CHAPTER VI.

ZERMATT IN 1845.

PASS OF THE SCHWARZ THOR.—ZERMATT TO AYAS.

SEVERAL years ago, in 1845, I passed some time at Zermatt, chiefly engaged in the double task of exploring the remarkable vegetation of the valley of St. Nicholas, and observing the movement of the two nearest glaciers—those of Gorner and Findelen.

The glacier observations, which cost an amount of labour disproportioned to their apparent value, were chiefly directed to verify the law of glacier motion then recently announced by Professor Forbes, the accuracy of which, though now universally admitted, was for some time disputed by several continental writers. Beyond a confirmation of the general rule, that the onward motion of the ice is retarded as we pass from the central part towards the side of a glacier, and proof that this retardation is as manifest in the lower steep and crevassed portion of the Gorner glacier, where the daily rate of progress, in summer, exceeds a foot, as in the level portion of the slow-moving Findelen glacier, that advances no faster than two inches in twenty-four hours, the only interesting fact that I noticed, was the indication of a double current in the latter glacier, with an intervening portion near the centre, that advanced rather more slowly than those on either side. Such an exception to the regular increase in the rapidity of the ice current in passing from the sides to the centre, is doubtless due to some peculiarity in the form of the bed of the glacier. A rock rising in the middle of the current would divide it, just as it does in water.

A more difficult problem is presented, by the recent history of the two glaciers upon which my work lay in 1845. They both arise from the great field of *névé*, that stretches from the rocks of the Nord End of Monte Rosa, for four or five miles to the foot of the Strahlhorn. From that plateau, whose mean elevation is not less than 11,000 English feet, extends to the westward a projecting ridge, that terminates in the Riffelberg, near Zermatt. On the north and south sides of this ridge are the valleys which contain the Findelen and Gorner glaciers, that drain the upper reservoir of snow. The

first receives in its course no considerable affluent. To the Gorner, on the contrary, are poured in, one after the other, six glaciers proceeding from the northern side of the main chain, between the Nord End of Monte Rosa and the Petit Mont Cervin. The fact to be explained, is the continued increase of the Gorner glacier, simultaneously with a nearly equal degree of waste in that of Findelen. For thirty or forty years, at least, the Gorner has steadily advanced into the valley of Zermatt, while during a great part of the same time, its companion has been retiring up the tributary valley below the châlets of Findelen, and has left a bare space, from whence the ice had stripped away the soil and its vegetation. The most natural conjecture, in this and other similar cases, is to assume that by some local change, such as the gradual abrasion, or sudden disruption, of a barrier of rock, a part of the ice proceeding from the basin drained by the two glaciers, which formerly flowed into the one channel, has since been diverted into the other. A nearer view of the localities does not, however, in the case here discussed, favour that supposition; it is, indeed, true that there is no such dividing ridge as is indicated in Schlagintweit's map between the Stockhorn and the Cima di Jazi, defining the precise limits of the area drained by each glacier; but, on the other hand, the form of the plateau makes it hard to conceive that any probable amount of change in the rocks beneath, or surrounding it, could have materially influenced the direction in which the accumulated ice and *névé* would seek an outlet; the indications of such a change, if anywhere traceable, should be sought in the neighbourhood of the Stockhorn.

Starting from the supposition that there has been a slow and gradual increase of snow in the upper regions of the Alps,—a conclusion which is certainly in accordance with general tradition and documentary evidence, and which, as I have sought to show elsewhere,* is not inconsistent with the admitted principles of physics,—another and different explanation of the above-mentioned difficulty has occurred to me. Perhaps I shall be excused for stating it here. Glacier ice, especially in the upper region where it is but imperfectly consolidated, requires a vast amount of pressure to cause it to flow in a channel of moderate inclination; spread over a sloping plain of irregular surface, it would, in the first place, seek an exit in the direction of least resistance, and the outflow would take place in that direction only, even though openings

* Philosophical Magazine for 1855, vol. ix. 4th Series.

should offer themselves in the irregular surface, through which, if the ice were a freely moving fluid, it would escape in other directions; but if the thickness of the stratum of *névé* were continually to increase, the pressure on the lower portion would at length reach such a point as would cause a new outflow to take place in the direction of *next least resistance*, and the immediate result would be, to diminish the pressure operating in the channel through which the entire of the drainage had previously passed.

To give an illustration, familiar to many Alpine travellers.—A great and gradual increase in the quantity of *névé* and ice on the Aletsch glacier would, of course, cause the lower end of the glacier to advance continuously down the gorge, through which its stream flows into the valley of the Rhone. If the accumulation went on until, in the upper basin of the glacier, the *névé* attained the height of the col leading into the Lötsch Thal, the ice would still be poured down through the present channel,* and the end of the glacier would continue to advance; but as fresh *névé* and ice became piled up above the Lötsch Sattel, the pressure would at length be sufficient to cause an outflow in that direction. This would go to increase the Lötsch glacier, which would advance more rapidly than usual, while on the Aletsch the first result would be to diminish the supply, and with it the velocity of the stream: the melting below would proceed faster than the diminished flow of the ice current, and the lower end of the glacier would retrograde. In other words, the phenomena actually seen in the Findelen and Gorner Glaciers would be exactly reproduced.

During my stay at Zermatt, I made many inquiries as to passes communicating between the valley of St. Nicholas and the adjoining valleys in every direction. The information that I was able to gain from the other guides, Damatter, J. B. Brantschen, and an old hunter of Täsch, was vague and unsatisfactory to a degree that would surprise those who do not know how amazingly our knowledge of this part of the Alps has been increased since 1845.

Excepting the established pass of St. Théodule, the only one that was admitted to be certainly practicable, was that of the Col d'Erin, accomplished by Professor Forbes in 1842; and occasionally, though at long intervals, by preceding travellers. Of the Trift Pass, described in the last chapter, there was but a spurious and baseless tradition. Doubts were expressed even as to the possibility of

* I say nothing of the lateral opening at the Märjelen See.

passing from St. Nicholas into the Turtmanthal; these I had the satisfaction of solving in the course of an excursion, in which I also visited the then almost unknown Einfisch Thal or Val d'Anniviers.

Of the passage of the Saas Grat I could obtain no certain information. It was certain that some hunters had passed from Saas to Täsch, and the danger and difficulty were said to be extreme; a party of Englishmen who made the attempt were said to have passed the night on the ice and to have been laid up at Täsch on their unsuccessful return. The Adler Pass had not at that time, I believe, been discovered.

My repeated inquiries as to the Weiss Thor, produced no more information than was obtained three years before by Professor Forbes. Damatter, who had certainly passed it several years before, declared that the ice had accumulated on the Zermatt side, so as to overhang the precipitous rocks by which the descent had been made to Macugnaga. It was reported, however, that a dare-devil hunter, "*Böser Jäger*," had found out a new way over the ridge, but kept it a secret.

This story of the old pass having become impracticable through overhanging ice, has been repeated to me at each of four visits made to Zermatt, yet M. Adolphe Schlagintweit made the passage successfully in 1851, in company with one of the Taugwalds. It is true that Lochmatter, who is the best guide at Macugnaga, and with whom I passed the New Weiss Thor in 1856, positively denies the possibility of descending by the old route. This testimony notwithstanding, it seems to me desirable that some one should make the attempt. Being considerably nearer to the stupendous eastern face of Monte Rosa, the scenery must be even grander than that of the new pass. This, which lies on the north side of the Cima di Jazi, exactly at the point where the main ridge of the Pennine Alps divides into two branches,—a northern one which includes the Strahlhorn and the Mischabel Hörner, dividing the valleys of Zermatt and Saas, and an eastern one which is the dividing ridge separating Switzerland from Piedmont,—is said to have been first accomplished by Professor Ulrich in 1852; but, as the story current seven years before would seem to show, it may have been previously known to some chamois hunters.*

* Since the appearance of the first edition of this volume, the editor has been favoured with a letter from the Rev. Edmund Docker, of Froxfield, Hants, giving

I have been led to say so much because erroneous impressions are still afloat among well-informed persons who are not personally acquainted with this famous pass, and I may take the occasion to correct a false impression which has become common through a singular mistake in the map published by the Messrs. Schlagintweit. When this part of the chain of the Pennine Alps was imperfectly known, and the names of peaks still unsettled, the name Cima de Jazi, by which the people of Macugnaga designate the highest point visible from that place in the ridge running northward from Monte Rosa, was supposed to belong to the remarkable peak of the Strahlhorn, at the upper end of the Findelen glacier, which is everywhere seen from the high ground above Zermatt. Canon Berchtold of Sion, who measured trigonometrically the heights of the chief peaks in this part of the chain of the Alps, determined the height of the Strahlhorn to be exactly 4,300 metres, equal to 14,108 English feet, or sixty-six feet higher than the Finsteraar Horn. That this great elevation should be attributed to the Cima de Jazi by those who confounded the latter with the Strahlhorn is not surprising; but it is hard to understand how the Schlagintweits, who were so familiar with this district, and who have correctly distinguished in their map the comparatively insignificant Cima de Jazi from the towering peak of the Strahlhorn, should have attributed to the first the height that belongs to the second. The Cima de Jazi is now often ascended from the Riffel; and when the snow is in good order, the excursion is no more than a very easy day's walk. The exact height of the Old Weiss Thor, according to Schlagintweit, is 11,870 English feet, and that of the new pass is 266 feet more, or 12,136 feet. The Cima de Jazi is not above 500 or 600 feet higher, or about 12,700. I know of no point in Europe nearly so elevated, that can be reached with so little labour or difficulty.

The main object of my inquiries, in 1845, was to ascertain the possibility of effecting the passage of the chain of Monte Rosa somewhere between the Höchste Spitz and the Breithorn, and thus

an account of a passage of the New Weiss Thor by himself, along with Mr. John Eardley Blackwell, on the 7th August, 1850. The course taken seems to have been exactly that which is now usually followed. It does not seem to be generally known that there is another shorter, but very steep, passage, by which the descent to Macugnaga may be effected without crossing the ridge or *arête*, which forms the watershed between the valleys of Saas and Anzasca. It joins the ordinary course about 1,000 feet below the summit.

establishing a direct communication between Zermatt and Gressonay. Of information on this point there was none to be had at Zermatt, beyond a vague story that fifty or sixty years before some people had arrived from Gressonay across the glaciers of Monte Rosa. Frequent and prolonged examination of the range, as seen from the Riffelhorn and the Gorner Grat, satisfied me that there were but two routes by which the passage could be attempted. The first of these would lie between the Zumstein Spitz and the summit of the Lys Kamm, ascending from the Gorner glacier by the rocks called Auf der Platte, and following the course of the great tributary glacier that descends from the highest plateau of the Rosa. By taking this course one great advantage would be secured: having once reached the plateau, there could be no doubt as to the possibility of descending on the southern side by the same way which Zumstein had followed in his numerous attempts to reach the summit of Monte Rosa. The objection, which at that time with my limited experience of the higher region appeared formidable, was the great distance to be traversed, and the risk of being benighted before effecting the descent to the lower part of the Lys glacier. According to Zumstein's barometer observations, the height of the plateau between the Lys Kamm and the Zumstein Spitz is 14,156* English feet, and M. Gnifetti, the curé of Alagna, who traversed it in his ascent of the Signal Kuppe, estimates its breadth at 2,000 paces, or more than a mile; the ascent is gradual and long, and there would be no chance of accomplishing it, even by passing the night at the exposed rocks of Auf der Platte, before the sun had softened the snow over the greater part of the distance. I had no desire to be driven to take refuge for the night in a crevasse, as happened to the intrepid Zumstein in one of his ascents, and I therefore rejected this route.

The alternative course that presented itself lay between the eastern end of the Breithorn and the two conical eminences of about equal height called the twins (Zwillinge), or, of late years, by the more fanciful names, Castor and Pollux. From the Gorner Grat, or, better still, from the less conveniently accessible Hochthäligrat, is seen a glacier much crevassed in its middle region that descends from this part of the chain, joining the Gorner glacier between the rocks which are named on the map Schwärzeberg and Oberes Triftli. On the south-west, this, which is called the Glacier of

* This determination is, perhaps, somewhat too high. See note to p. 128.

Schwärze, is bounded by the dark precipitous rocks of the Breithorn, that bear upon their summit a long nearly level ice terrace, but very little lower than the highest point of that mountain. At the base of these precipices the glacier falls rapidly in a giant staircase carried along their face, of which each step is separated from the next by impassable crevasses. To the left, from above the rocks of the Schwärzeberg, descends another portion of the glacier broken up into those huge blocks of ice and *névé* which Saussure called *séracs*, and below these a range of crevasses seemingly as impassable as the first. The latter system of crevasses was, however, inclined at a considerable angle to the others, and on careful examination I was able to trace, where the two systems intersected, a succession of snow bridges, by which the ascent might be continued for some distance. Above this it was impossible to trace the way accurately. Enormous ice cliffs seemed to have fallen together, and though they did not look hopeless, I could not be certain that a way would be found through them. These once surmounted, however, there could be no doubt about reaching the summit of the pass.

The essential point remained still to be decided, whether a practicable descent would be found on the south side of the ridge. Trusting to the very uncertain recollection of a view from the summit of the Grauenhaupt* over Gressonay, which I had ascended five years before, I persuaded myself that a glacier descended from the Zwillinge towards the south-east, by which it would be practicable to reach the head of the Val de Lys. On speaking of the project to some of the people at Zermatt, I found more interest shown than was usual among that rather phlegmatic population. There was an evident wish to encourage the attempt, and several affirmed that it was certainly by that part of the ridge that the mythical "men of Gressonay" had effected the passage.

The next point was to secure a companion in the undertaking. It is an indefensible piece of rashness to travel alone in the upper region of the glaciers; no amount of skill and experience can avert the almost certain consequences of the yielding of the snow coating that covers over a concealed crevasse. But I have always thought

* The Grauenhaupt is the highest point in the range that divides the Val de Lys from the valley of Ayas, and about 10,800 feet above the sea-level. The ascent is in great part a steep scramble, but the view is magnificent, corresponding in some measure with that from the Cramont.

that two practised mountaineers may safely undertake any expedition, and that they are just as likely to succeed as a larger number. A traveller prepared by previous experience, who is ready to take his full share of the work, both in carrying baggage, cutting steps, and making the track through the snow, has no occasion to take more than a single guide, and all additional assistance is rather a matter of luxury than necessity. I was somewhat disconcerted when I found that J. B. Brantschen, an elderly and slow, but steady and safe man, who had been my assistant for the preceding two or three weeks, was unwilling to start, and I rather reluctantly engaged a younger and stronger man, named Mathias Tangwald, but not, as I believe, the same who has since acquired a good reputation as a guide. My new friend was introduced as one of the best chamois hunters in the valley, but his countenance was heavy, and denoted neither energy nor enterprise.

Our arrangements were soon made: my baggage, including a large package of dried plants, was forwarded by Visp and the Simplon to Baveno, but, instead of emulating some of my friends who dispense with personal baggage in their Alpine expeditions, I adhered to the ancient practice of carrying with me a moderate supply of linen and other comforts. As I meant to carry my knapsack myself, I had no occasion unduly to stint myself. Perhaps I may mention a few articles which long experience has made me retain, after rejecting others that I have found less useful. Foremost, I place a knitted woollen waistcoat with sleeves, such as the country people wear in many parts of France; it is invaluable when a night has to be passed in cold or damp quarters after a hard day's walk. A few very small tin canisters are the best means of carrying a slight provision of tea, chocolate, and raisins. A one-volume Shakspeare is a safe resource for a wet day. I plead guilty to one or two other luxuries, including slippers to rest the feet after long walking. To my knapsack is strapped a stout piece of rope about thirty feet long, with a Scotch plaid and umbrella; the last, though often scoffed at, is an article that hot sunshine, even more than rain, has taught me to appreciate. A couple of thermometers, a pocket klinometer, and a Kater's compass with prismatic eye-piece, may be carried in suitable pockets, along with a note-book and a sketch-book, having a fold for writing-paper, &c.; a good opera-glass, which I find more readily available than a telescope; strong knife, measuring tape, a veil, and spectacles, leather cup, spare cord, and

matches. A flask with strong cold tea, to be diluted with water or snow, a tin box for plants, a geological hammer, of a form available for occasional use as an ice-axe, with a strap to keep all tight, and prevent anything from swinging loosely in awkward places, complete the accoutrement.

Mathias was to carry the provisions, which included a small wooden keg of wine for his own use, and in addition a light portable apparatus for boiling water, along with three pieces of iron made to fit two long and solid alpenstocks, so as to convert them into a temporary ladder or bridge. The last, however, I have not found of much practical use, except now and then to enable me to reach plants on steep walls of rock.

After a substantial early dinner, provided by the worthy Mme. Lauber, whose name is fresh in the memory of all the early visitors to Zermatt, we prepared for our departure; but sundry delays occurred, as I received in succession the visit of many of the village notabilities. A quite unusual degree of excitement was apparent, but it was only just before I started that I learned the real cause of the interest that had been shown in the success of my project. It was not any abstract interest in geographical science, nor a desire to enter into closer relationship with the German population of Gressonay, nor yet the notion that tourists might be attracted to their valley by a new and interesting pass: the practical mind of Zermatt had detected in the new route a grand opportunity for carrying on free trade with Piedmont, uninterrupted by the douaniers of His Sardinian Majesty. From Cormayeur to Val Tournanche a chain of posts is maintained, whereat the *préposés* pass a miserable life in keeping watch upon every gap in the chain by which it is thought possible that untaxed tobacco, spirits, or cotton goods may be smuggled into Italy; and they don't hesitate to send a rifle-ball after any man who attempts to evade their pursuit. But the three valleys of Ayas, Lys, and Sesia, abutting against the main chain of Monte Rosa, are supposed to be sufficiently guarded by the gigantic wall of ice-bound rock which closes them in. No *préposé* has ever been set to watch these ramparts, and if by any means a passage could be found, there would be no difficulty in carrying the smuggled goods into the interior of Piedmont.

With this prospect of becoming a public benefactor, it was not surprising that, as I left Zermatt at six o'clock in the evening of the 17th August, I was followed by the cordial good wishes of the

entire population, who turned out to see me off. As a message had been sent to prepare for our arrival at the châlet on the ascent to the Riffel, where I meant to pass the night, we did not hurry, and it was already dark when we reached the Augstkumme, a small group of châlets, about 7,000 feet above the sea, that are now-a-days passed without notice by many a fair tourist in the ascent to the Riffel Hotel. At the highest of these, kept, contrary to the usual practice, by a *Sennerin* named Louise, here called Lovisé, we were to halt. The door was bolted, and it seemed that Lovisé had given us up and gone to bed, but in half a minute she had struck a light, opened the door, and bid us welcome. Supper, though a superfluous luxury, was proposed, and met no opposition on my part. Hot milk, bread and butter, were soon ready, seasoned, in my case, with those tears which the wood-smoke so often draws from unpractised eyes. To close the entertainment, Lovisé set down before us a large bowl of *niedl*—rich thick cream, of which I partook sparingly; Mathias unwisely finished the remainder. While some arrangements were making for our night-quarters in an adjoining hay-shed, I went out to enjoy the night air, and to look about me, when I encountered a scene which, amidst the memories of many wanderings, still remains without a rival. The view from the western slope of the Riffel, now well known to most Swiss tourists, includes the range of peaks from the Matterhorn to the Weisshorn,* with the glaciers by which they are begirt. The moon had risen; the valley below, and all the lesser hollows, were filled with a bluish haze that stretched across to the base of the opposite peaks, not forming, as clouds do, an opaque floor on which they could seem to rest, but rather a dim mysterious depth, into which they plunged to an immeasurable distance. The great peaks and glaciers shone with a glory that seemed all their own; not sparkling in the broad moonlight, but beaming forth a calm ineffable brilliance, high aloft in the ether, far above the dwellings of mankind. Chief of them all, the astounding peak of the Matterhorn, that stupendous obelisk whose form defies the boldest speculations of the geologist—gleaming more brightly for some fresh snow that rested on every furrow of its surface—towered upward into the sky. All men, even the least poetical, are variously impressed by such scenes as these, and the mind is involuntarily carried back to some scene of wonder and

* Plate VII. of Schlagintweit's Atlas represents a portion of the view from the Augstkumme; but it can neither be commended for accuracy nor for general effect.

mystery that in early life has fixed its image on the imagination. My own fancy on that night recalled a half-remembered tale of the Scandinavian Sagas, wherein the mythical hero breaks into the assembly of the gods, where they sit in solemn conclave, fixed in deep slumber, with long white beards descending to the ground. Some such night scene, amid the wild mountains of Norway, may have suggested the picture to the old northern bard.

The deep, almost awful, silence was broken by the summons that reminded me it was time to take some sleep, and before ten o'clock I turned into the hay-shed, followed by Mathias. We were both soon asleep. At the first sound I started up, and striking a light with due care for the hay, I found that it was but half-past twelve. Mathias had gone to call Lovisé, and set her to boil the rice for our breakfast. I followed him into the open air. Strange as it might seem, the giant phantoms had not vanished, the scene was little changed; only the full moon had risen higher in the southern sky, and here and there threw a deep shadow, like a dark wrinkle, on the face of the peaks opposite, that rose in startling proximity. The cold, however, was too great to allow me to remain long. I thought it useless to start before three, and therefore turned in again to take another hour's light but refreshing sleep. At two breakfast was ready, and, thanks to the vigorous health that rewards active life in the mountains, I was able to do full justice to it. Our final arrangements were soon made, and exactly at 3 A.M. we started with cordial good wishes from Lovisé, who was at much superfluous trouble to impress upon Mathias the necessity for caution and prudence, with both which excellent qualities Nature had largely endowed my companion.

Keeping that slow measured pace which is so advisable at the beginning of a long day's work, we mounted the slopes of the Riffel; there was not a fleck of cloud in the sky, nor a breath of air stirring below, and no sound was audible save the crunching of our feet on the turf, stiff and crisp from the sharp frost of the night. As a milky hue became perceptible in the northern sky, I thought of repeating the observations which Professor Forbes had made in the ascent of the Col du Géant, on the comparative intensity of the light of the moon and that of the morning twilight. At 3h. 55m. the writing in my note-book, that was perfectly legible in the moonlight, could scarcely be discerned when the page was turned to the north-east. Watching alternately the page in my hand and the

snow on the opposite peaks, where portions that lay in the moon's shadow received the full light of the dawn, I was struck with the apparent contrast between the decidedly yellow and warm light of the moon and the cold bluish tint of twilight. As day approached, this contrast of colour was less marked, and at 4h. 6m. 30s. I could scarcely detect a difference of illumination on the snow, but on the written page the moonlight still appeared the stronger. At 4h. 9m. 30s. the intensity of the two lights appeared equal, and two minutes later there was no doubt that the dawn had triumphed. My attention was engaged elsewhere at the moment of sunrise, and I did not observe the exact time at which the sun touched the summit of Monte Rosa; but as the sun would have risen at the level of the sea in the same latitude at 5h. 3m. A.M., and the summit of Monte Rosa is 15,223 feet higher, we may reckon that the first rays of the sun would reach it about 8m. 45s. earlier, or at 4h. 54m. 15s., omitting the correction for refraction, which in this case would be very small. Professor Forbes found on the 23rd July that the light of the dawn was equal to that of the full moon, at about the same apparent altitude, 50 minutes before the sun touched the summit of Mont Blanc. My observation, therefore, tends to show that the intensity of the diffused light of dawn is diminished as we ascend into the higher regions of the atmosphere. In my case the dawn was not equal to the moonlight until 44m. 45s. before the appearance of the sun; but my position was about 2,000 feet higher than that of Professor Forbes when at 3.30 A.M. he found the lights equal in intensity.* It is desirable that the observation should be frequently repeated, as differences may be found to arise from the condition of the atmosphere, even when it appears entirely free from cloud.

Just before sunrise we had reached the Rothe Kumme, the steep slope over the Gorner glacier, whence the range of Monte Rosa is visible in its whole extent, when a new object of interest presented

* It must, however, be remarked that at an equal interval before sunrise the sun is farther below the horizon on the 18th August than on the 23rd July. Taking this into account, the dawn did not equal the moonlight on the Riffel until the sun was nearer the horizon by 4′ than at the corresponding moment on the Mount Fréty. As the sun rises on the 23rd of July at 4h. 32m. in latitude 46°, there seems to have been some uncorrected error of the watch in Professor Forbes's observation that the sun touched the summit of Mont Blanc at 4h. 20m.; but it may be assumed that the same error affected the previous observation as to the instant of equal intensity, so the result would not be affected.

itself. To the eye the air around us had appeared perfectly clear, and without the slightest tinge of vapour, when suddenly the lower zone between us and the opposite range became suffused with a rosy flush that was accompanied by an evident diminution of transparency; this appeared to be strictly limited within a definite thickness of the atmosphere, extending to a height of about 15,000 feet. At the moment when the change took place, my eyes were turned to the south-east, over the Matterjoch, where the colour of the distant sky near the horizon was of a dark hazy blue, when suddenly it took a violet tint from the interposition of the rose colour in the air between me and the pass of the Matterjoch, as if a gauze veil had suddenly been placed between the eye and the distant sky, and clearly showing that the tint was produced in the lower and not the higher regions of the atmosphere. Most travellers in mountain countries are familiar with this phenomenon, but few have had so favourable an opportunity to observe it in the region where it is produced. It appears to me to be one amongst numerous indications that vapour contained in the atmosphere in a state of rest has a tendency to dispose itself in horizontal strata of unequal density. The exquisite tint which is seen in the Alps about ten minutes after sunset, and, less commonly, before sunrise, may probably be caused by the reflection of the sun's rays from the under surface of some one of these strata lying considerably above the level at which the rosy glow becomes visible.*

I was watching the gradual development of colour in the south-eastern sky, when I became conscious of a change. Turning to the left, I saw the Höchste Spitz and Nord End, with a rim of bright light round the highest part of the two peaks, so nearly to the same extent, that I found it hard to believe the difference between them to be as great as is commonly believed. In point of fact, the height assumed for the Höchste Spitz is the mean result of a number of trigonometrical measurements; whereas, that of the Nord End is taken from the observations of Von Welden alone. Comparing together his measures of the two peaks, the difference of height is less than twenty-three metres, or just seventy-five English feet; and this is probably not far from the truth. The Lys Kamm, Zwillinge, Breithorn, and Mount Cervin, were touched so nearly at the same moment, as to make me suspect that the heights of the second and third have been under-estimated. Tri-

* See note, p. 134.

gonometrical measures of round-topped snow peaks, where no fixed mark indicates the actual summit, are necessarily exposed to serious error. The Dent Blanche and the Gabelhorn did not catch the sun for nearly half a minute after the last-mentioned peaks.

Now was the time to take a last careful survey of the course by which I hoped to ascend, a precaution that should never be omitted before starting on an unknown glacier. Mathias, who till now had probably never looked with any attention at this part of the snowy range, declared loudly that we never should succeed in mounting the broken part of the glacier. I thought it rather soon to give in, and merely said that I meant to try, and if we could not pass, it would always be easy to return. We were not long in scrambling down to the glacier at a point directly opposite to the Schwärzeberg. I had consumed, not lost, a little time in observations that could not often be repeated on so glorious a morning at so great a height, and it was twenty minutes past five when we touched the ice, still dry and crisp from the sharp frost of the night.

What enjoyment is to be compared to an early walk over one of these great glaciers of the Alps, amid the deep silence of Nature, surrounded by some of her sublimest objects, the morning air infusing vigour and elasticity into every nerve and muscle, the eye unwearied, the skin cool, and the whole frame tingling with joyous anticipation of the adventures that the day may bring forth? In this mood I advanced over the glacier somewhat ahead of Mathias, rejoicing in the friendly shadow that the Nord End flung for miles along the great ice-stream, when a new incident occurred, of which I fear that I can give to the reader no lively impression, although the recollection of it after so many years is still delightful. We were approaching the moraine from the Nord End; the air was perfectly still, as the glacier was; the thousand trickling runlets that furrowed the ice yesterday were now at rest, and there remained fantastic structures on the surface of the glacier, some of them like children's houses of cards, with walls and successive floors one above the other, the results of alternate melting and freezing, and draining away of enclosed water, on the porous surface of the ice. On a sudden, as if from some prodigious distance, there fell upon my ear the sound of musical instruments, pure and clear, but barely distinguishable. I halted and listened: there could be no doubt, there was the beating of a drum, and from time to time the sound of brass instruments. I asked Mathias, who now came up, what he thought of it, but he

had no idea of the cause. Then remembering that persons passing the night at the Grands Mulets have declared that they heard the church bell, and even the barking of dogs, at Entrêves or Cormayeur, I straight imagined that they were celebrating a festa in some of the valleys on the Piedmontese side of Monte Rosa, from which direction the sound seemed to come. We moved on, and the sounds continued, becoming rapidly more intense, and soon, as we approached a deep, narrow crevasse, the mystery was explained.

At a considerable depth below us, a trickling streamlet in the interior of the glacier fell from one ledge of ice to another; the crevasse under our feet played the part of an organ pipe, and the elastic mass of ice struck by the descending rill produced sonorous vibrations. Two interesting conclusions followed from this charming experiment in the laboratory of the glacier. First, that the movement of water in the interior of a glacier is not stopped at night, and hence that a sharp frost probably does not penetrate very far below the surface; second, that the formation of fissures transversely to the direction of the veined structure, and parallel to the surface of the glacier, is not confined to the lower extremity of a glacier, where such fissures are constantly seen in and above the roof of the cavern whence the glacier torrent flows, but may probably extend in many directions throughout the glacier. I had often suspected that the water which percolates the ice in warm weather finds here and there a channel along nearly horizontal surfaces in the interior of the glacier,* but during the daytime the sound of running water is heard in so many directions that it is impossible for the ear to follow any single streamlet; now, however, in the silence of the surface I could distinctly assure myself that the streamlet below ran along a slightly inclined bed until it reached the crevasse, from whence it fell to a lower level in the interior of the glacier.

We advanced rapidly, and soon crossed the great glacier, keeping a little to the right of the Schwärzeberg. The lower part of the Schwärze glacier was easily traversed, but we soon reached the fresh snow, of which a good deal had fallen a few days before; I therefore arranged the rope for immediate service, passing it round the body of each of us under the arms, and keeping it in its place with a bit of twine.

At the point where our difficulties began, at the intersection of

* See *antè*, p. 31.

the two systems of great crevasses, I made a rough sketch. At the very first bridge the snow yielded under both my feet, and I fell through as far as the waist, but with the help of the alpenstock, laid flat upon the surface, I had no great difficulty in scrambling back again. It was the first time that such an accident had occurred to me, but, as I wished to keep Mathias in good spirits, I treated it as a mere matter of course; that worthy was, however, grievously perturbed, and commenced an urgent request, which was destined to be repeated very often during the day, that I should abandon an attempt which he declared to be full of mortal danger. I briefly explained to him the security which the rope afforded to us both, and soon found a solid bridge, over which, with some persuasion, he was induced to follow me.

We now had before us, and to the left, the great mass of ice cliffs that I had been watching from afar, and through which I had failed to trace any probable issue; to the right was a labyrinth of wide crevasses, among which I determined to seek a passage along the base of the cliffs; but these, rising steeply to the southward, had sheltered from the sun the thick coating of snow that covered the ice ridges between the crevasses, and made it neither easy nor safe to attempt to spring from one ridge to another. Though it must cost some time, I resolved to try them systematically one after the other, so as to lose no chance of success. Some snow bridges supported us, others failed as the first had done; at length I thought that I had found a passage; but a few blows with the alpenstock on a snow bridge that spanned a wide crevasse, sent it crumbling down into the blue depths of the yawning chasm below, and I was forced to return. When each ridge had in turn been tried and found impracticable, Mathias said, with a provoking tone of triumph, "I told you we should have to return;" but he was grievously disconcerted when he found that, as a last resource, I was about to attempt to scale the ice cliffs. Most of them presented towards us nearly vertical faces of blue ice, but others, as if through some subsidence or internal dislocation, seemed to have heeled over to the southward, leaving on the opposite side steep slopes at an angle approaching to 60°. Here the snow, which had been so inconvenient a short time before, was of essential service. Covering the hard ice, which otherwise I should have scarcely dared to climb, it gave us a firm footing. I, of course, went first, and cautiously made the track. The scene was an extraordinary one, for I have never before or

since seen ice broken into such vast and imposing forms as those that now surrounded us. Sometimes, after laboriously crawling to the summit of a pinnacle more than a hundred feet in height, it was necessary to creep down again into a hollow from which no object was visible, save the sky and the threatening towers and spires of ice that rose on every side. Several times I found it necessary to pass just under the projecting cornice of snow, fringed with long icicles, that capped the top of each pinnacle. Silently and stealthily we crept by, between the ice wall and the pendent icicles, and I warned my companion carefully to avoid touching these, as the slightest disturbance might bring the frail roof down upon our heads.

We had surmounted the greater part of the ascent that was to conduct us to the comparatively level fields of *névé* above the ice cliffs, and were upon the outer slope of a lofty pinnacle that at a great height overhung the glacier. I had climbed to the top, expecting to descend on the other side, but I there encountered an ice wall descending nearly vertically for sixty or eighty feet. It was clearly necessary to return ; but I saw that if we could pass at a level along the face of the cliff we should be able to continue our route. The slope was formidably steep, certainly not less than 60°; and when Mathias perceived that I was preparing to attempt it, he began to remonstrate more loudly than ever, with the air of a man who was going to certain death. I was obliged to assume a tone of command, telling him that while he strictly obeyed me he was safe, but the slightest disobedience would certainly be fatal. As in truth I had no intention of doing anything foolhardy, I adopted unusual precautions. Desiring him to plant himself as firmly as possible in the steep snow slope, I advanced, cautiously making good tracks for each foot as far as the rope would allow, and then made myself firm with my heavy alpenstock. I then gradually drew in the rope as Mathias approached me, prepared to give him some help if he were unfortunately to slip. I was most afraid of his being unnerved, if his eye were to wander down the dizzy slope into the yawning crevasses of the glacier that lay far beneath us, and I ordered him to keep his eyes constantly fixed upon the spot where he was to place his foot. Three or four times the same process was repeated, and we had surmounted our most serious difficulty. We soon arrived near to the summit of the ice cliffs, and there remained at last but a moderately steep slope of twenty or thirty feet to attain the long-desired upper plateau of the glacier.

The sun was now beginning to tell with effect upon the snow. The slope consisted of ice, with a coating of six inches of snow. As I attempted to advance, the softened crust yielded, and slid down with me on the surface of the smooth hard ice. Over and over again the same thing was repeated, and it seemed as if, after overcoming so many serious obstacles, we were to be stopped by this petty barrier. With some difficulty, and a good deal of labour, I was able to clear away the snow from one step after another, so as to cut into the ice with my geological hammer, and when I reached the top I easily drew up Mathias with the help of the rope.

Now, for the first time, there was a pause in the struggle which had been maintained for many hours, and it was possible to look backwards at the view which had opened out to the northward as we had risen far above the minor intervening ranges. The most prominent distant object, between the beautiful pyramids of the Weisshorn and the Mischabel,* was the range extending from the Aletschhorn to the Nesthorn, and separating the valley of the Rhone from the Lötsch Thal. Time pressed, as it was yet uncertain what new difficulties we should encounter in the descent; and, as the view from above would be still more extensive, I resolved to continue without delay the ascent of the snowy slopes that still separated us from the pass. The glare of full sunshine reflected from the myriad crystalline facets of the snow had become intolerable, but, up to this point, while everything depended on my close attention to the most minute details, I had not ventured to use the veil. I now put it on, and thought I was entitled to ask Mathias to take a turn of the fatiguing, but no longer dangerous, work of going first to make the track in the snow, in which we sank at every step nearly to the knees, and here and there even above them. He accordingly went to the front, but, after ten minutes, stopped short at a narrow crevasse well bridged over, and, turning round, said he did not like to be the first to cross so dangerous a place. I resumed my old position without saying a word, but resolved that, come what might, I would not again ask any assistance from so spiritless a creature, and refused him the post of honour when he afterwards asked for it.

* Seen from the southward, it is scarcely possible to separate the twin peaks of the Dom and the Täschhorn: they show as a single pyramid of ice resting on steep rocks.

The distance up these snow slopes had appeared from below to be but trifling, yet an hour passed and we were still plunging on through the soft caky mass that formed thick balls round our ankles that had from time to time to be knocked off with the alpenstock. The heat of the noon-day sun on the head was almost insupportable, but I found some relief from hoisting an umbrella, the advantage of which in similar situations I have proved in subsequent expeditions. Twice we halted for two or three minutes, and I looked back with great interest on the same range which had been from below less fully visible. I believe that the three principal peaks were all visible. To the right is the Aletschhorn, not then known to be higher than the Jungfrau; the latter being 13,671 feet, the former 13,803 feet in height. Next come two peaks that may be counted as a single one, being nearly of equal height, and seen in the same line—the Schienhorn, 12,638; and the Gross Nesthorn of Dufour's map, 12,533 feet in height. Farther to the left is a beautiful 12,969 feet high pyramid, whose various names have caused some confusion among Swiss writers. On the north side it towers over the Lötsch Thal; and on the south it divides the parallel valleys of Bietsch and Baltschieder, and in each valley it has a different name, being known alternately as the Nesthorn, the Bietsch-horn and the Baltschiederhorn.

For a fuller enjoyment of the view, I waited till we should reach the highest point of the ridge, and pushed slowly onward. Whether from mere fatigue or from the diminished density of the air, the last part of the ascent was rather distressing, and at every twenty or thirty steps I paused for a few seconds to calm the circulation, which was somewhat, though not greatly, accelerated. At length, at a quarter past one, we attained the long desired summit of the ridge.

Until that moment we had not seen a single cloud in the sky; great, therefore, was my disappointment to find stretched out on the side of Italy, about three or four thousand feet below us, a vast boundless sea of fleecy clouds, through which arose here and there, like islands, the summits of some of the higher peaks in the ranges that diverge to the southwards from the great mass of Monte Rosa, or lie to the south-west of the Val d'Aosta. It was of great importance to us to determine our position with reference to some known point on the southern side. An occasional break

in the clouds immediately under us disclosed a deep valley, and it was, probably, rather the desire that it might be so, than any particular resemblance, that made me identify a high rocky peak, to the right or western side of that valley, as the Grauenhaupt. I had expected to find myself opposite to the ridge dividing the Val de Lys from the Val d'Ayas, and to descend by the eastern side of that ridge into the former valley somewhere above Gressonay la Trinité. It would, however, be all the better if the glacier below us were to conduct us directly into the head of the Val de Lys, as would be the case if my too hasty supposition were correct. Turning round to view the panorama to the northwards, I was surprised to find that it was no longer visible. During the ascent we had gradually approached the long wall of rocks forming part of the Breithorn. During the last quarter of an hour of the ascent we passed, without my remarking the fact, round the upper projecting corner of these rocks, which were scarcely 100 feet higher than where we stood, but completely shut out the view. By going a short distance to the east, I opened the view of the Dom, which bore 38° magnetic east. Had time allowed it, there would have been no difficulty in ascending the western peak of the Zwillinge, which rises immediately above the pass some 600 or 700 feet; but, having to descend over nearly ten times that vertical height of utterly unknown glacier, such an excursion was not to be thought of.

The south wind on the crest of the ridge, though not violent, was unpleasantly cold; and I accordingly advanced a short distance down the gentle snow slope, on the southern side, before halting for luncheon. Nearly twelve hours had passed since breakfast, and I had taken nothing but three or four chocolate lozenges: the small pebble of quartz, which I always carry in my mouth, had prevented any unpleasant feeling of thirst. Mathias, who complained much on this score, had had recourse to the wine, and seemed to be rather the worse for it, as he had no appetite, and I had some trouble to induce him to eat his share of our small stock of bread and cold meat. I set fire to my boiling-water apparatus, which was to supply a warm drink, and to measure the height of the pass; but, for the first time after a month's continual use, it was out of order, owing to a leak in the spirit lamp. Cold tea, mixed with a little wine and snow, formed a not unpalatable drink. The height of the pass I estimated at the time to be about 12,700 English feet; subsequent comparison with the adjoining peak of

the Zwillinge, whose height is 13,475 feet,* would lead me to add 50 or 100 feet to my first estimate: it is certainly by far the highest pass which has yet been effected in the chain of the Alps. By analogy with the name of the nearest pass on the eastern side, and to commemorate the long range of dark rocks that leads towards it from the Breithorn, I proposed at the time that it should be called the Schwarz Thor, and have taken the liberty of preserving that designation in the title to this paper. Owing to the irregular force of the wind, and the difficulty of shading them efficiently from the sun, the thermometers oscillated much; the temperature of the air was about 47° Fahr., and in the sun it varied from 49° to 53°.

It was now two o'clock, and high time to resume work: we shouldered our knapsacks, Mathias being now relieved of the greater part of his load, and got again into harness. My desire was, to effect the descent on the eastern side, so as to reserve to myself the power of bearing still further in that direction, across the ridge into the Val de Lys, in case it should turn out that the valley below us was, contrary to my present belief, the Val d'Ayas. A sudden opening in the clouds below, showing for a moment in the distance a village with its church, and an adjoining green expanse of level meadows, which was at once identified as St. Jean de Gressonay, helped to confirm my mistake. We now started, keeping at first as far as possible to the left. I soon came to the brink of an enormous *bergschrund*, which I followed for a short distance, till I was able to assure myself that on that side the descent is utterly impracticable. I afterwards saw from below that it presents a succession of precipitous faces of rock and ice, by which it could never have been possible to effect a passage. My next thought was to attempt the descent by the middle of the

* In Ziegler's Catalogue the following heights are given upon the authority of M. Berchthold:—Lys Kamm, 4,247 metres; Pollux, or the eastern peak of the Zwillinge, 4,107 metres; the Breithorn, 4,148 metres. In the same list, among the peaks of the Rosa group is enumerated the "Weissbrüder—height, 4,245 metres," authority, "B. und Müller." I do not know to what peaks the name and the height can apply, if not to the Zwillinge. It is nearly certain that all the first-mentioned measurements, which, for want of better, have been copied in the Appendix to this work, are considerably below the truth. Zumstein's barometrical measurement of the height of the plateau between the Lys Kamm and the Zumstein Spitz gives 4,315 metres. Mr. W. Mathews, who has been the first to effect the passage of that plateau from the Riffel to the Val de Lys, after levelling, and comparison with the neighbouring peaks, has estimated the height of the plateau at 13,850 English feet, and that of the Lys Kamm at 14,600.

glacier; three times I went forward, and each time was obliged to return, by the breaking of the snow bridges over which I attempted to pass. The last of these presented the most striking scene of the kind that I have ever witnessed. I was over a great *bergschrund* completely roofed in with a thick coating of snow; towards the crown of the arch the roof gave way with me, and though the position is not quite a comfortable one, I had become so far used to it in the course of that day, that I paused for a second to glance down into the vault over which I hung suspended. The chasm appeared to be about thirty feet wide, and went down to a depth that was veiled in blue darkness; on either side was a fringe of enormous icicles, forty or fifty feet long, suspended from the cornice of the roof; most striking of all was the exquisite pale blue light, that alone penetrated the snowy roof, and increased the mysterious character of the unearthly scene. The glance was but a momentary one, for there was no time to be lost in withdrawing from so unusual a position; my arms remained above the snow, and with a little help from the rope, I had no difficulty in regaining the solid bank. I may say, once for all, that where two men are united by a strong rope, there is no danger from the falling in of snow bridges, provided the man who remains behind keeps the rope stretched, and is attentive to give a moderate degree of assistance at the moment when it is wanted. On this score I had to give frequent warnings to Mathias.

Nothing now remained but to attempt the descent on the right hand by a steep *couloir* close under the Breithorn rocks, a course which my companion had already urged, and I had resisted, partly because it was the opposite direction to that which I wished to take, and partly because I knew that ice detached from the edge of the plateau above the rocks fell into this *couloir*. I found the descent easier than I expected, the only inconvenience being that the foot sometimes rested on a block of hard ice fallen from the rocks above, and at perhaps the next step would sink above the knee into soft snow. We advanced rapidly, and were before long out of the reach of falling ice.

We had gained a point commanding a view of the lower part of the glacier, when, fortunately, the clouds broke away, and for the first time I was able to see part of the route that we still had to traverse. For a considerable distance the *névé* on this side of the glacier stretched downward in rather steep slopes almost free from

crevasses, but in front the progress of the glacier was arrested by a precipitous buttress of dark rock, thrust out nearly at right angles to its course. Encountering this immovable obstacle, and forced abruptly to change its direction, the glacier is rent on all sides by wide crevasses. I devoted some minutes to a careful examination of the surface with an opera-glass, making mental memoranda of the arrangement of the crevasses, and the position of the snow bridges, which were all laid out before me like the pieces on a chess-board. We pushed on again, and before long found ourselves in the broken part of the glacier, the crevasses every moment becoming wider and more numerous. Mathias, who had not seen the coming difficulties, was now fairly overwhelmed with consternation. He had flattered himself that our troubles were at an end, and he now found himself, with evening fast advancing, in one of the most awkward positions that we had yet encountered. I soon saw that it was impossible to advance along the middle of the glacier. He urged me to keep to the right, towards the rocks. As these were quite inaccessible, and the glacier adjoining them was sure to be more crevassed than elsewhere, this plan was out of the question, and I told him he had nothing to do but to follow me. His astonishment and anxiety were great when he saw me face round and begin to reascend the glacier, but bearing to the east. I had no difficulty in finding a somewhat circuitous way that I had traced out from above, and in a short time we were safely landed on a rocky mound that rises in the middle of the Glacier of Ayas, and divides the lower part of it into two separate ice-streams.

I felt some satisfaction at again touching *terra firma*, after more than thirteen hours of snow and ice, and at having got through our difficulties before dark. As for poor Mathias, there were no bounds to his joy and his gratitude to me for, as he said, having delivered him from death! He thanked me again and again, as if I had exerted myself to find the way exclusively on his account. I was glad to meet on these rocks, perhaps never before visited by traveller or botanist, a few rare plants, one of which—*Senecio uniflorus*—served to fix our geographical position, as it is peculiar to the southern valleys of Monte Rosa. The clouds now closed around us, but our difficulties were at an end. After a few minutes' halt we quitted the rocks, where I left the opera-glass that had just proved itself so useful; a short scramble took us down to the eastern branch of the lower glacier, which was soon crossed, and

before long we struck upon a cattle track, that led us to a pasture close to the foot of the glacier. A lift in the clouds showed that we were near to a small châlet, with the herdsman standing by the door. Still believing that we were in the Val de Lys, I went up to him and asked him in German how far we were from La Trinité. He was seemingly bewildered with surprise, and for some time we could extract no intelligible reply to my questions. Failing German, I tried my best Piedmontese, with little better success; it turned out afterwards that French would in all probability have been more serviceable. Not being able to find out where we were, or how far we should have to go before finding shelter, we pushed on down the valley, declaring our new acquaintance to be incurably stupid. It was not surprising that this poor man, who probably passed his life at the foot of these glaciers, and looked upon them as the end of the world, should have been somewhat astonished at the first apparition of strangers, oddly attired, and armed with long spiked poles, suddenly presenting themselves at night-fall in a spot so remote and utterly unfrequented. It was past seven when we left the châlet, and in about an hour's walk over a rough track we arrived, as it became quite dark, at a small village. Shelter and rest were welcome, wherever we might be, but it was with a little disappointment that I found we were not in the Val de Lys, but at San Giacomo d'Ayas, the highest village in the valley of that name.

Without much trouble we found lodging in a house tenanted by a solitary old woman, whose husband, I think, was absent. The larder contained bread, butter, and eggs, with which, though tired after the day's hard work, I proceeded to make a good-sized omelette. Mathias, however, was regularly knocked up. It was not, as he declared, from fatigue, but from mortal anxiety, "grossen Angst," that he was now in a sort of collapse, unable to eat or to exert himself in any way. It seemed that for that day I was to do everything myself, so I not only cooked the omelette, but ate it. A hay-shed adjoining the house was our dormitory, and we should probably have slept well, but for the painful state of our faces and eyes. When we rose at six o'clock, poor Mathias, who in other respects was better, suffered grievously from inflamed eyes; and, partly owing to the cooking operations of the previous night, I was in not much better plight. We parted after breakfast, he to return towards Zermatt, I to cross the Betta Furke to the Val de Lys.

Mathias afterwards told me of an affair in which he played

a part, while on his way back to Zermatt. On the day we parted he slept at the châlets of Aventina, and on the following morning, the 20th of August, resumed his journey by the Cimes Blanches, and the Col de St. Théodule. The weather was heavy, and the clouds lay on the snow. When near the summit of the col he came upon a stranger, alone, and in a state of extreme excitement from anxiety and terror. He explained to Mathias that, a short time before, his guide, who was a few paces in advance, had suddenly disappeared down a chasm in the snow, which had given way under his feet. The stranger, who was an Englishman, and probably unused to glacier travelling, was utterly at a loss how to proceed, without the means of attempting to succour his unfortunate companion, and not daring to continue his journey in the midst of such unseen dangers. The appearance of my not very heroic companion was naturally regarded by the alarmed traveller as a providential deliverance. Nothing could be done to extricate the body of the guide, and Mathias had no difficulty in conducting the traveller safely to Zermatt. It turned out that the guide was a man from the lower part of Val Tournanche, not well acquainted with the pass, and that, wandering a little from the true course, he had got upon a part of the glacier where concealed crevasses are numerous. A rope would, of course, have saved this man's life, as it would most of those that are lost upon the glaciers. When it became known at Zermatt that the would-be guide was an interloper, and not one of the three or four men who at that time professed to show the way from Val Tournanche to Zermatt, complete indifference, or perhaps a little secret satisfaction, was felt as to his fate; and it was only when it became known that the traveller's money was contained in the knapsack which the deceased man had carried, that active steps were taken for the recovery of his body. A coroner's jury of the natives would certainly have returned a verdict of "Served him right;" and, if I had been one of the panel, I should have been tempted to agree in the finding, on account of his neglect of the rope.

On the day following the passage of the Schwarz Thor, the clouds lay low, and I had much trouble in finding my way over the Betta Furke. Local attraction interfered with the compass, which therefore misled me, and I had to redescend twice from unsuccessful attempts to force a passage where there was none. The skin completely peeled off from my face and neck, which felt uncomfortable

for several days, and during the same time my right arm was partly useless from the extreme exertion of sounding with a heavy alpenstock without intermission for so many hours. The effects of the severe day's work, doubtless increased by having carried my knapsack, were perceptible for some time. These drawbacks, however, were far from counterbalancing the great enjoyment of the expedition. With a companion, whether a professed guide or amateur, who could have taken an equal share of the day's work, there would have been no reason to complain of fatigue.

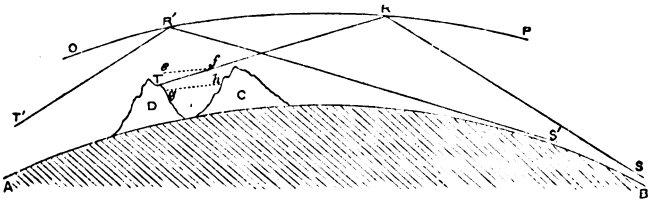
The account given by Mathias of the difficulties of this pass seems to have put an end to the hopes felt at Zermatt of using it for smuggling purposes. I have heard of but two attempts to cross it since 1845, the first of which failed, and the second, made by my friend the Rev. Mr. Davies and a party of companions, was successful. I am not aware whether they took the same route that I did, but I have since thought that by mounting along the rocks of the Schwärzeberg, and continuing in the same direction to the east of my track, the ice cliffs could be attacked at a higher point, and most of the difficulties of the ascent be thus avoided.

The foregoing narrative is nearly a translation of one written by me in 1846, at the request of a Swiss friend, for the *Bibliothèque Universelle* of Geneva, but which, owing to accidental circumstances, was not communicated to that journal. I fear that having been written at a time when the upper regions of the Alps were less familiar than they now are to many travellers, this account may seem to dwell more than is necessary on some of the not unusual incidents of high glacier expeditions. Most of the writers in this volume, and many other English travellers, have of late years accomplished feats much more remarkable than any of which I can boast; but this expedition having been made at a time when there were no guides at Zermatt at all familiar with the higher glaciers, and when their risks and difficulties were ill-understood and therefore overrated, it is probable that I myself, as well as some Swiss friends, may at the time have thought more of the expedition than it deserved. I have not, however, been able to detect any statement that seems to me exaggerated, nor have I found it possible materially to alter the form in which the account was originally entered in my journal. With this explanation, therefore, I submit it to the indulgence of the reader.

J. Ball.

NOTE.

The annexed rough diagram may make more clear the suggested explanation of the cause of the rosy glow seen in the higher Alps while the sun is below the horizon:—Let A B be a section of the earth's surface, C and D mountains with a valley between them, and O P a stratum in the higher regions of the atmosphere, wherein the aqueous vapour is in such a condition that the sun's rays are partially reflected from its under surface.



If we suppose the stratum of air between the mountains C and D, and bounded by the dotted lines *e f* and *g h*, to be charged with vesicular vapour of the precise degree of tenuity that gives the rose tint, it is clear that the rays reflected from the surface O P will reach it when the sun is a short distance below the horizon, and the ray S R T is reflected from R on the sunward side of the mountain C. But when the sun is on the verge of the horizon, the ray will impinge on the surface O P at a point R' over the mountain C, and the reflected ray R' T' will no longer reach the valley between C and D. Some such explanation I presume to be necessary to account for the interval that is always observed between the full glow of rose colour and the moment of sunrise or sunset. The reason why it is never seen in perfect purity and steadiness when the sun is above the horizon is, probably, that the heating power of the sun's rays disturbs the uniform condition of the vapour suspended in the stratum of air through which they pass.