across the narrow valley of the Mitre Glacier. The slope we desired was easily attained by continuing to the right on the W. side of the arête, and we easily reached the summit, 10,400 ft. above the sea.

Here we remained 1 hr. The haze rendered photography useless for the distant peaks, many of which were faintly visible. On a clear day this point would, in my judgment, be the finest scenic point in the whole group, not excepting Mount Temple, which is itself such a magnificent feature in the panorama. The northern slopes of Hazel Peak bear a large glacier, well seen from Goat Mountain, which descends from the two peaks forming the summit. We were upon the southern peak, the higher of the two, and the cairn which we built was well seen from the trail to Lake Agnes. We accomplished our descent to camp without difficulty, arriving at 4 o'clock, a total time of 9 hrs. The time could easily be shortened to six.

(To be continued.)

THE DESCENT OF GAPING GHYLL (YORKSHIRE).

A STORY OF MOUNTAINEERING REVERSED.

By E. A. MARTEL.

Though I have been acquainted with the glaciers of Chamonix ever since 1864 (when I was only five years old), though I have travelled more than twelve times through the Alps 'from end to end' between Vienna and Nice, and though I am passionately fond of this most magnificent 'playground of Europe,' yet it has been my misfortune to be able to make but a few important mountain ascents, none of which were more difficult than the Aiguille du Goûter and the Aiguille d'Argentière, both in the chain of Mont Blanc.* Further, when in 1887 I was able, as I had long desired, to climb high peaks, it happened that I had already been fascinated (since 1883) by a region in my own country which was full of mysteries and unknown beauties. The cañons of the Causses in Southern France led me to real discoveries, and I found such great enjoyment in their hidden and beautiful scenery, that I was led to believe that the Alps themselves had been too much explored. Moreover, after 1888, when I first began to look into the interior of the earth, through the dark mouths of tremendously deep chasms and abysses, or through the untrodden vaults of caves, as immense in point of size and as richly ornamented as those in Austria, such a wide field of scientific investigation opened out before my eyes that I could not resist the temptation of exploring it as thoroughly as possible. Thus for seven years (1888–1894) my time was fully

* See my articles in the *Annuaire* of the French Alpine Club for 1882, 1887, and 1894, and also *Le Massif de la Bernina*, by A. Lorria and E. A. Martel. Zürich: 1895.

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occupied by these underground researches in France, in Belgium, in Austria, in Dalmatia, and in Greece. The results of my explorations, as well as an account of the scientific problems that I had succeeded in solving, and of the unexpected natural curiosities that I had discovered, have been fully described in my large books, 'Les Cévennes' (Paris, 1890) and 'Les Abîmes' (Paris, 1895).

On the occasion of the sixth International Geographical Congress in London last summer I delivered a lecture, in which I pointed out the way in which the science of cave-hunting, or 'speleology,' might be further developed. I explained how the methods of cave-hunting could be greatly improved and extended, so as to be the means of bringing about many more curious discoveries, particularly by the systematic examination of 'swallow holes' and abysses, and I pointed out that cave-hunting might become, like 'limnology' and 'oceanography,' a distinct and independent science, by reason of its special objects and the great number of questions which it helps to answer.

I therefore profited by my presence at this Congress to carry out my eighth annual underground exploration in Great Britain itself. Having received a mission from the French Ministère de l'Instruction Publique, and having had much information courteously supplied to me by Professor Boyd Dawkins, Mr. Mark Stirrup (of Manchester), Dr. Scharff and Mr. Jameson (of Dublin), and Mr. Plunkett (of Enniskillen), I was fortunate enough to make some real discoveries and many new observations in the caves, swallow holes, chasms, and subterranean rivers of Ireland, Derbyshire, and Yorkshire. A detailed account of my doings and a comparison of their results with those of my former explorations will appear in the course of the present year in a new book which I am engaged in preparing. It will prove that the important researches and daring deeds of Messrs. Lloyd (1770, in Eldon Hole), Birkbeck and Metcalfe (1847, in the Yorkshire pot-holes), and Boyd Dawkins (1860 and later, in the Mendip Hills) need to be repeated and carried out on a wider scale. I have made it clear that Underground England and Ireland are still far from being thoroughly known, and that future cave-hunting, with all the improvements that I have introduced (telephones, long rope ladders, folding canvas boats, &c.), will be the means of bringing to light many novelties, whether from the scientific or the picturesque point of view. In the present paper I will merely endeavour to show that speleology, though played on a darker scene, is as rich as mountaineering in difficulties, perils, and romance.

I cannot help wondering why so many active, enterprising, and brave young Englishmen have hitherto refrained from exploring these unseen depths, which appeal so mysteriously to the imagination, and specially to the desire to increase the sum total of human knowledge. Many persons complain that European mountains are exhausted, so far as exercise and sport are concerned. But let them change this wish to ascend into a wish to descend, and many years

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will elapse before they have exhausted their own 'dark playground of Great Britain.'

The most interesting descent I made in the course of my journey last summer was that of Gaping Ghyll (Yorkshire) in Ingleborough Hill, and it is that which I shall select as the best example of 'mountaineering reversed.' Allum Pot had been already descended in 1847, 1848, 1870, by Mr. J. Birkbeck, Mr. Metcalfe, and Professor Boyd Dawkins,* and its mouth is larger than that of Gaping Ghyll, though the latter is deeper, for in 1872 Professor Hughes measured it and found the depth to be 330 ft. For many generations this awful pit was feared by man. It was thought that the Fell Beck (which flows into it) ran—

> Through caverns measureless to man,
> Down to a sunless sea.

Mr. J. Birkbeck, having long heard the roar of this cataract, tried about forty years ago to find out what Gaping Ghyll concealed. He descended it only in part, to the depth of 190 ft., at which point his further progress was arrested by the rushing water and his insufficient apparatus. Since that time no one has ventured to plunge again into this gulf. Professor Hughes's plummet alone revealed its depth, and the fact that it was full of water.†

On August 1, 1895, I arrived on the spot armed with all my apparatus. I cast down the hole my long rope ladder, and fastened it very strongly to an oaken post at the edge of the pit, driven into the grassy bog on the slope of Ingleborough. Mr. J. Farrer, the lord of the manor of Ingleborough, had been kind enough to cause, during the three previous days, the course of Fell Beck to be diverted as much as possible. Very heavy rains at the end of July had made the stream very strong, and without Mr. Farrer's most valuable assistance neither Mr. Birkbeck nor myself could have carried out our project. The whole of the beck was not done away with, but it seemed quite possible to stand what still remained of it. My wife stood at the mouth of the pit, in charge of the upper end of the telephone, while I was to take down with me the rest of the machine. No windlass was employed (I only used such things in 1888 and 1889, on my early descents), for I always descend by the ladders, having first secured round my body (in a peculiar way, so as not to run the risk of being squeezed) ‡ a rope which is held (in order to be lowered or pulled up as the case may be) by five or six men stationed above ground. In this way I enjoy greater liberty, and can rest when I like on any part of the ladder. This plan is also the safest, for at any time an accident might happen to the windlass. As none of my usual companions were with me, and there was no one present who was familiar with such explorations, I had to prepare everything myself,

* See the latter gentleman's *Cave-Hunting*. London: 1874. Pp. 46 *sqq*.
† *On Caves*. Proceedings of the Victoria Institute. London: 1887.
‡ See *Les Abîmes*, p. 17.

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leaving not a single detail to others. In particular, I tested every rope and knot most carefully (not Manila Alpine rope, which is far too thin, but my own hemp rope, two-thirds of an inch thick).

As I had brought with me from France a rope ladder of only 270 ft. in length, I had to go down about 60 ft. of doubled rope before I gained my ladder. It was necessary to arrange thus, so that if I was tired near the bottom of the pit I might rest on my ladder. Otherwise, if I had used the rope when far down I should have had to trust to my arms and legs, and my strength would by that time have been more or less exhausted.

My preparations lasted about three hours. Then, with about eighty spectators to watch my disappearance, I started on my descent at 1.22 P.M. This did not prove as difficult as I had feared, for the rope and the ladder rested against the sheer rock, and did not swing at all. I had only to dislodge with my hands and ladder a few loose stones, which might later have fallen on my head. I did not require any candle, for daylight penetrated quite to the bottom. This was most fortunate, as no lantern or electric lamp would have resisted the half-suffocating whirls of air and water which rushed and dashed through the pit, here from 10 to 16 ft. wide. This was the only inconvenience I experienced during my whole undertaking, but it was most disagreeable, and much disturbed my conversation through the telephone. I was wet through and half crushed by the waterfall, which came down perpendicularly upon me, so that I was glad enough to land, and to find some shelter on a ledge (12 ft. long, and 6 ft. wide) at a depth of about 190 ft. This is certainly the spot at which Mr. Birkbeck was stopped. In the case of future explorers unprovided with telephones, the best way of communicating with the surface will be to station a companion on this ledge, as he will act as 'voice bearer,' being pretty well heard both from below and from above. Beneath this ledge the pit contracts to a width of 7 or 8 ft. On the ledge I found the bottom part of my ladder (140 ft.) coiled up in one huge heap. A few minutes sufficed to unroll it, and to throw it down into the yawning and narrow gulf. Then I resumed this amazing descent, with the thin veil of a cascade falling perpendicularly from a height of 200 ft. above. Such things I have never admired in the Alps.

After a further descent of about 50 ft. I and the ladder began to swing in the air and in the water, and the rocky walls around seemed to retreat, for I was just emerging from the roof of a gigantic cave. After a long and tedious halt and dangling in the midst of this waterfall in order to allow my rope to be lengthened by another *upstairs*, I reached (at 1.45 P.M.) the end of the remaining 100 ft. of the rope ladder. The last rung was within half a foot of the ground, so precise and accurate had been Professor Hughes's plummet and my own.

I despair of giving my readers any idea of the view on which I gazed as I stood at the foot of my ladder, and at a respectful

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distance from the waterfall. There were no stalactites or sparkling diamonds of carbonate of lime to be seen (the cave is too frequently filled with water for that), but an immense cathedral, unsupported by a single pillar. There was one vast hall, 500 ft. long, 80 to 100 ft. high, 66 to 116 ft. broad. Thus it is one of the five or six largest caves known at present to exist in the whole world, and the scene ranks among the most impressive that I ever expected to come across in my underground wanderings, particularly by reason of the fantastic dropping of water, and the darting of the daylight through the funnel in the gigantic vault. No sound from the surface of the earth can penetrate to this spot, for the roar of the waters is too great to allow of that. The floor, covered with sand and pebbles, is almost level. The two ends of the cave are unfortunately blocked by boulders (15 to 20 yards long and high—they are included in the estimate of the total length at 500 ft.) which have fallen from the roof. Through the sand and tiny crevices the water percolates in the direction of the well-known Ingleborough Cave, which is only a mile distant and 150 ft. lower, and whence issues Beck Head, the source of the Clapham Beck, and certainly the outlet of Fell Beck, which descends through Gaping Ghyll. I ascended the S.E. slope of boulders, and, at its summit, through the joints of great stones, I heard the roar of a stream on its way to Ingleborough Cave. There was a draught of air, but I cannot say whether it came from beyond the boulders or from the large cave, because of the air whirling round the waterfall. By clearing out these boulders (a good piece of engineering work) it might be possible to discover other large caves connected with the one I discovered and with Ingleborough Cave itself. Being quite alone in this damp dungeon I could of course make no attempt of the sort, and, as I was wet to the bone, I did not care to mount the N.W. slope of boulders; but that too seemed to be blocked right up to the roof, though on its left is a small passage, choked with sand. So I contented myself during my stay of 1¼ h., with mapping the cave, and with taking geological and meteorological notes (published in the "Comptes Rendus de l'Académie des Sciences de Paris," January 6 and 13, 1896).

At 3.5 P.M., filled with regret at leaving so majestic a scene which I had been able to admire for so short a time, I began the ascent, which took 28 min.—a little longer than the descent—and was far more laborious. My telephone was filled with water, so that I could hear nothing from above, though my wife, on the contrary, heard through it my orders and my shouts. In the middle of the pit the telephone wire broke into two parts, having coiled round a sharp point of rock or got entangled with the ladder, as the men above pulled it too hard. Luckily I was then within reach of the voice, and could talk in the free air. When I issued forth from the pit I was quite sallow, and breathless from cold and wet.

On the whole my excursion down Gaping Ghyll would have been quite easy had it been possible to divert the whole of Fell Beck.

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The hole itself is one of the finest (though not one of the deepest) that I have ever visited, and daylight penetrates to the very bottom. The large cathedral cave acts as a reservoir to Clapham Beck, and so is very interesting and important.

I dare not hope that I shall ever have another chance of going down grand Gaping Ghyll, but I hope most sincerely that the Leeds gentlemen (Messrs. Calvert, Booth, Gray, Green, Bellhouse, &c.), who since my descent have been twice hindered by rain from repeating it, may succeed as soon as possible, not merely in order to confirm my report, but also to remove the boulders which stopped me, and so to discover the other caves which certainly exist there. To accomplish this a large party must be lowered down.

All round Ingleborough, and in many other parts of England and Ireland, there are many such pot-holes, well worthy to excite the curiosity and stimulate the boldness of the most capable and hardy Alpine climbers. To these I would venture to say, 'Try mountaineering reversed for once.'

THE RIDGE CONNECTING THE M. VÉLAN AND THE GRAND COMBIN.

By ALFRED G. TOPHAM.

Both the Italian Government map and the more recent sheet 532 *bis* of the Swiss map are terribly mixed in the nomenclature of this frontier ridge. In the scheme below I have endeavoured to put matters straight. The ridge, which is mostly very jagged, is very conspicuous from the south side of the Col de Fenêtre. It is also seen, though much dwarfed by its big neighbours, from Aosta, and from the Lac de Champex, and I have distinguished the Lake of Geneva from one of the summits. On the west side the cliff which cuts in two the Sonadon Glacier is carried right across the face of all the aiguilles, and it is only after gaining the Col de Valsorey, and from the upper névé of the Sonadon Glacier, that any approach can be made to the frontier. Several years since I attempted an ascent from this side, but the formidable lines of precipices one above another turned us back, and drove us another year to the east side. From the Vélan to the Col de Valsorey this side is composed of steep though broken-up rocks, but on touching the Trois Frères this is altered. On the lower slopes most uncompromising *plaques* are encountered, surmounted by the tall, thin aiguilles; but from Mont Percé onwards a narrow, easily gained snow-field lies high up at their feet.

In the following list the first column contains the recognised names of the summits and cols, in proper order; the second column the inadequate and often wrong nomenclature of the Swiss map; the third that of the Italian map, and the fourth details of ascents.

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