

this honour, to which certainly no one had a better right. In his last years he lost his sight, but doubtless this severe trial was partially lightened by his power of reproducing in imagination some of the many grand scenes which he had reproduced for the eyes of others.

Seventy years of climbing, fifty-two years of drawing, thirty-nine years of literary work—and all relating to the Alps—such is Gottlieb Studer's record. In the first pages of the 'Topographische Mittheilungen' he tells us how an irresistible impulse drove him to the mountains and to their wildest regions, a home-sickness he calls it for what seemed to be his true home, where life was so full of deep and pure enjoyment; this was the guiding principle of his life, and many who will never hear his name will be thankful for their introduction to pleasures which they owe indirectly to his writings and to his example.

The name of the Studerhorn in the Bernese Oberland was given to it by Agassiz in honour of Bernard Studer; but Gottlieb tells us himself (Swiss Alpine Club 'Jahrbuch' ii. 170-1) that in 1839 it was so named in his honour by one of his comrades on the passage of the Strahlegg; and it may well preserve the memory of the two cousins who have, in their different ways, done so much towards the exploration of the Alps. The best monument that could be set up in Gottlieb Studer's honour, besides the detailed life which is essential, would be a collected edition of all his Alpine writings—now scattered far and wide—together with reproductions of the principal panoramas he drew; and this task might well be undertaken and carried out by the Swiss Alpine Club, as a mark of its respect for the man who had the chief hand in making its existence a possibility.

ON GLACIER OBSERVATIONS.

BY CAPTAIN MARSHALL HALL, F.G.S., F.C.S., &c.

WHETHER we be young and enthusiastic, or whether we be jogging quietly down the hill of life, whether we be raw recruits, or whether, like the writer, we have loved scrambling from far-distant ages, when as yet no Alpine Club was, I imagine the word 'glacier' is very much to each and all of us as that of 'rat' is to every well-entered terrier. Wherefore I bespeak indulgence for a short paper upon the former subject.

Avoiding a history of past researches and glacial theories,

I will partially describe how things stand as regards actual observation of glacial advance and retreat in so far as regards central Europe. And I may say that, though there is plenty of room for more workers, an efficient body of men have taken the matter in hand.

First I must mention my friend Professor F. A. Forel, whose enthusiasm and devotion should be enough to make a recruit of every man—not utterly apathetic—with whom he comes into contact. His tenth report upon ‘*Les Variations Périodiques des Glaciers des Alpes*’ is before me, and he has kindly supplemented my knowledge as to the chief labourers in this field. I will mention some in connection with the countries most concerned.

To begin with Switzerland itself. Professor Forel, whose observations as regards the Rhone Glacier are amongst the most complete, devotes himself to the collection and comparison of the results sent in to him by the whole corps of workers. Amongst these I am glad to see that the Valaisan (Monte Rosa) section of the Swiss Alpine Club has been the first to appoint a committee to gather information in its domain. Considering the numbers of glaciers—many first-rate—which descend into the lateral valleys of that canton, and relatively to our subject, the field they have the glory of occupying is one of the most important that could be suggested.

I shall have occasion to mention several of the fellow-labourers of this committee later on.

Then, as regards Austria and Tyrol, we have Dr. Edward Richter, of Graz, Herr Bergrath F. Seeland, of Klagenfurth, and the veteran Hofrath von Simony, of Vienna.*

In Bavaria we have Dr. S. Finsterwalder, of Munich. In Italy, Dr. F. Virgilio, of Turin, Dr. G. Giordani, and many others.

France, including Savoy, gives us the names of M. Venance Payot, of Chamonix, and promised returns from Prince Roland Bonaparte; whilst M. Joseph Tairraz has

* We understand that in the course of last summer Herr von Simony visited the Dachstein Glacier and took photographs, which he compared with sketches taken by himself in 1840. The intervening half-century had reduced the glacier from a towering and unbroken mass of ice to a melancholy object, its lower part a mere fragment covered with débris, and separated by a cliff from the upper part, the stream from which falling on the lower part rapidly assists the process of disintegration.

been inspired with the idea of photographing the lower portions of the glaciers amongst which he lives, year by year—most important documentary evidence.

I omit a host of efficient workers in the present paper; but enough have been mentioned to show that central Europe is not destitute of men who are able and willing to make good use of observations communicated to them, giving due credit to their correspondents.

It will be well to take as an example—I may say as a pattern—the way in which Professor Forel has dealt with the information sent him. And I may mention that, often as I myself have sent him isolated measurements and trivial details, I have always found such items duly utilised, classified, and scrupulously acknowledged, a matter involving much work, considering his very many correspondents. Hence there has been no necessity for reference in the present paper to my own very limited observations.

The nature and causes of glacier movements have been more gone into than their possible periodicity. There is plenty of room for investigation as regards the former subject, but I think Professor Forel does wisely to give his chief present attention to the question of oscillation, since it is probably less understood and is equally important. And in most—perhaps more especially in physical questions—there is an interdependence between branches of research, a side-light thrown upon each point by others, which facilitates, controls, and directs the experiments and conclusions of those engaged. And in the present case, as all results are reported, there is no danger of useful material being omitted.

To begin with one of Professor Forel's most striking generalisations, he writes: '(3°) L'accroissement de la crue multi-séculaire a été la somme algébrique des variations partielles des crues semi-séculaires.'

He could hardly have written a sentence more suggestively pointing to the importance of plenty in number, and variety in place, of observations, since there is abundance of apparent incongruity even within the sphere of Swiss and Savoy glaciers. I may mention the difficulty in imagining reasons, as an instance, for the increase and diminution of some of the higher and less known glaciers upon the S. side of the Mont Blanc range, which used to strike me when, in my more youthful days, I frequented that district in search of sport. It will be seen, from the following table of their state in 1889, how much we must learn of climatic and

meteorological conditions before we can give probable causes for these fluctuations of the ice in mutual neighbourhood.

The signs + and - recapitulate the evidence. Where O and \pm occur, the former signifies decidedly *stationary*, the latter *doubtful*. The tenth report of Professor Forel, for 1890, is my chief authority. As regards the Chamonix districts, the communications of M. Venance Payot to the 'Revue Savoissienne,' 31^e année, 1890, Mars—Avril—Mai—Juin—Juillet—together with Professor Forel's report, above-mentioned, are my *pièces de résistance*. It is much to be wished that observations upon the mass of glaciers were more frequent.

Districts	Glaciers	Length	Mass	Notes
Valley of Conches	Rhone	+		
" Fiesch	Fiesch	+	+	
" Massa	Aletsch	-	+	
" Lötschen	Lötschen	O		
" Saltine	Kaltwasser	-		
" Saas	Allalin	-		
" "	Fee	+	+	
" S. Nicholas	Gorner	+		
" "	Findelen	+		
" "	S. Théodule	-		
" "	Gabelhorn	+		
" "	Weisshorn	+		
" Hérens	Ferpècle	-		
" "	Arolla	-		
" "	Pièce	+		
" "	Zigüenove	+		
" Bagnes	Otemma	-		
" "	Durand	-		
" "	Corbassière	-		
" "	Giétroz	+		
" Ferret	Laneuva	-		
" "	Saleina	-		
" Trient	Trient	+	+	
" "	Grands	+	+	
Allée Blanche	Minge	+	+	
Val de Monjoie	Trélatête	+	+	
" "	Bionassay	+	+	
Dauphiné "	Most of the glaciers	-		
" "	Meije	+		
" "	Étançons	+		
Aar	Aar	\pm		
"	Büchli		+	
"	Gauli	-	+	
Reuss, Maderaner-Thal	Hüfi	-		
Reuss, Maderaner-Thal	Brunni	-		
Linth	Biferten	-		
"	Sandfirn	-		

Districts	Glaciers	Length	Mass	Notes
Linth	Kistenfirn	—		See complete account, 10th report of F. Seeland See Richter
Engadine	Surlej	+		
Oetzthal	Rettenbachferner	—		
"	Hochjochferner	—	—	
"	Vernagtferner	—		
Glockner	Pasterzen	—	—	
Adige-Ortler	Zufall	+		See Richter
	Langenferner	—		

In Professor Forel's report, 1888, he gives the following results:—

Districts	Glaciers	Length	Mass	Notes
Valais	Aletsch	+		At Concordia hut
"	"	—		At terminal
"	Théodule	—		
"	Hochwang	+		
Oberland	Grindelwald Infer.	0		

Thanks to M. Venance Payot, the record of the NW. side of Mont Blanc is the fullest we have of any locality, so far as my knowledge serves me; it is, indeed, complete within the range of observation which M. Payot has undertaken. The writer has repeatedly accompanied him and assisted in his measurements, and can bear testimony to the care bestowed upon them on those occasions.

Districts	Glaciers	Length	Mass	Notes
Chamonix	Tour	+		See M. Tairraz' photographs Modern maximum in 1820 " minimum in 1878 " maximum in 1819 " minimum in 1878 " maximum in 1826 " minimum in 1879 " maximum in 1818 " minimum in 1868-1878
"	Argentière	+		
"	Mer de Glace	+		
"	Bossons	—		
"	Tacconna	+		
"	Pèlerins	+		
"	Blaitière	+		
"	Mont Blanc	+		
Val de Montjoie	Trélatête	+	+	
"	Bionassay	+	+	
Val Ferret	Mont Dolent	+		Not much difference " " " " " " " " "
"	Triolet	+		
"	Petites Jorasses	+		
"	Grandes Jorasses	+		
Allée Blanche	Brenva	+	+	Marked progression " "
"	Miage	+	+	

It is noticeable how deficient we are in estimates as to the increase and decrease of the mass of glaciers. Of course, the problem requires more work and continuous observation to solve. Articles such as that on 'The Glacial Epochs in Val Grande di Sezia,' by Dr. G. Giordani; series of annual notes, such as those of M. J. Guex, of Vevey, on 'The Glacier of Trient,' and of M. F. Doge, of Tour de Peilz, on that of 'Les Grands,' can only be expected from residents in, or annual visitors to, particular localities.

Nevertheless a certain discipline and uniformity of proceeding, such as a club, or an International or even a State committee could arrange, would enable us to piece together many isolated observations. Upon this point I propose to dwell later.

Without continuous, wide-spread knowledge, questions of periodicity, ably dwelt upon by Professor Forel, can rest only on a very narrow and insufficient basis; and, though they probably exist, I do not think we have as yet the means of determining the average duration of such periods. Still, careful examination and comparison of available material have enabled that savant to point to periods, which he well divides into semi- and multi-secular. He considers that continuous increase lasts from five to ten years, and decrease from thirty to fifty years. These semi-secular oscillations, he considers, form, so to speak, a smaller system of undulations, whilst climatic changes, lasting over whole epochs, are going on contemporaneously, constituting variations of a much higher order of periodicity. Modern advances of 50 mètres, which, continuing for fifty years, might amount to some $2\frac{1}{2}$ kilomètres, cannot compare with those which in times of glacial extension gave a length of 360 kilomètres to the Glacier of the Rhone, from the Furka to Lyons—an augmentation of some millions of cubic mètres, as compared with many cubic kilomètres!

The shorter periods of oscillation, according to whether those of retreat or advance (+ or - in fact) predominate, produce a multi-secular effect of accumulation or diminution.

When first I undertook to write this paper, it was my intention to sum up the evidence for and against these periods; but it would involve so much imperative consultation of so many works that I abandon the project, at all events, for the present, and until I can spend some considerable time where libraries are accessible. Sufficient for the day, I fear it will be said, is the present infliction. And,

unless we collect statistics not only from a few limited areas, but from various latitudes and climates—Norway, Iceland, Greenland (where, as also in Alaska, the motion is at racing pace), Africa, as instances, besides those in the many lands where the British flag flies—we can never be sure that we are not neglecting factors of the greatest importance, especially as regards climate.

But as to the numerous glaciers in British territory—the Himalayas, those of New Zealand, of the western portions of our American possessions—if there be any records on the subject, I am unaware how to lay hands upon such.

Probably no connected accounts exist. Our colonists, our military, naval, and civil officers, men of science, travellers, Alpine Clubs—all seem to have joined in a sublime indifference as to the history of glacial movements, and their increase or decrease, at least outside the ‘play-ground of Europe.’

This is the more surprising that English savans have borne so notable a part in investigations of the causes of ice-movement; whilst to our many geologists the sculpture of mountains, more or less of lakes, climate, fauna, and flora are all matters in which glacial history is eminently important.

There is one promising piece of comfort—the Monte Rosa section of the Swiss Alpine Club have the honour, I believe, of being the first to appoint a committee; it is charged with reporting upon the Valaisan glacier-world. I hope this will not long be allowed to be an isolated appointment!

The task of correlating individual observations and reports would be reduced easily to a minimum if such a committee, inviting the assistance of men in various countries, would arrange a code, so to speak, to be adhered to by all who could be induced to adopt it.

I am too much of a cosmopolitan, I confess, to care greatly where the domicile of origin of such a code might be. But, since the Alpine Club is admittedly the senior body of its kind, we should like to see that, after coming to the front, it also makes an early advance to the attack.

Our members, after ascending all the ‘inaccessible’ peaks, are now ranging themselves into two bodies of climbers—some of us strenuously determined to find what I may call all the wrong ways up the old peaks, the others exploring great ranges the world over.

It is true that there is a certain sameness in accounts of mountain scrambling, though it is to most of us still as

interesting as the story of a good run and a kill always is to an old fox-hunter, or that of a struggle with a phenomenally heavy 'fush' to an old hand at the river side.

It would certainly freshen up our own spirits and add to the interest of the Alpine Journal were some of us to bear a hand with these great ice questions. No individual can hope to be alive when the larger series of ascertained facts come to bear upon the periodic law, if there be such a law, of glacial and climatic variations. But let us hope this will not discourage earnest men from recording what lies within their power. As regards such things as advance and retreat, increase or diminution of masses, results must become immediately available after the first year.

For instance, armed with a small jar of paint, a brush and a measuring-tape, it consumes but a very small fraction of a climber's valuable time to go, say on an off day, to the foot of a glacier, take the distance of its extremity from some rock or boulder, not *too* near, and, making a mark upon such rock, simply record that distance in mètres, its magnetic bearing, and add the date and initials of observer. Suppose this had been done for a very few years past in a fair percentage of places where no record exists—in the Alps, in North America, New Zealand, the Andes, the Himalaya, the Caucasus—and this only by members of our own body of travellers, what a capital foundation would have been laid! Is not such an object worth so small a sacrifice of time and trouble? I do not expect any of us will be so virtuous as always to paint up the bearings of such glaciers as we come across! But even a few in each district would be a great gain.

The committee I suggest would of course lay down rules, suggest localities, mention the more marked and desirable things to observe, assist workers with easy formulæ, and so forth. Then we may quite hope for such an interchange of results as would lead to tabulation, and form a permanent record of the smallest contributions of any and all who gave themselves any trouble whatever.

In each country local committees, of which a member should always be in communication with the central international body, would furnish annual reports to it, and I may hope that the pages of this invaluable Journal would be so sought by the wide world as to represent at least their weight in gold, with a sprinkling of diamonds thrown in!

At the risk of drawing upon myself the scorn of the many university and service men amongst our members, who may think it very presumptuous in me to go near to teach so

simple a thing as the solution of triangles, I venture to point out the simplicity of sundry problems and the lightness of the necessary outfit for all but very precise and refined work. I may mention that, for my own part, a small leather case, the size of the infantry cartouch box of a few years since, is sufficient to hold all things which I would ever consent to carry—not that I would dissuade lighter men from such extra weight as they may consider luxurious.

The necessaries, then, for practical observations, are simply a note-book with a few tables as of sines, tangents, &c., pasted in, indiarubber, pencil, an aneroid barometer, protractor, measuring tape, some small pattern of compass combined with clinometer, and last, but by no means least, as good maps as can be got.

As regards the compass, there are two little instruments which at once suggest themselves—the prismatic compass, with a clinometer, and Galton's altazimuth. Both are efficient instruments, and, for the sake of 'bringing down' objects above the observer, both should be provided with an azimuth mirror. I have used Galton's instrument so frequently that I have a fondness for it, on account of its facile use in levelling and taking vertical angles, but the prismatic compass is a waistcoat-pocket affair, whilst the Galton, in leather case on the belt, looks like one of those toy revolvers which irritate, without always disabling, an adversary.

Of late years many patterns of range-finders have been introduced, and as with several the distance of an inaccessible object can be got at once and without calculation, it would save much time and trouble to add one to the outfit above mentioned. I had an opportunity of using the Labbez telemeter the summer before last at Torquay, and, having borrowed one, previously taking the distance by it of sundry objects about Tor-bay, mystified several officers by the marvellous approach to accuracy with which I seemed to be judging distance! The present occasion is the first upon which I let that cat out of the bag. Officers who have used it in range-finding report highly of its results up to, say, a mile and a half. It must be borne in mind, however, that after all it is not an instrument of precision—it is a saver of time and trouble. For ascertaining such things as the width of a glacier or of a river, the distance between blocks and moraines, and all work of that class, this telemeter ought to prove a capital friend. Still, I have had no personal experience of its use in the mountains.

A base of 30 yards or mètres (to either of which it can be graduated) should be used for distances estimated at



FIG. 1.—ACTUAL SIZE.

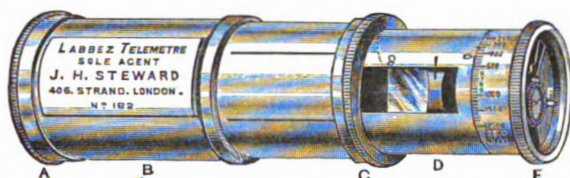


FIG. 2.

THE LABBEZ TELEMETER.

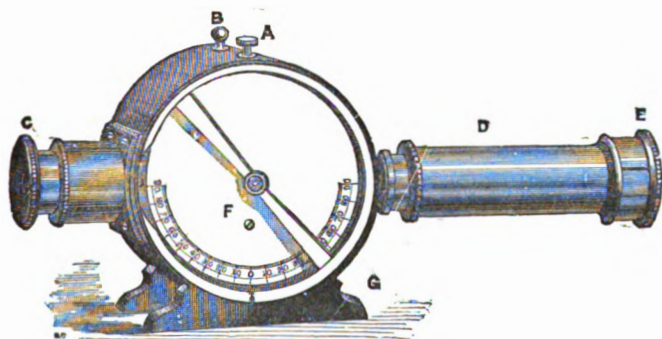


FIG. 3.—POCKET ALTAZIMUTH, WITH COMPASS.

between 300 and 1,000 yards. The result shown on instrument is then the actual range. For longer distances a base of 60, 90, or 120 yards should be used, according as the estimate is 2,000, 3,000, or 4,000 yards, the range shown on the instrument being doubled, trebled, or quadrupled according to the base taken. For objects between 200 and 300 yards a 15 yards base is said to be sufficient, an advantage when the ground is much broken. It is not necessary that the base be quite horizontal for determining distances. 'Experientia *does it.*' The orthodox military pace of

30 inches is pretty correct, when the ground allows of it, remembering that 30 yards=36 paces, and 30 mètres=about 39 paces (more exactly 39·37 inches = 1 mètre).

By the kind permission of Mr. Steward, cuts of the Labbez telemeter are given, as also of an altazimuth. Mr. Steward is good enough to say that he will with pleasure explain the use of these instruments to members of the Club, and suggests that Adelphi Terrace is near at hand, and is a quiet spot for estimating distances across the Thames. Of course, they can be verified by reference to the large scale ordnance map, if not already well known.

I need not enter upon the very simple formulæ in trigonometry which are wanted for field-work such as we have to consider. We want the angle of rise and its sine, which, multiplied by length of road, gives height attained, whilst the same angle with the horizontal distance (off a map, for instance, when it is considerable) and the tangent, multiplied by it, gives the height from station of observer, and, if we work in the metrical system, we are saved most of the incessant sums which have to be done by those who use the British unholy jumble of weights and measures, which must, I fear, be held accountable for a large percentage of the inmates of our lunatic asylums.

If ever the Glacial Committee, for which I call, should have an existence, it would come within the sphere of its duties to decide upon uniform methods, and I leave this part of the subject. It will be as well to mention a few objects, to attain which all travellers have it in their power to contribute assistance without serious loss of time, or, indeed, any great labour.

The first is observation of the fag end of a glacier. This has already been dwelt upon. But one of the committee's first duties would, I think, be to try and arrive at some understanding as to a date to be adopted. As an instance of its importance I may mention that, two years ago, the end of the Glacier du Tour was a mere tongue of ice lying on the ground, and separated by a crack from the rest of the ice. A measurement of this, when Mons. Payot and myself made it, in July 1888, would give a very different idea of the advance of that glacier to one taken towards the end of September; and unless very careful notes be taken of such dates, and an elaborate calculation of rates of melting—subject, of course, to much error—the value of our data becomes seriously impaired. Probably the committee of the future would decide that some such date as

the middle of August would find the greatest number of likely men present in the Alps. Within a week or so of such a time the exact day of measurement would scarcely matter.

Another item would be the nature of observations of the rate of movement. To do this day by day would require the very careful use of a theodolite, which, certes, few men will care to carry about.

But with the pocket instruments already mentioned, there would be no difficulty in fixing the positions, say, of blocks of stone, with regard to streaks painted upon rocks on each side of a glacier, nor in taking the bearings of spots figured upon the existing maps with sufficient accuracy to give the accumulated movement year by year, or at greater or less intervals; indeed, the painting of these stones is a very easy way of immortalising one's name! The man who paints the position of even one stone contributes his mite! And an excellent idea of the pace of various parts of a glacier would be gained by determining the position of three approximate lines, of three stones each, at three different levels in its length—an affair, including the terminal ice, of one enjoyable day. Once this done, we have, for years to come, the means of registering motion, and, indeed, mass, for stones do not run away, though they have an evil propensity to slide into crevasses!

The question of mass is a formidable one. No other way than guess-work has yet been found by which we can ascertain the form of a glacier bed, and but few spots exist where enough is seen of the ice-mass to arrive at a safely approximate estimate of it.

On the other hand, the variation in existing mass, be the latter what it may, is far more easy to be got at. Without entering upon elaborate surveys, the elevation and depression of surface at any point can be ascertained with reference to the sides of a glacier, with the aid of an altazimuth, and is, indeed, often very noticeable at intervals of a year or two, and the marking of rocks and boulders, before referred to, would here come in very handily. Travellers with eyes and ears open can pick up much local information. Again, Galton, in his little book on 'The Art of Travel,' advises men to seek out old and slow savages to carry their instruments, which will journey all the more softly. In the same way, if one is upon an excursion not requiring first-rate men, it is a good plan to get hold of some garrulous old porter, who, if he does not kill his *Herrschaft* with bore, often

affords an infinity of information, more or less correct—possibly less—respecting his own localities.

There is much to be learnt as to rates of motion and mass, above the snow-line. Only as there are comparatively but few big stones upon the surface of névés our committee must excogitate some available methods.

The permeability to and capacity for retention of water by névé and ice, more or less compact, seems to me worthy of even the rough attention which climbers could have time to give it. There is a paper by Professor J. Thomson (British Association Report for 1857), which is well worth study, upon the influence of stress upon the melting-point, bearing much upon the theory of glacier motion.

When, some years hence, we have a sufficient body of information, it will be interesting to know how many years subsequently a snowy winter tells upon the mass and length of the lower glaciers. We must, of course, bear in mind that a *severe* does not always imply a *snowy* season.

A few words as to signalling. Besides the attitudes given in the military signal-book, wherewith to work the Morse code, and which can be written down in one's note-book, a few conventional signs are easily remembered and taught one's guide. Frantic gesticulation is always a danger signal. The signaller and signalleé facing each other, both hands held up above the head = ascend; held out at right-angles like a cross = halt; one arm at right-angles = take ground in the direction indicated; both arms a little away from the body and pointing downwards = descend.

The light infantry calls on a whistle might be of use in a fog or after dark, and a convention for night signals with the boxes of fusees giving green and red lights, now sold in Geneva and other large towns. Our Club, by taking the initiative, and issuing a card showing the codes agreed upon, would do good service.

In conclusion, I may assure those who have never tried field sketching, that it immediately becomes a source of un-failing interest and amusement. Personally I should as soon think of gadding about without a corkscrew as without compass and map. And—I appeal to the Club—could the thing be put more strongly?

Amongst the earliest duties of a Glacial Committee would be to ask assistance of and to ascertain from official sources whether the good cause could be promoted by circulars inviting the co-operation of officials in our colonies and foreign possessions. Of general glacier history as yet we

know nothing, nor of their behaviour, synchronous or otherwise, in the two hemispheres, nor have we much information as to the Arctic and Antarctic ice-caps. A science of comparative glaciology * has to be created, and will probably afford unexpected clues as regards other phenomena.

SOME UNDESIGNED 'NEW ROUTES.'

BY THE EDITOR.

I LEFT the Gepatsch-Haus, Aug. 7, 1890, with Alois Gstrein, intending to ascend the Glockthurm. We took the usual route by the Krummgampen Thal (getting on the way the best view I ever had of marmots, two of which were playing on some snow quite close to us, and took no notice of us for some minutes), and went on very well till we reached the glacier. Unfortunately neither of us had been there before. There was a good deal of cloud about, and the directions we had received from Praxmarer, the *Wirth* of the Gepatsch Haus, were not minute enough to keep us right. So we went too far to the left, and, after a short climb up some rocks, found ourselves at the top of something. Alois maintained that we were right; I was very doubtful, on account of the absence of any stoneman, which could hardly fail to exist at the top of so well-known a peak as the Glockthurm. Presently the clouds broke, and the question was settled by the appearance of a summit a little distance to the N., some 400 or 500 feet above our heads. It then became clear that we had strayed to the top of the most northerly and highest of the Hennesiegel Köpfe (3,222 mètres = 10,581 feet, D.O.A.V. Sp. Karte). When we got back, Praxmarer, who is probably as good an authority on the point as anyone, said that he knew of no previous ascent, nor can I conceive any reason why there should ever have been one.

Next day we started with the intention of getting to *Unsere Frau* by the *Kesselwandjoch* and *Hochjoch*. Now the basin of the Gepatsch Glacier, up which the first part of our road lay, is a huge irregular quadrilateral, the sides from three to five miles long, and the angles pointing W., S., E., and N.E. On the E. side, where it abuts on the *Vernagt*, *Guslar*, and *Kesselwand* Glaciers, the *névé* on both sides reaches to the ridge, and the passes are easy. But on the S.E., while this is still the case with the Gepatsch Glacier itself, and the series of depressions which occur at intervals of about a mile all round the head of the glacier continues with unbroken uniformity, the traveller who reaches the ridge finds himself at the top of a very steep rock wall, some 1,000 feet high, falling to the *Hintereis* Glacier. The day though fine was cloudy enough for the landmarks to be frequently obscured. I had not been on the glacier for ten years, and then in bad weather, my guide not for six; and so it befell that we walked (though

* A vile hybrid. But unluckily another science has appropriated the Greek word for 'ice,' and 'cryology' might not be generally understood to refer to glaciers specially. Committee of the future, please suggest a term.