

Our holiday is over, my task is done. That the Dolomite country is delightful and fascinating I can assert; whether the climbing there is really mountaineering in its most complete sense is another matter, and one on which I should not like to be so dogmatic; indeed, I have not altogether made up my own mind. I do not agree with the man who, after some weeks here, is said to have 'pined for a real mountain'; but it is certain that the varied work and the long days of the big Zermatt, Chamonix, or Dauphiné peaks are lacking.

In conclusion, I must thank Messrs. Pryor and Thomson for their photographs, and the first-named for valuable assistance. It has been delightful to recall our scrambles; and if it ever gives anyone half the pleasure to read that it has given me to write these notes, I shall be more than repaid. I hope, too, that the minority who know this district well, and who have forgotten more about it than I ever knew, will pardon my presumption in trying to teach my Alpine grandparents how to suck Dolomite eggs.

THE KIRCHET AND ITS CRITICS.

BY PROFESSOR T. G. BONNEY, D.Sc., LL.D., F.R.S.

AN article entitled 'On the Aar Glacier and its Teachings,' by Dr. A. R. Wallace, appeared in the 'Fortnightly Review' for August 1896. In it he objected to some arguments that I had used against the excavatory action of glaciers,* referring to the Hasli Thal, and especially to that part of it above the gorge of the Kirchet, in support of his views. It is a prudent course, as experience has shown me, to make one of the ordinary periodicals a vehicle for questionable science. Criticism is thus practically barred, for the editor does not care to burden his pages with a controversy on that subject. So, as I found this to be the case, I determined to comment elsewhere on Dr. Wallace's arguments, but an unexpected pressure of work obliged me to delay for some months, and then I refrained because I thought it possible that I might have an opportunity of revisiting the district. This occurred last summer, when I spent, with my companion, Mr. J. Parkinson, F.G.S., nearly a week at Innertkirchen, examining the lower part of both the Hasli Thal and the Gadmen Thal (which I traversed in 1888), and the Urbach Thal. Dr. Wallace commences his article by an interesting piece of autobio-

* *Geographical Journal*, June 1898.

graphy, in which he says, 'I visited it [the valley of the Aar] for the first time last summer [1895], walking over the Grimsel Pass to the hospice and the Aar Glacier, and then along the old mule track and fine new road to Meiringen; staying there three days to visit the Reichenbach Falls, the Kirchet hill, the gorge of the Aar, and other interesting localities.' I may remark that this visit to perhaps the most important of the iceworn districts in the Alps was nearly two years after the date of his paper * on the excavation of lake basins in that chain, which had evoked my article already mentioned, and so will myself venture to indulge in autobiography. I saw the valley of the Aar for the first time in 1858, when I twice visited the Grimsel Hospice, at one time spending two or three days in scrambling about the neighbourhood (leaving it by the Strahleck Pass) and at the other walking from Meiringen up the Hasli Thal to the valley of the Rhone. My first paper on the excavatory action of ice was read before the Geological Society in 1871,† and between the two dates I had nine times visited the Alps, and had seen almost every important district between Monte Viso and the Gross Glockner, paying particular attention to the effects of glaciers. It may be an old-fashioned prejudice, but I have always preferred to collect my facts before I commit myself to an hypothesis.

Dr. Wallace's article, as might be expected, shows the experienced controversialist. The method consists in laying down with an air of elaborate precision, as if proof were needed, sundry canons which nobody would think of disputing, and slipping through under that cover the really questionable matters, like a party of invalids under a strong escort of troops.

I shall first deal more particularly with the immediate neighbourhood of the Kirchet, and then make some remarks on a property of glacier ice to which Dr. Wallace appeals, and without which his hypothesis would instantly fall to pieces.

As he has given a rather full description of the Hasli Thal and the Kirchet, and the neighbourhood is well known, I shall only repeat details on which I purpose to comment. I assume a knowledge of the narrow V-shaped valley in the crystalline rocks, of the sudden enlargement near to the incoming of the sedimentaries, of the level plain around Innertkirchen, like an old lake basin, and of the curious lime-

* *Fortnightly Review*, Nov. and Dec. 1893.

† *Quarterly Journal Geological Society*, vol. xxvii., p. 312.

stone barrier of the Kirchet, which would block the valley were it not for the gorge of the Aar. But before proceeding farther I must call attention to two inaccuracies, not so much as important in themselves as being indicative of hasty work. Of the gorge itself Dr. Wallace says, 'We are struck by its extreme narrowness, usually not more than six or eight feet, often not more than four, and in some places even less.' This is an unconscious exaggeration; there are two very narrow places, but putting both together they do not amount to nearly half the gorge; the rest is an ordinary cañon, which for some distance is at least thirty feet wide. Probably Dr. Wallace only went once through the gorge, and entered it from Meiringen; if so, he would naturally transfer the impression produced by the remarkably narrow part near the lower end to the gorge as a whole. The other inaccuracy relates to the rock. It is, he says, 'a hard crystalline limestone.' Neither epithet is correct; the hardness is that usual in a limestone, namely 3, or at any rate under 3.5 of the scale, and the rock is no more crystalline than is usual with one of the same geological age in the Alps—that is, no more crystalline than the ordinary Carboniferous limestone of Derbyshire.

But to pass to more important matters. Dr. Wallace is at much pains to show that the gorge of the Kirchet, together with others of like character to the Alps, is altogether the work of a subglacial torrent. I grant that with such a torrent the conditions are exceptionally favourable to the formation of a gorge, but think Dr. Wallace fails to prove that the existence of a gorge is practically a proof of the former existence of a glacier. He can make little of the absence of gorges in unglaciated districts of Brazil, a country where the rock is notoriously rotten, while he is obliged to admit the presence of cañons in Western America, which are merely the Swiss gorges on a vaster scale. Gorges and cañons also occur in the limestone district about the upper waters of the Lot, the Tarn, and the Garonne; nay, even in Derbyshire* and the Mendips, though on a small scale. The point would be unimportant, because the former presence of glaciers and the enlargement (at any rate) of gorges by glacial torrents in the Alps is not disputed, did I not perceive that it is one of the protective evolutions which I have mentioned above.

Here I must digress for a moment to remove a misconcep-

* I am aware that some persons assert that glaciers have existed in Derbyshire; that however, has got to be proved.

tion, which has been produced by an insufficiently guarded expression in my article. In speaking of the chasm in the Kirchet as sawn by the subglacial torrent, I did not intend to signify that it was wholly made by this any more than that (in the next clause) the ice alone had given shape to every rock on the barrier. As implied through all that follows for nearly two pages—and in one case directly stated—I hold the barrier of the Kirchet, and the main outlines of all the valley above it, to be pre-glacial. I think, however, for a reason to be presently given, that the torrent must have acted very energetically during the time when the ice rested on the Kirchet barrier. But a gorge, though perhaps a narrower one,* must have existed there from a comparatively early time, for the Aar must have been a strong river even before the Great Ice Age. If we pass over the days before the Post-Miocene uplifting, and only assume, as we may fairly do, that the height of the Alps during Pliocene ages was not less than at the present time, there must have been glaciers in the Oberland from early in the Pliocene period. These, as the climate became colder, would increase. A very moderate fall below the present mean temperature would bring the ice a long way down the Hasli Thal, so that it may have rested on, or even passed over, the top of the Kirchet,† even when the caves of the Dordogne were inhabited. But I venture to submit that these gorges, as a rule, do not ‘afford a distinct class of evidence in favour of the large amount of glacier erosion in general, and of the theory of the glacial origin of the Swiss lakes in particular.’ They prove no more than the power of a strong torrent, especially if the rock on which it acts be not seriously affected (from any cause) by subaerial denudation, and can only be cited,

* Perhaps also not quite so deep. It must be remembered that the basin of Innertkirchen occupies exactly the position where from the first I have consistently admitted the possibility of a *slight* excavating action on the part of a glacier.

† The ice in this valley, owing to the physical structure of the district, would be, I believe, rather sensitive to secular changes of temperature. At the present time the glacier-generating line in the Grimsel neighbourhood is lower than in many parts of the Alps. I think we might safely put it as not higher than 8,500 ft. If the mean temperature were raised from 6 to 7 degrees, this line would be at 10,500 ft.—part way up the wall of the Strahleck (10,994 ft.), and the Unter Aar Glacier would be reduced to very small dimensions. If it were lowered by as much, the line would come down to within 300 feet of the Grimsel Hospice, and the resulting glacier might reach the Kirchet.

under any circumstances, in favour of the excavation of a few small tarns, because, in the large majority of cases, these gorges do not sever a barrier, but saw a gradually deepening notch in a rocky step—that is, they prove torrent erosion, but to say they prove extensive glacial erosion is really to beg the question.

The Kirchet is reached from its upper end by a lateral gorge. This, I admit, must have been formed, as Dr. Wallace says, or at any rate greatly modified, by a subglacial stream, for it can never have obtained any large amount of water from the upper part of the Kirchet. There is, however, one difficulty; the bed of this gorge descends rapidly at an average angle of perhaps 35°. Dr. Wallace, I presume, supposes that the glacier first came when the basin of Innertkirchen practically did not exist; that its main stream cut the Aarschlauche, while a lateral one made this gorge, the two sawing down *pari passu* into the barrier as it was gradually developed. If so, what caused the glacier to excavate on a yet more gigantic scale below the present site of the Kirchet—viz., to dig out the whole basin (for it is really but one) from its western base to Thun? To this point I shall return. If, however, the basin was in existence, and the Aar had already cut itself a cañon, though perhaps narrow, down to something like its present level, then, when the glacier was resting on the Kirchet, part of the drainage of the ice might be diverted into the gorge by the slight depression which exists near the summit, and the cascade thus produced would rapidly saw a sloping notch in the rock. A parallel case, if I mistake not, occurs on the right bank a little lower down the main gorge. Here is a deep notch (also practically dry) waterworn from top to bottom, but narrower than that of which we speak. The two gorges are really identical, except that this one does not reach the level of the Aar, but terminates about 50 ft. above it. Hence, so far as we can infer anything from this lateral gorge, it makes more probable the existence of a cañon when the ice first topped the barrier of the Kirchet.

Dr. Wallace affirms that the only escape from his explanation of the erosion by ice of a basin nearly 1,000 ft. deep, is 'to call in the aid of hypothetical local subsidences or elevations.' That we shall see, but I may remark in passing that to assume the absence of any movement in the bed of the valley of the Aar during or since the glacial epoch is equally hypothetical, and that there is no evidence either of the removal of at least 150 ft. of limestone from the top of the Kirchet, or of the rock being at a depth of 200 ft. below the

plain of Innertkirchen. All we really know is that it does not reach the surface.

I pass on to examine the structure of the district in order to see how far it supports or opposes Dr. Wallace's hypothesis of ice erosion. The basin of Innertkirchen is a cultivated alluvial plain traversed by the Aar (now canalised). It is about half a league in length, and for some distance not much under half a mile in width. At its head the river emerges from a glen or gorge, cut into the crystalline rocks, down which it has descended rather rapidly. These, part way down the basin, but rather near to its lower end, rise rapidly from beneath the great mass of limestone (jurassic) of which the Kirchet and the adjoining mountains are formed. The Aar, as it passes through this basin, is joined by torrents from two important valleys, the Gadmen Thal on the right bank, and the Urbach Thal on the left. There is, as usual, a rather rapid descent from each into the main valley, but it is higher and more precipitous in the case of the latter, where it amounts to about 700 ft. ; the torrent in each case dashing down a glen which it has carved in the crystalline rock. The opening of the Gadmen Thal, with Im Hof itself, is slightly nearer to the lower end of the basin, which extends for a quarter of a mile or so above the opening of the Urbach Thal. This, though rather the shorter and steeper valley (for the Gadmen Thal might almost be called a valley of strike), leads up to a large glacier, the Gauli, and into the heart of the *massif* of the Oberland. In former days it must have been the outlet for a huge mass of ice.

After mounting the steep path which leads up from the meadows behind Brugg to the floor of the Urbach Thal, we find before us, on reaching the bridge across the torrent, a rather unexpected feature, which I am suprised Dr. Wallace does not mention, as it would have afforded him another proof of the excavatory power of ice. On the right bank of the valley craggy mountains, consisting chiefly of crystalline rock, but with a sharp infold of jurassic, descend rather rapidly to a perfectly level grassy basin.* This is bounded on the left bank by one of the grandest precipices that I have ever seen in the Alps—a vast wall crowned by the jagged crest, which culminates in the Engelhörner, and falling almost sheer for a couple of thousand feet, and perhaps more.

* So far as I can estimate from the map it is about 2 miles long, and this, from the time taken in walking along it, cannot be in excess of the truth ; the width may be about a third of a mile.

If then the basin above the Kirchet is the work of a glacier, so must this one be, for the two have much in common; and if that be so, then the ice stream which descended the Urbach Thal must have been not less potent as an agent of denudation than that which came down the Gadmen Thal, for in the latter we have hardly any level ground and not the slightest hint of a lake basin. This, as we shall see, has an important bearing on Dr. Wallace's argument. Near the higher end of this Urbach basin, just as in the case of the Innertkirchen basin, the crystalline rocks rise very rapidly, so that its floor probably consists of crystalline rock. In fact, the Urbach stream as it deepened its valley has cut back the basset edges of the sedimentary rock. I conclude that Dr. Wallace did not make this expedition during his 'three days' campaign from Meiringen, for otherwise he would not have passed over a feature which has such an important bearing on his argument.

The mass of limestone mentioned above sweeps round to form the left bank of the Innertkirchen basin and the barrier of the Kirchet. The cliff on this side also is only less magnificent than that already described. There we saw its outcrop; here we have a section roughly at right angles to the other; and the Kirchet extends like a long spur from the western end, the edge of the cliff descending rapidly to it. The slopes from the *massif* of the Engelhörner are less abrupt on the side of the Reichenbach, because the strata dip towards the west, so that the Kirchet itself is formed by the outcrop of the lower part, at any rate, of the same mass of jurassic limestone as is exposed in the great cliff overhanging the Urbach Thal. For a considerable distance on its southern side the Kirchet runs very nearly at the same level, perhaps about 500 ft. above the Innertkirchen basin. It then drops slightly, probably at the basset edge of a bed, but speedily rises again. Next comes a similar but larger hollow, affording a passage to the carriage road from Meiringen, with a bold cliff on its southern side; the Kirchet barrier then rises in a rounded hill to about its former elevation,* and from that slopes down to the edge of the Aar-schlauche; from this there is a short rise to another flattened hill, more plateau-like and perhaps slightly higher than the last, which is at the foot of the abrupt rise to the peaks bounding the right bank of the

* On the map the hill top on the south side of the road is marked 2,572 ft. that on the north 2,585 ft., and the highest point (as I suppose) on the road 2,318 ft.

Gadmen Thal. The outlines of the barrier are everywhere modified and moulded by ice. That can be seen at a glance; but to what extent? According to Dr. Wallace, about 150 ft. have been planed by the ice off the top of the Kirchet. If so, why did it leave the hill between these two glens, namely, the one which gives passage to the road, and that in the bed of which the Aar-schlauche has been cut? Each of these is some 200 ft. below the top of the hill, or the general level of the Kirchet. If a glacier acts as a gigantic plane, then surely the whole ridge should be almost level, as it is at the southern end. The outlines of this part,* if we obliterate the minor contours of the ice-worn rocks, correspond with the ordinary outlines of limestone hill-regions all the world over. The glen through which the road passes, allowing for the slight difference of colour and vegetation, might be in Derbyshire. On the western side of the Kirchet barrier, where the slope is more gentle than on the eastern, this glen seems to be connected with a shallow upland valley (followed for a time by the road) which is ultimately joined (then becoming more distinctly marked) by a tributary from the north. In fact, this slope of the Kirchet is much more irregular in its contours than the opposite one, for it is sculptured by small valleys—which form an ‘erosion’ system. Distinct traces of ice action can be detected only on their flanks, and sometimes rather near their beds. In other words, all that I could discover pointed to the dominant features of the scenery being due to ordinary subaerial denudation, and thus being anterior to the passage of the ice, by which they had been only modified.

Dr. Wallace asserts—and it is a very important point in his argument—that the ice flow from the Gadmen Thal was in former times even larger than that from the Upper Hasli Thal. Proof or disproof of this contention would be equally difficult. I can only say that I could find no evidence in favour of it. The valley, as he states, does descend a little less rapidly, and is slightly more open than the Upper Hasli Thal, but the Stein Inn and the Grimsel Hospice are nearly the same height above Im Hof. and their distances from it differ little. But the drainage area of the Gadmen Thal is smaller and is surrounded by lower peaks than that of the Hasli Thal; for the latter extends beyond the Grimsel, and its

* A depression between two hill-tops (the first mentioned above being the more eastern of them) connects the ‘pass’ to Meiringen with the lateral gorge in the Aar-schlauche, so that this does lead from a small drainage area.

branches are occupied by the great ice streams of the Ober and the Unter Aar glaciers, which descend from some of the highest peaks in the Oberland. The Gadmen Thal, no doubt, when the snow-line lay some three or four thousand feet at least below its present level, would bring down a large mass of ice, but I cannot admit, speaking from an intimate knowledge of the whole district, that its volume could exceed that from the Hasli Thal, while the plunging force of the latter certainly would be as great. At any rate, the basin of Imhof is simply an expansion in the valley of the Aar, and the Gadmen Thal, in order to effect a junction with it, has to make a rather rapid descent * over hummocks of ice-worn rock. Surely if this were the more powerful glacier, and ice such a potent excavator, the floor of the Gadmen Thal should be at least on the same level as that of the main valley?†

The glacier from this valley, as already stated, descended a broad hummocky slope about 300 ft. in height. On the left bank is a projecting ridge or bastion, over which the ice must have passed, and which one would take for a more ancient feature in the scenery. The torrent hugs the right bank and escapes through a deep gorge in the limestone. This in reality is cut into the slope of the hill, some slight object apparently having diverted the stream from its natural course, and forced it to carve a channel in the limestone.‡

But, according to Dr. Wallace, without this predominant partner in the form of the Gadmen Glacier the basin of Innertkirchen never would have existed. Its 'influx from the north-east must have so diverted that of the Aar, that

* It is important to remember that the head of the basin is above the junction of either of the lateral valleys.

† Dr. Wallace does not perceive that when he admits certain parts of the valley to have been originally much wider § he precludes himself from using the U-like form of the bed as a proof of any great erosive action. He (and we) are equally ignorant of the depth of *débris* beneath the present torrent. It may be only a few yards. All that is *proved* is that in this favourable position the ice can exercise a *slight* excavatory action, and this I allowed twenty-three years ago, and have never withdrawn the statement. But the concession of an inch, to use his own proverb, does not justify the taking of the ell. (*Quarterly Journal Geological Society*, 1874, p. 479.)

‡ It joins the Aar nearly a quarter of a mile below the bridge at Im Hof, while the valley opens to the river rather above that bridge.

§ *Ut supra*, p. 176.

the resultant flow would have been across the lower valley, and almost along the steep face of Kirchet instead of directly across it . . . the effect of these great inflows (including that from the Urbach Thal) must have been to cause a heaping up of the ice and to give it an eddying motion, thus producing the powerful grinding tool which hollowed out the rock basin above the Kirchet. The influx of the great ice stream from the north-east will also explain the curious abruptness of the Kirchet hill.' I venture to remark that in his argument the Urbach Glacier seems to appear and vanish like the Cheshire cat in Wonderland, for, if I mistake not, this is Dr. Wallace's meaning. 'The Hasli Glacier was descending along the line now followed by the Aar. It encountered, or was encountered by, the Gadmen Glacier. This drove it right across the valley and made it sweep round in a quarter of a circle under the cliffs of Im Grund (which I suppose are also due to it), and then along the steep eastern face of the Kirchet,* until somehow or other it managed to overflow the barrier,' the deepest hollowing, I presume, taking place on the N. side of the present Hasli valley, that is, near the Aar-schlauche. But what was the Urbach Glacier doing at this time? Was it so exhausted by its efforts at basin making in the valley above that it gave up the struggle, and made no effort to turn the Hasli Glacier into the straight path? Did it form an hypertrophied mass of ice just above the rocky descent to the meadows behind Brugg? or was it dragged along by the Hasli Glacier and made to help in doing erosive work on the Kirchet barrier?

Lastly—and on this Dr. Wallace's hypothesis must stand or fall—what evidence is there that the confluence of these three glaciers would produce an eddying movement of this kind? Is there any evidence of its occurrence at the present day? I have wandered over most of the greater glacier basins in the Alps. I have seen any number of confluent ice streams, not seldom under similar circumstances, and have never found any approach to such a movement. Granted that these ice-streams are small in comparison with those of the Ice Age, yet this would not affect their relative strength, so the more powerful should still act on the weaker in the same way. This is what really happens; the smaller is somewhat cramped and crowded by the larger, but the streams below the junction move on side by side down the valley. More than this, does ice ever possess the properties which Dr. Wallace

* This, I suppose, already existed as a low mound; but if so, when was it caused?

attributes to it in such phrases as these?—An ‘eddy in the old ice stream at the Grimsel’; ‘the portion [of ice] in the valley, fed by ice streams from nearly opposite directions would acquire a slow eddying motion, which would greatly aid its grinding power’; ‘a vast ice eddy’ at the junction of the three glaciers named above. Without this eddying motion, this hypothesis crumbles to pieces, but is ice a substance in which such a motion can take place? I have always maintained (notwithstanding Professor Tyndall’s criticism) that ice to a certain extent is plastic, but I cannot believe it to be capable of a vorticose movement, and have never been able to learn, either from study of it in the field or from reading books on its physics, that such a movement is possible. One passage, penned more than thirty years ago by a very close observer of Alpine phenomena, may be quoted in favour of Dr. Wallace’s argument, but I doubt whether he will care to avail himself of it: ‘There were, we will suppose, rotatory glaciers—whirlpools of ecstatic ice—like whirling dervishes, which excavated hollows in the Alps, as at the Baths of Leuk, or the plain of Sallenche, and passed afterwards out—“queue à queue”—through such narrow gates and ravines as those of Cluse.’*

The rest of Dr. Wallace’s article, so far as it affects the larger lakes, leaves the matter where he found it. He repeats his argument from the regularity of their shore line, and ignores the objection which I made to it—namely, that this was due to the subsequent deposit of *débris* by lateral streams—merely quoting in support of his view the testimony of two American geologists. Of course, foreign-made goods are always preferable to those of home manufacture, but with all respect to his authorities, I prefer the evidence of my own eyes, and should have been glad to know whether, from his personal experience, he could prove my statement erroneous.

The Kirchet barrier, no doubt, is difficult to explain, but after all it is only a rather extreme case of the alternation of narrow and open parts which is not unusual in mountain valleys,† and is probably due to the way in which the rock-masses and the torrent, in consequence of earth movements, have acted on each other. Before the Kirchet existed, the

* Ruskin, *Geological Magazine*, 1865, p. 50.

† We have something of the kind, on a smaller scale, at St. Maurice in the valley of the Rhone, and on a larger one, between the Untere Nase and Obere Nase in the Lake of Lucerne, or yet more nearly at the Klus at the entrance of the Prätigau.

Aar, as it seems to me, very possibly flowed on both sides of the hill between the gorge and the present road. It then deserted the more southern channel, and was checked by some slight disturbance. This caused it to oscillate over the site of the Innertkirchen basin and to work out an open space there, while its waters escaped in a rapid through the barrier and made a gorge; this was afterwards modified by the subglacial (and even postglacial) stream, and the ice, as I have said, possibly may have slightly deepened the basin. This hypothesis, no doubt, is not free from difficulties—these must attend the explanation of every rather exceptional physical feature—but they are far less, it seems to me, than those of ignoring all other evidence and endowing ice with new physical properties.

NOTE ON THE FIRST ASCENT OF THE JUNGFRAU.*

BY SIR MARTIN CONWAY.

THE first ascent of the Jungfrau is admitted to have been made by the brothers Rudolf and Hieronymus Meyer, of Aarau, with two Vallais chamois-hunters, on August 3, 1811. Doubts have been raised as to the route followed by them on that and the two previous days. I proceed to tell their story as interpreted by me.

On August 1, at 5 A.M., they mounted on to the Löttschen Glacier at the head of the Löttschenthal. At 9 o'clock they were on the Löttschenlücke, whence they sent back their three servants. They then proceeded forwards downhill, down the Grosser Aletsch Firn (still called Löttschen Glacier by them) to near its point of junction with the Aletsch Glacier. We may assume that they arrived there about noon, with plenty of daylight before them. They now divided into two parties, and went to look for the Jungfrau. Rudolf and a hunter went S., and climbed some emi-

* The following are the publications referred to in this article:—

1. *Reise auf den Jungfrau-Gletscher und Ersteigung seines Gipfels. Von Joh. Rudolf und Hieronymus Meyer aus Aarau im Augustmonat 1811 unternommen. Aus den Miscellen für die neueste Weltkunde besonders abgedruckt.*
2. *Reise auf die Eisgebirge des Kantons Bern und Ersteigung ihrer höchsten Gipfel im Sommer 1812. Mit einer Karte der bereiseten Gletscher. Aarau, 1813.* This pamphlet was put together by Zschokke from verbal and written notes given to him by Dr. Rudolf Meyer.
3. *Alpenrosen auf das Jahr 1852.* Von A. E. Fröhlich and others. Aarau und Thun. Article entitled *Erinnerungen an Professor Dr. Rudolf Meyer.*
4. Mr. D. W. Freshfield's notes on the Jungfrau in his contribution to Mr. W. Longman's 'Modern Mountaineering' at the end of vol. viii. of the *Alpine Journal.*
5. 'The Early Ascents of the Jungfrau from the Vallais Side,' by W. A. B. Coolidge, *Alpine Journal*, xvii. pp. 392-397.