The Avalanches of the Jungfrau. By Francis Galton, F.R.S.

DURING a stay of some days at Mürren, in 1862, I was seized with a desire to obtain a nearer view of the great avalanches, that rushed and roared at frequent intervals down the north face of the Jungfrau into the depths of the Trümenthal. I observed that in the lower portion of their course they all converged to one narrow channel, and a close scrutiny with my telescope failed to detect any signs of fallen ice or stones on either side of their habitual path. The avalanches in that channel resembled an intermittent cataract of ice, which might, perchance, be witnessed as closely and as safely as any ordinary waterfall. Circumstances then prevented me from exploring it, but this year my first mountain walk was directed to the channel in question. I found that it was the same channel that directly faces the Jungfrau hotel, on the Wengern Alp, which scores of tourists daily frequent, in the expectation of witnessing avalanches from a nearer point of view than is to be attained by any other mule-path. But even the Jungfrau hotel is far too remote a point of view to enable spectators to appreciate them justly. I triangulated the interval between the hotel and the channel, by such rough means as I had at hand, and found it about 1,500 yards, or a little short of a mile. It is clear that no cascade, whether of water or of ice, can be properly heard or seen at that great distance. It is by their sides, and almost amid their spray and dust, that the power and the uproar of such glorious scenes can alone be truly enjoyed.

The channel of which I have been speaking is the sole outlet of all the avalanches that fall during the summer months from the north face of the Jungfrau, and it occupies a break in the continuity of the Giessen glacier. If the cliffs of the Jungfrau were less precipitous, the Giessen glacier would flow in a continuous stream from the snow-fields above, to its melting level in the Trümenthal below, but the rampart-like configuration of the mountain sides causes it to break asunder. The snow or ice in the upper fields slides onwards, until it assumes the shape of an overhanging cliff, or else reaches a slope too steep to support it. Then a vast piece gives way, and it crashes into fragments, that roll and tumble and grind one another into globes, on their way to the head of the ravine or channel that forms the path of the ice-cataract. They thence bound in a succession of leaps down the ravine, and dash forth at its foot, in an enormous

hail-storm, upon the head of a long uniform slope or *talus* of snow and ice, that represents the lowermost portion of the Giessen glacier, and stretches into the remotest depths of the Trümenthal. Its appearance testifies to its origin. It is wholly unlike the termination of ordinary ice-streams, for it is made up of rounded masses loosely jammed together.

My object was, as I have explained, to reach the foot of the ravine, and to watch the avalanches as they dashed past me, just as I should take my stand by a waterfall of similar dimensions. I succeeded beyond my expectations. There was no difficulty in the climb and no danger in the approach. The neighbourhood of the channel proved free from strayed fragments of ice or stone, and the steep cliff through which the ravine is worn happens to rise in overlapping layers of solid rock, disposed naturally in the manner of slates or tiles. They yield a perfect shelter to within eighty yards of the ravine from a discharge of ice or snow over the face of the precipice, should such by any accident take place—an occurrence which I believe improbable during the summer months. A little scooping out of the rock, in conformity with its natural disposition, would make a perfectly safe covered way to within five yards of the ice-cataract.

I went from the Lesser Scheideck hotel and came back past the Jungfrau hotel. I did not note my watch, but am sure that an hour and a half would be an ample allowance to reach the channel from either inn. The goal is so near and conspicuous, and the way so easy to find, that it seems absurd to describe my course at length. Going straight to the bottom of the valley, a brook, derived from the melting of the Eiger glacier, is crossed by a bridge. Then comes the lower portion of the Kuhe glacier, which is fed by avalanches like the Giessen, and consists of similar rounded masses to those I have already described. It was not more than 120 yards across, and therefore, if a traveller were in the middle of it at the moment when an avalanche detached itself from the heights far above, he could readily retrace his steps, or continue them to the other side, long before danger could approach him. At an early period of the year, when the glacier is broader, the danger might be serious. I was told that the Kuhe glacier derived its name from the fact of 300 cows having been swept away by a single avalanche, that came down its path in the spring-time.

After crossing the glacier, the grassy base of the Jungfrau is reached and ascended. It is broken by two successive terraces of rock, which have to be surmounted. They are low, perhaps thirty feet high, but the rock is smooth, and does not afford good holding-ground: they would exceed the scrambling powers of

ordinary walkers. I should therefore advise everyone to make his guide take a rope by which he might be helped up. I should add, that a few nicks chiselled in the rock would obviate difficulty, and also, that an easier way might be found, though I doubt it, than that by which I went. If the expedition becomes, as I hope, a common one, some speculative landlord will doubtless make the way easy to all classes of tourists.

A narrow belt of sward and stone lies between the topmost terrace and the face of the mighty cliffs. I followed it till I reached the jaws of the ravine and the side of the *talus*, and I spent many hours at various points of view.

It was a dry August day, that had succeeded many others of the same character; consequently the avalanches came rarely, from lack of material to supply them. In some weather they are seen from the Wengern Alp to fall half-hourly; but I, throughout a long morning, only witnessed three grand ones, not to speak of occasional peltings. When they appeared, the sights and sounds were worthy of the scale on which they were enacted. The perpendicular fall of the detached masses of snow and ice, before they reach the head of the ravine, must be 2,000 feet. The depth of the ravine is nearly 1,000 feet more, and the descent of the talus extends through almost 2,000 feet beyond. Therefore the entire fall of the avalanche is nearly 5,000 feet of perpendicular descent. The finest effect was at the very foot of the ravine. I stood at one time so near to it that, had I been equipped as a fisherman, I could have thrown a fly over the avalanche. I waited for the third and finest avalanche under one of the overhanging slabs of rock I have already mentioned; but though I had persuaded myself of the absolute safety of my position, I freely acknowledge that the advent of the avalanche alarmed me. It gave notice of its coming by a prodigious roar, and the appearance of an exceedingly menacing cloud of snow-dust, that was shot out far above my head. I knew not what was coming, and I ran away as fast as I could, till I was reassured that all was right by the appearance of the ice-cataract in its wonted channel; when I hurried back again to its side, to rejoice in the storm and uproar. As to what became of the cloud of snow-dust, I can only speculate, for not a flake of ice nor a drop of water ever reached me. It must have melted into drizzle, and then evaporated in the hot dry air, before it reached my level. Probably it was the very fineness of the snow-dust that gave blackness to the cloud; its menacing appearance was therefore a gross imposition on my nerves. Had the particles that composed it been less minutely divided, they would have looked less appalling, but they would not have

melted as they fell. They were the less dangerous in proportion as they were the more visible.

The grandeur of the ice-cataract was greatly increased by close proximity. The hurtling of the ice-balls in the depths of the ravine, and the crush of the huge hail-storm that issued at its foot, were almost frightful. The storm was remarkable for the irregularities of its outbursts. Frequently these were accompanied by vast gushes of water, due, I suppose, to some sub glacial reservoir, whose foremost wall had toppled away and partly supplied the avalanche. Wind, in moderate blasts of cold air, accompanied each outburst. I was surprised there was not more of it, after the tales one is accustomed to hear about such things.

When the ice-balls have reached the *talus* or slope, the character of their descent is wholly changed. They no longer tumble about or jostle one another, but they slide swiftly and steadily side by side. We can now examine them leisurely, and we see that the surface of the moving mass consists of globes of a pretty uniform diameter of one foot; a few are as much as two feet across, and here and there a globe may be seen of no less than a yard in diameter. The larger balls are topmost, as we may observe in any vessel full of variously sized fragments after they have been well shaken together. Beneath and between the greater globes there lies an abundance of smaller balls. Few of these rounded masses, large or small, are of pure transparent ice; they are mostly aggregations of fragments imperfectly regelated, and afterwards rounded by mutual attrition.

As they slide down the *talus*, they follow its undulations like a ribband: they reminded me forcibly of an orderly multitude filling the streets, and hastening, but not hurrying, to the same goal.

There were two good points of view along the side of the slope. One was near a gorge, which interrupted the regularity of its course; and the other was much lower down, at the place whence almost the entire cascade, as well as the *talus*, could be seen in one long straight line.

The noise made by the ice-balls on the slope was very peculiar. I often shut my eyes and tried to conceive what I should have guessed it to be, had I heard it without learning its cause. It had a rustling and a hissing sound, that reminded me most nearly of a tide rushing rapidly through many channels. There was no *sloppiness* in the sound, in the early part of the day, though afterwards, when more water accompanied the ice-fall, the ear could detect its presence. The noises were not sustained, but rose and fell like those of the sea—owing, I suppose,

to the irregularity of the avalanche supplies, to which I have already alluded. I was surprised at the dissimilarity of the various component sounds of the avalanche, when heard close at hand, to the thunder-like roar which is so familiar at a distance. But in truth, thunder itself affords a precise analogy. When the lightning is close upon us, we hear no roar, but a tearing sound, composed ultimately of a large number of distinct electric crepitations. These are so reverberated between clouds and rocks and earth, that the frequency of the sounds that reach the ear is increased to what is necessary to create the impression of a continuous musical roar. Finally, certain notes of the roar are selected and largely intensified by the cliffs, that play the part of huge sounding-boards. The sound of the distant avalanche is therefore the voice of the cliffs, and is due in but a small degree to the original clatter of the ice-fall, or to the rustle that is heard on the slope.

I confidently recommend all lovers of nature to make this easy and remarkable expedition. It is eminently suited for a day of repose to the active mountaineer. If the weather be sultry, he will find that he can choose his waiting-place either in the sun or in the shade. So considerable a time elapses between the uproar that heralds the avalanche and its appearance at the foot of the ravine, that he may read, eat, or sleep, without any anxiety as to losing his opportunity by being taken unawares. I should not be surprised if this expedition became one of the regular sights of the ordinary Alpine tourist. It is a marvel to me that no one seems to have thought of attempting it before.

The Balferinhorn. By Robert Spence Watson.

> 'This that I see is not all, and this that I do is but little,
> Nevertheless it is good, though there is better than it.'
>
> Clough.

WE had crossed the Moro to Saas (finding six and a half hours' snow upon it), and were strolling up to the Fée valley in the cool of the evening, when we met the old curé, Herr Imseng, bearing a pail full of the freshest and frothiest milk in either hand, and making his way down to the 'Hôtel du Mont Rose,' where he is wont to reside. We hailed his reverence as an old friend, and, on our return to the inn, he was not long in making his appearance. After we had described our