

one of great importance ; and the road from Zīmāpān although dangerous and full of precipices, is described as the boldest and most picturesque portion of the Sierra Madre, south of Durango.

From Mexico to the Doctor, there are two routes, the one by San Juan del Rio and Cādērēitā, and the other a bridle-road, which is laid down in my map of routes, as given to me by one of the agents of the Catorce Company.

The mountainous district commences on crossing the river Tūlā, a little to the South of Tēpētītlan, (fourteen leagues from Hūehüetōcā,) from whence a succession of steep and barren ridges extends to the Indian village of Tēcōsōūtlā, situated in a valley, well watered, and abounding in fruitful gardens. From Tēcōsōūtlā the road crosses the river Pātē, in the vicinity of which there are mineral springs, emitting a dense sulphureous vapour ; and from thence it runs to the foot of a bleak and lofty mountain called Sōmbrērētē, upon which the Rancho of Oliveira stands. The Rancho is nine leagues from Tēcōsōūtlā, and four from El Dōctōr, which it is however impossible to reach in a single day.

The first of the four last leagues traverses a barren and rocky plain ; the second winds up a mountain of porphyry and marble, so steep as to be almost inaccessible ; and the third lies through a valley, covered with Oak, Ash, the White Birch, and the Pine, with plots of rich soil at intervals. Of the fourth, the first half is the ascent of the mountain

called El Pīnāl, the summit of which is elevated above the highest peaks of the surrounding Cordillera ; immediately beneath it, on a natural platform, stands the village of El Dōctōr, apparently not two hundred yards from the summit of the Pīnāl, but in fact nearly half a league distant, as the descent is effected by a zig-zag path, a great part of which is supported by terraces of masonry ; whilst beyond the village, and many hundred yards beneath it, there are a number of lesser mountains, mostly conical, and covered with timber, the valleys between them being inhabited by Indians, and sown with maize.

The Mina Grande of El Dōctōr extends almost beneath the village, and has two "Pertinencias" on the line of the vein, which runs nearly East and West, with an inclination of about sixty degrees : it varies from one to three varas in breadth, and yielded, when worked regularly, three hundred cargass of ore weekly. The buildings connected with the mine have been destroyed during the Revolution, and the village itself has gone to decay. It still contains, however, a large church, with ten or twelve good-sized houses, and a few Indian huts.

The mouth of the mine is 4,875 feet above the level of the river Tula, which, at the foot of the mountain of the Doctor is itself 4,519 feet above that of the Gulf of Mexico : the village stands therefore at an elevation of 9,394 feet ; and the Ēspōlōn, or summit of the mountain above it, attains

the height of 11,019 feet. The socabon, or adit of the Mine, (commenced in 1780, and concluded in 1794, at an expence of 90,000 dollars,) lies 753 feet below the village. It is 966 varas in length, but, from some miscalculation in the measurements, it did not enter the Mine below the lowest levels, and is consequently of little use at present.

The creation of a populous village in such a spot as that upon which the Pueblo of the Döctör stands, is a proof of the influence which the Mines, when successful, always exercise upon the population. The whole surrounding country is now settled, and should the vein, upon examination, be found sufficiently accessible to induce the Catorce Company to continue its operations there, a few months will ensure them an abundant supply of all the necessaries of life. The district contains a number of metalliferous lodes, by which the Indians, not employed in agriculture, have gained a subsistence during the last twenty years; and although none of them have been explored to any extent, they present sufficient indications of richness to render a more minute examination of them expedient. The Haciendas formerly belonging to the mine are situated at Mäcönī, (four leagues to the South-west,) where there is water in abundance; and at three leagues North of the Döctör, are the mines of San Crīstöväl, which abound in lead ores, and furnish large quantities of liga, or flux, for smelting. Two leagues and a half

beyond these, again, in a deep ravine, is the quick-silver mine of San Ōnōfrē, with a vein about nine feet wide, composed of Cinabar, and other mercurial oxydes. The ores differ from those of Almädēn and Huāncävēlică, inasmuch as they contain much native mercury, which is seldom found in sufficient quantities to be of much value. It exudes, however, in large drops from the ores which I possess, and the mine has been worked for some time by the present proprietor, with profit.

On the 20th of July we reached the town of Äctöpän, about ten leagues from Itzmiquilpan. The first part of the road is stony and barren, but after passing the village of Yölö, (five leagues from Itzmiquilpan,) the valley of Äctöpän commences, and on each side of it there are some fine Haciendas, following in their position the line of the mountains, from which they are supplied with water. The country is inhabited by Ōtömī Indians; and in the vicinity of Äctöpän is covered with rich crops of maize and barley.

From Äctöpän to Chīcö the road is wild and bad, but particularly the last six leagues, two of which lead, by an almost precipitous path, down the side of a very bold mountain, to a little eminence at the foot of it, upon which the town of Chico stands.

The whole distance does not exceed twelve leagues.

The great German Mine of Arēvälö stands upon another little hill, nearly opposite the town.

It enjoyed no sort of celebrity until the beginning of this century, when it fell into the hands of the present proprietor, Don Antonio Revilla, who, after working it for some time in an obscure way, was fortunate enough, in 1803, to fall in with a Bonanza, or mass of rich ore, which enabled him to carry on his operations upon a larger scale. In 1811, from one part of the level, called "El Divino Pastor," he obtained, in seven weeks, a clear profit of 200,000 Dollars.

During the Revolution, Revilla suffered, as all other Mining proprietors did, and was forced to mortgage the large estates in the neighbourhood of Arroyo Sarco, which he had purchased during the time of his prosperity. Having no means of paying off this mortgage, or of recommencing his mining operations and repairing his Haciendas, he was glad to accept the proposals made to him by the German Company, which undertook to advance him 100,000 Dollars, and to take his stock at a valuation, on condition that he should make over to them the entire management of the mine, and twelve Barras, or a Half-Proprietorship in it, for thirty years. The 100,000 Dollars advanced to Revilla in the first instance are to be deducted from his share of the profits, as is half the value of the stock on hand, which amounted to nearly as much more.

Upon these terms the Germans obtained possession of the mine, and there can be little doubt that it will prove a most lucrative speculation; for the

vein is, in many places, from *fourteen* to *seventeen varas* in breadth. The mine contains little or no water, and what there is, is carried off by a Socabon, or Adit, which enters it at the depth of 113 varas. The lowest workings do not exceed 168 varas, and that only at one particular point.

I had the advantage of visiting every part of the mine with the proprietors, who passed nearly three hours with us underground, and I certainly never saw so enormous a mass of metal. Of course, the quality varies, but although there are richer and poorer ores, there are none so poor as not to be worked with profit.

The most valuable ore, called Pepena, has been found, when smelted, to yield five Marcs to the Arroba, or 162 ounces to the Quintal; but this is rarely met with. The ordinary ores, which I saw amalgamated, produced seven and a quarter ounces to the Carga of three quintals, (equal to seven dollars and two reals;) and the expences of the process amounted to four dollars and four reals, leaving a profit upon each Carga of very nearly three dollars. Baron Humboldt's theory as to the saving which may be effected by the introduction of the Freiberg process of amalgamation into Mexico, has not yet been verified. The Germans merely shorten the process by placing the amalgam in stoves for twenty-four hours, which is regarded as equivalent to a week's exposure in the Patio. When the Hacienda is completed, it is their intention to carry flues under

the whole floor, by which means a small *Torta* may be amalgamated perfectly in four or five days, instead of employing as many weeks to effect it, as is the case at present.

It being absolutely impossible to avoid the use of Mexican mining terms, in an account of the mines of that country, it may be advisable to give here a concise explanation of their signification. The *Torta* contains fifteen *Montones* of ore, which has already undergone the process of dressing and stamping; and each *Monton* contains ten *Cargas* (or loads) of twelve *Arrobas* (25lbs.) or three quintals each.

To extract the silver contained in this mass, seven hundred pounds of quicksilver are required, of which from seventy-five to one hundred pounds are lost. To this are added eleven *Cargas* of Rock Salt, or four and a-half of Sea Salt, and from three to three and a-half *Cargas* of *Magistral*, (red copper ore roasted,) which is worth at Chico from eleven to sixteen dollars the *Carga*, being brought from Zacualpan, Angangeo, or San José del Oro, a distance of full thirty leagues.

All these ingredients are entirely lost in the process: the expense of which varies, in the different Mining districts, in proportion to the greater or less facility with which they are obtained.

The German Directors at Chico, Messrs. Du Berg and Kloppenberg, informed me that they found that no general rule or theory would apply to amal-

gamation in Mexico; and that they could give, as yet, no explanation of the peculiarities of the process. Long practice had given the old Mexican amalgamators a perfect knowledge of the quantity of the different ingredients required by their ores, and they added to the *Tortas*, Salt, *Magistral*, and sometimes Lime, with a precision which a scientific man would be glad to attain, although unable to assign any reason for what they did. The only improvements which the Germans have been able hitherto to introduce, consist in preparing the ores, by the Concentrating Machine,\* either for smelting or amalgamation; and in collecting more carefully the quicksilver which may remain in the *Tortas* after the Amalgamation has taken place. The residue of the *Torta* is then washed, and carried afterwards, in troughs constructed for the purpose, round the whole Hacienda, until it is deposited in an open yard, where, after the earthy particles have been again separated by water, that which remains is called *Polvillos*, and on being smelted, is often found to produce from two to three Marcs of silver to the hundred weight. The little quicksilver which may remain is lost in this last operation.

\* The concentrating machine (Stossheerd) is an inclined plane or frame work, upon which a quantity of pulverised ore is deposited, and subjected to the action of a small stream of water, which, by the peculiar motion of the machine, is allowed to carry off the earthy particles, and thus to *concentrate* the silver contained in a given quantity of ore, from one to ten or twenty Marcs in the *Arroba*.

The Germans have another Mine, between Actopan and Chico, called Santa Rosa, which, although the works are in a very dilapidated state, is free from water, (a circumstance to which they have always paid great attention,) and is producing ore even richer than that of Arevalo.

In their Hacienda they can command a water power to almost any extent; their smelting furnaces are completed; the country about them abounds in wood, and provisions are not particularly dear.

To set against these advantages, there is the smallness of their capital, which prevents them from acquiring a proper influence over the natives, and obliges them to introduce their improvements with the utmost caution; and the difficulty of obtaining workmen, except on the unreasonable terms which Revilla was compelled to grant during the Revolution, when one *Third* of the Pepena, or rich smelting ore, raised by each barretero, (common miner,) was allotted to him to be sold upon his own account. But these are drawbacks which time and perseverance will enable the Company to surmount; and they have displayed throughout such a thorough knowledge of the business which they have undertaken, so much assiduity, and such extraordinary economy, that I entertain not the slightest doubt as to their success.

Some of the English Companies have Mines in the vicinity of Chico, from which, however, but little is to be expected. At Cápulá, the United

Company is working the Mines of Las Papas, Santa Ana, and Santi Christi, the last of which, it is thought, may prove productive. In general, the Mines both of Capula and Chico (with the exception of Arevalo) are poor; and although, where one good mine has been discovered, others may be found, there are so many districts in which the chances of success are greater, that the investments made by the New Mexican, United Mexican, and Anglo-Mexican Companies, in the inferior Mines of Chico and Real del Monte, appear to me to belong to that class of injudicious experiments into which Foreign Adventurers were betrayed, in the beginning of 1825, by the absurd competition for contracts which the mining mania in England created.

On the morning of the 23rd July, we left Chico, and proceeded to Real del Monte. The distance is not above three leagues and a-half, but the road is one continued ascent, and, in many parts, so very rugged, that it requires as many hours to perform the journey.

There is, perhaps, no British Company to which so little justice has been done by the Mexicans as that of Real del Monte; a circumstance which is to be attributed entirely to a misconception of the system pursued there. Many people imagined that Captain Vetch, the Director, having it in his power to make the Mines pay at once, had not done so, in order to allow time for the completion of surface works; which, though highly advantageous at

a more advanced stage of the negotiation, were not essential in the first instance. Indeed, I had myself heard this statement so often repeated, that I could not but conceive that there must be some foundation for what so many agreed in affirming. Upon this point my visit to Real del Monte completely undeceived me, by enabling me to convince myself that the delay which had occurred, was owing entirely to the immense scale upon which the undertaking was carried on; and to the impossibility of effecting the drainage of any of the principal mines, before the arrival of the steam-engines, the departure of which from England had been unfortunately retarded.

A reference to the account of the operations of the Company contained in the Second Section of the preceding Book, will sufficiently prove the use which had been made of the interval.

By pursuing steadily one well combined plan, Captain Vetch had brought all the principal works upon Count Regla's grant, including the old Adit, which may be regarded as the key to the whole, into a fit state for the application of the powers of steam; a task which it required the labour of two whole years to complete. On the Santa Brigida vein, the shafts of San Jose and El Sacramento, and on the Biscaina vein, those of San Juan, San Francisca, Guadalupe, Santa Teresa, San Cayetano, Dolores, and El Zapatero, had been repaired and re-timbered down to the Adit level, (about 213 varas,)

in addition to which two new shafts had been sunk, (St. George and St. Patrick,) about fifty varas each, in order to render accessible the workings of some old shafts, upon a very rich portion of the vein, (between La Palma and San Ramon,) which it was found impossible to open anew.

One shaft on the Acosta vein, had been likewise re-timbered down to the Adit level. The shaft of San Estevan had been completely cleared, and was beginning to produce very rich ores.

The mine of Mörän had been likewise cleared down to the water, (about eighty feet,) and a horizontal steam-engine erected there, which was to begin working on the 12th of August. It is of fifty-horse power, when worked only to a pressure of 45lbs. on the square inch, but it is calculated to bear a pressure of 200lbs.

With regard to its being fully adequate to clear the mine of water, no doubts are entertained. The deepest workings of the Moran mine do not exceed one hundred and sixty varas; and a few weeks would, consequently, suffice to drain it entirely, were it not for the necessity of re-timbering the whole shaft, as the workmen proceed. There is one curious circumstance with regard to this mine; it has always borne a very high character, and yet, like San José del Oro, no accurate information can now be obtained with regard to the state or extent of its works. About thirty years ago an attempt was made to drain it by some German engineers