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Southern Peru: Notes on Two Expeditions. I. Regions of Sandia and Carabaya, and Lake Titicaca

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the idea which is behind recent legislation in regard to friendly societies and savings-banks for those who are able to save, and old-age pensions for those whose lot in life and whose misfortunes have prevented them acquiring a competence sufficient to give some sort of ease to their declining years.

I may say it has afforded me the very greatest pleasure to listen to Prof. Gregory, and I am quite satisfied that his paper, whether it is appreciated in this country or not, will find in Australia the very warmest acceptance. He is most accurate, so far as I know, in all his facts, and the picture he draws of Australia is one which I very much welcome. I believe what he has said will do an enormous amount of good, because he comes to Australia as an unprejudiced spectator, with just the knowledge which well-informed men have. He studied our customs, he studied our occupations, and brought back with him a most favourable impression, and an impression which is most gratifying to us who are natives of that great continent.

The Hon. J. GREELEY JENKINS (Agent-General, South Australia): I should be violating one of Australia's social laws were I to speak—the eight hours' principle. I do not wish to do that. However, for just a moment, I will take the opportunity of thanking the professor for the interesting paper that we have listened to to-night, and I would like to take the opportunity, also, of pointing to my friends, Sir John Forrest and Sir Horace Tozer, as two examples that Australian climate does not kill white men. Sir John passed from the driest part through the hottest part of Australia. That was thirty years ago. Look at him now! If you have in this beautiful climate of England any brighter or more healthy specimen, in the language of the Americans I might say, "Trot him out." I am not going to dwell on anything in relation to foreign labour—that has been discussed in this country; but there was one remark made, either by the lecturer or one of the speakers, that, coming from Australia, I strongly emphasize; that is, we ought to have a fairly good idea of what we want for ourselves. All we ask is that we shall have the privilege of making our own laws.

The PRESIDENT: I feel sure that you will all join in a most hearty vote of thanks to Prof. Gregory for the admirable geographical paper he has given us, and also for the political additions to it, and that you will include in that vote of thanks Sir John Forrest and others who have given us so interesting a discussion upon Prof. Gregory's paper.

Prof. GREGORY: I would like just to thank you very heartily for your kind vote of thanks, and especially for the kind remarks made by the President, Sir John Forrest, and the Agents-General. I am sure if my paper has had no other results than that of producing the valuable statistics of Mr. Coghlan, the trouble will be thoroughly repaid. I might remark that I think the final part of my paper was not so much political as economic. If it is not economic geography, I do not know what economic geography means. Unless one considers labour questions, it is impossible to estimate the value that can be made of the raw materials.

SOUTHERN PERU: NOTES ON TWO EXPEDITIONS.

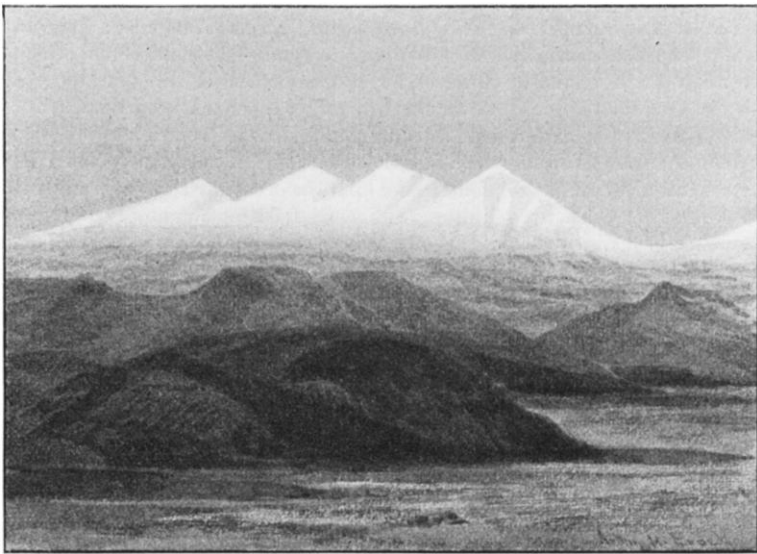
By C. REGINALD ENOCK, F.R.G.S.

I. REGIONS OF SANDIA AND CARABAYA, AND LAKE TITICACA.

EARLY in August, 1904, I left Lima with the object of examining some ancient gold-mines in the interior of Peru, beyond the Andes, upon the headwaters of the river Inambari. The river is an affluent of the

great Madre de Dios river, which forms part of the fluvial system draining the western portion of the watershed of the Amazonian basin, and which, rising in the Andes near the boundary of Peru with Bolivia, unites with the river Beni, and under the name of the river Madeira falls into the Amazon.

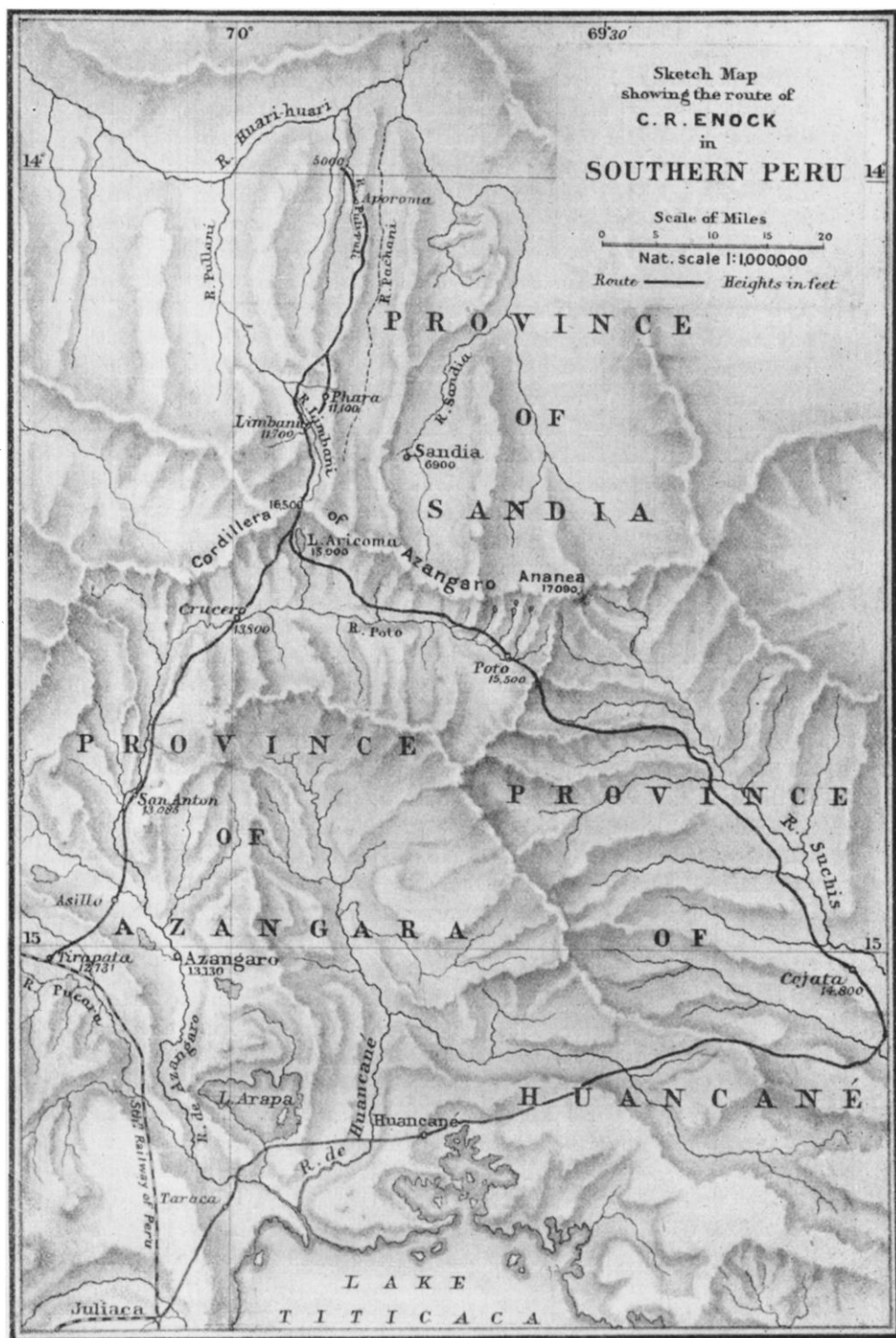
Three days' steaming from Callao brought me to the port of Mollendo, whence the southern railway of Peru, *viâ* Arequipa, took me to the station of Tirapata, a distance of 337 miles by train. The railway crosses the Andes at a height above sea-level of 14,666 feet at "Crucero Alto," and descends thence into the basin of Lake Titicaca. It then runs north-westerly to the station Sicuani, from which point con-



PEAK OF CORAPUNA.

struction work is now being carried out in order to complete the connection to the old Inca capital of Cuzco. Looking westward from the railway near the summit—Crucero Alto—a glimpse is obtained of the peak of Corapuna, of unknown height, but which, judging by its considerable ice-cap, must be of great elevation. The accompanying view is not taken from this point, however, but from much nearer the peak, on a subsequent journey.

The elevation of Tirapata, where I exchanged the train for the saddle, is 12,731 feet. It is surrounded by the vast stretches of flat land, or pampa, which extend north-westerly from the shore of Lake Titicaca along the Pucara and Azangaro rivers. Save at mid-day, when the sun shines strongly, the region is cold and bleak, and the air rarefied, due to the altitude. From the same cause cereals and alfalfa



do not flourish, and the chief product is that of potatoes, and the principal industry among the Indian inhabitants that of breeding alpacas and sheep for their wool, and llamas as beasts of burden.

The first three days of my journey was performed over a new road which had been constructed by an American mining company, and on the third night I arrived at the town of Crucero, 13,800 feet. From this point the road becomes very rough and broken, due to the steep ascent to the main summit of the Andes, known at that part of its course as the Cordillera of Azangaro. The name "Azangaro," I may mention in passing, is that of a town on the river of the same name, and is stated to be a corruption of a Quechua word meaning "the farthest away," and it is supposed to be the furthest westerly point—the Cordillera—dominated by the Inca *régime*.

The road crossing the summit skirts the shore of a large lake—Lake Aricoma—whose green and blue profundities reflected the peaks, covered with perpetual snow, which arise immediately upon its eastern verge, and whose glaciers give birth to the constant streams which feed it. The altitude of this beautiful lake is about 15,000 feet above sea-level, and the road ascends to about 16,500 feet shortly beyond, crossing a portion of the ice-cap. I again passed this point upon my return journey, and shall further speak of it. To the north-west are seen some of the snow-clad peaks of the Nevado de Vilcanota, a colossal range.

This summit of Aricoma marks the water-parting of the continent, the southern side forming that of the watershed of Titicaca, whilst the northern is that of the Amazonian basin. The usual Andian storm came on as I descended, and, pelted, battered, and soaked with rain and snow, arrived at nightfall at the village of Limbani, 11,700 feet altitude, and lodged at the house of the "gobernador." Here I met a Peruvian engineer, bound for the same place as myself, and we decided to make the journey in company to my objective point, known as "Aporoma," where the gold-mines are found.

Having overcome the difficulties and delays which are the invariable accompaniment of the organizing of an expedition in Peru, we set out in the early morning on the last day of August. The expedition included ten Indians, armed with machetes, etc., and carrying heavy packs consisting of our bedding, implements, and food for three weeks' journey, for the route lay through an uninhabited region where no supplies could be obtained. Nine of these Indians were the usual Cholos of the Sierra, whilst the tenth was a "Chuncho," of the—reputedly—cannibal tribe of that name, inhabiting the far interior of the Montaña. Nevertheless, the Chuncho, having come to the Sierra when comparatively young, had become somewhat civilized, and was, moreover, almost the only one among them who could speak or understand a little Spanish.

I had taken a consensus of opinion as to the route it would be necessary to traverse, and as a result decided to go on foot, a proceeding which I found to have been wise, as the trails were impossible in places for horses or mules. Our way lay at first along the river Limbani, and leaving this the trail wound up a long steep ridge to a height of 13,500 feet. The granite formation at Limbani had now changed to a slate, and gold-bearing quartz lodes are encountered in the region. Having crossed the high ridge, slowly and with frequent halts, for the rarefied air of that altitude renders walking fatiguing and the work upon the lungs severe, we descended the difficult zigzag and scarcely visible trail to a grass-covered valley below, and slept in a "tambo" upon the banks of a stream near a small Indian village known as Cutani. A "tambo" is a building which serves for the common accommodation of travellers, and a few of these huts—for they are nothing more—are maintained in one or two places in Peru by local authorities for that purpose, although unfortunately they are very scarce, notwithstanding that routes of travel often pass through uninhabited regions. Poor as was this tambo, its roof was waterproof, and there was some dry firewood inside, which ensured supper and a dry bed. For many subsequent nights these desirable adjuncts were only obtained with considerable difficulty, as, in order to sleep within a hut of any description, this had first to be constructed.

The progress of the party was, as regards actual leagues covered, relatively slow, for the Indian carriers were rather heavily laden, and my companion, moreover, was not a rapid pedestrian. I frequently found myself far in advance of the rest of the party, alone in those strange and untravelled solitudes of the Andes upon the border of the mysterious Montaña.

The descent of the eastern slope of the Andes is rapid, and the change of temperature as the traveller approaches the region of the forests very noticeable. At the end of the second day I found myself alone, following the trail along what appeared to be the back of a high sharp ridge, for the heavens were entirely obscured in a thick, warm mist, and the landscape entirely shut out from view. Looking through the bushes on either hand, it was apparent that the ground descended precipitously on both sides, and, indeed, on the right hand I could hear, as if far below, the murmur of running water. This I knew to be the river Pacchani, which rises in the Cordillera and empties in the Huarihuari, and so into the Inambari river, before mentioned.

The mist panoramas in these regions are remarkable at certain seasons, and the rains are heavy and continuous after mid-day. I sat down and waited for the rest of the party, and as soon as the Indians approached set them to work cutting boughs and building a shelter for the night on the only spot available—a small ledge of rock about 6 feet wide, with an abrupt precipice of some thousands of feet of sheer

descent into the river below, and over which our feet almost hudd as we lay down to sleep upon our blankets.

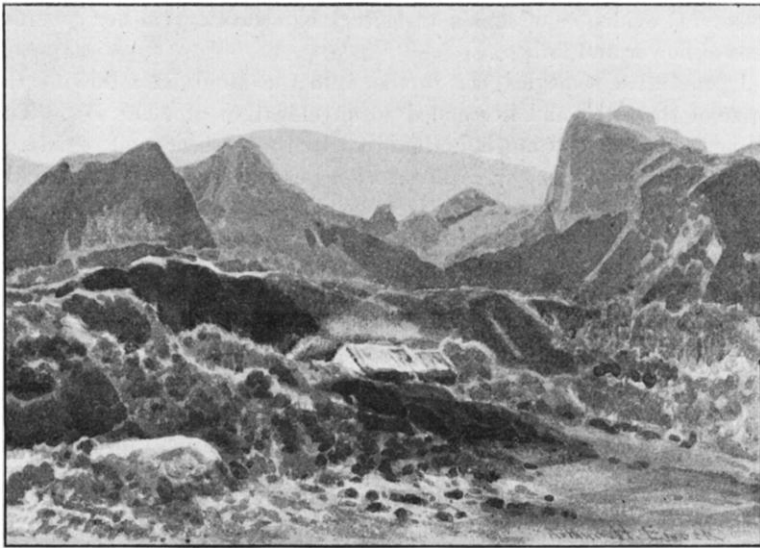
For two days more we pursued our journey, the rain pouring down upon us incessantly. The "trail," if by courtesy I may term it such, passed at times through a series of rock-basins worn in the slate, and progress was made through them as through a succession of "baths," for they were full of water from the rain. I made no pretence of keeping dry; it was impossible during the march, for, apart from the "baths" underfoot, the vegetation met overhead, and, being loaded with water, sent down its showers at every step. Impatient of the wearied Indian bearers, I carried a machete in my hand, and often was obliged to carve a way through the thick growth of the brushwood which covered the old trail, for we had now left the open slopes of the Cordillera and entered upon the upper edge of the Montaña, or region of forests.

The altitude at which this vegetation begins is from 10,000 to 11,000 feet above sea-level, and the line of demarcation is strongly noticeable. Above are the slopes and valleys of the "pajonales," or grass-covered areas, free of trees of any description, whilst below the traveller enters among thickets of tangled brushwood of all kinds, and in places of beautiful flowering shrubs. As he pursues his journey onward and downward palms and tree-ferns appear, the atmosphere becomes warmer, the mists lie heavier, and the silence is broken only by the patter and fall of the heavy water-drops from the boughs above. Scarcely a living thing appears to inhabit this upper fringe of the tropical Montaña. There are no monkeys, no snakes, no birds, and very few insects. An occasional puma is heard, and at times the swish of condorian wings in the ambient above; but nature here is in a changing phase, and her profusion of animal life seems to be reserved for the more tropical interior, still many leagues away towards the sunrise. At times the mists lifted for brief moments, and gave me glimpses of far-reaching tree-clad slopes divided by profound valleys, stretching away into the vast Amazonian basin. At a turn of the trail which brought me out upon the brow of a hill, I beheld a cascade on the opposing slope of a valley, a high white, lace-like fall among the green background of the branches, and I hailed it with satisfaction, for, from descriptions of the place, I knew it to be not far from the point of my destination. It forms the source of a small river, the Puli-puli, which runs close to the mines of Aporoma.

Difficult as the trail had been, it nevertheless bore witness to the considerable work which had at one time been carried on at these mines, for long portions of it were constructed of slabs of stone placed in the form of steps, and must have been made at considerable expense in the past centuries when the mines were worked, first by the Incas, and later by the Spaniards, for these latter did but work on a larger

scale, in many cases, what the former had previously discovered and used.

At length, after more than four days on foot from Limbani, and sleeping and eating under difficulties, we arrived at Aporoma. It was already evening; the rain was falling heavily, as usual, and there was no habitation or living being in the vicinity, notwithstanding that in bygone ages it had been the scene of the activity of thousands of workers, and that a village had existed there. But after diligent search among the vegetation, in a spot which the Indian guide, with that strongly developed faculty for locality which his kind possesses, had stated as being the site of the former house near which he had worked



OLD GOLD WASHINGS OF APOROMA.

when a boy, the walls of a habitation were discovered. Animating all hands, I directed the clearing away of the heavy growth of vegetation which cumbered them, and within a couple of hours the interior was free; a durable roof, composed of strong branches covered deep with leaves and grass, was constructed upon the walls; our beds were arranged upon a floor-covering of aromatic boughs; and a fire was kindled in one corner, so that we were able to contemplate the coming night with something of equanimity. The altitude at this point was about 7200 feet; the temperature at 8 p.m., 46° Fahr., and at 3 p.m. in the afternoon, 60° Fahr.

The mines are worthy of a brief description. They consist of a large area, between the rivers Huayna, or Puli-puli, and Pacchani, of Tertiary gravel; the bed of an ancient river, upheaved by some

eruptive action probably, and resting upon a bed-rock of clay-slate. As previously stated, they were worked many years ago as open placer mines. Conduits and sluices were constructed of stone, and tunnels through the gravel banks, and various other works, which in some ancient records are stated to have cost a sum equal to more than half a million pounds. Vast quantities of gold were extracted, and the old workings, very extensive, attest the activity which was displayed. A "grant" of six thousand Indians was "spent," it is stated, upon this work by a Spanish viceroy, and much of the gold extracted went to Spain. The "grant" of Indians principally left its bones in the vicinity of its toil; decimation of the population came about by rebellion, greed, and avarice, abandonment followed, and nature presently covered up the scarred evidences of man's transitory handiwork with her generous bores of flower and foliage.

I penetrated some leagues further into the Montaña, following the course of the river, and descended to an elevation of 5000 feet. The temperature here was much higher, due to the descent, and registered in the evening 69° Fahr. The hill-slopes and valleys are thickly covered with trees of comparatively small girth and height, and the existence of a few cedars marked the beginning of the region where these flourish. The country is exceedingly broken and difficult of access here, and the rivers are torrential and rapid. The geological formation is a slate, heavily charged with iron pyrites, and containing quartz.

Returning to Aporoma to finish my study of the mines, I was confronted with a strike of the Indians. The cause of this was the lack of provisions, which had given out. To gain a couple of days, we despatched those among them who were not absolutely necessary, and supplied the remainder with food from our own slim remaining stores. But at length I had to give the order to depart, for there remained nothing but rice and tea, and on this we were obliged to subsist for five days, under forced marches, in order to get out of the Montaña and return to Limbani.

The traveller has continually to observe the truth that misfortunes never come singly; and on the second day one of the Indian bearers, the Chunchu, disappeared, and left his baggage in the trail. As the other bearers were already overloaded, it was impossible to distribute his bundle among them, and, ordering a halt, I was obliged to have a selection made of articles which could be dispensed with most easily. I abandoned my travelling-cot and various articles of clothing, and my companion some of his instruments, whilst we reduced the number of our cooking-utensils to the lowest possible limit. The Chunchu we never saw again, and the Indians considered that he had gone to rejoin his tribe. As a tribute to aboriginal honesty, I may state that he took nothing away but his own things, notwithstanding that among the

articles he carried were my saddle-bags, containing a sack of Peruvian and Bolivian silver dollars !

At the end of the third day our meagre rations of rice and tea were concluded, and we formed camp early, with the intention of making a long march on the morrow to the town of Phara, which was rather nearer than Limbani. A rude roof of branches was constructed, but, fortunately, the rain had held off during the return journey. The sky had been clear, but as evening fell the mists arose and formed one of those curious and weird transformation scenes such as the traveller in the Andes may witness. I find in my note-book the following description, written upon the spot :—

“The sun has set, but it still tinges the western sky with its beautiful and indescribable tints. The palest saffron fades into the pearly green of the zenith, and the last and orange rays, calm and cold, flash faintly and expiringly upwards. In and among the deep cañons of the stern and purple-green hills below, the fleecy cloud-masses of pearly vapour slowly pour, filling them with impalpable lakes, so soft, so pure, they seem the essence of the elements, spread for the couch of some unseen god-traveller. Below, wrapped in the shades of darkness, are those steep ways and cañons I have passed, leading from the far *Montaña*. But the mist-sea is rising, urged by some evening breeze—appalling masses, which break over dim distant peaks like awful billows. They rise slowly, surely, terribly, as if to engulf even the high point whereon I stand. But night is at hand, and even as they rise they are dispersed or covered by its sleepy pall. A single and glorious jewelled planet has dominated the eastern escarpment, and gleams softly down upon the closing scene.”

We duly arrived at Phara, and breakfasted at the home of the “cura,” and in return for his hospitality photographed the ancient church there. Within this building is an enormous altar composed of mirrors and brasswork, which latter was at one time covered with gold and silver. The point of interest about this altar was that it had originally belonged to the church at Aporoma, I was informed, which had stood in the village there, the vestiges of which, as I have described, are now buried under the dense vegetation—the growth of generations.

At Limbani I paid off the Indians, and, having with great difficulty secured mules, we again ascended the steep eastern slope of the Cordillera, and arrived at Aricoma, before described. The Indians gave themselves over to a carousal at Limbani, and I may here mention the evil effects which are being produced in the regions of the Cordillera by the abuse of alcohol among the indigenes. I have on some occasions had to waste several days in attempts to secure beasts and a guide in these interior towns, but, nevertheless, have met cavalcades of twenty or thirty mules or horses entering or leaving the place, and loaded with—what? Square tins of alcohol ! This terrible stuff is alcohol of 40°,

made from sugar-cane, and enormous quantities are consumed by the Indians, who will go to any lengths to obtain it. At times it is impossible to purchase a piece of bread in the native shops, or anything in the way of provisions, but, nevertheless, they are all replete with bottles of this "aguardiente," or rum. I have seen huts covered with the sides of the empty tins, and in one place the church is actually roofed with these tins! It is a lamentable state of affairs, and must lead to the diminution of the working population, but its remedy seems to lie only in the hands of the wealthy sugar-growers, who make the rum, and who are sometimes the legislators of the country.

The lake of Aricoma runs north and south, about 2 leagues in length. Its depth seems to be very considerable, as I have observed in many other similar lakes which are so remarkable a feature of the Cordillera of the Andes throughout its length. The existence of these numerous bodies of water, actually astride the summit of the mountain range, is a matter which arrests the attention of the engineer, and probably some day they will form a valuable source of hydraulic power.

Our journey was slow, for my companion was not a good horseman, and a heavy snowstorm overtook us upon the edge of the lake. Night was approaching, and the group of Indian huts we had expected to reach was still many miles distant. It was useless to proceed, and I called a halt. The only shelter was that afforded by the remaining walls of an ancient Inca ruin, and I formed a sort of tent by securing the corners of the sheets of my bedding into the interstices of the stonework with stones rammed in. Under this we arranged our couches, and made coffee over our spirit-lamp, afterwards obtaining a few hours' sleep, whilst the snow steadily piled up on our fragile roof. Notwithstanding the altitude—15,000 feet at this place—it was not very cold, the thermometer scarcely going down to freezing-point, which was fortunate.

Instead of returning over my original route, I had decided to extend my journey to include others of the auriferous regions of the provinces of Sandia. We therefore followed a south-easterly course along the tableland which forms a plateau below the snow-capped peaks at an altitude more or less equal to that already recorded, with the town and mines of Poto as our objective point.

The topographical and geological formation over this distance is remarkable. Our way lay principally along the bank of the Poto river which runs through extensive pampas or plateaus, as above stated, of auriferous glacial or alluvial drift. In many places the Indians work on the banks of the streams by the method known to them as "acochar," which consists in damming the water up in a small reservoir, and then allowing it suddenly to flow out and impinge against a bank or area of auriferous material, washing it down into a rude stone-paved sluice, where the gold is recovered. These auriferous pampas and banks, which cover distances of many leagues, are probably deposits formed by

glacial action upon the gold-bearing slates and quartz of which the Cordillera is composed. The stones and material are not water-worn, as in alluvial gravel elsewhere, but are angular, and contained in an ashen-hued soil, carrying the gold. The pampas are strewn with boulders of white quartz for many leagues, which catch the rays of the sun. The more broken portions of the plateau and the lateral valleys are covered with pasture, and hundreds of thousands of head of sheep, llamas, and alpacas abound. I encountered large herds of vicuña, and quantities of geese, ducks, etc., upon the numerous small lakes. Some of these plateaus have probably been at a former epoch lake bottoms, and, indeed, I passed through remarkable formations, consisting of long "shores" of conglomerate, or indurated gravel, which stood up in vast cliffs underlaid by caves, and which latter were the home of thousands of "vizcachas," or native squirrels.

The town and mines of Poto are at an altitude above sea-level of nearly 16,000 feet. Very extensive mining has been carried out here by the Indians before and during the Spanish *régime*, by the method previously described of "acochar." There is at present a modern plant working by the "hydraulic" method, with water under pressure, upon an enormous moraine of gold-bearing detritus. The huge bank descends from the Cordillera of Ananea, above the line of perpetual snow, a few miles distant. There are also mines at Ananea, more than 17,000 feet elevation, and these workings are certainly among the highest on the globe. During my stay at Poto (in September) the thermometer registered generally 104° Fahr. at mid-day, in the sun, and 37°·4 Fahr. in the shade, by which it will be seen how considerable is the range of temperature due to heat of the sun and the rarefaction of the air. Nevertheless the cold is not intense even at the coldest season, although snow and rain storms are frequent and severe. Terrible thunderstorms occur, and the lightning continually strikes exposed points. I may here mention that the presence of electricity in the atmosphere, even at normal times, is very noticeable. The fur coats which one wears as protection against the wind, and one's clothing, "crackle" in a remarkable manner when the least friction is applied. The same effect is strongly produced in combing one's hair, and if it be done in the dark, sparks are observed to be produced by the friction of the comb.

Leaving Poto, I continued my journey alone, except for my Indian guide, still in a south-easterly direction, with the intention of skirting the northern end of Lake Titicaca, and arriving at the station of Juliaca, on the southern railway of Peru.

The country was entirely covered with freshly fallen snow. The temperature was like that of the breaking up of an English winter and the coming of spring, for the air was soft and mild in the early morning. Beautiful white cumulus cloud-masses against a glorious blue sky, with a bright sun, were reflected in the mirror-surfaces of the numerous

small lakes I passed. Magnificent water-fowl swam upon these lakes, and I obtained one of them with a shot from my long-barrelled Colt's revolver—this not as a wanton taking of life, but that the bird would supply the scarcity of provisions I knew I should encounter on the morrow.

Bands of vicuña stared wonderingly as I passed, and one splendid fellow—a sentinel upon a knoll—is almost within reach of the revolver's range, so near that I am tempted to try a shot. But I might have saved my cartridge, for he and his ten companions are away like the wind, only to stop and utter their curious and plaintive, protesting or warning cry 300 yards away, where they stand gracefully and gaze at me.

Ever these glorious white, cloud-massed, cumulus columns, upward flung into the blue empyrean; ever these silent and virgin everlasting peaks of eternal snow, which I am paralleling, upon the Bolivian border, and whose mysterious cañons and violet snow-cornices blend from time to time with the fleecy mist-matter above them; ever this unbroken solitude, and the feeling of being upon the top of matter; and ever this extensive silence, undisturbed save by the cry of the "alcamarini" * or the vicuña. Strange and beautiful region, working out some function of the world's changes in the plan of Nature's ceaseless and inexplicable operations!

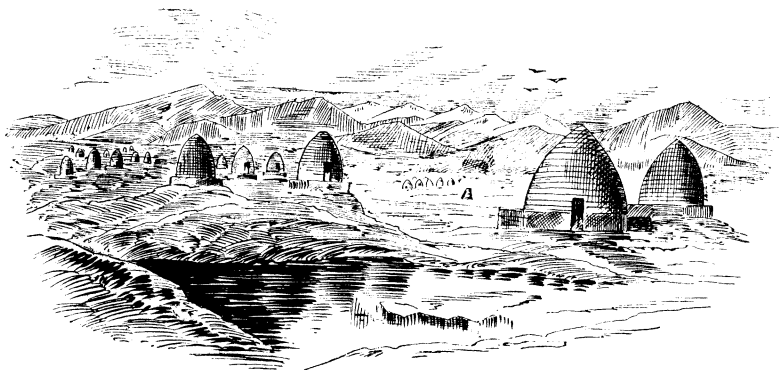
But the late afternoon advances, and a bitter wind arises from the snow-clad Cordillera and changes the aspect of all, and the sun has long since set, when, cold, hungry, and weary, I arrive at the town of Cojata. The industry of the people here is the breeding of alpacas, and the buying and selling of wood. Gold-mining is also carried out, and a considerable trade done with Bolivia in the "aguardiente," or rum, before spoken of. Cojata is very near the frontier-line of that country, which there consists of a small stream intersecting the pampa (part of the river Suchis). The vast glacial moraines of gold-bearing detritus are still a feature of the region, as are also the pampas of similar material; and there is no doubt that these provinces of Sandia and Carabaya form one of the most important auriferous regions in the world. The Bolivian and Peruvian Indians here speak nothing but their language of Aymará. They, men as well as women, wear their hair in long "trensas," or queues, like Chinamen, and they often have a distinctive dress and head-gear, highly ornate. Their principal diversion appears to be the consumption of aguardiente, accompanied or followed by a "jarania," or fandango. Physically, they are by no means an inferior race, and the women are often of fair height, robust, and not unattractive in appearance, save that they are unwashed. The altitude of Cojata is about 14,800 feet.

Leaving this point, the trail ascended an eminence, from which

* A white gull-like bird.

I got a faint and momentary view far to the south of the famous peak of Sorata (or Llambo) (23,600 feet altitude), in Bolivia. Passing now downwards and through areas of a remarkable rock-formation of hard white sandstone, lying in horizontal strata, the trail descends rapidly towards Lake Titicaca, and at every turn of the road I strained my eyes in search of its blue surface—my first approach thereto. At length I beheld it, still far off, and between the barren and rocky hills which I had to pass before reaching my halting-place—the town of Huancané. The first view of Titicaca was very beautiful.

From Huancané to Juliaca is a long day's ride, and, having secured a guide, I left before sunrise. The road lay at first through the lands cultivated by the Indians, and the swamps and marshes bordering upon the lake. These latter places are dangerous, and it was necessary to wade through a sheet of water, with my horse submerged to the saddle-



INDIAN HOUSES NEAR LAKE TITICACA.

bags. One may also cross by means of the curious "balsas," or rafts, which the Indians use for navigation, and which are constructed of masses of woven rushes. At one portion of the route the scenery is exceedingly picturesque. There are areas of yellow water-weed, from which numerous scarlet-feathered herons arise as the traveller passes. The tips of the white cordillera are reflected in the blue surface of the lakes, and the remarkable conical-shaped houses of the Indians give a character to the scene not found elsewhere in Peru. I examined some of these houses; they are square at the base, built in regular courses of adobe bricks. Each course is set in from the lower one, and thus the structure becomes a cone, curved in profile, and circular on plan in the upper portion.

After sundown the cold became intense, due to the bitter blast which swept across the plateau from the lake. The altitude of Titicaca is 12,578 feet above sea-level. My guide had brought me by a longer route than was necessary, and it was not until 9 p.m. that I drew rein

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T

upon my wearied horse before the station hotel at Juliaca, where I again enjoyed the luxuries of a good dinner and comfortable bed, after nearly two months' journeying in those interesting but inhospitable regions—in inhospitable not as regards man, but nature.

As will have been seen, some of the portions of the country I traversed are very little known, and upon the verge of the "Montaña," uninhabited. The most easterly point at which I arrived, near the junction of the streams before mentioned with the Huari-huari, or Inambari river, is south-west of and only about 25 or 30 miles from the port Markham, on the navigable river Tambopata, a port named after the late President of the Royal Geographical Society, whose work and interest in the country are always gratefully remembered by Peruvians. I had desired to extend my journey to this river, but the circumstances already described rendered it impossible.

The region is one of vast possibilities, both as regards the auriferous plateaux and the zone of the Montaña, which is healthy, and capable of producing crops of any kind after clearing and cultivation shall have taken place. Roads, however, or branch railways must be built before much colonization can be brought about, and some advance is already being made in this respect. When the project of uniting the railway system of the Pacific with the navigable headwaters of the Amazonian fluvial ways is carried out, a beginning will have been made in the opening up of one of the most valuable portions of the Earth's surface.

II. HUANCAMELICA AND ADJOINING DEPARTMENTS.

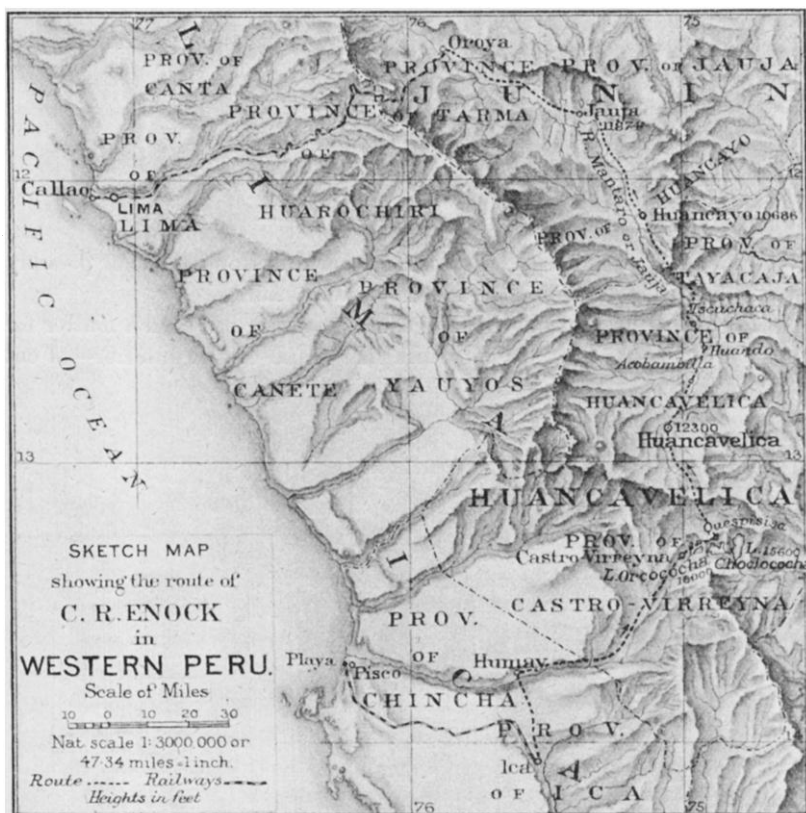
To reach the interior of Peru, and the rich mineral-bearing zone upon the eastern slope of the Andes, the traveller must, from the Pacific littoral, invariably cross the summit of the Cordillera, for this vast natural barrier runs parallel with the coast, and leaves no pass, speaking generally, at a less altitude than 14,000 or 15,000 feet above sea-level.*

The Department, or state of Huancavelica, which I visited in November, 1904, is one of the richest of the mineral-bearing regions of Peru, but it is difficult of access, due to its mountainous nature and to the fact that no roads, worthy of the name, have yet been constructed to give outlet to its products or communication with the coast. My way lay by the port of Pisco, about one day's steamer journey south of Callao, and past the town of Ica, a few miles from the port, with which it is connected by a railway. Ica is the centre of a fertile agricultural district, where cotton, sugar-cane, wine, brandy, etc., are produced. The crops here, like all those of the agricultural regions upon the coast zone, are grown under irrigation, for, as is well known, the whole of this vast stretch of continent, from Ecuador to Chile, is a

* There is an exception to this near Payta.—C. R. E.

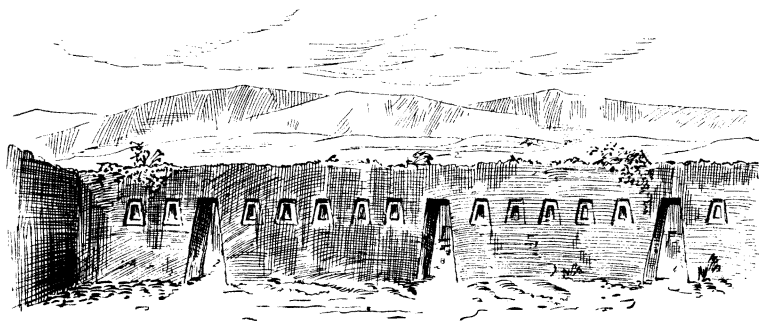
rainless region. Vegetation exists by virtue of the streams of water descending the western slope of the Cordillera—streams which have their origin in the ceaseless thawing of the ice-cap, and the heavy rains of that lofty region. For the Andes, having deprived the western zone of its rainfall by reason of the climatic conditions brought about through its agency, has, in part, remedied the defect by giving origin to these torrential streams.

My first day's journey lay across the usual sterile desert zone



between the coast and the foothills of the Cordillera—deserts over which the wearied horseman toils from sunrise to sunset. There is a group of extensive Inca ruins upon the desert, which I examined in passing. The principal feature is a large courtyard some hundreds of feet in length and width, with a series of doorways opening therefrom. Between these doorways, which are symmetrically spaced, are niches, and both are of the tapering form so often seen in Inca architecture. A portion of one wall is shown in the accompanying sketch. The walls were of adobe and rough pieces of stone, the

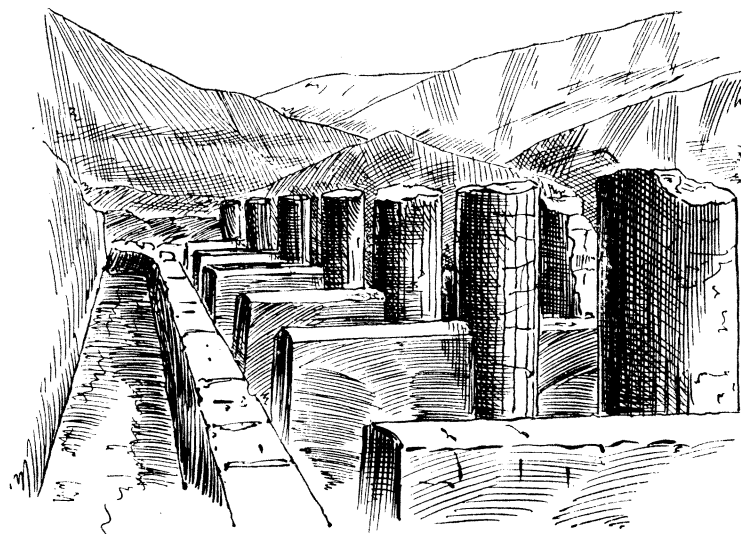
whole being made into a smooth surface with plaster formed of mud or clay. The general face of the walls has been coloured with red paints, and the niches with yellow paint or pigment. Parts of this colouring still remain, notwithstanding the centuries that have passed



INCA RUINS NEAR PISCO, PERU.

over it. The pigment may have been formed of iron oxides, or possibly vermilion from the cinnabar mines of the interior.

Regarding these ruins upon the coast zone, it has been a matter for observation that they are not built like those of the interior—of cut



RUINS OF INCAHUASI. INTERIOR COLUMNS.

stone—and they still exist only by reason of the rainless climate and the climatic conditions, which tend towards exceedingly slow disintegration.

Whilst speaking of this immediate region, I may mention the ruins

of "Incahuassi" (house of the Inca), which are found some 50 miles to the north-west of this point, near the coast also. They are chiefly interesting as showing the use of columns in Inca architecture, various writers upon Peru having asserted that columns were unknown, to those builders. They are shown in the accompanying sketch; they are 65 to 85 centimetres in diameter, and the ruins are stated by Señor Larrabure (an archæologist and late minister of foreign affairs in Peru), who visited them, to belong to the fifteenth century.

At nightfall I arrived at Humay, a hacienda upon the Pisco river, from which its extensive vineyards are irrigated. This place, although peaceful and picturesque, has not left a pleasant impression upon me, for during the night my room was invaded by swarms of mosquitoes, whose stinging was the cause, undoubtedly, of the "tercianias," or intermittent fever from which I suffered afterwards.

Upon leaving this point I knew little of the hardships I should be obliged to endure for the remaining four days of my journey to my destination. The road by which I had been directed passed through a portion of the country void of towns or villages, and consequently of food of any kind, notwithstanding that I had been informed that such was available. The arriero who conducted my pack-mule and served as guide was almost constantly drunk with aguardiente, and, as far as I could observe, took no other nourishment (!) during the last three days' travel. On two occasions I searched his saddle-bags and confiscated and destroyed the bottle of alcohol he carried, but he again obtained supplies of this from acquaintances among the Indian shepherds *en route*. These people were also drunk, even early in the morning, and there is no doubt that the effects of alcohol is beginning to ruin the inhabitants of these regions, as I have elsewhere observed. Due to the effects of the fever, I could not touch the coarse and scanty food of these shepherds' huts; at night the cold was intense, for we were now at a considerable altitude, and I had foolishly neglected to bring my cot or a mattress, desiring to travel rapidly without impedimenta.

There was nothing for it but to get out of the situation, and although I could scarcely mount my mule I was obliged to keep on, driving in front of me the drunken arriero and the pack-mule. Towards the close of the last day a violent attack of vomiting came on, and I fell rather than got down from the saddle, and lay upon the plain utterly exhausted. The altitude was 16,000 feet above sea-level, the air exceedingly rarefied, and a bitter blast swept across the plateau. I thought for some time that I should never rise again from the spot, and it was only by an effort of will that I did so. But I managed to swallow two or three spoonfuls of condensed milk, and, mounting with the aid of the arriero, who was now sober and penitent, I continued onward, and near midnight arrived at my objective point—Santa Inez.

Situated here are the silver-mines of Quespisisa, or Santa Inez, which

have produced great quantities of that metal. They contain extensive bodies of ore, which will be made available upon further working. Hydrographically, the region is interesting also, for there are two large lakes of true Andean character here. The higher, known as Lake Orcococha, is 16,000 feet, and the lower, Lake Choclococha, 15,600 feet above sea-level. They are separated only by a distance of a few thousand yards, the upper being dammed up with a natural dam formed by a moraine of soil and gravel. A noteworthy feature of this lake-basin is that, although it is upon the western or Pacific side of the summits of the Andes it nevertheless is drained into the eastern or Amazonian watershed, by means of the river Pampas, which breaks through the Cordillera and so into the Apurimac river and headwaters of the Ucayali and Amazon. Close at hand, to the west, and at slight difference of elevation, are other smaller lakes, which give rise to the Pisco river flowing to the Pacific. Here, then, is another of those numerous instances which are met with in the Andes, where the water-parting of the continent is defined by a lake, a part of whose waters in times of abnormal flow may positively belong to the one or to the other of its adjoining watersheds. There is no fish-life within their waters, a common characteristic of the lakes in these high regions. Each is 5 or 6 miles in length and about $1\frac{1}{2}$ in breadth; whilst at a depth of 250 feet, I was informed, bottom was not reached in the middle. Their blue surfaces reflect the snow-capped range to the east, but in the rainy season are lashed into fury by the terrific thunderstorms of this altitude.

The general rock-formation is a trap, whose terraced lines are seen far off upon the peaks, as they emerge from beneath the ice-cap. A remarkable peak of diorite stands solitary, not far from the lake-shore, and is known among the Indians by the name of Quispijahua, which means "the flower of glass." This name is due to its form, for at the summit it spreads out into almost a petal-like shape, a result partly of geological formation, and partly to its having been continually riven and split by lightning strokes. It is revered by the Indians, and legends have been woven around it.

The whole of this region, from Castrovirreyna on the west to Ayacucho on the east, is exceedingly rich in minerals, including silver, copper, gold, as well as salt, and in places coal, all of which, when the country becomes more known and opened up, will be valuable elements of industry. The highest elevation at which I arrived was 17,500 feet, just below the ice-cap.

After a sojourn of about two weeks in the neighbourhood, I continued my journey in a north-westerly direction. But my troubles were not yet over, for I was again attacked by the "tercianias," and rendered unable to go on. These intermittent fevers have the characteristic of quite suddenly depriving one of one's strength, and there was nothing for it but to give up the idea of reaching the next village and to sleep

out upon the "puna," or plateau. Fortunately, the temperature fell but little below freezing-point. During the night the arriero—not the former one—let the mules escape, and was obliged to follow them, leaving me alone and unable to get up for the whole of the following day. The sun blazed down, and I was consumed with thirst, and nevertheless unable to reach the shimmering blue lake which lay within 100 yards of me! At length I beheld afar off an Indian approaching with some llamas, and I hailed him. But, after the manner of his kind, he was afraid, and, instead of coming towards me, he quickened his pace and soon disappeared. I suffered greatly from thirst, and with the sun and the fever was almost delirious, and still no sign of the arriero. I managed to reach my saddle-bags and took a mouthful of extract of coffee, which revived me a little, but what I wanted was water. Again I saw another Indian, towards the close of day, and as he came within hearing, I called him, not this time, however, in Spanish, which might have had the same effect as before, but in the few words of Quechua which I was able to employ. "Shami! yacu-t-apami!" ("Come here! bring some water!") I shouted; and the poor Indian, gathering probably some confidence from being addressed in his own tongue, came up to me, and, following my directions, brought me water from the lake. I rewarded him with a silver dollar, and he stayed by me until nightfall, when the arriero returned with other animals from the hacienda.

After a loss of various days I arrived at the city of Huancavelica, 14 leagues from Santa Inez, and which can be accomplished in one long day's hard riding. The country passed over was the usual treeless puna, alternating with lakes, swamps, rocks, and streams, and generally covered with grass, which gives pasturage for herds of cattle and sheep. The climate is exhilarating, and the views magnificent, and in the intervals when the fever did not trouble me, I enjoyed the ride and the unfolding landscape.

At Huancavelica are the famous quicksilver-mines, which are generally mentioned in all geological treatises. The history of the mines would fill a bulky volume. They were discovered in 1566, and were administered under a Spanish viceroy, and since that period have produced approximately 60,000 tons of mercury from the cinnabar ores, which exist in an enormous lode, or "farallon," to use the Spanish term. In 1786 bad work caused the mine to collapse, and it is stated that five hundred Indian miners remained entombed therein. Huancavelica was visited and described by both Bufon and Humboldt, as also Raimondi. I penetrated into some of the vast subterranean caverns which have been excavated to extract the ore, and made an examination of the general conditions of the region, in order to draw up a report thereon. The workings are about 2400 feet above the level of the cathedral and city of Huancavelica, which latter is at an elevation of 12,300 above

sea-level. The Huancavelica river flows through the city, emptying lower down into the Mantaro, which in its turn falls into the Apurimac, before mentioned, and so into the fluvial system of the Ucayali and Amazon. The Mantaro river, almost alone of Peruvian rivers, runs in this part of its course to the south-east, or directly opposite to their general north-west direction, over nearly 3° of latitude to where its course abruptly changes near Huanta. The climate of Huancavelica is cold, but temperate. Alfalfa and cereals are not produced, owing to the altitude, and the principal industry is that of cattle, but was formerly, and some day must again become, mining. The general geological formation is limestone and sandstone, and hot springs occur, and are used as baths.

Leaving this remarkable place, my way lay across a lofty "puna," some thousands of feet above the town; for, notwithstanding the marvellous wealth in minerals that the region has produced, no road has been made beyond the primitive mule trail to the outside world. Such was the Spanish method of mining, from which no benefit accrued to the community, who toiled and died to enrich an arbitrary and distant monarch. The arms of Spain carved on the stone at the portals of the mine, with figures of saints, and ruined churches, are the principal remaining vestiges of this *régime*.

Descending rapidly from this plateau, the track passed into the valley below. The change from these dreary and inclement altitudes to the warmer climate of this valley was very agreeable, especially in my still weak state. The piercing wind gives place to a balmy breeze, and the dry grass of the puna changes to other vegetation. I pass a tree, and recollect "Thalaba and the Sledge"—

"Behold! the signs of life appear,
The first and single fir!"

It is not a fir; there are no firs on the Andes, but it is a real tree although a wind-beaten specimen, drawing its scanty nourishment from the rocky soil, and stretching its attenuated boughs athwart the path. A tree! the first I have seen for weeks. It has green leaves, and, moreover, a bird carols in its branches. A little lower down a patch of celandines and dandelions bring to my senses a waft as from England's lanes. Here, also, are glorious masses of yellow acacia, and other flowers and shrubs on either hand, through which my mule brushes as we descend. But what is this—this sweet familiar perfume which suddenly greets me? Familiar, although for the moment I cannot recognize it. I look about, and, behold! there it is—a low hawthorn bush in flower. Its leaves are somewhat different in form from those of English hawthorns, but there is no mistaking the well-known dark-green hue and glossy sheen of the leaves, nor the little white flowers and the sweet subtle perfume which carries the mind momentarily to another land. It is "may"!

I pass through the villages of Acobambilla and Huando, ascend and pass a high ridge, and again descend by steep and rapid zigzags down the sides of its cañon to the river Mantaro, or Jauja, before mentioned, and sleep at the town of Izcuchaca, 10 leagues of a broken, steep, and tortuous road from Huancavelica.

Izcuchaca is somewhat of a strategic point. A stone bridge crosses the river, and the place was generally promptly taken and held by various revolutionary forces in times past, as it commands the road to the interior of a large and important part of the country. I found the greatest difficulty in obtaining anything to eat along the whole of this route. The Indians are of a surly and suspicious character, and will sell absolutely nothing to the traveller. In Izcuchaca I had expected to find an inn and some comforts, but the place was dominated by a Chinaman, who was the "gobernador," as well as the owner of the inn. This individual, due to some caprice which I was unable to explain, absolutely denied me food and shelter, and even several Peruvians of respectable appearance who were standing by failed to offer such or indicate where it could be secured, notwithstanding that they knew I was a stranger, a traveller, and that night had fallen and a heavy rain set in. This is the only place in Peru where I have experienced such a lack of hospitality, and I retain an unpleasant impression of the place. But I found shelter at length in the hut of a humble but honest individual, who, moreover, obtained alfalfa for my animals, which was the most important, for they had eaten but little for several days. There was no food in the house, and it was too late to purchase anything in the place, and all that I and my arriero could obtain was a cup of weak tea and a piece of dry bread from my saddle-bags, the only food of which we partook until the following night upon arriving in Huancayo.

On the next morning at daybreak, I shook the dust off my feet of Izcuchaca. My road now lay along the bank of the rapid river for some distance. Leaving that I crossed another high ridge and plateau, and at length descended into the large and fertile plains of Jauja, and slept in a fairly comfortable inn within the important city of Huancayo, 13 leagues from my last stopping-place. This plain, through which runs the river Mantaro, or Jauja, that I had been more or less following, is one of the finest agricultural regions in Peru, and crops of every description are produced. Not far away are extensive and valuable mines of good coal, as well as of copper and silver.

From Huancayo to Jauja, my next day's journey, the road is flat, and passes through numerous towns and villages, which, with their cathedrals, squares, and trees, present a restful and old-world appearance. The altitude of Huancayo is 10,686 feet, and that of Jauja 11,874 feet, the distance between the two cities being 10 leagues. The small Indian shops all along this route seem to contain little but bottles

of "aguardiente," or rum, and a great deal of drunkenness is encountered among the Indian labourers.

On the morrow I began my last day's journey in the saddle. The road left the pleasant valley and wound up on to a high, cold plateau. Fourteen leagues lay between Jauja and my objective point, Oroya, the terminus of the famous Oroya railway, where I should take the train for Lima. It is a remarkable thing that the inhabitants of Jauja and of the numerous towns of the valley have been content to live through the many years since that railway was constructed without making any attempt at a road for vehicles which would give them cheap and comfortable communications therewith. The existing trail is simply a track over the limestone strata, where the wearied pack-trains stumble ceaselessly, in the same condition almost as when the Andes were upraised from chaos. However, this is now being remedied by the construction of a branch railway from Oroya.

The altitude of the latter place, where I arrived in the late afternoon, is 12,178 feet above sea-level, and the railway thence rises at the summit of the Andes to the west to 15,642 feet, the highest in the world, and doubtless the only existing instance where the traveller is carried from the limit of the perpetual snow-cap to sea-level in a few hours. Near Oroya great activity is being displayed upon the Cerro de Pasco mines, which are said to be the largest copper deposits in the world.

The region which I traversed is but little known outside the country. It is embraced between the parallels of 11° and 14° S. lat., and $77^{\circ} 10'$ to $74^{\circ} 45'$ meridians west of Greenwich. It is a region of great resources, and will undoubtedly be the scene of an early development, for the dawn of an era of progress is upon the old empire of the Incas, awakening it from its years of stagnation, and giving it a place among the progressive nations of its hemisphere.

RECENT CHANGES IN THE COURSE OF THE LOWER EUPHRATES.

By H. W. CADOUX.

IN the various descriptions which have been written during the last few years concerning the country which the so-called Baghdad or Persian Gulf railway is to pass through, there has been a somewhat marked absence of information about the country south of Baghdad which must be traversed by the railway to its ultimate destination on the Persian Gulf. The following notes of a journey made down the lower Euphrates from Baghdad in September, 1903, may therefore not be altogether devoid of interest.