



Sir W. Martin Conway, photo.

ACONCAGUA FROM THE SMUGGLERS PASS.

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THE SOUTHERN ANDES : AN OROGRAPHICAL SKETCH.

By SIR MARTIN CONWAY.

MUCH ignorance still prevails about the orography of the great western chains of South America, which traverse the continent from Panama to Cape Horn. By mere chance, several years ago, my interest was attracted to their southern portion, but I found it quite impossible to attain any kind of general knowledge about its character, its anatomy, its glaciation, or the accessibility of its various parts. The Chilean and Argentine Governments, in consequence of the dispute about their common frontier, have sent several expeditions up to the edges, and sometimes even into the heart, of the mountains in recent years ; but the results of these expeditions have only been partially published, and in a form not very accessible to English students. Now, however, this mass of material is being made available, and I owe chiefly to the instruction of Dr. Moreno, and the paper recently read before the Geographical Society by Dr. Hans Steffen, the information sketched in the present article.

Before proceeding to discuss the main subject of this article let a word be written about the accompanying view of Aconcagua. It is the only existing photograph of the mountain that clearly shows the routes followed in Mr. Vines' and my ascents respectively, and it has not yet been published. It was taken by the Argentine Boundary Commission from a pass in the watershed a few miles N. of the Cumbre, and approximately S.E. of the mountain. On the left is accordingly seen the great N.W. face from a level of about 18,000 ft. upwards. It should be compared with the photograph facing p. 91 of FitzGerald's book, and some-

VOL. XX.—NO. CXLVIII.

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what unfortunately entitled 'The Summit of Aconcagua.' The little bands of rock-face, or 'palisades,' will be recognised easily in both, and the three main couloirs leading through the top cliff to the summit ridge. In neither photograph is the highest point seen, but only the second summit. In the accompanying photograph the highest point is almost exactly behind the second. FitzGerald's highest camp was situated on the left of the great slope, close to the point where it is cut by the nearer ridge. On the right of the face, just above the nearer ridge, is a wall of rocks, which are conspicuously red in colour. My camp was just above them, behind the little teeth that stand up about two-fifths of the way from their left end. Vines' route was up the left side of the face, just below the rocks, to the foot of the final buttress, and then up the gully beside that buttress. My route was up the right side of the face, and up the second or nearer of the two gullies whose openings are prominently seen. Careful inspection will show the foot of a third less direct gully, which leads to the lowest point between the two great peaks. When FitzGerald and Vines return from serving their country in South Africa I hope to get them to dot in their route accurately for the information of future travellers, it being, in my opinion, the better way.

For some distance N. of latitude 32° S. the main range does not rise to any very high altitude above the level of the elevated region on which it stands, but from 32° to 35° S. there are a series of very high mountains, of which Aconcagua is the chief. The northernmost peak of the group is Mercedario (22,300 ft. or more), a great snow-mountain. After several lower but yet big peaks comes Aconcagua (23,392 ft.),* and then Tupungato (22,408 ft.), the only two important peaks in the group that have been climbed. S. of Tupungato are the Bravard (19,619 ft.), San José (19,849 ft.), and a nameless snow-peak (18,537 ft.), and finally, Maipu (17,556 ft.), which was climbed by Dr. Güssfeldt in 1883. Between them are other peaks of considerable altitude, and passes about 13,000 ft. in height. At the Maipu Pass (11,433 ft.) the high range comes to an end. All the high peaks are of volcanic formation, and those to the S. mostly maintain the rounded and, to a mountaineer, relatively uninteresting volcanic form. But from Mercedario to Tupungato the

* The altitudes here given are the latest of the Argentine Government survey. Mr. FitzGerald's careful measurement of Aconcagua made it 23,100 ft. high.

mountains are precipitous and craggy, decked with great glaciers, and with avalanche slopes gouged out by the sun into *nieves pendientes*. It is probably easiest, in a general sense, to approach this group from the Chilean side, excepting, of course, the mountains near the main trans-Andean route. The base of operations, at any rate, should be Chile.

The next great division of the range is defined by the Maipu Pass on the N. and the Las Damas Pass (9,514 ft.) on the S. Its principal heights are the Bayo (16,370 ft.) and Castillo (16,535 ft.) peaks, there being several other mountains from 13,000 ft. to 16,000 ft. scattered along, with passes of 12,000 ft. and upwards. There are several parallel ridges, and the orography is rather complicated. The whole region is capped by volcanic deposits, but most of the separate volcanoes here stand on the W., instead of, as further N., the E. side of the main chain. Summits appear to be of more broken form, with very splintered crests. Glaciers are inconsiderable in number and dimensions. Chile is the better base for the exploration of this district, though the W. is the bad weather side of the range. From Valdivia to the Straits of Magellan the Pacific slope is terribly rainy, the maximum fall probably taking place about lat. 44° S. The wide and easy Las Damas Pass has been suggested as a convenient route for a trans-continental line of railway connecting the R. Colorado and R. Grande valleys with the Chilean province of Colchagua. There is little doubt that it will be constructed some day.

From Las Damas Pass to Lake La Laja, or rather to the Copahue Volcano (9,787 ft.) in the latitude of Los Angeles, a little S. of Concepcion, is the next convenient division of the range, which is still a complicated mountain area of many ridges. Few of the peaks rise above 10,000 ft. An interesting group, well worthy, I am told, of careful exploration, is formed by Mounts Planchon (12,762 ft.), Azufre (12,382 ft.), and Peteroa (13,297 ft.), N. of the Valle Grande Pass (7,490 ft.); whilst the splendid Mount Campanario (13,140 ft.), a tower of jurassic rock with a volcanic cap, must not be forgotten, nor the fine, somewhat isolated snowy Longavi, situated to the west of the main chain, though only 10,430 ft. A solitary exception standing out alone to the E. of the chain is the Domuyo volcano (13,983 ft.) in latitude 36° 40' S. Passes about 8,000 ft. high are very numerous across this part of the chain. Owing to the greater rainfall on the W., the rivers falling into the Pacific have eaten their way back into the soft jurassic beds, so that

the watershed now lies some way to the E. of the line of big peaks. Here also isolated volcanoes stand at intervals on the W.

At Mount Copahue the range bifurcates, the western branch being presently cut through by the Bio-bio river, which has eaten its way back and robbed the head-waters of a branch of the river Limay. Originally what is now the upper valley of the Bio-bio poured its waters southward over the present Arco Pass and down the Alumine and Collon Cura valleys into the Rio Limay. The E. range comes to an end near latitude 39° S. The district may be described as a granitic plateau, flanked on the W. by volcanoes, and on the E. by jurassic and cretaceous formations. It is in this division of the range that the dense forest, nourished by the continual precipitation of moisture from the damp south-western air current, begins to clothe the Pacific side of the range, making the approach to it exceedingly difficult, so that from about latitude 38° S. the base of exploration shifts from the Chilean to the Patagonian side. The valleys and plains to the E. all the way from Copahue to the Straits of Magellan form an admirable base for a mountain explorer. Guanaco, ostrich, and other game is plentiful. Estancias belonging to Argentine, American, Welsh, German, and English colonists are becoming more numerous every year. The scattered Indians are good people; the climate is delightful for open-air life--in fact, a mountain explorer could hardly imagine a more agreeable field for the exercise of his energies. The most interesting route of approach from Central Chile is by the valley of the Bio-bio river, the Arco Pass and the Alumine, Colon Cura and Limay rivers to Lake Nahuel Huapi. But from Port Montt a quicker and far more beautiful route leads by road to Lake Llanquihue; thence by a steamer to its eastern end, whence a road leads eastward in 2 hrs. journey to Lake Todos los Santos, with another steamer. A short voyage along this beautiful lake to its north-eastern extremity lands the traveller at a German hotel, an excellent climbing centre. Thence a track leads eastward, amidst magnificent scenery, along the N. base of Mount Tronador (11,155 ft.), and over a low pass to Puerto Blest on Lake Nahuel Huapi. Tronador is described as a stately structure crowned by three outstanding summits and draped with half a dozen fine and steep glaciers. It appears, in photographs, a most attractive peak. From Copahue southward the average height of the mountains is about 9,000 ft., though many rise above that level, such as the Villa Rica (9,393 ft.), Quetru Pillan (7,782 ft.), and Lanin

(12,882 ft.) volcanoes. The last was climbed by Señor Hauthal, of the La Plata Museum, who photographed the panorama from the summit. The mountains topped with lava are splintered in character and decked with glaciers. Now begins on the E. side of the range a long series of lakes, many of them formed by moraine dams, which are so characteristic of the western margin of Patagonia.

The range from Mount Tronador to about 46° S. may be described as consisting of Swiss-like mountains, with glaciers ever more numerous and larger as they stand farther S. The peaks do not average above 8,000 ft., but the towering Mount Minchinmáhuída, overlooking the Corcovado Gulf, is stated to have an altitude of 7,907 ft., and Mount 'San Valentin' rises to 12,716 ft., not far from Lake Buenos Aires. The range in all its width is cut right through by the Rio Huahum (latitude 40° S.), and thenceforward to the S. by many other streams emptying into the Pacific, which, in process of time, have eaten their way back and robbed the head-waters of the less amply rain-fed Patagonian rivers, or obtained access to lakes originally drained eastward. Three chief centres for the exploration of this part of the Cordillera are Lake Nahuel Huapi, the Valley of the 16th October, and Lake Buenos Aires. On both lakes there are steam launches, and about all three centres are fairly numerous settlements of civilised men, whilst the scenery is everywhere superb, and the weather, on the E. side of the range at any rate, much the same as we are accustomed to in the Alps. Supplies are easily obtained, and there is plenty of game to fall back upon if other sources chance to fail. A good description of all the eastern side of this part of the range will be found in Dr. F. P. Moreno's 'Notes Préliminaires sur une Excursion aux Territoires du Neuquen, Rio Negro, Chubut et Santa Cruz' (La Plata. 1897. 8vo.).

South of Mount San Clemente, between it and Baker Channel (Calen inlet), which enters the Gulf of Peñas at the mouth of Messier Channel after completely penetrating the Cordillera, there stands a great unexplored glacier mass, 80 miles long by 30 wide, with Mount San Valentin rising in the midst of it. This elevated ice-sheet is only broken across by one deep depression, the unexplored valley of the River Exploradores. On the E. the glaciers descend towards Lake Buenos Aires (an excellent base for their exploration) and the Rio Baker, but it is on the W. side that they are most remarkably developed. There they actually descend into the Gulf of Peñas and the head of the wonderful Moraleda Channel.

This channel was formerly continuous with the Gulf of Peñas, but a moraine deposit has now formed the low Ofqui isthmus across it, which unfortunately unites the Taitao land mass to the main, and renders it a peninsula instead of an island. But for the existence of this isthmus (so narrow that canoes can easily be dragged across it) there would be a continuous inland sea channel from Port Montt, at the head of the Corcovado Gulf, to the Straits of Magellan. Perhaps the most interesting expedition that remains to be made in South America is this: Start in a boat from Port Montt with a party of the excellent Chilotes—men of Chiloe and Reloncavi, who are good boatmen and porters—and sail to the Lago San Rafael, at the southern extremity of Moraleda Channel, through superb scenery. This lake is a wonderful spot. A great glacier actually debouches in it, and there are others close at hand. ‘Nothing grander can be conceived,’ writes Dr. Steffan, ‘than the sight enjoyed by the eyes of the explorer in these places; nothing more striking than the contrast offered by the blue-white colour of the icy streams protruding from large openings of the Cordillera with the sombre hue of the rocks and cracks of the latter, the ashy green of the lake, and the deep green frame of the surrounding forests. The ice blocks, that become detached at every moment from the front of the San Rafael glacier, float on the lake, and are transported through its river outlet to the neighbouring estuary.’ From this centre it would be easy to explore the W. side of the San Valentin range. That work accomplished, and a suitable pass found, the boats would be sent back to Port Montt, and a crossing boldly made to Lake Buenos Aires, the base for the exploration of the E. side of the mountains.

From Baker Channel southward the great snowfields succeed one another in a long procession, many of them resembling the Svartisen Glacier of Norway. The principal peaks S. of St. Valentin are San Lorenzo, or Mount Cochran (12,081 ft.), in latitude $47^{\circ} 40'$; Mount Fitzroy (11,089 ft.), a peak of remarkably precipitous form; Mount Agassiz (10,433 ft.); Mount Stokes (8,860 ft.), in latitude $50^{\circ} 50'$; and Mount Geikie (9,800 ft.), N.W. of Last Hope Inlet. The farther S. one goes the more does the bad weather from the W. reach over the eastern slopes and ridges, but the glacial phenomena correspondingly increase in magnificence. The mountains at the head of the three great lakes, San Martin, Viedma, and Argentino, are said to be particularly fine; magnificent glaciers descend into all three lakes and

beautify their waters with numerous small white icebergs. There is a great glacier pass over a considerable ice-sheet leading from Falcon Inlet of Eyre Sound to Lake Viedma; and in general it may be said that glacier tongues descend in or close to all the chief inlets that branch from Smyth Channel into the continent. Even more magnificent is the scenery of the labyrinth of fiords leading from Smyth Channel to Last Hope Inlet, where the cliffs are precipitous, the summits of the peaks generally buried in a dark roof of cloud, which sheds a mantle of majestic gloom over the deep-lying channels of the sea. At the very head of Last Hope Inlet stands Mount Balmaceda; the snow-field resting in its lap pours down a splendid ice-fall to the waters. Last Hope Inlet can be reached overland from Sandy Point by four days' riding on the grassy pampas, and four days more will carry the traveller thence to Lake Argentino, where the weather begins to be a little better than farther S., and a season of excellent mountain exploration may be obtained. Both Lake Argentino and Lake Viedma are accessible in three days' hard riding from Santa Cruz. Seeing that Sandy Point is in direct communication with England by several lines of steamers, and that it is a town where horses can be bought, men hired, and stores of all sorts obtained, it is not improbable that these mountains may attract some explorer before many years are past. To the geologist they are exceptionally interesting, not only for the extraordinary development of tertiary beds rich in fossils, and the cave remains of recently extinct mammals, but also for the extent and puzzling intricacy of the moraine phenomena. At the time of glacial extension the whole of this southern range was smothered in an enormous accumulation of ice, which completely buried out of sight the lower ranges to the W. It is the moraine phenomena of the easterly extension of these glaciers at their various stages of retreat that are specially deserving of careful study.

THE HIGH PYRENEES.

By HAROLD SPENDER.

(Read before the Alpine Club, June 6, 1899.)

IN these days of the remote and the colossal, when no travels are complete without their tale of suffering or torture, and the level of noteworthy climbing is steadily