

fan. Under no conditions should any but safety-lamps be used in coal holds or bunkers.

A discussion followed, and the proceedings closed with a vote of thanks to the lecturer.

#### A WINTER EXPEDITION TO THE SONNBLICK.<sup>1</sup>

IT is not often that an Alpinist finds leisure to spend a month in winter at an altitude of 10,154 feet above the level of the sea. It may, therefore, interest the members of the Alpine Club, to have the experiences of one who, though not a member of their Society, yet was fortunate enough to make the unusual ascent, which was chiefly undertaken in the interests of science.

It is well known that since 1886, thanks to the united efforts of the Alpine Club, and of the Imperial Austrian Meteorological Society, and in a special manner to the energy and public spirit of Herr Ignaz Rojacher, there is now a thoroughly equipped Observatory on the highest peak of the Sonnblick. This Observatory has been established with the view of affording to students of natural science, physics, astronomy, and meteorology, the means of making such observations as are only practicable at great heights; and of providing them with accommodation in a part of the building which has been named by the owner "The Study."

In carrying on certain inquiries which are only to be solved on high mountains, I had for this purpose spent a month in the summer of 1881 on the Hoch Obir (6716 feet) in Carinthia, and I determined the first winter after the erection of the Observatory on the Sonnblick still further to resume the investigations in a situation which afforded a clear, cold, winter atmosphere, which was absolutely necessary. I was unfortunately unable to realize my intention the first winter (1887), which was the more to be regretted inasmuch as the winter of 1887, and especially the month of February, was unusually fine, whereas that of 1888 was the severest ever known. The "oldest inhabitant" of those parts had no remembrance of such heavy falls of snow and such dark and stormy weather as we experienced in the February of 1888—the month for which I had made all my arrangements for an expedition to the Sonnblick.

My expedition was undertaken with the following objects:—(1) To investigate the radiation of the earth into space, and the irradiation of the atmosphere upon the earth's surface, in order to ascertain, more accurately than had hitherto been done, the temperature of the aerial envelope of the earth. (2) To investigate the question of the blueness of the sky. (3) To discover whether the sparkle of the stars was altogether due to the lower strata of air. Having had a grant from the Imperial Academy of Sciences in Vienna for the purpose, I succeeded in enlisting the services of Dr. Trabert, a young indefatigable man of science, as assistant, to make simultaneous observations on the Rauris, whilst I observed on the Sonnblick.

We reached Lend on the morning of February 3, where we handed over our seven cases of scientific instruments, and my provisions for a month's sojourn on the Sonnblick, to Herr Rojacher's men, who conveyed the whole on a couple of sledges through Embach to Rauris; we driving to Kitzloch Rauris, where we found Herr Rojacher awaiting us, and, after a tough climb of an hour and a quarter up the mountain pass of Kitzloch, we proceeded by sledge to Rauris.

This first day was perhaps the finest during our stay in the Rauris Mountains; on the next, it began to snow; and it was in a heavy snow-storm that I had to set out for Kolm; and so heavy was it, that it was with the greatest difficulty that Rojacher and I, in our sledge, followed by the *Rossknecht* with my baggage, were

enabled to reach the Bodenhaus. From thence, through the woods, to Kreuzbichl, the snow fell thicker and thicker, and it seemed as if we should never get to our destination. Beyond Kreuzbichl there was no path of any sort, and we had simply to wade through the deep snow for fully an hour, before we reached Kolm, Herr Rojacher's residence (5249 feet). On my arrival, I was just in time to telephone to Rauris that I had reached so far in safety, the telephone communication being immediately thereafter interrupted. That journey from Rauris to Kolm had given me some idea of what a snow-storm in those regions meant. The avalanches caused by the weight of snow, had broken down the telephone wires, completely burying them, and, in one place, carrying them away for a distance of over two kilometres.

The *Rossknecht* had just reached Bodenhaus, but was utterly unable to push on further. It was four days before all my cases could be brought on to Kolm; and then the men had to carry them on their backs. Here was I, cut off from the world, snowed up at Kolm, and with little apparent prospect of getting to the Sonnblick; the snow falling faster and faster for four whole days, without intermission. But I was thankful enough to have reached there, for the valley beneath was laid waste with avalanches, making the roads impassable. However, the five days in which I was blockaded at Kolm were anything but wearisome. I could well have undergone a longer imprisonment with a companion so ingenious and intelligent as Rojacher. He had always some interesting subject to discuss, or new problem to set concerning the Tauern range. What perhaps interested me the most were his descriptions of winter life in this inhospitable altitude—its pleasures and difficulties, and particularly his explanation of the *Lahnen*, the local word for avalanches.

There are two kinds of *Lahnen*, he explained, *Windlahnen* or *Windsbretter* (wind avalanches), and *Jauk* or *Grundlahnen* (ground avalanches). The first belong exclusively to winter; the second to spring. These last are the avalanches of which people who live far out of the reach of avalanches have formed the one and sole idea of their nature and composition, thus confounding the two. They are, however, totally different.

The action of the ground, or *Jauk*, *lahn*, as its name denotes, is to break away from its base on the ground; and, as its second name denotes, mostly in consequence of warmer temperature, *i.e.* *Jauk*, south wind. It is composed of a huge mass of melting snow saturated with thaw water, that, restrained by the enormous friction of the earth, carries slowly along with it everything that impedes its course. It is set in motion when the moisture of the thawing ground has sufficiently diminished the earth's friction which has hitherto held it back. It needs no propelling medium; its own weight causes it to slide. The prevailing idea that any small particles of snow set primarily rolling by a bird, or any such unimportant agency, can gradually increase to the dimensions of an avalanche, is a pure fallacy. The rolling is a secondary matter; the primary agent in an avalanche is its sliding. They travel slowly, Rojacher said—that is, there is mostly time for escape on first hearing the roar of the heavy falling mass; with the *Windlahn* is no such hope, as both Rojacher, and all others whom I questioned, assured me.

The *Windlahn* he explained in the following manner. The first falls of winter snow fill up all inequalities of the surface. If it lies for a time, it consolidates and forms an even, slippery surface. More snow falling upon this smooth surface has a tendency, by its own weight, to slide off. This is certain to occur if after a heavy fall of snow the new layer has acquired such weight that its pressure overcomes the slight resistance of the underlying stratum, and any chance obstacles that hold it back. As soon as the top pressure is great enough to start a fissure, the

<sup>1</sup> By Dr. J. M. Pernter, of the Imperial Academy of Sciences in Vienna.

whole mass of the fresh-fallen snow sweeps with the velocity of the wind from off the slippery surface beneath. That is a *Windsbrett*, or *Windlahn*; so called, not that it is caused by the wind, but that in its headlong passage its velocity creates a storm wind which in its turn commits ravages and devastation far beyond the range of the falling avalanche.

I had many opportunities, while at Kolm and on the Sonnblick, of witnessing those terrible avalanches. During the night of February 4-5, a *Windsbrett* fell from Bucheben, filling the whole valley beneath for a distance of two kilometres with 13 feet of snow. The avalanche itself could not force its way up the side of the opposite mountain, but the wind caused by it unroofed a farmhouse, 650 feet above the valley, and blew in the windows.

The day I started for the Sonnblick, a *Windsbrett* parted from the Hoch Narr Glacier, causing such a terrific gale of wind in Kolm that the people were in terror of their lives. The next day we looked down from the Sonnblick on the snow-field whence the avalanche had parted, and Rojacher and his assistant, Peter Lechner, estimated its length and breadth at 650 feet, and depth 13 feet, representing a fallen mass of at least 160,000 cubic metres.

One peculiarity of wind avalanches, that makes them such a special danger to tourists, is that it is so easy to start one unawares. On an inclined, slippery surface of hardened snow, there lies a thick superstratum of fresh-fallen snow, ready, so to speak, to slip away at any moment. It often requires but the weight of one man, and there are generally at least two, to produce the slight pressure that sets loose the avalanche. In such a case there is heard a dull thundering crack, immediately after which, either the mass of snow starts, in which case the men are borne down on it with the swiftness of the wind, seldom to be seen again; or, after the first crack, the mass remains stationary, the *Windsbrett* has "settled," and the travellers proceed scatheless on their way.

I underwent such an experience during my ascent of the Sonnblick, not without considerable alarm, I must confess. Not far from the miner's lodge, at about 7550 feet of altitude, we had to cross a snow-field on a considerable incline. There were fifteen of us, with Rojacher and myself. Arrived at the middle of the incline, we heard a terrific muffled crack. We had started the *Windsbrett*. For a moment we knew not whether to go on or go back, the next we found that we had escaped with the fright—the avalanche had "settled."

It is not easy to say what are the causes that hold back an avalanche once started. It seems as if the "settling" of a *Windsbrett* only occurs when passed along at its top-most end; at any rate, prudence suggests that it is the only safe path to cross one; for, in the event of its giving way, the best hope of safety is to be on the highest point of the falling mass; there is, at least, the possibility of being able to obtain a foothold above, and thus of not being crushed by the on-coming snow. Should the *Windsbrett*, after being started, remain stationary, it is in all probability due to the fact that the lower part of the snow-field is too massive to be set in motion by the unsettlement of the upper portion, and therefore does not partake in the movement. Thus the former "settles."

The account above given of *Windsbretter* will explain why the inhabitants of the regions where they are to be met with maintain that it is next to impossible to escape with life from them. Once hear the fatal crash, the avalanche is upon them, and there is no escaping from it. Their advice is, to throw oneself prostrate, with hands outstretched, if possible behind some rock or boulder; there is the chance that the *Windsbrett* may pass over him, and if buried in the snow, one would be in the most favourable position to breathe, and therefore stand

the best chance of being dug out alive; while to stand upright would be, to a certainty, to be carried with it. There were many such cases among Rojacher's people during my stay on the Sonnblick. This and similar talk made the time pass agreeably enough while I was waiting at Kolm.

While thus employing ourselves, Rojacher spoke through the telephone from time to time to his men in the station (Berghaus), 7870 feet above, asking if some thirteen or fourteen of them could venture down to take up my cases. For the first four days, the invariable answer was that there was too great danger of avalanches to undertake the descent; on the fifth day at noon they decided to venture down upon their *Knappenrossen*.<sup>1</sup> Barely an hour after we saw them come tearing down the declivity behind the Kolm house, or rather saw but a thick cloud of snow coming towards us, amid which an occasional hat, or alpenstock, was discernible. After the men had well warmed themselves, and had invigorated themselves with draughts of hot wine, my traps were distributed among them, and at 3 o'clock we started for the station. Our ascent was effected by means of snow-shoes, we keeping carefully to the rut made by the men on their passage down. There were no deviations, the snow had so completely filled up all uneven places, covering rocks and stones with its thick mantle, that it was one straight path. Our ascent was comparatively easy, and in three hours we had reached the Miner's House (*Knappenhaus*), after having, as already related, had a considerable panic from a *Windsbrett* some twenty minutes before.

The weather, which had, so far, been tolerably favourable, had changed for the worse during the night, and I expressed my fears to Rojacher in the morning, that we should be snowed up there for some days. But his calm reply was, "Once so far, we must reach the Sonnblick before dusk, cost what it may." To my objection that we might run the danger of avalanches, he laughingly said, experience had shown him that they had no love for him. It would be an unheard-of thing for one to travel his road. His confidence reassured me, and I made no further demur to continuing our route.

Rojacher, however, added other ten men to our escort, whose duty was to go first and tread down the snow on the way to the plateau, where he expected to find the fall had been much less heavy, and where the extra men could then load themselves with the store of wood, already stacked, for the use of the house on the Sonnblick. Our party now assumed a somewhat droll appearance, marching along in Indian file, across the vast snow-fields. During the whole way to the top we were enveloped in a dense mist; and our ascent through the stupendous masses of fresh-fallen snow, was a very slow one. The first man, the pioneer, sank up to his hips at every step, despite the snow-shoes; in five minutes his strength was exhausted and he fell out, taking his place as the last but one; I always remaining the twenty-fifth man, which made the ascent comparatively easy to me. As each man placed his left foot exactly in the left foot-print of the one who preceded him, and his right foot in the right foot-print, I, as last man, had firm ground to tread, my one care being to plant my feet well into those spaces, and thus I reached the summit but little fatigued. We had taken four hours to make the ascent; and it had enabled me to form some idea of the incredible bulk of snow that can collect on the Hochgebirge. Even on the upper plateau, the snow of the last four to six days had reached a depth of ten feet. This was proved to us, on coming up to the wood-stack. It had been carried up before the last snow-fall, and stacked to a height of about ten feet. Fortunately the men had had the foresight to mark the spot by an upright pole; without this landmark we should never have found

<sup>1</sup> Miner's sledges, formed of stout boards on runners.



it, for the wood was completely buried, and only a short length of the pole visible. Even Rojacher had not foreseen this, he being convinced that falls of snow were considerably less on the heights. So far he was right. The fall had been lighter above than below; but then below it had been almost unparalleled. To have formed an estimate of the quantity of snow that fell that winter on the Tauern, I should have needed a previous knowledge of the locality in summer; as, unfortunately, I had not that, I was obliged to content myself with Rojacher's computation at various points. The deepest level we could see, was on the lower plateau, some 8200 feet above the level of the sea, where the telephone wire stretches over a little glacier valley. Rojacher knew that this wire was carried 66 feet above ground in the deepest part of the valley. On passing by it, we found that the snow not only reached to the wire, but that the valley had become one even snow-field; thus proving a depth of 66 feet in that part. It is unnecessary to give further instances; no description could afford a true idea of the stupendous masses of snow. They must have been seen to be believed. Rojacher repeatedly said how glad he was that a Vienna Professor should have had the experience; and even went so far, in his good-natured raillery, as to wish that—without prejudice to my scientific researches—I might taste to the full the meaning of a severe winter on those heights.

His wish was granted, even beyond his desires, for I spent a February such as had never been known before, not only as regards snow and avalanches, but of destructive storm and variations of temperature. However, although I could have desired finer weather for my investigations, my stay on the Sonnblick was most enjoyable. The mountain sickness, from which I had hitherto always suffered severely, was very slight, and of not above three days' duration. My provisions were good, and lasted out excellently. In fact, I came to the conclusion, as far as health was concerned, that my winter expedition on the Sonnblick suited me infinitely better than a month in the Riviera would have done.

Shortly before I had started on my expedition there had been such accounts in the Vienna papers of the suffering from cold experienced by the man in charge on the Sonnblick, that I expressed some fears whether I should be able to stand the extreme cold in the house. Experience soon set those fears at rest. Our rooms were most comfortably warmed; the heating apparatus is perfect; indeed we had more than once to open a window to let out the hot air. It is quite a fallacy to suppose that one cannot keep warm on the Sonnblick.

These few remarks may serve to show those to whom their *café*, daily paper, *tarok*, or whist club are not matters of vital importance, that a winter sojourn on the Sonnblick has no great difficulties—when once they get there. As for occupation, there need be no lack; at any rate, so I found. On fine days, of which I counted but nine in the four weeks, I could barely give myself time to eat or sleep; they being entirely devoted to the specific objects of my investigations. On wet ones, I had enough to do examining and verifying the meteorological instruments belonging to the Observatory; and in initiating its solitary occupant, Peter Lechner, still further into their uses. The results of my observations have been since reported to the Imperial Academy of Sciences in Vienna.

It was no light work to get my apparatus suitably adjusted, all my observations having had to be made in the open air; and it is thanks to the skill and indefatigable energy of "the Hermit of the Sonnblick"<sup>1</sup> that I

succeeded so well. Lechner is a most devoted servant of science, and carries out all his duties on that solitary peak in the most conscientious manner. He assisted me too in my observations on the radiation of the earth, and the sparkle of the stars. As these required to be made at night, the cold rendered it necessary to be well protected with fur-lined boots, fur travelling coat, fur gaiters and fur cap, well down over the ears; otherwise I could not have withstood those nights, standing and sitting, as we often required to do for hours, in a temperature of  $-4^{\circ}$  F.

The simultaneity of my observations with those of Dr. Trabert were certified by the telephone, which acted admirably. The day after I arrived on the Sonnblick, the interruption between Kolm and Rauris had been repaired, and from that time there was only one day when connection was broken again—that time, unfortunately, between the Sonnblick and Berghaus, so that we were quite cut off. The next day, however, the point of breakage was found, and connection made again. It is no little difficulty to find out the point of breakage on such a height, and when the whole wire is buried under the snow.

Herr Rojacher has found a method, I do not know if in use elsewhere—anyway he found it out for himself. It is, of course, known to electricians that two near telephone stations can speak with each other if instead of one of the earth plates, connection is effected by means of any large mass of metal, as a stove, for instance, with which one of the telephones is connected. By analogy it ought also to be known (I do not know if it is) that in the case of three stations, as Kolm, Bodenhaus, and Rauris, should there be an interruption between Bodenhaus and Rauris, if that interruption has occurred near Rauris, Kolm and Bodenhaus would still be able to speak together, although, through the want of the ground conductor, there is no closed circuit. I have made that experiment myself. Now the above-mentioned larger mass of metal can be made to replace the wire from Bodenhaus to the point of interruption, supposing the wire to be long enough. It was on this last hypothesis that Rojacher founded his method—that of seeking the point where communication ceases up in the snow-fields. Taking a hand telephone with him, he starts from one of the stations between which communication is interrupted, and connects the hand telephone with the wire at one of the *Untersuchungstangen* (test poles) that are placed at intervals, and through which the wire passes, thus raised in triangular form out of the snow. As long as he can still speak with the station whence he has come he knows that the breakage has occurred farther on. When he can no longer speak he fixes a trumpet on to the telephone; if the answer, also spoken through a trumpet, be audible, the point of breakage is not far off. If the trumpet tone reaches his ear no longer, the spot is close, and a little examination enables connection to be re-established. Only by this method could connection be as quickly restored under difficulties so immense; and it is by this means that Rojacher is enabled to send out regular meteorological observations, with scarce a break, through an electrical apparatus perhaps the most perilously placed in the world.

During my stay on the Sonnblick I had opportunity to witness many rare atmospheric effects; and to become more closely acquainted with meteorological phenomena at that altitude. The second day I was there I saw a splendid sight. A white mist enveloped the whole base of the mountain up to within 500 feet of the summit; the shadow of the house on the Sonnblick being clearly projected on it. Suddenly the shadow was surrounded by a

<sup>1</sup> Alone for the most part throughout the year, cut off from all intercourse during the worst of the winter months, his occupation is to speak through the telephone three times daily, to record his readings on the maximum and minimum thermometers, on the sunshine recorder, the psychrometer, the hygrometer, and the hygrograph, on the anemometer, the barometer,

and several other instruments; he hears, besides his own voice, generally that of one of his former comrades at the Miner's House where he used to work, inquiring, "Is all well on the Sonnblick?" And then the former silence is resumed.—Translator's note, from *Standard* of December 13, 1889.

triple rainbow of dazzling brightness. Had I not known that my eye was the centre of the exquisite sight, I must have judged the house, or rather its shadow, to be its central point. This I disproved by moving from east to west of the house, when the whole "glory" seemed displaced. I did not succeed in projecting my own shadow upon the mist, and in producing the effect myself; the "glory" remained attached to the shadow thrown by the house. I observed the same atmospheric effect several times afterwards while there, but never with such brilliancy. Another time I was struck on observing a magnificent ring round the sun, accompanied by other lesser rings. The sun was then in the east, about  $14^{\circ}$  above the horizon, and exactly over the peak of the Kleinen Sonnblick, at no great distance. The solar ring was  $23\frac{1}{2}^{\circ}$  radius, and of indescribably brilliant prismatic colours. At both extremities of the horizontal diameter was a lesser coloured sun of radiant brightness; but the strangest part of it was that I could see the lower portion of the vertical diameter of the solar ring, although it was more than  $7^{\circ}$  below the horizon. And now there appeared a lesser sun of dazzlingly white appearance, seeming as though rising behind the mountain peak; its dazzling whiteness rayed out high up into the heavens, forming, as it were, a column of light resting upon the Kleinen Sonnblick. On passing a horizontal line through this white secondary sun below the horizon, I found at a distance of  $23\frac{1}{2}^{\circ}$  to right and left of it, two coloured lesser suns, which, being also below the horizon, were projected on to the snow-fields of the Kleinen Sonnblick, and of the Goldberg-Spitze, forming a magical effect—indeed, the whole spectacle was one of entrancing beauty.

One lovely moonlight night, I was standing in front of the house, making observations with the scintillometer. After a time I was conscious of a series of rapid obscurations flitting over the field of my telescope. Looking up irritably, I perceived that small portions of the mist, which reached almost to the summit of the mountain, were being detached and borne swiftly over my head. My irritation, however, was quickly dispelled on looking at the moon through these icy veils of mist. Whenever a fleecy cloudlet passed between the moon and me, there was a gleam and lustre of rainbow hue with such intense brilliancy of the lunar surface that I had never seen the like before. I leave my readers to imagine the effect of this ever-changing moon, now of silver lustre, now iridescent with many-coloured rings, and they will understand that I quite forgot my interrupted observations in the absorbing sight.

The zodiacal light I saw there also, and more brilliantly than ever before. I cannot do better than recommend any one who is a lover of ærial effects to pass a winter on the Sonnblick. And perhaps the finest sight of all is the magnificent view—the grand panorama to be seen from such a height. The view from the Sonnblick, even on a fine summer's day, must be a sufficient reward for the toil of the ascent; on a fine day in winter it surpasses all description. The clearly marked horizon, on which there is no trace of mist or haze, the mountain ridges, even to the most remote, standing out in lines of perfect distinctness from the sky—the grandeur of the whole snow-clad scene is so overwhelming, that I could but express my surprise to Rojacher and his assistant, that no members of the Alpine Club had availed themselves of the hospitality of the house on the Sonnblick, to know and enjoy the delights of a fine winter's day on the Hochgebirge. Formerly the difficulty would have been that without shelter one could only have stayed a few minutes on the summit, and had the weather been unfavourable in those few minutes, the whole ascent would have been fruitless. But now that there is shelter on the summit, and a house so comfortably arranged, the whole difficulty is done away with. I have a strong conviction, moreover, that the ascent in winter is easier

than in summer—given a normal winter with average snow-fall. It is far less fatigue to ascend steep places and cross glaciers on a moderate layer of new-fallen snow; one does not become so heated, and consequently breathing is not so difficult as in summer. And then, the infinitely finer view.

I am convinced that it can only be the inconvenience of leaving their business or professional callings at that busy season that has hitherto kept men back. So fascinated was I with the view, that I determined to advise all whose duties would permit them to pass a few winter days on the Sonnblick—the more surely that I can vouch for Herr Rojacher's hospitality removing all doubts on that score.

If phenomena of light most pleased the eye, other meteorological conditions gave me fuller scope for observation. In the first place, the height of the clouds. For the most part, unluckily, we were in them. Often we were above them, and had then the grand sight of the vast sea of cloud surging and swaying beneath us, now rising, now falling, called *Nebel boden* or *Boden nebel*. Several times, for days together, only those mountains whose peaks were higher than 8200 feet rose above the clouds; and we would be walking about in bright sunshine, while the valleys beneath were filled with cloud. At other times the northern valleys would be quite clear, and the southern ones full of cloud, or *vice versa*. One evening we had the southern valleys a mass of cloud, the next morning, on looking out, they were perfectly clear, and the northern ones were thickly enveloped. It was as if the clouds had travelled over the Alps in the night from south to north.

With the exception of the cirri, I never saw clouds above us. These are easily traced to their source from the Sonnblick. They were more unwelcome to me even than the mist; they disturbed my observations to such an extent.

It is known that the cirri take their rise from the depression centres. Thus they were serviceable to me in determining the situation of the minimum pressure of the air. Nearly the whole of my stay on the Sonnblick depressions formed with curious persistency over the Tyrrhenian sea, passing over southwards. This was distinguishable to us by a heavy bank of cloud in the extreme south-west, whence the cirrus bands stretched out in our direction. With a change of depression to south-east, or east, the radiating point of the cirri shifted accordingly. We had nothing to fear from the southern depression; in fact, it in no way affected the weather on the Sonnblick. But if the cirri rose from the north-west, although from the extreme distance the heavy cloud bank was not visible to us, none the less were we certain within six to twelve hours that storm and mist would be the invariable consequences.

In the many violent storms I witnessed there, I directed my attention chiefly to two questions: Do the winds blow in gusts here on the summits of mountains, standing free as they do in the atmosphere? and What is the relation of the gusty winds to the "pumping" of the barometer? I had formerly been somewhat of opinion that on these free heights there was no sufficient cause for storms to blow in gusts; and in fact in storms from the south-west the gusts appeared to me to be considerably less than in Vienna, although fully perceptible. But with a gale from the north they far exceeded in violence anything on a lower level. I have no time to go more closely into this question, and will only briefly describe those of my observations which bear upon the "pumping" ("oscillations") of barometers during a storm. It is a subject that has been much under discussion of late; I will confine myself to my observations. I made use of four instruments—a mercurial barometer, a very fine Naudet's aneroid, a Richard's



barograph, and a Redier's barograph. My observations, made alternately with these four, came to the same result. If the wind appeared to have lulled for a short time, there would be a sudden fall in the barometer of often more than two millimetres. A violent gust would then follow on the fall in the barometer, its strength varying in proportion to the fall of the barometer. During the gust the barometer would rise nearly as much as it had previously fallen.

From these observations, carried on through whole days, and often far into the night, it seemed to me that the cause of the gusts must be that slight, quickly passing depressions were over us.

If these observations are correct, and I can hardly doubt them, the suction of the wind is of secondary importance in considering the causes of the "pumping" ("oscillations").

I cannot allow myself to enter into all the interesting meteorological subjects that there presented themselves, and my views upon them, without trespassing too largely on the space assigned to me in these pages. I would only refer briefly to what I observed of the marked electrical activity in the telephone. It may seem strange to speak of a strong electrical development in winter, and I must confess to have been surprised on many days to hear a loud crackling at the telephone, so loud that it was almost impossible to speak through it. Still more astonished was I to see electric sparks going off from the electric plate ("*Blitz Platte*"). Unfortunately I had not time to examine this increased electric activity in its relation to the weather; but I fancied that a fall of snow with a south wind had most influence upon it. I requested Lechner to make daily observations of the crackling in the telephone, at a given hour, and to register the four stages—weak = 1, moderate = 2, strong = 3, electric sparks = 4. I have heard from him that he has been recording his observations five times a day, and, he thinks, with good result. A prolonged series of observations will easily determine its cause.

From these hastily collected extracts of my experiments and investigations on the Sonnblick, all must be satisfied of what great importance to science is the Observatory on its summit, and not less to Alpinists. It matters little how highly I prize it; my aim is to make its value known in wider circles.

But it behoves us, scientific men and tourists, not merely to wax enthusiastic over the Sonnblick Observatory, but to take measures to ensure its permanency. I am aware that the Alpine Club has already done its part,<sup>1</sup> and do not doubt but that in future it will shrink from no sacrifice to uphold and support this, its foster child, which, in conjunction with the Meteorological Society, it has brought into life. But I am inclined to think that there are nearer supporters of this our most important mountain Observatory, on whom there exists a prior claim. I am under the impression that certain influential members of the Alpine Club had been called upon to form a special Sonnblick Verein, part scientific, part tourist, who by a small yearly subscription should ensure the keeping up of this invaluable station.

My descent from the Sonnblick began on March 4, amid a storm of north wind, mist, and temperature at  $-22^{\circ}$  F. We rode down on miners' sledges (*Knappensrossen*), but even then had great difficulty in forcing a passage, snow having fallen knee-deep overnight. We often had to call a halt, and wade through the snow, thereby causing great delay; it took us two hours to reach Kolm, a distance usually accomplished in one.

On March 5 I reached Rauris; leaving on the 6th with Dr. Trabert for Lend. Even on these two last days, the weather followed us with unremitting severity. The way

from Kolm to Rauris had been made under a heavy snow-fall; and in the night of the 5th–6th there were such deep snow-drifts, that we were two hours making our way from Rauris to Landsteg.

On March 7 we reached Vienna.

#### BEDFORD COLLEGE.

SOME time ago we drew attention to the fact that Bedford College, which has done so much for the education of women, was in need of funds. The new laboratories are now in use, but they are not yet paid for, and the stock of apparatus is not all that could be desired. Our readers will remember that Mr. Henry Tate had promised a donation of £1000 provided the Council could raise a like amount from other sources. We believe that the College authorities are nearly in a position to claim his generous gift; but though this will free the building itself from debt, at least £500 more is wanted to pay for equipment on a very moderate scale.

The last twelve months have been, in matters educational, a ladies' year; but the true meaning of the successes which have been won at Cambridge and elsewhere will be missed, if they are regarded only as a nine days' wonder, or as proving *ambulando* that the higher levels of undergraduate attainment can be reached by girls. The lesson which has been so strikingly enforced is that no branch of learning is the exclusive property of either sex, and that girls are wronged if we do not afford them the same opportunities for acquiring knowledge which are provided for their brothers.

The founders of Bedford College acted on this principle when it was not so widely accepted and not so self-evident as in 1890, and we can only urge on the friends of the education of women not to forget, in the hour of their triumph, the toilers who have paved the way to their success.

In an unpretending building in an uninteresting London street an effort has for long been made to supply education of the highest class for London girls. Faith in the future and effort in the present have never been wanting, even when the story of the past seemed most discouraging. The College is now undeniably a success, but it is still sadly hampered by want of means. The adequate equipment of its laboratories is surely an object for which an appeal will not be made in vain to those who believe that the benefits which science can confer will never be fully attained till a knowledge of its main principles and methods forms part of the training of all educated men and all educated women alike.

#### NOTES.

WE regret to have to record the death of Mr. William Kitchen Parker, F.R.S., formerly Hunterian Professor of Comparative Anatomy at the Royal College of Surgeons. Next week we hope to give some account of his services to science.

A REUTER'S telegram from New York states that the remains of the Swedish inventor, John Ericsson, will be conveyed to Sweden by one of the two new American war-vessels, *Baltimore* and *Philadelphia*.

THE Dutch Academy of Sciences in Haarlem has offered a gold medal of the value of 150 gulden for the best work in each of the following subjects:—(1) Researches on the part played by bacteria in the decomposition and formation of nitrogenous compounds in various kinds of soil; (2) Microscopic investigation of the mode in which different parts of plants can unite with one another, and especially the phenomena which accompany healing after the operation of grafting. The papers must be written in German, Dutch, or Latin (not in the handwriting of the author), and must be forwarded to Dr. J. Bosseka Haarlem, by January 1, 1891.

<sup>1</sup> The corporation of the Alpine Club has just signed an agreement with Herr Rojacher, by which it guarantees him a grant of 5000 fl. towards the enlargement of the Sonnblick Observatory.