some frail and narrow link could be discovered by which to attain the upper level. It will give a notion of the enormous lateral length of some of these 'rotures' when I say, and I believe it is no exaggeration, that it took us three-quarters of an hour to make the two tacks left and right across the glacier, which were requisite before we could arrive at the upper side of one of these great chasms. At length we succeeded in extricating ourselves from the séracs, and commenced the passage of the steep ice-slopes which lie immediately under the precipices of the Grandes Jorasses. The fresh snow, which was piled up on these slopes to a great depth, rendered our progress over them very slow and fatiguing. A slight crust of ice had formed upon the surface. When this was broken through, we sank over our knees, occasionally up to our waists, in the soft unconsolidated snow beneath. It was a considerable strain upon, and test of, the physical powers of those who undertook to trample out steps for the rest of the party. After ascending for some time in the direction of the col, we were compelled to deviate from the straight course in order to avoid two or three vast and

formidable bergschrunds, which intersected our line of march and defended the approach to the final wall of ice. To one of these our attention had been for a long while attracted. From its wonderful breadth and vast extent it seemed likely to prove insurmountable, and to be the utmost limit and destined goal of our endeavours. After a wide circuit, however, which carried us far up towards the Dome, its sides began to contract, and we passed on an arch of snow to the opposite shore. Owing to this and other obstacles and delays, it was half-past two o'clock before we touched the côte of ice—the last, but by no means the least, barrier that had to be surmounted before we could stand on the summit of the watershed. Crossing the narrow *schrund* which still divided us from the arête, we secured a firm footing and basis for our operations on the opposite side. The next two hours were consumed in hewing a way upwards. The côte was excessively steep, measuring rather more than 50° by the clinometer. During the whole of this last ascent we were exposed to a galling fire from particles of ice, which, broken and detached from the cornices above, came flying and whizzing through the air down upon us. It required some self-command to preserve a calm serenity under the infliction, especially for those who, not being engaged in the operation of step-cutting, had leisure to speculate upon the probable result, if the velocity and size of the missiles should increase to any considerable extent. Michel Payot led the way up the slope, and we could not but be pleased with the perseverance and good-will which he evinced while occupied in his trying and laborious task. He never once showed any signs of flinching, any disposition to give up, or desire to propose a return; though as hour after hour slipped away the prospect of a descent upon Italy became more and more problematical. At last we reached the col. It was past four o'clock in the afternoon. The col is about fifty yards from side to side. We pressed eagerly on to the extreme edge of the arête, and gazed wistfully down into the Val Ferrex, which lay some thousands of feet below us. A descent into it was hopelessly impracticable. A perpendicular couloir of smooth and treacherous rock dropped for many hundred feet from the edge on which we stood before its course became at all broken and its inclination less precipitous. On our right hand a dangerous cornice of overhanging snow ran up to the Dôme, while on our left rose the inaccessible cliffs of the Grandes Jorasses intercepting all outlook towards the east. Had there been a possibility, however remote, of making a descent upon the southern side, I am sure that we should have

attempted it at the risk, nay, certainty, of a night on the rocks. But it was evidently hopeless, and equally evident that it would be the height of rashness to linger where we were. For our situation had become rather a critical one. It was nearly five o'clock. We knew that we could reckon at the most upon three hours more of daylight, and we knew that unless we could extricate ourselves from the labyrinthine windings of the great séracs before darkness fell we should have to make the disagreeable experience of a night upon the glacier. The word then was given for a retreat, and we at once commenced our descent by the steep and slippery côte of ice. The steps which had been so carefully cut out a few minutes before were already more than half choked up and obliterated by the ever-falling particles of snow and ice. They were, however, quickly cleared out as we went, and we descended with as much speed as was consistent with safety to the snow-slopes beyond. Once on these, guided by the deep track which we had left on our ascent, we hurried on. Without let or pause we plunged and floundered down through the soft and yielding snow till we came once more to the séracs. Through these we were obliged to pass with somewhat more caution. Still we never slackened our pace till, just as twilight was fading into night, we escaped from the bewildering chaos of the great ice-fall and touched the comparatively smooth and unruven surface of the glacier below it. We were just in time. Had we been but a few minutes later the light would have become so uncertain, our progress in consequence so slow, that it may be doubtful whether we should have been able to extricate ourselves at all.

I have spoken of the exquisite loveliness of the sunrise on this most glorious of days: yet still more lovely was the sunset. As during the swift descent we had mechanically followed our former footprints, we had had full leisure to contemplate the changing beauties of the scene; to watch the wonderful effect of the dying light upon the mountains. Flushed by the beams of the setting sun, at one time they themselves seemed to shoot forth hot rays of light from their inmost recesses. Then there was a change. As though a glory had departed they appeared to assume a cold and cruel aspect, while a gloomy blackness settled down upon them. Again another change. A soft warm hue suffused the highest peaks, as a magical after-glow, that 'last messenger of the sun' as it sinks to its rest beneath the waves, lighted up the cold mountains with a tempered radiance, with a last sweet roseate blush before the expiring day. Then all at once it was night. The bright-

ness faded out of the deep azure of the sky, and darkness came on apace.

The stars shine bright amid the breathless air,
And every crag, and every jutting peak
Stands boldly forth.

But enough of this. To us it was given to enjoy, but not to linger upon our way that evening. A long tract of glacier, many weary hours of walking, were between us and the Montanvert—that haven of rest to which all our thoughts were now turned. It is one thing to stroll quietly up a glacier at early morning, when limbs are still fresh and unfatigued; another to retrace one's steps over the same ground in the obscurity of night after a day of long protracted exertion. A thousand snares lie in wait for the unwary traveller. A confused image of ice and stones and water dances before his excited brain. At one moment his feet seem to rest upon a hard and solid foundation: at the next, breaking through a thin layer of deceptive ice, he plunges then into a frozen pool of water, or painfully stumbles over some one of the countless rocks that strew the way as he draws near to the moraine. So much impressed, indeed, was Gurlic with the unpleasantness of this nocturnal march, that he announced his intention of leaving us and seeking a shelter for the night in the cave under the Pierre Berenger. Having vainly endeavoured to dissuade him, the other guides made a collection of such extra articles of clothing as could be spared, with which, and a small supply of food, the old chamois hunter left us and started off in search of a solitary but not unwonted couch. He met with an accident some years ago while chamois hunting. The lameness which was its consequence has naturally made him more cautious, and anxious to avoid all needless hazard, such as this walk through the night would have been. The rest of us continued on our rapid course. We were too many to feel oppressed with the real loneliness of our position. But no one could fail to be deeply moved by the strangely magnificent appearance and singularity of the surrounding objects as they loomed through the darkness. Impressive, too, were the weird whisperings and mysterious voices which broke upon the utter stillness,—the distant echoes of a falling rock, the murmuring of a sub-glacial rivulet, the groaning and cracking of the glacier. Once, too, our ears were invaded by what sounded to us like the regular beating of a drum very near at hand. Absurdly incongruous explanations of this startling phenomenon presented themselves to my imagination. For one moment I thought that a party had been sent out to look for us with

lights and a drum to attract our attention ; and then, by some ridiculous association of ideas, I fancied that I saw before me the spectral drummer-boy of Salisbury Plain as celebrated in the 'Ingoldsby Legends' ! At first we had been dimly conscious, now we began to be firmly convinced, that unless we could find the lantern that had been hidden behind some rock in the morning, our chances of getting off the glacier would be small indeed. I should myself as soon have set about looking for a needle in a bundle of a hay at midnight as seeking the lantern among the myriads of rocks and boulders that were heaped up about the moraine. Presently, however, Michel Payot and his brother evinced signs of restlessness, diverging on one side or the other, like dogs endeavouring to recover a lost scent. Suddenly one of them cried out in a cheery voice, ' I have it ! ' Never was the consumption of some two inches of the composition which is dignified by the name of a ' bougie ' watched by seven pairs of tired eyes with greater anxiety. It served, and just served, to carry us along the rather intricate and shadowy windings of the track through and across the moraine, by which alone an easy access can be obtained to the path which leads up from the ice to Montanvert. As we touched the rocks it faintly flickered and went out. We did not arrive at the inn till half-past eleven o'clock. Our friend François Cachat had of course retired to bed, and had probably sunk into his first blissful slumber. But a few lumps of gravel thrown up at his window soon brought him to the door, surprised but pleased to see us back again. He had quite ceased to expect us that night.

I have hitherto purposely refrained from alluding to the various halts that were necessarily made in the course of the day for the purposes of rest or refreshment. They had, in fact, been very few and far between, so pressed were we for time, so great had been the labour of the ascent. But I am compelled by a sense of justice to the hospitable Cachat to record the unexampled celerity with which at so late an hour he served us with a supper that seemed to us in our then humour a perfect masterpiece of the culinary art. How with his insufficient appliances, the smallest of kitchens, and a handful of sticks, such a triumph could be achieved, is a matter for profound speculation !

A few words as to the general result of our expedition. It had failed in so far as instead of descending upon Courmayeur, as in the innocence of our hearts we had proposed to do, we had been compelled to retrace our steps, and to return to the place whence we started. In every other respect it had

been to ourselves a most signal success; and, allowing for occasional weariness, had given us a day of prolonged and continuous enjoyment. The magnificent scenes, the marvellous wonders of the ice-world through which we passed, are graven upon our memories in characters which will never be effaced. Glorious visions of snowy summits, of rocky pinnacles, of transparent azure ice-caverns come flashing upon 'the inward eye,' as we labour along a crowded thoroughfare, or sit immersed in business amid the fogs of November; and then we lift our eyes to the distant mountains, and long for the day when it may be granted to us to revisit them. On this head I may, perhaps, be permitted to quote an extract from a letter which was written long afterwards by one of our party. He thus refers to our expedition, in which he made his first experience of alpine climbing:—'I confess that my trip this year has quite inoculated me with the love of alpine climbing; I do not mean that I dare to look forward to anything like an annual visit to ice-land, but that were it possible for me to do so, the anticipation would be very delightful, and that I feel a thorough sympathy with what used sometimes to seem to me rather a mistaken enthusiasm.'

Once more: we had had a splendid opportunity of gratifying that craving with which all men are, at some time or another, seized for physical exertion and exercise, for testing their steadiness and powers of endurance. This desire to be doing something while our limbs are still lissom and active has been so well expressed by a classical writer, that I have ventured, contrary to custom, to preface this paper with a quotation. It shadows forth, as I think, the ultimate *raison d'être* of the Alpine Club, and might well serve as its motto.

I do not know whether anyone may be tempted to make a second assault upon the Col des Grandes Jorasses, but I must not omit to express my opinion, an opinion in which so experienced a mountaineer as Mr. Alfred Wills, I believe, entirely concurs, that it is an excursion which in some circumstances might be attended with very considerable risk. To say nothing of the difficulties which may be met with among the *séracs*—difficulties that may by care and prudence be in part evaded and partly overcome—it is obvious that unless the snow upon the final *côte* is well consolidated, there must always be the great danger of an avalanche. It is equally obvious that if, as must often be the case, the flakes of ice to which I have alluded as sweeping down the *côte* should be much larger, or should bring down with them masses of disintegrated rock, it would be impossible to stand up against them, and a serious

accident would be the probable result. I think that the cliffs of the Grandes Jorasses might be ascended for two or three hundred feet beyond the point at which we stopped. As to whether they would be practicable any further, or would terminate in an abrupt impassable precipice, I can form no opinion. It is just barely possible that by creeping along them some couloir or snow-wall might be found to serve as a connecting link with the glaciers that are seen from the Val Ferrex. The climb would always, however, I am convinced, be very difficult, dangerous, and not to be lightly undertaken. In any case it would be most advisable to make a careful survey of the Grandes Jorasses on the southern side before embarking upon any more expeditions over their formidable precipices.

ON THE DETERMINATION OF HEIGHTS BY MEANS OF THE BAROMETER. PART II. By W. MATHEWS, JUN., M.A.

IN the last two Numbers of the 'Alpine Journal' I described the formula established by Laplace for the determination of heights by means of the barometer; I now proceed to explain how this formula is applied in practice, and to give a few directions for making the necessary observations.

It was assumed in the investigation that the two points, the difference of whose heights it was wished to determine, were situated in the same vertical, and in free air, out of the reach of direct terrestrial radiation. Now, as it is impossible to observe the barometer vertically under the summit of a mountain, and as both upper and lower station must be on the earth's surface, neither of those conditions can be fulfilled in practice. When therefore it is wished to ascertain the height above the mean sea level, or, as it is called, *the Absolute Height* of the summit of a mountain or a pass, the necessary observations must be made there, and these must be compared with simultaneous observations taken at a lower station of known height above the sea, and as near to the upper station as possible. In making the calculation it is assumed that the barometric pressure and air temperature at the lower station are the same as they would be if the mountain were to be removed, and the lower station were to be moved along a horizontal line to a point vertically under the upper one. This assumption can rarely be true, as waves of unequal pressure are frequently passing through the atmosphere, and the