

XVII.—*On the Province of La Rioja in South America to accompany a Map.* By J. O. FRENCH, Esq.

THE writer of this paper proceeded in April, 1826, from Buenos Ayres to the province of La Rioja, for the purpose of directing some mining operations. In that province and the adjoining one of Cordova he passed more than two years, during which he had occasion to make several journeys in the interior, and to become, in consequence, acquainted with a portion of South America unknown to Europeans. He is led to believe, therefore, that the following account, taken from his notes at the time, may prove of some interest; and, at any rate, add to our knowledge of the physical features of a large district very imperfectly laid down in all existing maps.

The city of Cordova in lat.  $31^{\circ} 26' 14''$  S., is 172 post leagues from Buenos Ayres, the last 30 leagues of which are diversified with a succession of park-like and forest scenery, which has a picturesque and pleasing appearance, offering a striking contrast to the unbroken monotony of the Pampas of Buenos Ayres.

Within 2 or 3 leagues of Cordova the road makes a decided ascent of about 200 feet, at the summit of which it breaks through low woods and coppices, and, piercing some whitish and yellowish cliffs, suddenly descends and opens out to the eye the broad shallow stream of the Rio Primero, winding round the city. This river is here from 100 to 150 yards broad, and fordable, except during floods. Of these, a remarkable one took place in April, 1828. The waters rushed from the mountains with a roar which was heard in the city several leagues distant; the town was in imminent danger of destruction, and must have been swept away, had not the river timely burst its natural bounds on the right bank. It laid the country under water for sixty miles southward, obliterating all the gardens and enclosures in the vicinity of the city, and covering them with a new stratum of sand. I was then on my way to the city from Buenos Ayres, and travelled with the water up to my horse's flanks. The swollen carcasses of drowned biscachas were to be seen in every direction floating on the waters for leagues.

Cordova is a clean town, with broad unpaved streets and neat houses on the usual Spanish construction. The principal edifices, the cathedral and churches, possess little architectural merit.

The climate presents a mean between the extreme humidity of Buenos Ayres and the great and uniform dryness of the adjoining province of La Rioja. It is remarkable for its serenity

and beauty in the spring and autumnal months; then the exhilarating freshness of the air to the seasoned traveller renders a day's gallop and a night's bivouac in the hills—with his saddle and its appendages for a couch, and the starry heaven, nowhere exceeded in brilliancy, for a canopy—delightful. In summer the heat is more endurable in the mountainous part of the province than in the city, which is built, as the natives say, *en un pozo*, in a well. At that season the air is dry and intensely sultry, without a breath to disturb it: on the other hand, on the approach of winter, currents of chill air will sometimes lower the thermometer 30 degrees in a few hours. As at Buenos Ayres, terrific thunder-storms, which have damaged, more or less, most of the public buildings, including the cathedral, are of ordinary occurrence. The soil of the province of Cordova, generally a sandy loam, is not fit for arable culture without irrigation. Very little wheat is in consequence raised; and the small supply required for the consumption of the upper class is imported from San Juan. The lower classes live upon beef, with Indian corn, raised chiefly in the mountain valleys, pumpkins, camotes (sweet potatoes), and fruits. Cattle, sheep, and goats, are abundant, and the market is well supplied with all sorts of common poultry, and a variety of game, hares, and partridges, and occasionally a small species of deer about the size of a large hare, found in the woods upon the table-land beyond the city. The common fruits are apples, cherries, figs, peaches, grapes, the melon, pomegranate, &c., all in abundance. The grape is, however, not cultivated for vintage, the wine used being imported from Mendoza, San Juan, and La Rioja. The *schinus molle* of Molina is found in the mountains growing to the size of a large apple-tree, and a fermented beverage, or chicha, is made from its berries.

The mountains of Cordova are divided into two ranges running north and north-westerly, distant from each other at their northerly extremes from 15 to 20 leagues. The intervening country is a succession of stony and sandy flats, alternating with broad pastoral valleys interspersed with plantations of figs and peaches. These ranges are highest where they meet at La Cuesta, and where the height may be about 2500 feet above the surrounding plains. From the summit of La Cuesta, the ascent of which is highly picturesque, the traveller has an extensive view over the wide sterile plains reaching to San Juan, and only broken here and there by low isolated hills.

Quitting Cordova for La Rioja, the route for some distance is by the high road to Peru, described by other travellers, skirting the base of the eastern range of the Cordovese hills, and passing through an undulating country diversified with picturesque woods.

The range in question is chiefly of granite and sienite. The Cuesta and its neighbourhood exhibits gneiss passing into mica-slate, sienite, and granular limestone. In the southern and central regions occur whole districts of compact limestone. From Serrezuela, the northern termination of the western range, southward to the middle of that range, are beds of greenstone in contact with a sandstone, which is probably calcareous, and in some instances has a slaty structure; but clay slate nowhere appears, nor is, I have reason to believe, any where found in the Cordovese hills. To the south of the last mentioned localities, the rocks become granitic, and mica-slate occurs, with beds of greenstone, sienite, and sandstone, and scattered fragments of milk quartz, with imbedded mica, are found among the detritus of the valleys.

To the left of the road, prettily situated, are the remains of the old establishments of the Jesuits, now converted into chacras and estancias (farms). These establishments, which generally attract the traveller's attention by a shattered belfry and architecture above the usual standard, appeal affectingly, in these remote regions, to his better feelings, in favour of men who successfully advocated a spirit of Christian mercy and benevolence, when conquest and a war of extermination desolated the land, and bid fair to put an end to the aboriginal nations. The chief, and first met with, of these establishments, is Santa Catalina, about 15 leagues from the city of Cordova. Thence to the N. E. extremity of the Cordovese chain is about 25 road leagues further over barren and rocky undulations, alternating with fertile and beautifully picturesque plains and valleys. Near their northern termination is an opening through the hills, passable with difficulty by a carriage; by which, gradually descending into the plains on the opposite side, we proceeded to the estancia of Las Algarobas, so named from the extraordinary growth of those trees in this district. I was shown a remarkable specimen of one in the neighbourhood, six feet or more in diameter: though the trunk for timber probably did not exceed 15 feet in height, its crooked branches spread over a diameter of not less than 50 feet.

Here we made preparations for crossing the great Salinas, or salt plains; nor were they trifling, considering we had but a single carriage: still that was the first four-wheel vehicle which had ever attempted to cross the Salinas: about seventy horses were collected for the service; a bullock was killed and cut up for *charque*, as it is called when dried for use, the broad pieces of which, hung out in the sun upon *lazos* fastened to the trees, looked like so many clothes hung out to dry: it was necessary, also, to lay in a stock of water for the journey: all this delayed us half of one day, and the whole of another. The family residing at this estancia, as usual in the remoter localities of the

upper provinces, were clothed in ponchos and other articles of their own cotton and woollen manufacture, and were in a comfortable condition of rural life. They presented us with some preserves made of the fruit of the *opuntia tuna*, and other *dulces* or sweetmeats for the journey. The estanciero himself, with whom we had a convivial evening, had lost little of his Spanish blood in intermixture with the Indian, and was a fine old man. He was to accompany us on the present occasion with an Indian, for our guide across the scarcely explored region. This man was a superb horseman, naked save the waistcloth, (*chiripa*). Under his direction, on April 4, we began our journey northward through an undulating country, partially wooded, the surface soil of which chiefly consisted of small stony and pebbly fragments, producing nothing but a very diminutive but thickly spread species of thistle, or what appeared to be such. At night we reached a hamlet consisting of about half a dozen huts or ranchos of the better sort, where we slept. The following day we pursued a more westerly course through fine open woods, in which we killed a rattlesnake, a rare occurrence in these parts, as it seemed: it measured five feet in length, and had five rings, or rattles; its fangs were nearly half an inch in length. I skinned it to preserve the specimen, but it unfortunately got mutilated by accident, and was thrown away. In the afternoon we arrived at some lonely huts on a bare open plain. The Cordovese hills out of sight and the woods had entirely disappeared; later in the evening we reached a solitary Indian hut, on the borders of the Salinas. Poverty and privation were on the sallow countenance of the inmates of this lone habitation, an Indian, his wife, and a boy about twelve years old. "We can hardly procure meat for ourselves here," was the reply to our demand for supper.

The wretched remains of the Indian tribes still existing in La Rioja live chiefly upon the pods of the algaroba, bruised into a paste they call *patay*. They also make a *chicha* by fermenting them in water—a beverage agreeable enough to those accustomed to it. They seldom taste other animal food than what they obtain in the chase—the flesh of the Vicuña or Guanaco. The Indian family of this hut had completely learnt the art of endurance; they were civil, respectful, and obliging. We slept here preparatory to crossing the Salt Desert, or great Salina, under the direction of our Indian guide, and in, as already observed, the first wheeled vehicle ever known to have entered them. The morning of our departure was ushered in by a cloudy mist, through which the red sun gradually rose, partially dispersing the upper vapours, while others appeared to resist his influence, and, attracted to the earth, remained dense and motionless near its surface. As we entered upon the Salina, the scene became

novel and striking—the wide plain, level and smooth as a floor, and snow-white with superficial salt, stretching its treeless and shrubless waste on all sides to the horizon, unbroken by any object, save a few stunted, straggling, and leafless alkaline bushes, the black and crooked branches of which, contrasting with the whiteness of the soil, were here and there hid and intersected by a broad, compact, and very thin stratum of mist, whose under surface was slightly elevated from the soil, while its upper was below the tops of the bushes; thus permitting only their stems and tops to be recognized. This was the *mirage*. Over head rolled thick and broad masses of translucent white vapour, which, except at intervals, hid the sun without greatly intercepting his light; and when his rays shot between these masses, they were reflected from the space on which they fell, by the saline superficies of the soil, with a dazzling effulgence. Such was the appearance of these vast salt plains at the time we crossed them, in the middle of April. Great changes, however, in their aspect are produced by a variation of circumstances. I have myself observed the most astounding change in the appearance of a portion of the plain of Famatina after sudden rain, (where rain rarely falls except with thunder,) succeeded by a hot sun. In a region where slight saline efflorescence is ordinarily seen, the ground became almost snow-white from the rapid crystallization of saline matter, and reflecting the rays of a fierce sun, rendered it most difficult to keep the sight fixed on the road-track—the landscape appeared in one blaze of reflected light, trees and shrubs seemed on fire, and the whole scene might have been mistaken for the land of the genii; while the hot north wind called the *sonda*, hereafter described—the Siroc of these regions—rose by degrees, and in squalls, to a gale, with a close heat like that of a furnace.\*

As we proceeded onward through the Salina, we came to some shallow basin-like hollows, that had apparently been filled with water which had evaporated, leaving a moist blackish earth effloresced considerably with saline incrustations, in passing which, in an untrodden region, caution was necessary. With these exceptions, we pursued our course over this trackless region at a smart gallop during the whole day, the western range of the Cordovese mountains appearing finally on our left front, and giving fair warrant of the accuracy of our Indian guide, who had the sun alone for his compass. The noble horses were in the pride of strength. They had neither food nor water during this day, nor until the evening of the following; yet they flagged not in spirit

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\* In the instance here related it is to be noted that nothing in the shape of cloud or mist was present; affording, in this respect, a perfect contrast to the journey across the salt plains.

or effort. The scene of lazo-ing them for a remount was frequently of a most animating description: the efforts of the horse-men to collect them together were often frustrated at the point of accomplishment, by the whole breaking bound, and scouring off in wild divergence, until, yielding to their gregarious instinct, they would rally again and again in small groups, till the peons, out-flanking them, would finally catch with the *lazo* the number necessary for the relay.

At nightfall we pitched our bivouac upon the margin of a plain very slightly elevated above that of the great Salina, where the first effort of vegetation, consisting of mosses and stunted thorny shrubs, from which it was barely possible to collect the materials of a fire, was struggling to display itself, the air chill and damp as it always is in the Salinas, however hot the day may have been,—the night moonless and starless. It was a lonely melancholy spot, apparently as little frequented by beasts as by man.

Advancing, next morning, westward over a trackless plain, sprinkled with stunted shrubs, and with the Serrezuela of the Cordovese range in sight on the left, we fell into the post-route leading from Cordova to Simbolar, and approached a more wooded region. In the way through these woods we passed an algaroba tree marked with a cross, which, it is said, commemorates the death of a Franciscan friar, who, having here pitched his bivouac for the night, was attacked by a jaguar, and pursued up the tree on which the memorial is carved.

We were more than once disturbed, at night, after our fire was kindled, by the yells and low growls of these animals, which we afterwards tracked through the woods: on one occasion no less than five of them were seen about us. The surface-soil through these woods is a loose and friable clayey loam, occasionally saline and efflorescent—grassless until within three leagues of Simbolar, when it becomes more compact, and covered by thin woods, chiefly of the algaroba, with abundant pasture. As the post of Simbolar is neared, the plain gradually becomes an open and treeless savannah; but at the post itself the woods re-appear on the onward route. The algaroba is everywhere in these woods abundantly distributed with others of the leguminosæ. The cacti are not so common as in the rocky and sandy plains of Arauco and Famatina. Simbolar is a post-station and hamlet, and the extreme S.E. habitable point of the province of La Rioja, and of the district of it called the Llanos: it is the last post-station in La Rioja, in the route to Cordova, and furnishes horses for crossing the Travesia, 24 leagues, to Serrezuela, on the Cordovese side. From Simbolar the country

traversed, by the old route, as far as La Cienega, is undulating, and covered with pretty dense woods, in which the algaroba still predominates. The post and hamlet of the Cienega occupies a most picturesque sylvan spot, adorned with groups of fine trees, among which the dwellings are loosely scattered. Milk is here abundant and good cheese is made. From this hamlet to that of Polco, about 4 leagues in a north-westerly direction, an undulating and interesting woodland country is traversed. I had a fruitless chase here after an iguana 3 feet in length; it is esteemed good eating by the natives. Polco is also situated on the margin of the great desert we had crossed, and upon the eastern habitable limits of the Llanos. The ground is here alternately rocky and woody, consisting, in some places, of beds of sienite and of sandstone, which crop out on the plain, and close to the hamlet a range of low rocky hills runs northerly and intersects the country for several leagues. (The traveller falls in with them again at Hediona, the next post-station.) Under this low range, among rocky and verdant dells, sprinkled with low woods, and intersected with green alleys, the cottages and huts of Polco are scattered, surrounded by small picturesque inclosures of vines, gardens, and Indian corn. Here we passed the night, the sixth since leaving Las Algarobas; having passed one in the woods between San Francisco and Simbolar, and another in those between the latter and La Cienega. Travelling in a vehicle through such regions is difficult work; we ran the greatest risk of its demolition. In the woods of La Cienega the horses dragged it over bushes, roots, and stumps, at the frequent risk of overturning it or breaking it in pieces. Not unfrequently we had to alight and cut down trees ere we could make our way through the woods. Still the scene was animating—the thoughtless peons cheered as they got on, apparently caring much less for the live lumber within the carriage than for the credit of getting rapidly over the ground. In these woods we met the two deputies of La Rioja on horseback, on their way to join the Congress at Buenos Ayres, and I could not help envying them their safer mode of conveyance through these wilds. Snakes, some of them venomous, are found in these regions; one in particular, a small black snake about 9 inches long, called *aspa* by the natives, is reputed deadly. The pumas are numerous in the Llanos, and are very destructive to the goat flocks: the jaguar is also found, but here and in the Cordovese mountains of a size much inferior to that met with in the lower provinces. I once purchased two skins which had only the day before been taken, the length of which did not exceed 4 feet. The jaguar is believed by the natives not to attack man unless he has tasted his blood. A species of the peccary, and another of

the armadillo—the *quiriquincha* of the natives—the latter excellent eating, and, when roasted, of the flavour of delicate young pork—are also found in the woods. I have shot some splendid varieties of waders on the ponds of the Llanos. The skunk, the sorino of the natives, and a large species of fox, are common, and infest the gardens of the villages. Flocks of green parrots, of two species, one of them small, are frequently met with in the inhabited valleys, and two species of wood-pigeon, and a diminutive dove, abound among the gardens and plantations, to which the parrots also resort. Wild asses are numerous in the neighbourhood of the Llanos. I once met a drove of 800 of them proceeding to Salta for the Peruvian mines: they are purchased at about 1 dollar each, from the peasants who catch them, and, after wintering at Salta, fetch from 8 to 12 dollars each on their arrival in Peru,—that is, such of them as do arrive; for the owner is fortunate if he loses not more than half the original number in their transport from the Llanos to Salta.

Hedionda, the next post from Polco, situated on the northern verge of the rocky hills before alluded to, consists of a few huts and a well of brackish water, from which it derives its name of Hedionda, or stinking. We noticed here some remarkable and enormous spiders, nearly 3 inches in diameter, and covered with short erect hair. The road from Polco to this post continues through the woody skirts of the great Travesia. The trees belong principally to the leguminous order; some of the acacias producing gum. The saponaceous acacia also occurs.

Beyond Hedionda the road is skirted on the left, for the greater part of a league, with steep low cliffs; it is stony, and appears to have been at some period the bed of a torrent. Emerging from this locality, low picturesque woods skirt the left, and the track breaks finally into the Travesia, in a direction N. and S., parallel to the line of the Rioja mountains, which are seen at intervals. The post-distance from Hedionda to the town of La Rioja is 32 leagues. The scene presented by the woody region of this part of the Travesia when traversed in autumn, after the fall of the leaf, is almost as wild as that of the salt desert itself. The interminable low open forests are varied by long avenues, alleys, and vistas, paved with a compact and hard clayey soil as flat and level as if laid with a trowel, although split into fine reticulated fissures by the sun's action, and destitute of grass or herb. These alleys, which sometimes spread into considerable openings, fringed with clusters of the algaroba, are called by the natives *bareales*. They appear to be formed by streams of alluvial detritus brought down by the torrents from the central Andes. The forest is everywhere cut through by them, sometimes for 15 leagues in



extent. In passing over them the horses' unshod hoofs patter aloud on the compact floor, the sound being more striking from the death-like stillness which reigns around. In these forests we saw neither beast nor bird of any sort; but, on another occasion, I encountered myriads of locusts, motionless, and literally heaped upon each other, covering the bark of a decayed fallen tree, glistening in the sun, and arraying the old trunk with a variegated shining armour of intermingled bronze, brown, and greenish-yellow; altogether presenting a very singular appearance. On the same journey, after an unexpected shower of rain, which fell in slight and distant drops, my horses' feet were on a sudden beset with small toads (*sapitos*) not an inch in length, which the peons declared fell with the rain.

On nearing the town of La Rioja, the plain becomes at intervals slightly raised, the woods alternate with more open spaces, covered with granitic or sienitic debris, and sprinkled with low black thickets of thorny shrubs. As we passed on, we found a party of Riojanos with their chief, a military officer employed in cutting a more direct road through the woods; but the felling of the trees and clearing them off formed the whole operation. The jolting of our vehicle over the stumps left in this new road, over a portion of which we passed, was intolerable.

From the southern extremity of the Rioja chain at Colorados, so called from the beds of red argillaceous and ferruginous sandstone there occurring, the town of La Rioja, situated on the eastern side of the chain, is distant about 25 leagues; nearly the whole interval being unfit for cultivation, from the want of water sufficient for the purposes of irrigation. It is only in a very few places that a scanty supply may be obtained from some mountain streamlets, which descend from the Rioja range into the great plain, or in a few depressed situations, miscalled Cienegas or marshes, where the casual rains appear to be in some degree retained by the subsoil.

On entering a cultivated belt which encircles the town, the traveller finds himself suddenly amidst green lanes and vistas, gardens and plantations. Enclosures of alfalfa or clover, the vine, orange, and citron, flourishing luxuriantly, and fenced with hedgerows, present a striking contrast to the wildness of the neighbouring plains, and the barren heights and elevated slopes and terraces of the Rioja mountains about three leagues distance beyond. The rich vegetation in the neighbourhood of the town is the result of irrigation by means of azequias, or water-courses, from a considerable mountain-stream, issuing from the Rioja mountains, near one of the very few passes by which they can be crossed, and situated immediately opposite, and

to the west of the town. About 7000 barrels of wine, of 16 gallons each, and 100 of brandy are made here annually; a small quantity of cotton and maize is grown; no wheat, but a little barley is sown for green food for cattle and horses. Few, however, except horses for the saddle, and milch cows, are, or can be kept in the neighbourhood, for lack of sufficient pastures. The cattle for consumption are chiefly brought from the department of the Llanos, where about 16,000 are annually reared.

The town of La Rioja consists of a plaza, or great square, from the corners of which the streets are carried, as usual, onward in a right line with one side of the square, and at right angles with another; the adobe, or sun-burnt brick, being the material principally used in the construction. This material, a very suitable one for the climate, is, however, so generally charged with nitre and saline matter, that, unless the earth it is made of be well cleansed from the salt by washing it, the foundations of the building, if the work be slowly carried on, may be seen mouldering before the superstructure is completed. Many of the houses occupy extensive sites, including orange plantations and gardens, and there is one very fine garden in the suburbs, belonging to the family of San Roman. The town possesses no building of any pretension, although the principal houses are substantially, and some of them neatly built. They are all constructed on the ground-floor, with unglazed windows. The ecclesiastical establishments, of which San Francisco Solano was the principal founder, were fast going to decay when I was there; the parish church of San Nicolas in the public square was little better than a large barn; the convents were nearly cleared of their old inmates, and the property belonging to them was about to be alienated and sold.

The whole population did not exceed 3000, or 4000 persons.

The site of La Rioja, which was founded in 1593, by Ramirez, was originally that of an Indian settlement: there is a tradition, that upon the arrival of the Spaniards, the Indians built a dyke or breast-work in the mountains, to arrest the descending stream, in order to let loose the accumulated waters upon the invaders of their country. The remains of this dyke (*calicanto*) are still extant; but I should rather suppose it to have been constructed to retain the waters for the purposes of irrigation.

To the northward of the town, and district of La Rioja, in the line of the mountains, lies the district of La Costa, where by irrigation about 2300 fanegas of wheat are annually raised, and a nearly equal quantity of maize. This district extends northward along the Rioja mountains to Catamarca, and with that of the capital, and the country south along the line of these

mountains to the Llanos, forms one of the four departments of the province—that of Arauco—which is thus bounded on the west by the Rioja mountains; on the east by the great desert plains and Travesia; on the south by the department of the Llanos, including a portion of the Travesia; and on the north by Catamarca.

The climate of the whole department of Arauco, and the town of La Rioja, is hot and dry—the thermometer rising to above 100 Fahr. in the shade. In the valley of Famatina, where it rises to a similar height, the refreshing south wind springs up at eve after a hot day, and diffuses a delicious coolness; but on this eastern side of the Rioja hills the oppressive sultry air is even more intolerable by night than by day.

From La Rioja we prepared to cross the mountain, the Sierra Velasco, into the Famatina valley beyond, by the only pass which occurs in its whole extent to its southern termination at Colodados. The estimated distance across this chain is 12 road leagues, and is probably about 7 direct. It contains granite, gneiss, mica-slate, greenstone, sandstone, and limestone. Near its S.E. termination at Tutcun, lime is made from a tufa or travertine.

It may here be observed, that in this part of the province of La Plata, primary, and also secondary and altered rocks appear to skirt the Andes, as in the Cordovese range, which contains granite, gneiss, greenstone, sienite, and primitive and secondary limestone; but no clay-slate appears until we approach nearer to the central ridges of the Andes, as in the Famatina range, where I first found the clay-slate in superposition to the gneiss, &c., agreeably to what has been observed of a similar distribution southward in the Cordillera in Peru. In the Andes to the westward of Famatina are found large beds of rock-salt. Gypsum is found northward in the Rioja mountains, and is used for making whitewash.

The road from La Rioja to the Quebrada, or pass through this Sierra, runs by the course of a mountain-torrent. The distance to the mountains is about 3 leagues. As they are approached the soil becomes sandy; but the vegetation along the banks, and in the vicinity of the stream is luxuriant, and includes a variety of cacti with gorgeous flowers—crimson, white, pale yellow, and pink, and the *flor del ayre*, or air-plant, floating from the branches of the larger trees.

The ruins of an old fort, erected by the first settlers as security against the Indians, were pointed out to us. On entering the Sierra we passed through long sandy ravines skirted with cliff and rock, variously wooded, and occasionally opening into

wider valleys, strewed with large blocks of reddish and whitish sienite, sandstone, and granitic rock. The strata on this side of the range appear to have undergone considerable disturbance. The principal of these ravines extends for nearly 3 leagues, throughout which it is floored with a smooth and regular bed of quartzose sand, and is flanked by dark mural elevations of granitic rocks more or less blackened on the surface. These are interspersed by groups of large trees disposed in terraces, which, shadowing the broken rocks on either side, present a singularly wild scene. The banks of the mountain-stream, which is several times crossed in the ascent, are clad with varieties of the mimosa, myrtaceæ, and other tribes. One species, an elegant tree about 12 feet high, has a delicate lanceolate leaf possessing a fine citron-scented fragrance; it probably belongs to Monimiaceæ. The tall mast thirty feet in length, of the stately cactus peruvianus is conspicuous. In the upper part of the ascent a singular and colossal block of brilliant white granite lies across the bed of the torrent, forming a natural bridge, the ends resting on broken ledges or boulders of rock, round which the waters foam onward. Shortly after we reached the most dangerous part of the road called the *Cuestas*, or steep ascents, said to be more difficult of transit than the passes of the great Cordillera. Near the summit, and on the slope of one of these steep acclivities, which we passed on our mules with considerable difficulty, stands a huge block of blackened granite, hollowed out by natural agency, called the *Casa de Piedra*, which serves for a traveller's refuge. The hollow forming the apartment is about 10 feet high, the floor about 12 feet square; there are two large openings, one on the east side, the other on the west. The rock appears as if about to "topple down" from the small inclined platform on which it stands, into the gulf beneath; it is, however, quite secure. Its external form is nearly that of a cube somewhat irregularly truncated and rounded at the angles. Other semi-spheroidal blocks of granite, hollowed out on one of their vertical sides, occur in the same vicinity: they are nearly all covered with a greyish-brownish or greyish-blackish incrustation like that of the Casa de Piedra, and some possess a semi-metallic lustre. On some of the heights in this vicinity, as well as on the opposite side of the Sierra, we saw some *guanacos*, generally in small groups of from 4 to 10. These animals are sometimes tamed and domesticated at Famatina, and become exceedingly familiar, but in that state evince a most mischievous curiosity. Beyond the Casa de Piedra alternate dells and steep rugged *cuestas* are crossed, broken by stony debris. We bivouacked in a glen for the night, where the mules were turned to pasture on the hill-side, no grass

being found in the valleys. There was a hoar-frost in the morning, which opened serene and beautiful. The onward route led through precipitous *cuestas*. In passing through a narrow sandy ravine hemmed in by cliffs, I was struck with the appearance of a wall of columnar greenstone 50 feet in height, the colour a greenish black. The columns composing it were not prismatic, but joined each to the other, presented an uninterrupted mural face for 50 feet, smooth as if chiselled. At last we reached the highest point of the ascent, where the pass suddenly opening out, revealed to us the great plain of *Famatina*, with the *Nevado* or snowy range stretched like a vast curtain across the sky in the west. It was owing to the extreme serenity of the weather, and the absence of the white gauze-like clouds that generally hang over the intervening plain, that this magnificent prospect was on this occasion obtained. Many times afterwards I passed the same spot without having a similar view.

The plain before us, and which lies between the parallel ranges of *La Rioja* and *Famatina* is about 7 leagues in breadth. The descent is rugged and precipitous, and not without danger. As the *Quebrada* or *Pass* opens into it it becomes sandy, and is strewn with broken rock and boulders, and fragments of quartz and felspar, interspersed with a few mountain-trees springing wildly from among them. A species of the geranium 3 or 4 inches in height here grows like a weed.

The road across the valley of *Famatina* runs nearly in a direct line from the *Pass* to the hamlet of *Nonagasta*, about 7 leagues distant; another branch of it runs in a more northerly direction till it reaches a remarkable chain of low hills nearly parallel to, and about 3 leagues distant from, the escarpments of the *Famatina* mountains. This route terminates at *Chilecito*, the *Asiento de Minas*, or mining head-quarters, situated on the western edge of these low hills, about 4 leagues from *Nonagasta*. These hills are remarkable as being the only elevations which break this great valley throughout an extent of from 40 to 50 leagues from its southern point at the *Colorados*. They commence about 3 leagues south of *Chilecito*, and extend 12 more to their northern termination at *Famatina*.

On entering the valley the soil changes gradually from a quartzose sand to a fine sandy loam exceedingly friable, and producing a fine deep dust, clouds of which are raised by the passing mules, whose route may be marked by it for leagues across the plain. Sometimes it is raised upwards by eddies of wind in compact cylindrical columns to the height of from 50 to 100 feet. Clayey tracts alternate, and the surface is frequently covered with salt, as is, indeed, almost every part of the valley occasionally.

Looking from the centre of the valley, one magnificent continuous

wall, presented by the Rioja range, with an almost unvarying elevation above the plains of about 3000 feet, appears to skirt it to the E. along its whole length, while on the opposite side the Famatina chain, bounded by the Nevado, or snowy range beyond, seems to fall off in height as it runs S., and, unmarked by the uniformity which characterizes that of La Rioja, trends to the W., forming at last a sort of truncated termination or elbow at the southern extremity of the great valley. The Rioja range, on the contrary, preserves its direct general N. and S. line to its termination at the Colorados.

The red sandstone which gives its name to that place (the Colorados) appears horizontally stratified: it is slaty, siliceous, and argillaceous; its surface powders and oxydated with iron, under the progress of disintegration, produces a red dust resembling brick-dust.

The southern part of this great valley is a miserable barren desert: though brackish springs occur at Colorados, no fresh water is to be found throughout the whole extent northward, from that place to Bichigasta, a distance of 22 leagues, except one small spring which bursts out in the midst of a soil highly saline, at a place called La Ramada, about 14 leagues N.N.E. from Colorados, on the flank of the Famatina range. Not a blade of grass is to be met with in all that distance, though the central parts of the plain are at first scantily covered by stunted mimosæ, and further north with woods more or less dense.

Bichigasta is an Indian village on the side of the Famatina range, and the country for six leagues to the north of it is covered by a rough stony detritus as far as the hamlet of Nonagasta, where, in consequence of the facilities for irrigation, vegetation once more improves. Here the first object which catches the eye of the traveller, if he arrive in due season, as I did, is a brilliant hedge of roses 15 feet in height and 250 yards in length. This hedge, which bounds a vineyard, and the road forming the southern entrance of the hamlet, is covered with a profusion of magnificent flowers like the large common garden rose, and forms a charming object, especially to one arriving from the barren wilderness I have been describing. The vine thrives luxuriantly, and three or four flourishing wine-making establishments were in full activity when I was there.

In an open space in the neighbourhood is to be seen the site of an ancient Indian station, with a mound of truncated conical shape, on which, tradition says, the domicile of the cacique was erected. The stream which fertilizes the environs of Nonagasta rises near Sañogasta, another hamlet on the flank of the Famatina range, and surrounded on the south and west by beautiful woods. Auriferous ores, obtained from the Cerro Morado of the Fama-

tina range, are here ground and amalgamated in a trapeche or mill, worked by the mountain stream. These ores are from the mine of Don Ramon Doria Davila, who resides here in a neat and convenient dwelling, romantically situated and superior in style to the ordinary taste of the country. In the luxuriant and picturesque woods of this neighbourhood a sort of plum-tree flourishes, the fruit of which is called *quinda* by the natives. The peach thrives everywhere, wild and cultivated. A tree called *bisco*, is also in abundance, the wood of which is of great weight and hardness, and in appearance bears great resemblance to the rose-wood of Brazil: planks may be cut from it 20 feet long by 3 feet in width. A brother of Don Ramon Davila had some of this beautiful wood made up for the first time into household furniture, under the superintendence of an English carpenter, during my sojourn at Nonagasta; the same individual, when I left the place was constructing for himself the first pump ever seen in that country. The mode of clearing water from the mines is by hide buckets; a miserable resource, the inefficacy of which has caused several mines of reputed value to be abandoned.

To the north of Sañogasta a ridge of granite runs easterly from the Famatina mountains for some distance into the plain, forming a sort of natural boundary to this locality. North of this line, and for the whole distance, 7 leagues N.E., to Chilecito the country is again sterile and rocky, and filled with granitic debris.

The neighbourhood of Chilecito, both west and east of the range of minor hills, presents large tracts covered by granitic and sienitic detritus, only varied in the vicinity of streamlets and torrents from the mountains, by beds of sand, and occasional patches of vegetable soil, producing the leguminous, myrtaceous, and laurel tribes in many beautiful and graceful varieties. In such localities are situated the villages and hamlets of Chilecito, San Miguel, and Anghinan, Sarmientos, and Mallagasta. In the vicinity of all those hamlets, every spot of soil to which irrigation can be applied teems with rich vineyards and clover, or with gardens in which the fig-tree, the peach, the walnut, and olive abound. Chilecito, as already observed, is situated near a remarkable ridge of low hills, the geological structure of which is deserving of notice, in connection with the great mountain chains in the vicinity. To the north of Chilecito they are intersected by the beds of ancient torrents, now filled with granitic boulders, and large rounded stones, at intervals piled in ridges, and alternating with tracts of sand and clayey loam: great blocks of sienite and greenstone also occur. Neither the commencement nor termination of these torrent beds is discoverable; both must therefore have been obliterated by subsequent deposits on the

surface of the plain, which here exhibits appearances of great disruption and aqueous action. The hills themselves have much of the conical appearance of granite hills, but are composed of a sort of coarse and very fissile gneiss, easily detached at the summits in cuboid and rhomboidal slaty fragments, but, as just observed, exhibiting in the mass no regular stratification. The mica of this stone occurs in coarse looking patches of a dirty brownish and greenish black colour. Large-blocks of flesh-coloured felspar, and rocks and boulders of sienite and greenstone appear at the bases of these eminences, which are strewn with fragments of milk and rose quartz, cemented to rather large plates of brilliant pearly laminated mica, schorl, &c. The gneiss at the summits of these hills appears to be undergoing disintegration from the decay of the mica: the only vegetation on their sides consists of the cacti, and a few stunted shrubs. Their height probably no where exceeds 250 feet above the plain.

About six leagues beyond Chilecito on the road to Famatina, the rocky debris are succeeded by a clayey soil, producing a better though still a dwarf vegetation: ten or twelve leagues north from Chilecito commence the huts or hamlets of Famatina, so called, scattered in romantic spots in valleys between the low hills at the base of the great mountain range. The most northerly of these hamlets are Indian, the rest Creole. They are almost concealed by enclosures green with the vine, the fig, peach, and orange trees. From shallow azequias or water-courses plots of Indian corn and trefoil clover are irrigated: of the latter several crops are produced in a season. The Indian corn is not used for bread, but the heads are boiled, and constitute the dish called choclo by the natives. The pumpkin here is greatly and justly esteemed for its fine quality; peas are produced in perfection; the artichoke, cauliflower, and cabbage thrive freely, and successful efforts are making in the cultivation of the potatoe, whose diminutive root occurs indigenous in the Famatina mountains. The verdure is very striking in the irrigated spots in this vast valley; these are, however, comparatively but a few specks on its surface. Immediately beyond their narrow limits the wild inhospitable plain bristles with rocks and cacti, and low thorny thickets, interspersed with meagre woods and coppices, chiefly of the algaroba, but including many varieties of thorny and other leguminous trees and shrubs, known by the natives under the names of chañar, brea, quebracho, tacoquenti, and the humo, the latter an alkaline shrub, from the ashes of which a lye is made for the home manufacture of soap. Most of these are thorny—the prevailing foliage is linear, lanceolate, and ovate, and a large proportion is compound, and variously pinnated.

In favoured spots occurs the tala, a magnificent evergreen, the



dense and impervious foliage of which affords an impenetrable shelter from the noon-tide sun. The tala grows to the height of 40 feet, and spreads its branches, densely clothed with a small dark-green leaf resembling that of the myrtle, almost horizontally over a diameter nearly equal to its height.

Such are the general features of this great valley, the average breadth of which may be about 7 or 8 leagues. The torrents in the rainy season in the Famatina mountains bring down from them considerable quantities of sandy and clayey alluvium, which is carried far into the valley by the swollen streams. This increase of soil blending with vegetable decay, and the pre-existent saline soil, is annually adding to the surface of the valley available for cultivation.

The climate of the plains of La Rioja is hot and dry. On Dec. 24, 1826, the thermometer rose at Chilecito to 106° Fahr. On the preceding evening, at 5 P.M., it was at 86°. The minimum of summer heat, at the hottest portion of the day, is probably seldom below 80°. The lowest temperature occurs in June and July; the highest in Dec., Jan., and Feb. During the summer months partial, but terrific and destructive storms of thunder and lightning, and hail-stones, frequently sweep over the valley from the mountains in the west. Rain to any extent seldom occurs, and snow very rarely, on the Rioja range, though it is common, at all seasons, on that of Famatina. During nearly two years' residence on the spot, I never but once saw the Rioja hills covered completely by a fall of snow. Speaking of the hail-storms, they are terrific, and the noise they make in their descent may be heard 3 or 4 leagues distant, like the roar of a distant cataract; of this I was myself a witness. The stones are of a size so large as to endanger the lives of animals exposed to its fury. The thunder-storms of the Famatina range often break there without descending to the great valley below: of this I remember a remarkable instance on the 8th Dec., 1827, 2 P.M. The whole of the Sierra and the Nevado, from being hid by a mass of dark vapour, was suddenly exposed to view by the bursting of a tremendous storm of thunder and lightning, whilst I stood a spectator in the plain below, surrounded with a serene sunshine and a bright sky. The rolling masses of cloud among the hills, and the reverberation of the thunder, produced on this occasion altogether a scene I shall never forget. The mountains of Famatina are at times covered with snow, the cold south wind blowing above, whilst below in the valley, perhaps, the thermometer stands at 90°, and the hot north wind, or *sonda*, the siroc of these regions, is raging. This wind, which usually rises in gusts, increasing to a strong gale from the northward, at times fills the atmosphere with clouds of sand and dust, as impervious as a dense fog. Its

whirlwinds raise the sand in the western valleys of Catamarca into conical hills. During its continuance the houses are obliged to be shut up, and the heat and suffocation become most oppressive: the animal fibre feels both relaxed and dried up, as if by an oven. This noxious gale produces an effect expressed by the natives by the term *sequedad*, or dryness; and other diseases, particularly the synochal and sometimes typhoid fever, are aggravated by its influence. The thermometer rises considerably at its commencement, and falls again as it goes off. It occurs exclusively in winter.

Goitre, to a frightful extent, occurs in the province of La Rioja: few women are wholly exempt. It is also frequently attended with mental imbecility, or complete idiocy. I have seen the tumour vie in size with the abdomen. It exists in this aggravated form in the valley of Famatina. It cannot arise from the use of snow-water, as the miners, who use no other, are, more than other individuals, exempt from it.

The habitable spots of this valley were once the abode of a peaceful race of aboriginals, whose chief occupation consisted in hunting, and in gathering, for subsistence, the fruit of the carob-tree or algaroba—the harvest or gathering of which lasted for two or three months in each summer. They appear, as far as tradition sheds a light on their condition, to have lived in patriarchal simplicity. Equally untutored and superstitious with the tribes of Pampas Indians, the original inhabitants of these valleys of the Andes, who must have formed a considerable tribe or nation, appear to have been remarkable for the absence of all ferocity of character; their descendants, even now, after many years of subjugation, present many points of interest and of admiration; they are simple, sober, and chaste in their manners; and the more benevolent and pacific spirit of the Indian, compared with that of the creole, is here well known. The Indian who engages himself to serve as a guide or peon, or even vineyard labourer, is a more steady and industrious servant than the creole peon, although, when living among his own people he is, when not employed in hunting, a most indolent being. As a guide, he possesses fidelity, patience, activity, and endurance. Among his tribe, his revels, if such may be designated their simple festivals, are never accompanied by the brutalities too often characteristic of the creoles here, as well as of the southern Indian. Inebriety among these Indians, when it does occur, is never marked by brutal excesses; their quarrels are never sanguinary, like those of the creole, of whom it is said, and, as far as my observation goes I can believe it, that the admixture of the Indian and mulatto produces a disposition more cruel and revengeful than any other.

The Indian of these regions is of middle stature, complexion

varying between dark olive and copper colour, frequently a blending of both; hair black, strong, straight, long, and exuberant; teeth fine, white, and regular; eyes very dark, and, under excitement, finely brilliant and expressive; cheek-bones rather elevated. The women are broad-chested, full-breasted, round limbed, and seldom thin in their persons. When pleasurably excited, their face exhibits a peculiar and pleasing expression, though it cannot altogether hide the natural and settled gravity which, more or less, belongs to it. But the Indian reserve is not allied to ill nature. Located in wildly-picturesque regions in these valleys of the Andes, the spirit of the lone, magnificent, and solitary scenery seems to be impressed on their temperament, while the sense, perhaps, of their being the feeble remnant of a conquered race, gradually sinking to extermination, may have its share in this characteristic. In their habits of life they are simple and temperate, avoiding, as much as they can, any close intercourse with the creoles, although a few of them hire themselves to work in the vineyards of the creole proprietors, and, as above observed, make better labourers than the creoles. They inhabit villages of their own, apart from the latter, and are governed by their own caciques: they intermarry exclusively among themselves, retain the domestic use of their own language, which is not *quichua*, pursue their own peculiar mode of life, and assimilate with the creoles in nothing but the having ostensibly embraced the Catholic religion. The introduction of Christianity, however, among them appears, as among the Peruvian tribes, to have had but small effect in changing their social, moral, or intellectual condition.

Looking westward from Chilecito, the first portion of the Famatina range presents the appearance of a projecting table-land. Beyond, and to the N.W., the distant elevations rise above each other very uniformly to the Nevado. The same geological formation which pervades the Rioja range re-appears in the granitic and composite low hills of Chilecito, and the conical granite hills which are passed in ascending the Famatina range from Chilecito, and still higher up at the point named La Cienega. This ascent is by a succession of quebradas, or ravines, the bottoms of which are strewn with granitic debris, to the several heights called the Cerro Cienega, the Cerro Negro, and the Cerro Morado. The Cienega is the first; here, and further westward in the range, gneiss and granite are found, passing into clay-slate, which toward the centre and summit of La Cienega, frequently resembles killas, but is deficient in the silky hue of the latter. In such ground a mine was opened in the Cienega. In some of the central passes among these elevations the gneiss forms mural beds and terraces, distinctly stratified; most of the summits, however,—the highest always—

presenting different modifications of clay-slate, in which occur beds or masses of hornblende, sienitic, greenstone, and quartzose rock—the *quijo blanco* of the natives. In some of the central elevations, called the *valletos*, or small valleys, and also in the Cerro Mexicana, the slate is very light coloured—a greenish, or rather greyish white, which becomes tarnished by the oxide of iron on exposure to the atmosphere. In some parts of the Cerro Negro it appears to pass into hornblende-slate. A vein of magnetic iron-stone, of which I possess a specimen, occurs in the Cerro Negro. Varieties of siliceous slate,—some of which are used for whetstones,—occur in this range. Garnets are also found, and steatite, in the veins of the Cerro Negro. In these and others of the central heights, and in the dells, sienitic hornstone, and altered rocks, containing more or less of iron, appear to be undergoing the process of extensive disintegration, producing large masses of a light ochrey dust on the hill sides and brows. Rapid disintegration is going on both here and in the Cerro Morado, and, as before observed, is contributing annually alluvial matter to the great valley, as carried down by the floods.

Proceeding up the pass leading to the Cerro Morado, also called *El Oro*, or the Golden Mountain, is a comminuted thin slate, which, slipping and sinking under the mule's tread, renders the ascent dangerous and impracticable during, and immediately after, rain in the mountains. High up in this mountain are minor hills, whereon the clay-slate friable as a shale may be found in a gradual state of disintegration, and an incipient soil forming, in which a wild potato not larger than a small gooseberry, is found vegetating.

A stream called *El Rio*, or The River, descends from the Morado, which, joining another from the N.W. from the neighbourhood of the elevation called the Caldera, supplies Chilcico and the neighbourhood with water. Before reaching that place it also turns (at *Candelaria*) a mill for grinding and reducing by amalgamation ores of silver; a similar establishment exists also at the foot of the Cienega. This stream in its upper branches is highly chalybeate. The Morado and the neighbouring mountains are largely impregnated with iron in almost every variety of its mineralization; its sulphates and oxydes deposited by the descending streams tint with shades of green and brown the white boulders and rounded stones on their margins. Native sulphate of iron is found.

In the Cerro Morado vast masses of sienitic greenstone and quartzose rocks are imbedded in, or alternated with, the clay-slate superimposed on the gneiss. The elevations of this Cerro are intersected with broad veins containing a friable and highly ferruginous indurated earth of a composite nature, but exhaling a strong

argillaceous odour. This earth contains deposits of auriferous cellular quartz, in which iron variously oxydated, but chiefly in the scaly oxydes is interspersed, and is apparently the agent in the disintegration going on in the quartz. Large specimens of this quartz, with fine grains of gold here and there visible on the surface, may be obtained. Copper and iron pyrites, said also to be auriferous, occur in these veins. Veins of pure scaly oxyde of iron are also met with, and are likewise regarded by the native miners as *creaderos*, or indications of the proximity of gold. Some of these auriferous veins attain the breadth of several yards, and in 1827 yielded from 1 to 20 or more ounces of gold in 50 cwt. of ore. Two of them, one being that of D. Ramon Doria Davila at Sañogasta, are worked with profit. Much gold doubtless exists in this district; and it would perhaps not be difficult to extend the present works without risking any great amount of capital.

The climate of the Morado is mild in comparison with that of the other great central elevations of the chain, both in respect to cold, and to the still more important circumstance of the *puna*, of which I shall presently speak. One almost continuous elevation, called the Rosario, connects the Morado and the Cerro Negro and Cerro Cienega; between these and the Nevado lie the ranges severally called the Valletos, the Tigre, and the Mexicana: the latter is perhaps within 300 feet of the height of the Nevado itself; the summits of the Cerro Negro, Morado, some part of the Valletos and the Tigre nearly equal in height that of the Mexicana. Ascending the great northern quebrada, termed the Escaleras, or ladder, from its long continued ascent by ravines and terraces, to the bases of the central elevations, a distance of 12 leagues from the trapeche or mill of the Escaleras is traversed. The region of lichens and mosses is finally arrived at in the upper ravines; and here the central elevations rise steeply, and often inaccessibly, from 700 or 800 to 1500 feet. This is the region of the condors, which, when glutted with the carcase of some dead mule, may be easily approached. Here also I observed a small active quadruped resembling the fox, scaling the rocks above the region of vegetation. At the northern edge of the Valletos occurs the *Cueva de Perez*, whence a ravine branches off to the right to the base of the Mexicana, which here presents a broad and very steep face, about 1000 feet in height, on which huts and entrances to mines may be seen at various elevations. A little way up the ravine from the cave some ancient Indian mining works exist; and here the *puna* begins to be sensibly felt, increasing as the ravine is ascended. At the entrance of this northern gorge of the Famatina mountains, near the Escaleras mill, long dikes, piled up, of smooth, rounded, bright gra-

nitic stones and flat beds of similar stones and boulders alternating with patches of sand, exhibit striking evidences of the force of aqueous action. Further in the ascent the features of the scene are on a grand scale. A mountain stream, from 15 to 50 feet wide, and from 2 to 4 deep, descends through this section of the mountains to the mill of the Escaleras, and is several times crossed in the ascent; it then flows into the valley below, and irrigates the district of Famatina already described. The pass of the Escaleras is generally impassable during the winter months of June and July, the stream frozen, and the ravines blocked with snow and ice. I, however, succeeded, in the comparatively milder winter of 1826, though not without difficulty, in ascending by this route and gaining the summit of the Mexicana, having passed a night in the Cueva de Perez blocked round with snow during one of those terrific storms so common in these elevated ranges. Their approach is well known to the miners, from the gathering of masses of small dark clouds sweeping eastward over the Nevado; the arriero with his mules, to or from the mines, then hastens to gain shelter in the huts above, or in the deep ravine beneath. These storms come always from the westward or south-westward: they sweep the ravines with furious gusts, which are succeeded by sudden momentary calms: they are generally confined to the upper regions of the mountains, without being felt at all in the valley of Famatina, where the weather may be serene and fine. The roofs of the low massive huts at the mines on the hill side, notwithstanding their being heavily laden with large stones, are sometimes blown away. In this remote and stormy region the poor miners lead a wretched existence: the spirit of gain, however, seems to set all difficulties at defiance. The highest part of the summit of the Mexicana, forming a point slightly elevated above the rest, called the *Espina*, is cut by a vein of silver ore which for several years has yielded a profit to its proprietor, D. Simon Herera, although worked at enormous expense. About 70 men were engaged in the working of this mine, and reducing the ores by amalgamation at the trapeche of Escaleras, distant 40 miles from the mine. Another vein in the same elevation has been profitably worked by Senor Goriti; and there is also another mine, which has been badly worked, in which considerable quantities of rich ore are exposed to sight in the vein. The ore of this elevation is a black, or greyish-black earthy sulphuret of silver, either pure, or more or less dispersed in a quartzose and hornstone gangue, and containing a proportion of gold sufficient to give the silver produced a yellow tinge. The average produce of the silver is 80 marks the cajon of 50 quintals from the mine of Santo Tomas in the *Espina* above mentioned. The other mines of this elevation yield an average from 40 to 50

marks, with the exception of that of D. Isidore Carbajal, which yielded 25 marks. There is probably considerable waste in the reduction of the ores. An assay, by a skilful German assayer, of some of the *relavcs*, or refuse of Santo Tomas, which had undergone amalgamation at the trapeche of the Escaleras, yielded in the ratio of 30 marks the cajon. The ores of this mine became latterly interrupted by a bed of pyrites. The veins of the Mexicana dip to the N.E. at an angle of about  $70^{\circ}$  to  $75^{\circ}$ ; the dip of the veins in the other elevations ranges between  $50^{\circ}$  and  $80^{\circ}$ . The inclemency of this region of the Mexicana is excessive; so much so, that the endurance even of the Indian is put to the test. The other elevations more remote from the Nevado are more tolerable, the Morado being the mildest. Pleurisy often occurs, and the victim not unfrequently dies on the route during his conveyance to the valley. "*Padecemos, mas sufrimos*,"—"We suffer, but we endure," was their reply to my question respecting the climate of this region. This inclemency is, however, not attributable to the degree of cold merely, but to the increased nervous sensibility, occasioned by the action of the puna affecting both the respiration and digestion, and rendering the cold less endurable. The puna is produced not altogether by atmospheric tenuity, although its action may be aided by this circumstance, since it occurs in widely different degrees at similar altitudes in these mountains. In the Morado its effects are comparatively slight—in the Mexicana extreme, although the altitudes differ little or nothing in relation to this phenomenon, which, I have little doubt, arises from certain mineral exhalations. This circumstance may account for some travellers having denied or thrown doubt upon its existence (vide Miers and others), while others relate of it the most startling examples (vide Miller's *Memoirs*, and the older voyagers in South America). The puna is not to be mistaken: it ordinarily produces a sense of weight in the head and limbs, hinders the progress of the pedestrian, as if his heels were lead, and sets him panting at a common walk, as if he were running a race; when considerable, it produces headache and nausea; when extreme, vertigo and vomiting. The complexion of the fresh-coloured European changes to a livid bluish tint; that of the Indian to a cadaverous yellow. In the Himalaya mountains a similar effect has been noticed; the cause is probably identical. The Mexicana exhales profusely sulphurous and other vapours: the clothes of the visitor at the mines become saturated with the effluvia, and it is probably as much owing to the puna as to any other natural obstacles that the Nevado is as yet unexplored, although conjectured to be rich in the precious metals. I suffered severely from passing a night in a low hut, half filled with snow, near the

summit of the Mexicana, with nothing but my saddle and its usual accompaniments, and a blanket for my bed, although the previous night I had slept on the rocks of the lower summits in the pass of Santa Rosa in the open air, with snow around me, with but little inconvenience comparatively—so much more inclement was the Mexicana. On this account no native visits it from mere curiosity.

Most of the ores of silver—the vitreous and other sulphurets, the muriate, red silver (*rosicler*) and native silver, in gangues varying from the hard quartzose to the slaty argillaceous, and the blending of both with iron-spar and the oxydes of iron—occur in the other elevations above named in these mountains; with the exception of those of the Morado, in which no silver ore has yet been discovered. As far as at present ascertained, the mineral veins of this range are limited to the central regions in the neighbourhood of the Nevado, and do not extend to the minor elevations of the range on the south, nor to those grouped on the N. E. and N. W. in the early portion of the ascent of the Escaleras. No mineral veins have been discovered in the range of La Rioja. On the Cerro Negro there is a mine—that of San Domingo, in which native silver, interspersed with the sulphurets, has been found in considerable quantity. I saw among other rich specimens, a piece of ore from this mine, extracted during my residence at Famatina, weighing above 20 pounds, three-fourths or more of the whole mass being native silver, imbedded with rich sulphuret, but presenting an almost uniform metallic granulated surface. The mines above mentioned, with some in the Rosario, now filled with water, but requiring only a small adit of a few yards to carry it off, are, as well as those in the Morado, in the hands of natives, and have never been under European management; the Famatina company of 1825 having, from various causes which it is unnecessary here to enter upon, been virtually rather one of exploration for new discoveries, than for the development of those already made. It would, therefore, notwithstanding the failure of that company—for which many extraneous reasons might be assigned, be presumptuous to say what future explorations, in connexion with the principal existing veins, might produce, or what undiscovered treasures might yet be brought to light, particularly should the Nevado itself be found accessible in some of its aspects. No disappointments have as yet been encountered, but such as have occurred in other mineral localities with equal title to consign them to oblivion.

Westward of the great Famatina chain lies the valley of Guandacol, which gives its name to the fourth and last department of the province of La Rioja. Its length may be stated at 35 leagues north and south; westward it extends to the foot of



the Cordillera. The inhabitants are for the most part of Indian origin. The river Bermejo, a considerable stream, rising in the Andes, flows through the whole district, the soil of which seems especially suited to the growth of wheat, for which, however, owing to the difficulties of communication, and the use of maize in the more central provinces, there is but slight comparative demand. No finer wheat than that of Guandacol, nor greater average produce—it has yielded 200 fold—is perhaps anywhere to be instanced, afforded by merely the scratching of a rude plough, and by irrigation. It is not, I believe, positively ascertained whether the Bermejo flows into the lake of Guanacache, or whether it be absorbed in the intervening Travesia between the Llanos of La Rioja and the habitable portion of San Juan. Copper, of which I have seen smelted specimens, is worked at Guandacol; but demand is wanting. The transit across the Andes to Coquimbo and Copiapo is comparatively easily accomplished by mules at this point. Merchandize was brought by this route to Famatina, in 1827; but the expense of exporting copper would probably be too great to render it, with this view, an object of production. The Indians of Guandacol hunt the vicuña, both for its flesh and fur; the latter is soft and fine, and is manufactured into ponchos and hats. A considerable number of cattle are reared in the farms, among the low hills of Guandacol northward; but, as already stated, the chief supply for the province is from the department of the Llanos.

In conclusion, I would observe that the most remarkable feature of the central plains of La Plata south of Tucuman, and bordering on the Cordovese range, as in those of San Juan, is the great scarcity of water and the total absence of the grasses over vast regions, and particularly of the kinds fit for cattle. Over tracts, wooded and unwooded, 50 leagues in extent, not a blade of grass is to be met with. With the exception of a portion of the plain in the immediate vicinity of Serrezuela, in the Cordovese chain, which is well furnished with coarse pasture, and in the neighbourhood of a spot called Balde de Nabor, the well of Nabor, about 6 leagues north of Serrezuela, in the Travesia, there is no known permanent grass or water to be met with over a distance of more than 40 leagues north from Serrezuela, and for a still greater distance east, from the line of the Rioja chain, comprehending a surface of more than 166 square leagues. I have stated how small a supply of it is to be found in the habitable portions of Arauco and Famatina. Those parts of the Llanos where grass and water are found form, as I have observed, but solitary specks, which again cede to the Travesia, including Salinas, between its south-eastern point,

Simbolar, and the Serrezuela; and between its south-western limit and the habitable portion of San Juan, 30 leagues of Travesia, a continuation south-westward of the former, again occur. The distinguishing feature of the wooded and grassless portion of the plains of San Juan, La Rioja, Catamarca, and Santiago del Estero is aridness. In some parts of the Travesias rain has been known not to fall for 18 months. Dew, which on the Chilian side of the Andes is abundant, is here unknown. The slight humidity afforded by the general state of the atmosphere appears to be drawn off towards this great saline desert, and absorbed by that and by the minor salinas, which thus exhaust the atmospheric moisture, so as to render unproductive of grass regions possessing a soil favourable for its growth. The salinas are almost the only places in which, under ordinary circumstances any moisture is apparent, and in these vegetation becomes extinguished by the excess of nitrous and muriatic salts, with the exception of a few scattered saline and alkaline shrubs.

Post Stations from the Town of La Rioja to the City of Cordova; through the western range of the Cordovese mountains:—this route was twice travelled by the writer.

|   | Post<br>leagues. |
|---|------------------|
| From the town of La Rioja, through the first Travesia, to Hedionda . . . . .                            | 32               |
| Polco . . . . .   | 6                |
| La Cienega . . . . .  | 4                |
| Simbolar—old road through the woods of Mimosas, &c. . . . .   | 8                |
| Serrezuela, through second Travesia . . . . .   | 24               |
| Paso Viejo, entrance to western branch of the Cordovese chain . . . . .                                 | 6                |
| Soto . . . . .  | 7                |
| Poblacion, mountain road . . . . .  | 4                |
| Vallecito, ditto . . . . .  | 7                |
| Ayanpitiñ (Indian word, signifying “death is arrested.”) . . . . .                                      | 4                |
| Matar Caballo, ditto, a fine level track over a mountain plain, covered<br>with dwarf herbage . . . . . | 4                |
| Quebrada, ditto, first post south side of the Cuesta . . . . .  | 7                |
| Saldan, Tablado of Cordova, a wooded and picturesque road . . . . .                                     | 3                |
| City of Cordova . . . . .   | 4                |

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[On examining the meteorological register kept at Chilecito in lat. 28° 52' S., near the centre of the Famatina valley, during the years 1827-8, it appears that the maximum height of the barometer was 27.5 in.; minimum, 26.45 in.; mean height 26.8 in.; indicating an elevation of about 3000 feet above the sea. During nearly two years' residence in this valley, the lofty summit of the Nevado was never entirely free from snow; in the great heats of summer the snow-line was about 200 feet below the summit. Now the limit of perpetual snow, in the parallel of 29°, is stated by Humboldt (*Pers. Narr.*, vol. i. p. 265) at about 12,000 feet; and we shall probably not be far wrong in assuming this as the approximate elevation above the sea of the summit of the Nevado of Famatina.—ED.]