# REVIEWS AND NOTICES.

*Travels among the Great Andes of the Equator.* By Edward Whymper. (London: John Murray. 1892.)
*Supplementary Appendix to the same.* (John Murray. 1892.)
*How to Use the Aneroid Barometer.* (John Murray. 1891.)

THE appearance of these interesting volumes—the first two on March 31, 1892, the last in December, 1891—must recall to the memories of his friends the great journey of one of the most accomplished members of the Alpine Club. Leaving England on November 3, 1879, Mr. Whymper reached Guayaquil on December 9 in that year, returned to Guayaquil on July 14, 1880, and to London on August 28. The journal of the expedition is published in six successive numbers of the *Alpine Journal* from November, 1880, to May, 1882, inclusive. Moreover, on February 1, 1881, a special meeting of the Alpine Club was held at the Royal Institution, at which Mr. Whymper described his ascents of Chimborazo and Cotopaxi.* Mr. Charles Edward Mathews was in the chair. The Prince of Wales, the presidents of the Royal, Geological, and Zoological Societies, and other notabilities were present. The audience numbered 920. Mr. Whymper subsequently described his journey in a paper read to the Royal Geographical Society on May 9, 1881.

The incidents and results of Mr. Whymper's expedition are therefore not new matters; they have been in their broad outlines more or less public property for about eleven years. That they can have remained so long a time either resting in the memories of his hearers or buried in magazines, and not have been embodied in a book, is one of the curiosities of literature. That there have been cogent reasons for delay it is impossible to gainsay; on the return of a traveller with a biological collection there is much to go through. The specimens must be re-examined, divided into groups, and allocated to specialists who are both competent and willing to undertake their determination. Each group must be subdivided into known and unknown species, and the latter must be described, named, and figured. Finally, the book must be published in America, and here new difficulties arise. No book is allowed copyright in that country unless it is actually printed there, and granted priority of issue. The latter regulation delayed the publication in England of Mr. Whymper's book at least three months.

Thus much premised, we turn to the Introduction to the principal volume, in which the author explains that his chief motive for undertaking the expedition was a desire to ascertain the altitude at which climbers began to suffer distress from diminished atmospheric pressure, or, as it is termed, 'mountain sickness,' and how far it would operate as a barrier to attaining the loftiest summits in the world; that the Himalayas and the Chilian Andes were at the time inconvenient districts for experiment in consequence of political disturbances, so

* See vol. x. p. 239.

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that he was practically limited to the Andes of the Equator, where Chimborazo, of a height, according to Alex. von Humboldt, of 21,425 feet, offered an appropriate means of examining the problem. Mr. Whymper further proposed to himself to determine the altitudes and relative positions of the chief mountains of Ecuador, the comparison of boiling-point observations, and of aneroids against the mercurial barometer, and collecting in botany and zoology at great heights.

A mountain traveller with such purposes in view should upon starting be properly furnished with all necessary services, instruments, means of collecting both plants and animals, and an adequate supply of food and medicines. The first requisite is a good staff of guides, and these must necessarily be drawn from Switzerland or some other part of the Alps of Central Europe. The number should not be less than three. Mr. Whymper secured the services of Jean Antoine Carrel, of Val Tournanche, celebrated in the history of the ascents of the Matterhorn, and singularly fitted to take the part of leading guide in such an expedition. He had engaged two other guides, who failed him at the last moment, and had ultimately to instruct Carrel to bring with him whom he could. He brought his cousin Louis, who became disabled for many weeks of the journey. Mr. Whymper was obliged to pick up a third man in Ecuador, who was naturally of no service on the higher peaks. Of the cousins Carrel he writes:—'I trusted my person, property, and interests to their care with perfect confidence, and they proved worthy of the trust and equal to every demand which was made upon them.'

Mr. Whymper's outfit included a photographic apparatus, a theodolite, three mercurial barometers, eight aneroids, and nine boiling-point thermometers. The behaviour of the instruments for the determination of heights is described throughout the narrative, in the appendices to the principal volume, and in a small brochure of sixty-one pages, entitled 'How to use the Aneroid Barometer.' This includes the appendix on the aneroid, and will be referred to as the 'special volume.'

These portions of the work may conveniently be noticed in this place.

The superiority of the mercurial barometer in the measurement of heights has long been recognised, but its tendency to break has proved a serious obstacle to its use. It is sent out by makers packed in a leather case with the cistern uppermost, and is supplied with a metal tripod, by which it can be suspended at about one-third of its length above the cistern. Mr. Whymper prefers to carry the case in a long wooden box, securely packed with tow, and to suspend the barometer when in use from the top of one of the legs of the theodolite. The writer can testify how many barometers he has lost from the neglect of these precautions, but the latter involves carrying a theodolite, and that means an extra man.

The various defects of the aneroid and, above all, its constant tendency to lag behind the mercurial barometer, were pointed out by the writer in an article communicated to the 'Alpine Journal.'* Mr.

* Vol. ii. p. 39.

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Whymper has paid more attention to this subject than any other traveller. He writes:—*

'Eight aneroids were taken. One of these by Casella, marked No. 580, had been made for an earlier journey; and through being only graduated to 20 inches, was of no service for comparison at great heights. The seven remaining aneroids were constructed expressly for the expedition, and were under trial and examination for nearly twelve months before our departure. They were selected from picked instruments, and only those were taken such as were, as far as one could tell, as perfect as could be produced. These seven aneroids were marked A to G. A, B, and C were graduated from 31 to 15 inches; E, F, G were graduated from 31 down to 13 inches.

'It became evident at an early stage of the journey (*a*) that the whole of the aneroids had acquired considerable errors, (*b*) that they differed among each other to a very large extent, and (*c*) that neither means of the whole, nor means of any combination, would give decent approximations to the truth. The more evident this became, the greater importance I attached to the preservation of the mercurials. Comparisons of the aneroids against the mercurials were nevertheless continued until the end of the journey; and, after two months' experience in the interior, the behaviour of the aneroids in ascending and descending was so well ascertained that one might, I think, have made use of their indications to determine differences of level without committing very great mistakes.'

On arrival at Guayaquil, the Port of Ecuador, Mr. Whymper was received by Her Majesty's consul, Mr. George Chambers, with whom he left aneroid No. 528, and a mercurial barometer. Mr. Chambers rendered Mr. Whymper an inestimable service in observing the latter twice a day during his stay in the interior. No serious errors affected the aneroids until the party began to ascend the Andes.† Aneroid C was lost or stolen on the way, so that the number available for comparison was reduced to six.

At Guaranda (8894′) the mean error continued to augment, being on arrival −0·520; it rose in one week to −0·655, and stood on Christmas Day at 0·800 of an inch. In quoting the index errors of the aneroids it would appear that Mr. Whymper reverses the method in use among scientific men. Thus for the Guaranda readings he writes:—

| | |
|---|---|
| Extreme differences . . . . . | 0·800 |
| Mean of aneroids . . . . . | 21·233 |
| Mean merc. bar. . . . . | 21·888 |
| Mean errors of aneroids . . . . | −0·655 |

But in the Kew certificate‡ we have the following note at the bottom of the page:—'*When the sign of the correction is* +, *the quantity is to be added to the observed scale reading, and when* −, *is to be subtracted from it.*'

In the Guaranda observations the quantity 0·655 should be *added* to the aneroid readings to get the truth, and should therefore be written

* Spec. vol. p. 3. † Spec. vol. p. 5. ‡ Spec. vol. p. 51.

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+, instead of −. The same error runs through all Mr. Whymper's work. In noting the behaviour of the aneroids we cannot do better than follow them in the ascent of Chimborazo, omitting the minus signs:—

Camp on the Arenal (14,375 feet), Dec. 26, 1879. Aneroids 0·737 below mercurials. Greatest diff., 0·880.

Second camp on Chimborazo (16,664 feet), Dec. 30. Aneroids (mean) 0·903 below mercurials.

Third camp (7,285 feet). B, beyond range. Mean of 5 aneroids below mercurials, 0·974. Greatest diff., 1·120 inches.

Summit (20,545 feet), January 4, 1880.

| | |
|---|---|
| Merc. bar., No. 558 . . . . | 14,110 inches |
| Aneroid D. . . . . | 13,050 „ |
| „ E. . . . . | 12,900 by estimation |

The mean of the two aneroids is seen to be 12·975 inches, and the error upon the mercurial 1·135 inches, the value of which at the altitude in question exceeds 2,000 feet. If, therefore, the height of the mountain had been determined by the aneroid, it would have come out more than 2,000 feet too high.

The prolonged residence on Chimborazo had disabled aneroids F and G. Comparisons for the remainder of the journey were restricted to A, B, D, E only. B had the largest index error, but it remained tolerably constant, varying from 1·781 to 1·863. In the following pages of the spec. vol. Mr. Whymper gives a series of instances of the irregularity of the variations of these aneroids. It is worthy of notice that the aneroid which went so far wrong on Chimborazo returned nearly perfectly to its proper reading when brought back to Guayaquil.

Mr. Whymper arrives, among others, at the following conclusions:—*

That with aneroids of the present construction it is unlikely that decent approximations to the truth will be obtained at low pressures, even when employing a large number of instruments. The errors of the whole series (A to G) were invariably below the truth, and in the worst cases amounted to as much as two inches upon the mercurial barometer.

That differences of level at great heights (low pressures) may be determined with considerable accuracy with aneroids even when they have acquired very large index errors.

That in observations of this description a nearer approach to the truth is generally obtained by employing the mean of ascending and descending readings than by taking the means of ascending or descending readings separately.

Part II. of the special volume is entitled 'Experiments in the Workshop.' After his return Mr. Whymper undertook a series of experiments extending over a long space of time—first in the workshop of Mr. J. J. Hicks, and subsequently in his own.

In the first set of these experiments Mr. Whymper had eight aneroids under a pressure of 22·5 inches for six weeks, with a mean

* Appendix C. p. 411; spec. vol. p. 9.

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loss on the mercurials of 0·373, of which about two-thirds occurred at the end of the first week.

In the second set he had three aneroids under a pressure of 17 inches for five weeks; mean loss on mercurials in five weeks, 0·764 inches.

In the third set he had three aneroids under a pressure of 16 inches during eight weeks. Mean error on mercurials, 0·442.

In the fourth set he had four aneroids under a pressure of 19 inches during five weeks. Mean error on mercurials, 0·361.

These four experiments showed clearly that the greatest part of the loss which occurred took place during the first week, and that the mean loss which occurred exceeded two-thirds of the total mean loss on the mercurial barometer.

In his own workshop Mr. Whymper constructed a receiver 30 inches high, in order to have twenty or more aneroids under examination at one time, at pressures ranging from 26 to 14 inches, for periods of days, weeks, and even months at a time. In these experiments a number of aneroids, amounting on the whole to 71, were compared with the mercurial barometer.

On p. 21 Mr. Whymper shows the behaviour of 71 barometers, kept for one week only, at pressures varying from 26 to 14 inches, equivalent to approximate altitudes of from 8,450 to 20,770 feet. One of these, at a pressure of 14 inches (equivalent to an altitude of 20,770 feet), showed a loss on the mercurial of 1·033 inches, and a height too great by 2,005 feet. This table is not without humour. It includes the behaviour of aneroids belonging to the Royal Geographical Society, carried by travellers under the auspices of the Society. For instance, the aneroid by Cary, carried by Mr. T. Thomson in his journey in Morocco in 1888, showed, at a pressure of 17 inches, a loss on the mercurial of 1·267 inches, and a height too great by 2,005 feet. Mr. Whymper points out that the errors in altitude, serious as they are, are only about two-thirds of the errors which the aneroids would have developed if they had been kept continuously at the same pressures for one month and upwards. The remainder of Part II. is chiefly devoted to the recovery of aneroids, or their reading after various intervals of times after their pressure had been restored.

Part III. of the special volume deals with the use of the aneroid barometer in the determination of altitudes, and the means by which the errors of aneroids may be guarded against.

§ 40, p. 35. When an aneroid experiences diminished pressure (as it does when a traveller is ascending) it at once commences to lose upon the mercurial barometer, and to indicate a greater diminution of pressure than the truth. This tendency to lose will cease in a few weeks at a constant pressure; the aneroid will then indicate the natural (hourly or diurnal) variations in pressure almost as accurately as the mercurial barometer itself.

§ 41, p. 35. When an aneroid experiences restoration of pressure, it at once commences to regain its previous loss. This recovery always goes on for several weeks, and when it ceases the aneroid will again indicate hourly or daily variations with reasonable accuracy.

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§ 42, p. 36. Aneroids which may be employed at upper or lower stations, with the view of applying corrections to simultaneous observations at lower or upper stations, ought to be installed at such upper or lower stations for several days before being used for simultaneous observations.

§ 44, p. 36. The best hypsometric results will be attained when the least possible amount of time intervenes between the readings at two stations upon different levels.

The remainder of Part III. contains a large amount of valuable information which it is impossible to epitomise here. The results of Parts I., II., and III. are recapitulated in Part IV., which concludes with the following paragraph:—'Comparison of travellers' aneroids against the mercurial barometer, at natural pressure, upon return to the level of the sea after prolonged journeys in elevated regions, have not the value which is at present assigned to them.' Surely no value can have been assigned to them for many years.

In Appendix D of the main volume Mr. Whymper gives four pages to the boiling-point thermometer. The writer entirely agrees with him in the many defects and inaccuracies of this instrument. It resembles the aneroid in lagging behind the mercurial. Mr. Whymper made seventeen observations of this instrument in the field, including thirteen stations at greater heights than 13,000 feet, and three at the summits of Cotopaxi, Antisana, and Cayambe—each above 19,000 feet. Five, four, and two thermometers were boiled at the three last stations, with a mean error of 513 feet. It is much to be desired that Mr. Whymper would study the boiling-point thermometers in the workshop, and that some competent analyst should recalculate the tables of Regnault.

In order to appreciate Mr. Whymper's labours it is necessary to give a *résumé* of his journey, which may be followed in the pages of the main volume and on the Route Map in the pocket at the end. On December 9, 1879, he and the two Carrels landed at Guayaquil, where he engaged the services of Mr. Perring, an Englishman who had lived many years in Ecuador. Guayaquil, the chief port and second city in the Republic, is situated at 2° S.L., whereas Quito is just below the Equator, and 9,343 feet above the sea. He proposed to attack Chimborazo by the ordinary route to Quito, which is by steamer along the river Guayas as far as Bodegas and thence by mule track along the southern face of Chimborazo. They left Bodegas at 1.20 P.M. on the 14th, having seen nothing of the mountains since they landed. They had endless troubles with the mules, and found the mule track or 'Royal Road' almost impassable. They rode upwards until the 18th, when they reached a pass or gap in the mountains, 'the view from which was a revelation.' 'We had left the steaming Pacific slopes behind and passed as it were into another world.'

The pass reached was a notch in a range which intervened between Chimborazo and the sea, unknown to all previous geographers. Two small huts on its summit were called Tambo Gobierno. Their height was found to be 10,417 feet above the sea. The range which the author crossed he believed to have a length of about 65 miles from

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north to south, to contain summits approaching 15,000 feet in height, and to be separated from Chimborazo by the river Chimbo. He proposes to call it 'the Pacific range of Ecuador.' On the eastern side of the range the road descends, and crossing the river the party arrived at nightfall at the small town of Guaranda, 8,894 feet above the sea.

He had selected this place as the base of his operations, because it had been reported as nearer to Chimborazo than any other town or village. The road to Quito leads through it, and crosses on its way the sandy plain called the Grand Arenal. They remained at Guaranda until December 31, when they obtained their first view of Chimborazo, hitherto hidden in clouds. Two things arrested their attention. First, that Chimborazo had two summits of nearly equal elevation, secondly, that the whole of that part of the mountain which was seen from Guaranda was nearly covered with glaciers. Previous writers, notably Humboldt and Boussingault, have spoken of one summit only, and Humboldt had expressly declared that he saw no glaciers in Ecuador. These travellers attempted to climb Chimborazo in 1802 and 1831 respectively, and claim to have reached heights of 19,286 and 19,698 feet. There is no doubt that the heights are over-estimated, the routes difficult to understand, and the speeds, especially of descent, grossly exaggerated.

While waiting at Guaranda for the Carrels, who had gone off to examine the ground, Mr. Whymper set up his mercurials, boiling points, and aneroids, and found the serious errors which had affected the latter.

At 9.45 A.M. on the 26th, the troup of fourteen animals, ten for baggage and four for riding, filed out of the yard, followed by three arrieros (muleteers) and two Indians. The Indians gave so much trouble that the party occupied seven hours in getting to the Arenal. After passing its summit and leaving on the right the place called Tambo de Tortorillas, they turned out of the usual Quito track and, under the leading of Jean-Antoine, steered a nearly north-eastern course over the upper and level portion of the great plain to a point at the mouth of one of three vallons leading directly towards the western summit. The night was bitterly cold, and it was found in the morning that the Indians and five of the mules had disappeared. So passed the night in the first camp on Chimborazo at an altitude of 14,375 feet and a minimum temperature of 21° F. Deprived of seven backs, two journeys became necessary to reach the second camp, and the best arrangement Mr. Whymper could make was to send forward Jean-Antoine with the remainder of the caravan and to remain behind to stop any further desertion.

Of the three vallons which lead up into Chimborazo, the most westerly one was that upon which Carrel had gone, and Mr. Whymper named it the 'Vallon Carrel.' This valley was chiefly lined with volcanic dust, toilsome to ascend even on moderate gradients. The caravan returned in about three hours, when it was reloaded, and the remainder of the provisions and stores were left in depôt at the entrance of the Vallon Carrel. For 1,000 feet above the first camp the reladen

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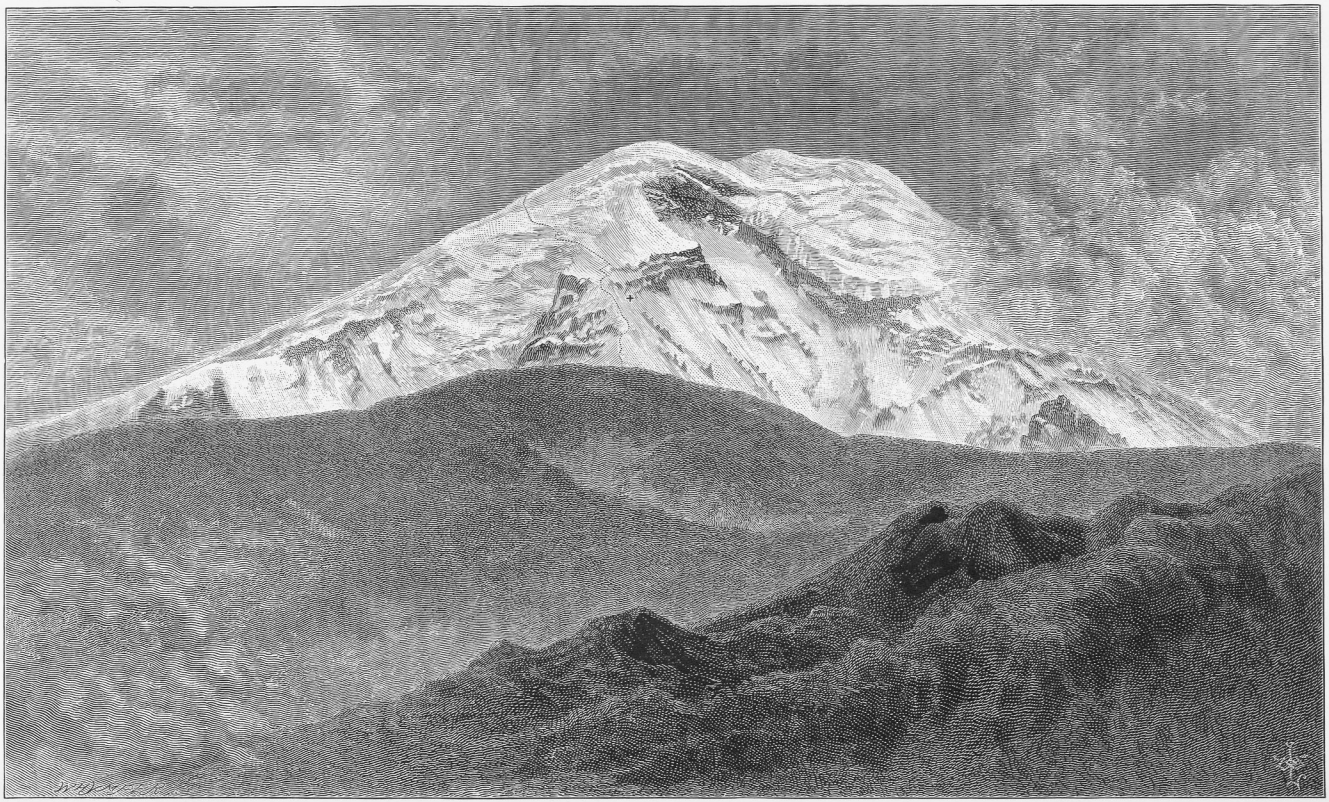

CHIMBORAZO, FROM THE SLOPES ABOVE GUARANDA.

caravan progressed at a fair pace, and then, at a pressure of 17,250 inches, straggling began.

Carrel had selected a position for the second camp, with sound judgment, at the foot of a wall of lava which protected the tent on one side. The baggage animals struggled upwards one by one and by 5.30 P.M. all had arrived. The barometer stood at this place at 16½ inches.

The party were in high spirits. The weather had been fine and the move successful. It was arranged that one of the arrieros should sleep at Tortorillas, and come up daily to learn what was needed, and all the rest of the troop were sent back to Guaranda, for although the party had succeeded in establishing the camp at the selected spot, it had only been done by great exertions on the part of the people and their beasts. 'When we others,' writes Mr. Whymper, 'had arrived at the second camp we were ourselves in good condition, but in about an hour,' he continues, 'I found myself on my back along with both the Carrels, incapable of making the least exertion, and knowing that we were experiencing our first attack of mountain sickness.'

The symptoms of this ailment are intense headache, difficulty of respiration, and inability to consume tobacco. It lasted all night, and all the next day, but Perring did not appear to be affected at all. He kept the fire going, melted snow, brought his comrades drink, attended to their wants in general, and did not seem any worse at the second camp than at Guaranda.

The camp was situated on the southern side of a rather conspicuous gap in the ridge. Below them the ridge spread out as it approached the Arenal, and above them it led for a long distance towards the western dome. The Carrels were of opinion that another camp must be made before they could attack the summit. On the morning of the 30th Jean-Antoine was crippled by inflammation of the eyes, but his cousin was sufficiently revived in the afternoon to be sent with Perring down to the depôt to fetch the tent which was to be advanced to the third camp.

On the 31st the party went up the ridge to select a third camping place, and chose a site close to the crest of the ridge on its eastern side, at a height of 17,285 feet (merc. bar. at 1 P.M. read 16·081 inches).

The author next gives us an interesting account of the investigation of the tinned provisions, which he had brought or sent to Ecuador. He had purchased a quantity of ox cheek which turned out to be putrid. In some cases the tins had burst and had ruined almost the whole of the food in the case. The end of the matter was that they found themselves obliged to hurl over the cliffs a mass of provisions which had cost endless trouble to prepare. One searches the pages for some explanation of this stuff having found its way into the commissariat, when one sees the words at the head of the page, 'the Ox cheek of Chicago.' Even food from Chicago might be tested by knocking in the heads of a few casual samples before carrying a quantity of it to Chimborazo.

The labour of porterage was again thrown upon Jean-Antoine and Louis, who started off at an early hour on January 2, with a couple of loads to the third camp. Mr. Whymper utilised two natives for a similar

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purpose, and at the end of the afternoon had got three weeks' provisions at the upper station. A line of communication was now fairly established. However bad the weather, they could always retreat upon the second camp and from it to the depôt near the first one, scarcely more than two hours from Tortorillas, where they could communicate with Guaranda, and the word was given the same afternoon that Chimborazo was to be assaulted on the next morning. At 5.35 A.M. on January 3 they left the tent, and, scrambling through the shattered lava behind it, crossed the arête and emerged on the western side of the ridge.

In the immediate foreground large beds of snow covered the ridge. After these were traversed, the ridge steepened and became partly covered by pure ice and partly by ice mingled with small stones and grit. At 7.30 A.M. they arrived at the foot of the lower series of the southern walls of Chimborazo, and the termination of the south-west ridge. A breach in the walls rose at an angle exceeding 50°, and the Carrels were soon at work cutting steps in it, until further progress was arrested by a furious storm of wind, and the party retreated to the third camp.

They started again on January 4 at 5.40 A.M., and finished the escalade of the breach at about 8.

The author proceeds as follows :—

'At about 11 A.M. we fancied we saw the Pacific above the clouds which covered the intervening flat country, and shortly afterwards commenced to enter the plateau which is at the top of the mountain, having by this time made half the circuit of the western dome. We were then 20,000 feet high, and the summits seemed within our grasp. We could see both—one towards our right, and another a little further away on our left, with a hollow plateau about one-third of a mile across between them. We reckoned that in another hour we could get to the top of either; and, not knowing which of the two was the higher, we made for the nearest. But at this point the condition of affairs completely changed. The sky became overclouded, the wind rose, and we entered upon a tract of exceedingly soft snow, which could not be traversed in the ordinary way. The leading man went in up to his neck, almost out of sight, and had to be hauled out by those behind. Imagining that we had got into a labyrinth of crevasses, we beat about right and left to try to extricate ourselves; and after discovering that it was everywhere alike, we found the only possible way of proceeding was to flog every yard of it down and then to crawl over it on all fours, and even then one or another was frequently submerged and almost disappeared.

'Needless to say, time flew rapidly. When we had been at this sort of work for three hours without having accomplished half the remaining distance, I halted the men, pointed out the gravity of our situation, and asked them which they preferred—to turn or to go on. They talked together in patois, and said, "When you tell us to turn we will go back, until then we will go on." I said, "Go on," although by no means feeling sure it would not be best to say "Go back." In another hour and a half we got to the foot of the western summit, and as the slopes steepened the snow became firmer again. We arrived at the top of it about a quarter to four in the afternoon, and then had the mortification of finding that it was the lower of the two. There was no help for it; we had to descend to the plateau, resume the flogging, wading, and floundering, and to make for the highest point, and there, again, when we got on to the dome, the snow was reasonably firm, and we arrived at the summit of Chimborazo standing upright like men, instead of grovelling as we had been during the previous five hours like beasts of the

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field. The wind blew hard from the north-east, and blew the light snow before it viciously. We were hungry, wet, numbed, and wretched, laden with instruments which could not be used. With much trouble the mercurial barometer was set up; one man grasped the tripod to keep it firm, while the other stood to windward holding up a pouch to give a little protection. The mercury fell to 14·100 inches, with a temperature of 21° F., and lower it would not go.'

By the time the barometer was in its case again it was twenty minutes past five. They ran down for their lives, passed the breach just as night was closing, and reached the camp soon after 9 P.M., having been out nearly sixteen hours and on foot the whole time.

The weather on June 5 was cold and windy. Jean-Antoine and Perring descended to the second camp for wood, Louis remained all day in the tent, and Mr. Whymper obtained what views he could, among them an occasional glimpse of Sangai, an active volcano on the south-east, which seems to be known only by name. On the morning of the 7th Jean-Antoine expressed his determination not to attempt any further ascent of Chimborazo, in fact, to leave the mountain at once. This, of course, was a great chagrin to Mr. Whymper, who had taken infinite pains to establish a line of camps almost to the summit, and had hoped to secure a clear day for observing, with the theodolite, all the peaks in Ecuador. During the time Mr. Perring was absent all the baggage was concentrated below, and on the 10th, when the team arrived, it was speedily loaded and despatched to the Tambo of Chiquipoquio, on the east side of Chimborazo. Mr. Whymper remained some days longer measuring a base line and taking angles for the construction of a map of the south side of the mountain, and arrived alone on the evening of the 12th at the Tambo of Chiquipoquio.

Early on the next morning the mystery was solved. Louis's feet were severely frost-bitten. He had left home with ill-fitting boots, and no gaiters, and his boots had become filled with water, in floundering through the soft snow. Mr. Whymper also had acquired a complaint which rendered riding impossible. It was necessary for both of them to seek a doctor, and they were recommended to one at Amboto, a village on the road to Quito.

Mr. Whymper found that his residence on Chimborazo had extended over seventeen days. One night was passed at 14,375 feet, ten more at 16,664 feet, and six others at 17,285 above the sea. In these seventeen days they had experienced the reality of mountain sickness; it had attacked them at a pressure of 16½ inches, and they had suffered from it for a few days, but in course of time the more acute symptoms disappeared, and ultimately they did not suffer from it during their whole stay in Ecuador. During their residence on Chimborazo Mr. Whymper's unflinching determination enabled him to achieve almost all the purposes of his journey. He solved the problem of Alpine sickness, he ascertained for the first time the true elevation of the most celebrated mountain in the new world, he found that the aneroid would have given the height of Chimborazo 2,000 feet higher than the truth. He enlightened mountaineers upon two subjects which were not within the range of his designs. He discovered that guides may run the risk of losing their feet, if not their lives, from the

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want of proper equipment, and that ox cheek, even if tinned in Chicago, may perhaps cause the wreck of an expedition if it is not examined before it is packed.

The party, Mr. Whymper in a litter, the remainder on mules, arrived at Amboto, and were skilfully cared for by Mr. Abel Barona. Amboto (8,606 feet) is the lowest point on the road to Latacunga (9,141 feet), whence one rises to the ascent of the Tiupullo ridge (11,559 feet), the highest point on the Quito road, and after passing a gently modulating plain, descends by somewhat abrupt zigzags into the basin of Machachi. The party stayed in the village (9,839 feet) for several weeks, at the Tambo of Antonio Racines.

Illinga, Corazon, Alacalzo, Pasochoa, and Rumiñahui stand around the rim of the basin of Machachi. From the absolute heights of these mountains one would suppose that the panorama must be exceptionally fine. This, however, is not the case. They rise from a base of about 9,000 feet. The lower slopes are unusually long and rise at very moderate inclinations. By reason of this it is possible to take beasts of burden to the great heights that are mentioned in the volume.

Mr. Whymper and Jean-Antoine were able to turn their attention to mountaineering, but Louis was still disabled and obliged to amuse himself as best he could. They first examined Corazon, said to have been ascended by La Condamine and Bouguer on July 28, 1738. These explorers, in the prosecution of their work, encamped twenty-eight days upon the mountain, but there are no precise indications of the route which was taken by them, nor could any information be obtained at Machachi, though a certain Ecuadorian named Lorenzo vowed that he had been to the top. He was engaged to act as guide. He led Mr. Whymper a long way to the south of the summit and then stopped. He was subsequently tied on to a rope and the party ultimately reached the summit.

The author cannot exhaust the wonderful beauties of Machachi. At first its dimensions were unappreciated. Objects which looked a mile distant sometimes proved to be two or three miles away. The naked-looking plain was found to contain dells decorated with ferns, some of them English species, such as *Aspidium Trichomanes* and *Cystopteris fragilis*, and to be gay with salvias, fuchsias, and verbenas, giving shelter to a countless population. 'Pumas and deer ranged over the high rugged ground; foxes, weasels, and opossums dwelt on the lower slopes, and down in the basin there was a zoologist's paradise. Butterflies above, below, around. Mayflies and dragonflies danced in the sunlight, lizards darted across the paths, and legions of spiders pervaded the grass. Crickets in infinite numbers, flies innumerable, hymenopterous insects in profusion, and occasional phasmas (*caballo de palo*) crawling painfully about like animated twigs.'

Mr. Whymper's thoughts next turned to the great volcano Cotopaxi. It was reported that there was a large slope of ash at the apex of the terminal cone. He proposed to camp upon it close to the top of the mountain. The chance of having a nocturnal view of the interior of the crater, though a secondary, was a powerful attraction.

When the gashes of the frost-bitten feet of Louis began to heal, and

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he could hobble about, preparations for the adventure were set going, and the party recrossed the Tiupullo ridge to the farm of Rosario. This is nearly due west of Cotopaxi, and its altitude is sufficiently great (10,356 feet) to enable one to judge the proportions of the mountain. Mr. Whymper found the general angles of the northern and southern slopes to be less than 30°, and a week later, when due north of it, that the eastern and western slopes scarcely exceeded 32°. It has been represented, like the Matterhorn, as much steeper than it is. The last great eruption took place on June 26, 1877, and, as it is the best known one that has occurred, the author records it before proceeding with his narrative. He also gives a list of the persons by whom the mountain has been ascended.

Whilst staying at Rosario Mr. Whymper, with Jean-Antoine, attempted to ascend Illinitza. This mountain is probably seventh in rank of the Great Andes of the Equator, but little is known of it as it is almost perpetually shrouded in mist. The author was at one time or another seventy-eight days in its vicinity, yet did not see the whole of the mountain on any single occasion. They started from the farm on February 8, under local guidance, but at 14,700 feet the local guides came to the end of their knowledge, and the animals struck work. The two principal performers were ultimately stopped by séracs, and if they could have passed these they would have been prevented from reaching the summit by a snow cornice of a novel and formidable description. They then quitted a mountain upon which, Mr. Whymper says, 'we were fairly beaten,' and, resigning themselves to the inevitable, set to work preparing for a journey to Cotopaxi.

They started from Machachi to Cotopaxi on February 14, but a violent storm drove them for refuge into the little village of Pedregal. They camped at a height of 15,130 feet, and sent all the animals back to Machachi. The night of February 15–16 passed away without excitement. The first business in the morning was to improve the shelter for the people, and to sort them off, for there were too many mouths to feed. The preparations for a start to the summit were now completed. The tent below was left standing well provisioned in case they had to make a precipitate retreat, and there was food enough near the top of the mountain for several days should they be kept prisoners there. The ascent of Cotopaxi by the route they followed was a walk, no climbing whatever was necessary. Mr. Whymper describes the terminal slope of the mountain—how they hurried up it and reached the western edge of the rim exactly at midday. They had great difficulty in excavating a plateau near the rim so as to form a site for the tent, and in securing the tent ropes to large blocks of lava. The floor of the tent indicated 110° F. where it was nearest the mountain, and the other side indicated only 50°. Outside during the daytime the air was intensely cold, and the minimum of the night of February 18 was 13° F., the lowest temperature observed during the whole of the journey.

During the whole of the time they spent upon the upper part of the mountain, no special effects were produced by the rarity of the air. 'When night had fairly set in,' writes Mr. Whymper, 'we went up to

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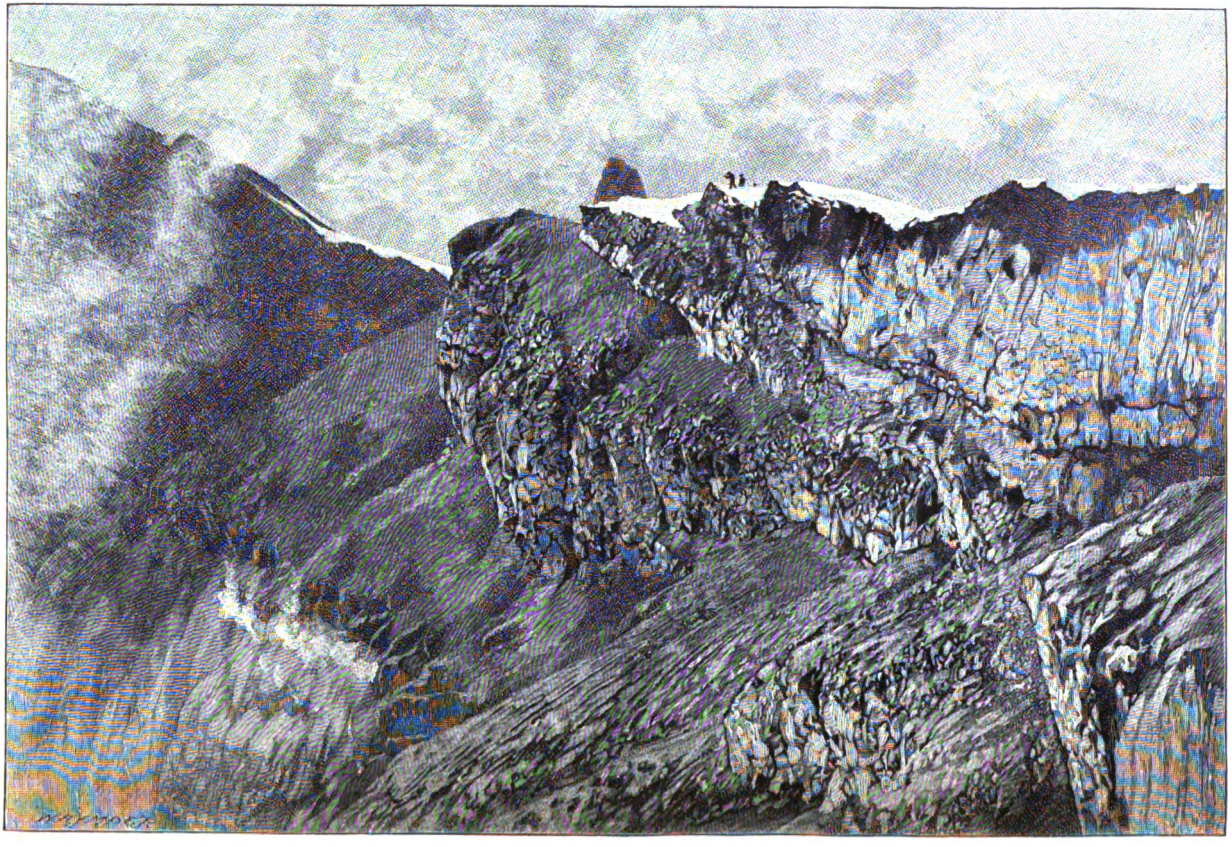

PART OF THE INTERIOR OF THE CRATER OF COTOPAXI.

FROM A PHOTOGRAPH TAKEN AT 19,500 FEET.

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view the interior of the crater. The atmosphere was cold and tranquil; we could hear the deadened roar of the steam blasts as they escaped from time to time. Our long rope had been fixed both to guide in the darkness and to lessen the chance of disturbing the equilibrium of the slope of ash. Grasping it I made my way upwards prepared for something dramatic, for a strong glow on the under sides of the steam clouds showed that there was fire below. Crawling and grovelling as the lip was approached, we saw an amphitheatre 2,300 feet in diameter from north to south, and 1,650 feet across from east to west, shining with ruddy light. At the bottom, 1,200 feet below us, there was a nearly circular spot filled with incandescent if not molten lava.' The author continues to describe the behaviour of the crater and the way in which it blew off steam. The party were up again before daylight on the 19th, and then measured sixty feet on the western side of the crater, and took angles to gain an idea of its dimensions. Mr. Whymper photographed it and made final observations of the mercurial barometer to determine the altitude of the mountain. From the mean of the whole the summit appears to be 19,613 feet above the level of the sea. From the observation of previous observers it would seem that Cotopaxi has materially increased its elevation in the course of the last century and a half.

After twenty-six hours passed upon the summit, the party returned to Machachi. The two Carrels longing for mountain work, Mr. Whymper indulged them with the ascent of Sincholagua, a mountain south-east of Pedregal.

Louis, after several weeks' rest, was sufficiently restored for active exertion, and Mr. Whymper, proposing to make his way to Antisana, shifted his headquarters from Machachi to Quito. Quito is the capital of the Republic of the Equator, 9,343 feet above the sea. The best view of the city is from the top of a regularly formed 'panecillo,' and from the same spot there is an admirable panorama of the Great Andes in the immediate neighbourhood of the Equator—Cotocachi (16,301 feet), Majanda (14,083), Cayambe (19,186 feet), a grand, snow-clad extinct volcano, followed by Sincholagua, Cotopaxi, Pasochoa, Rumiñahui; the three hills of Champi on the Tiupullo ridge—Corazon, Atacatzo, and Pichincha.

The author stayed some time in Quito, and devotes a chapter to its social, political, and financial institutions. Here Perring left him, and gave place to Mr. Verity, an English mechanic. They started for Antisana on March 4, and, crossing the Puengasi ridge, descended into the basin of Chillo. Boussingault had previously published some meteorological observations said to have been made thirty-three years before at the hacienda (farm) of Antisana. The most interesting part of the record was that in 375 days there was recorded 130 of fog, 122 rainy, 36 with snow, and only 34 in which the sky was visible.

On March 6 they took up their quarters at the hacienda of Antisana, and kept constant watch for Antisana itself, which had been invisible for the last few days. They would not have had the slightest suspicion that they were in the neighbourhood of a mountain of the first rank, or of a mountain of any kind, if the herdsmen had not told them the con-



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trary. From occasional glimpses of the mountain, Mr. Whymper made out that the upper 3,500 feet of Antisana were almost crowned with snow and glacier, and that on an ascent they would absolutely not touch rock at all. He further observed that the glaciers were fissured by long and complicated crevasses. Anticipating, however, that nothing would be gained by waiting, he gave the order to march. The party started from the hacienda of Antisana at 4.35 A.M., arrived at the base of the glacier, 15,295 feet, at 6.40, proceeded on foot by moraine, on the northern side of the glacier, and then arriving at the termination of land, dismissed the natives who had carried the baggage. The elevation of this point was 15,984 feet above the sea. At 10.30 A.M. the mist caught them up, and half an hour later they arrived at a prodigious schrund, not less than 200 feet deep and some 60 feet wide. They wasted more than two hours in attempts to cross it, and by 5.55 were back at the hacienda.

So failed their first attempt to scale Antisana, which produced in the case of Mr. Whymper a violent attack of snow-blindness. On the evening of March 8 he began to recover sight, and planned another attempt to scale the misty mountain. The complicated ice navigation near the summit of Antisana could not be effected in a fog. It was therefore arranged to camp out at the edge of the glacier as high as natives could be taken. On March 9, at 12.55 P.M., they started again, and got all the baggage up to the camping place by 4 P.M. On the 10th, at 5.38, Mr. Whymper and the Carrels got away, in very bad weather, and in ceaseless mist reached the summit at 10.20 A.M., where they remained an hour and forty minutes. The height, by the means of six readings of the mercurial barometer, comes out 19,335 feet. During the time they remained on the top the temperature in the shade ranged from 44° to 60° F., though the highest temperature observed at the hacienda was only 49°.

During the descent a dramatic incident occurred. The three men were striding at their best pace tied together about fifteen feet apart, Louis in front, Mr. Whymper in the middle, Jean-Antoine last. In the twinkling of an eye the surface gave way, and Mr. Whymper shot down as it were through a trap-door, nearly pulling both men over, and in the next second found himself dangling between two varnished walls of glacier which met 70 feet beneath. With slow and anxious pulls the cousins hauled away, without effect, until Jean-Antoine leaped the chasm and landed Mr. Whymper poorer by a cap, though not otherwise the worse for the emersion. By 6.40 they were back at the hacienda, reputed the highest farm in the world, and famous ground for the collector.

It will be remembered that Mr. Whymper, on starting, had proposed to bring with him three first-class guides, but had been obliged to content himself with two. Four men on a rope is always a wise precaution, and this incident shows what danger may happen to a smaller number.

On the return of the party to Quito they made the ascent of Pichincha, and spent two nights upon the mountain. It is 15,918 feet above the sea, and 6,000 feet above Quito. Pichincha is evidently rich in plants and animals; close to the extreme top was a large plant

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with thick woolly leaves, and a nearly white, pendant, downy flower. It made its appearance at 14,000 feet, and was never seen much lower. Twenty-one species of beetles were collected upon Pichincha. The whole are new to science; eight species were found only on Pichincha. 'The first competent naturalist,' says Mr. Whymper, 'who devotes his whole time to this mountain, will reap a splendid harvest. After he has satisfied himself with beetles and butterflies he will be able to feast his eyes upon the ruby and emerald breasts and cyanine tails of the numerous humming-birds abounding upon it, which include some of the most beautiful forms that are known.'

The party left Quito on March 27, on their way to the great mountain Cayambe, and did not return until May 3. The village called Cayambe was the nearest place of any size to the mountain, and the only one where food was likely to be obtained. After proceeding a few miles from Quito, the party quitted the main road and turned to the east towards the plain of Tumbaco. It was on the eastern side of this that La Condamine and his associates measured their famous base-line in October–November, 1736. In its neighbourhood is a great earthquake fissure called the 'Quebrada' of Guallatumba. The fissure was 3,000 feet deep, and was utilised by Mr. Whymper for comparing his barometers. The aneroids—one with an index error of half an inch, and the other with an index error of an inch and a half—gave, nevertheless, very approximately the depth of the ravine. The party next proceeded to the village of Guachala, and thence to Cayambe, where they met Señor Espinosa, the owner of Cayambe mountain, who invited them to his farm at Chuarpongo. At 4 A.M. on March 30 he conducted them in the dark a long way to the south-east. In the meantime Jean-Antoine disappeared, and Mr. Whymper, in searching for him, found his way back to Cayambe on the morning of April 1, and was later in the day joined by Espinosa, Jean-Antoine, and Verity. Ten others had been left on the mountain, where a camp had been constructed at an elevation of 14,762 feet. On April 2 Mr. Whymper returned to the camp. On the following day he caused steps to be cut in the roundest slopes of the glacier above the camp, and advanced food and instruments to the very edge of the ice. On April 4 they left the tent at 4.40 A.M., and arrived on the summit (19,186 feet) at 10.12 A.M. 'This,' says Mr. Whymper, 'was our fastest ascending rate.' In 320 minutes of actual going they rose 4,424 feet, or 831 feet per hour.

Cayambe is the fourth in height of the great mountains of Ecuador, and is the one which is nearest the Equator, having a N.L. of about 4 minutes only.

Mr. Whymper's next task was to hunt up a mountain called Sarurcu, said to have a height of 17,276 feet, and to be south-east of Cayambe. Leaving the camp on Cayambe on April 6, he descended to a hut called La Dormida, S.W. of the mountain. Here he remained on the 7th, 8th, and 9th, and sent out his men to examine the country ahead. The next day they made a forward move, but had to pass the night in a swamp 13,000 feet above the sea, exactly on the point where the waters divide between the two oceans. From this point



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until the next station, Corredor Machai, the country was entirely marsh, covered with cutting reeds from 8 feet to 10 feet high. On the evening of the 12th they were in camp on Sara-urcu, so at least they supposed, for the mountain was quite invisible from mist and rain. In the afternoon they descended to Corredor Machai, and arrived drenched from the waist downward. The highest point reached was 13,754 feet. From the 12th to the 16th Mr. Whymper remained at Corredor Machai collecting fresh stores of provisions, and on the evening of the 15th actually saw the mountain, after six days' incessant rain. On April 17 he started again, and took to the ice at 10.50 A.M. He could not see 100 yards in any direction, and steered E.S.E. To insure return, Louis carried a quantity of 4-foot lengths of the reed-tops, and planted another as soon as the last had become dim. They rose steadily, crossing many crevasses, and when about 15,000 feet high suddenly emerged from the clouds and found themselves face to face with the pointed snow-peak. Above this a wall of snow led to the true top, which they reached at 1.30 P.M. It proved to be a shattered ridge of gneiss, without a trace of vegetation. Blue sky above, the whole of the surroundings shut out by impenetrable mists, limiting the view to a few hundred yards around the summit, which was surrounded by glaciers on all sides. Barometer 17·230 inches, height only 15,502 feet—another instance of exaggeration. He returned on the 20th to Cayambe village, understanding better than when he left it why Gonzalo Pizarro kissed the ground when he stood again on terra firma.

The author next points out the numerous mistakes made by Villavicienda in his description of this mountain, and the extraordinary statements of Humboldt respecting the ejection of fish in a living state from the craters of Ecuadorian volcanoes.

On April 21 he left Cayambe and travelled northwards, with the intention of ascending Cotocachi, and of collecting antiquities in the Imbarra country. On April 24, at 11.35 A.M., he reached the highest peak of Cotocachi, the most northerly point of the journey.

After descending to Otovalo, the Carrels proceeded to Quito, and Mr. Whymper went to Imbarra, where he made a large collection of antiquities in stone and pottery. Many of the latter were smashed on the return to Quito, where he arrived on May 23.

In the middle of the month he made an excursion to the Pyramids, which should mark the ends of the long base-line that was measured in 1736 by La Condamine and his associates, from which they carried a chain of triangles along an arc of the meridian over three degrees of latitude. The work caused infinite labour, and extended over ten years. Two years later the King of Spain gave orders that the Pyramids should be destroyed. Such, in fact, was their fate, but the Republic ordered them to be replaced, and one at least was rebuilt by a President of Ecuador, who moved it some hundreds of feet on one side in order that it might be better seen.

Mr. Whymper left Quito on June 7 on his journey home, and, after abortive attempts to climb Illinitza and Altar, camped on the Quito road on the lower slopes of Chimborazo. The mountain Carihuarizo

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nearly adjoins Chimborazo on the north. Mr. Whymper left camp to attack it at 5.50 A.M. on June 29. The summit was not seen until they were actually upon it, and the leader was often invisible to the last man on the rope. Almost the whole of the upper part of the mountain was covered with snow and glacier. Carihuarizo has two principal peaks. It was not until the party returned to camp at 4 P.M. that the clouds opened and they discovered that they had climbed the more westerly peak, which is distinctly, though slightly, lower than the eastern one. In a few hours all the members of the party were attacked by snow-blindness, and were incapacitated for two days.

Mr. Whymper then commenced his second ascent of Chimborazo, and camped twice on the northern side of the mountain. He had come to his very last day. In one way or another all his margin of time had been dissipated, and unless the ascent was effected on July 3 it could not be made at all. At 5.15 A.M. they left the camp. He writes:—'The sky was bright, the air serene, and long before dawn, sixty miles away, we saw the cone of Cotopaxi clear cut against a cloudless horizon, and remarked how tranquil the great volcano looked, and that not a sign of smoke was rising from its crater. Soon a cold wind sprang up. I lingered behind to beat my hands and feet, and whilst resting back against a rock saw the commencement of an eruption. At 5.40 two puffs of steam were emitted, and then there was a pause. At 5.45 a column of inky blackness began to issue, and went straight up in the air with such prodigious velocity that in less than a minute it had risen 20,000 feet above the rim of the crater. I could see the upper 10,000 feet of the volcano, and estimated the height of the column at double the height of the visible portion of the mountain. The top of the column, therefore, was nearly 40,000 feet above the level of the sea. At that elevation it encountered a powerful wind blowing from the east, and was rapidly borne towards the Pacific. It was then caught by wind from the north, and borne towards us, and appeared to spread quickly. At a higher point on the mountain,' the author continues, 'we could see to the bottom of the basin of the Chimbo, 11,000 feet below, and overlooked the country on the west by 4,000 or 5,000 feet. Between us and the sea the whole expanse from north and south was filled by the Pacific range of Ecuador with countless peaks and ramifications, backed by the ocean rising above the haze which obscured the flat coast land.' He next describes the extraordinary colours produced by the clouds of Cotopaxi intervening between himself and the sun, the arrival of the party on the summit at 1 P.M., the fall of the barometer until 2 P.M. when it stood at 14·028 inches with the thermometer at 16° F. 'The dust,' he says, 'commenced to settle about ten minutes after our arrival on the summit; it filled our eyes and nostrils, rendering eating and drinking impossible, and at last reduced us to breathing through handkerchiefs.' Mr. Whymper's last act before leaving was photographing the top of Chimborazo. It is reproduced literally in one of the illustrations, 'an authentic record of a memorable occasion.' The volcanic dust from this eruption was spread over many hundreds of square miles, and he estimates that not less than 2,000,000 tons must have been ejected.

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The dust has been carefully examined by Dr. Bonney, who found it to consist of rock fragments and mineral fragments ranging from ·001 inch to the finest size.

On July 4 they continued the circuit of the mountain by a high-level route; the march was made in a trifle over five hours for most of the way, at an elevation of 14,500 to 15,000 feet, without meeting any impediment. On July 6 Mr. Whymper descended to camp No. 7, and resumed his measurement in the high road for a 'scale for Chimborazo,' so completing his work among the Great Andes of the Equator. The narrative, however, contains two further chapters—Chapter XIX., 'On some Results of the Journey,' and Chapter XX., 'On the Return to Guayaquil.' It will be convenient to take them in inverse order.

After leaving Riobamba the party marched southward, on the eastern side of the Chimborazo ridge, for a distance of about thirty miles, where they camped at a height of 11,722 feet. The track then led to the south-west, through a thick forest, to the river Chimbo, a descent of upwards of 10,000 feet. The right bank of the river formed the terminus of the railway to Yaguachi, whence they proceeded by steam launch to Guayaquil.

The results of the journey have been already, to some extent, anticipated in this notice.

It has been shown that the aneroid invariably brings out the heights too great, and that the author was exceptionally fortunate in having his mercurials unbroken throughout the journey, and in securing simultaneous observations at the sea level, thus setting at rest for ever the heights of the principal mountains in Ecuador.

These may be divided in the following classes:—

| | | |
|---|---|---|
| 1st. | Chimborazo, over | 20,000 feet |
| 2nd. | Cotopaxi „ | 19,000 „ |
| | Antisana „ | „ „ |
| | Cayambe „ | „ „ |
| 3rd. | None between 18,000 and 19,000 feet | |
| 4th. | Many below 18,000 feet | |

All the mountains visited are of volcanic origin except Sara-urcu, which is metamorphic, and lies far from the main chain on the east of the volcanic mountains. Only Cotopaxi and Sangai are of constant activity; some others are intermittent, and the remainder have been extinct for many years.

Mr. Whymper was the first traveller to set foot upon the summits of Chimborazo, Antisana, Cayambe, and many lower mountains.

The author's experience of the effect of low pressures on the human frame is that at a pressure of 16·5 inches (16,664 feet) he was suddenly incapacitated for work, and found himself pre-occupied by the paramount necessity of obtaining air while the attack lasted; it was impossible to breathe through the nostrils alone; there was feverishness, headache, marked acceleration in the rate of the pulse, and rise in body temperature. The acute symptoms continued for about two days and then gradually disappeared. He is also of opinion that there are certain permanent effects from which there is no escape. These are accelerated breathing, lassitude, and want of muscular power. They

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were first noticed at about 10,000 feet, and continued throughout the journey.

I am, nevertheless, of opinion that altitudes much higher than 20,000 feet may be attained if proper precautions are taken.

The observations and collections in various branches of natural history are among the most important results of the expedition. The plants noticed in the most interesting localities are given in the foot-notes. The occurrence of common European ferns has already been mentioned.

A list of plants with the highest range is given at pp. 352, 353. Among these are three gentians, gathered on the south side of Chimborazo, at an altitude of 16,000 feet. The occurrence of this genus here and elsewhere in the Andes is remarkable, as, although most characteristic of the Alps, it does not even pass into Algiers.

The author next describes the zoology. The insects collected were the most numerous, and among the insects the beetles. The number of beetles collected and described is 206, among which 104 are new species.

The volume concludes with nine appendices on the most important points referred to in the narrative.

The second volume is a 'supplementary appendix' on the natural history of the journey, with a chapter on the rocks by Professor Bonney.

Mr. Whymper brought home with him a large collection of animals, chiefly insects and arachnida, and entrusted them to various specialists for examination. The late Mr. H. W. Bates seems to have taken the largest share of the work. The collection was made chiefly at high altitudes. It contains a large number of species new to science, but many still remain unexamined and undescribed. The volume is illustrated by beautiful figures engraved by Mr. Whymper himself.

The length to which this notice has extended prevents my entering into detail upon this most important part of the author's work.

It remains only to record the admiration with which every member of the Alpine Club must regard the success of this remarkable journey, the excellent style in which the narrative is written, and the beauty of the illustrations engraved by the author himself. The success was due to the unflinching determination and endurance of the traveller, displayed in the face of some of the most serious difficulties which can beset a mountaineer, such as constant bad weather, the necessity of camping out continuously at high altitudes, frequent snow-blindness, and the like. It is not probable that Mr. Whymper will find many followers, and yet six peaks of the Andes, four in Peru and two in Chili, all higher than Chimborazo, still remain to be climbed. Aconcagua, in Chili, the highest of the Andean chain, should tempt some members of the club. W. Mathews.

[We have to thank Mr. Whymper not merely for permission to use the illustrations which accompany this review, but for the actual provision of the required copies.—Ed.]

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*Our Life in the Swiss Highlands.* By John Addington Symonds and his daughter Margaret. (London and Edinburgh: Adam & Charles Black, 1891.)

The Swiss mountains have given Mr. Symonds health and strength, and he is gratefully appreciative. He tells us that it was fourteen years ago that serious lung-mischief induced him to spend a while in Davos; that he found, after several experiments, it was impossible for him to live in an English climate; that he consequently built himself a house there, and managed thoroughly to enjoy life. He has studied the folk-lore and the history, the rare amusements and the habitual toil of the people around him, and has really succeeded in learning something, not only of their ways of life, but of their habits of thought. His vivid sketches are obviously faithful, and whether he is benighted in a snow-storm on the Fluela, hobnobbing with wrestlers in a village inn, taking part in the wildest of fancy balls at Wiesen, investigating the stages of a Graubündner's career from stable-boy to hotel-porter, or 'roystering'—the word is his own—with Bacchus Alpinus when the produce of the Val Tellina is being conveyed in a long procession of cask-laden sledges to the inns of the Engadin, he has always something to say which is worth reading. Miss Symonds's contributions, too, are very bright and attractive. The chapter which possesses most interest for mountaineers is that on Avalanches, a subject which, as a whole, has been somewhat neglected in Alpine literature, and which his residence at Davos in the winter of 1887–8 enabled him to study with peculiar advantages. In that year the avalanches in Graubünden are believed to have beaten the record both as regards number and size. An official return of those which damaged life or property gave the number as six hundred and the damage as 14,300*l.*, but Mr. Symonds says that the gross total must be reckoned by thousands. Some valleys were entirely blocked up, and for months were shut off from the outer world. From a window of the Hôtel Belvedere he saw a coal-cart and two horses swept away by what seemed a quite insignificant 'Schnee-Rutsch.' The man and one horse kept their heads above the snow and were extricated, the other horse was dead before he could be dug out. The 'Staub-Lawine,' formed of finely powdered snow that has been lifted by a whirlwind from the mountain side, and is driven through the air, is universally feared more than any other form of avalanche. A man who had just escaped the clutch of one of these terrors told Mr. Symonds that he had been carried off his feet and rendered helpless by the swathing snow, which tied his legs, pinned his arms to his ribs, and crawled upwards to his throat. Luckily his head emerged, and he could breathe, but, as the mass congealed round him, he felt that the compression on his lungs would speedily suffocate him. He was fast losing consciousness when rescuers came, hacked away the frozen snow round his thorax, and then rushed off to free some other victim. Meantime his position was by no means pleasant while a natural ice-cast of his limbs was being taken, but he was eventually extricated undamaged. Of stories of such hair-

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breadth 'scapes, as well as of fatal accidents, Mr. Symonds has accumulated a plentiful store, but it must be admitted that one or two of them, which he does not profess to have had at first-hand, are somewhat trying to the reader's credulity. For instance, we are told of one man who was clean shaven on the day when he was carried off and killed by an avalanche, but who was found to have grown a thick curling beard when he was dug out some months afterwards. All physiologists would pronounce this to be impossible; and indeed our experience of mummies who have had some thousands of years' opportunity for posthumous hair-production, is enough to disprove the story. Again, we hear of a native of the Prättigau who was swept away by an avalanche on the Fluela road, and whose body, stark and livid, was carried to the Hospiz and there left for dead. Shortly afterwards a neighbour of the dead man arrived at the Hospiz with his wine sleigh, and was asked to take the corpse home with him. He answered that Hans had been a surly ill-conditioned fellow in his lifetime and that it would serve him right to drag his body down at the tail of the sledge. For this highly improbable reason he proceeded to lash the body by the heels, and to set off at a quick trot down the pass, trailing it behind him as Achilles trailed dead Hector. It was not till he reached Tschuggen, where he stayed for the night, that the corpse found breath to protest, but it seems that this vigorous surgical treatment was precisely what was wanted to revive him, and he was shortly able to walk home to Prättigau, where Mr. Symonds, who evidently implicitly believes the story though he has not himself seen its hero, says that he now lives to tell the tale. It may be added that he can tell it with the more freedom as it was his rescuer, like Goldsmith's mad dog, who died, and he certainly deserves to take rank with the indispensables of fiction who are sure to turn up safe and sound, despite poisons, drownings, and mine explosions, at the end of the third volume. H. P.-T.

*Section Lyonnaise du Club Alpin Français. Huitième Bulletin.* (Lyons: Storck. 1892.)

For some reason the 'Bulletins of the Lyons Section' are about the best reading of any Alpine literature now current. Whether there is something in the climate of Lyons which conduces to lively description, or something in the 'greater freedom and less responsibility' of a section which allows it to adopt a tone somewhat less serious than that which befits the central editorial staff of a great club, we cannot say; but that such is the fact all impartial readers will agree. Nor is the absence of conventionality conspicuous in the style only. People from Lyons seem to do, and to do with impunity, what elsewhere is regarded as a trifle hazardous. The first paper in the present number, for instance, relates how M. Théodore Camus went up the Meije for a 'training-walk,' accompanied by his brother, who was a complete novice at mountaineering. Except for a high wind on the ridge, the elements were propitious, and Père Gaspard, with the aid of Turc and Roderon, brought them through; but one cannot help feeling

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that the expedition was a risky one under the circumstances, and that, if anything had gone wrong, one of the brightest and most intelligible descriptions of an ascent of the Meije which we ever remember to have read would have remained unwritten. The paper is illustrated with a singularly good 'photocollograph' (if that is the right word) of the mountain.

Still more lively at times, even to the point of *gauloiserie*, is M. Edouard Bonnet in his account of the Levanna and the Aiguille de la Za. No great addition to our knowledge of those peaks can be extracted from the paper; but we may note that M. Bonnet's party crossed the Colle Perduto* between the central and eastern peaks of the Levanna, and were a good deal impressed by the route. The incident with the English party on the Aiguille de la Za has a very apocryphal ring about it. Certainly it is not usual for English climbers to start off in the morning 'd'un train d'enfer,' with the amiable intention of walking another party's guide to a standstill.

Mlle. Louise Lacharrière describes some ascents, chiefly in the Graian Alps, which she made with a sister in 1890, ending with an attempt on Mont Blanc. This, however, owing to the storm of August 23–24, was cut short; and the writer gives a vivid description of the night in the Quintino Sella hut, and the difficulties of the descent next day.

M. Gabet in Corsica, and M. Jérôme Mital in Kabylia, carry the banner of the Lyons section beyond the limits of the Alps.

Our countrywoman, Miss Richardson, gives a short but interesting account of an ascent of the Aiguille de Bionassay, and a passage from thence to the Dôme effected by her in 1888.

M. Jean Tavernier's 'Six days in the Maritime Alps' were spent in the valleys and over the lower cols; but M. Emile Piaget, in his short paper headed 'En Oisans,' describes in some five pages the most adventurous tour which the number contains. Not only did he, on July 5, effect the first ascent of the central Pic de Neige du Lautaret (3,504 m.=11,518 ft.), but he made an attempt, frustrated by bad weather, to ascend the Meije by the route which Mr. Gibson afterwards successfully reversed, and having ascended the Ecrins by the south face, and started to descend on the other side, he was compelled, again by bad weather, to recross the summit and bivouac at a height of over 12,000 feet.

M. Paillon describes a 'tourmente' in Mont Blanc, and the attempt —unjustifiable we venture to think—which his party (comprising three ladies) made to reach the summit 'weather or no.' It is just this sort of proceeding which causes the worst accidents; and though M. Paillon's party did, by great good luck, return safe and sound, stronger parties have undoubtedly perished under very similar circumstances.

Twenty-one seems rather a large climbing-party; probably a 'largest on record,' if we except the pilgrims who go to the Roche Melon. But nothing else of note seems to have distinguished M. Claudius

* See *Alpine Journal*, vol. ix. p. 477.

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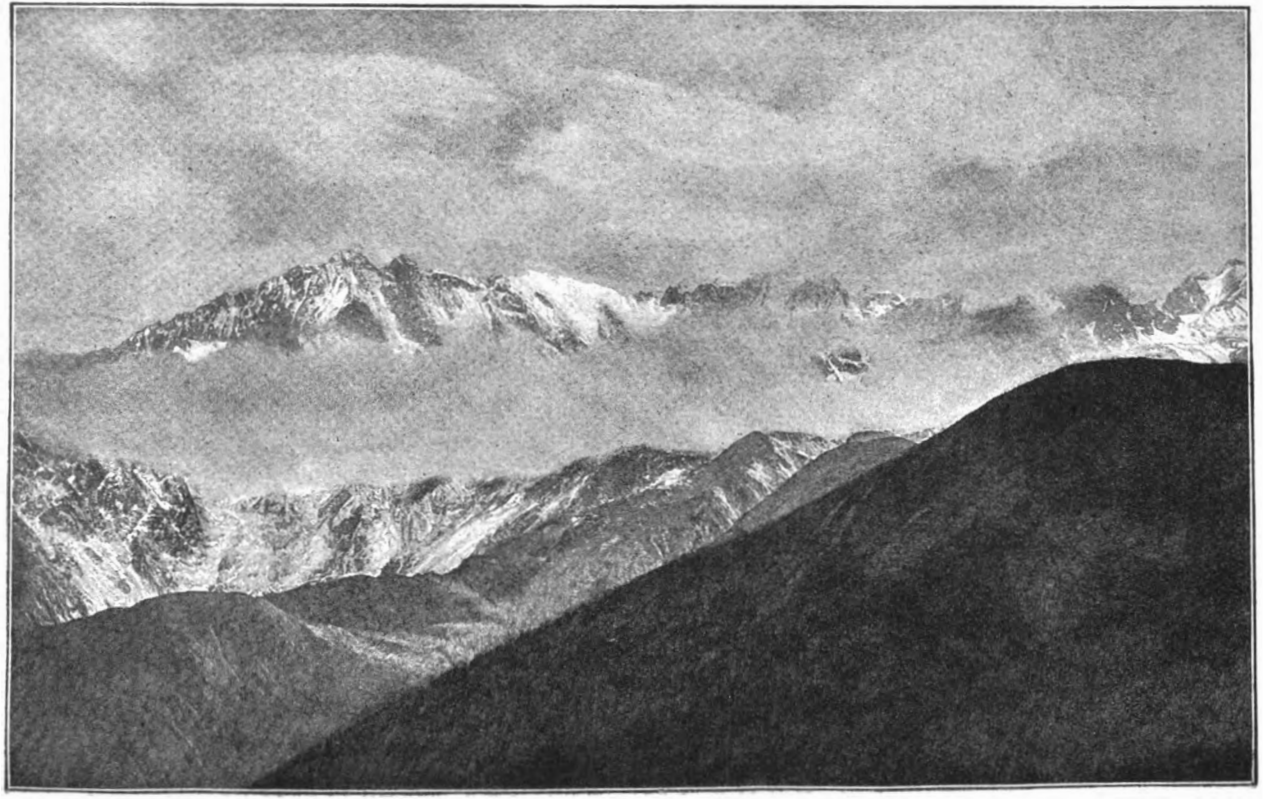

HAUNTS OF THE *Lophophorus L'Huysii* AND *Crossoptilon tibetanum*. ALTITUDE OF CAMERA, 13,520 FEET.

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Regaud's ascent of the Dome de Chasseforêt. The expedition is exceedingly well described; but that is a characteristic common to nearly all these papers.

M. Jérôme Mital closes the volume with a memoir of a former vice-president, M. Louis Vignet.

*The Snows of Tibet.* By A. E. Pratt, F.R.G.S. (Longmans.)

Though Mr. Pratt is not himself a mountaineer, and though his journey was undertaken in the interests of natural history only, his book deserves notice in this Journal as drawing attention to a district to which mountaineers may one day turn for a playground—at all events, when the Karakorum and the Himalayas are exhausted. The district in question lies at the east of the Chinese province of Szchuan, close on the Tibet frontier. It has been visited pretty frequently: Mr. Cooper was there more than twenty years ago, and during Mr. Pratt's stay in the country, M. Bonvalot and Prince Henry of Orleans passed through. Moreover, there is a permanent settlement of French missionaries at Ta-tsien-lu (8,300 feet), the principal town. But no one interested in mountaineering for its own sake seems to have been that way, and consequently we have very little information as to heights, &c. Mr. Pratt, however, seems to have reached an altitude of 15,000 feet or more in the pursuit of beetles, butterflies, orchids, and lilies, while from the views which he took (one of which, by the kindness of Messrs. Longman, illustrates this notice) it would appear that the actual mountain still rose to vast heights above him. One view given in the book, from the summit of the Mo-si-mien Pass (12,800 feet), shows what appears to be a large glacier; but the photograph (which we have seen) was unluckily not very successful, and it is difficult to be sure. At any rate, it is clear that a noble group of mountains exists in this region, and that the district is easily accessible to anyone who has time and money at his disposal, and does not mind taking his chance of being called a 'foreign devil,' and possibly, if the weather is very bad, suffering the penalties prescribed for 'rain-makers.' If the mandarin is friendly, he will be confined to the town; if not, he may be put to one of those 'lingering and humorous' forms of death which the Chinese affect. But all travel has its little *contretemps*.

*Tschingel.* Par Jean Vénéon. (Privately printed.)

M. 'Jean Vénéon' has compiled, from notes furnished by Mr. Coolidge, a short biography of a personage who certainly deserves the honour better than many who have received it. That dogs can go pretty much where men can, everyone knows, but usually the dog requires some inducement—such as the chase of possible prey—to induce it to depart from the level of ordinary life. In the case of Tschingel, however, so far as one can judge from her behaviour, the ascent of heights became a pleasure for its own sake. Nor was she ever an incumbrance to her party; so far from it that, on one occasion at least, she hit off the right line in a new descent, where the regular

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guide was baffled. Looking to the extraordinary sagacity shown, not only by dogs but by many wild animals, in finding the safest and easiest route over snowfields, it is quite conceivable that a dog might occasionally prove a useful addition to the outfit of a mountaineer. Another way in which Tschingel's instinct was utilised by her owners is thus recorded by M. 'Vénéon':—

Lorsque, au bivouac, la tente était dressée, on y faisait entrer, la première, Tschingel, qui, après quelques tours attentifs, avait infailliblement trouvé la place la moins bosselée, la moins coupée par les courants d'air, la meilleure en un mot, et s'y couchait en s'étirant; mais il est juste d'ajouter que ses maîtres se hâtaient alors de l'en chasser pour la prendre, tant il est vrai que le mérite le plus reconnu n'est pas toujours le mieux récompensé. A Anglais, Anglais et demi! [We do not see how the last remark comes in here.]

It is interesting to know that Tschingel's barking powers were in no way affected by the rarefaction of the air. On the top of Mont Blanc she 'gave tongue' quite as vigorously as at the sea-level. Nor did the glare of snow appear to affect her eyes, though her nose peeled like any biped's. That her biography should be written in French is curious, for, while she understood German and English equally well, she could never be got to own to a knowledge of the tongue in which her memory is now preserved.

*Den Norske Turistforenings Aarbog for* 1891–92.

This Norsk annual is a capital number, and proves conclusively, if proof be needed, that the 'fjelde' of Norway form a most delightful playground for the adventure-loving mountaineer, especially if he have a taste for, and the patience to overcome the difficulties of, genuine exploration.

The indefatigable secretary of the club, Captain W. Morgenstierne, has contributed two excellent papers describing a very successful campaign which he enjoyed last year, during which he climbed Knutshultind, made the wild pass of Morka Koldedal, broke new ground over glaciers at the head of Fortunsdal, then crossed the Justedalsbræ from Kronen to Næsdal, where, by reason of bad guiding, he had a very narrow escape from an avalanche. This adventure provided him with a text for moralising on town-bred ladies taking to mountaineering, as several have already crossed this fine glacier pass. After many wanderings he crossed the Folgefond snow-field on a sledge. Now this may be safe, as the crevasses are, I believe, very small, or it may not. Of one thing, however, I am certain, namely, that if sledging be introduced upon the Justedalsbræ during the tourist season, which has often been proposed, disaster will ensue sooner or later. In warm summers the glaciers in Norway become infinitely more dangerous and fickle than is the case in the Alps, because the lips of the crevasses become much more deeply undercut in the north, because the sun shines more horizontally and for many more hours during the day than it does in the south of Europe. A fortnight of warm weather often converts a spotless snow-field into a maze of crevasses.

Herr Hall has written a valuable paper on Skagastölstind. Though

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this mountain was first climbed in 1876, it has only been ascended six times since that date. There have been, however, nine or ten failures on account of bad weather or ice-glazed rocks. Herr Hall also relates an adventure on the Smörstabbræ, where he fell into a crevasse from which he was extricated with great difficulty.* Owing to a bruised knee this ardent climber was not able to secure so many victories last year as he is wont to do.

There is an 'In Memoriam' notice of the death of Herr Emanuel Mohn, accompanied by an excellent portrait, and a letter by the present writer, who had the privilege of making a long tour in his company in 1876, and for many years enjoyed his close friendship. Though never very strong, Mohn, during a period of twenty years, climbed an immense number of mountains, and explored, before the days of comfortable tourist huts and well-bridged rivers, the wildest tracts of the fatherland of which he was so justly proud. Mohn had a marvellous topographical ability, was an excellent sketcher, and had the rare power of being able to describe most accurately, and in the most charming manner possible, the details of a complicated mountain expedition. His enthusiasm on the mountains was boundless, and he succeeded, as few others could do, in instilling much of this enthusiasm into the breasts of hundreds of the young, middle-aged, and old people of Norway. The loss to the Turistforening has indeed been great.

Herr P. A. Öien has contributed a paper on the variation of temperature at great heights, but, unfortunately, he had no contemporaneous observations at other places, with which to compare them. Very probably, before long, several high meteorological stations will be established in various parts of Norway.

Herr Bredo Berg describes an ascent of the Hardanger Jökul, and Herr Hugo Samzelius has added an interesting paper on sledging in Lapland in winter, and life among the Lapps.

With his usual courtesy, the editor has permitted several English papers to be inserted in the 'Aarbog.' One, by Mr. B. Goodfellow, is a most welcome addition to Norsk-Alpine literature, and is well illustrated. This gentleman and friends began their campaign by climbing the Romsdalshorn and other mountains in that district; then they visited and crossed the Justedalsbræ, combining with it an ascent of the Lodals Kaupe. Finally they climbed Skagastölstind, and they found there four hours of rock-climbing, where ice-glazed rocks gave them considerable difficulty. Though this mountain was first ascended by the present writer, no other Englishman has been on the summit until Mr. Goodfellow's party reached it last year.

Mr. Hoddinott, who was singularly successful in Norway last year, has added a paper to the 'Aarbog.' Unfortunately, he has merely recorded, without describing, his adventures, which is a great pity. There are two or three other English papers, in one of which the

* Another party met with an accident on the Gjertvasbræ which nearly proved fatal—the result of a man slipping on a steep snow-slope, presumably from the absence of nails in his boots.

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writer describes the ascent of a new peak, which, though probably not recorded, was climbed about twenty years ago.

Two other men, one Norsk, the other English, give lessons in globe-trotting, which we trust will not be followed by others.

The 'Aarbog' is admirably illustrated, and well worth the perusal of all who visit Norway. The Turistforening do their work now almost too well. The mountain huts are in reality capital little inns, and may even be termed luxurious. They are, of course, a great boon to the mountaineer, who can now climb four or five fine peaks where a dozen years ago he could only climb one, because it was formerly needful for him to keep descending to the valleys for provisions and decent shelter. Some of the mountain paths are now too good, and it is true that, though bridges are often very welcome, yet their erection has removed one item of adventure, and often of real good fun, from a visit to the wilds. W. C. S.

*New Zealand Alpine Journal.* (Christchurch: Whitcombe & Tombs.)

We must congratulate our brethren at the Antipodes on the birth of their journal. Its appearance is a credit to colonial typography, and its contents, both in style and matter, promise well. A country where the mountains are like Alps with the bottom 3,000 feet removed ought, indeed, to produce a good race of climbers; and the day may yet come when the Harry Birleys and Geordie Grants of the future, developed into regular guides, may, like professional cricketers, follow the summer from side to side of the globe in the exercise of their craft.

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