

TRAVELS AMONG THE GREAT ANDES OF
THE EQUATOR.¹

MR. WHYMPER'S expedition to the Great Andes of Ecuador, occupied him from December 1879 to July 1880. The results were briefly indicated in communications to the Royal Geographical Society and the Alpine Club, but the full description has been long in coming. Horace recommended giving literary work nine years to ripen: Mr. Whymper has more than followed his advice. Possibly the delay may be a mistake from a commercial point of view, but it is a gain to the readers when a book of travel in an interesting region is not written in a hurry and rushed through the press, but is rendered complete in every detail with an almost loving care.

The principal object of Mr. Whymper's journey was to observe the effect of greatly diminished atmospheric pressure on the vital powers. There was already very strong cumulative evidence that, at elevations of rather more than 14,000 feet above the sea, serious inconveniences were often felt, such as difficulty of breathing, acute headache, a sense of extreme prostration, and sometimes hæmorrhage. Some of the symptoms, some of the suffering on record,

forbade travel in the very highest region of the Andes, so that ultimately the mountains of Ecuador were selected as the most lofty accessible district.

Chimborazo being the culminating peak of this group, the ascent of this was the main object of Mr. Whymper's expedition. He determined to encamp on its slopes at gradually increasing heights, with the aim of ultimately reaching the summit. "But as there was no certainty that this could be done, and a possibility, at least, that the results of the investigation might be of a negative character, various other objects were kept in view; chief among them being the determination of the altitudes and relative positions of the principal mountains of Ecuador, the comparison of boiling-point observations and of aneroids with the mercurial barometer, and the collection of specimens, botanical, zoological, and geological, at great heights." Mr. Whymper was accompanied by two Alpine guides—one being the well-known Jean-Antoine Carrel, of Val Tournanche, whose sudden death on the Matterhorn in 1890 was so generally regretted among mountaineers; the other, his cousin Louis. Of their services and willing help at all times, he speaks in the highest terms. Chimborazo had been attempted without success by Humboldt and by Boussingault; Cotopaxi



FIG. 1.—Crossing the Great Arenal.

might doubtless be attributed to other causes; still the connection between "mountain-sickness" and diminished air-pressure appeared to be indubitable. The problem had already been investigated, so far as could be done in the laboratory, by M. Paul Bert, and an account of his experiments forms an appendix to Mr. Whymper's book. Balloon ascents also had been made, one with disastrous results; for of three aëronauts who had remained for some time at a height of from 26,000 to 28,000 feet, two had died, and the other had narrowly escaped with his life.

But a balloon ascent is an unfairly severe test, since the atmospheric pressure is so rapidly diminished; so Mr. Whymper determined to encamp for some time at an elevation at which others had begun to suffer, and from that level to "carry exploration and research up to the highest possible limits." The Himalayas were at first selected as the place for these investigations, but, before he could start, the attempt to construct a "scientific frontier" aroused so many jealousies that, in all probability, the experiments and the life of the operator would have been simultaneously cut short. War also

had been ascended, but very few of the other high peaks in Ecuador, though many measurements of altitudes had been made by Drs. Reiss and Stübel in 1871-73, who kindly placed their results at Mr. Whymper's disposal.

Mr. Whymper spent 212 days in the upland or mountain district of Ecuador. During 204 nights of this period the barometer never gave a reading higher than 22.51 inches, or the observers were over 8000 feet above sea-level; during 90 of these it ranged from 21.72 to 21.11 inches (9000 to 10,000 feet); during 36 it was 18 inches or less (above 14,000 feet); during 19 it stood between 16 and 17 inches (15,801 to 17,285 feet); and on one night the reading was 14.75 inches, corresponding with a height of 19,500 feet. He landed at Guayaquil on December 9, and reached Guaranda (nearly 9000 feet above the sea) after crossing the Pacific range of the Andes, of which Chimborazo is the culminating point, by a pass about 10,400 feet above the sea. In preliminary explorations on that mountain Mr. Whymper ascended to a height of about 12,900 feet, and his guides, on another occasion, to about 16,500; and his party left Guaranda to attempt the ascent on December 26. They passed the first night at a height of 14,375 feet, on the great sandy plain known as the Arenal, without feeling the slightest inconvenience

¹ "Travels among the Great Andes of the Equator." By Edward Whymper. With Maps and Illustrations. (London: John Murray, Albemarle Street, 1892.)

ished pressure, and next day pitched the second camp at a height of 16,664 feet (pressure 16.5 inches). This was reached without inconvenience, but the mules during the last six or seven hundred feet of the ascent had shown marked and unusual signs of exhaustion. Mules and drivers were sent back, and the explorers remained in excellent health and spirits, but about a couple of hours afterwards all three were suddenly and almost simultaneously prostrated; their respiration became laboured, "accompanied by spasmodic gasps or gulps," they suffered from acute headache, with feverish symptoms, and an "indescribable feeling of illness pervading almost the whole body. . . . The attack seemed to arrive at a maximum quickly, to remain equally intense for several hours, and then it died away imperceptibly." In about 36 hours the Carrels got better, and felt well enough, on the

Carrel was suffering severely from the effects of frost-bite.

How the investigation was continued may be read in the book. In addition to excursions to lower points, Mr. Whympster, with one or both of his guides, ascended the following mountains: Corazon (15,871 feet), Cotopaxi (19,613 feet), where they encamped for the night, close to the brink of the crater, Pichincha (15,918 feet), Sincholagua (16,365 feet), Antisana (19,335 feet), Cayambe (19,186 feet), Sara-urcu (15,502 feet), Cotocachi (16,301 feet), and Carihuairazo (16,515 feet), all but the first three being new ascents. The Carrels also reached the summit of Illiniza (17,405 feet), and on two other occasions Mr. Whympster arrived within a few hundred feet of it. The expedition concluded with a second ascent of Chimborazo, when the travellers were favoured with better weather,

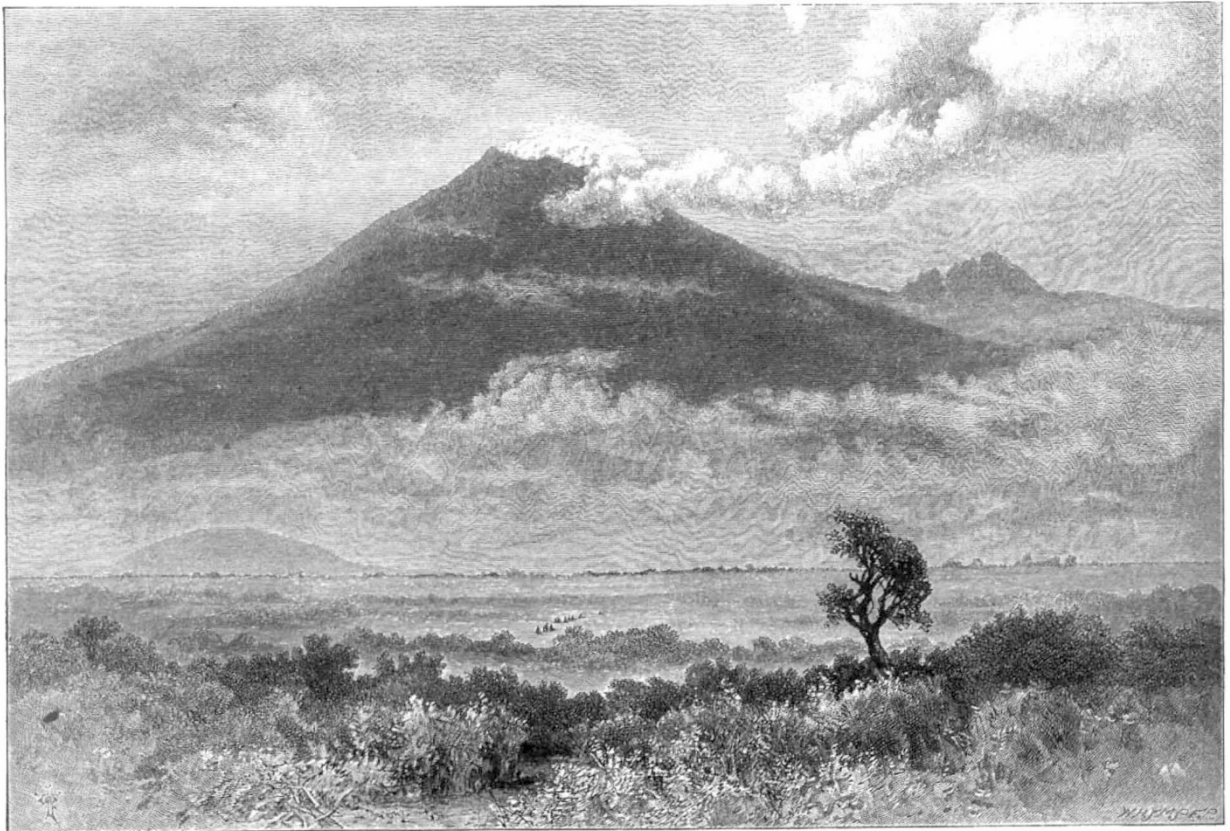


FIG. 2.—Cotopaxi.

29th, to set off for a preliminary exploration; they reached a height of about 19,300 feet, but were much exhausted when they returned in the evening. Mr. Whympster recovered rather more slowly, but during the whole time Mr. Perring, a native of the country, who remained with them at the camp, was unaffected. On January 2 they moved on to a height of 17,285 feet, and after an attempt next day, frustrated by bad weather, which appears to be almost chronic in the mountains of Ecuador, reached the summit (20,498 feet) on January 4. The weather was still unfavourable, and the work laborious, but they progressed more slowly than they would have done under similar circumstances in the Alps. They remained at the camp till January 10—for Mr. Whympster contemplated another visit to the summit under more favourable conditions—but were then obliged to return to Guaranda, as Louis

and with an exceptionally interesting incident. As they were mounting the slopes, Cotopaxi was full in view, nearly sixty miles away. Suddenly it ejected a column of "inky black smoke" to a height of about 20,000 feet above the lip of the crater. At this elevation the cloud was caught by an easterly wind, and borne at right angles to its former course; then it was taken by a northerly current and carried down upon Chimborazo. When the party reached the summit, at 1.20 p.m., the snow was still perfectly white; but, before long, the dust began to fall thickly, shutting out all view, penetrating into instruments, and adding an unpleasing condiment to their food. It had taken rather more than 7½ hours on its aerial journey. During these excursions, neither Mr. Whympster nor his guides suffered any return of the severe symptoms which they had experienced on the flanks of

Chimborazo ; but he proves, by his careful and elaborate observations, that, though they became somewhat habituated to low barometric pressures, their bodily powers were sensibly diminished. In his own case this appeared to begin at a pressure of about 21 inches (roughly, 10,000 feet above the sea). He comes to the conclusion that, after some habituation, life can be sustained, when the body is at rest, at a height of 20,000 feet or more ; but "when in motion it becomes difficult to enlarge the breathing capacity to the extent necessary to meet the further demand for air which was the result of muscular exertion"¹

During these laborious expeditions Mr. Whymper was constantly occupied in carrying out the other objects of his journey. The physical geography of the region was studied, sketch maps were constructed, and many specimens of rocks and volcanic dust were collected, espe-

Cyclopium cyclopium), which he does not believe to be ejected from Cotopaxi. These have been examined by various specialists, whose reports are summarized in the work, and some of them are collected in a supplementary volume, which will receive a separate notice. Mr. Whymper also made an interesting collection of stone implements and of ancient pottery, of which many specimens are figured. In one of the appendices he discusses the results of observations of mercurial and aneroid barometers. These, though of much interest, we must pass over.

In the space at our disposal it has been impossible to do justice to the varied topics of this volume. It must suffice to remark that Mr. Whymper has more than maintained the reputation which he won in his well-



FIG. 3.—The contents of a grave.



FIG. 4.—"This is very old, Señor."

cially from the higher points. The mountains (except Sara-urcu, the rocks of which are crystalline schists and gneisses) all consist of volcanic rocks, varieties of andesite. Cotopaxi and Sangai are still active ; in some of the others, even the craters cannot be distinguished. The glaciers were carefully observed, for Mr. Whymper has proved that, contrary to the received statement, glaciers are by no means rare in the Ecuadorian Andes. Botanical and zoological collections were made, especially from the higher localities. Lichens were found as high as 18,400 feet, mosses to about 16,660 feet, grasses nearly as high, with a few Phanerogamous plants ; the highest *Lycopodium* found was at 15,871 feet. *Coleoptera*, *Orthoptera*, *Rhynchota*, and *Lepidoptera* were all found at or a little above 16,000 feet, and *Arachnida* nearly as high. *Crustacea*, *Reptilia*, and *Batrachia* are rare ; and Mr. Whymper could only obtain one fish (the noted

known "Scrambles among the Alps." The present work is admirably written, clear and terse in style, and often enlivened with a spice of dry humour. Of the illustrations it is almost needless to speak ; they are even better than those in the former book. Some are delightful renderings of comic incidents ; others represent stone implements, pottery, insects, and various examples of the Ecuadorian zoology ; others are pictures of the mountain scenery, including the upper part of Chimborazo and the summit crater of Cotopaxi. The book, in short, is not only a record of pluck and endurance (for the hardships, lightly as they are treated by Mr. Whymper, were often great), but also a literary success, and a contribution to science of no small value.

T. G. BONNEY.

SCIENCE AT THE ROYAL MILITARY ACADEMY.

MANY of our readers will have seen that on Thursday last Sir Henry Roscoe asked the Secretary of State for War whether the military authorities were aware that at present it is possible for a cadet at the Royal Military Academy to pass through the course of work required of him successfully, and even to win admission to the Royal Engineers, without gaining a fair elementary knowledge of any branch of experimental science, and whether Mr. Stanhope would investigate and remedy this evil.

¹ I have never suffered (when otherwise in good health) from mountain-sickness in the Alps, but have often observed that I got "out of breath" more quickly in ascending peaks above 10,000 or 11,000 feet. This was especially noticed in an ascent of the Matterhorn, when, owing to threatening weather, I went as fast as possible up the last thousand feet or so.

We understand that this step has been taken by Sir Henry Roscoe because the disadvantageous position of cadets who have entered the Royal Military Academy with a knowledge of science as compared with the position of those who have offered a second modern language at the entrance competition,¹ makes it increasingly difficult to maintain science studies in the Army sides of public schools. It may also be expected before long to have the effect of seriously diminishing the proportion of officers in the scientific branches of the Army who have had the advantage of such a prolonged study of experimental science as was admitted to be desirable when this subject was discussed a few years ago.

The answer made by Mr. Stanhope was partly of a satisfactory character and partly not so. He undertook to investigate the subject to which his attention was

¹ Usually, we believe, the second selection is German.