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MINES OF CHIHUAHUA

1907

History,

Geology,

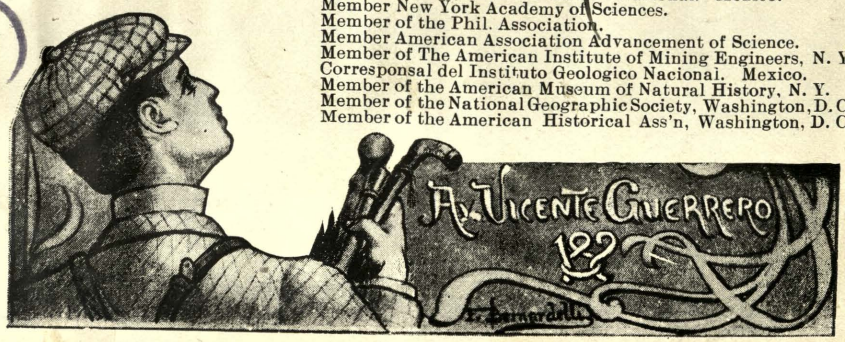
Statistics,

Mining Companies

Directory by

Jorge Griggs,

Director State Permanent Mining Exposition.
Late Assayer for Modoc Concentrator Co. Las Cruces, N. M.
Ex-Consejo de Vigilancia. Baja California.
Colaborador del Instituto Medico Nacional. Mexico.
Member New York Academy of Sciences.
Member of the Phil. Association.
Member American Association Advancement of Science.
Member of The American Institute of Mining Engineers, N. Y.
Corresponsal del Instituto Geologico Nacional. Mexico.
Member of the American Museum of Natural History, N. Y.
Member of the National Geographic Society, Washington, D. C.
Member of the American Historical Ass'n, Washington, D. C.



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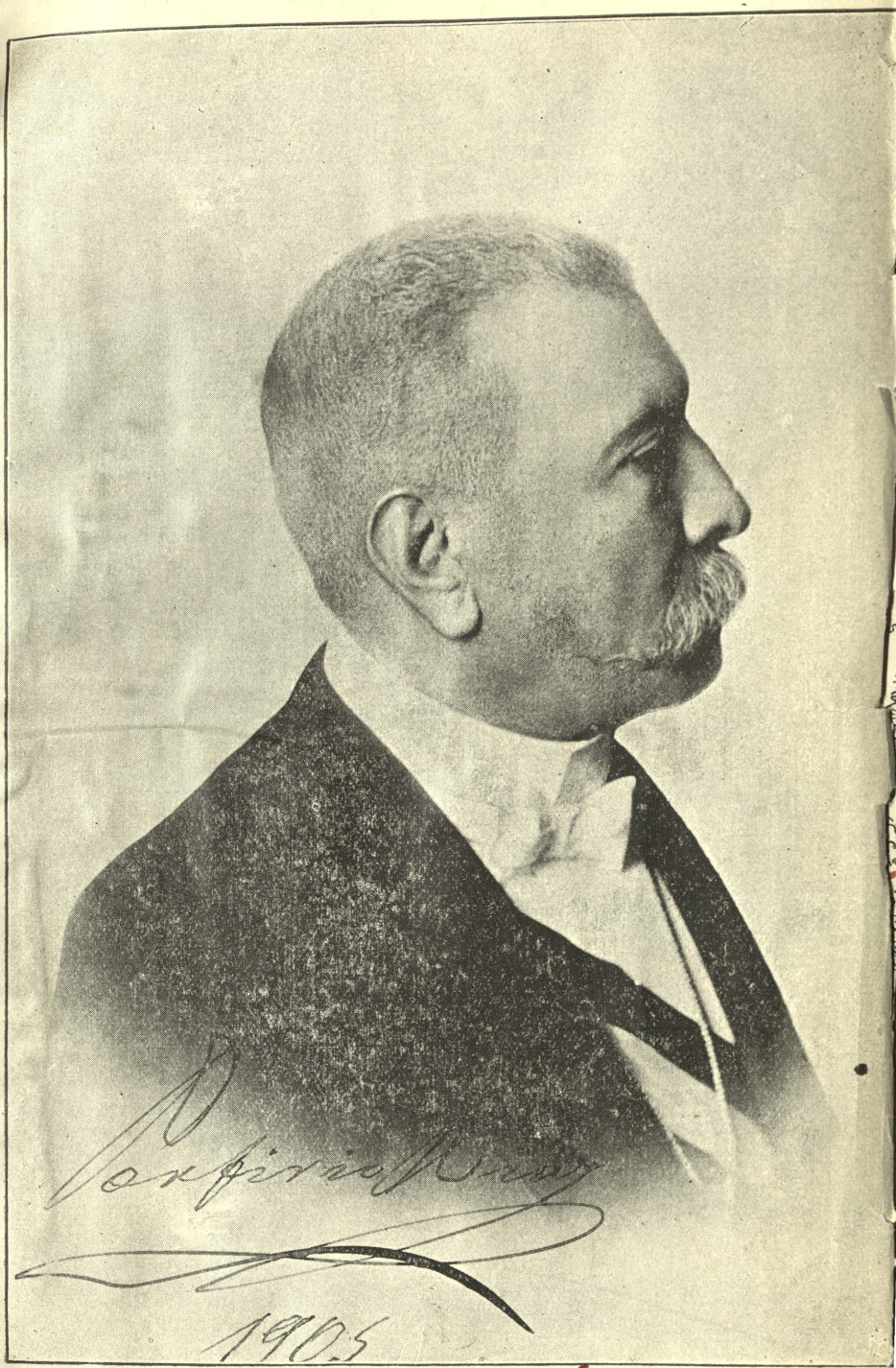
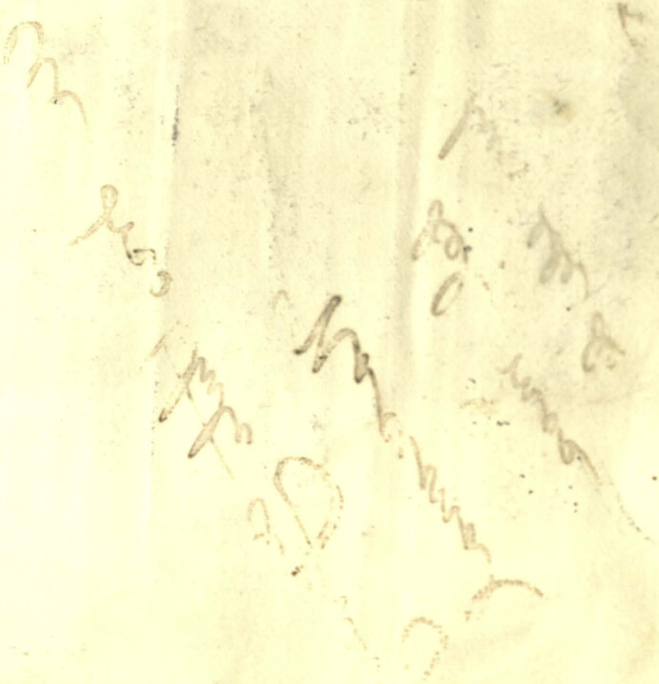


GEN. PORFIRIO DIAZ.

President of Mexico.

KANSAS CITY, MEXICO & ORIENT RY.
Map showing
LOCATED & PRELIMINARY LINES
through the
REPUBLIC OF MEXICO
Office of the Chief Engineer
Kansas City, Mo. February 1906.
M.P. Parel. Chief Engineer
Located Line shown thus
Preliminary Line shown thus
Elevations are shown in ft. above sea-level (mean tide) thus
and mines thus +
The following information was collected prior to Jan. 1st 1902 and even at that time only covered "the more important mines and prospects and such as are commonly known. A fraction of the actual number in existence." Many very important mines have since been discovered and developed.
Map No. | Industry | No. Men | Remarks
CHIHUAHUA
SAN ANTONIO
SAN ANDRES
CUSIHUIRIACHIC
STA. ISABEL
ALDAMA
DOLORES
STA. EULALIA
COYAME
PUEBLITO
LAS VIGAS
OJINAGA OR PRESIDIO DEL NORTE
MIÑACA
GUERRERO
ATLANTIC DRAINAGE
PACIFIC DRAINAGE
LAGUNA DE CASTILLA
MEXICAN CENTRAL R.R.
Fine fruit and farming district. 1500 acres of fruit in town.
Pueblito has an annual output of 3000 barrels of sotol and 3000 tons of farm produce.
Las Vigas - mines, rope making and farming on small scale.
The entire valley of the Rio Conchos is black virgin soil, producing two crops of cereals each year. Both it and the valley of the Rio Grande are well adapted to the growing of cotton.
The Santa Eulalia mining district has a daily output of from 500 to 800 tons of ore.
Dolores has 5000 head of stock and 4500 acres land under cultivation.
10,000 head of stock
Well of crude petroleum. Discovered in 1885.
LLANO DEL CHILICOTE 2000 acres in cultivation
1000 head stock
The Rio Grande or Rio Bravo del Norte, as it is called by the Mexicans, is the international boundary line between the United States and the Republic of Mexico.
ESTADOS UNIDOS DE TEXAS
Chupadero
Mula
Tapacolmes
Nogal
Presidio
San Juan
Cuchillo Parado
El Alamo
Fortin
Ojo Caliente
Ojo del Cuervo
Lagrima
Ojo del Carrizo
Ojo del Mesteño
Agua Nueva
Ojo del Poncho
Ojo del Venado
Encinillas
Sauz
Boca del Potrero
Hormigas
Sacramento
Tabalaopa
Mapula
La Noria
San Diego
Cholome
San José del Carrizo
Bachimba
Ortiz
Colonia
Sto. Domingo
Sta. Rita
San Ignacio
Gomez
Culebra
Soldado
Chorreras
San Domingo
Plomosas
Picachos
Placer Guadalupe
Mimbres
Salas
Palomas
Tinajas
Fresno
San Nicolas de las Carretas
Sta. Rosa
Aguaje
San Juanito
La Boeza
Majada
Tres Ojitos
Concepcion
Boquilla
Galera
Coyachic
La Manga
La Cienega
Sta. Lucia
Piver
Mesa
Aldana
Bustillos
Chivarria
San José de Zubia
San Juan
Malpaso
Pedernales
Rosario
Hacienda
Basuchic
Dolores
Mala Noche
Sainopuchic
Rubio
Cerro Prieto
Temechic
Pichachic
Pachera
Cebolla
San Juanito
Cusarare
Bocoyna
Laguna
Llano
Sisoguichic
Carichic
Panalachic



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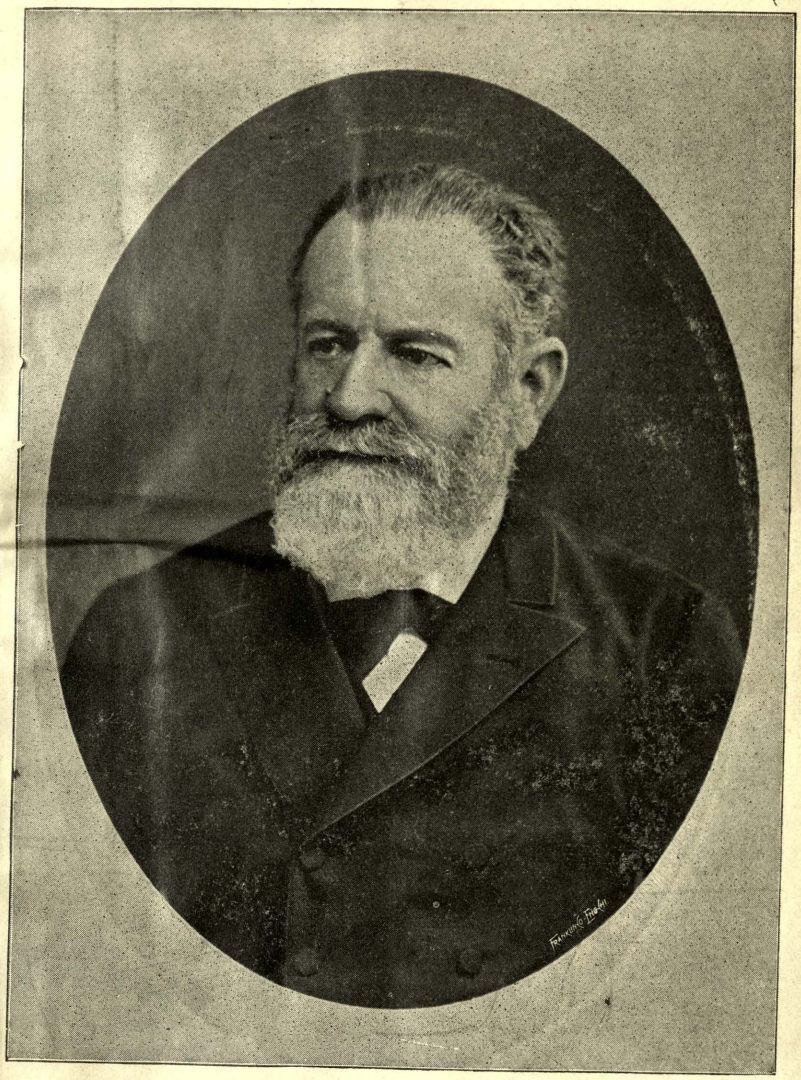
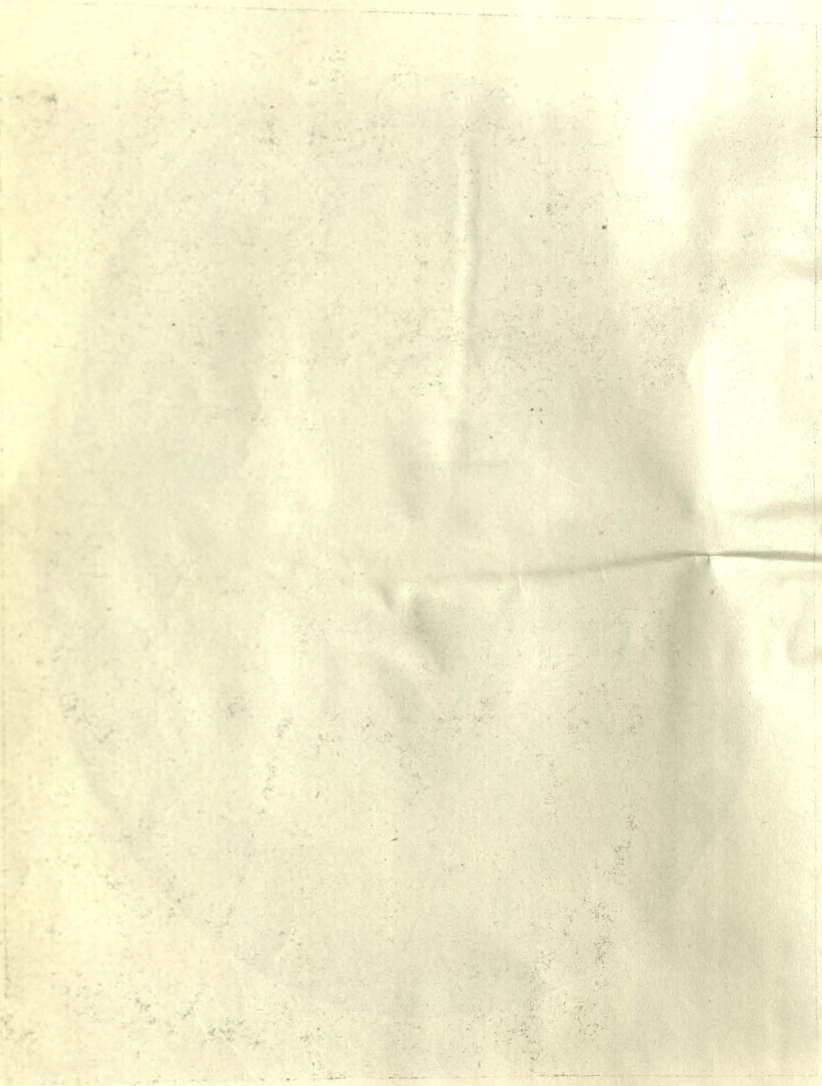


GEN. LUIS TERRAZAS

Constitutional Governor of the State of Chihuahua.



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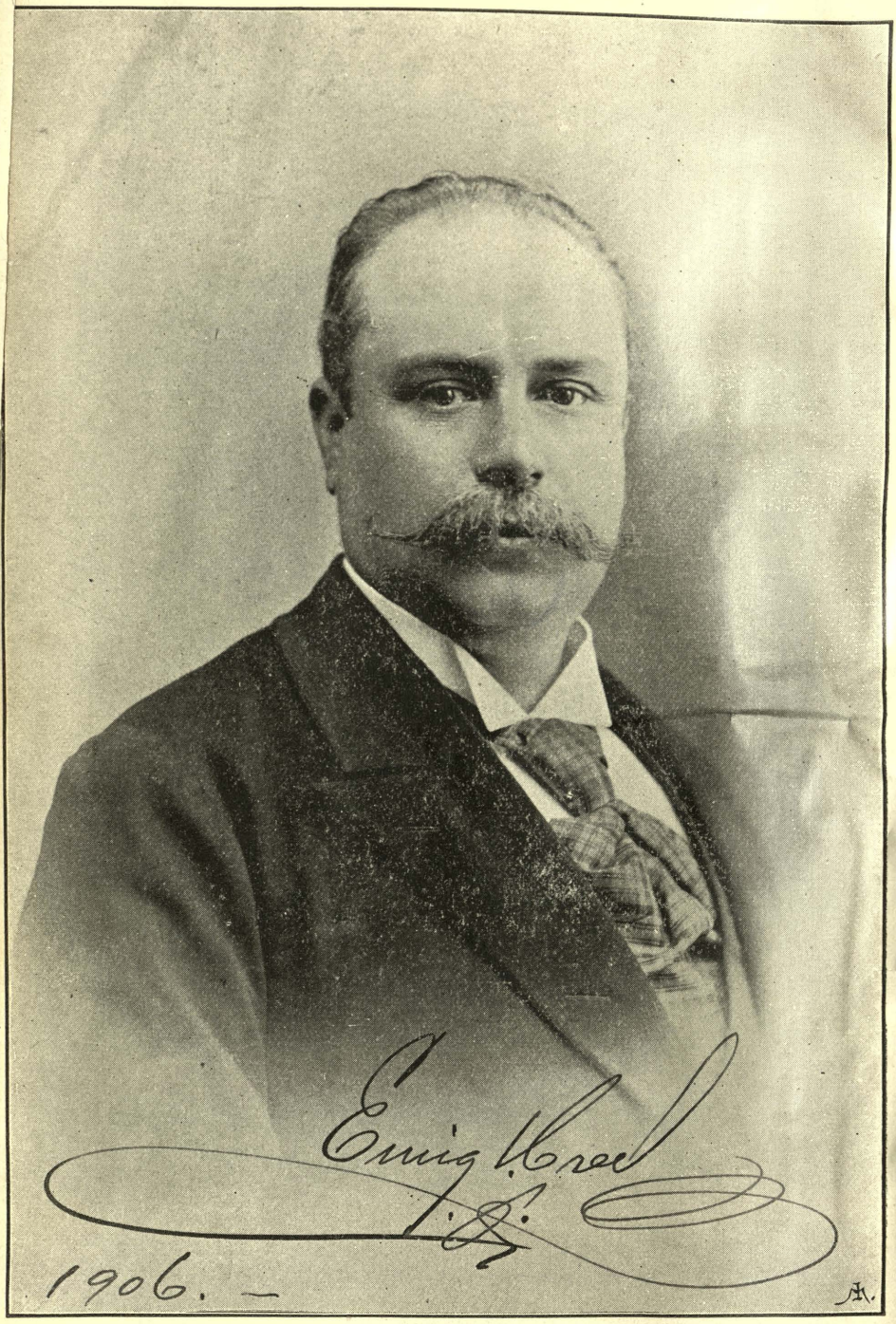
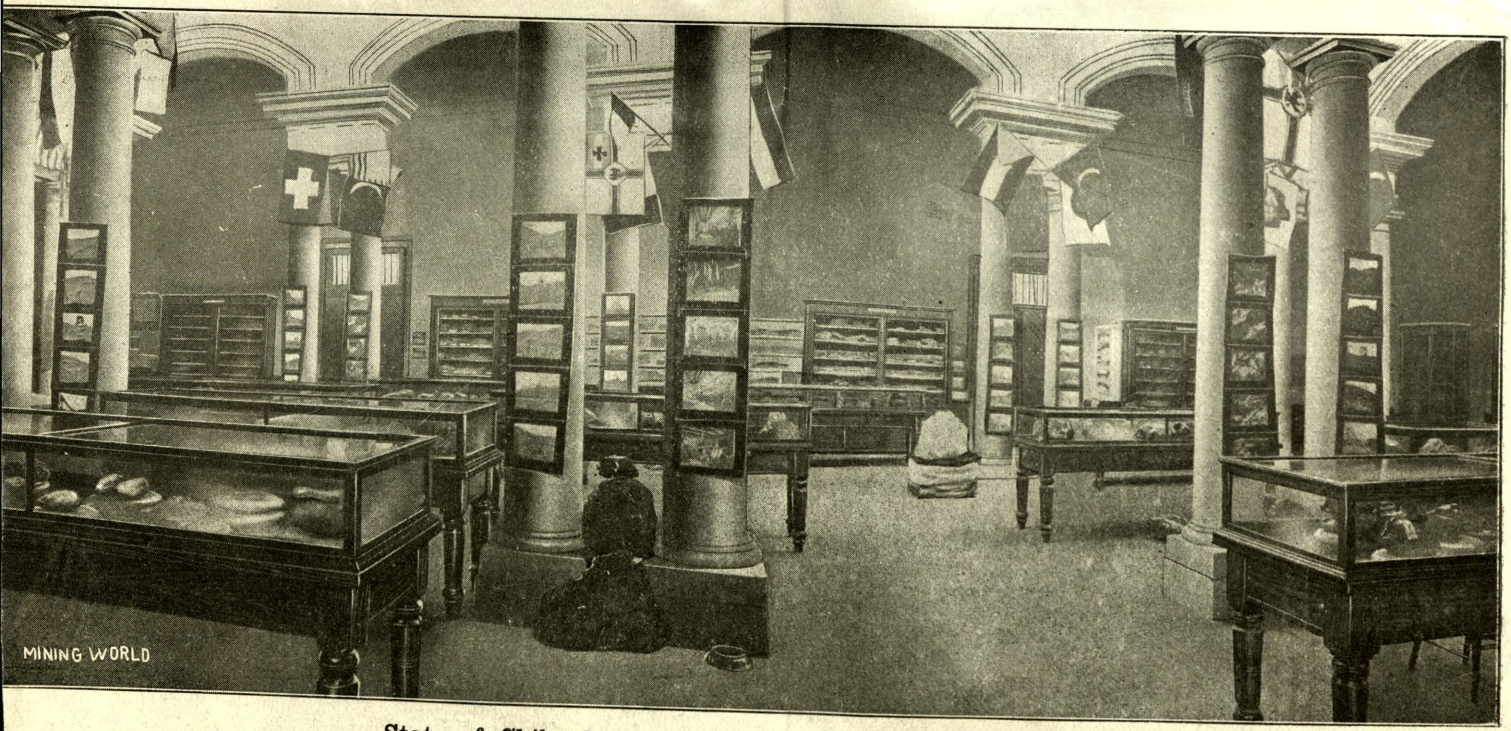


ENRIQUE C. CREEL.

Former Acting Gov. of Chihuahua, now Ambassador from Mexico to the U. S.



State of Chihuahua's Permanent Mineral Exhibit.

MAPA
DEL ESTADO DE CHIHUAHUA MEXICO.

Por W.D. PEARCE

RAILROADS IN OPERATION.
RAILROADS UNDER CONSTRUCTION.
RAILROADS SURVEYED OR PROJECTED.
DISTRICT LINES.
TOWNS WITH MUNICIPAL LANDS.
CHIHUAHUA MEXICO, AUGUST 10. 1906.
W.D. Pearce.

INSTITUTO GEOLOGICO DE MEXICO

PORFIRIO DIAZ.

BY COUNT LEO TOLSTOY.

(Translated from the French by Jorge Griggs).

THERE in a secluded spot on the western hemisphere is detached the solitary silhouette of a modern Cromwell; his spirit, if we eliminate the proverbial fanaticism of the great protector, is identically the same. It is a reconstructive force, the existence of which alone shows that the soul has no nationality and that when it is about to choose its mortal coil it has no preference as to race. This fact in itself demonstrates that the human spirit is universally distributed; a doctrine sustained by the immortal Pythagoras.

How is it that Diaz made order out of chaos? The great statesmen of Northern Europe are also imminent according to the critics of modern history, because they found themselves surrounded by ductile elements with no difficulties in shaping them to their own ideas, as they had attained a more or less advanced state of civilization.

But in Mexico there was nothing but chaos, nothing but shades, nothing but elemental civilization; during half a century the only light that shone in the darkness was that which flashed from the cannon's mouth, and the beautiful septentrion sky of America was flushed by the blaze of incendiary. Lo, out of the vortex of the mælstorm appeared a mounted warrior like the hero of the Cossack legend, with "a bloody horse and a flaming sword." Is he an exterminating angel or only a drop of water of that dark torrent? He is lightning but of light and not of death! He makes his way to the front of the fray, the legions disperse like the snowflakes when the south wind blows, leaving behind a radiant sun to dry up blood of the battlefield.

He dismounts and sees the heart-rending scenes at his feet, then he throws his armor far away, takes the plow and opens the furrows and plants the seed.

The land is covered with verdure, the birds sing and peace and prosperity reign. The fugitives return to see the soil covered with crops and wonder who wrought this change, there they see the stern figure of Diaz and as nature's sons they bow before his presence.

Diaz preaches to them the gospel of peace, showing that with blood the cockle-burr only blooms, while the breadstuffs grow only by the sweat of the brow. It is not an autocratic empire like Russia, but democratic in its national construction. Mexico does not enjoy the liberties of its powerful neighbor on the north, nor would it be proper to have them, for liberty is like dawn which first appears in the faint tints of dying night.

Nature is an enemy to abrupt change; people who have remained long in a state of darkness and suddenly see the light, fall back dazzled. Precisely in this point consists the genius of the Mexican statesman; in the gradual and methodic counting of the pulse of the national existence. Another reformer of lesser talent would have made his country a multitude of demagogues without law, without God, or a group of tyrants and slaves. But God knew how to avoid extremes, creating a government unique in the annals of history, which is in form a republic.

Democracy, if I am not mistaken, is the idea of Diaz, and if to achieve this he may use autocratic methods, it is not his fault, but of the heterogeneous elements that constitute a national organism.

OFFICE

OF THE

SECRETARY OF STATE OF CHIHUAHUA.

To The Miners:—

From the time of the conquerors up to our days, Mexico has held the attention of the whole world for its rich mineral resources. The Economist, W. A. Shaw, in his great work, entitled "The History of Currency" says: that "the discovery of America was the salvation and monetary resurrection of the Old World, by means of the remittances of precious metals." Humboldt makes reference from what country those remittances were principally made, and the statistics show that Mexico had produced silver above the amount of $4,000,000,000 of which sum $2,500,000,000 have been coined since 1535 up to the present time in the mint of the Capital of the Republic.

This extraordinary production has furnished the means of silver circulation, to great extent both in America and Europe, and has satisfied the greed for white metal in the Eastern countries.

If Mexico stands to the fore in such notable mineral production, notwithstanding the great political, economical and scientific difficulties, that have hindered this industry for several centuries, it is easy to understand what may be expected now that we enjoy peace, that the means of transportation and the scientific and industrial progress, invite new and far reaching advantages for its exploitation.

In that same advance of mineral richness, the State of Chihuahua occupies a most distinguished place, as it has contributed with a production of the white metal, to the enormous sum of $1,500,000,000. Until now silver has been the principal mining product of Mexico, but it is now beginning to produce also various other metals which already represent a very considerable amount and which are new factors of energy, activity and work in this most notable branch of public resources.

The Governor of the State being convinced that the mineral resources of its territory offers a wide field for investigation, activity and work, in the exploitation of which profitable investment of large capital and employment of a great number of laborers, Congress of the State has initiated under date of the 12th of September last the establishment of a permanent Mining Exposition in this Capital, with a view to furnishing an attractive field for the study of the mineral resources of the State to the scientist and business man. In order to form this Mineral Museum, the Governor counts on the in-

telligent and progressive spirit of the different mining corporations of the State, and he has not erred in expecting that they will come to his assistance.

The Governor has already made reference to the importance and progress of the mining industry of the Republic and the part the State of Chihuahua plays in its evolution, an importance easily appreciated from the figures I mention and the present production, which amounts to more than fifteen million pesos per annum.

It is well known, however, that mineral regions exist in the State as yet little explored, though the extensive mineralized zone and isolated discoveries that have been made open a great field for investigation. It is further well known that large iron deposits exist, and that this mineral as well as copper, lead, zinc and others are required for use in the industries of the country and more particularly so when the exploitation of the coal-bearing and oil-bearing zones is begun along the Rio Grande, in this State, which also offers great attractions.

The Governor of the State, lively interested by this progress, thinks that the Permanent Mining Exposition will greatly assist in calling the attention of the capitalist and at the same time facilitate scientific studies.

With this end in view the Governor has seen fit to request of you, as I have the honor of doing, to kindly send him samples from each of the mines, said sample weighing from one to three kilograms, together with the name of the mines, location by Municipalities and Districts together with whatever other data you may see fit to furnish, in accordance with the circular for that purpose herewith enclosed, making such remittance either direct to the Director of the Permanent Mining Exposition or through the Jefaturas Politicas, to whom instructions have been given in order to facilitate such remittances.

The Governor further requests that you send any scientific studies or descriptions that you may possess in reference to your mines and those of your District in general, with the object in view of collecting such documents and having same printed in various languages.

The Governor feeling confident that you will accede to his request, which I take the liberty to make known to you, in order to further the realization of the improvement indicated, thanking you in advance and requesting a reply as soon as your occupations will permit,

Liberty and Constitution,
Chihuahua, Oct. 11, 1904,
Joaquin Cortazar,
Secretary.

WHAT THE WORLD HAS SAID ABOUT MEXICAN MINES IN GENERAL AND PARTICULARLY ABOUT THE MINES OF CHIHUAHUA.

I

"Who'd hear great marvels told—
Come listen now:
Who longs for hidden gold—
Come listen now.
—"The Aztec Treasure House." Thomas A. Janvier, 1901.

II

High on a throne of royal state which far
Outshone the wealth of Ormus and of Ind.
Book Lines 1 and 2.
In spirit perhaps he also
Saw RICH MEXICO, the seat of Montezume.
Book XI., Lines 406 and 407.
—MILTON, "PARADISE LOST."

III

One of the first acts of HERNAN CORTEZ after having assured the stability of his New Monarchy was to send two of his men in quest of GOLD. After months of search they returned with glowing descriptions of MINES. Both of these heroes were to figure later in History, the first was Captain Francisco Pizarro, who later filled the pages of the History of Peru. The second was Captain Francisco Ibarra, FIRST MAN TO DISCOVER THE NOW STATE OF CHIHUAHUA.

—PRESCOTT.

IV

Luis de Velasco, who succeeded Cortez as Viceroy, sent Captain Don Francisco de Ibarra to explore the North. He left Tenoztitlan; then invaded the territory of Guadiana and founded the City of Durango. Then entering the mountain region of Topia and Tarahumara, he founded the "Reales de Minas" Inde and SANTA BARBARA, in the year 1547. SANTA BARBARA (State of CHIHUAHUA) was at one time the Capital of the Provence of Nueva Viscaya; comprising the States and Territories of Chihuahua, Texas, New Mexico, Arizona, California and part of Sonora and Coahuila.

—GARCIA CUBAS.

V

Northern Nueva Vizcaya or Modern Chihuahua. Near the Franciscan Mission of Nombre de Dios, mines were discovered in the year 1704 which proved to be among the RICHEST in the New World. Contradictory statistics extant make the production of silver before 1800 from fifty to one hundred Millions of Dollars. Two "Reales de Minas" or mining camps were founded a few leagues apart and named respectively "SAN FELIPE and SANTA EULALIA." The former in 1718 was made a villa under the title of "SAN FELIPE EL REAL DE CHIHUAHUA," this being the first appearance of the name Chihuahua since applied to the state, having probably been the Indian name of a rancheria in the vicinity.

—Page 599.

—BANCROFT, "NORTH MEXICAN STATES."

VI

The word Chihuahua is from "Nahuatl" origin; it has two meanings, some historians say it comes from "Xicuahua," formed from "Xi" meaning "so" and "Cuauhua" corruption of "Cuahualqui" which means "Dry," thus we have "So Dry" or "Very Dry." Others say it stands for "Very Sandy."

—ALFREDO CHAVERO.

VII

Before 1767, as we have seen, it had a population of five thousand, while Santa Eulalia had that number in its vicinity including many haciendas. The grand Cathedral which is still shown to visitors as the city's chief attraction cost nearly a million by tax of a real on every mark of silver, or twelve and one half cents on each eight ounces Avoir., built it is said from 1738 to 1750.

—GACETA DE MEXICO, November, 1828.

VIII

MEXICO and Peru have been the most productive countries in Silver. In Mexico it has been obtained mostly from its ores. A Mexican specimen obtained from BATOPILAS (Chihuahua) weighed when obtained 400 pounds. During the first eighteen years of the present century, more than 8,180,000 marks of silver were afforded by the mines of Guanajuato alone. In Durango and Northern Mexico are noted Mines affording native Silver.

—J. D. Dana's Mineralogy.

IX

Silver specimens have attained a weight of 100 kilogrammes. These from Mexico and Peru the largest producers in the world.

—MINERALOGIE par F. Wallerant.

X

The annual product of silver in Mexico is over $22,000,000, an enormous sum that rivals the wealth of California.

Silver is found in (quantities progienses) in prodigious quantities all over the plateau of Anahuac. The Mine of Batopilas in the State of Durango [should say CHIHUAHUA] in the most Septentrinal part of Mexico produces native silver; elsewhere it is to be found in Sulphides, Clorides (rouge) ruby silver, etc. The mines are to be found always surrounded by cultivated farms, forests in its mountains, town and villages, hence facilitating the exploration of the subterranean riches.

—PIERRE LAROUSSE, M. Michel Chevalier, Revue des Dues Mondes, 1863.

XI

CHIHUAHUA.—Its Mining industry is its principal source of wealth.

—Diccionario de Geografia, D. L. Campano, 1869.

XII

CHIHUAHUA IN THE EARLY TWENTIES.

Proceeding again into the interior, we find the central table-land occupied by the states of Chihuahua and Durango, formerly composing the intendency of New Biscay. To the Inhabitants of the southern and central provinces, everything north of Zacatecas is "terra incognita" and the traveler is surprised, after passing it, to find an improvement in the manners and character of the inhabitants. Durango, where the change first becomes visible, may be considered as the key of the whole north, which is peopled by the descendants of a race of settlers from the most industrious provinces of Spain (Biscay, Navarre and Catalonia), who have preserved their blood uncontaminated by the cross with the aborigines, and who retain most of the habits and feeling of their forefathers. They have much loyalty and generous frankness, great natural politeness, and considerable activity both of body and mind. The women, instead of passing their days in languor and idleness, are actively employed in affairs

of the household, and neatness and comfort *are nowhere so great and general as in the north.* These characteristics extend with some local modifications, to the inhabitants of the whole country formerly denominated the Internal Provinces of the West (Nueva Viscaya) and which now compose the states of Chihuahua, Durango, Sonora and Sinaloa with the Territories of New Mexico and California. Containing some rich mines of silver which is coined at the Mints in Chihuahua and Durango. —H. D. WARD, London. 1824.

XIII

The discovery of America contributed to abandonment of Mining in Spain. Forgetting even the thought of the wealth of the Mother land FOR THE VISION OF THE DISTANT EL DORADO.

About the year 1555 the celebrated Silver Mines at Guadalcanal and about the same date THE INVENTION OF EL PATIO SYSTEM OF TREATING ORES BY AMALGAMATION by BARTOLOME DE MEDINA of MEXICO.

—Vol. III, Page 92.

MEXICO has been and is one of the most productive countries in precious metals. Having produced from the time of the conquest up to 1870 the sum of 21,000,000,000 (Twenty-one thousand million) PESETAS.

—Fred Gillmen. Page 157, Vol. III., LOS GRANDES INVENTOS.

XIV

It is generally admitted and recognized that the wealth of Mexico explored till date is nothing but a drop of water in the ocean in comparison with the virgin mines that lay in all directions; all that is required is enterprise and capital.

—CHARLES LEVIN, London.

XV

From the mining point of view Mexico is one of the richest countries in the world. The mines of Mexico have played a very important part in the history of Mexico since the time of Cortez. In the State of Chihuahua there are 100 mining camps and 575 mines. Silver is found in the State of Chihuahua in relatively large masses. If Mexico, deprived of all means of communication, has been able to produce with the rudest kind of material a fabulous production of metals, what will it do in the future, when it will have all sorts of ductile elements and ways of transportation?

—ENCYCLOPAEDIA HISPANO-AMERICANA, Madrid.

XVI

The center table-land may be considered as nearly terminating in Chihuahua, which consists in part of dry, unwooded plains; the soil is here impregnated with carbonate of soda and saltpeter. The Capital of same name is well built, and contains some costly churches, monasteries and other public edifices; but the population has been reduced from 50,000 to one-third that number. The rich mines of Santa Eulalia in its vicinity once produced 5,000,000 dollars a year. Parral, famous for its mines, had once a population of 50,000; but the mines are now filled with water and the population is reduced to 7,000. The mines of Batopilas are noted for their richness. Having in its vicinity some of the richest mines in Mexico.

—Encyclopædia of Geography, Hugh Murray, F. R. S. E., 1838.

XVII

Extracts from John Russell Bartlett, 1851.

American gentlemen and officers who stop at Chihuahua, are always treated with politeness and attention. * * * On the 28th I was invited together with officers to a dinner. There were about forty others present, embracing officers of the Mexican army and citizens of the place. The entertainment was conducted in true Mexican style embracing a great variety of dishes served up in courses. * * * A band of music was in attendance, and the affair was, on the whole, an elegant one. Patriotic toasts were drunk, and among those given by the Mexicans were Washington and Franklin. In return we gave the heroes of the Mexican revolution. * * * On leaving the table, we adjourned to the drawing room, where a large number of ladies soon after assembled to a ball. This was an afterpiece as unexpected to us as it was agreeable. The Mexican ladies, it is well known have a passion for balls, and are most graceful dancers. The music was very good and consisted of harps and violins. One would hardly expect to find in a town situated as this is, on the confines of civilization, twelve hundred miles from the capital, and six or eight hundred from either ocean, so much elegance of manner and taste in dress for few of the ladies had ever been from home. Many possessed as fair complexions as English or American ladies, although the brunettes predominated. The Mexican like the Spanish ladies have a natural gracefulness of manner, which has been observed by all travellers. On this occasion one would imagine the most fashionable dressmakers and hair-dressers had been employed, and that Stewart had a branch of his great New

York establishment here, from the gorgeous silks and satins displayed in such profusion.

I took advantage of my stay here to seek information relating to the northern boundary of the State and was so fortunate as to find in the Governor's office a large manuscript map of the State of Chihuahua made by Don Pedro Garcia Conde and Mr. Staples. It appeared that in the year 1833, the legislature of the state ordered a geographical, topographical and statistical survey of the state.

The city is regularly laid out, with broad and clean streets, some of which are paved and contain handsome and well built houses both of stone and adobe. An aqueduct supplies that greatest of luxuries, an abundance of pure water. The Cathedral stands on one side of the plaza. It partakes of the Gothic and the Elizabethan styles. Its appearance is very imposing, and is equalled by few churches in the United States.

The Cathedral of Chihuahua was built at a cost of one million eight hundred thousand dollars and a church at Santa Eulalia at a cost of one hundred and fifty thousand dollars. From this may be formed SOME IDEA OF THE RICHNESS OF THE MINES OF THIS COUNTRY. These sums raised by a tax would require a gross income on part of the mine of nearly a million dollars for seventy-two years. There is a Casa de Moneda or Mint here which I visited. For coining a mark of silver, without separating the gold, the charge is two reales (twenty-five cents) ; for coining and separating the gold, five reals (sixty-two and one half cents). This coin is said to produce a profit of five percent upon its current value at the United States Mint.

At present I will merely say, that the mineral wealth of Chihuahua is NOT SURPASSED, if equalled, in variety and extent by any state in the WORLD.

XVIII.

CHIHUAHUA. (Extracts) Campaign with Col. Doniphan, 1847.

But a course which took us past the unfinished Jesuit's College, plaza and fine cathedral, and through nicely paved streets to the "Alameda" or public park soon showed us that we had got into a City far superior to any place we had before entered. Most of the houses had white stone fronts while the paved streets and good walks made it somewhat home like, for we had seen no pavement before, since leaving Missouri. We quartered at the Plaza de Toros or bull ring. This is a fine amphitheatre and being Government property it

is built in the best manner with several rows of white stone seats. In front of the Ring and extending the whole length of the city, is the public Alameda handsomely planted with rows of cottonwood trees and streams of water running through it, and here and there white stone seats. In the middle of the city is the Plaza or square and in the centre of this a fountain to which is brought the water about six miles away.

The Plaza is surrounded by numerous handsome resting places or rather large stone sofas. Fronting it towards the north is a large building and the Congress Hall which consists of a beautiful room with railed enclosures at one end, in which sat the legislature, etc., etc. On the south side of the Plaza is the cathedral of which the inhabitants are justly proud. Its exterior is covered with fine carving and statues. Its steeples which are square and composed of fancifully carved pillars. The next day after we entered I had an opportunity of seeing the inside of the building. The cathedral cost two millions of dollars and was thirty years building * * * built from REVENUES of THE MINES. Indeed these savages (Apaches) will not let the inhabitants work the mines.

The occasion on which I first visited it was, however, a very melancholy one. In the centre of the church lay the body of Major Owens. He having been a Catholic, the priests had willingly offered to inter him. It was sad to know that under that velvet pall lay the man who had so exultingly dashed before us in the charge a few days before. At the head of the coffin stood a high pyramidal stand, covered with velvet, and upon it was candles in silver sconces set all over it; the priests were in full canonicals of velvet and gold, chanting the Mass, while around them knelt numerous Mexicans and outside them were our men standing closely together.

Crossing a valley about three miles from the city are numerous very tall arches supporting the aqueduct, which brings the water to the fountain in the plaza. By some freak of the architect, two of the arches are imperfect, being made to incline in opposite directions, and giving it a very singular appearance. * * * For the coining of the SILVER OF ITS VAST MINES here is to be seen a very EXTENSIVE MINT.

XIX

We, on our side of the Rio Grande, have something to be proud of in the magnitude of our operations and in the rapid advance which we have made not only in mining engineering, but along all

lines. It is wholesome that we should assemble here before this brilliant audience, and should turn our thoughts backward and consider what we owe to the Latin races for our start. Was it not your Spanish ancestors who discovered the shores of the Western Hemisphere, and was not their quest for gold one of the great moving causes which lured them on? Our institutions, our mining operations, date back but a few decades, while you can point out operations that have been moving along steadily for hundreds of years. When we discovered the Comstock Lode and our other western mines of early date, where did we get our first miners, except from this country where we are now so royally entertained? And when it came to treating our ores, on whom did we call for knowledge but on the Mexicans, who taught us the "Patio" process, which we modified into the Washoe pan—merely your "ARRASTRA" made of iron. Where did we get our nomenclature, if not from the beautiful Spanish language? Have we not received our "BONANZAS" from you? Are there not more, hidden in your mighty mountains, which all of us wish to see developed in the best, most economical and most profitable manner? We did not, unfortunately, found our mining law on yours; if we had done so, the vexatious perplexities of the "apex question" would have been avoided, and the rational, understandable, rectangular claim would have been adopted. With a history IN MINING WHICH SURPASSES ALL; MEXICO is "par excellence" the Mecca for a Congress of MINING PILGRIMS.

—E. E. OLCOTT (President Am. Institute Mining Engineers), 1902.

XX

Travelers have long told us the tale that Mexico is the land of amazing contrasts; is the most picturesque under the sun. And now I have recent evidence that this is truth. Strawberries at 5c a quart. "American Beauties" at the exorbitant price of 8c, a cluster of superb orchids at 50c. Cathedrals magnificent and sublime with famed altars with marvelous choir rails and superb candelabra. Not yet melted down by the Mexican Government (for they are solid silver), and all from their famous mines; such is the Golden Land of Montezuma. Some late afternoon you meet the typical Mexican beauty as she comes from the confession, in soft black gown; coquettishly and discreetly she flurts by. You catch a flash of her fine dark eyes and dropping your manners you stare and stare again, adoringly after her. Mexico is a great enchantress in love; AS MINES FOR THE SPECULATOR. Yes! Mexico, my Mexico has been very rich in loveliness.

—OLIVE PERCIVAL, 1901. Mexico.

XXI

Very fortunate it is for Northern speculators and the railway men that the Governor, Don Luis Terrazas, and the Mayor, Juan Zubiran, are gentlemen of broad and enlightened views, courteous and refined, who enter in into the progressive movement and strive with all their power to allay, rather than promote sectional animosities. There are two newspapers printed here, in the interests of Americans, "The Enterprise" and "The Chihuahua Mail." We need not to be reminded that Chihuahua is a silver producing state FOR IT HAS LONG BORNE THAT REPUTATION. The State contains eighteen to twenty well defined mineral districts in which are valuable mines, working, with others abandoned through Indian incursions. The number of large reduction works is twenty and the number is constantly increasing. The systems employed are the smelting and the patio, though the greater portion of the metal is extracted by the former and by an improved process introduced by American capitalists.

—"Travels in Mexico," FRED A OBER, pages 616-617, A. D. 1884.

XXII

The first decree of Antonio de Mendoza, Count of Tendella was of liberating 150 Indians from slavery, who were working the mines. He established in Mexico the security of travelers.

—HISTORY OF READY REFERENCE, Vol. 3. "Mexico."

XXIII

Chihuahua, the residence of the Captain General with considerable mines in the neighborhood such as Santa Eulalia and on the east Real of Santa Rosa de Cusihuariachic, San Pedro de Batopilas, celebrated for the great wealth of its mines, San Jose de Parral, the residence of a Deputation of Mines; this Real as well as of Parras receive their names on account of the great number of wild vine sprouts which the Spanish found in this part of the country; ARE ALL FAMOUS FOR THEIR MINES.

—Alexander Von Humboldt, Political Essay of New Spain.

XXIV

Mining is being constantly extended and in 1897 there were 109 Mines operated for Gold alone, 254 for Gold and Silver and 310 for Silver alone.

—ANNUAL CYCLOPAEDIA.

XXV

I think it is impossible that the production of the Mexican Mines be $50,000,000 a year, which the Mexican Ambassador, Mr. Matias Romero, tells me is a conservative figure; it is really incredible and I thought he had made a mistake as I am well aware what Silver Mines in China yield and then are exhaustive.

—LI HUNG CHANG, Chinese Viceroy, Washington, August, 1896.

XXVI

Undoubtedly I saw Mexico at a disadvantage, and indeed I took more pleasure leaning over stone balustrades of the Palace, regarding the different regiments going through their evolutions, particularly the Seventh Infantry, who impressed me so deeply with their soldierly bearing and national pride for the hard fought battles they have fought and gallantly won. Page 256.

The town itself is extremely pretty, a remarkably handsome Church faces the Plaza. * * * While the branch of the Rio Grande rushes swiftly through. * * * At the Mint. There were two of this apparatus and they were able to coin about thirty thousand pieces in twenty-four hours. I saw vast piles of pure metal in the vaults and an uncountable mass of dollars. Page 224.

—"LOS GRINGOS." Lt. Wise, U. S. N. 1850.

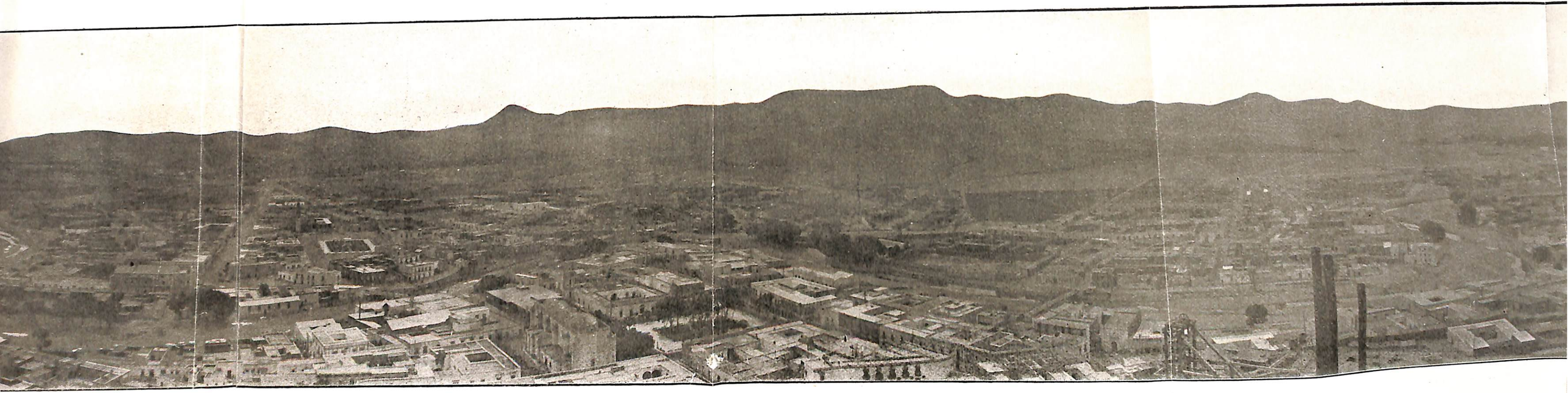
XXVII

An elaborate description of the mineral wealth of Mexico would require a large volume. We have only a space for a brief account of the MINES. * * * The Cordillera from Chihuahua on the North and Oaxaca on the south CONTAINS ALMOST INEXHAUSTIBLE Deposits of Gold, Silver, Iron, Copper and Lead. * * * The greatest variety of ores is found in the States of Sonora, Chihuahua, Michoacan, Guerrero and Oaxaca.

Humbolt states in his work on New Spain that two-thirds of the silver supply of the whole world was annually shipped from the port of Vera Cruz.

A few foreigners are employed at high wages in the mines of Chihuahua, but they generally occupy positions like that of superintendent or engineer.

—Alfred R. Conkling. "Guide to Mexico." (Ex. U. S. Geologist). Pages 76-77.



PARRAL. Hidalgo District.

XXV

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XXVIII

When the Spaniard had conquered Mexico, Bogota and Peru, they began to look around for new sources of wealth. * * * "EL DORADO" the phantom God of Gold and Silver APPEARED IN MANY FORMS.

—C. R. MARKHAM, "Hakluyt Soc." 1861.

XXIX

The principal districts containing the richest deposits of silver are Guanajuato, Catorce, Zacatecas, Real del Monte, Bolanos, Guarisamey, Sombrerete, Tasco, BATOPILAS, Zimapan, Fresnillo, Ramos and PARRAL.

—Alexander Von Humbolt, Political Essay on New Spain. Vol. 3, page 138.

XXX

Mexico with all her resources of soil, climate and MINES has not attracted much of the attention of people of other lands until the last three or four years. Now with the rapid strides she is making AND IS DESTINED TO MAKE, TOWARDS A COMMERCIAL PROSPERITY RARELY EQUALED BY ANY NATION IN THE PAST, travel in that country will increase many fold.

—GEN. U. S. GRANT (Letter to Alfred R. Conkling, Dec. 1883).

XXXI

The discovery of America was the salvation and resurrection of the monetary system in the Old World, due installments of precious metals.

—The History of Currency. W. A. Shaw.

XXXII

The configuration of the Western Sierra Madre, as crossed from east to west through Chihuahua is a succession of narrow and continuous north and south ridges, with foot hills separating broad and (longitudinally) remarkably continuous valleys. The whole surface thus characterized rises towards the west in breadth in the same direction. The western slope, however, as seen from Sonora is passing from west to east, is rugged and steep, and there is considerable evidence that this is a great faulted zone which down throws towards the Pacific.

—JAMES P. KIMBALL.

XXXIII

The mines of Mexico contain enormous hidden wealth. In the years 1871-5 it produced 27 million dollars of Silver. It is calculated that in the years 1581-1875 it produced 265,040 Kilograms of GOLD and 76,205,400 Kilograms of Silver.

—Encyclopædia Popular. F. Gilliam. 1884.

XXXIV

Although the "Barranca de Batopilas" (Canyon) is not as narrow and inspiring as the one we had crossed before (Barranca de Cobre) nevertheless seeing the bottom from above one shivers with fear.

Following the zig zag turns of a well made trail we came to the town of Batopilas. The silver mines to be seen there are both famous and antique, discovered in the XVII century. The well known and intelligent miner, Mr. A. R. Shepard, received me very cordially and captivating each and every one of my expedition with his courtesy and bountifulness.

The sun was relentless in its heat, especially just before the rainy season. Even the beasts were getting thinner and thinner, and when we left Batopilas it was a painful journey the climbing of the Barranca on the southern side; but once on top we were more than repaid by the cold breezes that made such a contrast with the enervating heat at the bottom.

—Unknown Mexico. Carl Lumholtz.

XXXV

Montezuma fearing the prophecies of Quetzalcoatl he ordered the Axtec nobles to pay homage to Cortez; the amount of these precious gifts was valued at $162,000 gold. This was enough to convince Cortez and his conquerors of the wealth of the New El Dorado.

Cortez in his first letter to His Majesty Charles V says: "The amount of presents that I have, Sire, in Gold, Silver, Feathers, Precious Stones, etc., is worth over 100,000 ducats."

—Lic. Manuel Orozco y Berra.

XXXVI

THE MINES OF SILVERLAND.

Of all the silver mined yearly throughout the world Mexico yields one-third, which is assessed at a value of about £15,000,000. Thanks to the enormous deposits of Nevada, Montana, Colorado,

New Map of State of Chihua hua.

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PREFACE.

"Individual self-assertion, at the unrighteous expense of no man, is the lode-star of a wise civilization."—(Mining.)

> ....."Cortez, in order to secure the wealth of the Moctezumas, conceived a method simple but effective, the roasting of the feet before a slow fire. When Cuauhtemoc's fellow victim turned in anguish as if appealing for compassion, he exclaimed rebuking: 'AM I REPOSING ON A BED OF FLOWERS?'"—(Robertson Hist., Vol. II.)

A person holding now a high position in the Government employ was appointed first Director of the State Permanent Mining Exposition. Shortly afterward he resigned.

The Chamber of Commerce sent several hundred circulars to miners for information, with little or no response.

J. R. Southworth, in his "MINES OF MEXICO," has this to say: "Unfortunately this state (Chihuahua) has not until the past few months had a department of statistics and for that reason no very accurate statements can be made as to its mineral wealth. The records in operation have not been sufficient for gathering the data required.

"The Report of 1900 of the State of Chihuahua contains valuable information concerning all of its resources except the mining interests, to which only *one* page of the 400 is devoted."

Likewise the Report of this year contains only a few pages.

With these facts before me, it is needless to say my appointment as Director of the State Mining Exposition and the compiling of the present book was far from being "A BED OF FLOWERS." Yet with persistent and untiring effort I have been able to show a passable display of the vast resources of the State. "EL MUNDO ILUSTRADO" of Mexico City of October 17th, ult., says: "We hereby publish a picture of the Mining Exposition inaugurated March, last, by Governor Creel. It was visited by the members of the 10th Geological Congress, who were highly pleased with the varied and rich specimens to be seen there."

Prof. R. T. Hill, in a letter (see engraving) to Mr. W. H. Holmes, Smithsonian Institute, Washington, says: "I find a most creditable

beginning of a museum * * * it has some wonderful and marvelously fine specimens.'' This from so eminent a geologist is flattering to say the least.

To ''The Pillars of State:'' General Luis Terrazas, Dr. Mariano Samaniego, Enrique C. Creel and Inocente Ochoa, I respectfully dedicate this book. The second and the last named parties for recommending me, the other two for honoring me with the position of Director of the State Mining Exposition, and wishing to show my appreciation I now present to the Public

''THE MINES OF CHIHUAHUA''

with the History, Geology, Directory and Statistics of our Mining Industry.

Far more through the encouraging suggestions of friends than any confident promptings of my own, I conceived the idea of compiling said work. In speaking of Mexico's wealth in general, I do so metaphorically, for has not the State of Chihuahua contributed one fourth of it?

I am the first to recognize its deficiencies, but as I intend publishing a work more worthy, any corrections as well as data will be thankfully received.

It can be plainly seen that this work is ''sui-generis,'' *i. e.*, the only one treating of Chihuahua's mines. To compile same has been no easy task, with little or no financial help, and depends on kind advertisers as a last recourse. Well has Tolstoy said that we have ''no ductile elements.'' With all this in view can critics ''cast the proverbial stone?'' Yes, with clemency,

THE AUTHOR.

March 25th, 1907.

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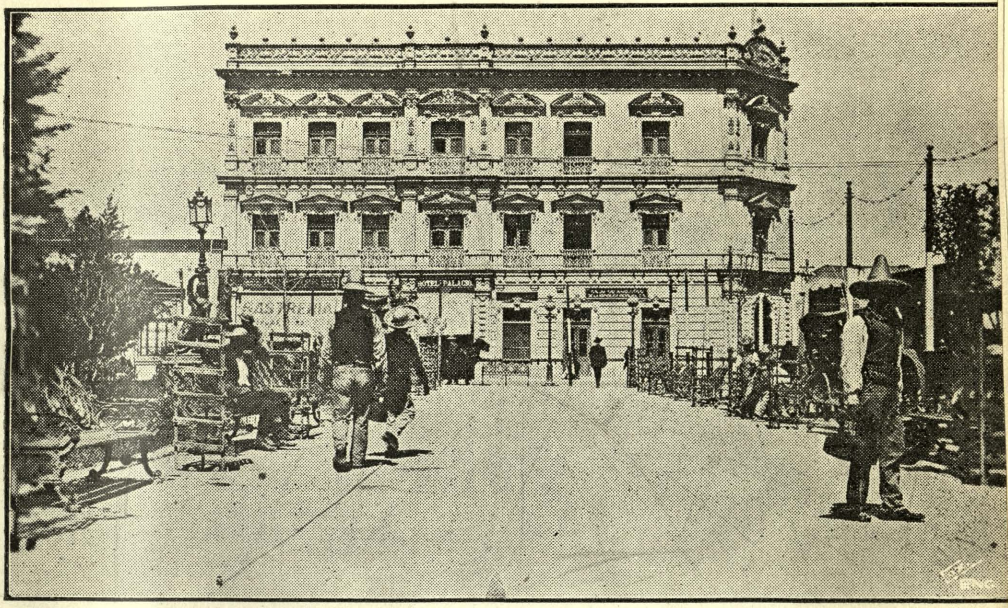
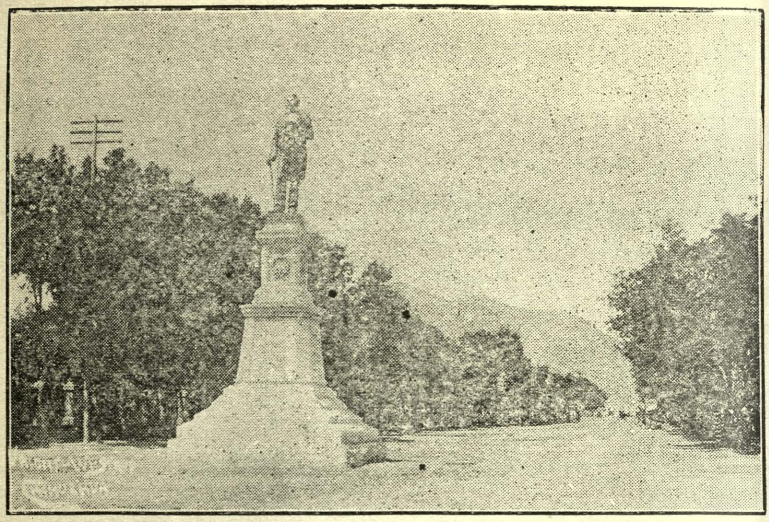
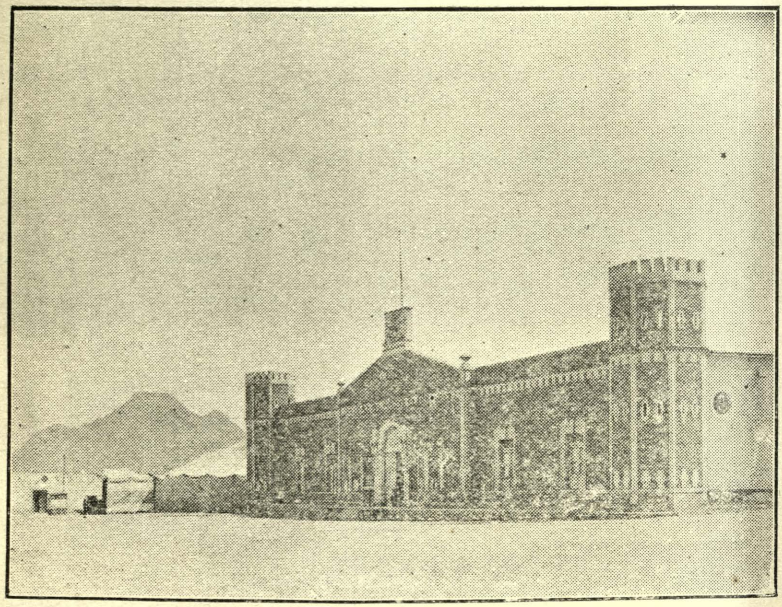


Palace Hotel.

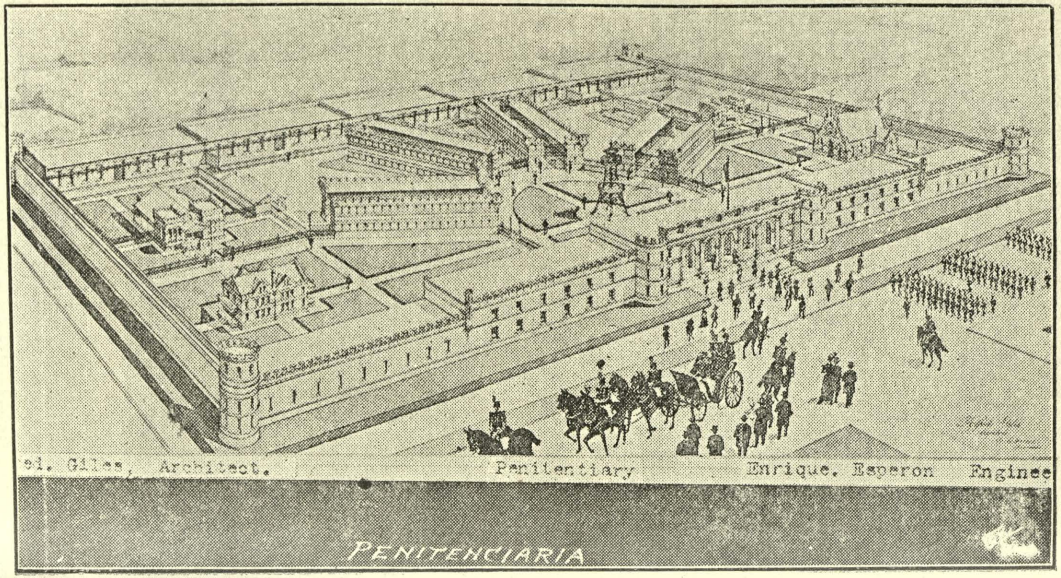
Guadalupe y Calvo, Open cut workings on Rosario vein.



Benito Juárez Monument.

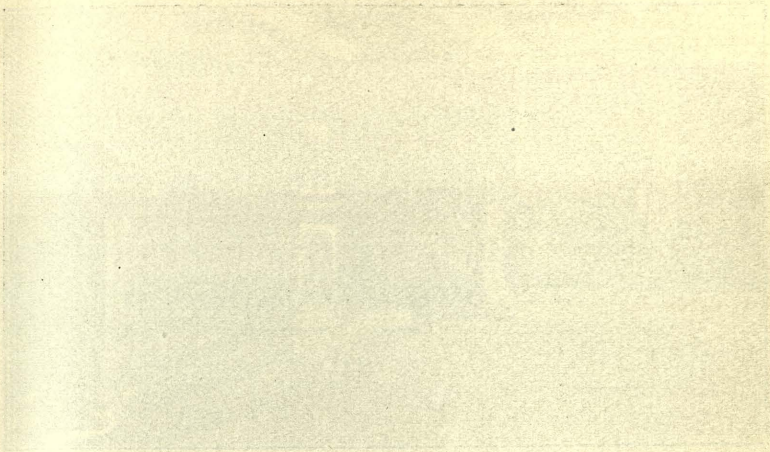


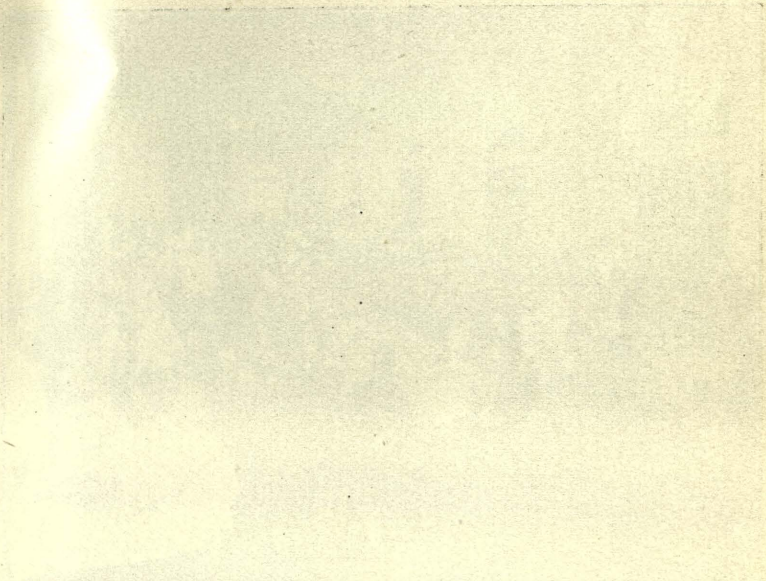
Correctional School.

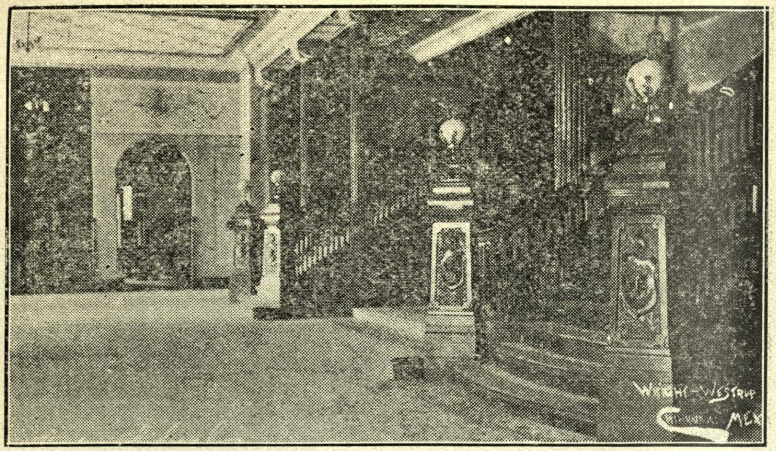


Penitentiary.

Chihuahua Investment Co. & Chihuahua Grocery Co.

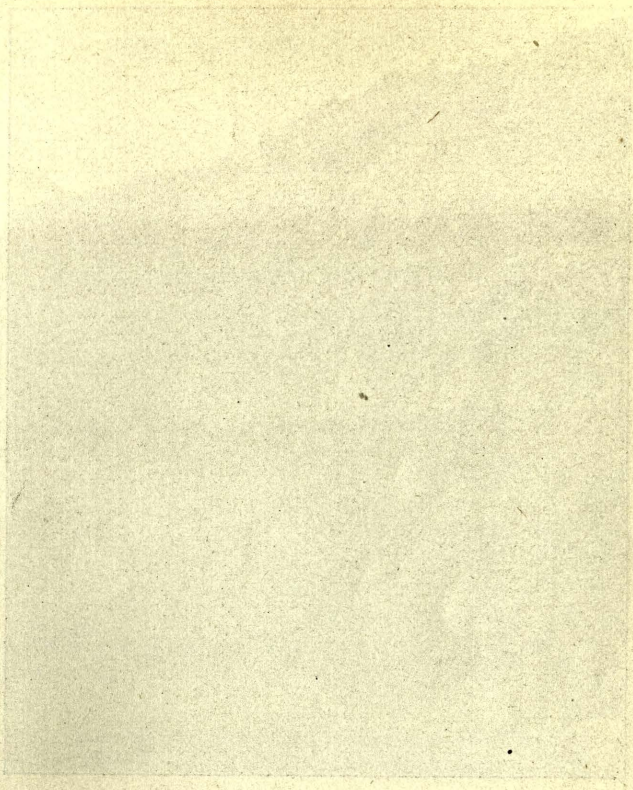


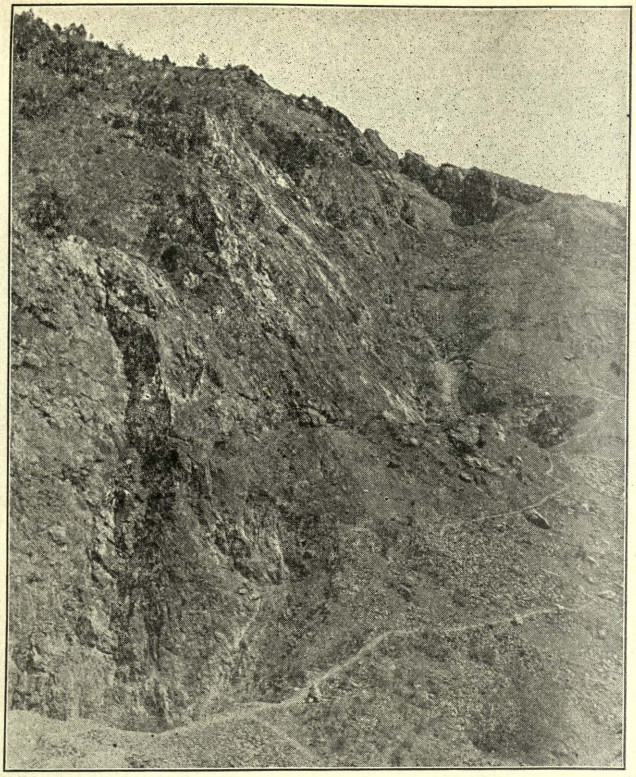




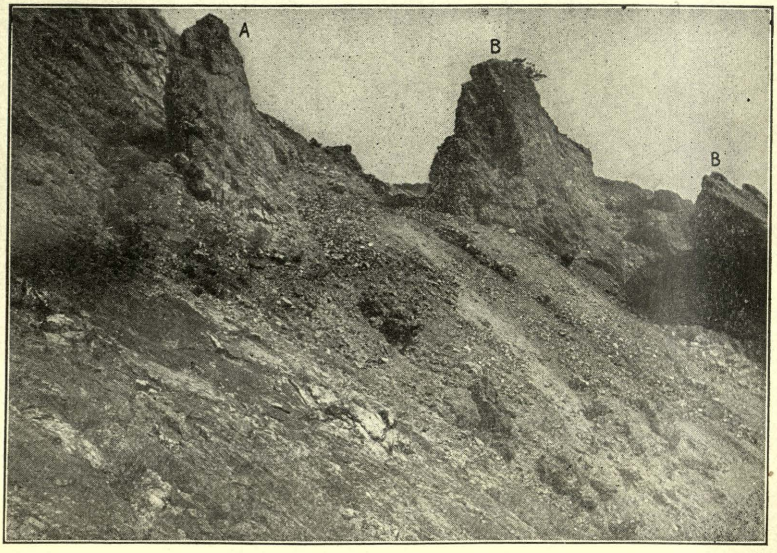
Lobby of Theatre of "Los Heroes."

Banquet to the 10th Geological Congress.

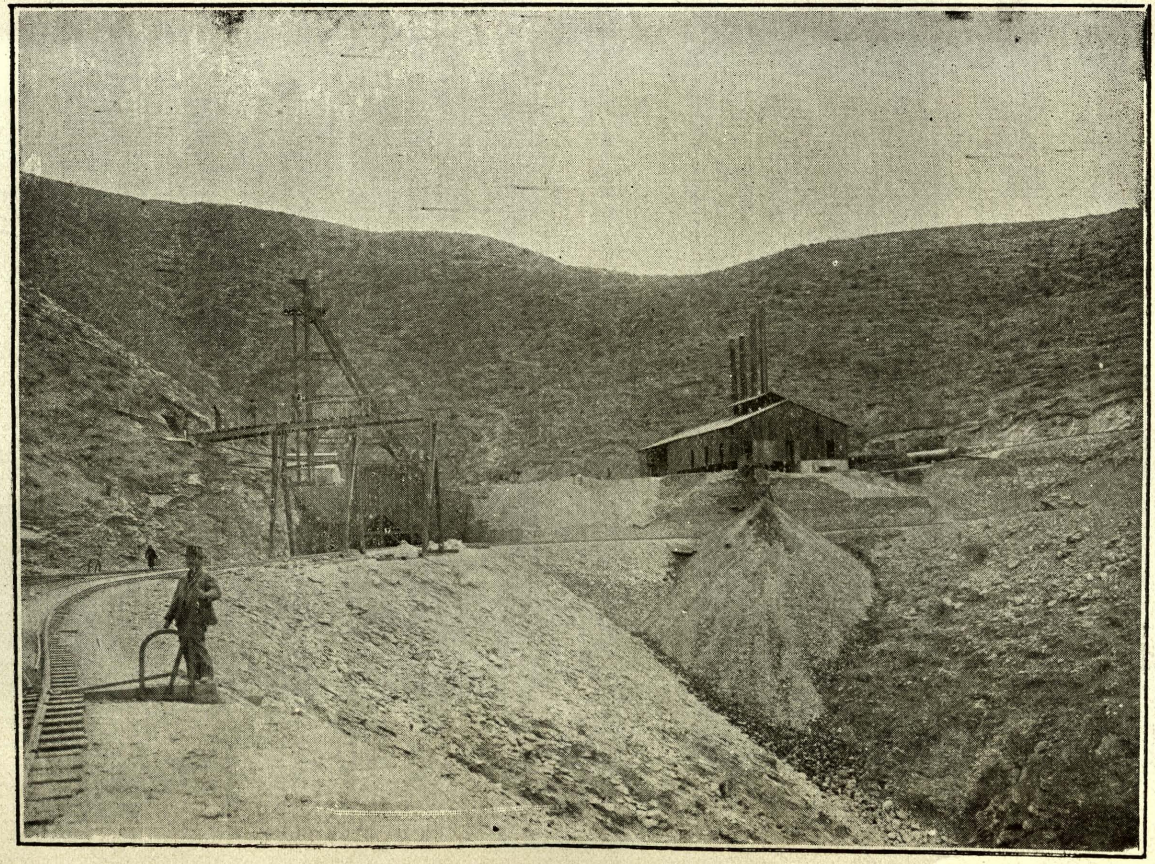




Foot wall streak, outcrop of Rosario vein, Guadalupe y Calvo, Chihuahua, Mexico.

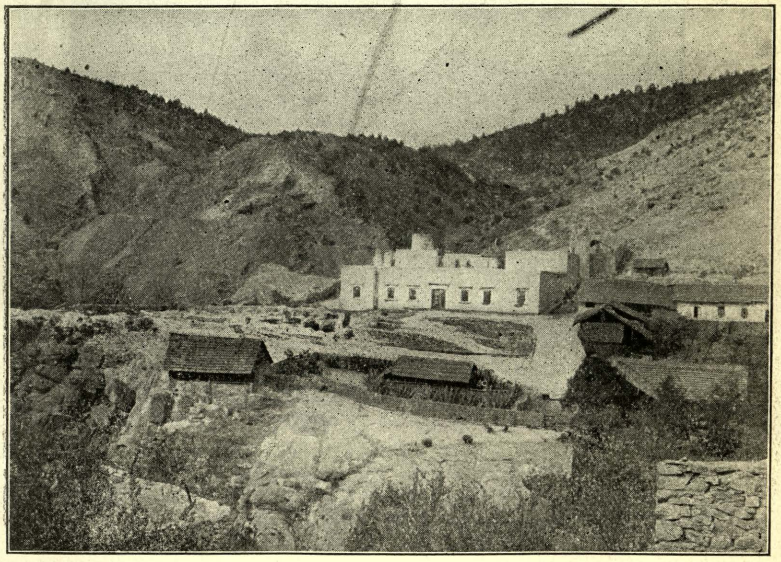


Outcrop of Rosario Vein. A. foot-wall streak. B. Hanging-wall streak.



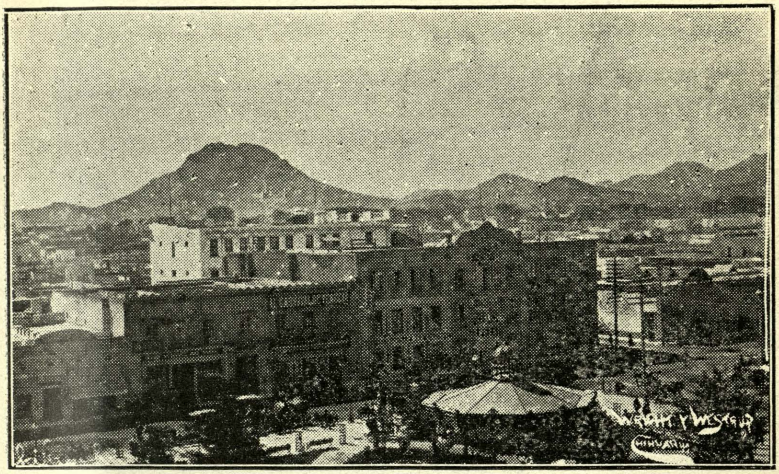
Potosi Mine, Santa Eulalia. (Showing Limestone Bedding Planes)

Face of quartz, Rosario vein, Guadalupe y Calvo.

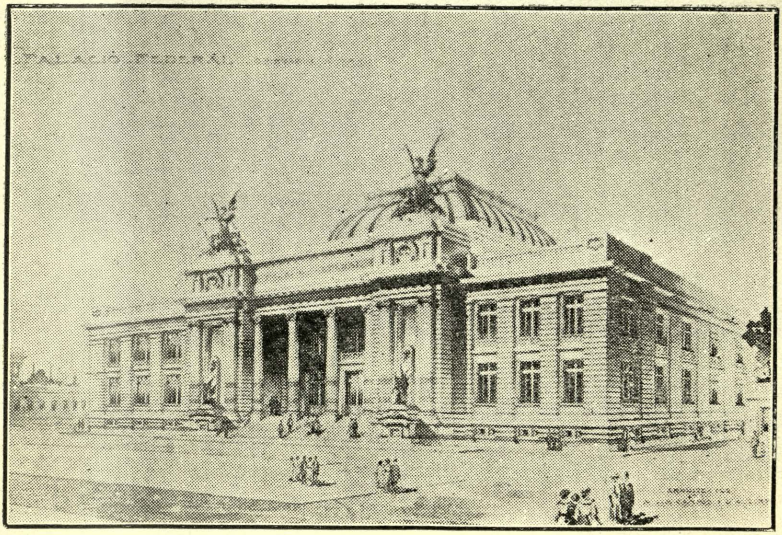


Old mint at Guadalupe y Calvo, Chihuahua. Outcrop of Rosario vein seen in background on left. Dacitic tuffs covering vein on right, and forming plateau on which buildings stand.

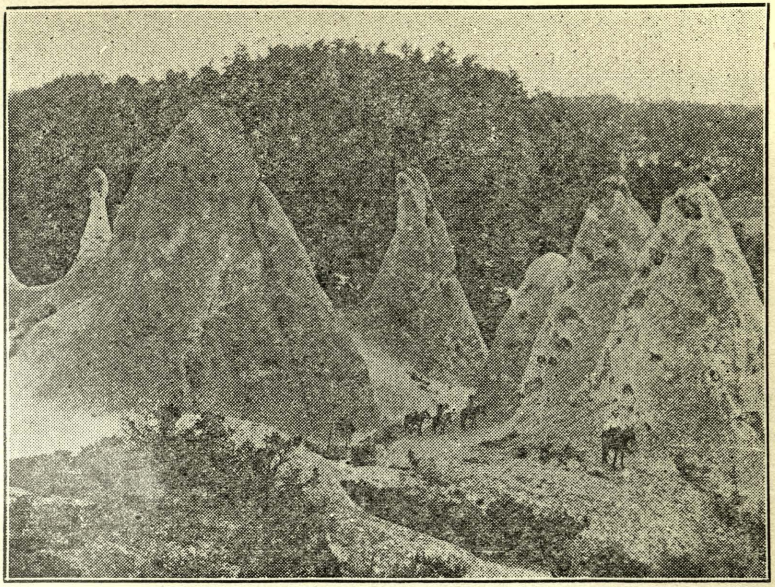
Pine Forest on Creel Forest on line of K. C M. & O. Ry.



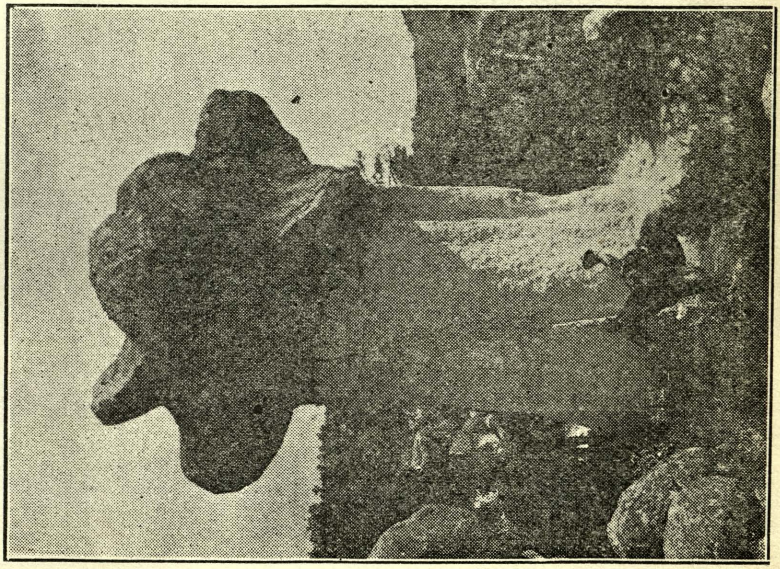
Plaza of the Constitutton.



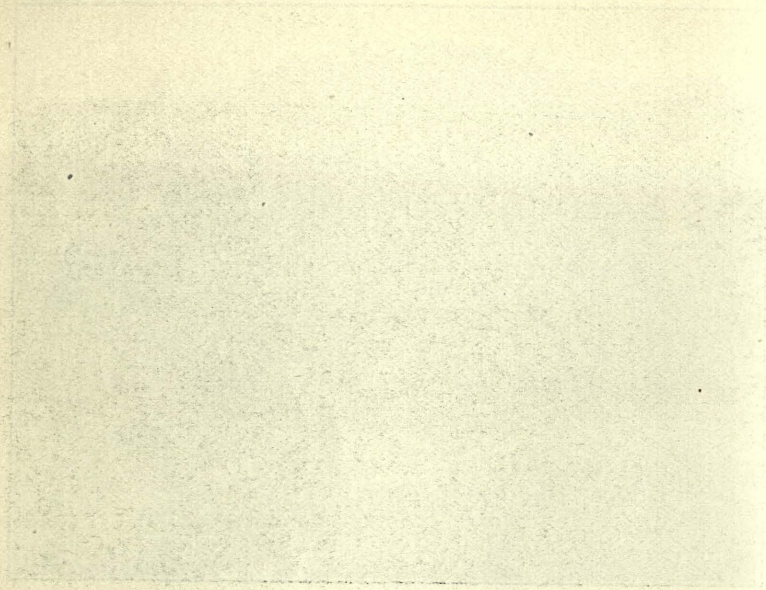
Federal Palace

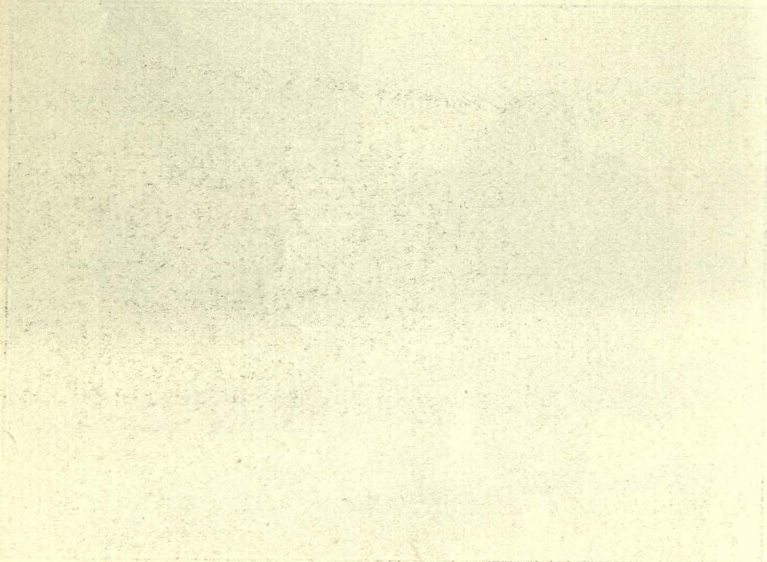


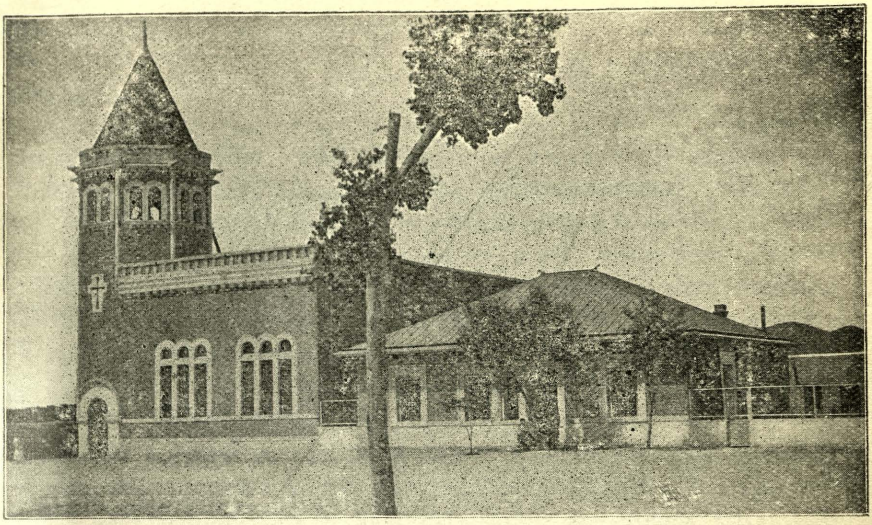
Peculiar formation of group of Sandstone rocks on trail from Bocoyna (Station on the K. C., M. & O. R. R.) to Sisoguichic.



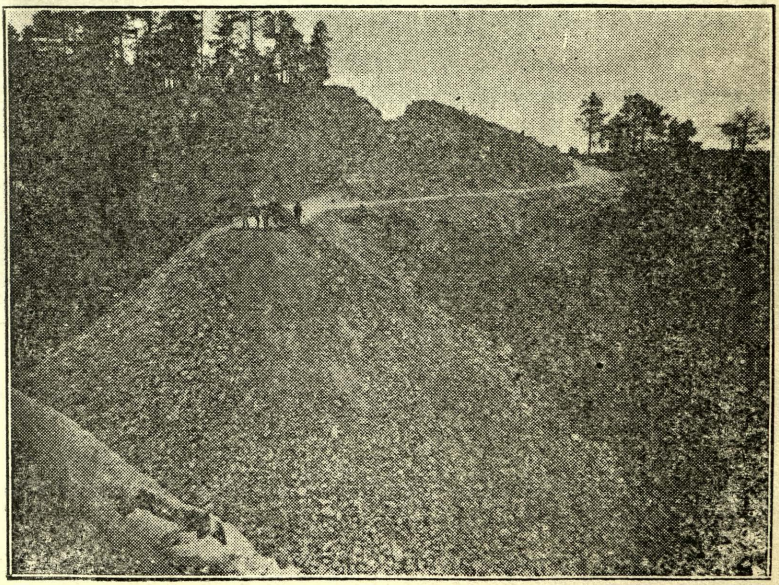
View showing the famous rock that was at one time worshiped by the Tarahumar Indians.







Trinity Church.



Heavy fill at kilometer 116 on the K. C. M & O. R R.

Utah and Idaho, the United States comes in a very good second with fourteen millions sterling; but other individual countries are "nowhere."

It was gold that attracted Cortez to the land of the Aztecs in the sixteenth century. The natives, ignorant of silver mining, had amassed, as we have already noticed, large quantities of the more precious metal; though their accumulations were a mere trifle in comparison with the silver wealth which they left untouched. Silver! Silver! Silver! is the cry which now draws engineers, capitalists and adventurers of all classes to the Republic so ably ruled by Porfirio Diaz, a man whose career is as full of romance as that of the country which he has recovered from chaos and given a leading place among the Trans-Atlantic nations.

Silver is found in most parts of Mexico, either as pure metal, or in chemical combination with various other minerals. But the provinces most distinguished by their silver mines are Sonora, CHIHUAHUA, Durango, Zacatecas, San Luis Potosi, Guanajuato and Hidalgo; to name them in their due order from north to south. When Humbolt visited Mexico in the beginning of the nineteenth century, he calculated that the great silver lodes were honeycombed by 3,000 to 5,000 mines, each of which had several shafts and many galleries; and he reckoned the silver extracted since the Spaniards first began work to be worth £130,000,000. These figures are now quite eclipsed, for recent calculations assess the total value till the end of the last century to be £800,000,000 sterling.

What these colossal figures mean may be concretely represented by assuming that the silver has an average price of 3s. 4d. per ounce. If you care to work out an arithmetic sum, taking as your basis the fact that one cubic foot of silver weighs 10,700 odd ounces, you will arrive at about 450,000 cubic feet, which would suffice for a pillar of metal ten feet square and higher than the loftiest mountain in the British Isles!

That such huge quantities should have been mined is due to the "kindly" nature of the ore, which permits it to be reduced by comparatively primitive methods, or crumbling; and in places masses of solid silver have been found which completely eclipse the records of other countries.

The mine of Arazuma takes first place as the producer of monster silver nuggets. So sensational are the figures that we should hardly dare to quote them, were they not backed by unimpeachable testimony. At Arazuma, then in the middle of the eighteenth cen-

tury, the owner paid duty on several pieces which together weighed 4,033 lbs., the largest lump scaling 2,700 lbs., or about a ton and a fifth! Even the largest gold nuggets of Australia hardly equal this in value.

You will easily understand that in a country so impregnated with precious metal many enormous fortunes must have been made during the three and a half centuries which the miner has been at work there. The stories of individual success and attainment of dazzling wealth would suffice to fill a large volume, and we must therefore but briefly notice the luck of a few persons and the productiveness of a limited number of mines.

The "Good Success" (at Batopilas) Mine was found by an Indian who swam a river after a heavy flood. On arriving at the other side he found the outcrop of an immense vein which had been laid bare by the force of the current. All the inhabitants of a neighboring town went out to see this wonder. Though he was prevented by water inroads from going deeper than about three yards, he took out a large fortune. Of a neighboring mine (the Pastiano) Ward writes: "The ores were so rich that the lode was worked by bars, with a point at one end and a chisel at the other, for cutting out the silver. The owner of the mine with flags flying, and the mules adorned with cloths of all colors. The same man received a reproof from the Bishop of Durango when he visited Batopilas for placing bars of silver from the door of his house to the great hall for the Bishop to walk upon. The Santa Eulalia Mine yielded so enormously that two and a half per cent of the silver extracted in a few years sufficed to build the magnificent Cathedral of Chihuahua.

—THE ROMANCE OF MINING. Archibald Williams. London. Pages 191, 192 and 193.

XXXVII

At least $150,000,000 of foreign capital was invested in Mexico during the first year year as a gold standard country, about one-half of which was American and the rest French and Canadian. * * * The total American investment in Mexico is now $600,000,000 in round figures. * * * Most of the new capital was invested in railway construction, mines, smelters, reduction works and plants for the treatment of custom ores. * * * French capital in Mexico is calculated to be $180,000,000. English about $80,000,000.

—The Mexican Mining Journal. November, 1906.

XXXVII

The United States cannot reach Latin America in the same way that Mexico can. * * * Her growing commerce, her railway construction and extension, the introduction of new enterprises * * * her adjustment of the money question and rapid accumulation of gold reserve all tend to make her worthy of the emulation of her brothers in blood and tongue. * * * MEXICO HAS ATTAINED "THE PREMIER RANK IN LATIN AMERICA."

—NEW YORK GLOBE.

XXXVIII

The railroads projected in Sonora and Chihuahua are very important as they will open a wonderfully rich territory. * * * Chihuahua under the inspiration of Governon Creel has made a very proper move by establishing a permanent mineral exhibit in the City of Chihuahua. It is proposed to gather ore and rock specimens of scientific and practical interest. * * * The example thus set by Chihuahua can well be followed by other Mexican States.

—The Mining World. Sept. 15, 1906.

XXXIX

The Mining Laws of Mexico are liberal, just and easily understood and with the reduction of duties on mining machinery and other advantages offered which policy that government has wisely adopted to induce the most general and profitable development of her mineral lands possible, constitute a basis for profitable investment in the fabulously rich mining properties which that country abounds. * * * The output in the state of Chihuahua has been PHENOMENAL in the last ten years. During the past year alone it has amounted to over $15,000,000. But it is in its silver that it leads with a production to the present time of 1,500 million ounces, a third of the World's total yield.

—NEW YORK COMMERCIAL.

XXXX

Pedro Terreros, afterwards Count of La Regla, promised to pave the road from Vera Cruz to Mexico (550 kilometers) with silver ingots if his Majesty the King of Spain would pay him a visit.

One Zacatecas miner paved the street with ingots from Casa de Gobierno to the Paroquia (between 50 and 60 yards) for a christening procession. In 1800 the Viceroy Ananga passed a law forbidding godfathers to fling handfuls of coin into the street on such occasions.

—"The Awakening of a Nation." C. F. Lummis. Page 30.

XXXXI

One Peter Terreros, an enterprising merchant, in twelve years took out over £3,000,000. Of this he spent two and a half million dollars on the mines and refineries, laid out six million dollars on plantations and loaned the King of Spain a million (which of course were never repaid). For this pecuniary help and the present of two equipped ships of the line the once humble Peter Terreros was ennobled as Count of Regla. * * * When his children were baptized, the procession walked on bars of silver. * * * By way of expressing his gratitude for the title conferred on him, he sent an invitation to the king to visit him at his mine assuring his Majesty that if he would confer on him such an exalted favor His Majesty's feet should not tread upon the ground while he was in the New World. Wherever he should alight from his carriage it should upon a pavement of silver and the places where he lodged should be lined with the precious metal.

—Robert A. Wilson. Mexico.

XXXXII

Several smelters get a large per cent of their zinc ores from Mexico, some from the Monterey district, some from the Parral district and MORE OF IT FROM CHIHUAHUA. The Mexican zinc ore while not of a very high quality is in DEMAND for the reason THAT THE RICH JOPLIN ORE IS GROWING SCARCE AND THE SUPPLY WILL NOT HALF SUPPLY the smelters. * * * An average of 10,000 cars of zinc ores are shipped out of Mexico every month and about a third of this amount goes to Kansas and Missouri.

—A. B. Cockerill. Monterey News.

XXXXIII

The Moreton Mine in Northern Mexico was struck in 1826 by two Indian peasants, so poor that on the night before their great discovery, the keeper of the store had refused to credit one of them for a little corn for his "tortillas" cakes. They extracted from their claim 270,000 dollars in a year's time.

—Ward's History of Mexico. Vol. 2, page 578.

XXXXIV

The western half of Chihuahua will prove the richest of precious mineral deposits on the face of the Globe.

—Baron Alexander Von Humbolt.

XXXXV

In a neighboring mine, the Pastiano (means Pastrana, mine Batopilas) the ores were so rich that the lode was worked by bars, with a point at one end and a chisel at the other, FOR CUTTING OUT THE SILVER. The owner of the Pastriano used to bring the ore from the mine with flags flying, and mules adorned with cloths of all colors. The same man received a reproof from the Bishop of Durango when he visited Batopilas for placing bars of silver from the door of his house to the great hall for the Bishop to walk upon.

—Ward's History of Mexico.

XXXXVI

Famous in the centuries that have passed and still more today is the Republic of Mexico, as the country which exceeds in her boundless stores of MINERAL WEALTH. Page 6.

The great source of wealth of Mexico lies more in the abundance of ores than in their richness * * * in the celebrated MINING STATE OF CHIHUAHUA. * * * The natural conditions of the country in which the various mines are situated are UNSURPASSED FOR ECONOMICAL WORKING as an even climate is maintained throughout the year and an abundant supply of good water is to be had as well as timber.

—THE MINES OF MEXICO. J. R. Southworth.

XXXXVII

In these true fissure veins we find silver principally abounding with a small percentage of gold whilst lead, zinc, antimony and arsenic sometimes constitute combinations in the same veins. This is characteristic of the States of Sonora, CHIHUAHUA, etc.

—Ing. EXEQUIEL ORDONEZ. Mines of Mexico. Page 17.

XXXXVIII

MEXICO is by far the most interesting portion of the new world whether from the viewpoint of the geographer, the naturalist, the geologist, the archæologist, the ethnologist or the historian. Mexico is the United States' nearest and most important American neighbor, a good friend and customer for it must be remembered that our Canadian friends are still European in their allegiance.

—Robert Thomas Hill. (In Mining World, Chicago).

XXXXIX

About fifteen miles from the City of Chihuahua the Santa Eulalia Mountains rise in a gentle turf capped fold to a height of about 1,500 feet above the PLAIN. * * * This mountain is massive limestone and in it occur those rich and extensive deporits of silver lead ores that for the past 200 years have made the mining district of Santa Eulalia ONE OF THE MOST FAMOUS IN MEXICO.

—Philip Argall. 1903. (See article).

L

From carefully prepared schedules compiled from taxes paid to the Crown and the Republic, the total shipments of Santa Eulalia mines up to 1903 aggregated over $800,000,000. The mines were first worked by the Spaniards then the Mexicans and now principally by Americans. * * * From this summit (picacho Oriental) which rises several hundred feet above other hills in the vicinity, one has a magnificent view of the hills, valleys, box canyons, arroyos and cliffs painted by Nature's oxides of iron and manganese presenting a panorama of Nature's incomparable handiwork like one grand kaleidoscope, vast, beautiful, enticing and interesting beyond description. To the northeast, north and northwest, the east, south, southeast, southwest and west the whole country is decorated with white mountains designating the boundaries of MILLIONS OF HIDDEN TREASURES IN GOLD, SILVER AND LEAD VALUES.

—Robert T. Hill. Report. 1904.

LI

Here we have an inspiring view (Barranca de Cobre) deep gorges and ravines, the result of prolonged weathering and erosion, gashing the country and forming high ridges, especially toward South and West. Here we observe for the first time the "Barrancas" which from now on form an exceedingly characteristic feature of the topography of the Sierra Madre. The precipitous abysses reach a depth of from 4,000 to 5,000 feet with appearance of towering walls; of course they do not continue equally narrow but open up gradually. They are known as the Barranca de Tararequa and comprise the Barrancas of "Cobre," "San Carlos," "Urique" and "Batopilas." Page 144.

--CARL LUMHOLTZ. "Unknown Mexico." Vol. 1.

LII

The merciful hand of Providence has bestowed on the Mexicans a magnificent land abounding in resources of all kinds, A LAND WHERE NO ONE OUGHT TO BE POOR; and where misery ought to be unknown. * * * It is a country endowed to profusion with every gift that man can desire or envy—ALL THE METALS FROM GOLD TO LEAD.

—LEMPRIERE. "Notes on Mexico." 1898.

LIII

Mexico is famous for its silver. * * * The wealth of the argentiferous beds of MEXICO IS THE WONDER OF THE METALURGIST, says Humbolt. * * * The vein of the Veta Madre at Guanajuato is fifty meters in width; at Zacatecas it is twenty-five meters. * * * With an extension of 2,200 kilometers would be enough to cover the entire world. At Casas Grandes are the ruins of the ancient Aztecs. * * * The Aztec soldiers known as "The Gentlemen of the Eagle and Tiger" wore coats of mail of solid gold. * * * The Emperor had a mantle of gold thread with emeralds and other precious stones.

—"LA GEOGRAFIA APLICADA A LA HISTORIA." E. Braconnier. Translated to the Spanish by A. Villacampo, Madrid, 1852.

LIV

When Li Hung Chang was in Washington he inquired about the production of Mexican mines and I informed him that it produced fifty millions a year. * * * This seemed incredible to him and yet at present it is verified that they exceed sixty million.

—MATIAS ROMERO. Notes on Mexico. New York, 1898.

LV

Silver and Gold! Silver and Gold! The image and measure of wealth; the shadow, superior to substance, before which throughout the ages all men bow; what magic spell these metals cast upon the destinies of mankind! Without referring to the earlier mining fields of history, the Ophir of the Jews, the pactolian placers of the Greeks, and the gold-producing colonies of the Romans, there is enough to command present attention in our Pacific States territory, throughout the length and breadth of which nature strewed liberally the precious metals. In the present volume I shall speak only of the deposits of * * * Mexico; accounts of those of the northern re-

gions will appear in the subsequent divisions of this historical series.

As there is pleasing fiction in their value, so there is fascinating romance in their story.

Gold and goldiness were the two great engines which drove on the Spaniards to overrun and occupy the lands discovered by Columbus. The dissolute indulgence of these passions, so opposite, and yet in them so strangely blended, resulted not alone in the extermination of the ancient glory of Spain, and sent rottenness to the bones of the then most powerful nation of Europe. "In that climate," says Gomara, "as in Peru, the people turn yellow." It may be that the desire for gold which fills their hearts shines forth in their faces. Some claim to have computed that during the first century there went from the New World to Spain silver enough to make a bridge across the Atlantic a yard and a half wide and two inches thick, or that brought together in a heap it would overtop the mountains of Potosi! * * * In some districts, as in Sonora and CHIHUAHUA, the ore lies near the surface. * * * In the northern provinces of Durango, Sonora, Sinaloa and CHIHUAHUA, though most of them were supposed to be equal if not superior in mineral wealth to the other districts.

—HUBERT HOWE BANCROFT. Vol. XI. Page 553.

LVI

During the past few years it has become evident, however, on account of the enormous increase in gold and silver production in Mexico that the capacity of the lead smelters is insufficient and that enough lead cannot be obtained to take care of the increasing production of precious metals. * * * The greater part of the gold and silver is found in the center plateau of the Republic and along the lines of the main railroads, the principal districts being Pachuca, Guanajuato, El Oro, Zacatecas, Mapimi, Parral, Santa Eulalia, Catorce and Matehuala.

—James W. Malcomson. (Paper read before Mining Congress).

LVII

One cannot go very far into Mexico without seeing and hearing a great deal of Mining Industry, but the subject is so vast, it cannot be now treated, there are mines everywhere. Page 84.

—Alec Tweedie. 1901. "Mexico as I Saw It."*

*Courtesy El Paso Public Library.

LVIII

The exploitation of extraordinary rich mines in Mexico, and Peru increased the estimated value of the world's supply of minted metal from 34 to 240 million pounds sterling between 1492 and 1636. Changed the market ratio of gold and silver from 1 to 11 to about 1 to 15 1-2. * * * The stream of gold and silver which flowed from the new mines into Spain and afterwards into every country of Europe was constant.

—MONEY AND BANKING. Wm. A. Scott. Page 317. A. D. 1903 *

LIX

"Vamonos!" shouts the smartly uniformed American conductor in the "estacion" on the further bank of the Rio Grande. * * * Chihuahua, the first city on the Mexican Central, has become a prominent point for mining operations. And probably a larger number of Americans are congregated there than any place outside of the captial city. It has fine climate, situated in a beautiful and fertile valley with all the accessions of a healthful and thrifty population. * * * Has a beautiful Cathedral and aqueduct and MUST ALWAYS BE IMPORTANT AS A MINING CENTER.

—"Face to Face with Mexicans." F. Chambers Gooch. A. D. 1886.* Page 129.

LX

Mexico has sent out 3,000 millions. Here all is silver. Invest in the operations, they are as old as God, and as new.

—"Our Next Door Neighbor, or a Winter in Mexico." G. Haven, 1875.*

LXI

The Provincias internas de la Comandancia de Chihuahua, erected into a Capitana General in 1779, was composed of 59,375 square leagues. * * * The third branch of the Sierra Madre, however, acquires again a considerable degree of height under the thirtieth degree of latitude in the Tarahumara District. * * * Where it forms the mountains of the Primeria Alta celebrated for their gold. * * * We may follow it through Durango and the PARRAL of New Biscay to the Sierra of Mimbres, situated on the West of the Rio Grande del Norte.

—ALEXANDER VON HUMBOLT. Page 509.*

*Courtesy El Paso Public Library.

LXII

"And where duty may call him to roam;
Through the hills or the valleys of Old Mexico * * *
So tonight I am happy in Old Mexico
While I sit in the moonlight alone."
—Capt. Jack Crawford, at Lake Gusman, Chihuahua, Sept. 15, 1880.*

LXIII

But we cannot expect one man to combine the RICHES OF MONTEZUMA and the graces of a Chesterfield. Page 82.
—"WEST FROM CAR WINDOW." Richard Harding Davis.*

LXIV

There was the Rio Grande and across it you could see the famous Sierra Madre with its buried treasures. (El Paso del Norte).
—"House of the Desert." Mayne Reade. London. 1880.*

LXV

The State of Chihuahua is traversed by the Sierra Madre, IS RICH IN MINERAL, ESPECIALLY SILVER.
—Century Dictionary. Volume IX, Page 244.*

LXVI

There were seventeen great jars and sacks of gold and jewels and many precious objects and among them there was a likeness of the head of Montezuma fashioned in solid gold and it was so heavy that it was as much as Guatemoc and I could lift; it had emerald eyes and seemed to glare at me. This treasure worth a king's ransom was buried forever in the lake.
—"MONTEZUMA'S DAUGHTER." H. Rider Haggard. 1900.*

LXVII

"Thou Italy of the Occident, glorious, beautious Mexico."
—Joachim Miller.*

LXVIII

It is not solely (State of Chihuahua) El Dorado of fortune seekers.
—"Adventures in Texas and Mexico."
Abbe E. M. DOMENECH, F. E. S. London. 1858.*

*Courtesy El Paso Public Library.

LXIX

Another famous ruin and similar to this (speaking of the ruins of Casa Grande of Arizona) is that at Casas Grandes in Chihuahua, Mexico, where many valuables have been found proving the wealth of its neighboring mines.

—FRED S. DELENBAUGH. "North Americans of Yesterday."* 1901.

LXX

Another strong confirmatory fact is that in 1884 a group of mountains were discovered at McPherson County, Kansas, explored by the Professors of Bethany College, Lindsborg, who found among other relics a piece of chain mail armor of hard steel, undoubtedly part of the soldiers of Cabeza de Vaca. (Who first discovered the State of Chihuahua).

—"The Old Santa Fe Trail." COL. H. INMAN. 1899. Page 5.*

LXXI

In the north provinces, Chihuahua and Durango, though most of them were supposed to be equal if not superior in MINERAL WEALTH to the other districts, mining was conducted on a smaller scale.

—Ii. 464. Santos Cronologia.

LXXII

In the higher ranges the prevailing formations are plateaus, above which rise the traps, basalts, mineral bearing porphyries and more recent lavas. Hence Lyell's theory that Mexico consisted originally of granite ranges with intervening valleys subsequently filled up to the level of the plateaus by subterranean eruptions.

But the Mexican table lands seem to consist mainly of metamorphic formations some of which have been partly upheaved, partly interpenated and overlaid by igneous masses of all epochs and which are chiefly represented by shale, greywache, greenstone, silicious schists and especially unfossiliferous limestone. All of these formations are alike remarkable for the abundance and variety of the metalliferous ores such as silver, silver glance, copper, gold. In the higher ranges are formed mainly of plutonic and volcanic rocks such as granites, syenites, diorites, mineral bearing trachytes, basalts, porphyries, trachytes, basalts, porphyries, obsidion, pearlstone, sul-

*Courtesy El Paso Public Library.

line drawn from the Capital to Guanajuato and thence northwards to the mining camp of Guadalupe y Calvo in Chihuahua and southward to Oaxaca thus cutting the main axes of upheaval at an angle of 45 degrees will intersect probably THE RICHEST known argentiferous region in the WHOLE WORLD.

world has been supplied by MEXICO. The total yield of precious

In recent times one-half of the silver produced in the whole metal from 1537 to 1880 was £622,000,000. Of other minerals the most important is copper found in pure state near the City of Guanajuato and associated with gold in CHIHUAHUA.

Chihuahua founded in 1691, and in the 18th century was the seat of a Capitan General of the Inner Provinces. * * * At one time having a population of 70,000.

—ENCYCLOPAEDIA BRITTANICA. 1892.

LXXIII

Americans in Mexico, especially those in mining camps, do not always deport themselves in a manner calculated to increase the regard of the Mexicans for them. They often maintain toward all Mexicans, and particularly towards the miners and peons, an ATTITUDE OF BRAVADO and unlicensed authority which is, at its best, uncomfortable. There is always the danger of this spirit of bravado forcing to the surface the feeling of outrage which is all too common an attitude with many of the Mexicans of the interior towns. AMERICANS ARE often queer people in the eyes of the Mexicans. They seldom understand the relation which superiors are, *by ancient Mexican custom, expected to maintain toward their inferiors, a spirit of affectionate and interested paternalism.*

It is the newly arrived American who comes to Mexico, and, for the first time, comes in contact with a true "lower class" who abuses his position and the opportunities it opens to him. Because he is looked upon, in his first coming, as a sort of prince, he too often assumes the air of the bully, with disastrous effect on his princely rights, and with a vastly changed attitude on the part of the peon, who begins to regard him as a personal enemy, and not as a noble friend.

—MODERN MEXICO. Page 14. November, 1906.

LXXIV

The fertility of this vast table-plain varies with its elevation. The summit is absolutely devoid of vegetation (hence its name) not from the severity of the climate, which belongs only to the temperate

zone, but from the absence of moisture, occasioned by the force with which the rays of the sun strike on this open plain, the absence of trees and the porous nature of the rocks, which causes the water to filtrate down to the lower regions. On this high arid plain, muriate of soda and other saline substances exist in extraordinary abundance, and give it a resemblance to Thibet and the saline steppes of central Asia. * * * The mines of Comanja, which are situated in syenite afford veins of silver ore; and the most copious mines in America those of Guanajuato, are situated in a vein of silver which intersects a primitive clay slate, passing into talc slate. Many of the Mexican porphyries are rich in gold and silver. These rocks are characterized by the general presence of hornblende and the absence of quartz and of the felspars; the ryakolite, or glassy felspar is the most frequent. The rich silver mines of Real del Monte, Pachuca and Moran are situated in a porphyry. The transition rocks of Mexico which most abound in ores are limestone and greywacke; the transition limestone affords ores of silver at Real del Castillo, etc. * * * The secondary deposits most prolific in ores are those of the limestone series: thus we are told that the silver mines of Real de Catorce, as well as those of "El Doctor" is called ALPINE LIMESTONE. While those of Tasco and Tehuilotepec is the Jura limestone. The silver obtained from Mexican mines is extracted from different ores. In Mexico there are about 500 towns or principal places which afford silver; these places comprehend together about 3,000 mines, there are between 4,000 and 5,000 veins and other repositories of silver. The mean product of the mines of New Spain, including the northern part of NEW BISCAY (Nueva Viscaya) is estimated at about 1,541,015 Troy POUNDS of silver; a quantity equal to two-thirds of that which is annually produced from the whole globe, and TEN TIMES AS MUCH AS IS FURNISHED BY ALL THE MINES IN EUROPE. A GREAT PART OF NEW SPAIN MUST RANK WITH THE FIRST REGIONS OF THE EARTH.

—Baron Alexander Von HUMBOLDT in Cosmus.

LXXV

HISTORY.

During the years 1865 and 1867, Chihuahua had the distinction of being the seat of the Supreme Government of the Nation. General Luis Terrazas, who had done service to the State, especially his triumph of the 26th of March, 1866, a great historic and political event, having received congratulations from no less than the President

of the Republic. . . . . General Terrazas time and again helped him financially, had the distinction on several occasions of being present at the meetings of the Cabinet when business of vital interest was discussed for the welfare of the Nation.

—EDUARDO DEL HUMEAU. "Centenario de Juarez," March 21st, 1906.

The President and party, after a distressing journey of three hundred leagues arrived. And the citizens of Chihuahua gladly made a contribution amounting to one hundred thousand dollars. . . . At the moment that the United States was ordering Napoleon III to retreat, President Juarez was toasting in Chihuahua on the 4th day of December, 1866.

—LEONARDO S. VIRAMONTES. "Biografia de Benito Juarez."

The State of Chihuahua is to be congratulated because her children are worthy and generous. Its sentiments always greatly more so in epochs of adversity. . . . The Government has seen with satisfaction that not only the citizens of Chihuahua but also strangers that live here have done their utmost. . . What we have seen here, we shall never forget. Our wishes are for the prosperity and aggrandizement of Chihuahua; that you reap the magnificent gifts of your soil, as the elements have endowed the *State of Chihuahua* as no other in the Republic.

—S. LERDO de TEJADA. Secy. of Foreign Relations, Chihuahua. March 21st, 1865.

LXXVI

Chihuahua mines have been celebrated for centuries. The silver mines of Batopilas, Jesus Maria, Parral and Santa Eulalia are the most noted. Those of Parral produce annually more than one million dollars worth of silver. Batopilas where an American company produces about one million dollars a year from seventy mines; where another American company produces six hundred thousand dollars a year, etc., etc. In fact Chihuahua is one of the richest states in deposits of every kind.

—M. Robinson-Wright. "Picturesque Mexico."

LXVII

FAULT BRECCIA VEINS IN THE SIERRA MADRE.

By Rufus M. Bagg, Ph. D.

There is a type of vein formation widely distributed in the mining regions of the Sierra Madre of Mexico which is worthy of special description. They may be designated "fault Breccia veins," for they occupy a distinct position in the classification of ore deposits. The origin of these veins is two-fold and they are really a combination of the fissure and fault types which have been subject to extensive deformation after deposition along defined shear-zones. The classification of mineral deposits given by Kemp in his book on ore deposits includes under "Solution Deposits" No. 6 "Veins occupying shear-zones or dynamically crushed strips along faults," as at Butte, Mont. To this class belong some of the veins of Boulder County, Colorado, described by me in the *Engineering and Mining Journal* in 1903, where, owing to irregular fracture in a homogeneous porphyritic rock, successive layers, or rather lenses (pockets of the miners), were formed by infiltration of gold-bearing solutions. This infiltration of quartz is limited in width and thickness to the amount of space left vacant between the irregular fracture line through horizontal shear. Such conditions resulted in alternate layers unevenly distributed at various depths, roughly like the slightly overlapping scales of a fish.

Such examples are entirely different from the peculiar mineral-bearing lodes of the Mexican mountains, if we have rightly interpreted the origin of these veins, for here the walls of the original fracture were first opened as a simple fissure along a more or less regular line. This fissure was filled with mineral-bearing quartz solutions, which became solidified and possess well-defined walls. At some later epoch, which probably came at a long interval after the first disturbance, since the successive eruptive flows vary so widely in composition and structure, very extensive faulting took place along the same disturbed lines. When this intensive movement occurred the original solid quartz was either pushed to one wall (I have found this quartz ore-bearing on both the foot-wall and the hanging in the same mine, but with the crushed portion of the breccia completing the vein-filling first on one side and then on the other), or it was split into two or more parts, with the brecciated eruptive porphyry thrust in between, or, more rarely, when the quartz vein was narrow the quartz became broken and was carried along into the breccia

portion of the vein. While professional obligations will hardly allow me to mention the particular mines I have in mind while writing this article, still I give a few general sections of vein-structure illustrating this point. These are not theoretical deductions, but are exact examples of measured veins in some mines which are found in the southwest portion of the State of Chihuahua, and these conditions are by no means rare in the mountains of northern and western Mexico.

The slight mineralization of the breccia becomes more pronounced when the vein has greater width, although in most places the gold and silver are practically confined to the quartz of the vein proper.

To one unfamiliar with the character of the mines in the State of Chihuahua, it is rather surprising to see how intense has been the faulting. In many instances, as at the Reina silver mine, 14 miles south of Cusihuirachic, the slickened wall west of the ore-bearing vein stands like masonry to a height of some 50 ft. and shines like polished marble. It is not claimed by me that this vein structure is not known already, but the two-fold origin of marked brecciation along already mineralized belts is extremely interesting and instructive. This same condition has been observed in the Needle mountains of Colorado, and it has presumably a wide distribution elsewhere, but I believe that it is best illustrated in the high Sierras, where extensive faulting has taken place.

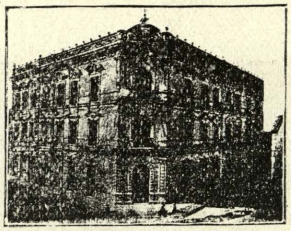
LXXVIII

MINING CONDITIONS IN A PORTION OF THE SIERRA MADRE MOUNTAINS OF MEXICO.

Abstract of Paper read by A. W. Warwick of Denver April 7, 1906, before the Colorado Scientific Society.

(Mexico is the mining country of the near future. Although for this continent so old a state there are vast areas that are as little known as the wilds of the interior of Africa, hence we follow Mr. A. W. Warwick in his exploration of a portion rarely traversed by white men with peculiar interest.—Ed.)

The region is that of the Sierra Madre Mountains in the Southwest corner of Chihuahua and Eastern border of the state of Sinaloa. The country at first strikes the traveler on the main trails as an uncultivated, uninhabited one, with very sparsely scattered mineral resources, though rich ones.



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CHIHUAHUA Feb 14 1907

Dear Mr. Holmes

Passing through here I found a most creditable beginning of a museum under State auspices under charge of Mr Jorge Griggs a most enthusiastic and creditable young man

Incidentally Mr. Griggs is on a position to monopolize the Casas Grandes collecting and has some wonderful. marvellous fine specimens and I want you to correspond with him and help him all you can

Sincerely Yours

Robt T Hill

Mr. W H. Holmes
Bureau of Ethnology
Smithsonian Institute
Washington D.C.

"Passing through here I find a most creditable beginning of a State Museum.... and has some wonderful, marvellous fine specimens."—Prof. R. T. HILL.

In the Sierras there are no wagon roads, and a wheeled vehicle is unknown. All transportation is by pack animals. The muleteers avoid the main trails and select others promising more feed, wood and water. Moreover the beaten trails were the highways of robbers. The farmers also settled off from them for obvious reasons. There are several notable mineral deposits in this region, which was at one time exploited by the Jesuits whose towns are still characterized by their neat and picturesque architecture and by old "haciendas" for the treatment of ores both gold and silver by smelting. After the Jesuits mining operations were continued by English and Scotch companies; one company alone produced upwards of a million from three enormous mines, one of them being the Rosairo of Guadalupe y Calvo. In 1885 Americans came and reopened some of the mines that had been closed owing to a period of chronic insurrections. To-day there are many American and English companies operating in this part of Mexico.

The structure of the Sierra Madre is that of a lofty and deeply dissected table land cloven by canyons, some of which are over 5,000 feet deep. On the rim of these canyons grow pines, oaks, and ferns and in the "barranca" below, bananas, oranges and guaybas. The Western slope of the Sierras is very steep and bounded by an almost inaccessible precipice.

There are a few sedimentary rocks. The predominating rock is volcanic rhyolite and andesite, some basalt and enormous masses of volcanic breccia and tuff. Granite is observed underlying the West side.

The great Western cliff or escarpment is due to a great fault plane. Two fault systems occur running Northeast and Southwest. Where these faulting planes cross one another occur the volcanoes of Southern Mexico. There is also a minor fault system running East and West particularly favorable to the occurrence of ores. The town of Guadalupe y Calvo was built as a result of the discovery of the famous Rosario Mine whose enormous outcrop forms a prominent feature in the landscape.

The coast plains, like those in California, are very fertile and raise immense crops of corn. The main drawback to mining in the Sierras is the necessity of having all machinery made sectional for transportation on mule back. The boilers have to be built on the ground. The boiler sheets are brought in rolled to radius. Parts of the machinery are apt to come in irregular detachments. Thus, bags of rivets may be received long before the boiler plates, making

it impossible to commence the work of erection until all has arrived. The material may come straggling in for a space of six months. Freight rates are not so very excessive, considering the circumstances. The price $15.50 cents per "carga" for each day's travel for a mule. A mule loaded with 300 pounds travels about 12 miles a day. The cost of freight is about one dollar United States money per hundred weight for a distance of 120 miles.

Taxes are based partly on the acreage, partly on the production. The Mexican miner is as a rule a faithful and efficient workman, if carefully watched, and his tendency to lay off checked. In drilling and blasting, the holes are generally so placed that each hole goes off independently of the others. They do not understand the art of firing in volleys.

The Mexican also becomes, with training, a good timber man. Mines keep company stores. Men work from 8 to 10 hours a day and receive $1.50 to $2.50 per day, Mexican money. Good surveyors are greatly needed, the local so-called "practical surveyor" being very unreliable.

As typical of the mining region we may select the Guadalupe y Calvo district with its Guadalupe y Calvo mine.

The Rosario vein is one of the great quartz mines of the world, and the outcrop presents a remarkable appearance. The property has been idle for the past 50 years, although during a period of ten years it produced thirty million dollars when operated by an English Company. It is quoted by Murchison as an example of material that became less productive as the mine deepened, till the gold thinned out and was replaced by aregntiferous galena. The production of the vein was so enormous that a local mint was established on the premises by Government consent.

About the time the English lease expired, the vein had become poor and considerable water was encountered. The property for many years was worked by "Gambusinos" who robbed the mine of the pillars of medium grade, and scavenged it so that the hope of the mine today is the discovery of new ore bodies, which is very probable. Upwards of $100,000 was realized by working over the old dumps and robbing a few pillars. Enormous bodies of low grade ore still exist in the mine and in the huge ore dumps.

The vein occurs in quartz andesite as a replacement of the country rock, in a crushed fissure zone formed by the numerous oscillations of the Sierras. The quartz is over 100 feet wide.

The Guadalupe y Calvo district is an isolated patch of quartz

andesite (dacite ?) from which the overlying tuffs and breccias have been eroded. Mr. Warwick's description seems to liken it and its geology to the Tonapah-Goldfield district of Nevada.

As a rule, the values in the veins in this part of Mexico have been leached out near the surface, but show good values in depth of 10 to 50 to 100 feet. After the veins had been formed they were covered with rhyolite flows causing the decay of the underlying andesites and their feldspars.

The effect of heat and moisture on the feldspars and pyrite and other sulphides may have given rise to the formation of alkaline sulphide dissolving the gold. These solutions would have a run-off at the contact between the breccias and underlying andesites, and so influence the leaching of gold and its secondary precipitation lower down.

LXXIX

NOTES ON THE SANTA EULALIA MINING DISTRICT, CHIHUAHUA, MEXICO.

By Philip Argall. Read at the Meeting of the Society, Aug. 1, 1903.

Following up the suggestion made at the last meeting of the Society, "that members should present notes on any subject of interest, not necessarily for publication, but rather to form a basis for discussion," herewith offer some rough notes on the above district, together with my present views on its ore deposits, based on observations made during a hasty visit to Santa Eulalia last January, and subject to change or amplification after a further and fuller examination that I hope to make in the near future.

THE SANTA EULALIA MINING DISTRICT.

About fifteen miles southeast of the City of Chihuahua the Santa Eulalia Mountain rises in a gentle, tuff-capped fold, to a height of about 1,500 feet above the plain. This mountain is massive limestone, and in it occur those rich and extensive deposits of silver-lead ores that for the past 200 years have made the mining district of "Santa Eulalia" one of the most famous in Mexico. Worked by the Spaniards and Mexicans in the most primitive manner for 190 years, this district is said to have produced from $300,000,000.00 to $600,000,000.00, though these figures cannot be verified and are simply local estimates, the latter doubtless too high. For the 86 years following the discovery in 1703, the total output on which the crown tax was

paid is estimated at $112,000,000.00. During the last decade gasoline hoists, steam engines and railways have to a large extent replaced the malacate, the human ore elevator, and the mule, so that today modern methods of mining may be said to prevail.

Transportation.—The Chihuahua mineral railway (3-foot gauge) connects the small mining town of Santa Eulalia with Chihuahua City, providing cheap and rapid transportation for passengers and minerals.

A narrower gauge railway (about 30 inches) connects the principal mines with the Chihuahua mineral railway at the town of Santa Eulalia, where ore is transferred from the narrower to the narrow-gauge, and on its arrival in Chihuahua is again transferred to the standard-gauge cars of the Mexican Central railway. The Chihuahua Mining Company, owners of the narrower-gauge railway, carry the ores from their own mines to a point about two miles below Chihuahua, where direct transfer is made to the standard-gauge equipment of the Mexican Central railway.

Geology.—The geology is extremely simple. The Santa Eulalia Mountain is, according to Mr. Walter Weed, a massive cretaceous limestone;* it has approximately east and west axes. The limestone dips gently under the plains along the southern margin, and, so I am informed, on the northern sides also. The mountain would thus appear to be an anticlinial fold in the strata, with the chief ore deposits occurring along fissures mostly at right angles to the main axis. The limestone appears to have been weathered into a series of benches extending from the plain back to the summit, and deeply eroded with narrow valleys, prior to the eruption of the volcanic breccia and tufa which filled up these valleys, covered the benches, and formed the "cap" now covering the greater part of the mineral district. This cap of tuff is usually a light-colored, rather fine-grained rock, "Cantera" of the natives, passing in the other extreme into a fairly coarse breccia containing limestone fragments.

This cap of volcanic rock forms, with perhaps one exception, the highest peaks, and extends well down towards the plains, rounding off the rough benches of the underlying limestone. Where the tuffs and breccias extend 200 to 300 feet in thickness, very little prospecting has been done until quite recently, hence the earlier maps of the district show large blanks, but in later years these have been pretty well covered with locations. In places deep shafts are now in progress

*Transactions of American Institute of Mining Engineers, November, 1901, Mexican meeting.

through the cap rock to reach the underlying limestone formation, which unquestionably extends uninterruptedly from the eastern to the western limits of the district.

The richer mines are, at present, The Potosi, San Domingo, Mina Nueva and Prieta, situated practically in the center of the district, while the western limits have such mines as the Santa Rita, Parcionera and Mina Vieja, all famous for their production, and the eastern limits of the district have the San Antonia, Las Tres Mercedes, and San Juliana. All excepting the last are old and famous producers. The San Juliana is a new mine now (January, 1903), shipping largely from a cave recently discovered within 100 feet of the surface.

Porphyry dikes or intrusions are, so far as present developments show, by no means plentiful. The San Antonia mine, on the extreme eastern limits of the district, and practically on the plains, is, however, on a porphyry dike, the ore making in the limestone on either side, often extending to considerable distance long the bedding planes. Immediately west of the San Antonia, and along the course of its dike, there is quite an out-flow or porphyry, which assumes a rough bedded appearance, and has been extensively burrowed by the Mexicans following small seams of ore, which occur irregularly throughout the porphyry, but at times follow the bedding structure somewhat closely.

I am informed that at least one porphyry dike exists in the Mina Vieja, while in the adjoining property I saw some evidence of intrusive porphyry 1,000 feet below the surface. The present development, outside of the San Antonia mine, does not show that intrusive porphyry has had any direct influence on the ore distribution in the district, yet I am led to believe that at greater depths, porphyries will be more plentiful, and that igneous rocks may, to some considerable extent, underlie the ore deposits.

The present proved thickness of the ore bearing limestone is about 2,500 feet—it probably will exceed 3,000 feet in total thickness. This great limestone uplift appears to be singularly free from faulting. In seven mines which I partially examined, fissures and caves abound, but I did not see a single fault exceeding one foot displacement. The main fissures, often represented by an incipient fracturing, have an approximately north and south strike, and it is along these that the great caves, water courses and ore deposits occur, more particularly where the small cross fissures intersect, a splendid example of which is the great ore deposit on the 1,450 level of the Mina Nueva on the San Domingo line.

Ores.—The Santa Eulalia ores are lead carbonates containing in places rich bunches of silver chloride, the average ore being of high tenor both in lead and in silver. The main ore masses are oxidized as deep as present developments has proven them, though as depth is gained the nodules of galena become more plentiful, as do also the branches and veinlets of galena in the walls of the caves. The smaller deposits and branches off the main channels of circulation may, however, contain sulphides quite close to the surface. Much of the ore in the deep caves is almost a pure cerussite, and, taken altogether, the oxidized ore very much resembles the Leadville high grade carbonates. The sulphites that I saw, at a depth of 1,400 feet from the surface, in the San Domingo, were principally iron pyrites, and appeared to contain very little zinc and were low in lead.

Ore Deposits.—The fissures connecting some of the great cave deposits can be traced into the overlying tuffs "dap" rock carrying ore in both rocks, and in places a small deposit at the contact. If this is the prevailing condition, the fissures and mineralization would appear to be subsequent to the ejection of the breccias and tuffs, and is probably due to a later period of igneous activity.

While my limited observations lead me to adopt views, I freely admit that it may not be correct; however, proceeding on this hypothesis, I would elaborate as follows:

First.—Volcanic disturbances resulting in the deposition of tuff and breccia.

Second.—Second period of igneous activity resulting in the incipient fissuring of the limestone and probable intrusion of porphyry.

Third.—Deposition of ascending solutions.

Fourth.—Period of oxidation, formation of caves by descending waters.

Fifth.—Calcification of the caves sealing up the oxidized ores in their walls.

The miners recognize two classes of ore deposits: the "manto" or blanket form, and the "abras" or fissure partly filled with mineral; they belong, however, to the same system. The small fractures and fissures in the limestone, enlarged by circulating waters, formed the "abras," while the "mantos" are limited to the more soluble beds, or, we might say, certain favorable strata, where replacement of the limestone with ore extended to a considerable distance from the fissures.

From an examination of the smaller cave and watercourse system, I was first led to the conclusion that the ore was deposited in pre-

existing cavities—that is to say, the caves and watercourses were first formed and afterwards filled with mineral. After seeing the extensive "manto" in the "Tres Mercedes" mine, it became clear that here, at least, was a simple case of replacement between limestone and the sulphides, while a more extensive examination of the great caves confirmed me in the conclusion that they were formed after the original ores were deposited.

It appears to me that the ores were deposited from ascending solutions, which found their way upwards through the more open parts of the incipient fissures and joint planes in the limestone, enlarging them and depositing the ore as sulphides. The more soluble beds were acted upon for considerable distances from the fissures (Fig. 1), and the "mantos" formed by metosomatic action. After the close of this period of ore deposition there followed one of oxidation, probably with reversed currents and descending surface waters, oxidizing the sulphides to sulphates, oxides and resulting carbonates, attacking the limestone above and below the "mantos" forming great caves (Fig. 2) which today are one of the most wonderful features of this most interesting mining district. During this period of oxidation, the ores near the surface were leached, to a great extent, of their lead and silver values, which were reprecipitated at greater depths, thus enriching the "deeps" at the expense of the shallow deposits; furthermore, mechanical enrichment has also played its part in removing through the large watercourses and fissures, oxidized ores from the caves and fissures near the surface and depositing them in the deeper caverns. Thus we find the shallow caves often empty, or containing only a small floor deposit of impoverished ore, while the caves at 1,400 feet are almost filled to the roof with loose deposits of rich argentiferous lead carbonates. At present the deepest mines in the district may be said to have both the largest deposits and the richest ores. It is quite probable that this will be the general experience with deep mining at least in the larger ore bodies, due solely to the leaching of the shallow ores and mechanical and chemical enrichment of the deeps, as previously described. With the close of active oxidation the interior of the caves became coated with a beautiful crystalline deposit of calcite, probably while they were yet filled with water, and later stalactites and their counterpart were formed, as in the usual limestone cavern.

I had the good fortune to see two newly opened caves. The sight was one not easily forgotten. On every side the most delicate crystalline growth covered everything in sight, sparkling in the

candle-light like beautiful objects of cut glass, crackling under our feet as if we were walking on thin ice, while here and there huge stalactites hung jauntily from the roof or joined hands with their fellow stalagmites rising in graceful curves from the floor of the cavern. The eyes of the miners, however, were directed to the blemishes in this indescribably beautiful scene, the discolorations on the walls almost too faint to notice in passing, but indicative, nevertheless, of the mineral wealth hidden from view by a few inches of sparkling incrustations.

A word as to the size of these caves: I am credibly informed that some of them reach a width of 300 feet. I saw one 160 feet across and 300 feet in length. The fissures or joint planes along which the ore deposits occur and the caves are formed are generally mere films out-side the caves, and difficult to follow on their strike. The same remarks often apply to the vertical position, though there is usually a system of open cracks and watercourses connecting a given cave (of a series) with the next one below and above it.

In one mine I went from the surface to a vertical depth of 700 feet through natural caves and watercourses—the most unique and inspiring experiences that I have encountered in a rather varied mining career. The trip completed my visit to the deep mines of the Santa Eulalia district, and, had I been then told that twenty million tons of limestone had been dissolved and removed from the mountain by the silent, yet potent influence of circulating carbonated waters, I would not have questioned the statement. Even now, after calm reflection, though lacking data to form more than the crudest estimate, I would not feel like reducing that figure more than 50 per cent, assuming the unexplored portion of the district has a similar mineralization and cave system.

The facetious names given to some of the caves and stopes are rather suggestive of their size, as, for example, the batallion stope, in which 200 men were said to have been steadily employed for some years; the Patio de Toros, and such like. In one mine I visited, a roadway had been constructed from the mouth of a cave in the side of a canyon, down through a series of immense caves and stopes, until finally the working faces were reached at a vertical depth of 300 feet below surface. At one point in this roadway, connection was made from one cave to another 40 feet below by a spiral roadway shot out of the solid walls of the connecting cave or watercourse—an admirable piece of engineering. By means of this road the festive mules were brought right up to the working faces, so that the ore could be

packed out to the surface on the animals' backs—the acme of cheap underground transportation from a Mexican's point of view.

I might have here stated that the most disappointing thing to me on arriving at the Santa Eulalia Mines was the practical absence of dumps. Not that they are absolutely necessary for profitable mining (they are usually a necessary evil), but one could scarcely conceive that mines had been operated there for a century or more, producing millions of dollars' worth of ore, but only three or four thousand tons of waste as represented by the surface dumps. When I asked for an explanation it came quickly—"the ore was very rich, the Mexicans smelted everything they took out of the mines." The real cause is the immense cave system in the mines, providing ample room for stowing all the waste, not only that produced from mining the ore, but also from the development work. Practically the only mine dumps are those recently made under modern management, and it is questionable if it would not have been better mining to have used the rock to fill up old stopes and caves, as the Mexicans formerly did, instead of hoisting it to the surface.

The Santa Eulalia limestone appears to pass readily into solution. All surface exposures show the flints and fossil standing out prominently, while many of the joint cracks are enlarged and in places caves are formed which appear to have no relation to the ore deposits and are in all probability of later age. Some of the watercourses connected with the system of ore caves are oval-shaped tubes, devoid of ore and quite smooth except for the insoluble flints that stand out in strated layers and an occasional bump of silicified limestone.

Another form of deposit is shown in Diagram 3. When solutions ascending a joint plane follow suitable strata to the next joint, ascending along it for a distance and then repeating the phenomenon, replacing in each instance the limestone with ore, as outlined, subsequently a cave may be formed as shown by the broken lines. Fig. 4 is a sketch made at a depth of 1,500 feet from the surface, where solid mixed sulphides can be seen for the first time in that mine. The pyrites and galena appear to be secondary, these ores having been deposited on eroded limestone in what was apparently a watercourse, adjoinng and connected with a large cave of oxidized ore. The galena was quite fresh and apparently unaltered; the pyrites was in places oxidized to quite a considerable extent, but the greater part of it appeared to be unaltered. Some native silver appears in the druses of the mixed sulphides, and the superintendent informed me that he found a loose deposit of native silver on the floor of the water-

course behind the stalagmite shown on the sketch. The mixed sulphides, he told me, assayed about 59 per cent lead and 80 ounces of silver per ton.

An interesting speculation on the Santa Eulalia deposits is, To what depth will the zone of oxidation extend? and, furthermore, Will the first zone of solid sulphides be enriched by secondary agencies?

These are difficult questions, but, reasoning from analogy, I am inclined to the opinion that the latter will be moderately enriched for a shallow depth—I might possibly call it superficial enrichment. It must be remembered that the oxidized ores are simply chemical concentrations from the original sulphides, and that the beds of cerrussite and bunches of chlorides and bromides of silver contained in the mass of the oxidized ore should account for the greater part, if not all, of the values leached from the original sulphides; consequently, one could not, I think, reasonably expect a zone of heavy sulphide enrichment, nor could even a moderate sulphide enrichment be expected to extend to any great depth in the original sulphides. The depth to which oxidation will reach must naturally vary with the size of the ore bodies. The larger deposits, I take it, should extend in a partially oxidized condition for a considerable distance below the water level of the district. The water level may not be an easy matter to determine. The mines are practically dry at a depth of 1,450 feet, as measured at the San Domingo shaft, and considering the arid nature of the country, it is doubtful if any material amount of flowing water will be encountered.

LXXX

Extracts from Prof. Robt. T. Hill's Report of January, 1904, and Other Reliable Sources of a Later Date.

SITUATION, GEOLOGY, ORE BODIES, MINERALIZATION, PAST HISTORY, ETC.

The range of mountains is about five miles in width and eight miles long. Everywhere it is composed of igneous rocks (rhyloite or porphyry), except within the mineral district proper, which ranges from three-fourths to one and one-half miles wide and probably extends from the southeast denouncements, called the "San Antonio," etc., to the Pueblo de Dolores at north end of "Las Plomosas" denouncements. (See plans). This mineral district proper is composed

of two formations, a superstructure of massive cretaceous limestone, surrounded by and traversed or capped by dykes of eruptive volcanic material consisting of the specie of rhyolite known as decit or porphyry and locally called cantera. The limestone has been proved to be 3,000 feet in thickness, is drab and gray-blue in color, with firm texture and accompanied with numerous flints and fossils. In the mineralized belt some of the highest summits are of limestone, but they are usually buried under a capping of igneous stuffs. The decit tuff or cantera which caps most of the mountain, is a highly silicious rhyloite white upon fractures but oxidizing to a deep brown, and which mantles most of the slopes and tops of the ridges. The source of it is not definitely known, but was probably extruded from fissure eruptions, the stock of which are represented in the great rhyloite dykes which cut and cap the limestone vertically. The limestone strata are not seriously disturbed, although they show a variety of low dips, anticlinal and monoclinal. There are also some thirty or more well defined lateral dykes cutting the limestone, and one mine (the San Antonio) at the southeast end of the mineral zone obtains its ore in great pockets at the contact of the limestone and porphyry. Until recently it was generally considered there were no true dikes cutting the limestone, but several of these certainly exist and others will probably be found in the near future as explorations advance. The ore, which consists of silver-bearing lead carbonates (galena), occurs either in the limestone in fissures, floors, caves, or irregular ore bodies. The limestone is stratified, being usually to the east.

At some geological period there has been a disturbance, or convulsion of Nature's elements whereby porphyry (rhyloite) became an intrusive element, filling the fractured limestone, and it is chiefly in or near these fissures or dikes that the ore bodies are found. These openings or fissures form the channels for the flow or percolation of mineral solutions penetrating the bedding planes of the true country rock from the crevices or fissures, which, under favorable conditions having dissolved and carried away immense bodies of limestone, leaving great natural caves at various depths, often several hundred feet away from the fissures, and then afterwards by a process of alteration and deposition, mineral solutions have filled or partially filled these caves with carbonates or galena. These caves are abundant all along the line of the great mineral basin for a distance of over six miles, as now practically exploited, from the "San Antonio" group of mines on the southeast end to "Mina Veja," "Jesus," "Santa Rita," "Porcionera," etc., on the north end, and undoubtedly will

be found as far as the same geological surface exist to the north, or to the Pueblo de Dolores, when the northern portion of the field is prospected or developed. In the cave called "Bull Pen" (from its oval shape), in the Santa Eulalia mine, (Hearst estate), which measures 450 feet in diameter and 100 feet high, many thousand tons of high grade ore have been taken. This cave is at the 1,300 foot level. The great cave at the "Parcionera" is said to be large enough to contain the Chihuahua Cathedral, the north end of which is close to "Las Plomosas." Similar caves are found in the "Mina Vieja," "San Juan," "Bustillos" and everywhere along the great mineral zone as lower levels are reached. The "Potosi" (purchased recently for $250,000 contains now in sight, practically in caves below the 1,000 foot level, high grade ores, which it is estimated it will take 50 years to ship at the present shiping rate of 500 tons per day. One ore body alone has been proved to be 300 feet by 600 feet in size and is proved to be 300 feet deep. By estimates this ground contains 5,400,000 tons which, at $50 per ton, contains ore to the fabulous value of $270,000,000 pesos. And the richest, and possibly most extensive ore body ever discovered in Santa Eulalia, was made in the "Buena Tierra," lying to the northeast of the "Potosi," by Prof. Jackson, General Manager of the Santa Eulalia Exploration Company, a California syndicate that recently purchased about 100 pertenencias in and to the north of the Santa Eulalia field. Twelve months ago the "Buena Tierra" was only considered a good prospect. Prof. Jackson got permission to do a little prospecting from an adjoining claim, where he followed up a small leader or vug only a few inches in diameter, which opened out into an immense cave filled with carbonates and galena, running from 100 to 800 ozs. in silver and already known to contain millions in dividends below the 1,000 foot level. This property and other valuable mines were bought on a long favorable bond for $375,000 gold, and without selling a share to the public, the syndicate will pay for the properties from shipments. The "Buena Tierra" shipped 3,700 tons of this ore last month. Recent developments prove this to be the richest mine in Santa Eulalia, silver ore in immense caves coming in, showing great bodies of chlorides, bromides, native silver and silver as high as $8,000.00 per ton.

Where the great ore bodies are exploited there is no sign of water level, and there is every reason to assume that the carbonates will be found in a succession of caves, or "mantas" (blanket veins), to a great depth. The great silver-lead mines of Broken Hill, New South Wales, Australia, turned into a body of zinc, blended with a low

grade sulphides, at the 300 foot level, of the most rebellious character, but the sulphides of Santa Eulalia, proved to the 1,700 foot level, mixed with carbonates of lead are free of zinc and generally are richer than the carbonates.

LXXXI

HISTORY.

The Santa Eulalia mines were discovered by the Spaniards in 1703 and it is said that during eighty years succeeding the discovery royalties were paid to the Crown on an output aggregating $112,000,000.

The mines were worked by the primitive native methods, all ores being carried or packed out of the workings on the backs of the coolies until the last ten years, all the machinery of the district having been introduced during that time. The mines were first worked by the Aztecs, later by the Spaniards and Mexicans, and now principally by the Americans. It is evident that the Spaniards were better prospectors and more systematic miners than the Mexicans and during their term of occupation they extracted many tons of ore. The Mexicans who followed did little more than remove the bodies of ore exposed by the Spaniards, after which they abandoned the mines. The Mexican does no prospecting work and rarely goes deeper than the miner can pack out the ore, climbing up a "chicken ladder" (escalera), or crude ladder made by cutting notches in a tree for steps, up or down which it is difficult for a foreigner wearing boots and shoes to travel. At one time all the mines were abandoned except the "Santo Domingo," "Bustillos," "Dolores," and the "Zacatecas." About ten years ago the abandoned properties were gradually redenounced by Mexicans and Americans, since which time many of the old mines, and new ones discovered, have produced millions. The "Mina Vieja," near "Las Plomosas' " south boundary, is the oldest steadily worked mine in the north field and is still a large shipper. The "Porcionera," "Galeano," "Santa Rita," "Potosi," "Santo Domingo, " "Buena Tierra," "Cristo," "Santa Juliana," "San Antonio," "Dolores," "Escondida" and "Esmeralda" are now shipping an aggregate of over 500 tons per day. In twelve months this output will be doubled, and in twenty-four months it is conservatively estimated that the shipments will be over 3,000 tons per day. The Santa Eulalia ores are more sought after by custom smelters as fluxing ores and command the best smelting rates. From carefully prepared schedules compiled from taxes paid to the Crown and the

Republic the total shipments up till 1903 aggregated over $800,000,000.00

The deepest shaft is the "Santo Domingo," next to "Potosi," which is down 1,750 feet. The largest ore bodies ever discovered in the history of the mines have ben developed within the past five years and nearly all below the 1,000 foot level, and wherever shafts or bore holes have reached this level along the whole line invariably large ore bodies have been found, excepting only in one instance on the Baltimore (see plans), on which a shaft is down over 1,300 feet, cutting numerous pockets and leaders, which if followed up, will undoubtedly open out into "abras" or "mantas" of ore similar to those in the adjoining mines.

FIRST WORKINGS BY AZTECS AND SPANIARDS.

Although the lower workings have been made by American enterprise within ten years on the mines between El Potosi and Mina Vieja, on the northern portion of the titled mineral zone for a distance of about 2,500 meters (8,100 feet) and it is within these boundaries that the greatest ore bodies on the field are now proved, simply because this portion of the vast mineral zone has received more attention than the southeastern or middle zone, the older workings were commenced at the extreme southeast end of the field, on the mines now called El Chiribel, Carlota and Sorecuero, which, it is claimed were worked extensively by the Aztecs, or Indians, long before the advent of the Spaniards in 1703. Remnants of ores left by the Spaniards, who came in first at this end of the field from El Rio Conchos and subsequently worked El Chiribel for many years, proves that this mine was the richest ever worked in the district. It is claimed that El Chiribel produced at this time gold and silver values aggregating over $4,000,000.00. The mine was opened on the side of a perpendicular bluff, or mountain, which rises some 400 feet above the dry creek bed, the face of the bluff being perpendicular and as straight as the side of a sky-scraper building, the opening being about fifty-eight feet above the apex of a box canyon, where a hole is in evidence about twenty feet long and ten feet high, where the ancient miners followed in a sprout of ore which, about forty-five feet in, opened out into an enormous manta or blanket vein. On entering this mine immense caves and open cuts are to be seen where acres of ore have been extracted. This mine evidently yielded many thousands of tons of high grade ore with practically no waste or non-payable ore, as only about twenty tons of ore, assaying in value about $30 gold, silver and

lead are left on the dump or side hill in front of opening. El Chiribel is the only mine having a gold producing record in the Santa Eulalia district, except possibly the Josefina, which also assays in gold. (See note later on).

LA CARLOTA AND THE CARLOTA ANEXAS.

Recent explorations by Don Carlos Gosch has demonstrated that on La Carlota there are most extensive old workings, the dumps of which were over grown with brush and vegetation so as almost to obliterate them. This mine has remained unknown and hidden from the prospector for over 250 years, until Don Carlos took it up a few months ago. He finds most extensive antique workings and is now opening up new rich ore bodies near the surface, having denounced 100 pertenencias called La Carlota and La Carlota Annexas.

JOSEFINA SILVER AND GOLD LIMITED.
(Originally called El Sorquero).

This great property known as the Josefina group contains the following properties: (See plan).

La Josefina of 4 pertenencias
Las Carolinas of 13 pertenencias
La Enriqueta of 231 pertenencias and
La Enriqueta Anexas of 50 pertenencias,

or a total of 298 pertenencias—about 745 acres— is situated in a most coveted area of the district of Santa Eulalia, occupying a low horizon which has an important bearing in opening up the ground.

Extending through the property a limestone and porphyry ore-bearing contact occurs being a continuation of El Promontorio Dike (see plan) and to the east the great San Antonia Dike or contact cuts through the Enriqueta to La Carlota (see plan). In no section of the District are the rhyolite and cretaceaus limes so clearly outlined as in the southeast field. Many years ago the features of mining in the entire District were confined to extracting ore from the numerous water courses, caves, mántas and spouts near the surface, and under these antiquated and obsolete methods vast ramifications of underground workings are in evidence along these contacts and dikes on the Josefina group.

The early excavations by the Aztecs, Spaniards and Mexicans of the entire District, as compared with La Josefina group, show that the latter property must have produced its proportion of ore to the many smelters whose slag dumps are scattered in every direction.

From a small ore pile remaining on one of the old dumps largely altered by its long exposure to atmospheric changes, a sample was taken by the manager, Mr. S. C. Burn, which, from its geological nature, evidently came from the deepest workings, gave silver $78.65, gold $9.09, total per ton $87.74.

The showing of gold at this deep point I consider of great importance, as it strengthens the theory held by many that this part of the District especially was mined by the ancients principally for its gold values, the same as "El Chiribel."

It is estimated that the old workings in the Josefina Group will sum up in drives and shafts some 5,000 feet. The new work under Mr. S. C. Burn is as follows: Josefina shaft No. 1 sunk 300 feet, Maria shaft 104 feet, Maria drifting 400 feet, Enriqueta shaft 200 feet and drifting 200 feet, Carolina shaft sunk 70 feet and driftings 50 feet, developing great reserves of ore ranging from $20 to $192 per ton in values.

The old workings were principally confined to El Sorecuero pro- Mr. S. G. Burn is as follows: Josefina shaft No. 1 sunk 300 feet, dicate to float and operate this promising property. Some 500 pertenencias have recently been denounced to the south of La Enriqueta and La Carlota by Don Paulino Decanini and Mr. J. Todd McClammy, which carry most favorable surface showings. This property is called The Wild Horse.

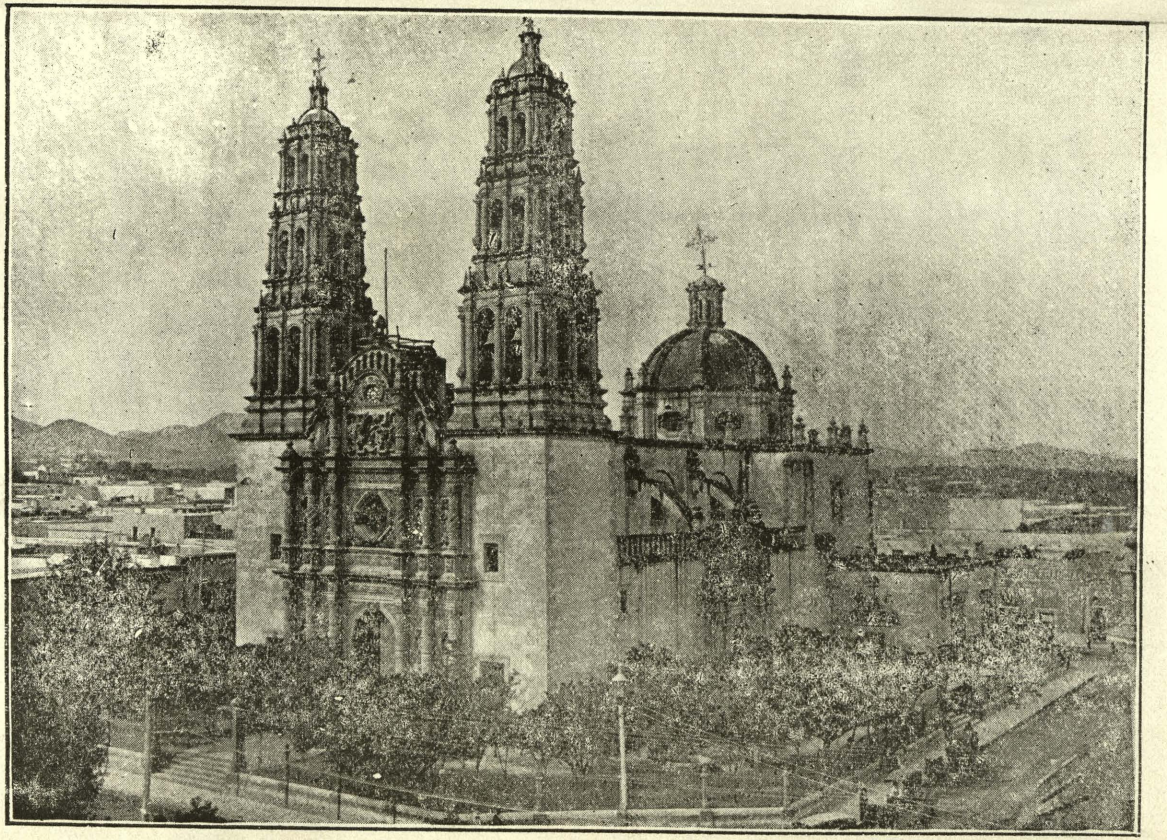
THE PERUANA GROUP.

This group embraces,

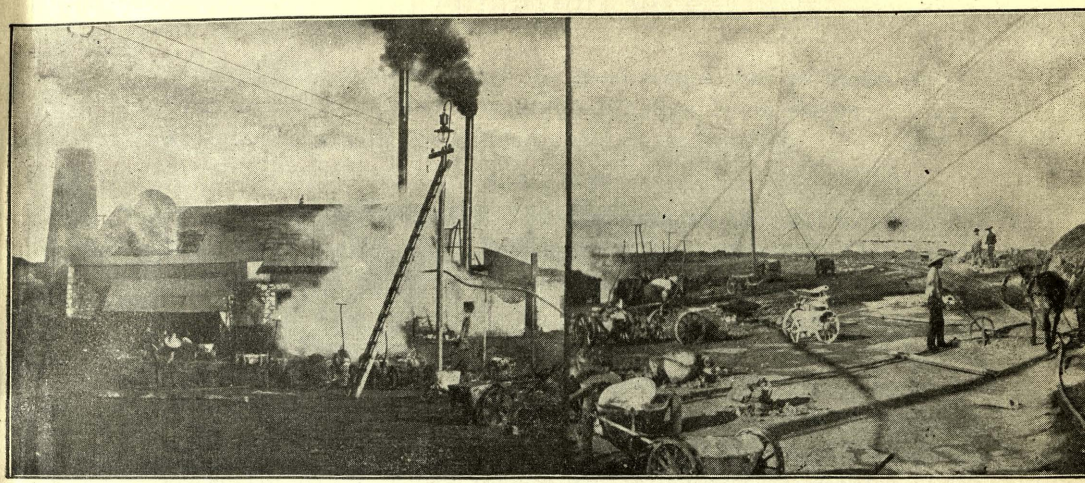
El Chiribel of 15 pertenencias
El Pirineos of 9 pertenencias
La Peruana* of 36 pertenencias and
Las Estrellas of 25 pertenencias
Total of 85 pertenencias.

This group is most favorably situated and contains the great mineralized dikes and fissures which were the indicators for the great bonanzas found in the San Antonio and Dolores mines to the north. There are five distinct lodes coming into this ground called Los Promontorios Dike, San Antonio Dike, the Dolores Fissures (3 so called), Dolores Main Dike, Middle Fissure and the Yellow Fissure. Excepting the old workings heretofore alluded to in El Chiribel there are only a few pot-holes to be seen on the Peruana but the mineralized dikes are very prominent and heavily charged with manganese and

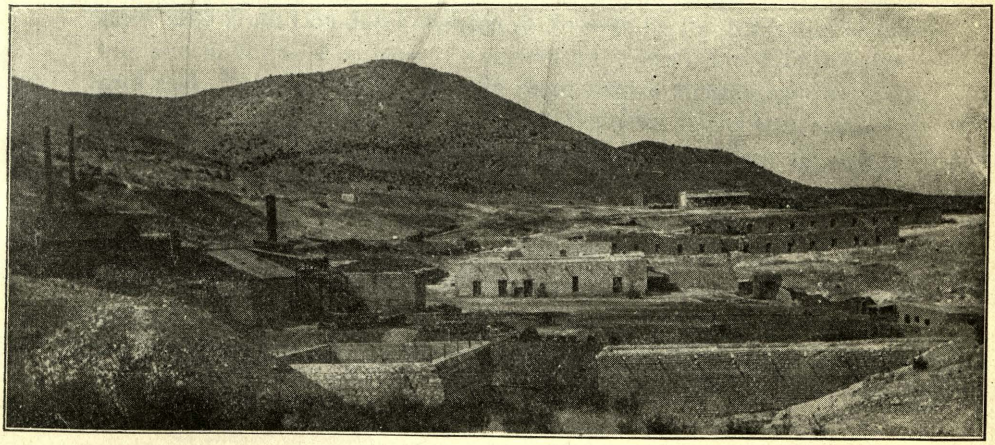
*See Mining Directory.



Cathedral of Chihuahua.



View of Smelter of Río Tinto Mexicano, Terrazas, Chih.



View of Mill of Magistral Copper Co.

iron. And it is evident that the great manta that produced its millions in the old Chiribel workings is tributary to the San Antonio Dike at the base of the cliff.

THE DOLORES MINE.

The Dolores* contains 5 1-2 pertenencias, the title to which has never been caduca (forfeited) since it was worked in 1703 by the Spaniards, but no work has been done on it for many years until about six months ago, when Geo. B. Jacobs, E. M., took charge of it, and in less than two days ran into a great manta of ore by following a small leader from old workings. The mine has improved every day since and now there are large reserves of ore blocked out and with a simple and cheap concentrating plant on the mine they are clearing $3,000 per month, which amount can be doubled by addition to the plant. There are three great dikes or lodes cutting through the Dolores Fissure, Middle Fissure and the Yellow Fissure. The deepest workings are only about 250 feet and this property has a great future.

LA IBERA NO. 2.

La Ibera No. 2, which is situated between the San Antonio, El Dolores and El Chiribel*, Peruana and Quien Sabe denouncements has splendid surface showings and contains both the main vein of the Dolores and the San Antonio. The former will probably dip into it from the west and the latter strike it from the north. Dikes Nos. 1, 2, 3 and 4 pass through La Ibera No. 2, and it evidently only needs a little work here to open up a payable mine.

SAN ANTONIO DIKE AND MINE.

The San Antonio dike and mine contains 36 pertenencias and is made up of a group of small denouncements which were recently purchased from Don Jesus Aguirre y Nevarez by the American Smelting and Refining Company (Guggenheim Trust) for $250,000 gold spot cash. At the time of the sale about twelve months ago the main shaft was down only sixty feet, since which time it has been extended to 700 feet, all in ore, and following rhyolite, dike or lode the deepest true fissures proved in the Santa Eulalia district ,and now has blocked out millions of ore values ready to ship. The San Antonio is equipped with a 44 horse power hoisting plant good for 1,600 feet. A survey has been made and the mineral railway terminating in the Bustillos mine will be extended on line designated on plan to San Antonio. The San Antonio dike can be followed like a wagon road to the north of its junction with the main dike of the Santa Eulalia (See plan).

*See Mining Directory.

passing through the Colon denouncement. The San Antonio probably has more ore blocked out than any other mine south of the the Potosi. In opening the mine 19,000 tons of ore were extracted netting $10 gold per ton and the mine was turned into the Smelting Trust at a valuation of one million dollars gold. The Trust expert measured up 110,000 tons of ore at a valuation of $10 per ton. A tunnel taps the vein from the north side at 600 feet level and water has been developed in the valley about one mile from mine for concentrating purposes.

La Isla, Buen Diaz and Socorro are most favorable surface showings, with old workings in evidence, and will probably prove great mines when properly opened up. (See items regarding Socorro later on).

NUEVA SANTA EULALIA.

The Nueva Santa Eulalia contains 12 hectares and is a proved mine of rich ore, having recently been sold to the Santa Eulalia Exploration Company for $72,000 gold spot cash. The shaft is on the Sirena, where the spout of ore came to the surface, cutting a large blanket vein in passing into the Nueva Santa Eulalia, and has been opened up extensively from said shaft. The property shows much pre-historic workings.

THE SANTA JULIANA.

The Santa Juliana contains 9 pertenencias and is developed by three shafts, one down 600 feet and two each down 20 feet. It is equipped with a 22 horse power engine (oil) and hoisting plant and one 12 horse power engine and plant. The ore came to surface in a spout which opened into extensive ore caves, and it remains a regular shipper, paying satisfactorily. It was floated into a company called the Eureka Mining Company. This mine has more ore blocked out ready to ship than any other mine in the southeast field except the San Antonio.

LA IBERA NO. 1.

The iIbera No. 1 contains 50 pertenencias and was recently bonded to Ryan & Dudley for $77,000 gold, 10 per cent deposit, balance on terms. The shaft is down 100 feet and is opening out into large bodies of rich silver-lead ore.

The Aurora, Escondida, Continente No. 2, and Sirena, are consolidated and were recently sold to Qualey Bros.,* who floated them into a large New York company. I have not examined this group in

*See Mining Directory.

detail, excepting La Aurora, which in on La Gloria dike. This branches from the Santo Domingo dike, passes through La Ibera No. 1 to the northwest through La Gloria, thence through Mercedes, La Gloria and Mina Vieja and forms a junction with Adams dike on La Minerva denouncement. (See plan). The Aurora is supplied with a 22 horse power engine and H. W. The shaft is down 600 feet and the showing is said to be very satisfactory. The Aurora contains 22 hectares. On February 5th a great cave decorated with beautiful stalectites of lime and partially filled with rich carbonates was broken into in the mine.

LAS MERCEDES.

Las Mercedes contains 20 pertenencias and was bought by the Chihuahua Mining Company (same company as Potosi*) for $100,000 gold spot cash. It has a 22 horse power engine and hoist. The shaft is down 325 feet and there is a good showing in old workings. All the mines in the southwest part of the field, except Santa Juliana, Dolores and La Gloria are waiting for the extension of the railway from Bustillos to San Antonio before commencing shipments. The old workings in Las Mercedes yielded under Governor Creel's ownership over $500,000 Mexican currency.

La Ibera of 7 1-2 pertenencias is surrounded by mines with millions in values in sight and under the able management of Mr. Jas. Gasson, who has had 16 years practical experience in the Santa Eulalia field, will undoubtedly prove a good property.

LA GLORIA AND CONTINENTE NO. 1.

La Gloria and Continente No. 1, owned by Don Lorenzo Arellano and containing 10 and 12 pertenencias respectively, have shafts down 100 feet worked by windlass. The showing here is equal to any in the vicinity for the amount of work done, and this ground, especially La Gloria, through which La Gloria dike passes, should prove equal to any in the vicinity when opened up. The property is now bonded for $200,000 gold.

LA DINAMITA.

La Dinamita, positioned in the center of La Sirena denouncement, is a fine surface showing. It contains 10 pertenencias, and being in the hands of C. B. Jacobs, it will make a great mine under his able management.

The Los Angeles and Cabello properties containing 45 hectares are excellent showings, having been extensively worked by the Span-

*See Mining Directory.

iards. These properties are also under the suprvision of Jas. Gasson. The Los Angeles, La Central and Santa Eulalia main dike all cut through these properties.

During the past eighteen months over $16,000 has been extracted in pot holes and shallow surface workings along the southeast main dike on these properties. A grab sample from some twenty sacks of ore on surface that I took assayed 96 ounces silver, $2 gold and 15 per cent lead.

LA MINERVA GROUP.

Consisting of La Minerva of 13 hectares, La Gitana of 17 hectares, Excedencia of 6 hectares and El Hueco of 1 hectare, total 39 hectares, is a fine selection surrounded by great producers and mines that have sold for large figures recently, containing junction of the Santa Eulalia main dike and La Gloria dike with their great mantas of ore close to surface makes this group exceedingly inviting. I have arranged a deal for these properties through Mr. A. McKenzie, who will float them in London and raise ample capital for modern development.

La Oriental, containing 9 hectares and known on the map as Socorro, has just been bought by Mr. Howard Anderson and is situated north of the great producer Santa Juliana, which was also owned and sold by the aforesaid gentleman. It also lies east of the great producers Las Mercedes and La Gloria. The Oriental was worked years ago by the Spaniards to a depth of 50 feet from which large superficial bodies of ore were won. The most valuable property has remained idle many years, but now under the able management of Mr. Anderson, who is associated with Monsieurs Girard and Calkoen of Paris, who have a large working capital to operate and work this property and the adjoining mine called El Buen Diaz of 42 pertenencias and are bound to become numbered with the regular producers.

This is the first advent of French capital amalgamated with American knowledge of a superior class in the Santa Eulalia field.

EL COLON.

El Colon joins San Antonio on the north and carries the great San Antonio dike from end to end and is a finely positioned block of 16 hectares and is to be developed by Don Lorenzo Arellano who owns it. The San Antonio tunnel starts on this ground and taps the San Antonio at the 600 foot level on the main shaft.

Los Promontories of 15 hectares was bought by the Chihuahua Mining Company for $100,000 gold spot cash; is a splendid showing

with numerous ore spouts and a great mineralized rhyolite dike, which is the same as cuts through Quien Sabe and the Josefina group.

La Gigana, of 15 pertenencias, is owned by a member of the Guggenheimer trust and is a similar showing as Los Promontories. It can not be bought for a million gold.

Santa Eulalia and Continente to the north of Los Promontories are undeveloped properties of great prospective value.

To the southwest of La Minerva group are El Carlos, Bella Vista, Olga, Sorpresa, Panama, Panama Anexas, General Prim, La Trinidad, San Andres and Anexas, Zubiata and Anexas, San Antonio Chico, Las Leonidas, Puerto Arturo, Buena Ventura, Granuja, Carmen, etc., etc. This part of the field, although presenting excellent surface showings, still remains undeveloped, except old workings on the San Andres, which produced many hundreds of tons of payable ore.

El Garabaldi is situated on a high mesa and is capped by an immense overflow of rhyolite, breccia or conglomerate and will need deep exploration to prove its value.

To the east of the Pueblo of Santa Eulalia a high mountain is mantled by the same volcanic breccia as on the Garabaldi and may prove valuable when deep explorations are inaugurated. The same applies to the mountain lying to the west of the Pueblo of Santa Eulalia.

Lying to the northeast of La Minerva group are La Reina, La Victoria, Limantour, El Asalto, Dora, La Reinera, Adela, Matilde, Napoleon, Mira Flores, El Triunbirato and Elvira, most of which are recent denouncements and undeveloped. The formation of this vicinity is principally cretaceous limestone. The Los Angeles dike strikes northwest through several of these denouncements. (See plan).

Las Ampliaciones de la Lisa of 40 pertenencias was surveyed and cut off of La Lisa and sold to Messrs. Ryan & Dudley for $100,000 gold. This is a splendid surface showing. The main Santa Eulalia dike cuts through it from east to west and the San Antonio dike strikes through the center from north to south with lots of old surface workings in evidence. A little modern development work here should make this property a steady producer.

There are about 1,500 pertenencias plowed with rhyolite dikes cutting through cretaceous limestone embraced in the denouncement called El Golfo to the east of the San Antonio, etc., which is at present in litigation. A great portion of theis area is pregnant with most favorable indications for ore bodies to be developed in shallow work-

ings. The revised mining laws under preparation by Lic. Rodolfo Reyes, approvd by President Diaz, will force these holders under fraudulent litigation either to put up the government taxes or let others denounce the ground who will do so, and this great area will soon be a most valuable adition to the mineral zone, which has been recently denounced and called "Finance."

This winds up my detailed description of the southeast field, but before passing passing to the great bonanzas of the north and northwest let us have a look from "Pecacho Oriental," the highest point in the midst of the great southeast mineral zone.

From this summit which rises several hundred feet above other hills in the vicinity, one has a magnificent view of the hills, valleys, box canyons, arroyos and cliffs painted by Nature's oxides of iron and manganese, present a panorama of Nature's incomparable handiwork like one grand kaleidoscope vast and beautiful, enticing and interesting beyond description. To the northeast, north and northwest, the east, south, southeast, southwest and west the whole country is decorated with white mountains designating the boundaries of millions of hidden treasures in gold, silver and lead values. From this vantage point the great mineralized rhyolite lodes or dikes can be traced plain as rivers traversing the cretaceous limes and rhyolite formations and it is from this point of observation that I have prepared by plan showing the courses of those surface indicators, and from this hill and the Chiribel cliff most of the panoramic photographs accompanying this report were taken. Nearly all the hoisting plants as far north as No. 3 shaft on the Potosi and Bustillos, the San Juan and Vergara plants are in view, and standing on the hill between the Santo Domingo and San Juan on the northern field all the hoists of the northern field are under observation. From these two points my topographical dike plans were prepared. As an example of some Mexican development work a tunnel is in evidence from the collar No.1 Potosi shaft which pierces the rhyolite mountain rising 1,500 feet above and taps the Bustillos' old workings at 600 feet on either side of the mountain, being about three-fourths of a mile long, all of which was money expended for nothing, as all the ore is below this level except the spouts and mantas which made up the San Juan and Bustillos surface mines and which were exhausted before the tunnel reached the old workings.

—Wm. Adams, E. M., Chihuahua, 1905.

LXXXI

The Castilian of those times was to the Italian what the Roman in the days of the greatness of Rome was to the Greek. In no modern society, not even in England during the reign of Elizabeth, has been so great a number of eminent men at once in literature and in the pursuits of active life, as Spain produced * * * the American Viceroys and the farmers of the revenue became rich. *The ascendency which Spain then had in Europe was, in one sense, well deserved; it was an ascendency which had been gained by unquestioned superority in all the arts of policy and of war.* * * * At the same time Spain had what Napoleon desired in vain, ships, colonies and commerce. ALL THE GOLD OF THE WEST * * *

Some veins of ore exceeded expectation. But the revenue of the State depended on *the whole annual produce of two continents. The Mexican Mines* were through the reigns of Philip IV and Charles II in a steady course of improvement. (Volume 1.)

*The Spanish Viceroy, who leaving behind him the curses of Mexico * * * entered Madrid, with a long train of gilded coaches, and sumpter horses trapped and shod with silver.* (Vol. .II, Page 246).

—MACAULAY'S Critical and Historical Essays.
London, 1903.

LXXXII

"The Two Americas." Speech Opening of Pan American Exposition, Buffalo, N. Y.

I welcome you her; you our brothers of the North and you my brothers of the SOUTH. We say to you that we earnestly hope for your well being. Not only for your sake but also for our own for it is a benefit to each of us to have the other do well. The relations between us now are those of cordial friendship and it is to the interest of all alike that this friendship should ever remain unbroken. * * * * * Yours is the world of the merchant, the manufacturer and mechanic, the farmer the ranchman, THE MINER. * * * You are subduing the prairie and the forest, tilling farmland, building cities, striving to raise even higher the standard of Right, to bring ever nearer the day when Justice shall obtain between man and man; and we wish Godspeed to you and yours and may the KINDEST OF TIES OF GOOD WILL ALWAYS EXIST BETWEEN US. * * *

—THEODORE ROOSEVELT. Strenuous Life. 193.

LXXXIII

We view with lively interest and keen hopes of beneficial results the proceedings of the Pan American Congress convoked at the invitation of Mexico, and now sitting at the Mexican capital * * * The Delegates of the United States are under the most liberal terms to co-operate with their colleagues in all matter promising advantage to the GREAT FAMILY OF AMERICAN COMMONWEALTHS.

—Presidential Address, Vol. II, Page 605.

LXXXIV

All the other enterprises of the Spaniards in the New World, subsequent to those of Columbus, seem to have been prompted by the same motive—it was the sacred thirst of Gold * * * that carried Cortez to MEXICO. Their first inquiry was if there was any Gold to be found there * * * the passion which had suggested to so many people the absurd idea of the philosopher's stone * * * The dream of Sir Walter Raleigh concerning the golden city and country of EL DORADO. Every Spaniard who sailed to America expected to find an EL DORADO. Fortune too did upon this one what *she has done upon very few other occasions. She realized* in some measure the the *extravagant hopes of her votaries, and in the discovery and conquest of Mexico she presented them with something not very unlike that profusion of precious metals which they sought for.* (Vol. II, 71).

—Adam Smith's WEALTH OF NATIONS. London. 1906.

LXXXV

Mr. Creel like all truly cultured men wishing to educate youth, donated to the Scientific Institute of this city a magnificent Collection of Botany valued at over $2,000. Thereby giving the scholars an opportunity to study some of the rarities of the Vegetable Kingdom. Unfortunately this collection was shipped to the Paris Exposition, which it never reached, having been lost on the way.

—SEVERO I. AGUIRRE. "Revista de Chihuahua," March, 1897.

LXXXVI

Mexico City is a reminder of Spain and often of Italy, but in the country and the small towns the appearance is Oriental or rather Egyptian. * * * With little of the customs of all and the wealth of a Golconda.

—CHARLES DUDLEY WARNER, June, 1897.

LXXXVII

Today Chihuahua is a happy State, and its Capital (of same name) is almost a model little city. Indeed I, who am not old, can remember when it would have been a miracle in New England to have training schools for girls. * * * Here in Chihuahua they have one with a hundred young ladies; one of the finest Cathedrals in Mexico built from revenue of the silver mines of the famous Santa Eulalia. DON LUIS TERRAZAS has been more than once Governor. It was he who made the really remarkable campaign which obliterated Victorio, the foremost of Apaches, and not only won for Chihuahua peace after harried generations but did more for the QUIET OF OUR OWN TERRITORIES than any one else has done except General Crook. He offered to lend the City $100,000.00 for five years without interest or larger sum if needed for their waterworks. This is mentioned not as much becauses it touches a man admired and loved by all who know him as because it indicates the sort OF CITIZEN UPON WHOM THE GUIDE of modern Mexico is able to count. There is a touching fitness in this swift uprising of Chihuahua by the Path of Progress. * * * I have never found brighter children nor anywhere pupils so alert as the thousands visited and talked with in this latest review of Mexico. * * * Such vivid faces, such swift upward hands, such impetuous speech, and right as trivet. * * * I would like to see the seven year olds of the ESCUELA Anexa de Ninos in Chihuahua, for instance spirit against any similar school of ours in the sum of mental arithmetic. Not only the schools in Chihuahua awaken, but everything else as well. Almost where the execution of Hidalgo "The Washington of Mexico" took place, today stands the State House of a Government which any State might be proud of. Almost everywhere the Spanish American female face in interesting. Photographs tell but half the story. Not even the Parisian face is so flexible in expression. To no woman on earth is religion more vital, ever present all pervading actuality and that is why you meet the face of the Madonna almost literally at every corner. * * * There is none in whom the wife-heart, the mother-heart is truer womanly. I wonder to find our philosophers so dumb about it, that even when outcast no woman of Spanish blood falls to the vileness which haunts the purtreus of any English speaking great city, thanks to her religion. Years of study have given me time to know and to respect her. * * *

For 300 years Mexico has been rich by not much else than mines. * * * But today though it is a conservative estimate that

not 10 per cent of the mineral wealth of Mexico HAS BEEN EXPLOITED. * * * Unlike enough to Chihuahua but still in the catagory of Mexican progress are the mining camps.

—"Awakening of a Nation." CHARLES F. LUMMIS. 1899.

LXXXVIII

"SWASTIKA," the earliest known symbol used by the prehistoric man was found on the vases and is being dug out of ancient mounds at Ohio and other parts of the Mississippi Valley and at Casas Grandes. * * * Proves beyond doubt that Egypt and Mexico have received their civilization from Atlantis.

—"THE LOST ATLANTIS." DONNELY.

LXXXIX

Today marks the greatest event in the social history of Ciudad Juaraz, Mrs. McKinley, wife of President William McKinley, Mrs. Hay and other ladies of the cabinet will come across to this city and dine at the residence of Don Inocente Ochoa; the menu will consist of the typical Mexican dishes. * * * Among other presents there will be some exquisite specimens of doilies of drawn work with the pictures of President McKinley and Diaz.

—Clarin del Norte. Cd. Juarez, May 5th, 1901.

XC

I beg you will convey my warm regards I have for President Diaz. * * * We are on the borderland between the United States and another great Republic. * * * So we are dwelling in peace and amity and we can sing: "Peace on earth and good will to men."

—WILLIAM McKINLEY. El Paso, Texas, June 5th, 1901.

XCI

The district of Jesus Maria, State of Chihuahua, is thoroughly mineralized and is pierced by veins more frequently than any other district I ever saw. The general formation is very similar to that of Cripple Creek with exception that it is not traversed by the great porphyry dikes. * * * The country formation is braccia. The ore is generally free milling. (Report of a noted Geologist).

—MATIAS ROMERO. (Mexican Ambassador). Notes on Mexico.

XCII

No mining center in Mexico gets more attention from American capitalists than the city of Chihuahua, the capital of the state of the same name. It is the first large city reached by the Mexican Central railroad, after leaving the international boundary line at El Paso. It is the first place where the traveler from the North gets a real glimpse of Mexican life, with its true refinement and pleasing simplicities. It is headquarters for many American mining men, who operate mines in different localities throughout the state, and the city is only fifteen miles from the famous mines of Santa Eulalia, which are the largest lead and silver producers in the world.

Chihuahua besides being on the main line of the Mexican Central railroad, has two railroad lines connecting the city with the Santa Eulalia mines, and also has the Chihuahua Pacific railroad extending west to the Sierra Madre, one hundred and fifty miles. The latter line is to be a part of the Kansas City, Mexico and Orient, which will connect Chihuahua with the western port of Topolobampo.

When the first railroad reached the city of Chihuahua, in 1882, the present governor, General Luis Terrazas, was then also governor of the state. He is, and was at that time, a progressive and broad-minded man. It was his difficult duty, which he most ably accomplished, to rid his state of the savage bands of Apache Indians, who made life and property unsafe in all the mountain sections. He put state troops in the field and constantly harrassed the Indians until Chihuahua suffered no more depredations. General Terrazas always welcomed Americans to his state and was friendly to them at all times, assisting them in every way in their business enterprises.

To this early established policy of this wise governor Chihuahua owes its quick mining development and the utilization of vast tracts of Chihuahua lands for stock raising purposes by many foreigners.

The mining camp of Santa Eulalia, at the very door of this capital city, is a larger producer today than at any time in its history of several hundred years. The ore bodies in the camp are of enormous dimensions, measuring in many places over a thousand feet in length by an average width of about three hundred feet and a depth of nine hundred or more feet. The product is lead carbonate ore containing silver and sometimes a little gold. This is the fluxing ore used by the El Paso smelters by the train load every day.

Reliable data on the agricultural, mining and industrial interests of the state will be cheerfully furnished by the Chamber of Commerce, Chihuahua city.

—THE CAPITAL CITY OF CHIHUAHUA, El Paso Daily Times. 1905.

XCII

James Dwrite Dana's Mineralogy.

Noted MINERALS DISCOVERED IN MEXICO and reference made about Chihuahua.

SILVER in Northern Mexico are noted mines affording native silver. * * * A Mexican speciman from Batopilas (CHIHUAHUA) weighed when obtained 400 pounds. Page 20.

Gold. * * * They (mines) occur at many points along the higher regions of the Rocky Mountains in MEXICO. Mexico produced 31 millions in the years 1790-1830. (Estimated by Humbolt) Page 18.

IRON. * * * Meteorites. Some of the masses are very large. The Butcher irons of the Bolsom Mapimi in the State of CHIHUAHUA and Coahuila, Mexico, include several masses, one estimated to weigh five (5) tons. Page 30.

AGUILARITE. Sulpho selenide of Silver from San Carlos mine Guanajuato, Mexico named after superintendent Sr. Aguilar.

BOLEITE. Discovered at Boleo, near Santa Rosalia, Lower California.

BUSTAMITE. (Manganese metasilicate, calciferous) M. Bustamente, Mexico.

BUSTAMENTITE. Hypothetical lead iodide. Not known to occur in nature.

BRONGNIARDITE. From Mexico. Alexander Brongniart. Sulphur 19.5, Antimony 2.2, Silver 26.2.

COSALITE. Sulphur 16.2, Bismuth 42.0, Lead 41.8. Casala, Sinaloa. An argentiferous variety occurs at CANDAMENA, CHIHUAHUA.

CRISTOBALITE. Pure silica. Cerro San Cristobal Pachuca.

CASTILLITE. (A massive mineral resembling Bornite) discovered by Castillo, at Gunacevi, Durango. S. Cu. Fe. Zn. Pb. # 5

COCCINITE. (Iiodure de Murcurio DEL RIO). In particles of a reddish brown color on selenide of mercury, adamantine in luster, Casas Viejas, Mexico and supposed by Del Rio to be iodide of mercury.

DURANGITE. Fluo arsenate of sodium and aluminum. Found at the Barranca tin mine, near Coneto, State of Durango.

DAUBREELITE. Sulphur, chromium, iron. M. Daubree, found at Coahuila, also at Toluca, Mexico.

GUADALCAZARITE. Found at Guadalcazar, Mexico. Castillo mentions rhombahedral forms.

GUANAJUATITE. Bismuth selenide. Sierra Santa Rosa, Santa Catalina, mine at Guanajuato.

JALAPAITE .Cuproferous aryentite. Jalapa, Mexico.

OPAL. Variety called feureopal. Humbolt. MEXICO, Queretero, etc.

ONAFRITE. Sulpho selenide of Mercury. San Onofre, Mexico. Del Rio early called the attention. He mentioned two ores at Culebra, Mexico.

TAPALPITE. (A del Castillo) San Antonio Mine District of San Rafael Sierra, Tapalpa, Jalisco.

SILAONITE. Shown by Fernandez and H. D. Burns to be a mixture of guanajuatite and native bismuth. "La Republica," Guanajuato.

VALENCIANITA. Valencia Mine, Mexico.

ZIMPANITE. From Zimpanite, Mexico. Credited to Del Rio.

XONOTLITE. It resembles a pink chalcedony and is closely associated to gyrolite. From Tetela de Xonotla, Mexico.

RAMOSITE. From Ramos, San Luis Potosi, Mexico.

TEQUEZQUITE. Corruption of Tequixquitl; a mineral formed of mixtures of different salts, especially sodium carbonate and sodium chloride from Texcoco, Zumpango, Valle de Mexico.

BARCENITE. Named after Mariano Barcena, a Mexican Mineralogist from Huitzuco, State of Guerrero.

TRYDIMITE. First observed in crevices and druses in an augiteandestyte from Cerro San Cristobal, near Pachuca, Mexico.

RAMIRITE. As after the Mining Engineer, Santiago Ramirez. At Zacatecas, Mexico.

VANADINITE. This Mineral was first DISCOVERED at ZIMAPEN IN MEXICO by ANDRES DEL RIO.

LIVINGSTONITE. Anal. Barcena. Occurs at Huitzuco, Guerrero, Mexico; also at Guadalcazar, San Luis Potosi.

MIMETITE. Pseudomorphis have been described by Genth and Rath from Mina del Diablo, Durango, Mexico.

NEPHRITE or Jade was brought in the form of carved ornaments from MEXICO and Peru soon after the discovery of America. Del Rio in his Mexican Mineralogy (1795) mentions no locality. It was found with the relics of the early man, thus in the remains of the lake dwellers of Switzerland at various points in France, in MEXICO, Greece, Egypt and Asia Minor. Prumpells remarks that "chalchihuitl" of the ancient Mexicans of which he has seen many specimens, is probably the same mineral.

P. Al H. Cu.

TURQUOIS. Occurs in Los Cerrilos Mountains, Santa Fe, N. M., a locality long mined by the MEXICANS. * * * W. P. Blake regards the bluish green turquoise of Los Cerrilos as the "chalchihuitl" of the Mexicans; he proposes the mineralogical name CHALCHUITE. (L. c. and ib. 25, 195. 1883).

MASSICOT. Is found in many places in the provinces of CHIHUAHUA and Coahuila. O. Pb.

EMBOLITE. Found at (Santa) EULALIA, CHIHUAHUA, MEXICO. Ag. (Cl. Br)

SELBITE. Del Rio describes a silver carbonate from Real Catorce, Mexico, where it is called "PLATA AZUL." (Gilb. Ann., 71, 11, 1822).

ENARGITE. Also found at CUSIHUIRIACHIC (Chihuahua), MEXICO. S. As. Sb. Cu. Fe. Ag.

POLYBASITE. Occurs in the mines of Guanajuato and GUADALUPE Y CALVO (CHIHUAHUA), MEXICO; also at Durango.

XCIII

Among all the countries of the world, Mexico is characteristic for the extension and height of the center tableland situated at an altitude of 2,500 meters above sea level * * * occupying over three fifths parts of the whole country * * * on these porphyric rocks from which industry can take copper, iron, silver and gold.

—A Drama in Mexico. JULES VERNE. Page 14.

We shall not speak of all of that land, for this same land is impregnated with gold and although we step on it, it is not a sign that we depreciate it. * * * Nature there is beautiful and seems to revive under the ardent rays of the sun.

Mexico is a magnificent city. * * * Who can count the different races that are to be found in this EL DORADO of MEXICO? On my return I shall take more time to study this beautiful Mexican country *where ships are stranded in reefs of gold and silver.* * * *

—Un Drama en Mexico. JULES VERNE. Page 16.

All THE NATIONS OF THE WORLD have given MEXICO as their trysting place; it is here that they come to enjoy the PRODUCTS OF THIS EL DORADO.

—THE FIRST MEXICAN SHIPS. Jules Verne. Page 57.

XCIV

The predecessors of the Aztecs, the Nahues, made their way across the STATE OF CHIHUAHUA where the great ruins of CASAS GRANDES are still to be seen from; thence through Sinaloa where they formed for the first time the image of the fierce "Huitzilopochli," God of War.

CLAVIGERO. Ancient History and Conquest of Mexico.

XCV

It is accepted that the Aztecs made their way across the State of CHIHUAHUA where the great ruins of CASAS GRANDES are to be seen. * * * A country made accessible, like MEXICO attracts the traveler from ALL PARTS OF THE WORLD. Some return to their country to praise, and some to draw deductions, but none can do otherwise than ADMIRE ITS WONDERFUL RESOURCES * * * he can turn his attention *to its vast, and even yet undeveloped resources, its wonderful mines.* * * * one and all are open to the man of enterprise and the man of capital. But it is not only the investor who comes to Mexico and is interested, but the man of science and the artist as well. Thus Mexico is a land of surprises.

—UNDER MEXICAN SKIES. Annie C. Galloway. 1904. Page 135.

XCVI

VISIT OF GEOLOGISTS.

Were Given Luncheon. Visited Mineral Exhibit.

Last Saturday there arrived in this city a special train over the Mexican Central railroad with about 95 of the delegates who had been attending the International Geological Congress in Mexico City. The distinguished scientists were given a luncheon here in the Salon Blanco of the Teatro de los Heroes and afterwards visited the state's Permanent Mineral Exhibit and then took a short ride about the city.

The party was met at the station by Sr. D. Martin Falomir, jefe politico, and a committee consisting of Carlos A. Nieto, Lic. Rafael I. Alvarez and Victor A. Cabrero, on the part of the city, and H. Nordwald, president of the Chamber of Commerce. Automobiles and carriages were there to take the guests to the Salon Blanco in the Teatro de los Heroes where they were received by acting Governor Jose Ma. Sanchez at a pretty luncheon prepared by Sr. D. Andres Garcia.

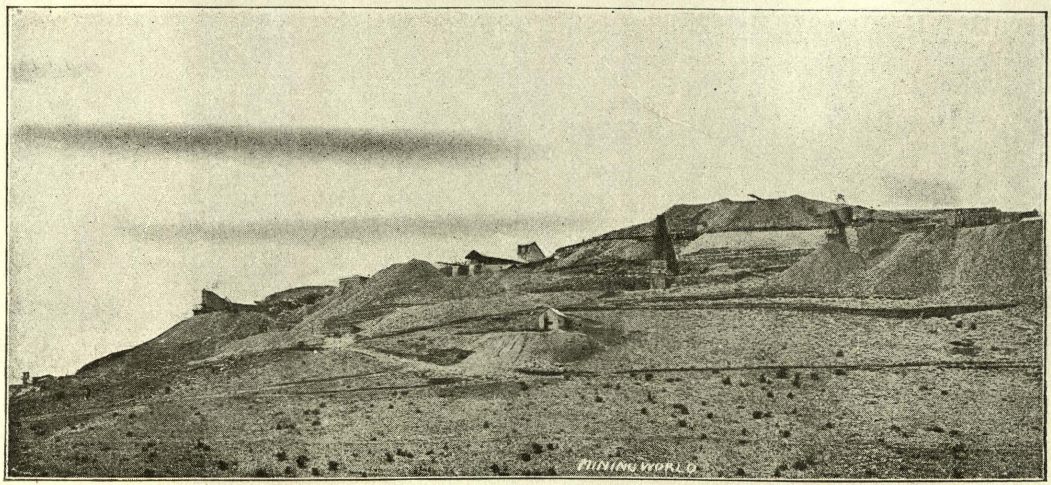
About 150 persons, including the guests, were seated at the luncheon which was presided over by the acting Governor. At his right was Gen. Jose Ma. de la Vega and the Belgian Minister to Mexico. On Sr. Sanchez's left sat Engineer Jose G. Aguilera, the newly elected president of the Geological Congress, and Lic. Carlos Munoz, president of the Supreme Court of the state.

The luncheon was a pretty and enjoyable affair and many expressions were heard among the guests in appreciation of the generous Mexican hospitality here and everywhere they had been over the republic. Numerous speeches were made by local men and by a number of the visitors, mostly in the French language. Among the speakers was the brilliant Mexican orator, Lic. Jesus Urueta, and Dr. Viramontes. During the function the 18th Battalion band played many of the national airs of the various countries represented by the various scientists.

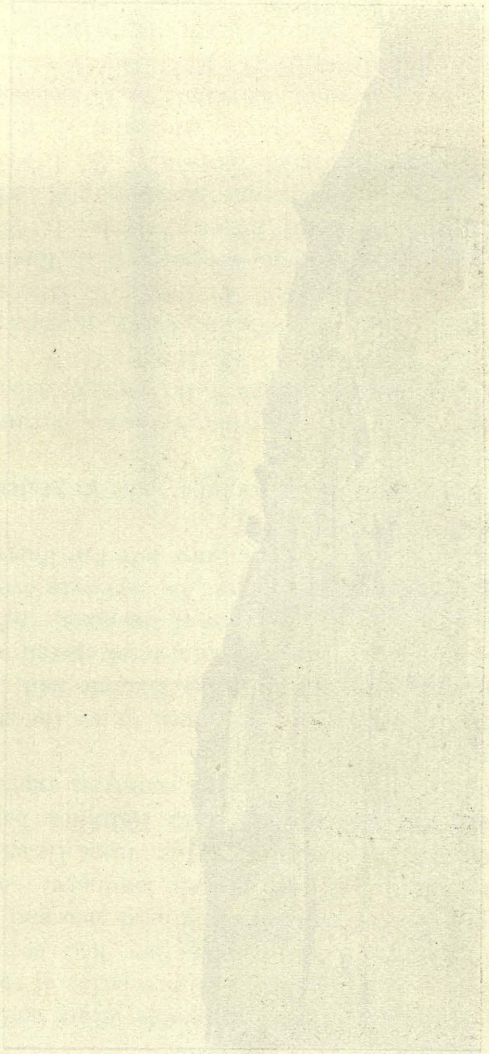
After the luncheon the guests were taken to see the state's Permanent Mining Exhibit. On entering the Exhibit hall, they were addressed by Victor Hector, of this city, in a brief speech which gave the strangers an idea of the vast resources of the state. After spending time here the party was taken around in carriages over the city and thence to their train. At 9 p. m. they left for Parral to visit that noted mining camp.

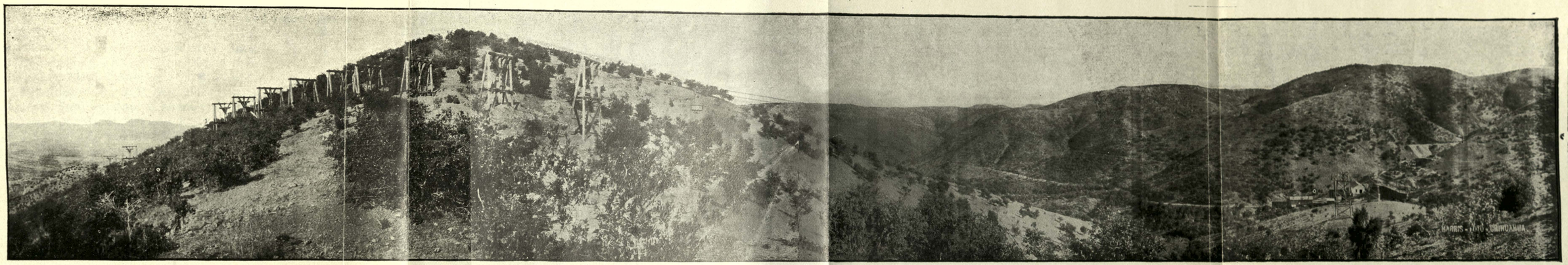
Following is a list of the delegates who came in yesterday from Mexico:

Celestino Pimental, Mexico; A. Drink, A. Osann, Germany; Tempest Anderson, England; Konrad Keilhack, B. Wigand, Alberto Plagemann, A. Dannenberg, Germany; C. O. Hovey, U. S.; C. Diener, Senora Diener, Wilhelm Hammer, Bela von Inkey, Austria; C. Berg, H. Credner, M. Vorwerg, Germany; F. V. Daner, C. Hlawatch, Austria; Gustav Zahn, George Silberstein, Germany; J. J. Reynoso, Mexico; A. Schmidt, Germany; Rudolf Zuber, Austria; L. Wolff, Germany; G. Stefanesan, Srta. Stefanesan, Roumania; H. Fischer, A. Schneck, Germany; J. J. Kemp, A. C. Lawson, U. S.; I. Friedlander, Italy; H. Sjogren, Sweden; J. W. David, Australia; J. R. Richards, F. L. Ransome, U. S.; H. Marshall, England; A. P. Coleman, U. S.; Carlos Graef, Mexico; L. K. Leith, U. S.; E. H. Dunikowski, Austria; Emil Philippi, Germany; T. Stanton, U. S.; E. Wittich, Germany; Hans von Staff, Germany; M. Alborge, England; George Becker, U. S.; Tsunenaka Iki, Japan; Leopold de Dordolot, Belgium; Florence Bascom, U. S.; W. Scipico, Hugo Erdmann, Germany; O. Wenstrom, Mexico; C. H. Cleland, E. F. Dumble, H. B. Kummel, U. S.; A.



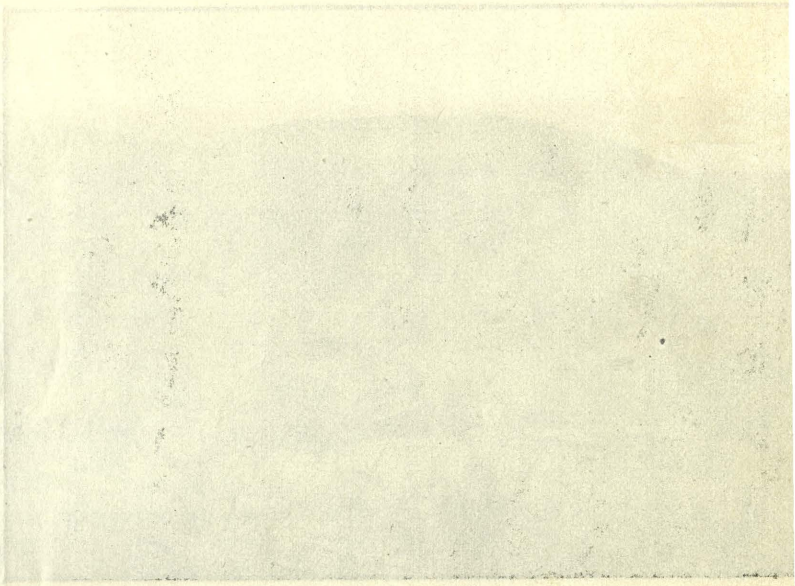
Palmilla Mine. Parral Owned by Pedro Alvarado.

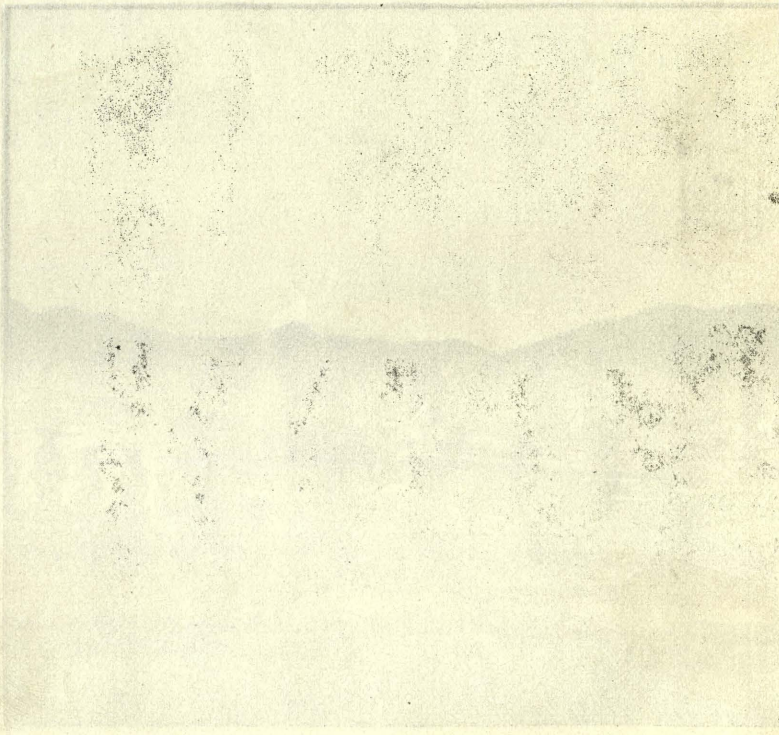




San Francisco del Oro, Hidalgo District.

Santa Bárbara, Hidalgo District.





Rothpletz, Fritz Freck, Germany; C. R. Arango, Luis Basave, Mexico; Bryant, U. S.; W. E. Miller, Canada; C. E. Cummings, U. S.; P. Didion, France; M. Villasenor, Mexico; C. Bergeat, Germany; W. Frendenberg, Germany; M. F. Cirat, Alex Anderson, C. C. Wanters, Mexico; Franz Stradal, Austria; J. M. S. Aldape, V. Gonzalez, Mexico; Ed Shepard, U. S.; A. P. Low, Canada; O. Archibald, U. S.; J. G. Aguilera, Srta. Aguilera, E. Ordonez; J. D. Villarello, Sr. Bose, Srta. Bose, C. Burkhardt, T. Flores, R. Robles, P. Ulaitz, F. de P. Carbajal, Dr. Garcia, L. Sargento, J. Garcia y Garcia, A Villafana, F. Martinez Baca, F. Rael V. von Vigier, Srta. Piedad Rosales, Mexico.

—CHIHUAHUA ENTERPRISE. Sept. 22, 1906.

XCVII

THE GEOLOGIST'S VISIT.

The International Geological Congress, consisting of 110 members from all parts of the world, which arrived here last Sunday morning at eight o'clock on two special trains, was met at the depot by Mayor Don Rodolfo Valles, several committees, the general public and a band. The ladies of the party numbering about sixteen, who did not care to go to the mines, were driven about the city in carriages and shown the several places of interest.

About thirty of the visitors went to Villa Escobedo (Minas Nuevas) in two of their own Pullmans, which Asst. Manager R. J. Long of the Parral and Durango R. R. kindly pulled for them with the new engine. They were accompanied by a committee to the Quebradillas Mine, which was inspected and praised highly for its equipment and excellent underground condition. This property is very warm in the lower levels and upon coming to the surface, the party was treated to a shower bath and a very sumptious lunch and many were the expressions of gratitude tendered Manager John W. Connor for the many courtesies shown them. The party returned to Parral in time to join the rest of the party in a grand banquet at the Salon de Patinar of two hundred covers, where three very pleasant hours were spent in eating, drinking and speech making. The welcome extended to them was received with round after round of applause and speeches of gratitude were given in many languages by members of the Congress. After the banquet those who had been to the mines in the morning were taken to the Foreign Club and Casino and shown a good time generally. Their trains left here at six o'clock in the evening for Parras, Coahuila, and tears were even seen in the eyes of some of the party when they pulled out of the station.

—PARRAL MINER. Parral, Sept. 24, 1906.

XCVIII

Synopsis of the Mines and Mining Camps in the State of Chihuahua in 1887.

DISTRICT ARTEAGA. Guazapares and Batosegachic (discovered in 1628) has eight veins, running N. and S. 10 feet in width and about ten miles in length. The Santa Clara Co. has a mine named "San Miguel" whose vein can be traced for 30 miles. Among the noted mines are "Union," "San Jose," "San Juan," "Dolores," "Patrocinio," "San Gregorio," "Santa Teresa," "San Luis," "Guadalupe," "Santa Clara," "San Andres," "La Soledad," "San Antonio," "Cinco Senores," "La Sociedad," "Sangre de Cristo," "Refugio," "Santa Rita," "Providencia,". * * * In the mineral district of Huarapa, "Animas," "Guadalupe," "Providencia;" in the Mineral District of Babarigame, "Dolores," "Santa Ana," "Trinidad," "Concepcion," "Durazno," "Hiedra," "Trinidad," "Refugio," "Erchuchi," "La Prieta," "Nuestra Senora de Monserrate," "del Zapote," "Batopilillas" y "Cieneguita."

ANDRES DEL RIO DISTRICT. (Batopilas, see article by same author).

MORELOS. Discovered 1826 by Juan N. Avila. Mines, "Cerro," "San Anastacio," "Cerro San Joaquin," (El Arroyo de las Halis) "San Pedro," "Alcantara," "San Antonio," "San Juan," "San Gil," "Rosario," "Refugio." This district produced in the years 1851-67 over a million dollars.

URIQUE. Discovered in 1630. ZAPURI. Discovered in 1873. Mines, "Aguila," "Chinaco," "Compromiso," "Descubridora," "Dolores," "Frontera," "Guadalupe," "Independencia," "San Martin," "Santo Nino," "San Rafael."

GUAJUGILLA (or Jimenez) and TUBARES (or Subares).

GUERRERO DISTRICT. Yapachic, Yoquivo and Dolores.

GALEANA DISTRICT. "Corralitos" and "Galeana."

HIDALGO DISTRICT. San Jose del Parral or Hidalgo del Parral. Discovered in 1675. This district has produced sixty millions. Mines are "Jesus Maria" on Cerro de la Cruz, "Filadelfia," "Batoguena," "Prieta Tarco." Nine miles away is the "Veta Grande." This district is second only to the Batopilas District. Santa Barbara; a report made in 1733 says the average worth per ton is 48.13 dollars. Noted mines are the Tecate and San Francisco del Oro.

ITURBIDE DISTRICT. Santa Eulalia produced in the years 1704 and 1833 344 millions. First group of mines are "Santo Do-

mingo," "Rosario," "Sta. Gertrudes," "Chiquite," "San Lasaro." Second Group; "Dolores," "La Vieja," "Aguedo," "San Jose," "Parcionera," "San Matias. Third Group; "Guadalupe," "Negrete," "Grande," "Negrita," "Chica," "Arragon," "Santa Rita," "San Francisco," "Prisima," "Carmen."

Magistral. OJINAGA. Sierra Rica Mountains (40 miles from Ojinaga). "San Carlos," "San Vicente," "Purisima," "Tutelas," "Aguila," "Sacramento,". Prof. J. R. Newberry considered these mines a gigantic proposition.

JIMENEZ DISTRICT. Huejoquilla.

JUAREZ DISTRICT. Santa Rosa de Cosihuiriachic had at one time ten thousand inhabitants. Produced in 1666 and 1778 35 millions. Total production about 80 millions. Mines in "Sierra de los Metales." San Miguel group; "Nuestra Senora de Candelaria," "Negrita," "Cerro Alto," "San Sartunino," "San Rafael," "San Jose del Profeso," "La Soledad," "Santa Marina," "San Antonio," "San Nicolasito," "San Nicolas," "Madrono," "Grande," "Bufa Grande," "Aguedo," "Rosario," "Soledad," "San Francisco," "San Luis Gonzaga."

MINA DISTRICT. Guadalupe y Calvo. In 1848 the mint at said place coined one and a third millions; one fourth being gold. An English company alone up to 1848 extracted from these mines 31 millions.

Real de MINORA. Mines, "Santa Eduvigues," "Rosario," "Animas," "Tacote," "San Pedro," "Juan de Dios," "San Jose," "Guadalupe," "San Francisco," "Dulces Nombres," "San Antonio," "San Pedro," "San Jose de las Piramides," "Santo Nino," "Patrocinio." REFUGIO, "Tenorita," "Higuera," "YEDRAS," "Charcos," "Cuerros." MILPILLAS, "San Juan de Cieneguilla," "Cuacogorinichic," "Minas Nuevas," "San Augustin," "Uriguillo," "San Juan Neponuceno," "Santa Cruz de Rosales," "Sierra Rica," "Ojinaga," "Babroigame," "San Juan de los Arrieros," "Nuestra Senora de Loreto," "Oro de TOPAGO."

RAYON DISTRICT. JESUS MARIA (now Ocampo). Discovered in 1810; "Senora del Rayo" discovered 1810; "Eduvigues," 1839. Mines, "Santa Juliana," "Rosario," "Belen," "Refugio," "Divina Providencia," "Candelaria," "Animas," "San Rafael," "Santa Margarita."

URUACHIC. "San Martin," "Bolas," "Nuevas," "CERROCAUQUE," "Sangre de Cristo."

PINOS ALTOS. "Santo Nino," *"Nabosagame," "Potrero,"*

"Rosario," "Maguarichic," "Batuchic," "Carmen," "Moris," "Remedios," "Cajurichic (in bonanza in 1750)*," "Candamena," "San Luis," "Pinal," "Quipore," "Maguarichic," "Septentrion."* (1829)
—HISTORIC MINES OF MEXICO. Charles B. Dahlgren. 1887.

XCIX

"In the Republic of Mexico the American people have more than a billion dollars invested."

"In each section of the country there were certain men of influence and power who had the habit of making revolutions whenever it suited their convenience. By wise and judicious management Diaz succeeded in controlling these revolutionary characters, and got them for the time being to give him their influence and assistance.

"He set them about developing the country by giving subventions putting more as it is needed to develop the country. It will pay them better than investment in any other business. Mexico holds out today greater inducements for American capital than does the United States.

"The mines of Mexico are the greatest producers in the world. No other country has yielded so much wealth from the earth, and the ground is scarcely scratched up to the present time.

"Above all stands the commanding figure of President Diaz, the maker of a nation, and the guarantor of peace and prosperity."
—General A. G. Greenwood. New York World.

C

"Gold and silver and lead and copper mines have given us an insight into the great mineral resources of your country, but through it all we have been waiting to see the coal and the iron, the two mighty minerals around which a country's industrial progress swings. We have now visited your great coalbeds and have begun to realize that Mexico is on the way to becoming a great commercial entity, with her arms reaching out to the ends of the earth, through iron and steel and coal."

—J. F. KEMP. Columbia University, New York.

CI

THE URIQUE RIVER AND THE BARRANCA DE TARARECUA.

Heading a little to the Northwest of the village of Norogachic, in the Southwestern portion of this State, the Urique river flows almost due West for some 35 miles; it then takes a sharp turn Southward to its junction with the Batopilas river and the two make the Fuerte,

which empties into the Gulf of California. Its total length is about 140 miles. From about 18 miles above the Barranca del Cobre mine, to the village of Guadalupe, the river is known as the "BARRANCA DE TRAECUA," and for grandeur, ruggedness and impassibility, equals the Grand Canyon of the Colorado, while being almost as deep. From about the village of Guasivori, to the Barranca del Cobre mine it is very narrow, dark and deep, with walls almost perpendicular and it is impassible for even the native Indians. In the winter time, the sun only shines into this part of the canyon for about two hours in the middle of the day and reaches only about half the way to the bottom. In several places, barometric readings, show a depth of a mile, from the mesas on top to the water in the river. There are trails across it at Barranca del Cobre, Machirichic, La Patria, Tohuerachic and the Chihuahua-Urique trail drops from the Churo mesa to the river's edge in Urique, almost 5,000 feet. As one goes down into the canyon, the vegetation changes in a very marked way, from the pines on top, to the oaks, then to the ash and similar woods, to where every tree and bush has a thorn or sticker on it and from sleeping under two pairs of blankets in the winter time on top, once at the bottom you find even a sheet burdensome.

The most accessable view, is obtained at a point on the Chihuahua-Urique trail, between "Los Ojitos" and "Arepondapochic" known as "Primera Vista," where the trail suddenly comes out of the timber, to within 50 feet of the edge of a vary grand, deep, lateral canyon, and the Real Canyon showing in the distance.

The Kansas City, Mexico and Oriente Railroad has surveyed its line so it will pass within a few yards of this precipice and will no doubt arrange that the sightseers have hotel accomodations, making this place very attractive to the tourists.

It would not be a very difficult problem to arrange a way to lower visitors to the bottom of this gorge, thus allowing them to do such exploring as they might desire.

The "Barranca de Tararecua" is more or less mineralized and its mines have been worked for many years and are in operation today.

The difficult transportation has been and also will remain a serious drawback to the development of the mineral riches. Ruins of the old furnaces built and operated by the early Jesuits are still to be found in many places, and many legends telling of the rich mines that were abandoned in the early part of the 19th century, when the general uprising occurred, are told by the Indians and others familiar with the section.

Patches of terraced land are cultivated by the Indians, who live on the top mesas during the summer and below in the winter. —SCHUYLER LAWRENCE, M. E. Chihuahua, Mex., Aug. 22 1906.

CII

MINES OF "JESUS MARIA." (OCAMPO.)

As you are personally acquainted with the mining district of "Jesus Maria," you will be able to give much valuable information on that head; and besides, I think that the mining region of the "Sierra Madre" is sufficiently famed to be known in the United States and in Europe. Yet what must strike persons not personally acquainted with Mexico most, and requires explanation, is the fact that there are so many good mines in an abandoned state, and that many of those that are known to be in inherent richness and steadily worked, do so seldom enrich their owners. You and I and many hundred others of foreign residents in this country, know the reason of this; but persons abroad can hardly imagine that in a country like this, famed for its mineral wealth, there should be so little theoretical and practical knowledge of mining, of labor-saving machinery, of practical application of scientific inventions; that, in short, everything be managed in pretty much the same style as a century ago. Want of enterprise, or of capital in enterprising men; want of mutual confidence and consideration; want of security in many localities on one hand, and an almost total want of industry and perseverance, of prudence, forethought, and economy on the other, are among the principal reasons important pursuit has fallen of late.

The many millions of gold and silver yearly exported from this republic attest the abundance and richness of the Mexican mines; yet this product, as you well know, is nothing to what they might produce under a different state of things. Almost all the old Spaniards who worked mines in this country after the discovery of its mineral wealth realized fortunes so rapidly and easily that their successors thought their fortunes assured by merely being the owners of mines, altogether forgetting that it was also indispensable to personally look after their business, and to practice economy and prudence. Their riotous mode of life, their laziness and negligence, no mine in the world was rich enough to sustain, and, consequently, when a "borasca" made its appearance, as it will in every mine once in a while, they not only found themselves without the means of indulging in further luxury and extravagance, but also without the necessary funds to pierce through the "poor ores" and dead rock in order

to strike the "rich ores" again. Credit under such circumstances they could not obtain—for who would trust a gambling spendthrift? Consequently they were obliged to sell or abandon mines that had produced millions. Their successors, no sooner did they strike a "Bonanza" than, either by inclination or seduced by others, they commenced to enjoy life in pretty much the same manner, which with very few exceptions, ended in like results. "Like master, like man," the overseers and servants finding the business left entirely in their own hands, soon began to think that a few pounds of ore every day, more or less, made no difference to their masters, and would never be missed; and being excellent judges of ore, they always selected the very richest for themselves—ore so rich that a few pounds of it often enabled them to imitate their masters gambling and carousing on a small scale. Yet this working of mines, and living in great profusion and pleasurable excitement, in hope of a speedy fortune, was too good to be monopolized by Mexicans alone.

The fame of the rich mines has spread to Europe, and induced men of capital to come out or to send representatives. The example of one foreigner, whose name it would be cruel to mention, will exemplify the case of many of his class who sunk fortunes in this manner. He had been sent out by a joint stock company to inspect the mines and veins of "Jesus Maria," and to invest a considerable capital in some of them, with a view of realizing fifty per cent per annum on it. Furnished with plenty of introductory letters, he no sooner made his appearance at this mining town than its *elite*, rejoiced to see a new face, overwhelmed him with profuse hospitalities, shortening the nights, and many days too, with excitement of gambling and all sorts of debauchery. Pleased and gratified by this warm reception in a strange land, he deemed himself in honor bound to show his appreciation by a return of similar hospitalities; and thus dinners, balls, picnics, shooting and fishing parties, with bands of music hired for the nonce at a couple of hundred dollars, and champagne at fifty dollars a basket, not to mention the other questionable inventions for killing time, was the order of the day for six months in succession. Being far removed from Europe, it took a long time to correspond; but at last answers arrived from home to letters which he had dispatched after his arrival (and which had been filled with glowing accounts of the wealth of the "Jesus Maria mines" and their owners), expressing the hope of soon hearing the result of his investments. Brought to his senses, and overcome with shame at having squandered nearly half of the capital intrusted to his care, he

bethought himself of some profitable investments, and of eschewing his riotous friends. Having purchased a good neglected mine, which required the construction of a drain-tunnel, and other expensive works, to be reopened, he went to work in earnest, and soon expended the remaining capital in the prosecution of these works without, however completing them. After he had duly notified his constituents at home that, in order to complete the commenced works and to work the mine, another large sum would have to be remitted to him, he was startled with the orders of the shareholders to abandon an enterprise that, from the large outlays already made without any tangible results and proofs, promised to be a most unprofitable investment. Disgusted, he left for parts unknown, a victim to the reckless life in Mexican mining towns, and since that time foreign capitalists have fought shy of Jesus Maria mining investments. Yet, had he strictly attended to his business, and invested the subscribed capital entirely in the enterprise, there is no doubt that good results would have crowned the undertaking.

It is but just to give another example attesting the richness of a "Jesus Maria" mine; that of Mr. Augustin Remuley, a poor French gentleman, who, in order to better his fortune, had been induced to accept the situation of administrador of the mine of Santa Juliana, with an annual salary of $480.00, his board and lodging, and three per cent of the net profits of the mine. He realized in one year $37,000.00 of his own, while the fortunate owners of this celebrated mine shortly after became bankrupt, with a deficit of nearly a million of dollars, likewise victims of extravagance and gambling.

It is to be wondered at that, under such a regime, the pursuit of mining should gradually have fallen into decay and general disrepute, and that this most important branch of industry should have been languishing of late years for want of capital, of credit, and of confidence in it, when the apathy and demoralization of the people have had the tendency to cause a general retrogression and gradual impoverishment of the whole country?

I have been thus prolix on this head, because I think it is necessary to the object in view to show the real causes of the disastrous results of mining investments in this country, and to disabuse the public mind abroad of the too often predisposed unfavorable opinion of the Mexican mines. It was but recently stated by Sir Roderick Murchison, the eminent president of the Royal Geographical Society, communicating to the R. G. Society the results of the travels of Mr. Charles Savin, F. R. G. S. (who accompanied by an

assayer and practical Cornish miner, had visited the Sierra Madre, in Sinaloa and Chihuahua), that, with British capital and perseverance and almost all the mines and veins of this part of the world would yield good returns, and the dividends that several foreign companies in this republic have of late been paying incontestably show that with proper management, investments in the mines of this country are not only safe, but also highly remunerative.

—Notes on the Mineralogy of Jesus Maria, etc. By A. W. C. Brawns, Esq. SYLVESTER MOWRY. "ARIZONA AND SONORA." 1864.

CIII

"I was aware that many of the statements in this and preceding books respecting the mineral riches of the north of NEW SPAIN years, the public, familiarized with facts, which are questioned only not so. They will be confirmed by every future report; and in after years, the public familiarized with facts, which are questioned only because they are new, will wonder at its present incredulity, and regret the loss of advantages which may always be within their reach."

—History of Mexico. H. D. WARD. 1827.

CIV

MEXICAN MEETING EXCURSION.

CHIHUAHUA.

The party arrived at Chihuahua on Nov. 5th, at about 6 p. m., several hours behind schedule time, by reason of the excessive weight of the two special trains, which are said to have been the heaviest that ever entered Mexico. Notwithstanding this serious interference with the plans of the Local Committee, its programme was carried out with energy, night being turned into day for this purpose. On arrival at the railway station, the party was immediately conveyed in carriages to the magnificent State Palace, where is was received by Governor Miguel Ahumada with an address of welcome in Spanish, to which President Olcott made an appropriate reply in the same language. The guests were then presented individually to the Governor. A large and excellent band, consisting of pupils of the School of Arts under 16 years of age, furnished appropriate music; and elegant refreshments were served in an adjoining room.

A large part of the night, after 9 p. m., was devoted to a brilliant ball, given in honor of the visitors, in the Theatro Heroes, a hand-

some building erected by the State. The array of Mexican beauty and fashion presented on this occasion added greatly to the splendor of the scene, and, together with the interesting novelty of Mexican dishes served at the midnight supper, constituted a characteristic and impressive introduction to the hospitality of the Republic and its citizens.

Wednesday, November 6th was occupied with visits to points of interest in and about the city, conducted by English-speaking guides.

Coaches were provided by the Local Committee for the use of the visitors on all occasions.

Special trains were provided by Messrs. C. S. Sheldon and A. S. Dash, managers, respectively, of the Chihuahua and Pacific and the Chihuahua Mineral railway to Santa Eulalia, to run to Minaca and Santa Eulalia.

During the evening, the band of the School of Arts gave a promenade concert on the main plaza, which was elaborately decorated with flags and bunting, while the facade and spires of the Cathedral were brightly outlined and illuminated with innumerable twinkling lights. The smaller plaza in front of the Governor's palace was also illuminated, and the festive scene was full of picturesque and fascinating variety.

The adjectives of praise, admiration and thanks will necessarily be employed again in this narrative; but they will not have been in any later instance more thoroughly deserved than in Mexico. The lavish and thorough preparations and the unwearied courtesy of Governor Ahumada and the Local Committee; the cordial co-operation of the citizens and ladies of Chihuahua; the interesting features and typical spectacles presented by the city, and the great historic, present and future importance of this State as a mining field, combined to establish Chihuahua in the memory of its visitors beyond the danger of eclipse by any subsequent experience, however splendid.

From the pamphlet guide and program furnished by the Local Committee, the following particulars have been condensed as worthy of preservation:

Chihuahua, a city of 35,000 inhabitants, and the capital city of the largest state of Mexico, was founded early in the seventeenth century by the Spaniards, who worked the rich mines of the surrounding hills. Some of these are still productive.

Those of Santa Eulalia District, 15 miles east of the city, have been in operation for 300 years, and are estimated to have produced silver and lead to the value of nearly $2,000,000,000.00. The present

output is more than 3,000 tons of ore daily, running from 30 per cent of lead and 40 oz. of silver per ton to still higher values.

Chihuahua ranks first among the States of the Republic as a mining region. The present product of gold and silver bullion alone (not including ores shipped to smelters for treatment) exceeds $800,000.00 monthly, of which $250,000.00 is exported to the United States and England. The chief producers of silver bullion are the Batopilas Company ($180,000.00 per month); J. J. Watterson, Ocampo ($50,000.00); El Concheno ($26,000.00); Pinos Altos ($42,000.00); Santa Eduviges ($38,000.00); Belen Co. ($25,000.00); and El Refugio Co. ($24,000.00). Among the few properties in this State which produced gold exclusively are La Gloria and Cerro Colorado, near Batopilas (reported to produce, together, $44,000.00 per month); the Guazapares mines (which have yielded in the past an enormous amount of ore, and have been purchased lately by a strong American company, with a view to exhaustive developments) and the Placer of Santa Domingo (likewise recently purchased by a foreign syndicate, which is now expending more than $500,000.00 gold in new machinery and plant). The largest known Mexican gold nuggets have been found in the last named district.

The principal mining camps of the state are Santa Eulalia, Parral, Jesus Maria, Batopilas, Guadalupe y Calvo, El Concheno, Pinos Altos, Santa Barbara, Cusihuiriachic, Magistral, Dolores, Guazapares, Morelos, Urique, La Descubridora and Corralitos. The largest copper mines are at Magistral and Gaynopita.

The construction of the proposed Kansas City, Mexico and Orient railroad is expected to increase greatly the productiveness of many districts.

For all these mining regions the City of Chihuahua is the distributing center, and their progressive prosperity will increase its importance. Fortunately, under the able administration of Governor Ahumada (who is now serving his third term), and who constructed the public school system, water works, sewers, macadamized streets and State Theatre.

The city contains a number of important industrial establishments, including the large La Paz textile mill, a fine brewery, a very extensive meat packing and canning factory (with capactiy to handle 300 head of cattle per day); and, most interesting of all to members of the Institute, the iron and steel works of La Compania Industrial Mexicana, of which the following account is taken from the Iron Age of Nov. 21, 1904:

COMPANIA INDUSTRIAL MEXICANA.

"La Compania Industrial Mexicana is under the management of Juan A. Creel, an exceedingly progressive and alert Mexican, a native of Chihuahua, who, with his brother, Enrique C. Creel, is identified with the different industries and with extensive mining enterprises. Mr. Creel, who was partly educated in the United States, began his career in a local bank, and has now, at the age of 35, reached the point where he can work out his patriotic desire of devoting his abundant energies to the uplifting, from an economic point of view, of his countrymen and to the development of the extensive, though still largely dormant, resources of the state. Mr. Creel took hold of the Compania Industrial Mexicana in 1893, when the plant consisted of a small foundry and machine shop. Under his management is has prospered and grown, and is still expanding rapidly. A most interesting feature of much significance which has taken place simultaneously with this development is the education of native labor to the rank of skilled artisans. They have taken their places as molders, pattern-makers, machinists, rollers and melters, callings unknown to them until now. They are paid the same wages as those earned by the American mechanics, the machinists receiving $3 to $5 per day, Mexican money, while the pattern-makers earn as high as $6, Mexican, per day; wages which, in gold, are about on a par with those paid in the United States.

"The plant consists of a 15-ton Wellman tilting basis open-hearth furnace, equipped with a Wellman charging machine, the steel being cast into groups of small ingots on car, bottom-casting having been adopted. The two bottom runners are of such dimensions that after the spreus are cut off a 4-inch billet is produced, which can be rolled into shapes for which an absolutely perfect surface is not necessary. The pig-iron is purchased in the United States, but the works use largely old car wheels, and, of course, depend upon the country for the wrought scrap. Purchased muck-bars are the raw material for such iron bars as are rolled.

"The rolling mill, which is equipped with a modern heating furnace, has a 12-inch and an 8-inch train, and produces bars down to 1-8 inch rounds. It is driven by two engines, both of which were built in the works.

"There is a large foundry and a good sized machine shop, crowded with American tools, although a number of the tools were made in the shop. The company make a specialty of mining machinery, stamp mills, slag and metal ports, etc., and build Corliss engines up to 1,000

horse-power. In the shops, in course of erection at the time of the visit of the engineers, was a 1,000 horse-power horizontal Corliss compound engine for an electric plant. The foundry makes also miscellaneous castings, and quite recently the manufacture of stoves has been taken up. There is a brass foundry and a special department for the manufacture of valves, this being the only plant of its kind in Mexico. All the parts of the plant outside of the rolling mill are driven by electric motors, the engine being a product of the shops. There is now in course of erection a new electric plant, housed in a building the structural work of which was furnished by the American Bridge Company. It is large enough for an equipment of 10,000 horse-power. The present electric installation is supplying the town with light, but has reached its limit of capacity in that direction. The fuel used for the boilers is wood and coal, the latter costing $12 per ton for Mexican and $18 for American coal. The plans are being drawn for a very large new machine shop, the old one having outgrown its quarters.

"Friends of Mr. Creel relate a recent experience which illustrates both his enterprise and the difference between foreign and native management. At a short distance from Chihuahua is a copper mining property which has passed through the hands of several English companies, the last having spent about $1,000,000.00. As an indication of the character of the work done, the fact may be cited that the slags made by the smelter ran 2 per cent of copper. The property, being regarded as a complete failure, was hawked about in vain. Mr. Creel finally purchased mines and smelter for $25,000, Mexican money. He put in new machinery at the smelter and made improvements which cost in all $29,000.00, Mexican currency. In 14 months the entire outlay had been recovered, and the company, known as the Rio Tinto Mexicano, is earning handsomely."

—Transactions American Institute Mining Engineers.

CV

PARRAL.

Delegations from the Local Committee boarded the two sections of the excursion trains en route, early in the morning of Thursday, November 7th, and many miles away from their stopping place. Reaching Parral at 11 a. m., the party was met by the remainder of the Committee, with a brass band, at the railway station. After an address of welcome from Mayor Sr. Don Tito Arriola, they were divided into three parties, one of which, under the guidance of Mr.

Edward Dufoure, the American Superintendent of the Montezuma Lead Co., visited the Santa Barbara district (15 miles from Parral, on a branch of the Mexican Central railway), another was conveyed over the Parral and Durango narrow gauge railway to Minas Nuevas; and the third inspected the mills and other points of interest in and around the town itself.

At 4 p. m. the three parties were reunited and conducted, through a vast crowd of peons in the picturesque costume, to the Bodega, a large warehouse, which had been emptied, re-plastered, kalsomined and decorated in their honor, to partake of an elegant banquet, for the several courses of which sundry distant localities had been drawn upon. Oysters came from Corpus Christi, fish from Tampico, on the coast of the Gulf of Mexico, and strawberries from Irapuato. On entering the spacious hall thus extemporized, the guests were showered with confetti by the ladies of the city, while the band played "The Star Spangled Banner."

Here as in many other places in Mexico where the representatives of the Institute were entertained, the portraits of Hidalgo, Juarez and Diaz, who occupy in the history of the republic places of honor and esteem corresponding to those of Washington, Lincoln and McKinley in the United States, were prominent among the festal decorations. This fact was gracefully utilized by Sr. D. Felipe Arellano, member of the National Mexican Congress, who, as the appointed representative of the municipal authorities and the Local Committee, offered at the close of the banquet, and in the English language the toast.

A suitable response to this eloquent address was made by President Olcott; and the remainder of the day, together with the early evening, was spent in informal social entertainments, including a visit to the Casino, where a ball was in progress. At 9 p. m. the special trains left Parral.

The "historical book" mentioned in the address above quoted was a beautifully illustrated souvenir, entitled Hidalgo del Parral, a Mining District Abounding in Mineral Wealth, Indian Legends and Interesting Superstitions, from which the following account has been condensed, with the insertion of some additional remarks from other sources:

The exact date of the first discovery of ore in Parral cannot be fixed. That is was before 1652 is proved by a report of that date by the Alcalde, Capt. A. Guerra, which mentions 29 mines as working in what was evidently the mine now called *Jesus Maria,* and 14 in

the "*Negrita,*" evidently the present "*Tajo.*" The town record of mines and denouncements (locations) for 1632 shows great activity in mining at that period. All the municipal records earlier than 1612 are lost; but it is known that the town was established considerably before that date.

Prior to 1634 the mines were worked for gold only; but in that year Gov. Don Gonzalo Gomez de Cervantez reported to the Marquis of Sinaloa that ores had been discovered carrying 12 oz. of silver per 100 lbs., and that some of these could be successfully amalgamated, while others must be melted. The records of 1634 show 4 amalgamating works and 20 smelters in operation.

In the Parral Assay Office, the record from 1641 to 1647 shows 569,741 marcos (or 4,557,741 oz.) of silver; and it may be inferred that after a few years of decline, between 1634 to 1641, there was a considerable revival of the industry. From 1649 to 1688, however, the registry of only 313,472 marcos (2,507,776 oz.) of silver indicates another decline. Such fluctuations are doubtless due to the fact that, with the crude early methods of mining and reduction, only very rich ores could be mined with profit, so that the condition of the industry depended from year to year upon the opposing factors of the exhaustion of old *bonanza* and the discovery of new ones, rather than upon the systematic and continuous working of the same mines.

The old records from 1688 to 1718 were destroyed by the French during their intervention in Mexico, a century and a half later; and only a few facts can be gleaned from the remaining documents.

It may be inferred from the records that from 1718 to 1820 the immediate vicinity of Parral maintained a considerable output, mostly or wholly from shallow workings. The later records of this period frequently refer to Parral as containing ores of low grade but boundless quantity. What was meant by "low grades" at that time seems to be indicated by the statement (in a petition for the establishment of suitable reduction works) that the ores contained only 12 oz. of silver per carga of 300 lbs, or, say, 80 oz. per ton!

It is hoped that a full account of the ore deposits and mining industry of this district prepared by a competent hand will be published hereafter in the Transactions of the Institute. Meanwhile, the following scanty notes are reproduced from the little book of the Local Committee.

Parral is located in the foot-hills of the Sierra Madre, the main range of which forms an imposing background to the series of successive elevations which ascend, step-like, from Jimenez, on the great

Mexican plateau. From this place a branch of the Mexican Central railroad runs to, and about 60 miles beyond, Parral. With the completion of this branch to Parral, about three years ago, the present revived activity in mining began. Previously, ores were hauled by wagon to Jimenez, and shipped thence to Socorro,N. M., El Paso, Texas, or Mapimi, Mexico, for treatment.

In the immediate vicinity of Parral the general rock is "porphyry," which contains strong and well defined veins, carrying siliceous silver ores low in lead. Large bodies of low grade ore, formerly not profitable, will now be mined by economical modern methods and machinery, and concentrated or reduced in the district. It is reported that the mills completed during the last two years, or now under construction, have a capacity of 1,200 tons of ore daily.

SANTA BARBARA.

This place, 10 m. S. W. of Parral, in the most important part of the general Parral district, is the oldest camp in northern Mexico. It was founded in 1547 by Spanish explorers, who are reported to have opened ten gold mines, producing from 12 to 14 oz. of gold per carga of 300 lbs. (12 arrobas of 25 lbs.) supplying 700 *arrastras*, and supporting a population of 7,000. In 1580 Santa Barbara was the seat of the Spanish Viceroy, who ruled over what is now the western and southwestern part of the United States, as well as the northern part of Mexico.

Early in the 17th century the prosperity of Santa Barbara seems to have been interrupted by a general "stampede" of miners to the new district of San Diego de Minas Nuevas—now simply Minas Nuevas—of which mention is made below. The official records have little to say of the older camp for some two hundred years. It is noted that early in the nineteenth century foreign capital was invested, especially in the Mina del Agua, which was sunk 60 feet below the water level, and then abandoned. (In 1892 this mine was reopened by a foreign company, which realized from it in a few months, and with small outlay, a net profit of more than $80,000). There are also allusions to extensive gambocino (gopher) workings on all of the large veins, which proved, as usual, profitable to the operators, but ruinous to the mines and the camp.

The general country-rock at Santa Barbara is slate and shale, traversed by N.-S. veins, dipping 45 degrees E. Of these the Tecolotes and the Mina del Agua can be traced for 3 or 4 miles over the moun-

tains. Pockets of very rich gold ore were found near the surface, but below the oxidized zone the grade was much lower, though the quantity of ore is large and regular.

MINAS NUEVAS.

The origin of this camp was later than that of Santa Barbara, doubtless considerably earlier than 1645, which is, however, the first date of mining location now accessible in the books at Parral. In 1657 there were fourteen competing ore buyers in the camp—a proof of considerable production at that time. The first mine in the district is said to have been the Veta Grande, located on the Veta Colorada, which is the strongest vein in the district, and perhaps, in Mexico. Its outcrop is plainly traceable for ten miles over the mountains, and averages, so far as it has been developed, 500 feet in width. The deepest mine in this vein is the Veta Grande, the incline of which has reached the depth of 1,250 feet (about 1,000 feet vertically) and shows at the bottom a vein from 15 to 18 feet wide, assaying from 40 to 50 oz. gold per ton. Other old and new mines on the vein are the San Francisco de la Merena (700 feet); Nopal (700 feet); Preseña and Alfarena (900 feet); Biscayana about (600 feet); Pachuquena (700 feet); and the Quebradillas, the south end of which has been worked to the depth of 550 feet, while the north end, opened within the last 10 years and now in bonanza, is 725 feet deep. (The figures above given all signify inclined depth, unless otherwise specified).

The ores from this vein, are red with iron oxide—whence the name *Veta Colorada.*

—Transactions American Institute of Mining Engineers.

CVI

When he left Mexico (Baron Alexander Von Humbolt) I gave him a copy of my experiments written in French so he might publish same when he arrived in Europe if he saw them fit. * * *

The article I am sure would have caused wonder and the scientists and chemists would not have waited 30 years to hear of the discovery of the new metal, Vanadium. (He refers to what was known as yellow cromate of lead; but after close study at the lead mines of Zimpan he discovered an entirely new metal.)

—Elementos de Orictognosia. 1832. Andres del Rio.

CVII

In the mines of Batopilas pieces of pure silver 400 pounds in weight were found on several occasions.

—Quotation from Humbolt. In Prescott.

CVIII

The State of Chihuahua is equal in area to the states of Maine and Colorado. * * * The mines are divided in three classes. First.—Veins that are found in porphyry with felspar and with quartz matrix, as Parral, Ocampo, Guadalupe y Calvo, Cusihuiriachic. Second.—Those that contain Alpine limestone, such as Santa Eulalia, Urique (these resemble Leadville, Colo. and Eureka, Nevada). Third.—Those in which clorides are found over water level, bromides, ambolite below water and farther down sulphides and native silver, as Baptopilas, Cueros, Tubares, Morelos.

There are actually 10 principal or historic mining camps, but there are many that will become of first order with the help of railroads, etc. and modern methods and with the aid of American capital that are actually finding employment in Chihuahua.

—Charles B. Dahlgren. Historic Mines of Mexico.

CIX

At six o'clock one bright morning in November, we moved out of the Alameda of the city of Chihuahua. Our party consisted of five Americans and six Mexicans, "mozos," or servants. It being the intention to cross to the far side of the mountains and examine certain mines abandoned because, in military phrase, "they were within the lines of the Apaches"—a work likely to occupy four days at least—we went well armed with rifles and revolvers. Besides their ordinary service, two ambulances held our bedding, provisions, and wine. The clatter of hoofs and the rattle of wheels over the stony streets did not fail to draw the population to the doors.

"EL REAL DE SANTA EULALIA," whither we were immediately bound, is the town of the district, distant from the city of Chihuahua thirteen miles. Of the two roads thither, one is by the "Junta and Tabaolopa," the other past the "Sierra Grande." Our conductors chose the latter, although the first is the most interesting. I call it the most interesting because there are those yet living who remember the day when it was lined with houses and dotted with "*fundiciones*" to a point far down the river. They speak in melancholy tones of the business that used to pass over it; of the coming

and going of long trains of *"burros"* laden with sacks of ore; of the shouting of drivers; of the column of dust, which, like a yellow curtain, stretched perpetually across the valley from mountain to mountain; for it was the road established by the Spanirds in the glorious day of Santa Eulalia, when thousands of men found occupation in her "pockets," when the annual profits of the various owners summed up millions, when the Real de Santa Eulaia was a city of seven thousand souls, and Chihuahua, with her far-reaching suburbs, a mighty metropolis of seventy thousand. At the mention of such greatness strangers are generally astonished; looking over the capital as she now appears, her population reduced to fifteen thousand, and with not so much as a chimney of a furnace left standing to speak of mining operations present or past, he very naturally concludes the pleasant picture to be a baseless tradition. The ancient inhabitants solemnly repeat the history, and silence doubt by adding with equal gravity: "Not only was it all so, but it will be so again. Santa Eulalia is not exhausted. San Jose is only the initiative of operations yet to be. A man will come along some time with brains enough to appreciate the old mother-mountain, and with capital; and then you will see."

Our road by the Sierra Grande was not without evidence of the glories to which I have alluded. Off to our right runs the aqueduct which at present supplies the city with water. If a visitor will ride out to its point of connection with the river, he will be amazed at the extent of the structure. I is of stone, several miles in length, and built massively and for all time; and when, at one place, the stranger stands in its shadow, and follows the lines and curves of the great piers and arches by which it leaps across the bed of a broad *arroyo,* the engineers and masons engaged in its construction are certain of their meed of admiration. But how will the wonder grow when he is told that this aqueduct was not built by the city for its present use; that, on the conrary, it originated with the master-miners of Santa Eulalia, and was intended to be continued, in the same enduring style, so as to conduct water for mining purposes across the valley thirteen miles further! The mint of Chihuahua is full of statistics showing the wealth taken out and the wealth yet in the district. As evidence they are convincing; a shrewd inquirer, however, will rather address himself to the proofs left by practical experimentalists—proofs not made for the purpose, and therefore the more reliable. Of this class is the unfinished work I am mentioning. Reports, figures, tables, ruined haciendas, and hills of "slag" enlighten one as to what used to be done at Santa Eulalia; but the

aqueduct serves better, perhaps, to assure us of the confidence of the old Spanish proprietors in the inexhaustibility of that wonderful deposit.

Having passed the Sierra Grande, the descent through the pass is gradual and by a smooth road. The double spires of the cathedral slowly disappear from view behind us, and away to our front stretches a valley ten miles wide and fifty long, in which a railroad can be built to run in any direction almost without a fill or excavation. A glance to the Northeast shows how easily and cheaply the river can be made to irrigate the whole plain—naturally so fertile that with half cultivation it could subsist a population equal to that of New York or Paris. A this time it was a wide pasture, dotted wih grazing herds of cattle, horses and sheep. Beyond the valley lies a range of high mountains, veiled beautifully with a purple atmosphere. The compass says the direction of the range is Northeast and Southwest. Near its centre, and opposite the point from which our first view of it is obtained, rises the object of our visitation, the Silver Mountains of Santa Eulalia.

And now, as we bowl merrily along the first-rate road, our horses on the "lope," the gait so affected by the Mexicans, let us listen to what one of the M———'s relates of the history of Santa Eulalia.

"Like most visitors," he said, "you no doubt have the idea that Santa Eulalia is a mine which can be 'done' in a day, leaving plenty of time to eat, drink, and *siesta*. You will find that a mistake. In the first place, it is a *district*, as indicated by the Spanish *Real*. The district embraces an area of five leagues square. The number of mines it contains is unknown. I doubt if there is anywhere a record of them. It is safe to say, however, that there are a good many more of them than you will care to ride to.

"When the French were in Chihuahua, a short time ago, there was a scientific gentleman deputed to accompany the expeditions, make reconnoaissances of this district, and report. I accompanied him. When his force returned to Durango he went with it.

"After a thorough examination of the district, including explorations of the interior of most of the mines, he expressed the opinion that Santa Eulalia consisted of silver strata in the nature of vast deposits of ore, not so rich as abundant and inexhaustible; that the oblong mountain in which we will find the San Jose, Parcionera, Negrita, and Santa Rita mines was a kind of mother-mountain, or silver core, from which the metal radiated in all directions, growing less rich according to its distance from the centre; that five thousand

men might dig and pick and blast away at it for a hundred years, and at the end of that time the yield would be as rich, if not richer, than when they began; and that, if it were possible for an able and wealthy management to concentrate all the mines of the mother-mountain under its single control, there would be treasure enough taken out every year to pay the cost of the work and the cost of the French army in Mexico.

"The discovery of the silver was romantic. As the story runs, in the year 1700, or thereabouts, three fugitives from justice, hunted out of the 'haciendas' around Chihuahua, itself nothing better then than a lively Catholic mission, took refuge in the fastnesses of what is known as Santa Eulalia. Shifting from mountain to mountain, they took up quarters finally in a tremendous ravine, in which there was a natural 'tanque' of water, and where they could remain, with prudent conduct perfectly safe. One day the Senor Padre in the city, through a friendly Indian, received a message from the outlaws to the effect that if he would absolve them and obtain their pardon from the offended authorities they would put him in the way of getting enough silver to build the grandest cathedral in New Spain. The offer was accepted. They were absolved and pardoned. The mines were opened. Their fame went rapidly through the country. Miners flocked from all parts of Chihuahua. Traders followed, of course. The mission became a city of seventy thousand inhabitants—a growth and prosperity attributable to Santa Eulalia alone.

"As to the yield of the mines, it is impossible to determine the amount with even approximate certainty. The proprietors used to keep accounts based upon the product of their furnaces, but they are out of reach now. It is true that besides the record of operations in the mint there are, or used to be, in its archives whole volumes of reports, public and private, many of which were conscientiously made. The mint is probably the best place of reference on this point; there you can, at least, obtain the total of the coinage from the year of its establishment—a great part of which, you may be sure, came from Santa Eulalia. According to the received opinion, at least one-third of the raw silver extracted and turned into bars for commercial convenience never reached the mint, but is exported in a thousand ways and forms—some lawful, others unlawful. Avoiding positive statements, the yield from Santa Eulalia has been incredible.

"Suggested, it may have been, by the propositions of the fugitive discoverers, the Cathedral in the city really owes its existence to Santa Eulalia. It cost about a million of dollars, and was paid for

by contributions at the rate of a *real* (12 1-2 cents) for every mark ($8) of silver extracted from the mines, or 0.015 per cent of the production.''

In such style was the gallop across the valley made pleasant. Almost before we were aware of it we came to EL REAL DE SANTA EULALIA.

Tucked away, as it were, between great mountains, this *pueblito* has a truly strange appearance. So quaint, so irregular, so *outre*, so unlike anything of the kind in the United States, it must be seen to be appreciated. A pencil cannot begin do it justice. It is made up of houses and haciendas, adobe and to the uniform one story, with flat roofs. Relatively to each other, in defiance of order, the whole collection of structures seem to have been shaken out from the nearest summit. The ''haciendas''—places in which the ore from the mines are smelted—are low but spacious, and surmounted with from one to three conical, smoke-blackened furnace chimneys.

''When we inspect the haciendas tomorrow you can make a calculation of the number of square yards each black hill, or slag-dump contains. In that way you can get an idea of the work done here in the hundred and fifty years past. And what is most singular, the 'slag' can be resmelted with profit. The experiment has been tried, with good result, in Chihuahua.''

An *arroyo*, now dry, winds at will through the town, doing service in many places as a street. Descending into its bed, we pass through a defile or canyon but little wider than an ordinary alley, and find ourselves in the ''city limits.'' A little further on we come to men working silver placers.

I hardly know whether we are warranted in using that term. In time the lumps of ''slag'' crumble and rot, and give up globules and chunks of the mixed silver and lead which the imperfect processes in vogue have failed to extract, and which settling in the sand, are found by digging eight or ten feet down to the bed of the rock. They call this ''silver-washing.''

A great part of the inhabitants of the town live by it; and they say it is good enough for the present, and will do until the mines are worked regularly as they used to be. They take out from three to six dollars a day, according to their industry and skill. Unfortunately for the poor people, the owners of the furnaces make most of the profit.

As this was the first time we had ever heard of ''washing for silver,'' our curiosity was so greatly moved that we stopped to in-

vestigate the *modus operandi* of the novelty. Nothing could be simpler. The operator provides himself with a crow-bar, a shovel, and a cow skin. This latter he fashions into a water-tight basin by stretching it upon a square frame. Filling it with water, he stands over it, rocking a little tub containing sand and grit, from which washed free of clay and earth, he separates the worthless pebbles and selects the valuable particles.

At the end of the day the workman puts his pile of metal into a bag and takes it to the nearest hacienda. It is weighed, paid for, and the proceeds lost, after dark, in gambling.

The vale was still in mountain shadow next morning when our mules and horses were brought to the door. We bolted the coffee, strapped on revolvers, and climbed into our saddles. The guide put himself at our head, and off we started.

Our road tended in the first place, to the mine of San Domingo, over a league distant—a league and more of continual ascent! The air of the November morning was crisp even in the town; but as we went up, step by step, it grew crisper; under its influence I was conscious of a rising spirit, and of a freshening of the flow of blood in my veins.

On the further side of the first summit we met a "peon" conducting half a dozen "*burros*" laden with raw ore from the mines. They were en route for the haciendas below. As the path was narrow and rough, we reined in close to the innr side and made room for the patient pack-bearers. They passed us in single file, stepping carefully, their noses close to the dust, and their ears thrown well forward. Evidently the universal "first law" had them in complete subjection. They never deigned to notice us.

The packing arrangement was simple. It consisted of a bag well stuffed with maguey fibres, and girthed stoutly next to the back; on that, lashed by ropes, was mounted the cargo, in stout leathern sacks, swung in saddle-bag style, and balanced to an ounce. I watched the old-fashioned train, thinking of the millions which had thus gone to swell the currencies of the world.

Higher and higher. A short way ahead is the second summit, and it seems that we are to go over it also. But no; our path breaks off suddenly to the left, bringing us to a precipice to which I can see no bottom. The guide does not hesitate; he goes square at it, like a huntsman at a ditch; with his head clean over the abyss, his mule steps cautiously down, twists its body to the right, and moves on unconcernedly. The new path at this point does not exceed a yard in

width. From wider terraces than it better riders have been tossed to death.

That "*burros*" pack each three hundred pounds of metal along such a mountain-face looked incredible; yet such is the case, and for so many years have they practiced it that the rocks up which they toil are worn into hoof-holes large as washbowls.

By paths too giddy to be remembered and too devious for description, we at last reached "S. DOMINGO."

On the terrace are two old *adobe* houses, and just beyond them a hole cut in the face of a solid rock, large enough to admit a man well doubled up. The rest of the scene is mountain and precipice. From Senor Mateas' lecture last night we know that there is no yield of silver here. The processes of extraction in the district are those of fire. To precipitate the precious metal it requires to be beneficiated in the furnace with what is called "liga," a lead ore taken in great quantities from this and the mine "Dolores." But for this S. Domingo would be without value.

Our first survey of the locality is yet in progress when out of the black door of the mine comes a figure so unqualifiedly Tartarian that I despair of accomplishing his portrait. He steps out quickly, lightly, although weighed by a sack (zurone) containing a hundred and fifty pounds of ore. A broad rawhide band (*mẽ*nacapal) attaches the burden to his forehead. He is naked as when born. His neck and limbs are massive. The perspiration streams from his sooty face and body, and his breast heaves spasmodically. For two hours he has been down in the hydrogen of the mine—down two hundred yards perpendicularly. The path he has traveled in ascending winds hither and thither; now up, then down; now it turns a sharp corner; now it traverses rough masses of rocks which are not all debris from blasting, for some of them have tumbled from the roof, and may be followed by "companion pieces" at any moment. Woe to him whom they catch! Thus for more than half an hour the poor wretch has come. To such a feat, performed regularly six times a day, what is crossing the rapids of Niagara on a wire? What wonder that the breast heaves and the sweat pours! Have you not heard of a man, escaped from drowning, tell of the agony that thrilled him the instant the life-saving air rushed into the cells of his collapsed lungs? Something like that this poor miner and his comrades say they suffer every time they pass the door of the mine suddenly into the rarefied atmosphere of the upper world. Horrible life!

I watch the man with interest quickened by sympathy. His first

act on stepping into daylight is to snatch the little tallow dip from it is such a friend down in Tartarus; without it could he have ever itis such a friend down in Tartarus; without it could he have ever risen to the light? He proceeds next to the door of the roofless house. A man meets him at the threshold, helps unload him, takes the sack to a rude contrivance and weighs it, giving a ticket of credit. Not a word is spoken. Resuming the now empty sack, the naked wretch turns, walks quickly to the entrance of the mine, lights the friendly taper, looks once to the sky, as if to bid the glad sunshine farewell, reenters the rocky jaws, and wades back into the outer darkness. Yet he is not alone; he is a type; he has comrades whom he will meet on the way—comrades in the extremest pit wherein the sounds of rueful labor are blended with peals of laughter. What is there to which men cannot accommodate themselves?

We enter the mine boldly, meaning to go to its bottom. Only a very few yards in and we become conscious of awkwardness. We do not know how to hold the candle—stuck, for facility of management, in the slit end of a stick about a yard long—to project its light where we want it; our feet slip; a sharp nose in the face of the wall scalps our elbows; the adamantine roof has a propensity to stoop unexpectedly and hit us on the forehead. From the beginning the progress is slow; insensibly it grows slower; when we have fell, bumped, and slipped probably a hundred and fifty times we feel admonitions that, at such rate, the goal will never be made. All this does not prevent us from stopping frequently to thrust our lights into crevices and look for veins of metal; for, be it confessionally noted, one of the weaknesses of every non-professional making a first descent like ours is a delusion that the workmen who opened the very passage traversed, and who, with eyes sharpened by training and experience, must have a hundred times scrutinized every square inch of the surface, might have failed in observation, and at this point or that lost the traces of a vein or deposit, the discovery of which is, perhaps, reserved for him, happy child of destiny! Yet we progress two—three hundred feet. The floor and even the walls are slippery; the friction of the coming and going of miners through generations has polished them to glassy smoothness. We begin to tire. Suddenly the procession halts for debate. Word is passed back that the guide has come, in swimming phrase, to a "step-off" of unknown depth. Shall we go on? A gust of wind, having no bones to break or life to lose, rushes recklessly to the interior, overwhelms debate; it leaps upon our feeble tapers, extinguishes them with a puff, and passes on, leaving us in darkness

not many degrees removed from suffcation. We appeal to our Mexican "lucifers." The dips are relighted; still we linger. Sight-seeing in this mine is playing out; shortened breaths, bumped heads, bruised arms and legs affirms the conclusion. As we ponder, sitting—to stand, the great mountain must be uncapped—other lights come up and mingle with ours; almost before a question can be asked half a dozen miners are upon us from "the lower regions." What shall we do? Who shall give way for the others to pass? Politeness and courtesy need room and fitting circumstances. Suddenly we are made to acknowledge that even here there is a law imperious as in a palace; for we look at the black figures; we glance at the burdens which seem forcing them down, strong as they are, and, as they come nearer, into their corded, sweat-covered faces; we hear their lungs laboring fiercely to catch what little life there is in the mephitic air; then we do as our guide has already done: the passage being at this point very narrow, we lie flat down until the counter-procession passes, quickly, lightly, skillfully—we scarcely know how. That circumstance resolves us. We right-about as best we can, and make slow and painful haste to the door. Outside how beautiful is the world and its sunlight!

"It is nothing," said M———' enjoying our discomfiture. "San Jose is different from San Domingo. There you can go for miles and find plenty of room, and see all that is here and more."

We were consoled. Tightening the girth, I improvised a breast-strap and asked, "Which way now?"

"There," said Pedro, pointing over the mountainous lump on San Domingo's back.

Upward again, over huge rocks, down deep ravines, facing every enumerable point of the compass. About noon our guide announced, "LA MINA DOLORES."

This mine separated from San Jose by a deep gorge, is situated on the edge of what the French *savant* called the mother-mountain. Standing in the shade of the ruin in the foreground of the picture I catch a fine profile view of that famous eminence, and, turning round, see, a short way off, the entrance of "Dolores." Four columns of rough limestone covered with a roof of earth and rocks, and overgrown with short, gray shrubs, mark its site. In front of it is a ravine; in the background, all over the ridge's side, are accumulated evidences of the departed prosperity of the district, in the shape of *adobe* ruins once the abodes of a busy population.

The "liga" of Dolores, unlike that of San Domnigo, yields a per cent of silver of itself sufficient to pay working. As the interior

of the two mines are alike, we thought it best not to interfere with the workmen who came up every little while and emptied thir sacks within the four columns. In fact, much of the life of our curiosity was lost in the sepulchral shades of San Domingo. We preferred to look across the great gorge and study the profile of San Jose.

In the depths of the gorge, on the bank of an *arroyo* far below us, was a collection of ruins similar to those around Dolores. The guide says they are the remains of what used to be quite a village. The statement appears incredible until the visitor goes down, and, standing among the falling walls, comes to understand that within the radius of a mile are mines of SAN JOSE, VIEJA, SANTA RITA, and PARCIONERA, reputed the richest in the *Real.* There is no data to enable us to ascertain the number of miners they employed. such immense works, however, could have only been accomplished by many thousands of men. This, it is known, was one of the centres of the faded industry; and tradition gives a lively picture of the communication between it and Chihuahua. From the same source we derive reminiscences of life and society in the rude, half-civilzed community; among others we hear of the excitement that at times thrilled the entire district when, from mouth to mouth, passed the electrical news, "SANTA RITA IS IN BONANZA!" Holiday followed, of course; and in the *Real* and all the settlements there was singing, feasting, *bailes,* rockets, gambling and general jubilation.

Descending to the arroyo, and following its windings, we turned a projecting rock, and were rewarded for all our toil—the mouth of old SAN JOSE was before us! Involuntarily we halted. I drew my pencil and paper. It is true I could not put down what most impressed me, but I could reduce the physical idea to be retained, and possibly convey to others what the simple efforts to describe would, I know, make incredible. When my drawing was finished I looked at it, and then at the sitter, and felt that he was insulted.

The mountain, as seen in the drawing, is probably six hundred feet in height and as many in width. Its ledges and crevices support a thin vegetation peculiar to the region, chiefly the chaparral bush, very stunted, and mixed with cacti and a species of palm known familiarly as the "Spanish bayonet." But for the most part the surface is bare, outcropping limestone. As a building material nothing could surpass it. That every ton of it contain from forty to a hundred and fifty dollars of silver—never less than thirty-five, according to the Mexican assayers—would be no detraction. What an improvement a house-front of silver ore would be! No fear of exhausting the supply!

Back of the fence I have attempted to present the mountain rises to a peak of twelve to fifteen hundred feet above the *arroyo*. When the great cone is levelled it may be truly said that the work is but begun; the richest metal lies below, and the deeper the richer.

Outside, in broad daylight, the tawny workmen were engaged, some crushing the rocks, some bearing off the débris of ore, others drilling. The clink, clink of the latter was not unpleasant.

"It is not rich, but it is certain," said one of the old miners, giving me a specimen freshly blasted.

"You are following a vein?" said I.

"No," he replied, "there are no veins here."

"You work, then, where you please?"

"Yes, the mountain is all alike."

I was standing at the time within the mouth. Overhead was a mass of solid brown ore, every pound of which could be profitably reduced, so also the floor beneath me.

It was thought best to enter the "PARCIONERA," as, by following its galleries, we could, if desirable, strike into those of the San Jose. Such a programme would require of us a walk of about two miles. Making our exit at the end of the round, through the wide mouth of the latter mine, we would be so tired that the ride back to the *Real* would be a rest.

We found the entrance to the Parcionera fully one hundred feet above that of the San Jose. The first quarter of a mile was rough, but well enough. A little close air was compensated by ample room. The old miners, feeling doubtlessly like outgoing tenants, seemed to have cared little about the condition in which they left things. In excavations system and science had been utterly ignored. The débris from blasting was sometimes an impediment to the miners, particularly those who came and went burdened. The roofs were unsupported by columns. At places where the sensation of void forced itself upon my conscienciousness, I tried to explore the space above and around; but the darkness defied our feeble lights, and I was left to wonder what stayed the mountain from tumbling in. When understood—and until then a nervous person has no business in the Parcionera—the reason is plain enough. In running these slopes and galleries, if such they may be called, the early miners set no value upon the common ore; in preference they sought the pockets of soft, yellow clay, which could be scooped out rapidly with horn spoons. The clay pockets were sometimes of immense extent, requiring years to exhaust. Rich with silver, they were cleaned out carefully, and, when

cleaned, left immense chambers with self-supporting arched roofs, like those of natural caverns. As observed, a general description, like that of the Frenchman, makes this mountain a deposit of ore; but once within the Parcionera we perceive that this deposit is sandwiched with strata of limestone, seldom more than twelve or fifteen feet thick. Following no rule, governed by whim, or most frequently by dreams—the medium of communication preferable to the patron Saints—the old miners did sometimes energize enough to blast through a limestone layer. If a "pocket" rewarded the enterprise out went the stirring cry, "La Parcionera está en bonanza!" Picking up clay by the spoonfuls, little cared the lucky fellows for the débris. If there was room for the passage of a loaded miner, well enough. "Sufficient unto the day is the evil thereof." Hence the obstructed galleries. Another result of the peculiar stratafication is that as yet the great mines, San Jose, Parcionera, and Negrita, for instance, run horizontally into the mountain; in no place does the variation from the level exceed thirty feet. As a consequence, operations are troubled by a want of, not by, water. Even Dolores, though shafted hundreds of feet beneath the brook, was never known to admit a drop. The great man for whom the *Real* is waiting will find himself at liberty, when he takes possession, to convert the mines already opened into initial galleries, and operate from them upward, downward, or laterally, as he pleases.

As we penerated farther it became warmer; hardly a mile within the perspiration fairly rained from us, a little beyond that we stopped to recover wind. While C———, compass in hand, cast up his reckonings, the rest of us scourged the covetousness which had chosen to sacrifice Heaven only knows how many lives to sinking a short shaft for ventilating purposes perpendicularly from the summit above us.

But up and on. Forward now, if only to get out. Our second candles were burning low; hats, hands, and shirts were plastered with tallow drippings; we were weakening in the knees, the *gastroknemia*, vulgarly called "calves," were becoming insubordinate.

"*A que distancia mas?*" ("How much further?") became a frequent inquiry. The guide, far to the front and moving lightly, like one "to the manner born," affected not to hear.

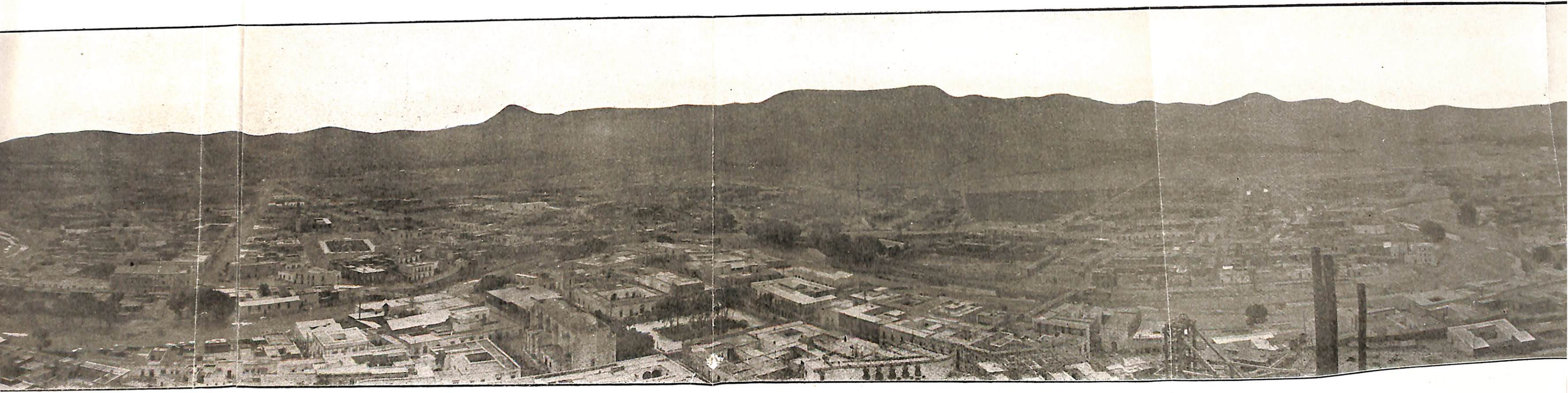
Now that we are deep into the interior we rarely meet a miner. Where are they all? Working in some of the out-way burrows; each one, it appears, has his favorite spot, where probably the ore is richer than common—a mine within a mine—accessible by paths unknown to others.

Quite far in we observed, off to our right, a light dimly reddening the rocky wall. Slowly, carefully, painfully we drew near the beacon. There was no sound of voices, no ring of hammers or echo of blows. A solitary workman was plying the mystic art. He had not heard our approach, and we stopped to observe him before speaking. A little basket at his left hand contained two or three tallow dips and some tortillas. Close by, in position to illuminate brightly about two feet of the wall directly in front of him, was his lighted candle; a pile of fine crushed ore, the result of his labor, covered the floor to his right, and on it lay an iron bar and a pick; above him extended a vault in the darkness without limit. He had come there about the break of day in the upper world; he came alone, and alone he had remained; not a word had he heard, not one spoken; the tapers had been his only companions; they not merely lighted his labor, but, since each one would burn about so long—a certain number exhausted by noon, another bringing the night—they also kept his time. The solitude was awful. And this was life in the mine! The moment we came upon him he was bending forward to examine more closely the ore to be broken off. In the uncertain light his naked, crouching body seemed that of an animal. Looking at him, disgust struggled with pity. Is is possible *he* is one of the masters through whom all the silver is introduced into the world? We spoke to him; the voice was kindly, yet it sounded in his ears, so long attuned to silence, like a pistol-shot. He started up and turned upon us in an attitude of defense. It will be long before I forget that poor solitary. He may be squatted at the base of the same wall now. Pity for him wherever he is! Pity for all his class.

Securing a specimen from the selected ore, we said *adios* and pushed on. When we went in at Parcionera the sun was flooding the great gorges with candescent glare, when we came out of San Jose the whole was swathed in shadow. We had seen what are unquestionably two of the most wonderful mines in the world.

"Let us go up, then, across the pinnacle of the cone, and take the Guadalupe and Negrita on the way. They are convenient for the return of the *Real.*"

We shook off the lassitude and mounted. That ride was probably the most agreeable part of the visit. As our friend had said, it took us exactly over the back of the mountain. An adobe house, constructed a century since for a look-out against Indians, crowns the extreme summit. The view from its falling doorway is inexpressively beautiful. Off to the southwest, white yet clear shines the city of Chihua-



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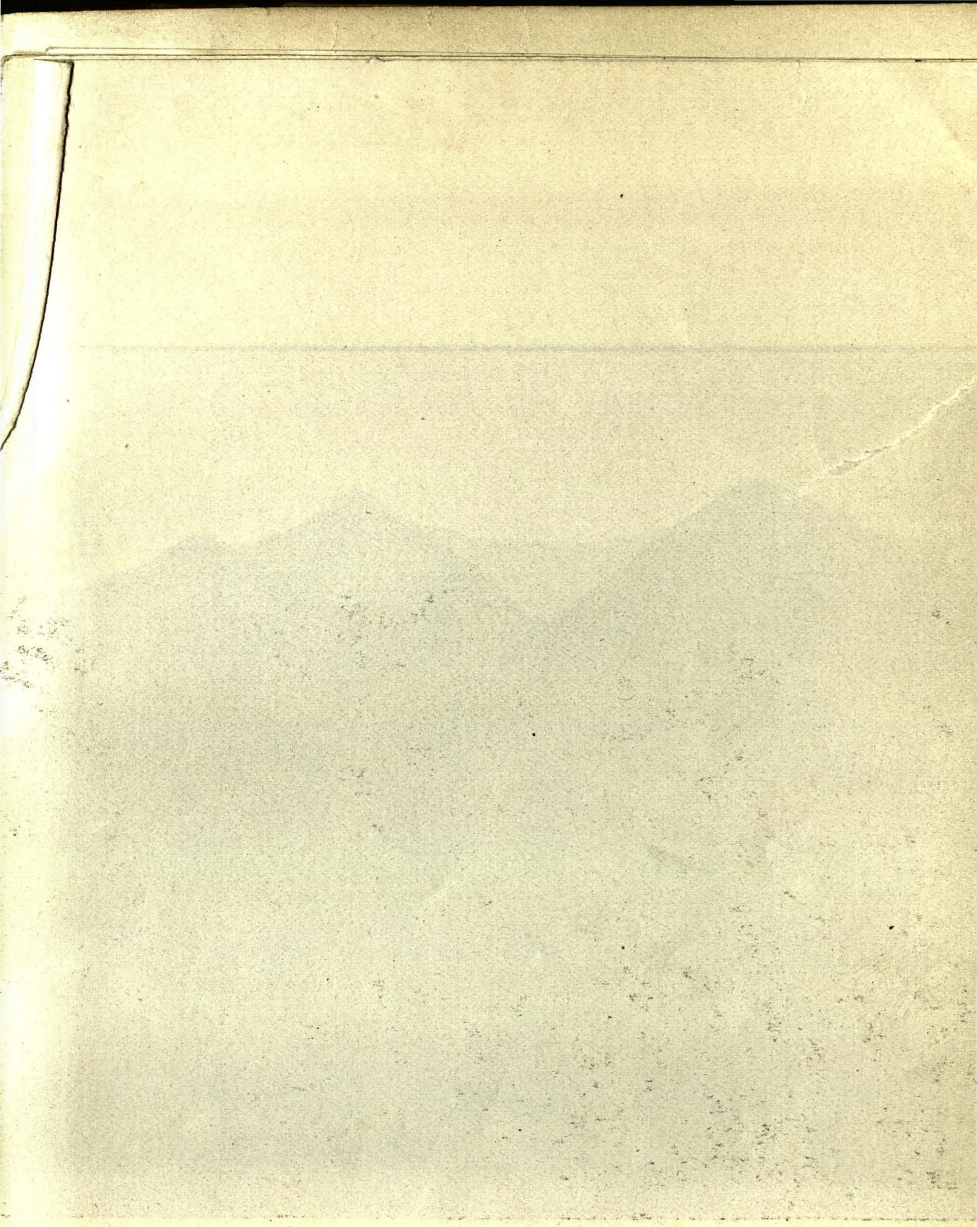


south and southwest, are range upon range of mountains, aptly covering the whole earth. Twined among the multitude of ks, like tangled ribbons, we see streakings of blue and purple, ath which, as we know by experience are outspread valleys, d, treeless, and scorched with endless drought. And the atmohere so pure, so transparent, admitting of such boundless horizon.

"Stop here," said M———, as we were rapidly descending. This is the 'GUADALUPE.' "

We followed him over a heap, or rather a mound, of limestone, d drew up around a shaft which had opened in the superior slope the mountain, without reference to any discernible object or adntage. The Guadalupe is now little worked. Its owner is said to ve joined the Imperialists and taken himself into exile. It has elded richly. And, strange to say, though not very deep, it is what e miners call "suffocated."

By some rude steps we descended the shaft about thirty feet; here a passage led horizontally into the mountain. Deep within, and arely discoverable through the dense shade, was a gate or door of tout wooden cross-beams. The damp from the interior had covered he bars with blue mould, which dripped with rapid condensation. Within we were almost immediately struck by a current of foul air, hich, besides extinguishing some of our candles, drove one of the arty hastily out. Such a reception literally staggered us all. The uide, more familiar with the debilitating gases, continued on. Summoning courage, we followed, nor stopped until we gathered a quanity of the silver-bearing clay in the extreme depth of the mine. When we turned to go out my hands were swoolen, the veins of my eck distended, and my head seemed bound with a tightening cord.

The sun was far down the western sky when we took to the sadle again and entered the trail that leads from the Guadalupe to the *eal.* The approach of night and the difficulty of traveling by staright, hurried us. At the "Negrita" we delayed barely long enough o enable me to make a sketch of its entrance.

Without accident we arrived at the *Real.* It was in the gray of vilight, yet the villagers, released from labor and care, were enjoying a bull-fight in the main street. The women and children looked on safely from the house-tops.

Before returning, however, we inspected the "Haciendas," and gained further insight into the processes of reduction and separation, about which our host, Señor Mateas, was very instructive.

The ore in the raw, but sufficiently crushed, is poured into the furnace, mixed about half and half with "liga," or flux, the ben-

eficiating metal, from Dolores and San Domingo. A big fire is kindled under it. Several bellows—a little larger but in no respect different from those used in our blacksmith shops—are then put in motion, some by hand, some by foot.

In the course of twenty hours this method of blowing accomplishes its result. Out from the glowing *horns* runs the liquified metal of silver and lead. Conducted into little basins conveniently located in the earther floor, it fashions itself into solid cakes. When cooled these are carried off and put through the ordinary process for the separation of silver.

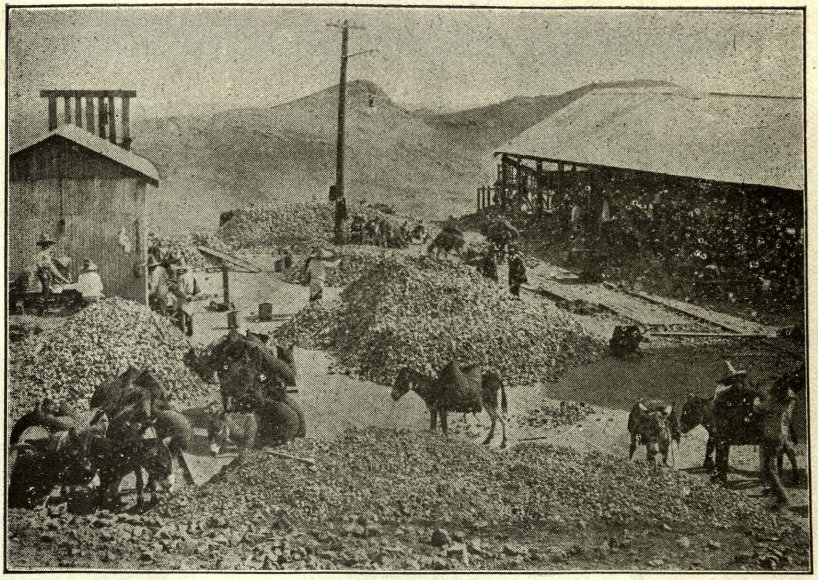
We were fortunate enough to find Señor Mateas' principal furnace in operation. The bellows were working with asthmatic wheezing; a muffled roar of fire proceeded from the massive pile, and the attendant darted here and there on special duty. Low down, at the base of the furnace, several jets of blue flame leaped hissing from the plastered wall, and from their midst flowed a sluggish but continuous stream of the molten metal. With the utmost gravity our host made his explanation; with equal gravity we listened. Out of his hearing, however, we laughed not at him, but his mode of smelting down the great old mother-mountain—as if her treasure could ever be exhausted in that way! Our return was by the ancient Spanish road, via Taboalopa and the Junta.

Santa Eulalia really ceased to be worked in any magnitude when the Spaniards were driven out of Mexico. In different ways the mines fell to owners who had little capital and still less energy.

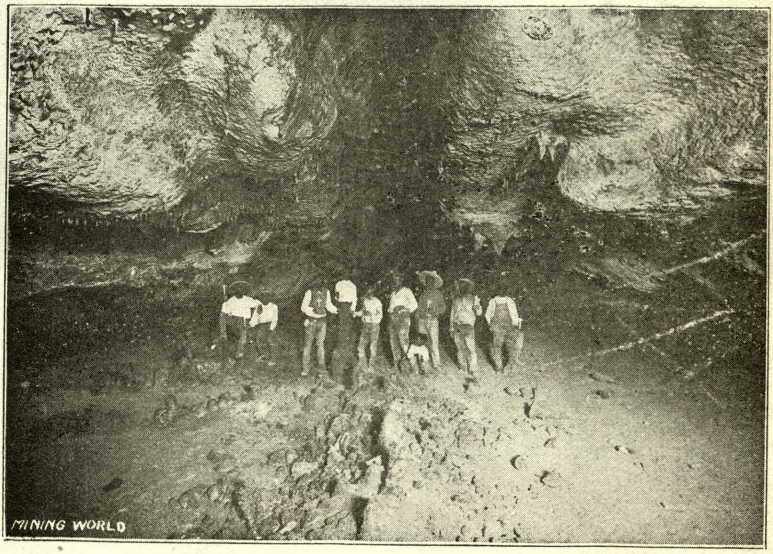
Our route has been as follows:

To Sto. Domingo, 3 1-2 miles distant, of continual ascent. Across arroyo was trail to S. Jose. Over the lump on Sto. Domingo's back (Puerto-Suelo) to MINA DOLORES, separated from San Jose by a great deep gorge. Below, in the depths of the gorge, is a ruined village, and within 1 mile are S. Jose, Vieja, Sta. Rita, Parcionera. We had descended to the arroyo—to Boca de S. Jose, which is 600 feet to top of Relise. We had then entered Parcionera, and its underground workings were 2 miles to S. Jose. It runs horizontally almost into the mountain. Up across the cone or backbone, past Guadalupe and Negrita, to the S. W., is the City of Chihuahua. Rapidly descending, we came to Guadalupe. We then struck into the trail that leads from Guadalupe to the Real, passed Negrita, and so returned to the town of Sta. Eulalia.

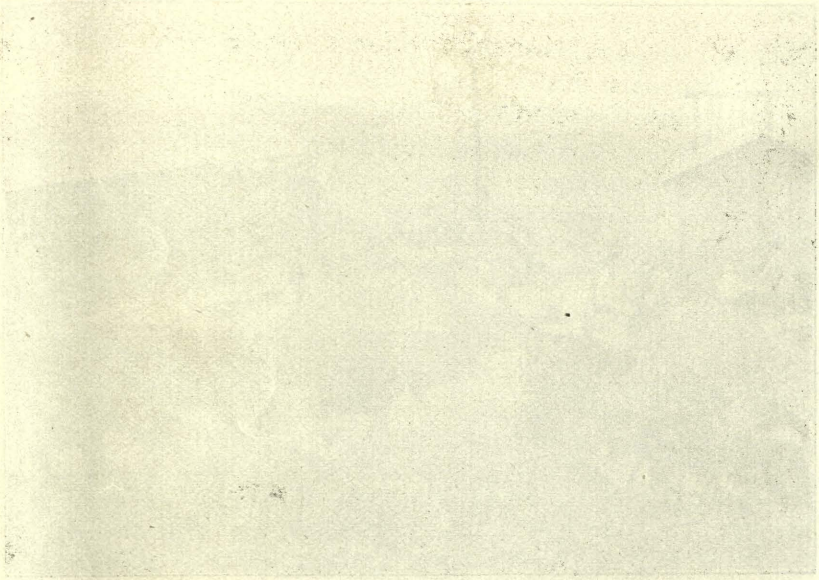
—GEN. LEW WALLACE (Author of Ben Hur, Fair God, Prince of India, etc.), Visit to the Mines of Santa Eulalia, Chihuahua. —HARPERS MONTHLY. 1867.

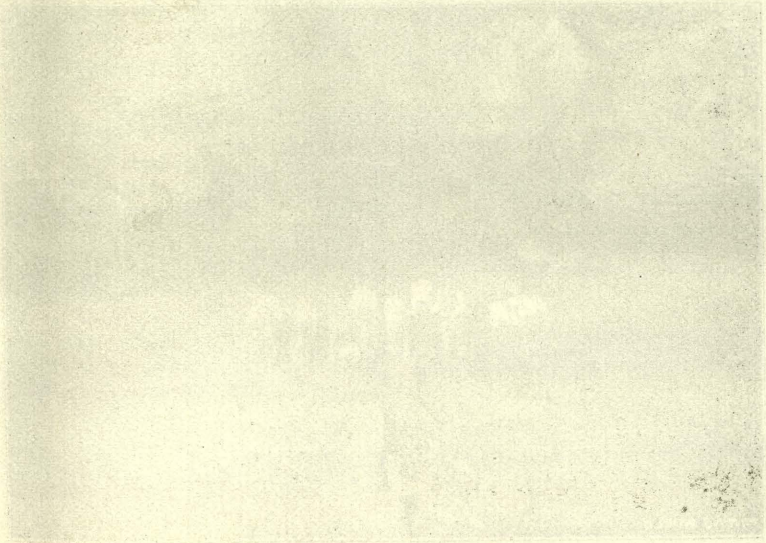


Palmilla Mine showing portion of ore yard. Parral.



Coyame Caves, 600 feet Underground. Iturbide District.





COMPLETE LIST OF MINES OF

Andrés del Río (Batopilas). (County Seat.)

Name.	Locality.	Hectaras.	Owner.
Hidalgo.	Urique.	5	Rafael Becerra.
Porfirio Díaz.	„	4	„ „
Juárez.	„	1	„ „
Anexas de Hidalgo.	„	2	„ „
Aurora.	„	2	Miguel Cruz.
Guadalupe.	„	5	Buenaventura Becerra.
Sangre de Cristo.	„	2	„ „
Guadalupe.	„	1	Crispín Gutiérrez.
Victoria.	„	20	John Jones.
Santos Reyes y Anexas.	„	5	Celso B. Rodríguez y socio.
San Navor y Anexas.	„	2	Buenaventura Becerra.
Providencia.	„	1	„ „
San Francisco.	„	1	„ „
El Salto.	„	4	„ „
El Cobre.	„	17	Rafael Becerra.
San Navor.	„	1	Buenaventura Becerra.
El Nuevo Siglo.	„	8	„ „
La Luz.	„	1	Marcelino Beldusco.
Túnel Patrona.	„	5	Pablo Frías hijo.
San Agustín.	„	3	Alfredo S. Monje.
Santa Adelaida.	„	5	Bernardo García.
Guadalupe.	„	5	Frank Lee.
Last Chance.	„	20	E. W. Iliff y socios.
Zaragoza.	„	10	Bernardo García.
San Nicolás.	„	30	Astolfo E. Mendoza.
Kruger.	„	12	Alfredo S. Monje.
Baltimore.	„	50	E. W. Iliff y socios.
San Rafael.	„	3	Hermenejildo Gutiérrez.
El Piñón.	„	15	Hermenejildo Gutiérrez.
La Fortuna.	„	5	Ramón Cota y socios.
Bravo.	„	24	Buenaventura Becerra.
La Corregidora.	„	10	Buenaventura Becerra.
Santa María.	„	3	„ „
San Giraldo.	„	2	„ „
Todos Santos.	„	10	„ „
Santa Teresa.	„	2	„ „
San Ignacio.	„	6	Everardo y Herculano Amador.

Arteaga.	Urique.	2	Buenaventura Becerra.
La Purísima.	„	6	Fraclio Valdez y socios.
Hermosillo. Urique.	„	7	E. W. Iliff y socios.
Anexas á Sangre de Cristo	„	18	Buenaventura Becerra.
Nueva Anaconda	Bahuerachic.	36	M. A. Knapp y socios.
Benares.	Urique.	14	„ „ „ „
El Sufragio.	„	60	Buenaventura Becerra.
Flor de María.	„	5	Epifanio Rodríguez.
Anexas á Bravo.	„	70	Buenaventura Becerra.
La Patrona.	„	5	„ „
Anexas á Cruger.	„	2	Alfredo S. Monje.
San Antonio.	„	5	Astolfo E. Mendoza.
Guadalupe.	„	10	Espiridión Barrios.
La Juárez.	„	6	Tirso Loya.
Anexas al Salto.	„	1	B. Becerra.
La Princesa.	„	4	María M. de Hermosillo.
San José.	„	5	Guadalupe Loya y socios.
San Bernardo.	„	12	Alfredo S. Monje.
La Paz.	„	3	Carlos A. Morris.
Belem.	„	15	J. W. Boyd
El Gallo.	„	24	Buenaventura Becerra.
La Luz.	„	13	Becerra. Nesbitt y Cía.
San José.	„	5	Alfredo S. Monje.
Nueva Babilonia.	„	10	J. Becerra y socio.
El Rosario.	„	6	Buenaventura Becerra.
Virginia.	„	6	Gustavo Lehman.
El Niágara.	„	6	Bernardo García.
Santa Eulalia.	„	10	Federico Moye.
San Miguel.	Batopilas.		Batopilas Mining Co.
Santo Domingo.	„		„ „ „
Roncevalles.	„		„ „ „
Todos Santos.	„		„ „ „
Palo Blanco.	„		„ „ „
Pirámide.	„		„ „ „
América del Sur.	„		„ „ „
Satevó.	„		„ „ „
Los Remedios.	„		„ „ „
Capuchin.	„		„ „ „
Penasquito.	„		„ „ „
Descubridora.	„		„ „ „
Animas.	„		„ „ „
Ballinas.	„		„ „ „
Túnel General.	„		„ „ „
San Antonio.	„		„ „ „
Carmen.	„		„ „ „
Carmen de San Miguel.	„		„ „ „
Santo Domingo.	„		J. P. Logan.
Túnel "La Vereda."	„		Creel y Salas.
Los Tajos.	„		Caballero y Larriva.
Valenciana.	„		E. Valenzuela.

San Néstor.	Batopilas.		E. Valenzuela.
Cinco de Mayo.	„		O. Bustamante.
La Fragua.	„		„ „
San Epifanio.	„		„ „
San Gabriel.	„		„ „
El Rosario.	„		Becerra Hermanos.
Recompensa.	„		„ „
Santa Lucina.	„		„ „
El Congo.	Urique.	20	Tiburcio Becerra y socios
San Rafael.	„	2	„ „ „
Bolívar.	„	5	Laureano Gil.
Nueva York.	„	21	Becerra y Nesbitt.
San Juan.	„	9	Tiburcio Becerra y socios.
Topeka.	„	40	W. C. Stephenson.
San Juan.	„	10	„ „ „
La Orozca.	„	6	S. Lawrence.
W. C. S.	„	20	W. C. Stephenson.
Los Angeles.	„	4	María M. de Hermosillo.
Víctor.	„	5	Clemente Yungk.
Carlos.	„	5	„ „
Lodi.	„	5	E. W. Iliff
Santa Eulalia.	„	5	S. Lawrence.
Luisa.	„	10	Clemens Junk.
Nápoles.	„	26	Federico Moye.
Nueva España.	„	2	Hermenejildo Gutiérrez.
O Colome.	„	50	Lázaro Caballero.
La Unión.	„	30	B. Becerra.
Alpes.	„	10	José Corral.
La Roy.	„	5	Frank McKenney.
Arlone.	„	4	„ „
Pastrana y Cata.	Batopilas.	11	Dolores B. de Valdés.
San José.	„	2	Pioquinto Bustamante y Hno
Cinco de Mayo.	„	5	„ „ „
San Agustín.	„	11	Jesús Alvarez.
La Nevada.	„	6	Becerra Hermanos.
La Purísima.	„	8	„ „
San Pablo.	„	8	„ „
Los Tajos.	„	6	„ „
El Orichic.	„	5	Juan H. Mendoza y socios.
San Felipe.	„	6	„ „ „ „
Demacías entre Orochic y San Felipe.		5	„ „ „ „
Demacías Nopal, Orochic y San Felipe.		5	„ „ „ „
Nevada Socavón.	Batopilas.	11	Becerra Hermanos.
San Marcos.	Urique.	3	„ „
El Refugio.	„	4	„ „
Providencia.	„	4	„ „
Giral.	Batopilas.	10	Sto. Domingo Silver Mg. Co.
Mendoceña.	„	16	„ „ „ „ „

El Carmen.	Batopilas.	11	Sto. Domingo Silver Mg. Co.
San Antonio.	„	8	„ „ „ „ „
Sto. Domingo y Socavón	„	½	„ „ „ „ „
El Rosario.	Morelos.	10	Francisco Larriva y socios.
Año Nuevo.	„	2	Eduwigis Portillo.
La Esperanza.	„	6	José M. Franco.
S. Rafael del Zapuri.	Batopilas.	20	Lázaro B. Caballero.
Ampliación de San Gil y El Refugio.	Morelos.	12	Enrique C. Creel.
Id. de San Antonio.	„	8	Enrique C. Creel.
La Unión.	„	3	Bonifacio Rojas.
Prolongación de Dul.	„	1	Carlos H. Miliken.
La Aguila.	„	3	Bonifacio Rojas.
Dulces Nombres.	„	4	Carlos H. Miliken.
La Australia.	„	2	W. H. Schaefer y socios.
Los Barrones.	„	2	„ „ „ „
Junio.	„	2	W. H. Schaefer y socios.
San Gerónimo.	„	6	Mauricio Montañez y socio.
La Rochela.	„	6	Fortino Peña y socios.
La Tseguinera.	„	22	Fortino Peña y socios.
La Unión.	„	27	M. Lachica y socios.
La Peña Chica.	„	12	„ „ „
Ampleación de la Esperanza.	„	6	José M. Franco.
San Justo.	„	4	„ „ „
San Alberto.	„	4	„ „ „
La Nueva España.	„	5	Esteban Rubio y socios.
Nazareno.	„	1	Refugio Salazar.
Ntra. Sra. del Rosario.	„	10	Catarino Chávez y socios.
Klondike.	Zapuri.	10	Enrique C. Creel y socios.
El Rosario.	Morelos.	8	C. H. Milliken y socios.
La Dura.	„	2	C. H. Milliken.
El Porvenir.	„	10	Santos Estrella y socios.
Cinco de Mayo.	„	9	José M. Echevarría.
San Guillermo.	„	6	C. H. Milliken.
Santa Ana.	„	5	W. H. Thompson.
Humberto I.	Batopilas.	6	Alberto H. Malaney.
La Libertad.	Morelos.	7	Alberto H. Malaney y socios.
La Verdosa.	„	5	H. A. Johnton.
Independencia.	„	6	Cruz Sánchez y socios.
Loreto.	„	12	Juan R. Malaney.
La Blanca.	„	2	Tomás Enving.
San Nicolás.	Urique.	30	Adolfo E. Mendoza.
La Trementina.	Morelos.	6	Juan N. Malaney.
Margarita.	„	7	Juan R. Malaney.
San Agustín.	„	4	Urbano Baiz.
El Santo Niño.	„	4	Carlos H. Milliken.
Dolores.	„	8	Nicolás Pérez y socios.
Nueva Anaconada.	Balmerachi.	36	Henry S. Mackay.
La Dura al Norte.	Morelos.	2	Carlos H. Milliken.

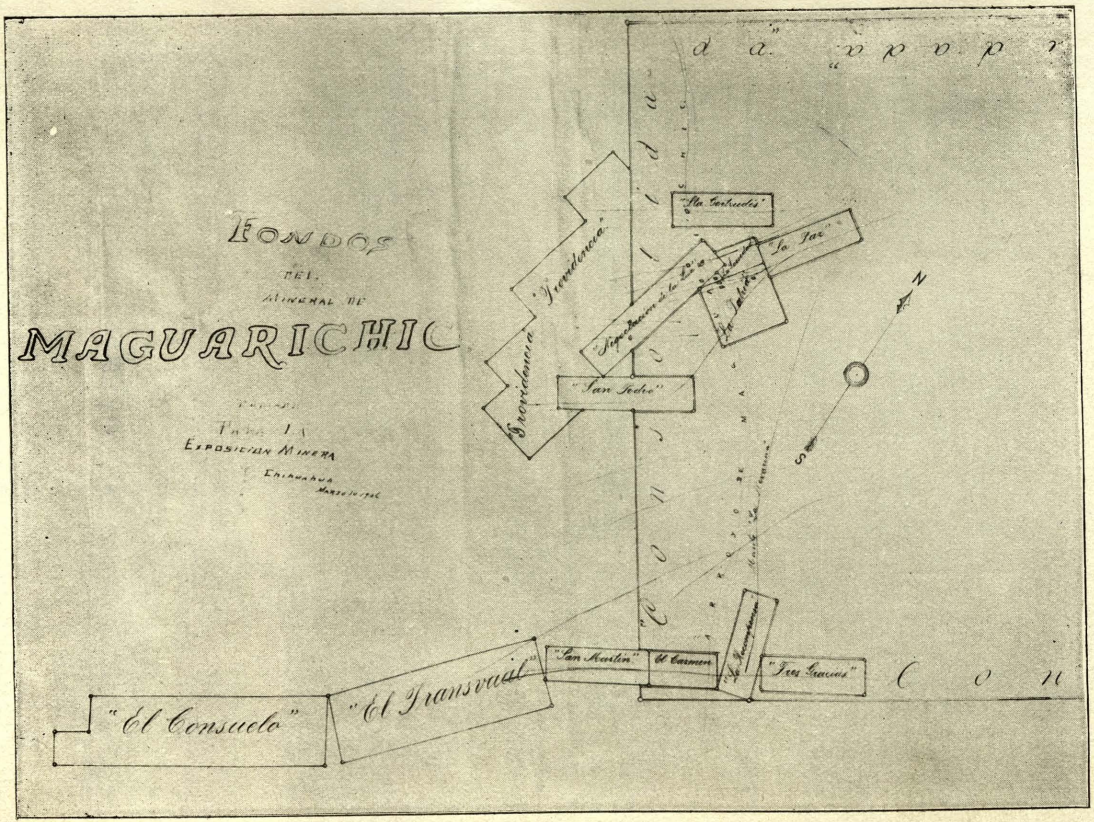
La Dura al Sur.	Morelos.	2	Carlos H. Milliken.
Providencia.	„	4	Laura S. Vda. de Rocha.
La América.	„	5	Juan R. Malaney.
El Carmen.	„	9	Ignacio Pérez.
La Bufa.	„	8	Pánfilo Guerra Sucs.
Charcas.	„	8	Urbano Baiz.
San Alberto.	„	4	Alberto R. Malaney y socios.
Santo Domingo.	Batopilas.	10	Ignacio Ramírez.
San Antonio.	Morelos.	4	Ambrosio García y socio.
Grant.	„	16	Juan R. Malaney.
San Ignacio.	„	40	Macedonio Rocha y socios.
Juana de Areo.	Batopilas.	10	Ramón Cota.
San Carlos.	Morelos.	2	Carlos H. Milliken y socios.
Santa Elena.	„	10	Enrique Kurth.
La Restauradora.	„	4	Cecilio Díaz y socios.
La Esperanza.	„	10	Ross E. Douglas.
Las Cruzadas.	Batopilas.	12	Carlos Moye y Socios.
Rosario de Oro.	Morelos.	3	Ignacio Pérez y socios.
El Porvenir.	„	2	J. M. Echavarría.
San Pedro No. 2.	„	3	Manuel Pérez.
Santa Cecilia.	Batopilas.	6	Trinidad Chávez.
Demacías del Porvenir.	Morelos	3	José M. H. Echevarría.
McKinley.	„	9	Alberto H. Malaney.
Tres Hermanos.	Batopilas.	10	Carlos Moyers y socios.
Abundancia del Río de Batopilas.	Batopilas.	53	Arturo Shepherd.
San Antonio	Morelos.	3	Mauro Castro.
El Madroño.	„	10	Manuel F. Peña.
La Prieta.	„	18	R. B. Steel.
Fénix.	Batopilas.	10	Alfredo Johnson.
Oro Fino.	Morelos.	20	George W. Bradley y socios.
Kuroki.	Zapuri.	6	Gaudencio Montoya y socios
Santo Domingo.	Batopilas.	49	Sto. Domingo Silver Mg.
Cinco de Mayo.	Morelos.	4	Refugio Salazar y socios.
Eureka.	„	6	J. Ignacio Ochoa y socios.
America y Miramonte	Batopilas	8	Alfredo Johnson.
San Juan.	„	6	Arnulfo Vega.
Galeana.	„	8	Leonardo Ramírez.
Ampl. de la Primavera.	„	6	José Vázquez y socio.
La Esperanza.	„	5	Luis Musy.
Reyes.	Morelos.	10	José M. Franco.
La Primavera.	Batopilas.	5	Blas Orpinel.
El Porvenir.	„	18	Pedro Zavala.
Estaca del Judío.	„	36	Leonardo Ramírez y socios.

ARTEAGA DISTRICT

Name.	Locality.	Hectaras.	Owner.
Ntra. Sra. del Socorro	Palmarejo	6	The Palmarejo Mining Co.
Ntra. Sra. del Carmen.	„	10	„ „ „ „
San Miguel.	„	11	„ „ „ „
El Presidente.	Guazapares.	24	„ „ „ „
San Rafael.	„	3	Ramón A. López.
Santa Clara.	„	3	„ „ „
San José.	„	2	„ „ „
Santo Niño.	„	1	„ „ „
Abundancia.	„	13	Ramos Hnos y Ca.
San Pedro.	„	3	Becerra Hermanos.
Santa Rita.	„	3	„ „
Providencia.	„	2	„ „
El Refugio.	„	2	„ „
La Esperanza.	„	2	„ „
San Juan de Dios.	„	5	„ „
Hilos Blancos.	Chínipas.	16	Juan R. Harbotle.
Sangre de Cristo.	„	16	Juan R. Harbotle.
Guadalupe.	„	4	Ignacio G. Montenegro y S.
América Libre.	„	1	Francisco Piña.
Moctezuma.	„	10	Dionisio Torres y socio.
Santa María.	Guazapares.	6	Miguel Torres y Ca.
Santa Rosa.	Chínipas.	12	Dionisio Torres y socios.
Tres Hermanos.	„	2	Palmarejo Mex. Gold. Field.
S. Miguel del Castillo	„	6	Miguel Torres.
San José.	Guazapares.	3	José E. Ptanik.
El Carmen.	„	3	„ „ „
San Miguel.	„	3	„ „ „
Santa Clara.	„	2	„ „ „
San Luis.	„	2	„ „ „
San Juan.	„	3	„ „ „
La Unión.	„	2	„ „ „
La Victoria.	Chínipas.	4	William Lidde.
La Reforma.	„	2	William Lidolf.
San Antonio.	Guazapares.	2	José E. Ptanick.
La Patria.	„	4	Martín Salido.
Todos Santos.	„	4	„ „
El Carrizo.	„	4	„ „
San Agustín.	Chínipas.	6	Reinaldo Ramos.
La Buenaventura.	„	3	„ „
La Pasión.	Guazapares.	2	Baltazar Olivas.
Ntra. Sra. del Carmen.	„	5	Martín Salido hijo.
Aldama.	„	14	Negociación La Millonaria.
San José.	„	6	Miguel Torres y socios.
Las Flemas.	Chínipas.	1	Francisco Piña.
San Angel.	Guazapares.	2	Cenobio C. Muñoz.
Ntra. Sra. de la Luz.	Chínipas.	2	„ „ „

La Mexicana.	Chínipas.	9	Reinaldo Ramos.
Fin de Siglo.	„	6	Ramón Márquez y socios.
El Santo Niño.	Guazapares.	2	Miguel Torres y socios.
Jesús María.	Chínipas.	3	Isidoro G. Almada.
San Gabriel.	Guazapares.	2	Miguel Torres y socios.
La Cruz de Plata.	„	2	Palmarejo Mex. Gold. Field.
Santa Aurelia.	„	5	Jacobo Breach.
La Aurora.	„	1	Palmarejo & Mex Gold Field
Restauradora.	„	1	Feliciano Rodríguez.
Anex. á San Antonio.	„	2	José E. Ptanick.
Anexas Sur á el Carmen	„	1	„ „ „
La Esperanza.	„	2	The Gold Field of Mex Limd
Mina del Agua.	„	1	Juan R. Harbotle.
Colón Anexas.	„	3	Palmarejo & Mex Gold Field
Guadalupe.	„	5	Reinaldo Ramos.
Los Hilos.	Guazapares.	5	Santiago Rascón.
La Intermedia.	„	3	Isidoro G. Aldama.
Nueva Valencia.	„	16	Palmarejo Mex. Gold F. Lt.
Eloisa.	„	12	„ „ „ „ „
Agua Blanca.	„	16	„ „ „ „ „
Los Hundidos.	„	16	„ „ „ „ „
La Península.	„	16	„ „ „ „ „
Guerra del Tirano.	„	7	„ „ „ „ „
Maclovia.	„	4	„ „ „ „ „
Aguaje.	„	1	La Guazapares Mining Co.
San Rafael.	„	½	„ „ „ „
La Paz.	„	4	José E. Ptanick.
El Porvenir.	„	2	Jesús A. Cruz.
Protección.	Chínipas.	1	Palmarejo Mex. Gold. F. Lt.
El Rosario.	„	5	„ „ „ „ „
Santa Julia.	„	8	Ramos Hnos y Compañía.
Anexa á La Abundancia.	„	8	„ „ „
Nueva Esperanza.	„	12	„ „ „
Meridional de San Agustín.	„	3	Santiago Almada.
Septentrional de San Agustín.	„	6	„ „
La Prieta.	„	3	The Palmarejo & Mex. Gold. Field Ltd.
San Antonio.	Guazapares.	3	José A. Cruz.
Margarita.	„	5	Juan R. Harbotle.
Fernández Leal.	Chínipas.	3	José María Meraz y socios.
Anexas á La Mexicana	„	27	Reinaldo Ramos.
Anexa á N. de Guadalupe.	„	6	Miguel Torres y socios.
Ampliación de Sangre de Cristo.	Guazapares.	8	Feliciano Rodríguez.
Zaragoza.	„	10	Luis G. Torres y socios.
Dolores.	Chínipas.	2	Ramos Hermanos y Cía.
Tres Amigos.	Guazapares.	6	Juan R. Harbotle.
New York.	Guazapares.	8	Juan R. Harbotle.

Santa María.	Chínipas.	3	The Palmarejo & Mex. Gold Field Ltd.
America Libre.	Chínipas.	3	Richard Gird y socio.
Anexa Oriental San Miguel del Castillo	„	8	„ „ „ „
Anexa Occidental S. Miguel del Castillo	„	12	„ „ „ „
Anexa Oriental de Guadalupe.	„	4	„ „ „ „
Anexa Occidental de Guadalupe.	„	5	„ „ „ „
Cordón de Oro.	„	3	Alejandro Balderrama.
Transvaal.	Guazapares.	8	Luis G. Torres y socios.
La Cruz.	„	50	Luis G. Torres y socios.
Santa Matilde.	Chínipas.	7	Dionisio Torres.
El Rosario.	Guazapares.	10	„ „
La Purísima.	Chínipas.	5	„ „
Anexas á Batanori.	Guazapares.	10	Luis G. Torres y socios.
América.	„	20	Luis G. Torres y socios.
San José.	Chínipas.	1	Ramón Piña.
Oriente.	„	1	Ignacio Rascón.
Los Otates.	„	2	„ „
Fortuna.	„	3	„ „
California.	„	16	Miguel Torres.
La Aparición.	„	5	„ „
La Princesa.	Guazapares.	5	„ „
San Juan de Dios.	Chínipas.	4	„ „
San Miguel.	„	8	„ „
San José.	Guazapares.	2	Alberto Valderrain y socios.
El Estaño.	„	2	„ „ „
El Oro.	„	2	„ „ „
Advertencia.	Chínipas.	4	Ramos Hermanos y Cía.
Anexas Sur del Refugio.	„	8	„ „ „
El Magistral.	„	4	„ „ „
Eureka.	„	3	„ „ „
La Trampa.	„	10	„ „ „
El Progreso.	„	2	„ „ „
Fin de Siglo.	„	3	„ „ „
Morelos.	Guazapares.	3	Santiago Rascón.
Anexa Sur de Guasisaco.	Chínipas.	4	Ramón C. Russo.
Anexa de Escobedo	Guazapares.	5	Gilberto Valenzuela.
El Capricho.	Chínipas.	10	The Palmarejo & Mex. Gold. Field Ltd.
Matías.	„	50	Ramos Hermanos y Cía.
Independencia.	„	4	„ „ „
Los Gachupines.	„	10	„ „ „
La Independencia.	Guazapares.	3	The Palmarejo & Mex. Gold. Field Ltd.



MAGUARICHIC. Mining Claims.

El Refugio.	Chínipas.	5	José María Piña.
Ricarda.	Guazapares.	10	Luis G. Torres.
Santa Elena.	Chínipas.	8	„ „ „
Batánori.	Guazapares.	10	„ „ „
Santa Teresa.	„	6	„ „ „
San Antonio.	Chínipas.	6	Francisco A. Esquer y socios
Guadalupe de los Re yes.	Guazapares.	3	Francisco B. Salido.
Esperanza.	Chínipas	11	Dionisio Torres.
Providencia.	„	13	Dionisio Torres.
El Churito.	„	1	Ramos Hermanos y Cía.
Santa Julia.	Guazapares.	6	José E. Ptanick.
Guasisaco.	Chínipas.	2	Ignacio Rascón.
Jesús María.	Guazapares.	6	Miguel Torres y socios.
La Reforma.	Chínipas.	4	Miguel Torres y socios.
El Refugio.	„	1	Ramos Hermanos y Cía.
Escobedo.	Guazapares.	10	Gilberto Valenzuela.
Yorimerachic.	„	20	Luis G. Torres y socios.
Cuba Libre.	Chínipas.	8	„ „ „ „
El Triunfo.	Guazapares.	8	The Palmarejo & Mex. Gold. Field. Ltd.
San Francisco.	„	19	Luis G. Torres y socios.
La Patria.	„	32	„ „ „ „
Guerra al Tirano.	„	4	„ „ „ „
Hidalgo.	„	8	„ „ „ „
El Porvenir.	„	23	„ „ „ „
San Luis.	Chínipas.	2	„ „ „ „
Guadalupe.	„	1	Ramos Hermanos y Cía.
El Salto.	Guazapares.	2	The Palmarejo & Mex. Gold. Field. Ltd.
Guadalupe.	„	7	Palmarejo Mex. Gold. F. Lt.
Anex Sur de la Aurora.	„	4	„ „ „ „ „
La Prueba.	„	2	„ „ „ „ „
Las Animas.	„	2	„ „ „ „ „
La Esperanza Anexa	„	2	„ „ „ „ „
La Protectora.	„	3	„ „ „ „ „
La Promesa.	„	2	„ „ „ „ „
Cruz de Oro.	„	7	„ „ „ „ „
La Verde.	„	5	„ „ „ „ „
Anex. N. de la Aurora.	„	6	„ „ „ „ „
La Colorada.	„	10	„ „ „ „ „
Anima Anexa.	„	4	„ „ „ „ „
Los Amigos.	„	3	„ „ „ „ „
Canadense.	„	16	„ „ „ „ „
Kansas City.	„	8	Juan R. Harbotle.
Las Cruces.	Chínipas.	4	Antonio E. Cruz.
Anexas á Dolores.	„	2	Ramos Hermanos y Cía.
Predilecta.	Guazapares.	2	Juan R. Harbotle.
Cuauhtemoc.	„	2	„ „ „
Natalia.	„	2	„ „ „

Jumbo.	Guazapares.	1	Juan R. Harbotle.
Tetamra.	Chínipas.	14	Ramos Hermanos y Cía.
La Millonaria.	Guazapares.	5	Testamentaría de Martín Salido.
Anexa á S. Agustín.	„	37	Reinaldo Ramos.
La Siberia.	„	1.	A. Valderrain y socios.
Santa Eduwiges.	„	5	Miguel Torres.
Zarpazo.	Chínipas.	8	Santiago Almada y socios.
Santo Domingo de la Calzada.	„	4	Miguel Torres y socios.
San Nicolás.	Guazapares.	5	Luis G. Torres y socios.
Loreto.	„	3	Francisco Ramos.
Las Maravillas.	„	5	Miguel Torres.
El Durazno.	Chínipas.	1	Luis G. Torres y socios.
Billonaria.	Guazapares.	17	Dionisio Torres y socios.
Anexa á la Millonaria.	„	14	R. Salido por la Intest. de M. Salido.
El 93.	Chínipas.	24	Rómulo G. Márquez.
Esperanza.	Guazapares.	4	W. D. Pearce.
Corona de Oro.	„	4	W. D. Pearce.
Colón.	„	3	The Palmarejo & Mex. Gold. Field Ltd.
Complemento.	Chínipas.	10	Ramos Hermanos y Cía.
La Estaca.	„	2	Santiago Almada y socios.
San Vicente.	Guazapares.	12	Próspero Rochin.
Furman.	Chínipas.	14	Ramos Hermanos y Cía.
La Bandera.	Guazapares	10	W. Mc Donald.
La Americana.	„	5	Miguel Torres.
Cruz Alta.	Chínipas.	7	Miguel Torres.
Juárez.	„	1	Pedro Ortiz Vera.
San Luis.	Guazapares.	3	Miguel Torres.
Las Tres Garantías.	„	4	Manuel Valderrain.
La Corregidora.	„	10	Miguel Torres.
La Constancia.	„	3	Miguel Torres.
Santa Bárbara.	„	16	Rodolfo Cruz y socios.
Cleopatra.	„	8	Cruz y Díaz.
La Bonanza.	„	144	The Palmarejo & Mex. Gold Field Ltd.
La Esperanza.	Chínipas.	8	Miguel Torres.
Lois.	Guazapares.	4	W. F. McDonald.
Santa Ursula.	„	4	Miguel Torres.
El Socorro.	Chínipas.	1	Ramos Hermanos y Cía.
La Esperanza.	Guazapares.	6	John L. Case.
El Canadá.	Chínipas.	10	Miguel y Luis G. Torres.
El Pavo.	Guazapares.	2	Antonio E. Cruz y socios.
Mercedes.	„	3	Reinaldo J. Almada.
San Pedro.	„	3	Miguel Torres.
El Durazno.	„	32	John L. Case.
Nuevo Monserrate.	„	6	The Palmarejo & Mex. Gold. Field Ltd.
Nueva Patria.	„	7	Miguel Torres y socios.

La Luz.	Chínipas.	3	The Palmarejo & Mex. Gold. Field Ltd.
La Chistosa.	Guazapares.	4	Gilberto Pérez Rodríguez.
La Cruz.	„	2	Francisco Pérez.
La Cascada.	„	6	Arturo Henser y Co.

MINING CLAIMS IN BRAVOS DISTRICT.

	Name of mine.	Locality.	Owner.
1	La Negrita.	Ciudad Juárez.	Pedro Ortuzar.
2	Veta Grande.	„ „	„ „
3	Contención.	Carrizal.	F. Orozco y García.
4	Willis.	„	A. C. Baxton.
5	Flor de María.	V. Ahumada.	P. D. Lozano y socios.
6	La Bonita.	Guadalupe.	N. Rodríguez.
7	San Juan.	„	N. Rodríguez.
8	Contención. Ampl.	Carrizal.	F. Orozco y García.
9	El Camino.	Casas Grandes.	W. Wallace.
10	La Fortuna.	Ojinaga.	L. Quiroz y socios.
11	Carolina II.	Villa Ahumada.	George Sauer.
12	S. Fernando.	Carrizal.	A. Samaniego.
13	La America.	Villa Ahumada.	S. Dobbins.
14	Carolina	„ „	G. Daily y socios.
15	Rosario y 2 de Abril.	„ „	Enrique C. Creel y socios.
16	La Encantada.	Ojinaga (Iturbide.)	Crispín Valero.
17	El número 7.	C. Juárez.	Refugio García y socio.
18	Maud	V. Ahumada.	James Dobbins.
19	Gloria.	C. Juárez.	Santiago Blanco.
20	Los Pajaritos.	„ „	Camilo Argüelles.
21	Lucky	„ „	Luis L. Samaniego.
22	La Cumbre Nevada.	V. Ahumada.	A De Lecumberri.
23	Tres Amigos.	Temósachic, (Guerrero.)	B. L. Croff.
24	Cinco de Mayo	Temósachic, (Guerrero.)	B. L. Croff.
25	La Chihuahuense.	Ojinaga. (Iturbide.)	Herculano Quiroz y Co.
26	Cerro de Cobre.	Uruáchic. (Rayón.)	H. S. Durel.
27	Benito Juárez.	Ojinaga.	Feliciano Salcido.
28	Quo Vadis.	V. Ahumada.	L. H. Davis y Co.
29	Lolita y Viola.	C. Juárez.	W. P. Gluber.
30	La Córnea.	V. Ahumada.	Hilario F. Bennett y socio.
31	Fin de Siglo.	Ojinaga. (Iturbide).	Antonio Medina.

32	La Constancia.	V. Ahumada.	A. C. Brocton.
33	J. R. Burton.	Ojinaga, (Iturbide.)	Tri-State Developement Co.
34	La Buena Suerte.	Carrizal	Alberto C. Brocton.
35	Homsteake.	V. Ahumada.	L. H. Davis y socios.
36	San Ignacio.	V. Ahumada.	Jorge Sauer.
37	Ventura.	Carrizal	J. D. May y socios.
38	Emilia.	Ojinaga. Iturbide	Rafael Elías.
39	Providencia	Ojinaga. Iturb.	Inocente Saenz y socios.
40	Alice.	Carrizal.	Luis Fenchler y socios.
41	Chapultepec.	Guadalupe	S. L. Bean.
42	La Imperial.	„	„ „ „
43	Washington.	„	„ „ „
44	Magdalena.	V. Ahumada.	Jorge Sauer.
45	Veta Grande.	„ „	Enrique Flint.
46	La Unión.	C. Juárez.	José L. Ortega.
47	Dolores.	V. Ahumada.	I. José Enrique.
48	San Ignacio.	Guadalupe.	A. M. de Rogers.
49	Good Luck.	V. Ahumada.	L. N. Neil.
50	El Rey del Cobre.	„ „	S. D. Bridge.
51	San Francisco.	Guadalupe.	Juan Carbajal y socios.
52	San Pedro.	„	Juan Carbajal y socios.
53	San Fernando.	V. Ahumada	H. H. Bailey y socios.
54	Palmilla.	„ „	G. Dailey y socios.
55	Lola Rey.	„ ,	H. H. Bailey y socios.
56	D. Juan.	„ „	H. H. Bailey y socios.
57	Reina del Cobre.		S. D. Bridge.
58	Lilia.		Agustín Samaniego.
59	Juárez.	S. Buenaventura.	Eleuterio R. Prado.
60.	Lidia.	V. Ahumada.	Samuel D. Bridge.
61	El Rey del Cobre	„ „	J. B. Bridge.
62	Julia.	Guadalupe.	Julia Ville.
53	Oro Amarillo.	Temósachic. (Guerrero.)	J. H. Hefron y socios.
64	La Corona.	V. Ahumada.	Rodolfo Terry.
65	Portland.	„ „	William Crosby.
66	Sta. Elena.	C. Juárez.	Luis Samaniego y Co. Mex.
67	California.	V. Ahumada.	William Crosby.
69	El Tesoro Escondido.	„ „	C. M. Romsey y socios.
70	El Rey del Cobre.	„ „	Luis L. Samaniego y Co.
71	Sta. Mónica.	Valle del Rosario (Hidalgo.)	Daniel P. Holland.
72	La Bella Isabel.	Satevó. (Iturbide.)	Daniel P. Holland.
73	San Ignacio.	Iturbide. Satevó.	Daniel P. Holland.
74	San Luis.	V. Ahumada.	Luis Toix y socios.
75	El Transvaal.	„ „	L. H. Devis y socios.

76	Mina Frank	V. Ahumada.	Henri Faivre.
77	Mellie G.	„ „	G. S. Burgos y socios.
78	María.	C. Juárez.	Alejandro H. Daguerre y socios.
79	Bismuth.	V. Ahumada.	A. C. Broxton.
80	Los dos Tejanos.	Guadalupe	W. B. Prenet y socios.
81	El Carbonado.	V. Ahumada.	Ignacio Acosta.
82	Portland.	„ „	William Crosby.
83	Benito Juárez.	„ „	Francisco Orozco Gómez.
84	El Labrador.	„ „	Francisco Orozco Gómez.
85	Díaz-Roosevelt.	„ „	George Jones Cole.
86	La Unión.	Cusihuiriáchic. (Iturbide).	W. L. Saye y socio.
87	Carolina I.	V. Ahumada.	Joaquín A. Alvarez.
88	Carolina.	„ „	W. M. Daily y socios.
89	El Barradán.	„ „	Félix McDonald y socios.
90	La Unión.	„ „	L. N. Heil y socio.
91.	La Unión.	Cusihuiriáchic. (Guerrero).	W. L. Saye y socios.
92	General Bravo.	V. Ahumada.	Francisco Orozco Gómez.
93	Benito Juárez.	„ „	„ „ „
94	El Labrador.	„ „	„ „ „

COMPLETE LIST OF ALL THE MINING CLAIMS IN THE CAMARGO DISTRICT.

Ciudad Camargo (Santa Rosalía) (County Seat)

Nome of mine.	Locality.		Owner.
San Miguel.	Santa Rosalía.	26	Victoriano Gándara.
La Purísima.	Julimes.	11	Luis G. Saldaña y socios.
Ampliación de San Miguel.	Santa Rosalía.	16	Victoriano Gándara.
La Soledad y El Colmilludo.	„ „	6	Eduardo Lightdonn Hes.
Gibraltar.	„ „	6	Manuel de la O.
La Constancia.	„ „	2	Felipe Villanueva.
Relámpago.	„ „	1	Ceferino Calderón.
La Paz, La Unión y La Recompensa.	Julimes.	8	Eduardo Lightbonn y Hes.
La Fé.	„	1	Eduardo Lightbonn y Hes.
La Solitaria.	Santa Rosalía.	6	Santiago Stopeli.
San Márcos.	Saucillo.	50	Victoriano Gándara.
La Estrella.	Rosales.	3	Manuel de la O.
Almaden Chihuahua	Saucillo.	50	Victoriano Gándara.
La Providencia.	Julimes.	20	Alberto Terrazas.
Don José Lino.	„	18	Alberto Terrazas.
Las Reynas.	Santa Rosalía.	5	Salvador L. Mallen.
Las Riquezas de Creso.	„ „	6	Leonides Villa.
Xochitl.	„ „	13	Cía. Minera de S. Antonio.
Marina.	„ „	10	Cía. Minera de S. Antonio.
Dolores.	„ „	13	Encinillas Mines Lt.
Lepanto.	Rosales.	73	Antonio de Stefano.
Nuestra Oportunidad.	„	20	Pablo Guinther y socios.
Catacumbas.	„	20	Eduardo G González y socios
Anexas á S. Patricio.	„	22	Juan Ortiz.
Aplicación.	„	9	Cía. Minera San Antonio.
El Triunfo.	„	14	Cía Minera de Naica.
El Cerro de las Campanas.	„	8	José D. Hernnádez y socio.
La Luz del Siglo XX.	„	17	José María Guevara y socio.
Cuepo.	„	20	Juan R. Carey.
Anexas de Dolores.	Santa Rosalía.	36	Encinillas Mines Lt.
Ampl. de Gibraltar.	Rosales.	18	Manuel de la O.
Sensitiva.	„	18	Ramón T. Luján.
La Historia.	„	6	Luciano Núñez y socios.
El Faro.	„	50	Romualdo González.
Anexas de Dolores.	Camargo.	10	Anglo-Mexican Syndicate.
Ramón Corona.	Rosales.	18	Emilio Valle.

Walhalla.	Santa Rosalía.	6	Anglo-Mexican Syndicate. L.
Gracia.	„ „	6	Anglo-Mexican Syndicate. L.
El Monarca.	Rosales.	10	Enrique Tinoco.
El Renacimiento	Santa Rosalía.	3	Francisco A. Vidal.
San Antonio.	Julimes.	9	E. W. Marshall y socios.
El Hércules.	Santa Rosalía.	148	Henry Guinther.
Zolá.	Rosales.	24	José María Guevara y socios
Salomón.	Julimes.	9	Geo G. Wanless.
Ampl. de Zolá.	Rosales.	17	José María Guevara y socios.
El Refugio.	„	20	Vicenta Leos y socios.
Esteban Coronado.	„	21	Pedro de la O. y socios.
Fuerza y Alianza.	Santa Rosalía	45	Enrique Visconti.
María.	Santa Bárbara.	12	Ramón Gómez Salas.
Rocambole.	Rosales.	40	Ignacio Mariñelarena.
Micaela.	„	7	José T. Villarreal.
San Antonio.	„	34	Ignacio Mariñelarena.
La Calabria.	„	16	Francisco Baca.
S. Pedro y S. Pablo.	„	32	Francisco Orozco G. y socio.
El Emperador.	„	6	Enrique Tinoco.
Constitución de 57.	„	34	Francisco Orozco G. y socio.
Historia Anexas.	„	5	Luciano Muñoz y socio.
Leandro Fernández.	„	30	Francisco Portillo y socio.
El Tigre.	„	24	Francisco Roca.
Carolina.	„	18	Manuel L. Luján.
El Presidente.	„	59	W. T. Swoyer.
Ampl. de L. Hernández.	„	5	Francisco Portillo.
Charcas de Plomo.	„	50	Manuel de la O.
Canopas.	„	10	Cía. Sruzaels.
Felicidad.	„	45	Francisco Orozco Gámez.
San Carlos.	„	20	Simón Oloya y socios.
San Francisco.	„	50	Vicente Visconti y socio.
Corlone Ignacio Orozco.	„	10	Francisco Orozco Gámez.
Benito Juárez.	„	24	Francisco Orozco Gámez.
Anexas de Lepanto.	„	6	Antonio de Stéfano.
Juanita.	Julimes.	20	R. J. D. Morambert.
Omega.	Rosales.	24	J. Joaquín Valles y socios.
Aurora.	„	50	Othón Sartorius.
Demacías del Monarca.	„	9	W. Trevor Swoyer.
Demacías del Emperador.	„	6	W. Trevor Swoyer y socios.
Cruz del Sur.	Naica.	60	Cía. Minera Cruz del Sur.
Volcán.	Rosales.	14	Fortino Bustamante y socios
El Refugio.	„	15	Ignacio Velázquez.
General Mireles.	„	15	Francisco Orozco Gámez.
El Transvaal.	„	10	Jesús Cobos.
Antares.	„	15	Cía. Minera Cruz del Sur.
La Purísima.	Julimes.	40	Francisco Portillo.
El Plomo.	Santa Rosalía.	20	Federico Reuter.
Elvira.	Rosales.	30	Eleuterio Avila.
Carolina.	Conchos.	32	Esteban Cadena y socios.
El Japón.	Julimes.	35	Celestino Dufau.
Esther.	Rosales.	35	Manuel de la O. y socios.

Morelos.	Saucillo.	51	Natividad Salcido.
La Flor de María.	Rosales.	8	Julio C. Yaurrleto.
La Reina del Plomo.	Julimes.	70	Federico Renden.
La Aurora.	Saucillo.	22	Alberto Caballero.
Omega.	„	53	Hesiquio Cobos y socios.
Kuroki.	„	18	José Muñoz Lumbier.
Carmen.	„	29	Luis G. Alvarez.
Chihuahua y Boston.	„	40	Francisco Orozco Gámez.
Zuloaga.	„	35	Telesforo Castañeda C.
El León.	„	20	Manuel L. Luján.
Yokohama.	„	24	James E. Garret.
San Miguel.	„	18	Enrique McNerny.
Ampliación de Omega.	„	36	Telesforo Castañeda C.
La Suerte.	„	80	Enrique McNerny.
Francisco Javier Mina.	Rosales.	30	Francisco Orozco Gámez.
La Leona.	Saucillo.	20	Manuel L. Luján.
Winie Emmerson.	„	10-18	Roberto Emmerson.
Dos de Abril.	Julimes.	21	Mariano Aguilar y socio.
Julio Verne.	Saucillo.	33	Telesforo Castañeda G.
Segunda Naica.	„	8	Mauricio Chavira.
Segunda Naica.	„	8	„ „
Segunda Naica.	„	14	„ „
El Diamante.	„	15	J. M. Bernhardt.
Winie Emmerson.	Saucilo.	10	Robert Emmerson.
Coronel Ig. Orozco.	Rosales.	10	Francisco Orozco G. y Co.
General Morelos.	„	15	„ „ „ „
Chihuahua y Boston.	„	39	„ „ „ „
Salomón.	Julimes.	9	George J. Wanless.
Juanito.	„	20	R. J. de Moranbert.
Mathilde.	Rosales.	32	Othón Sartorius y Co.
Anita.	„	20	„ „ „

MINING CLAIMS IN GALEANA DISTRICT.
Casas Grandes (County Seat.)

Name of mine.	Locality.	Owner.
P. y Flor de Marzo.	Ascensión.	Cía. Flor de Marzo.
Planchas de Plata.	„	Seijas y Cuarón.
Santo Domingo.	„	Britton Davis.
Aventurero.	„	„ „
Bismarck.	„	S. Munzemberger.
La Fortuna.	„	Britton Davis.
Dos Hermanos.	„	„ „
Santa Victoria.	„	„ „
La Unión.	„	„ „
Cuatro Amigos.	Casas Grandes.	W. Wallace.
Bella Vista.	Ascensión.	Krakauer Zork y Moye.
La Esperanza.	„	A. Corral.
Santa María.	Casas Grandes	Mr. Sandoval y socios.
El Camino.	„ „	W. Wallace.
Anex á Flor de Marzo	Ascensión.	Heraclio Rivera.
Veta Grande.	„	John Corbett.
Estrella del Oriente.	„	H. W. Higley.
Estrella del Norte.	„	„ „ „
Estrella del Poniente.	„	„ „ „
México.	„	A. Ibave.
	„	Britton Davis.
La Niñita.	„	„ „
El Progreso.	Casas Grandes.	Tomás Wallace.
Grandeza.	Ascensión.	John Corbett.
La Cortada.	Casas Grandes.	Cía Minera de Corralitos.
Sierra de Cobre.	Casas Grandes.	Britton Davis.
Cinco de Mayo.	„ „	F. Sandoval y socios.
4a. y 5a. de la Cortada.	„ „	Britton Davis.
Rosario y 2 de Abril	„ „	Enrique C. Creel y socios.
El Oro.	„ „	W. Wallace.
El Querido.	„ „	„ „
Margarita.	„ „	„ „
Patrocinio.	„ „	Cía. Minera S. Pedro, S. A.
San Pablo.	„ „	G. Portillo.
América.	„ „	I. E. Palmer y socio.
Santo Niño.	„ „	L. González y socios.
Providencia.	Ascensión.	Celso Lugo y socios.
Santa Isabel.	„	Celso Lugo y socios.
La Constancia.	Casas Grandes.	J. M. Gándara.
Florida.	„ „	Nicolasa Ponce.
La Fortuna.	„ „	Zeferino Díaz y socios.
Jesús, María y José.	„ „	F. Fernández y socios.
Santa Cecilia.	„ „	F. Fernández y socios.
Estrella del Sur.	Ascensión.	W. H. Higley.

Anexa á Mina Díaz.	C. Grandes.	I. E. Palmer.
D. á Cuatro Amigos	„ „	„ „ „
Hueco id y el Oro.	„ „	„ „ „
San Bernardo.	„ „	Lino Maldonado.
Encantada.	„ „	Ed. W. Mead.
La Esperanza.	„ „	Alfredo E. Turner.
La Frontera.	Ascensión.	B. J. McKeyes.
Fin de Siglo.	Casas Grandes.	Jesús Granilo.
Casas Grandes.	„ „	Donaciano Mápula.
Chiquita.	„ „	H. F. Brown y socios.
Todos Santos.	„ „	D. C. Sutton.
Amelia.	„ „	Clarke E. Friend.
Knable.	„ „	Clarke E. Friend.
Loelia.	„ „	John K. Friend y socio.
Cerro Colorado.	Corralitos.	J. F. Crosby.
San Pedro Barranco.		
Candelaria.		
San Lorenzo.	„	Cía. Minera S. Pedro, S. A.
San Silvestre.		
La Dorita.		
Criadero León y Congreso.	„	J. F. Crosby.
Escondida.	„	„ „ „
Lincoln.	Casas Grandes.	J. E. Palmer y socios.
Juárez.	„ „	J. E. Palmer y socios.
Carolina.		L. I. Hyelin.
San Salvador.	Ascensión.	Longino González y socio.
San Joaquín.	Casas Grandes.	J. E. Palmer y socios.
América núm. 2.	„ „	J. E. Palmer y socios.
La Escondida.	„ „	Paul Piaderth.
San Salvador.	Ascensión.	Davis Kosar y socios.
Liberty.	Casas Grandes.	James N. Samburny—I. F. G.
Díaz.	„ „	J. E. Palmer.
Mammoth Queen	Ascensión.	A. C. Peterson.
Anexas á la Cobriza	Casas Grandes	Cía. Minera S. Pedro, S. A.
Paul Hammett	„ „	S. Charles Pratt.
Promontorio.	„ „	Franco. M. Sandoval y socios.
Lemus, Ochoa y S.	„ „	Joaquín Losolla.
Mineral de S. Pedro	„ „	Cía. Minera S. Pedro, S. A.
San Gonzalo.	Ascensión.	Daniel Cr. Sutton.
Sierra Madre.	Casas Grandes.	P. H. Durack.
Colombia.	„ „	P. H. Durack.
San Antonio.	Ascensión.	Daniel C. Sutton.
Fácil.	Casas Grandes.	I. F. George y socios.
Lincoln.	„ „	I. E. Palmer y socios.
Toltec.	Ascensión.	D. C. Sutton.
Aztec.	Casas Grandes.	D. C. Sutton.
Huecos de la Fortuna y Sto. Niño.	„ „	Francisco Hernández y socios.

Anex á Sto. Domingo	Ascensión	Briton Davis.
Standard.	„	A. A. Ireland.
Vecina de la Florida.	„	Serafín de Cory.
La Oriental.	S. Buenaventura.	Jesús M. Carbajal y socios.
Morelos.	Ascensión.	Orren Allen.
El Negro.	„	„ „
Santiago.	„	„ „
Pájaro Azul.	„	„ „
Washington.	„	S. L. Bean.
Lart Chance.	Casas Grandes.	I. E. Palmer.
Carbonado.	Ascensión.	Ketelsen y Degetau.
Ahumada.	„	Orren Allen.
Loma Rayada.	„	Daniel C. Sutton.
El Nogal.	Casas Grandes.	David A. Stevens.
Demasías entre la Fortuna y Jesús María y José.	Casas Grandes.	Ramón Almanza y socios.
Triphtle.	„ „	H. B. Zymoal y socios.
Carolina.	„ „	Aurtacio Castillo y socios.
Isabelita.	„ „	Brook M. Baker y socios.
Anexas á Isabelita.	„ „	Brook M. Baker y socios.
Juárez.	Ascensión.	B. F. Moore.
San José.	Casas Grandes.	David B. Smith.
San Pablo.	„ „	„ „ „
San José.	„ „	„ „ „
Frisco.	„ „	„ „ „
La Esperanza.	Ascensión.	Jorge E. Briggs.
Florencia.	„	Francisco Mateus.
La Cobriza.	Casas Grandes.	Cía. Minera de S. Pedro, S. A.
Picacho.	„ „	„ „ „
El Camino.	„ „	„ „ „
San Matías.	„ „	„ „ „
La Cara.	„ „	„ „ „
Cortada.	„ „	„ „ „
San Francisco.	Guadalupe.	Juan Carbajal y socios.
San Pedro.		
San Rafael.	Janos.	Eduardo Gutiérrez.
La Esperanza.	S. Buenaventura	Eleuterio R. Prado.
Eduardo VII.	Janos.	Eduardo Gutiérrez.
Mexican Lolita.	Ascensión.	Arturo H. Gruber.
Juárez.	S. Buenaventura.	Eleuterio R. Prado.
Puerto Rico.	Ascensión.	S. T. Wylye.
San Luis.	„	S. T. Wylye.
Georgia Bell.	Janos.	Eduardo Gutiérrez.
La Cruz.	Ascensión.	Ignacio Alvarez y socios.
Laura.	„	I. E. Palmer.
Laura núm. 2.	„	I. E. Palmer.
Independencia.	S. Buenaventura.	L. H. Heily y socios.
Las Nieves.	Casas Grandes.	Edmundo Goncer.

Josefina.	Ascensión.	Ignacio Chávez.
Anaconda.	„	J. M. Caldwell y socios.
Punta del Oro.	Janos.	George H. Paul y socios.
Santa Inés.	Casas Grandes.	L. I. Hjelm.
La. U. del Cobre.	Ascensión.	Longinos González.
La Purísima.	„	José L. Arteaga.
San Eduardo.	„	„ „ „
Bonanza.	„	„ „ „
Trinidad.	Casas Grandes.	Candelario Quintanor.
Santa Anita.	„ „	Andrew Bain.
San José.	Ascensión.	Adolfo Schwartz.
La Exploradora.	Casas Grandes.	Francisco Fernández y socios.
Mexican Vista.	Ascensión.	Ella A. Grumer.
La Nacional.	Casas Grandes.	Serafín D. Cori.
San Joaquín.	„ „	David B. Smith.
King Edward.	„ „	Frederick A. Chiftor.
Klondyke.	„ „	Chas Montafart.
Onix.	Ascensión.	José L. Ortega.
Providencia.	„	„ „ „
Santa Juliana.	„	„ „ „
Victoria.	„	„ „ „
Terrazas.	„	David B. Davison.
La Viznaga.	„	Daniel G. Sutton.
La Patria.	Casas Grandes.	Jesús J. Gutiérrez.
Estrella de la Tarde.	Sabinal.	José L. Ortega.
Isabel.	Ascensión.	José L. Ortega.
El Nopal.	„	Daniel E. Sutton.
La Cruz del Palenque	C. Grandes.	Ciriaco Toloya.
El Escondite.	„ „	Luis B. Booker y socios.
Lillie.	Ascensión.	B. F. Moore.

COMPLETE LIST OF ALL THE MINING CLAIMS IN THE GUERRERO DISTRICT.

Ciudad Guerrero. (County Seat.)

Name of mine.	Locality.	Hectaras.	Owner.
Jay Gould.	Temósachic.	14	Daniel Rico.
La Fortuna.	Guerrero.	9	Frank Ashton.
La Bonanza.	„	9	Frank Ashton.
San Sebastián.	„	10	Silviano González y socios.
La Providencia.	„	10	Teodoro Enríquez.
Guaynopita.	„	6	George Look y socios.
El 2 de Abril.	Temósachic.	15	P. H. Heffron y John W. Piper.
San Antonio.	Guerrero.	5	Silviano González y socios.
La Exposición.	Temósachic.	20	Federico de la Vega.
El Tesoro.	„	16	Federico de la Vega.
Las Fronterizas.	„	44	Pedro Macías.
Monterrey.	„	32	R. S. Truin y socios.
Siete Estrellas.	„	9	Roberto E. Vance y socios.
Montecristo.	„	20	Walter Browning y socios.
El Conde.	„	10	Walter Browning y socios.
San Gonzalo.	„	3	Gil de Herrera.
San Félix.	„	8	The Earl Syndicate Limited of London.
La Unión.	„	40	The Earl Syndicate Limited of London.
Esperanza.	„	6	The Earl Syndicate Limited of London.
Hondo de Dios te Guie.	„	24	Dios te guié Gold. Mining Co
La Esperanza.	„	10	The Earl Syndicate Limited of London.
San Salvador.	Namiquipa	3	Francisco Javier Ruiz y soc.
América.	„	20	Hermenejildo Rascón y soc.
Más Prieta.	Temósachic.	1	Dolores Mines Co.
Mayor.	„	2	„ „ „
Buena Vista.	„	2	„ „ „
El Picacho.	„	3	„ „ „
El Borrón.	„	2	„ „ „
Carmen.	„	5	„ „ „
Hidalgo.	Guerrero.	25	Manuel Meras y socios.
S. Francisco del Barril.	„	40	Genaro Forzan y socios.
Cuatro de Julio.	Temósachic.	6	L. A. Dockery.
Bohemia.	„	28	Bayles C. Clark y socios.
La Ca idad.	„	20	John McDonald y socios.
Los Letreros.	„	14	Charles W. Boggs y socios.

Continuación de San Patricio.	Temósachic.	36	Fabián Revilla.
El Ranchero.	„	6	L. A. Dockery y socios.
San Juan.	„	9	La Cía. Minera de Dolores.
Demacías de S. Juan.	„	1	La Cía. Minera de Dolores.
La Fortuna.	„	10	E. Carabeo.
La Asunción.	Namiquipa.	12	M. Aguilar Saenz y socios.
El Clayton.	Guerrero.	12	H. W. Jungk y socios.
Zincville.	„	18	W. H. Hoffman y socios.
Buena Vista.	La Concepción	12	Renne Cognne.
La Descubridora.	Temósachic.	11	Nep. Miramontes y socios.
El Hijo de Montecristo	„	20	Hilario Pérez y socios.
Victoria.	La Concepción.	18	W. H. Hoffman y socios.
Independencia.	Temósachic.	6	Charles W. Boggs y socios.
Poleachic.	„	3	Reinaldo Casavantes.
Santa Eulalia.	„	10	Urbano Zea.
Josefa.	„	15	L. A. Dockery.
Beatrice.	„	11	Manuel Cereghino y socio.
El Porvenir.	Namiquipa.	11	Luis J. Comaduran.
Juanita.	Temósachic.	10	L. A. Dockery.
Aurora.	„	14	Roberto Nichol y socios.
La Empresa.	„	15	L. A. Dockery y socios.
Anexas de la Caridad	„	2.91	L. A. Dockery y socios.
Independencia.	„	59	W. P. Dunhan.
Más Verona.	„	20	Miguel I. Mendelson.
Anexas de la Margarita.	„	8	P. A. Wickam.
De Soto.	„	41	Ed. Ten Eycke.
Utah.	„	200	Edmundo Richardson.
El Progreso.	Guerrero.	6	Cástulo R. Chávez.
María.	Temósachic.	10	L. A. Dockery y socios.
La Gloria.	„	33	L. A. Dockery y socios.
Francés	„	2	L. A. Dockery y socios.
Cuatro Hermanos.	„	42	P. A. Wickham y socios.
Monclova.	„	45	C. Junck y socios.
Luz de Oro.	„	60	P. H. Heffron y socios.
Joplin.	„	9	R. E. White y socios.
La Despedida.	Guerrero.	20	Juan Chávez y socios.
Juárez.	Temósachic.	10	Ramón Chavarría y socios.
La Escondida.	,	23	L. A. Dockery y socios.
Sirena.	„	8	Roberto E. Vance y socios.
El Salto.	„	14	Bailey C. Clark.
La Margharita.	„	24	P. A. Wicham.
La Cobriza.	„	7	Jesús María Casavantes y s.
Conses Valles.	Namiquipa	7	Jesús María Casavantes y s.
La Paz.	Temósachic.	8	Simplicio Reyes y socios.
La Cobriza.	„	45	James Carr y socio.
La Patria.	„	40	Nep. Miramontes.
Hidalgo.	Guerrero.	36	El Continente S. A.

La Libertad.	Temósachic.	48	Urbano Zea.
Guerrero.	„	15	Santiago Casavantes B.
El Manto.	„	12	Urbano Zea.
San Francisco.	„	29	Francisco Carranco.
Promontorio.	„	20	José Rico y socios.
Dos Picachos.	„	34	A. H. Cauch y socios.
La Esperanza.	„	10	Urbano Zea.
América del Sur.	Namiquipa.	25	Guillermo Bünsow.
Chihuahua.	„	32	Guillermo Bünsow.
Capitán.	Temósachic.	10	Rob. E. Vance y socio.
Golondrina.	„	7	Rob. E. Vance y socio.
Nuevo León.	„	26	Jesús Ma. Casavantes.
Carolina.	„	73	J. M. Patch.
El Marruzco.	Guerrero.	12	R. E. White y socios.
Santa Marina.	Guerrero.	24	Urbano Zea y socios.
Mercedes.	Temósachic.	20	Urbano Zea.
San Francisco.	„	12	José Córdoba.
Colonel Jones.	„	12	June A. Hunt.
La Estrella.	„	12	Pascual Orozco y socios.
Lugar.	„	4	Roberto E. Vance y socios.
Más Esperanza.	„	12	Urbano Zea.
San Antonio.	„	20	Alexander Bouthorone.
Olimpo.	„	23	Jesús Cásares.
Huisopa.	„	8	Gil Herrera.
San Agustín.	„	26	Juan A. Hernández.
Caas de Moneda.	„	60	Federico Schmidt.
Hijo de Montecristo.	„	10	Alejo Amaya.
Zaragoza.	„	40	Manuel Rico y socios.
Mascota.	„	60	Francisco J. Fournier.
Demacías de Bohemia.	„	1.85	Dolores Mg. Co.
El Consuelo.	Temósachic.		Consuelo Mg. Milling & Powder
La Prieta.	Guerrero.		Enrique C. Creel.
San Luis Gonzaga.	Temósachic.		Dolores Mines Co.
El Rosario.	„		„ „ „
Juan K.	„		„ „ „
San Salvador.	„		The Earl Syndicate Ld. de Londres.
Providencia.	„		The Dios te Guie Gold Mg. Co.
Venturera.	„		„ „ „ „ „ „ „
Philadelphia.	„		„ „ „ „ „ „ „
La Concordia.	Guerrero.		„ „ „ „ „ „ „
La Regeneradora.	„		„ „ „ „ „ „ „
Tres Amigos (Guaynopa).	„		Tres Amigos Gold Mining Co.
Utah.	„		Mexican Gold Copper Co.
Guadalupe.	„		Edmund Richardson.
Anexas de Dios te guie.	„		The Dios te Guie Gold. Mg. Co.
La Prieta.	„		Dolores Mines Co.
Santa Rosa.	„		„ „ „

COMPLETE LIST OF ALL THE MINING CLAIMS IN THE HIDALGO DEL PARRAL.

Name.	Locality.	Hectaras.	Owner.
San Francisco	Las Cuevas.	7	Guillermo C. Beckmann.
La Luz.	„ „	2	„ „ „
El Nopal y Eureka.	Parral.	7	Cía Minera del Nopal.
San Fco. del Oro.	Sta. Bárbara.	3	Cía. San Francisco del Oro.
San José	„ „	12	„ „ „ „ „
El Agua.	„ „	12	Moctezuma Lead Co.
Alfareña.	„ „	19	Cía Minera S. Francisco del Oro y Anexas.
Preseña y El Salto.	Minas Nuevas	11	Hidalgo Mining Co.
Santo Tomás.	Santa Bárbara.	4.	S. Francisco del Oro Mine Ld
San Rafael.	Minas Nuevas.	12	Santiago y Long.
San Cristóbal.	„ „	3	„ „
La Alfareña.	„ „	11	Hidalgo Mining Co.
El Cabrestante.	Santa Bárbara.	8	Moctezuma Lead Co.
Jesús María.	Parral.	5	Herederos de N. A. Cowdrey
Filadelfia.	„	6	Hidalgo Mining Co.
S. Francisco y Morena.	Minas Nuevas.	18	Hidalgo Mining Co.
Las Vacas.	Santa Bárbara.	8	The Parral Mines Lim.
La Unión.	„ „	8	The Parral Mines Lim.
El Refugio.	„ „	2	The Parral Mines Lim.
Terrenates.	Minas Nuevas.	7	Juan Almanza.
La Palmilla.	„ „	4	Herederos de Francisco Alvarado.
Quebradillas.	„ „	6	Tomás R. Villarreal.
San Gregorio.	„ „	3	Jesús Chávez.
San Pedro.	„ „	3	Jesús Chávez y socios.
San Antonio.	„ „	3	United States Mining Co.
Ampl. de Preseña y El Salto.	Minas Nuevas.	4	Hidalgo Mining Co.
La Gomeña.	„ „	3	Moctezuma Lead Co.
La Prieta.	Parral.	2	José D. Knotts.
Santa Clara.	Balleza.	2	Enrique Bordier.
El Verde y Veta Grande.	Minas Nuevas.	3	Guggenheim Exploration.
El Porvenir.	Santa Bárbara.	3	The Beckman Lt.
Dos Demacías.	Minas Nuevas.	1	Guggenheim Exploration.
Terreritos.	„ „	3	José M. Botello.
El Embajadero.	Santa Bárbara.	3	Dámaso Cano.
San Miguel.	„ ,	3	The Beckmann Mines Co.

La Recompensa.	Santa Bárbara.	2	Ignacio Ortiz y socios.
Santa Rita.	Minas Nuevas.	2	Inés Bueno y socios.
Quebradillas.	„ „	5	James R. Wleard.
Verde y Sangre de Cristo	Parral.	19	Gugenheim Exploration Co.
La Esmeralda.	Minas Nuevas.	2	Cía. La Esmeralda, S. A.
El Tajo.	Parral.	3	Cía. Minera El Tajo.
La Aurora.	Santa Bárbara.	2	The Díaz Mines Ltd.
La Presa.	Parral.	6	Hidalgo Mining Co.
San Juanico.	„	5	„ „ „
La Esperanza.	„	3	„ „ „
Los Hilos.	„	2	„ „ „
Las Gijas.	„	5	„ „ „
La Luz.	„	2	„ „ „
Las Animas.	„	4	„ „ „
San Miguel.	Santa Bárbara.	3	H. C. Gerber y socios.
San José.	„ „	10	„ „ „ „
San Antonio de Caldas.	Minas Nuevas.	1	José M. Botello.
Santa Gertrudis.	Santa Bárbara.	20	H. C. Gerber y socios.
Los Angeles.	„ „	10	Moctezuma Lead Co.
La Soledad.	„ „	2	Teófilo Martínez.
La Soledad.	Las Cuevas.	3	Marcos Basoc.
Santa Inés.	Parral.	2	José M. Botello.
La Antorcha.	„	6	Gugenheim y Cía.
La Favorita.	Santa Bárbara.	6	Moctezuma Lead Co.
Los Remedios.	Minas Nuevas.	2	Albino García.
San Nicolás.	Santa Bárbara.	3	Guillermo C. Beckman.
La Cobriza.	„ „	2	„ „ „
Guadalupe.	„ „	4	Wilsado Vázquez y socios.
Cabritas.	„ „	7	Víctor Esperón.
El Pájaro.	Las Cuevas.	1	Ramón y Tomás Montoya.
El Nopal.	Minas Nuevas.	2	Luis G. Irigoity.
La Vencedora.	Santa Bárbara.	3	Rodolfo Chávez y socios.
La Cruz.	„ „	6	J. F. Johnston.
San Raafel.	„ „	4	Guillermo C. Beckmann.
La Concordia.	Parral.	5	Luis G. Irigoity.
La Paz.	Santa Bárbara.	2	Pedro Elizague.
La Candelaria.	„ „	10	J. F. Johnston.
La Bonanza.	Minas Nuevas.	4	Onésimo Bejarano.
San Carlos.	„ „	1	Albino García.
El Rincón.	Santa Bárbara.	2	Moctezuma Lead Co.
San Pedro.	Minas Nuevas.	5	Albino García y socios.
San Antonio	Santa Bárbara.	4	Moctezuma Lead Co.
San Máximo.	Minas Nuevas.	1	Esmeralda Mining Co.
San Antonio de las Peñas.	„ ,	3	José María Botello.
Los Remedios.	Santa Bárbara.	2	Moctezuma Lead Co.
La Argentina.	Minas Nuevas.	2	Albino García.

Ampl. de la Aurora	Sta. Bárbara	6	The Diaz Mines Limited.
San Diego.	„ „	15	Cía Metalúrgica de Torreón
La Espevia.	„ „	3	Miguel Tinooc.
San Lorenzo.	„ „	4	Aurelio Torres y socios.
La América.	Parral.	3	L. W. Knotts.
San Joaquín.	Minas Nuevas.	14	Blas Bejarano.
Los Fresnos.	Santa Bárbara.	4	Carlos Dietmar y socios.
Los Madroños.	„ „	10	Rafael Aguilera.
La Capitaneña.	„ „	5	Francisco Garza Treviño.
La Purísima.	Minas Nuevas.	6	Emiliano de la Fuente.
Las Auras.	Santa Bárbara.	6	Carlos Dietmar y socios.
La Aurora.	„ „	12	„ „ „
El Carmen.	„ „	8	„ „ „
La Esperanza.	„ „	3	The Beckman Mines Lt.
El Santo Niño.	Parral.	4	José Angel Vargas y socio.
Alta Vista.	Santa Bárbara.	5	Albino García.
La Granadeña.	„ „	3	Hans Arnoldo y Víctor Primrose.
Ampl. de S. Juanico	Minas Nuevas	4	Hidalgo Mining Co.
San Rafael.	Santa Bárbara.	17	Manuel Aguilera y socios.
San Carlos.	„ „	4	Andrés G. Urkuart y socio.
La Blanca.	Zaragoza.	4	Alejandro Elguezabal.
El Retiro.	„	4	Alejandro Elguezabal.
La Encarnación.	Santa Bárbara	5	Albino García y socios.
La Cobriza.	„ „	4	Manuel Aguilera y socios.
Febo.	Minas Nuevas.	6	Francisco Gómez y socios.
Santa María.	Parral.	10	Eulalio Porras y socios.
Guadalupe.	Rosario.	10	Martín A. Mariñelarena.
Adela.	Las Cuevas.	16	Jorge Wich y socios.
San Antonio.	Rosario.	10	Martín Mariñelarena.
La Presa.	Parral.	1	Hidalgo Mining Co.
Cabras.	Santa Bárbara.	2	Víctor Esperón.
La Soledad.	Las Cuevas.	2	Gabino Flores y socios.
Ampl. de S. Antonio	M. Nuevas.	3	United States Mining.
Los Pinos.	Santa Bárbara.	8	Manuel Aguilera y socios.
San Francisco de Pilares.	Id.	4	Moctezuma Lead Co.
Demacía.	Santa Bárbara.	½	Gran Fundición Mexicana de Monterrey.
La Candelaria.	Zaragoza.	6	Alejandro Elguezabal.
La Esmeralda.	„	6	„ „
La Providencia.	Parral.	4	Alejandro Alvarado.
Segovia núm. 4.	Santa Bárbara.	½	Guggenheim Exploration.
La Constancia.	Minas Nuevas.	3	United States Mining.
Demacías de La Constancia.	Minas Nuevas.	1	„ „ „
Ampliación de La Constancia.	„ „	3	„ „ „
La Novedad.	Santa Bárbara.	16	Moctezuma Lead Co.
Segovia núm. 2.	Parral.	6	Pedro Erquicia Sucesores.

El Estandarte.	Santa Bárbara.	2	Rodolfo Chávez.
Ampl. de los Remedios.	Minas Nuevas.	2	Albino García.
Ampl. de S. Carlos.	„ „	1	„ „
La Cobriza.	Santa Bárbara.	10	S. Francisco del Oro Mg. Co.
Veta Rica.	„ „	5	Moctezuma Lead Co.
La Europa.	Parral.	12	L. W. Cuots.
Hércules.	„	1	Marcial Basoxo y socios.
Ampliación del Pabellón.	Minas Nuevas.	5	Albino García y socios.
Ampliación del Estandarte.	„ „	5	Albino García y socios.
Los Hilos.	Santa Bárbara.	10	Víctor Esperón.
El Pleito.	„ „	8	Carlos Schack y socios.
La Esmeralda.	Minas Nuevas.	10	Luis Díaz Couder y socios.
San Carlos.	Santa Bárbara.	4	Rafael Aguilera y socios.
San Pedro.	„ „	1	Antonio Aguilera.
El Potosí.	Las Cuevas.	2	Pedro Alvarado y socios.
Santiago.	Minas Nuevas.	5	James Y. Long.
Las Catitas.	„ „	4	Angel García.
El Pabellón.	„ „	5	Albino García y socios.
El Estandarte.	„ „	5	Albino García y socios.
El Refugio.	„ „	4	Angel García.
La Mecatona.	Las Cuevas.	5	Prudencio Alvarez y socio.
Ampl. del Carmen.	„ „	4	Jesús José Chávez y G.
Las Dos Repúblicas.	Parral.	8	Gerber y Urkuart.
Las Animas.	Santa Bárbara.	3	Carlos Schack y socio.
El Coyote.	„ „	8	Carlos Schack y socio.
San Antonio No. 2.	Minas Nuevas	4	United States Mining Co.
Los Bronces.	Santa Bárbara.	6	José Frendestein.
Orión.	Minas Nuevas.	5	Pedro Elízague.
La Esmeralda.	Parral.	22	Esmeralda Mining Co.
Ampliación de La Argentina.	Minas Nuevas.	2	Albino García.
Santa Rosalía.	Parral.	6	Guillermo Petit y socios.
La Argentina.	„	4	Juan J. Weisel.
Demasías.	Minas Nuevas.	1	Albino García.
Concordia.	Santa Bárbara.	5	Arturo Longega.
San Nicolás.	Minas Nuevas.	8	Salomón de la Garza.
2a. ampl de San Gregorio.	„ „	3	Crisóforo Herrera.
Ampl de Terrenates.	„ „	50	Juan Almanza.
La Reyna núm. 2	Sta. Bárbara.	8	Moctezuma Lead Co.
El Refugio.	Zaragoza.	4	Francisco Portillo.
Demasías de San Antonio.	Minas Nuevas.	25	Carlos Schack y socios.
Demasías de La Valenciana.	„ „	11	Carlos Schack y socios.
La República.	„ „	4	Santiago Cuningham.

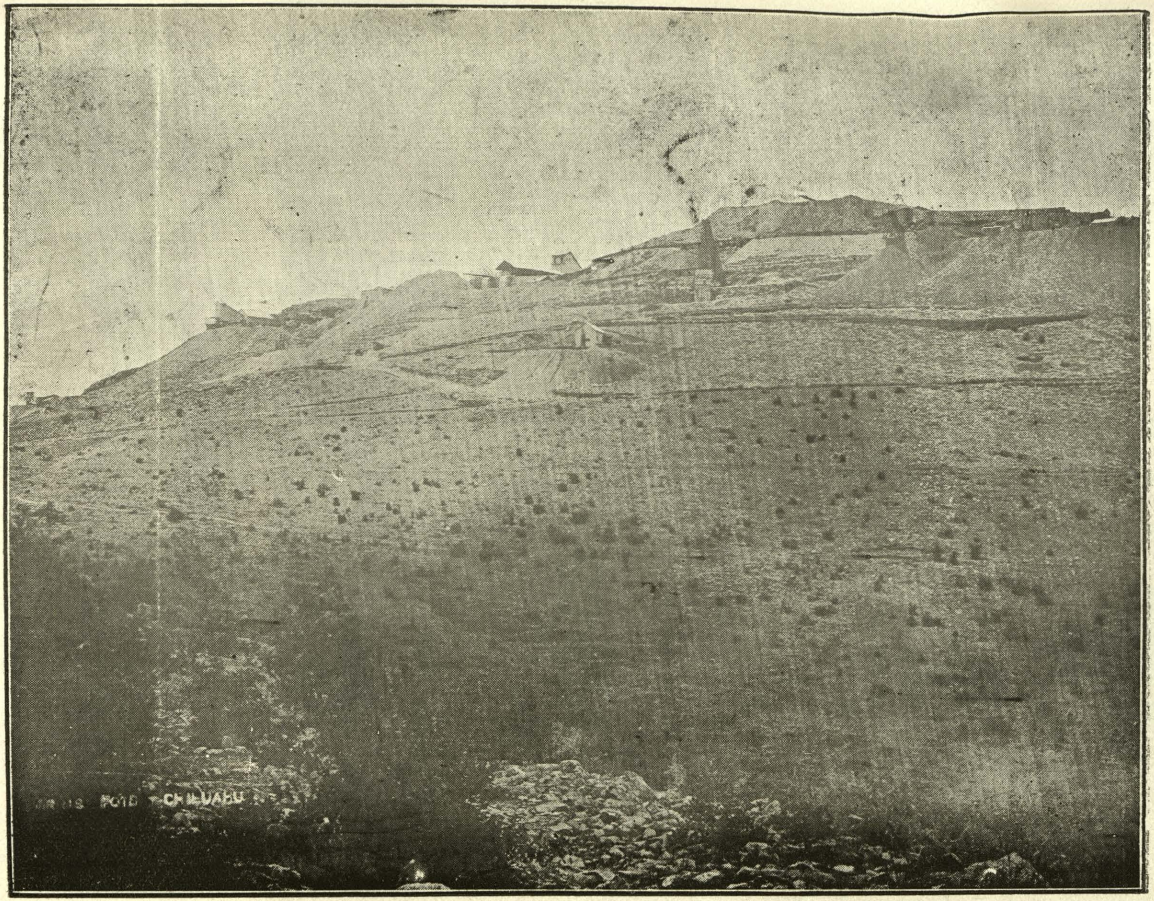
Eureka.	Parral.	6	Jesús Fierro y socios.
La Sierra Madre	Minas Nuevas.	2	Antonio García y socios.
La Mexicana.	„ „	16	Santiago Cuningham.
La Olvidada.	„ „	1	Apolonio Eandoval.
Santa Bárbara.	„ „	6	Apolonio Sandoval.
La Reina.	Santa Bárbara.	4	Moctezuma Lead Co.
La Esperanza.	Olivos.	2	Eduardo C. Knujil.
La Recompensa n. 2	Sta. Bárbara	1	Florencio Villegas.
1a. Ampl. de San Gregorio.	Minas Nuevas.	2	Crisóforo Herrera.
San Salvador.	Parral.	6	Jesús Fierro y socio.
Ampl. de S. Rafael	Sta. Bárbara.	4	Guillermo Beckmann.
La Luz.	„ „	4	Julio Santiesteban.
Santa Eduwigis.	„ „	4	Jesús Fierro Olvera.
2 de Abril.	Parral.	4	Luis G. Irigoity.
Germania.	Minas Nuevas.	40	Carlos Schack y socios.
Ampl del Refugio.	„ „	4	Angel García.
La Providencia.	„ „	3	Alejandro Elguezabal.
El Refugio.	Minas Nuevas	3	Alejandro Elguezabal.
La Favorita.	Parral.	4	Celestino Enríquez y socios.
S. Vicente Ferrer.	„	10	Juan Weissel.
La Buena Fe.	Santa Bárbara.	2	Rodolfo Chávez.
La Coahuilense.	Parral.	4	German T. Romano.
Las Mercedes.	Las Cuevas.	2	Ramón Gómez y socios.
El Refugio.	Parral.	2	Eduardo Irigoity y socios.
Argentauro.	Las Cuevas.	1	Ramón Gómez y socios.
El Salto.	Santa Bárbara.	3	Guillermo C. Beckmann.
Catarinas.	„ „	4	Cía. Metalúrgica de Torreón
Ampl. de las Cruces.	M. Nuevas.	1	Hidalgo Mining Co.
Ampl. de Las Cuijas.	„ „	3	Hidalgo Mining Co.
La Esmeralda.	„ „	10	Emiliano de la Fuente.
S. José de Gracia.	Sta. Bárbara.	3	Carlos Dietman y socios.
Mina Grande de Santiago.	„ „	4	Guillermo C. Beckmann.
El Aguajito.	„ „	6	Manuel I. Llorente.
Landa.	„ „	6	Pedro Erquicia Sucrs.
La Soledad.	„ „	4	Guillermo C. Beckmann.
Ampl. de Los Hilos.	M. Nuevas.	1	Hidalgo Mining Co.
El Bosquecito.	Santa Bárbara.	6	Manuel Aguilera y socios.
Ampl. Terrenates.	Minas Nuevas.	4	Juan Almanzan.
Nueva Australia.	Santa Bárbara.	5	Albino García.
La Varita.	„ „	5	Miguel Tinoco.
San Martín.	„ „	20	Pedro Elizague.
Nuestra Señora.	„ „	10	Cía Minera S. Francisco del Oro y Anexas.
La Central.	„ „	3	Moctezuma Lead Co.
La Central No. 2	„ „	7	Moctezuma Lead Co.
El Polo Norte.	Minas Nuevas.	10	Ambrosio Barraza.
La Cruz.	Santa Bárbara.	6	Moctezuma Lead Co.

San Pedro.	Parral.	4	James Terry y socio.
Carbonato.	Minas Nuevas.	4	G. P. Mackey.
Ballona.	Santa Bárbara.	10	Justo Prieto.
La Soledad.	Minas Nuevas.	4	Cía. Minera la Soledad y Anexas.
Belem.	Balleza.	6	Kruger y Cía.
Victoria.	Santa Bárbara.	6	Cía. Metalúrgica de Torreón
Ampl. S. Joaquín.	Minas Nuevas.	12	José María Botello.
La Azteca.	Parral.	4	Santos Molinar y socios.
El Potosí.	Minas Nuevas.	6	Carlos Tornesi.
Luisa.	Parral.	3	Luis G. Irigoity.
Las Nueces.	Minas Nuevas.	4	Jesús Hernández.
La Indita.	Santa Bárbara.	10	Exploradora Hidalgo, S. A.
Cuauhtemoc.	„ „	6	Francisco Gomez.
La Reynera.	„ „	3	Luis Tinoco.
La Florida.	„ „	4	Enrique Schefer.
La Primavera.	„ „	4	„ „
La Unión No. 2	Minas Nuevas.	5	„ „
El Aguila.	Santa Bárbara.	7	Enrique Schafer.
Predilecta.	Minas Nuevas.	15	Enrique Schafer.
El Hallazgo.	„ „	2	Cía Minera Sta. Ana y Hallazgo.
Adela.	Santa Bárbara.	10	Juan J. Weissel y socios.
La Montaña.	„ „	6	Juan J. Weisel y socios.
Trino.	„ „	5	Enrique Ridotodo.
San Expedito.	Minas Nuevas.	4	Cía. Minera La Soledad y Anexas.
La Bufa.	Las Cuevas.	2	Francisco Galván.
La Soledad.	Parral.	4	Miguel Pérez y socios.
El Santo Niño.	„	4	Juan Millian y socios.
Marina.	Santa Bárbara.	25	Guggenheim Esptn. Co.
Demasía.	Minas Nuevas.	27	Pedro Alvarado y socios.
Sin Nombre.	Parral.	34	James Y. Long.
Ampl. La Prieta.	„	1	E. W. Knotts.
La Azteca No. 1.	„	3	Marcelo Gutiérrez.
La Plateada.	Las Cuevas.	2	Ramón Gómez y socios.
San José.	Santa Bárbara.	2	Juan Morales y socios.
La Helvecia.	Santa Bárbara.	4	Cía. Coahuilense.
Las Espérides.	Parral.	4	Cía. Coahuilense.
San Agustín.	„	4	Eulalio Porras y socios.
San Martín.	Minas Nuevas.	6	José Brason.
El Culantrillo.	Santa Bárbara.	2	José Brason.
El Conde.	Minas Nuevas.	1	Salomón de la Garza.
El Duque.	„ „	11	Salomón de la Garza.
La Cubana.	Santa Bárbara.	3	Frank L. Tolly y socios.
La Locomotora.	Parral.	5	La Exploradora Hgo. S.
Clarines.	Santa Bárbara.	6	Carlos Dietmar y socios.
Ampl. S. Miguel.	„ „	4	The Beckmann Mines Ltd.
Santa Isabel.	Parral.	3	Luis G. Tarín y socios.

Santa Isabel.	Parral.	4	Benjamín Sáenz y socios.
La Dudosa.	„	4	Francisco M. Domínguez.
La Olvidada.	Minas Nuevas.	17	Apolonio Sandoval.
S. José de Gracia.	Las Cuevas.	3	Jesús J. Vargas y socios.
La Buenaventura.	Santa Bárbara.	3	Rayo Sapién y socio.
La Buena Suerte.	„ „	7	L. H. Puoder y socio.
La Carbonera.	„ „	6	Moctezuma Lead Co.
La Margarita.	Parral.	2	Bernardo Murillo y socio.
Las Conchas.	Balleza.	3	Cruger y Cía.
La Cumbre.	Las Cuevas.	2	Francisco Galván.
La Regeneradora.	Sta. Bárbara.	6	Rafael Aguilar y socio.
La Unión.	Parral.	6	Julio Sandoval.
La Reforma.	Santa Bárbara.	5	Rafael Aguilera y socios.
La Aurora.	Parral.	5	Julio Sandoval.
El Cometa.	„	5	Julio Sandoval.
El Carmen.	Las Cuevas.	2	Rodolfo Chávez y socios.
La Vencedora.	Santa Bárbara.	18	Rafael Aguilera.
La Esperanza.	Parral.	6	Ramón Gómez Salas.
San Antonio.	Santa Bárbara.	6	Jesús Fierro O. y socios.
San Juan.	Minas Nuevas.	3	Carlos Schack y socios.
Demacías S. Antonio	„ „	11	Carlos Schack y socios.
La Esperanza.	Santa Bárbara.	4	Pedro Elizague.
Pansotas.	Parral.	3	Salomón de la Garza.
La Negra.	„	14	Félix Maujer.
La Esperanza.	„	36	Felipe S. Schafer.
San Nicolás.	Las Cuevas.	3	Juan Parad y socios.
La Purísima.	Parral.	6	Pedro Salazar
La Parraleña.	Minas Nuevas.	12	Carlos Schack y socios.
La Prueba.	Parral.	6	Cía. Venecia y Roma.
El Pleito núm. 2.	Santa Bárbara.	2	Carlos Schack y socios.
La Reforma.	„ „	12	Moctezuma Lead Co.
Hidalgo.	„ „	7	Moctezuma Lead Co.
Veta Blanca.	Parral.	3	Narciso Baca y socios.
La Germania No 2	Minas Nuevas	9	Carlos Schack.
La Soleda.	Santa Bárbara.	4	Florencio Villegas y socio.
El Vesubio.	Parral.	4	Carlos Tornesi y socios.
La Escondida.	Santa Bárbara.	1	Florencio Villegas.
Ampl. de la Soledad.	Las Cuevas.	3	Marcos Basoco.
La Guadalupana.	„ „	6	José Torres y socios.
La Fortuna.	Parral.	6	Manuel I. Llorente.
Santa Catalina.	„	8	Juan Almanzan.
San José.	Minas Nuevas.	5	Jacinto Ponce y socios.
El Sarcillo.	Parral.	4	Luis G. Irigoity.
La Taza.	Las Cuevas.	4	Pedro Alvarado.
San Isidro.	Balleza	3	Isidoro Bordier.
Juárez.	Parral.	6	Juan B. Acosta y socios.
Iguán y Sta. Rosalía.	„	4	Guillermo B. Petiti y socios.
Santa Rita.	Las Cuevas	4	Eduardo Irigoity y socios.
La Salcideña.	Minas Nuevas.	2	Juan Millian y socios.

Elena.	Santa Bárbara.	2	A. G. Urquart y socio.
La Estrella núm. 2	„ „	2	Cristóbal López y socios.
Hidalgo.	Parral.	12	Hidalgo Mining Co.
La Paz núm. 3.	Santa Bárbara.	2	Pedro Elizague.
Sangre de Cristo	„ „	4	Nicolás Hernández y socios.
Ampl. la Plateada.	Parral.	1	Villeado Vázquez.
S. Carlos núm. 2.	„	4	Luis G. Irigoity y socios.
La Esmeralda núm. 2.	„	16	Ismael Galán.
Demacías de Santa Gertudis.	Santa Bárbara.	1	Moctezuma Lead Co.
La Sultana.	„ „	6	Moctezuma Lead Co.
El Volga.	„ „	3	Ramón Gómez y socios.
La Prudencia.	Parral.	8	José M. Botello.
Santa Clara.	Santa Bárbara.	3	Nicolás Hernández y socios.
San Pablo.	Minas Nuevas.	7	Blas Bejarano.
La Merced.	Santa Bárbara.	8	J. M. y Bartolo Gutiérrez.
La Invencible.	Parral.	12	Enrique Schaefer y socios.
El Palmar.	„	30	Enrique Schaefer y socios.
Cuba Libre.	Santa Bárbara.	14	Maclovio Gamboa.
La Flauta.	„ „	6	Esteban M. Gándara.
El Porvenir.	Parral.	4	José M. Botello.
Ocampo.	„	2	Juan J. Weissel.
Sin Nombre.	Santa Bárbara.	13	Guillermo C. Beckmann.
Sin Nombre.	„ „	4	Moctezuma Lead Co.
S. Nicolás núm. 2.	„ „	8	Guilermo C. Beckmann.
Monte Cristo.	Minas Nuevas.	3	Salomón de la Garza.
La Gran Bretaña.	„ „	6	Santos Molinar y socios.
Ampl Gran Bretaña.	„ „	3	Santos Molinar.
El Porvenir núm. 2	Parral.	4	Francisco M. Domínguez.
El Coyote núm. 2.	Sta. Bárbara	8	Carlos Schack y socios.
La Cruda.	„ „	7	S. Francisco del Oro Mg. Co.
Porfirio Díaz.	„ „	5	Manuel I. Llorente.
Santo Tomás.	Parral.	4	Cía. Sto. Tomás y Anexas.
San Florencio.	„	15	Francisco Torres y socios.
Coronado.	„	6	Hernández Hnos.
La Reynera.	Las Cuevas.	12	Vicente Visconti.
La Fé.	Santa Bárbara.	8	L. Ponce y C. Ortega.
S. Francisco no. 2	„ „	3	The. S. Francisco del Oro,
S. Francisco no. 3.	„ „	13	The S. Francisco del Oro.
Zaragoza núm. 2.	Las Cuevas	7	Luis Pérez.
Nápoles.	Santa Bárbara.	6	Moctezuma Lead Co.
Valenciana.	„ „	6	Arturo Longega.
María.	Las Cuevas.	10	Luis Fhelan.
El Sultán.	„ „	8	Carlos Tornesi y socios.
El Bronce.	„ „	6	D. W. Fergueson y socios.
La Chiripa	Minas Nuevas	10	Ruperto Aizpuru y socios.
Nueva Olvidada.	Parral.	2	Julio Sandoval.
Santa Lucía.	Santa Bárbara.	5	Benito Gándara y socios.
El Porvenir.	Minas Nuevas.	5	Benito Gándara y socios.

Perros Bravos.	Santa Bárbara.	21	F. Stallforth y Hno. Sucs.
La Perla.	Parral.	10	H. W. Higley y socios.
La Perlita.	„	8	H. W. Higley y socios.
La Libertad.	Balleza.	3	Antonio Rodríguez.
América Libre.	„	6	J. Antonio Rodríguez.
Dem. de la Unión	Minas Nuevas.	2	Julio Sandoval.
El Progreso.	Santa Bárbara.	6	Moctezuma Lead Co.
Carolinas.	„ „	10	Moctezuma Lead Co.
Santa Ana.	Minas Nuevas.	3	Cía. Minera Sta. Ana y Ago.
Ampl. de Sta. Ana	„ „	4	Cía. Minera Sta. Ana y Ago.
Veta Rica.	Santa Bárbara.	1	Moctezuma Lead Co.
La Resolana.	Parral.	2	Cía. Minera Sta. Bárbara.
Apodaqueña.	„	1	José María Botello.
La Trinidad.	Minas Nuevas.	2	Julio Sandoval.
La Palmota.	Parral.	4	Marcial Gutiérrez.
La Reyna núm. 2.	Sta. Bárbara	4	Hernández Hnos. Sucrs.
La Emperatriz.	Las Cuevas	12	Zacarías Persa y socios.
Cristobal Colón.	Parral.	4	Felipe Schaefer.
San Baltazar.	„	10	Enrique Schaefer.
San Baltazar.	Minas Nuevas.	1	Felipe Mauger.
La Germania no. 4.	„ „	2	Manuel Aguilar y socios.
Los Fresnos no. 2.	Sta. Bárbara	6	Carlos Ditmar y socios.
La Esperanza.	Minas Nuevas.	5	Marcos Chavira.
El Volcán.	Parral.	5	Luis Timoco.
La Concha.	„	10	Agustín Domínguez y socio.
La Revancha no. 2.	Minas Nuevas.	16	José M. Botello.
La Revancha.	„ „	16	José M. Botello.
San Camilo.	Las Cuevas.	10	Juan Almanzan.
La Fierrosa.	Santa Bárbara.	6	Arturo Longega.
Santo Tomás.	El Tule	21	Arturo oLngega.
La Mesalina.	Santa Bárbara.	10	Enrique Ridotodo.
Pompadour.	„ „	10	Enrique Ridotodo.
San Pedro.	„ „	14	Bartolo Gutiérrez.
La Paz.	„ „	29	Bartolo Gutiérrez.
La Sorpresa.	Parral.	20	A. G. Uruquat y socio.
La Cruz núm. 2.	Santa Bárbara.	12	J. F. Johnston.
Landa núm. 2.	„ „	6	Pedro Erquicia Sucr.
2a. ampl. La Dudosa.	Parral.	1	Francisco Domínguez.
Sta. Gertrudis 2.	Santa Bárbara.	8	Francisco Gómez y socios.
La Esmeralda.	„ „	6	Francisco Gómez y socios.
Sta. Bárbara n. 2.	„ „	8	J. J. Brazon.
Ampl. La Dudosa.	Parral.	4	Francisco N. Domínguez.
La Luz.	Santa Bárbara.	6	Esteban Gándara y socios.
La Florida.	Minas Nuevas.	10	Francisco Gómez Chávez.
Cinco Amigos.	Parral.	8	Leandro Ríos y socios.
Minerva.	„	20	Enrique Schaefer.
El Nuevo Porvenir.	M. Nuevas.	7	Julio Sandoval.
La Peregrina.	„ „	5	Apolonio Sandoval.
La Luna.	Parral.	10	Carlos Dietmar.



View of Palmilla Mine. Parral District Hidalgo.

Area of Example Acute Apical Dihedral Angles

Virginia.	„	4	José María Alvarez y socio.
San Juan de Luz.	Minas Nuevas.	27	Eduardo Irigoity y socio.
El Jazmín.	„ „	3	Eduardo Irigoity y socio.
Hidalgo.	Las Cuevas.	10	Félix Mauger.
Anita.	Minas Nuevas.	16	James I. Long y socios.
Roldán.	Santa Bárbara.	4	Eduardo Irigoity.
Las Guijas.	Parral.	24	Cía. S. Francisco del Oro.
La Realidad.	Minas Nuevas.	8	Juan Harvie.
Vulcano.	Santa Bárbara.	8	Cía. Metalúrgica de Torreón
Rolando.	Las Cuevas.	8	C. L. Leonard y socio.
Guadalupe núm. 2.	Parral.	10	Vicente Visconti.
Ampl. Las Mercedes.	Las Cuevas.	2	C. N. Leonard y socio.
Guadalupe núm. 3.	Parral	8	Vicente Visconti.
Roncesvalles.	Las Cuevas.	8	Enrique Schefer.
La Recompensa.	Parral.	9	Félix Mauger y socio.
La Gemela.	Minas Nuevas.	12	Narciso Baca.
San Francisco.	Parral.	12	Eduardo Jackson y socios.
Ampl. de S. Pedro.	Minas Nuevas.	5	Guillermo C. Beckmann.
La Inmensidad.	„ „	16	Hernández Hnos.
La Insistencia.	Santa Bárbara.	6	Ramón Hernández y socios.
La Trinidad.	Parral.	6	Tomás Montoya y socios.
La Sultana núm. 1.	Las Cuevas.	10	Feliciano Zermeño.
2a. ampl. de los Hilos	M. Nuevas.	3	Hidalgo Mining Co.
La Frontera.	Parral.	5	Feliciano Zermeño y socio.
El Fogonero.	„	3	Exploradora Hidalgo, S. A.
Santa Brígida.	Minas Nuevas.	2	José María Botello.
El Consuelo.	Parral.	8	José J. Brazón.
La Nueva Soledad.	„	4	Francisco Gómez Chávez.
Anáhuac.	Santa Bárbara.	137	Moctezuma Lead Co.
Alejandría.	„ „	12,72.	„ „ „
Filipinas.	„ „	39.3.	„ „ „
Los Angeles n. 2.	„ „	2	„ „ „
La Ventura.	Santa Bárbara.	1	Moctezuma Lead Co.
Ampl. de Valenciana.	M. Nuevas	8	Carlos Schack y socio.
La Luisa.	Las Cuevas	8	J. J. Brazon.
El Puro.	Minas Nuevas.	5	E. M. Parrish.
El Cerillo.	„ „	6	E. M. Parrish.
Dems. del Porvenir	Parral.	2	Manuel Aguilera y socios.
San Luis.	Las Cuevas	2	C. M. Leonard y socios.
El Cigarro.	Minas Nuevas.	4	E. M. Parrish.
4 de Julio.	Parral.	10	J. I. Vazquiny y socios.
El Rayo.	Santa Bárbara.	8	Enrique Schefre.
Dems. La Nevada 2	„ „	1	Moctezuma Lead Co.
Id. id. núm. 3.	„ „	10	Moctezuma Lead Co.
Independencia.	„ „	8	Enrique Schefer.
Marta.	„ „	10	Emilio Arroyo y socios.
La Fortuna.	„ „	2	Vicenta Gutiérrez y socio.
El Coyote No. 3	„ „	6	Manuel Aguilera y socios.
Germania No. 5.	Minas Nuevas	2	Carlos Schack y socios.

Pompeya.	Parral.	1	Luis Díaz Couder y socio.
Klondyk.	Santa Bárbara.	6	José Larroque.
Andromeda.	Minas Nuevas.	6	Agustín Erquicia.
Carbonalte 2.	„ „	8	G. P. Mackey.
El Encanto.	Las Cuevas.	10	Luis P. Phelan.
San Luis.	Minas Nuevas.	6	Ricardo Rodríguez y socio.
Ampl La Mecatona	Las Cuevas.	8	William H. Mealy.
El Pto. d los Navegantes	Balleza	10	Jesús Manuel Lozano.
Anexas á Wyoming.	Las Cuevas	4	William H. Mealy.
Wiyoming.	„ „	15	William H. Mealy.
Noway.	„ „	13	William H. Mealy.
Ampl de Territorios.	M. Nuevas	2	José Angel García y socios.
La Valenciana.	Minas Nuevas.	12	Albino García y socios.
Don Cástulo.	Las Cuevas.	12	William H. Mealy.
El Centavo.	Parral.	8	Florencio Torres y socio.
La Sorpresa.	Las Cuevas.	6	Rafael Galán.
La Recompensa.	Santa Bárbara.	5	Albino García.
Anex á La Mecatona.	Las Cuevas.	3	William H. Mealy.
La Amistad.	Parral.	18	E. A. Crauser y socios.
El Porvenir No. 2.	„	20	Manuel Aguilera y socios.
La Buena Ventura.	„	2	Guillermo B. Pettit.
La Bretaña.	Minas Nuevas	12	Manuel Aguilera y socios.
Dms. del Salvador.	Parral.	6	Manuel Aguilera y socios.
El Camino.	„	5	Sebastián López.
La Coyotera.	Minas Nuevas.	8	León Reyes y socios.
La Confianza.	Santa Bárbara.	15	J. F. Johnston.
Los Sauces.	Balleza.	4	Isidoro Bordie.
El Aguila.	Santa Bárbara.	4	Manuel Aguilera.
Las Dos Repúblicas.	Parral.	10	A. G. Uruquart y socios.
El Día P. J.	„	10	Florencio Torres.
Anexas de Rolando.	Las Cuevas	2	Luis Phelan.
Ampl. de Rolando.	„ „	10	Luis Phelan.
La Germania N. 2.	Minas Nuevas.	3	Carlos Schack.
Omega.	Parral.	3	Eduardo Blanckensee.
Catitas No. 2.	Minas Nuevas.	12	Albino García.
Zaragoza.	„ „	6	León Reyes y socios.
El Salvador.	Parral.	32	Manuel Aguilera y socios.
El Salvador No. 2.	„	40	Manuel Aguilera y socios.
El Pasado.	„	10	Manuel Aguilera y socios.
Negrete.	Santa Bárbara	4	Miguel Hernández.
Marrí.	„ „	10	James II Long.
Hidalgo.	Las Cuevas.	8	Ismael Galán.
Diamante.	„ „	8	C. R. Dilenbeck y socio.
San Juan del Río.	Balleza.	20	Manuel Aguilera y socios.
El Porvenir.	Parral.	6	Manuel Aguilera y socios.
Santo Tomás.	Balleza.	8	Sebastián López.
El Tepeyac.	Minas Nuevas.	4	Albino García.
La Fortuna.	Parral.	7	Manuel Aguilera y socios.
La Europa núm. 2.	„	6	L. W. Knotts.
Filipinas.	Santa Bárbara.	18	Juan D. Casillas y socios.

Perros Bravos 4.	Santa Bárbara.	2	F. Stallforth y Hno Sucs.
Perros Bravos 5.	„ „	3	„
El Salvador.	Minas Nuevas.	20	Narciso Baca.
Roncesvaux.	Las Cuevas.	30	William H. Mealy.
La Soledad N. 2.	Minas Nuevas.	2	Pedro Alvarado y socios .
Providencia.	Parral.	18	Pedro T. Gómez y socios.
La Soledad.	Balleza.	6	Carlos Basoco.
La Durangueña.	Santa Bárbara.	8	Gabriel Soto y socios.
El Pinito.	„ „	10	Luis Phelan.
Santa Rosa.	„ „	4	Carlos Guimbarda.
Pilar y Anexas.	Zaragoza.	13	Francisco Portillo.
San Juan.	Santa Bárbara.	10	Bartolo Gutiérrez.
La Ventura.	Parral.	4	Pedro Alvarado y Socios.
Vesper.	„	2	Cía Minera Vesper y Anexas
La Escuadra.	„	4	„
Guadalupe.	„	10	Vicenta Visconti.
La Olvidada N. 2.	Minas Nuevas	4	Enrique Schefer.
La Nopaleña.	Parral.	12	Bernardo Gilpin, jr.
El Lirio.	Minas Nuevas.	1	„
San Agustín.	Las Cuevas.	10	C. López y socios.
Dems del Volcán.	Parral.	3	Luis Tinoco.
El Zapato.	Ballea.	22	Cruger y Cía.
Hortensia.	Parral.	3	Eduardo Irigoity y socios.
La Invencible n. 2.	„	2	N. Minera La Coahuilense.
Sin Dey.	Santa Bárbara.	100	Pablo Martínez del Río.
La Asturiana.	„	4	Gabino Fernández.
Bienvenida.	Las Cuevas.	10	L. Morales y socios.
Las Peñitas.	„ „	4	Pedro Alvarado.
Moctezuma.	Santa Bárbara.	86	Moctezuma Lead Co.
Cuauhtemoc.	„ „	6	Florencio Villegas y socios.
La Aurora.	Las Cuevas.	6	Florencio Villegas y socios.
Dems. de Parral.	Parral.	1	Julio Sandoval.
La Fierrosa.	Las Cuevas.	2	Enrique Schefer.
Ampl. de Hércules.	Parral.	5	Alberto López.
El Progreso.	Santa Bárbara.	6	Agustín Bermen.
Dems. de Resolana.	Parral.	1	José M. Botello.
San Francisco	Las Cuevas	3	Guadalupe Galván.
La Giralda	„ „	2	Antonio R. Ortiz.
La Corregidora	„ „	6	„
Santa Fé	Baleza	6	Celso Amparán.
Fin de Siglo	Minas Nuevas	7	Fernando de Dios.
Zaragoza N. 1	Las Cuevas	5	Luis Pérez.
Perros Bravos VI	Santa Bárbara	3	Leopoldo Iwonsky.
Dems. de Homero	Minas Nuevas	2	J. Weissel.
Las Dos Repúblias	Parral	20	Andrés G. Urquart y socio.
San Expedito	Las Cuevas	10	Saturnino González y socio.
Las Maravillas	Santa Bárbara	20	Albino García y socios.
Guadalupe	Parral	4	Patricio Páez.

S. Vicente Ferrer 2	Parral.	10	Eduardo M. Blankense.
Dems. de Juárez	„	1	José M. Botello.
Catitas núm. 3.	Minas Nuevas	2	Albino García.
El Castigo	Las Cuevas	3	Enrique Schefer.
La Sorpresa 3	Parral	3	Andrés G. Urquart y socio.
Dems. de Hortencia	„	3	Luis Irigoity.
El Indio	„	7	Ramón Hernández y socios.
Santa Lucía.	„	4	José M. Botello.
La Soledad 2	Las Cuevas	6	G. Guzmán y socios.
Porfirio Díaz	Santa Bárbara	2	Moctezuma Lead Co.
La Estrella	Parral	10	W. Knotts y socios.
Aida	Minas Nuevas	45	J. J. Brazon.
Guadalupe	Santa Bárbara	4	Guillermo C. Beckmann.
El Caballo Prieto	Parral	10	Máximo Fischbein.
Dems de la Soledad de la Presa	„	1	A. G. Urquhart.
Palermo	„	4	Jesús Sáenz Armendáriz.
El Chico	Minas Nuevas	0.9	Tomás H. Tatcher.
La Concordia	Parral	0.20	M y R Gómez Salas y socios
La Joya.	Minas Nuevas.	4	José Perches y socios.
La Junta.	Santa Bárbara.	20	J. F. Johnston y socios.
La Victoria.	„ „	12	Justo Prieto.
El Gavilán.	Minas Nuevas.	9	M. Parrish.
Guadalupe.	Parral.	12	Gerardo P. Mackey.
La Purísima.	Minas Nuevas.	6	José Barraza.
2a. Dems Maravillas	Sta. Bárbara	2	Albino Garcia y socios.
Las Maravillas 2.	„ „	6	„
Dems. Maravillas	„ „	2	„
El Salvador.	Parral.	10	Francisco Alvarado y socios.
Morelos.	Santa Bárbara.	12	Enrique Scheffer.
Las Dos Repúblicas.	Parral.	10	Andrés G. Urquart y socios.
Ofir.	Minas Nuevas.	6	Miguel Tinoco.
Santa Fé.	Parral.	10	H. W. Molley y socios.
Perros Bravos VII.	Sta. Bárbara.	7	F. Stallfoth y Hno. Sucs.
2a. Ampl. La Prieta.	Parral.	1	L. W. Knotts.
El Triunfo.	Las Cuevas	5	Enrique Schaefer.
Polifermo.	Parral.	7	Jesús Lugo.
Dems. Las Guijas.	„	3	Hidalgo Mining Co.
Ampil. 4 de Julio.	„	3	C. Dietmar y socios.
El Firmamento.	Santa Bárbara.	5	León Reyes y socios.
Atenas.	Parral.	30	Enrique Schaefer.
Dems. de 2 de Abril.	„	4	Luis G. Irigoity.
Carmen.	„	14	Frco. Chaparro Monjarrieta.
Buen Viento.	„	9	Luis D. Couder.
La Sorpresa 2.	„	5	Andrés G. Urquart y socio.
Josefina.	„	11	Cía. Cerro Colorado y Anex.
Dems. S. Patricio	Minas Nuevas.	12	Francisco Gómez y socios.
La Yegua.	Parral.	46	Feliciano Zermeño.

2a. Dms. Valenciana.	M. Nuevas.	0.19	Albino García y socios.
La Valenciana.	„ „	9	„
Anexión.	Parral.	4	Ramón Hernández.
Dems. San Pedro.	Minas Nuevas.	0.24	Albino García.
S. Vicente y Capusaya.	Parral.	3	Félix Mauger.
El Parral.	„	8	Guillermo Martín y socio.
S. Fco. de la Soledad.	„	5	Rosendo Esparza.
San Rafael.	Las Cuevas.	6	J. J. Brazon.
La Unión.	El Tule.	10	José Larroque.
El Rosario.	Minas Nuevas.	8	Erasmo Chávez y socios.
Ampl. de La Aurora.	Sta. Bárbara.	2	The Díaz Mines Ltd.
La Reforma.	Balleza.	4	Victoriano Aguilera.
Chapultepec.	Santa Bárbara.	14	Cía. Metalúrgica Mexicana.
Dems. S. Luis.	„ „	6	J. J. Johnston
Los Espantos.	Parral.	3	Juan B. Baca y socios.
La Golondrina.	Minas Nuevas.	4	Agustín Reyes B.
Santiago de Cuba.	Santa Bárbara	2	Ignacio y Julio Sandoval.
Archiipélago.	„ „	3	Enrique Schaefer.
San José.	Parral.	2	Gerardo P. Mackey.
Alsiviades.	Minas Nuevas.	1	Luis Irigoity.
Sto. Tomás 3.	Parral.	6	Cía. Minera S. Tomás y a.
La Rosa.	„	1	Manuel Aguilera.
Santo Tomás.	Minas Nuevas.	29	Enrique Braden.
La Constancia.	„ „	8	Antonio G. Rubio y socio.
Noé.	„ „	3	Vicente Chávez.
Laffayet.	Parral.	6	Alejandro Elguézabal.
Ney.	„	8	„
Junot.	„	20	„
Napoleón.	„	40	„
El Refugio.	Las Cuevas.	4	Norberto Balera.
Dems. 2 de S. Pedro.	M. Nuevas.	1	Albino García.
Dems. La Negra.	Parral.	5	Alejandro Elguézabal.
La Florida 2.	Santa Bárbara.	6	Enrique Schaefer.
Dems. 2 del Volcán.	Parral.	2	Juan F. Johnston.
La Colorada y Sta. Rosalía.	Las Cuevas.	10	Ramón Gómez y Salas.
Anex Sta. María.	Parral.	10	Francisco Cedilla y socios.
El Parral.	„	36	Julio Sandoval y socios.
San Antonio.	„	10	Tomás J. Hill y socios.
La Granada.	„	12	José Daun.
Dems. La Aurora.	Santa Bárbara.	3	Manuel Aguilera.
Dems. del Palmar.	Parral.	1	„
Almanceña.	„	30	Leopoldo Iwonsky.
La Esperanza.	Santa Bárbara.	16	Pedro A. Gutiérrez y socio.
El Ojito.	Parral.	2	José Murillo.
La Regla.	„	5	Aurelio Bueno y socios.
El Gran Tesoro.	Santa Bárbara.	45	Juan F. Johnston.
La Alianza.	Parral.	0.39	Feliciano Zermeño y socio.

Anex á S. Cristóbal	„	0.36	Santiago I. Long.
El Gran Tesoro 2.	Sta. Bárbara.	40	Jhon F. Johnston y socio.
Ampl. La Azteca 1	Parral.	1	Guadalupe Ríos y socios.
La Flor.	Minas Nuevas.	5	Enrique Schaefer.
La Rosa.	„ „	3	„
La Unión.	Santa Bárbara.	12	„
Sin Nombre.	Parral.	2	Eduardo M. Blankense.
Refugio.	„	3	Juan J. Weissel.
Sin Nombre.	„	0.26	Eduardo M. Blankense.
Dems. Buenaventura	„	2	Leopoldo Iwonsky.
El Muchacho.	Las Cuevas.	4	D. W. Ferguson.
La Granadeña.	Santa Bárbara.	3	Hans Arnol y socios.
Roma.	Balleza.	100	Cía. Minera Venecia y Roma.
Santa María.	„	40	Manuel Aguilera.
El Refugio.	Santa Bárbara.	8	Francisco L. Botello.
Jobe.	Minas Nuevas.	0.32	Vicente Chávez.
El Clavel.	„ „	0.44	Luis G. Irigoity.
Escondida.	Parral.	10	Francisco Berg y socios.
Cinco Señores.	„	12	Gabino Fernández y socios.
El Tajito.	„	4	„
Ampl. de Aida.	Minas Nuevas.	2	Cía. Minera La Coahuilense.
San Francisco.	Santa Bárbara.	10	Blas Aguirre y socios.
Don Quijote.	„ „	10	Jesús Saiz Armendáriz.
Chantre Ramos.	„ „	30	Lauro Ramos.
La Fé.	Parral.	4	Ramos Chávez y socios.
La Casualidad.	„	2	B. B. Fourt y socios.
Anexas de Cuba.	„	1	Julio Sandoval y socios.
Santa Teresa.	Zaragoza.	6	Cesáreo Barraza y socios.
Promontorio.	Parral.	4	Ricardo Rodríguez D
Alta California.	Santa Bárbara	54	Juan F. Johnston.
Dems. de Cuba Libre.	Parral.	2	„
Amparo.	„	10	Rodrigo Uribe y socios.
El Siglo XX.	Las Cuevas.	3	Lorenzo Morales y socios.
Buenos Aires.	„ „	6	León Reyes.
Máximo Gómez.	Santa Bárbara.	8	Juan F. Johnston.
La Soledad No. 4.	Las Cuevas.	4	Concepción Ríos y socios.
Santa Bárbara.	Santa Bárbara.	1	José I. Prieto.
La Sociedad.	„ „	13	Enrique S. Schaefer.
Anita.	Parral.	8	Francisco Gómez Chávez.
La Libertad.	„	8	Carlos Pérez y socios.
Florinda.	Santa Bárbara.	10	Lauro Ramos.
Adela No. 2.	Las Cuevas.	2	Jorge Uriche.
La Judía.	„ „	8	Felipe Arellano hijo.
Cinosura.	Santa Bárbara.	25	Giraldo Posadas.
La Insistencia.	Parral.	2	José Murillo.
San José.	Minas Nuevas.	5	Miguel Rodríguez y socios.
El Salvador.	Santa Bárbara.	8	Miguel Hernández.
Demasías de Alix	Minas Nuevas.	4	Cía. Minera La Palma.

La Concepción.	Las Cuevas.	27	Eduardo Escárcega.
San Carlos.	Parral.	10	Carlos Guimbarda.
Algonquin.	Balleza.	10	Will Frevol Swoyer.
Santo Domingo.	Las Cuevas.	6	Luis P. Dávila y socios.
Matilde.	„ „	0.35	Cosme Bengoechea y socio.
Santa Clara.	Minas Nuevas.	5	Segundo Zertuche y socio.
San Rafael.	Parral.	11	Primorose y socios.
Todos Santos.	Minas Nuevas.	3	Cía. Minera Sta. Ana y Anex
15 de Mayo.	Santa Bárbara.	10	Feliciano Zermeño y socio.
Netzahualcoyotl	Minas Nuevas.	20	Cía La Soledad y Anexas.
La Resonala.	Santa Bárbara.	10	Lauro Ramos.
Montaña de Plata.	„ „	10	„
El Chamaquito.	Parral.	7	Manuel Gómez Chávez.
La Soledad.	Balleza.	5	Anastacio Jáquez.
Amanda.	Olivos.	20	A. P. Dignowithy.
La Espléndida.	Santa Bárbara.	20	Bibiano Ramos.
Dems. La Insistencia.	Parral.	1	José Murillo.
Grecia.	Santa Bárbara.	3	Enrique Schaefer.
Perseverancia.	„ „	1	„
La Rubia.	Balleza.	30	Will. Frevol Swoyer.
Arthur.	Olivos.	10	E. L. Dignowithy.
Florentina.	Parral.	15	The Hidalgo Placer Mg. Mill
Hidalgo núm. 2.	Santa Bárbara.	10	Enrique S. Schaefer.
Dems. del Porvenir.	Parral.	2	Manuel Aguilera y socios.
Sonámbula.	Santa Bárbara.	4	Moctezuma Lead Co.
Dems. La Germania.	M. Nuevas.	1	Jorge Himinhoffeim.
Perros Bravos 3.	Santa Bárbara.	6	Leopoldo Iwonsky.
La Chinaca.	Parral.	8	Gildardo Posadas.
Filadelfia Girl.	„	21	Silvestre G. Gutiérrez.
Las Paralelas.	Minas Nuevas.	30	Cía El Meridiano, S. A.
Boston.	„ „	10	„
Baltimore.	„ „	6	„
Galveston.	„ „	6	„
Gran Veta.	„ „	10	„
Atenas.	„ „	12	„
Roma.	„ „	18	„
Orange.	„ „	3	„
Transvaal.	„ „	13	„
Natal.	„ „	16	„
Chicago.	„ „	20	„
Intermedias.	„ „	6	„
Londres.	„ „	6	„
Jesús María.	El Tule.	6	José María Loya y socios.
Santa Antonia.	Santa Bárbara.	10	Juan J. Weissel.
El Parral.	Las Cuevas.	6	L. W. Knotts.
Santa Ana.	Parral.	9	Eduardo Becerra y socios.
Sonora.	Santa Bárbara.	26	Juan F. Johnston.
Cortés.	„ „	7	Guillermo B. Pettit.

Ciénegas.	Las Cuevas.	8	Rafael Moriel y socio.
El Sabio.	Parral.	0.37	Saturnino González.
Anex Gran Tesoro.	Sta. Bárbara.	20	Juan F. Johnston.
Dems. Pompadour.	„ „	3	Arturo Longega.
La Lucita.	Parral.	4	Henry Braden.
Dems. Gran Tesoro.	Sta. Bárbara.	12	Juan F. Johnston.
Lo Sonámbula 2.	„ „	1	Moctezuma Lead Co.
San Juan.	Balleza.	10	Ramón Hernández.
Garibaldi.	Las Cuevas	14	Domingo Silva y socios.
Delfina.	Olivos.	18	Hidalgo Placer Mining Co.
Ampl. de Vesper.	Parral.	10	Cía Minera Vesper y Anexas
Demasía.	Santa Bárbara.	1	The Beckman Mines Lt.
Los Remedios.	„	8	Pedro Lobo.
El Triunfo.	„	2	Rafael D. Tarín.
El Rosario.	„	1	„
Poder de Dios.	Las Cuevas.	10	Miguel J. Pérez y socio.
Salomón.	„ „	5	José Luján M. y socios.
Las Maravillas.	Parral.	6	Cía. Consuelo y Anexas.
3a. Dem. S. Antonio.	Parral.	0.8	Carlos Dietmar y socio.
La Forma.	„	4	José M. Botello.
Aquiles.	Las Cuevas.	9	Aureliano S. González.
Descuidado.	El Tule.	8	Francisco Morales.
Dems. Palmarejo.	Minas Nuevas.	1	Luis G. Irigoity.
El Hueco.	Las Cuevas.	8	C. P. Cruger.
Las 2 Escuadras.	Minas Nuevas.	5	José J. Brazón.
La Firmeza.	Parral.	4	Primitivo Uro y socios.
Dos Amigos.	„	6	Tito Arriola.
La Tinaja.	Minas Nuevas.	4	León Reyes y socios.
El Rayo.	Las Cuevas.	10	Juan Bilbao.
La Luz.	Parral.	6	F. Romo y J. M. Casavant.
Garantía.	Minas Nuevas.	8	Cía. Soledad y Anexas.
Dems. 2 de S. Miguel	Sta. Bárbara	1	Cía San Miguel de Solices.
Florentina.	Parral.	1	Francisco G. Chávez y socios
La Dificultad.	„	2	Víctor Esperón.
Ampl. Guadalupe.	M. Nuevas	6	Manuel E. Rosas.
Dems. del Tajo.	Parral.	1	M. Chávez.
Virginia.	„	0.11	Pedro Alvarado.
María.	„	3	Carlos Storek.
Aurora núm. 2.	Minas Nuevas.	5	Julio Sandoval y socios.
Victoria.	Las Cuevas.	10	Cástulo Oaxaca.
Anexas de Corona.	Parral.	10	James F. Flynn.
La Corona.	„	4	„
Cuauhtemoc 2.	Sta. Bárbara.	5	Florencio Villegas.
El Triunvirato.	„ „	21	Luis Tinoco.
La Concepción.	Zaragoza.	3	Guadalupe Casas y socios.
Los Incautos.	Las Cuevas.	10	Hilario Nevarez.
Santa Anita.	Parral.	6	Marcial y Antonio Gutiérrez.
Ds. Santiago de Cuba	St. Bárbara	1	Leonardo Sandoval.

Adelita.	Las Cuevas.	0.33.	León Reyes.
Guadalupe.	Minas Nuevas.	6	Id. id.
México.	Parral.	50	A. L. Rosen.
La Casualidad 2.	„	1	Gerónimo Sanguinetti.
S. Patricio y Anex.	M. Nuevas.	16	Francisco Gómez y Cía.
El Clavo.	„ „	3	Francisco Gómez y socios.
La Reforma.	„ „	8	„
Tentonia.	Santa Bárbara.	15	F. Stallfirth y Hno. Sucs.
El Septentrión.	Parral.	20	Tito Arriola.
Carmen.	Minas Nuevas.	3	Miguel Chávez.
The Raud.	Minas Nuevas.	84	James F. Flynn.
La Isabela.	„ „	42	Parral Deep Level Co.
Ampl. de María.	Parral.	7	Bernardo B. Marshall.
La Confianza.	Minas Nuevas.	12	Doroteo Castañeda.
La Tejana.	Santa Bárbara.	2	„ „
La Asunción.	Minas Nuevas.	10	„ „
La Matutina.	Santa Bárbara.	4	„ „
Virginia 2.	El Tule.	16	José Larroque y socios.
El Faro.	Minas Nuevas.	1	Carlos Guimbarda.
La Central.	Parral.	3	José Murillo.
La Sirena.	Olivos.	16	Carlos Ortega.
La Predilecta.	Parral.	8	Epitacio Lermann y socio.
Las Marías.	Santa Bárbara.	10	Florencio Villegas.
La Boquilla.	Parral.	4	Daniel H. Braly.
La Esmeralda.	Santa Bárbara.	4	Independencia Mining Mll.
La Estrella.	„ „	3	Pascual Arellano y socio.
La Central.	Parral.	4	Edger Kock.
Body.	Olivos.	10	E. L. Dignowity.
Morelos.	Las Cuevas.	8	Félix Maujer.
5 de Mayo.	Santa Bárbara.	10	Exploration Co. Beleville Lt.
Camelia.	Parral.	6	Eduardo Irigoity.
Exon de Los Esapntos.	„	1	Juan B. Baca.
Solita.	Las Cuevas.	6	Antonio R. Ortiz.
Corregidora.	„ „	4	„
Promontorio.	Santa Bárbara.	10	Luis F. Pehelan.
La Victoria.	„ „	21	Ambrosio Ramos y socios.
El Crédito Leonense	„	7	Everardo G. Escárcega.
La Espectativa.	„ „	5	Joaquín Botello y socio.
Dems. de S. Luis.	Minas Nuevas.	0.25.	León Reyes.
Ampl. de Amada.	Olivos.	5	Ramón Gómez Salas.
Ampl. del Pinito.	Santa Bárbara.	5	Luis Pehelan.
Santa Eduiwiges.	Parral.	12	Pedro Alvarado.
Aurora No. 2.	Santa Bárbara.	8	Guillermo C. Beckmann.
Dems. Aurora 2.	„ „	0.41.	„
Dewey.	Las Cuevas.	8	Luis Phelan.
4 de Julio.	Santa Bárbara.	12	Alfredo H. Kraft.
El Cafre.	„ „	10	Jesús Sáenz Armendáriz.
El Milagro de la Virgen	Cuevas	6	Luis Pérez.

El Abrigo.	Santa Bárbara.	21	Carlos Guimbarda.
La Previsora.	Las Cuevas.	6	Cía. Cerro Colorado y anex.
Los Remedios 2.	Parral.	6	Cía. Consuelo y Anexas.
Cuevecillas.	„	2	Teodoro Yáñez y socios.
El Porvenir.	„	10	Arnoldo Moreau.
La Mascota.	„	6	Rafael D. Tarín.
Victoria.	Balleza.	9	Pablo Alvarez.
Dems. de S. Luis 2	Sta. Bárbara.	1	Filemón A. Schaefer.
El Sable.	Parral.	5	Enrique Braden.
Dems. del Rey.	Santa Bárbara.	22	Luis Tinoco.
Ampl. de Consuelo.	Parral.	6	Cía. Consuelo y Anexas.
El Nigromante.	Santa Bárbara.	5	Aureliano de León.
La Gran Tenoxtitlán.	Parral.	2	Jesús Cisneros Olivas.
Ampl. la Soledad.	Santa Bárbara.	4	León Reyes.
El Danubio.	„ „	40	Luis Tinoco.
Amp Coahuilense.	Minas Nuevas	2	Germán F. Romano.
Las Palmas.	Parral.	7	Manuel Gómez Chávez.
La Fortuna.	„	6	D. Valles.
La Liga.	Minas Nuevas.	22	Parral Deep Level.
La Amistad.	Parral.	0.83.	León Reyes.
La Predilecta.	Santa Bárbara.	10	Roberto R. Hampton y socios
Dems la Oliver.	Parral.	4	James F. Flynn.
Dems La Vencedora.	Sta. Bárbara	0.27.	Guillermo A. Burr.
La Providencia.	„ „	4	Florencio Villegas.
La Parreña.	Minas Nuevas.	15	Cía. La Coahuilense.
La Predilecta 2.	Parral.	4	Epitacio Lerma y socios.
El Fraternal.	Minas Nuevas.	6	León Reyes.
La Cantera.	Balleza.	10	Ambrosio Hernández.
El Rey.	Minas Nuevas.	8	León Reyes.
Barardón.	Las Cuevas.	10	Rodolfo Chávez y socio.
Logaritmos.	„ „	6	Genaro Ochoa y socios.
El Refugio.	„ „	7	Esteban García.
La Constancia.	„ „	4	„ „
Agamenon.	Parral.	3	Filemón A. Schaefer.
La Cruz.	Las Cuevas.	5	Enrique S. Schaefer.
Augusto.	Santa Bárbara.	8	Filemón A. Schaefer.
La Florida 3.	„ „	9	Enrique S. Schaefer.
Aquiles.	Parral.	3	Filemón A. Schaefer.
La Porvidencia.	Las Cuevas.	8	José Torres y socios.
Sta. Eduwiges 2.	Santa Bárbara.	26	Juan F. Johnston.
Oneida.	„ „	14	„
La Fronteriza.	Minas Nuevas.	10	Rafael Galán.
Dems. de Camelia.	Parral.	3	Eduardo Irigoity y socios.
Morelos.	El Tule.	20	Ramón Alvarez.
El Salto.	Minas Nuevas.	3	Rodolfo Sostman.
Dems. la Libertad.	Parral.	4	Carlos Pérez.
La Chifladora.	Las Cuevas.	16	Percy B. Butler.
La Iguana 2.	Parral.	4	Bernardino Murillo.

La Reyna.	Minas Nuevas.	0.47.	Ceferino Arámbula.
S. José de P.	Parral.	36	Praxedis González.
Santo Domingo.	Parral.	6	Eduardo G. Edward de Wit
Donato Guerra.	Las Cuevas.	12	Joaquín Durán hijo.
Ampl. del Transvaal.	„ „	44	Luis Pérez.
La Genoveva.	Santa Bárbara.	10	W. B. Stevens.
La Australia.	„ „	8	Wisel y Kock.
La Tosca.	Las Cuevas.	15	James F. Flynn.
Dems. Victoria.	Santa Bárbara.	1	Alfredo A. Kraft.
Tinta.	„ „	36	Cía. S. Francisco del Oro Ld
La Casualidad.	Parral.	5	Albino García.
La Junta.	„	14	Enrique Braden.
Ampl. la Isabel.	Minas Nuevas.	17	Parral Deep Level.
La Aurora.	Parral.	10	Jesús M. Casavantes y socio.
Los Alpes.	Minas Nuevas.	6	Carlos Guimbarda.
Las Carolinas.	Zaragoza.	12	Mateo Portillo y socio.
Eustolia.	Parral.	8	Enrique Hiriart.
Dems. 2 las Maravillas.	„	0.9.	Cía Consuelo y Anexas.
Alaska.	Santa Bárbara.	15	Rafael Aguilera.
Fuerza y Alianza	„ „	10	Francisco Zepeda y socios.
Gran Filón.	Parral.	9	Julián Escárcega.
La Argentina.	Santa Bárbara.	18	Aureliano S. González.
Costa Rica.	Parral.	5	Cesáreo Garza y socios.
La Mariquita.	„	12	Cía. Minera Venecia y Roma.
Venecia.	„	11	„
El Minero.	„	13	„
Nápoles.	„	10	„
El Invierno.	„	49	Manuel Aguilera y socios.
Aguila.	„	10	José Campillo.
Horizonte.	Las Cuevas.	6	Virgilio García.
Crisantema.	Santa Bárbara.	2	Pedro Alvarado y socios.
San Francisco.	Parral.	32	Manuel Aguilera.
Palo Alto.	Santa Bárbara.	3	Exploration Co.
El Patrocinio.	Parral.	6	Celestino Enríquez.
Dems la Tinta.	Santa Bárbara.	2	Eduardo M. Blankense.
Independencia.	„ „	33	John S. Auheart.
Santa Elena.	Parral.	8	Aureliano Valdés.
El Carmen.	„	3	Antonio Pichardo.
San Juan.	Las Cuevas.	5	Felipe Santiesteban.
San Pedro.	Parral.	10	Pedro Lambron.
Gavita.	Minas Nuevas	6	Rosario Caballero.
Anex. Candelaria.	Las Cuevas.	4	Filemón A. Schaefer.
El Rayo n. 2.	„ „	8	Juan Bilbao.
Dos de Abril.	Parral.	6	José M. Aguirre y socios.
La Velia.	Las Cuevas.	10	José Griensen.
Ulises.	Parral.	1	Luis Tinoco.
Luisa.	Santa Bárbara.	2	Pedro Alvarado.
El Indio.	„ „	21	Juan F. Johnston.

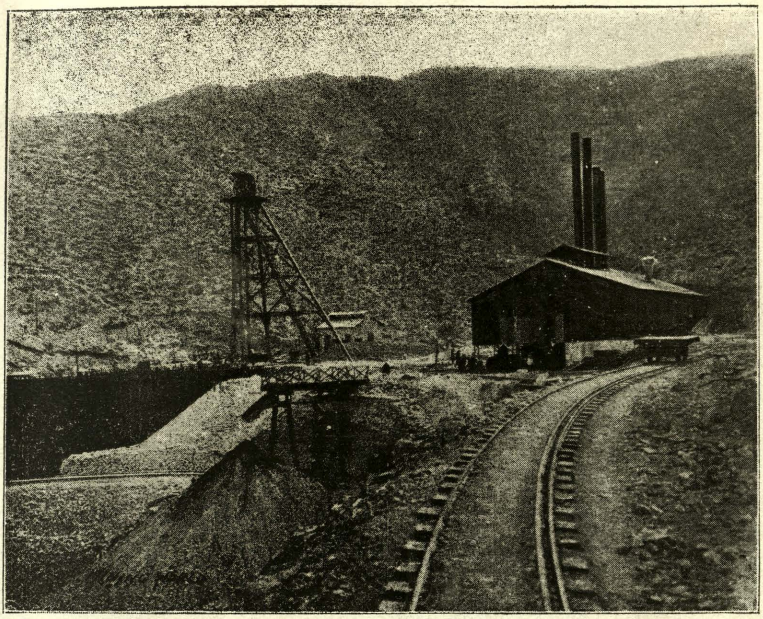
Anex á S. Miguel.	Sta. Bárbara.	1	Andrés G. Urquart.
Santa Rita.	„ „	6	Félix Maujer.
Las Delicias.	„ „	20	Ambrosio Ramos y socios.
El Comanche.	„ „	14	Enrique S. Schaefer.
Guerrero.	„ „	25	„
La Guerra.	„ „	10	„
Santa Mónica.	Rosario.	12	Daniel P. Holland.
Maravillas.	Santa Bárbara.	20	Juan A. Sears y socios.
El Salvador.	Las Cuevas.	8	José Torres y socios.
Santo Niño.	„ „	4	German F. Romano.
Los Borregos.	Santa Bárbara.	8	Jesús Sáenz Armendáriz.
La Reina 2.	Minas Nuevas.	1	Ceferino Arámbula.
La Nena.	Parral.	4	Manuel E. Rosas.
Esperanza.	Santa Bárbara.	9	Narciso Talamantes.
Dems. Sta. Elena.	Parral.	1	Aureliano Valdés.
San Juan.	„	5	Saturnino González.
Morelos M.	Minas Nuevas.	12	Manuel de la Garza C.
La Angostura.	Parral.	7	M. Aguilera y socios.
Victoria.	Las Cuevas.	3	Enrique S. Schaefer.
La Alicia.	Santa Bárbara.	8	Percy B. Butler.
Lugarda.	Zaragoza.	3	Guadalupe Casas.
Los Precavidos.	Las Cuevas.	14	Joaquín Botello y socios.
El Monterrey.	Santa Bárbara.	14	M. Ferrara.
Ampl. la Cruz.	„ „	4	„
Platero.	Parral.	12	Celestino Enríquez y socio.
El Nene.	„	2	Manuel E. Rosas.
S. Miguel n. 2.	Sta. Bárbara.	4	A. Urquart.
Ntra. Señora.	Parral.	6	José M. Botello.
El Porv. de Botello.	„	4	„
El Cometa.	„	5	Julio Sandoval.
La Salcideña.	Santa Bárbara.	0.47.	Jesús G. Pérez.
El Yalú.	Parral.	9	F. Stallforth Hno. Sucs.
Ampl Estrella 2.	Sta. Bárbara.	1	Ramón Alvarez y socios.
La Sierra Madre.	Balleza.	24	Ismael Leal.
Dms. Buenos Aires.	Las Cuevas	1	León Reyes.
Anexiones.	Santa Bárbara.	2	Epigmenio Ayarzagoitia.
Dems Confianza.	„ „	2	Juan F. Johnston.
Vinicio.	Parral.	6	F. Stallforth y Hno. Sucs.
La Buena Fé.	„	4	Romualdo Sepúlveda y socio.
Jesús María.	Santa Bárbara.	10	Ausencio Meléndez.
Triste Esperanza.	„ „	9	B. Petterson.
La Escondida.	„ „	9	Eduardo Anchondo y socio.
Ampl. el Refugio.	„ „	4	Filemón A. Schaefer.
Jesús María.	Las Cuevas.	6	Félix Maujer.
Tiro.	Minas Nuevas.	42	Parral Deep Level.
La Victoria.	Parral.	3	José M. Aguirre y socios.
La Luz.	Santa Bárbara.	4	Everardo G. Escárcega.
Las Playas.	Cuevecillas.	6	Pedro Lobo y socio.

Esparta.	Santa Bárbara.	4	Enrique S. Schaefer.
La Esmeralda 2.	Parral.	4	G. A. Urquart.
La Recompensa.	„	12	José Tamayo y socios.
Jorge Washington.	„	11	Carlos Tornesi.
El Refugio.	Zaragoza.	10	Pudenciano Ontiveros.
San Nicolás.	Parral.	4	Everardo G. Escárcega.
La Soledad.	„	6	Alejandro Rigaud.
La Francia.	Santa Bárbara.	9	Ambrosio Ramos.
La Ventana.	„ „	1	Francisco Chávez H.
La Sultana.	Parral.	18	Rodolfo Sostman.
Benito Juárez.	„	4	Weisel y Kock.
El Nacimiento.	Zaragoza.	9	Manuel Sánchez Villa.
Ampl. San Antonio.	Sta. Bárbara.	6	Carlos Flohr y socios.
Ampl. La Azteca.	Parral.	20	Felipe Arellano H.
La Esmeralda.	Santa Bárbara.	10	Fernando Santacruz.
La Virginia.	„ „	6	Percy B. Butler.
Dems. 3 Perros Bravos	„	0.10.	F. Stallforth y Hno. Sucs.
Crisantema.	Minas Nuevas.	4	Juan Millican.
La Providencia.	Santa Bárbar.	5	Ramón Torres y socio.
La Concordia 3.	Parral.	12	Gregorio I. Rueda.
La Concordia 2.	„	4	Antonio R. Ortiz.
Numancia.	Minas Nuevas.	0.24.	Juan Millian.
La Valenciana.	Santa Bárbara.	4	Francisco Solana.
Puebla.	Parral.	11	Carlos Iwonsky.
Gran Fingal.	Olivos.	84	J. F. Body.
Benito Juárez 2.	Parral.	4	Alberto L. Delattr.
La Puerta del Oro.	Sta. Bárbara	30	Narciso Baca.
Anexas Recompensa.	Parral.	35	James P. Cruger.
El Tesoro.	Santa Bárbara.	2	Jorge Himmighoffen.
Dems. la Almaseña.	Parral.	2	Leopoldo Iwonsky.
Samuel Morse.	Santa Bárbara.	0.71.	Treville F. Casuma.
San Isidro.	Parral.	4	Juan Rodríguez.
Los Federicos.	Zaragoza.	6	Faustino Sáenz.
Armesterang.	Olivos.	38	Eduardo B. Dignowty.
La Demasía.	Minas Nuevas.	1	W. L. Knotts.
Yole.	Parral.	5	Carlos Tornesi y socio.
Veta Gde. de Zaragoza	Zaragoza.	25	José M. Rodríguez y socio.
Sierra Madre 2.	Parral.	8	Juan Gutiérrez.
Santo Niño.	Santa Bárbara.	5	Ramón Torres.
La Esfinge.	„ „	2	Juan J. Weissel.
Ampl. Sta. Rita.	„ „	7	Félix Maujer.
Los Peñoles.	„ „	25	Ramón C. y Salas.
La Favorita.	Parral.	4	Esteban García y socio.
La Palmira.	„	81	Manuel Aguilera.
La Palmira.	„	81	„
La Purísima.	Santa Bárbara.	16	Florencio Villegas.
Sinney.	„ „	20	J. J. Brazón.
Tres Reyes.	Parral.	13	John F. Johnston.

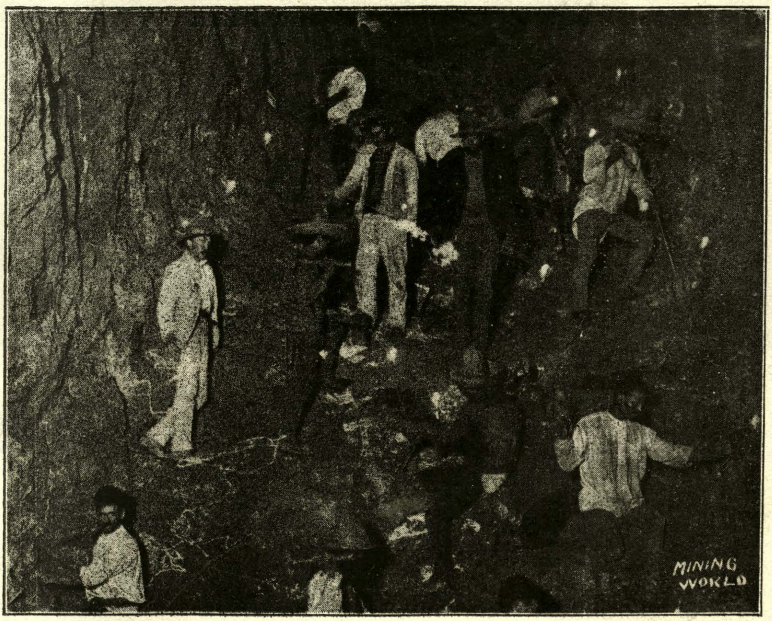
Dems. Esmeralda.	Parral.	0.43.	Andrés G. Urquart.
San Vicente.	„	8	Benito Aguirre.
Oportunidad.	Santa Bárbara.	8	Francisco Galván.
Recompensa. S. Isidro las Cuevas		7	Félix Maujer.
La Recompensa.	Zaragoza.	18	Alejandro Rigaud y socios.
San Esteban.	Santa Bárbara.	0.12.	Manuel Gómez Chávez y s.
La Aislada.	Huejotitán.	9	L. W. Knotts.
La Buena Fé.	Parral.	16	Daniel H. Bradley.
La Vencedora 2.	Sta. Bárbara.	6	León Reyes.
Hiawatha.	Santa Bárbara.	49	Frank Fletcher y socios.
Ampl S. José.	Parral.	12	Santos Molinar.
La Unión.	Zaragoza.	30	Reyes B. del Río.
San Rafael.	Minas Nuevas.	2	Faustino Sáenz y socio.
La Banco H.	Parral.	5	Manuel Aguilera.
El Meridiano.	Las Cuevas.	55	Luis Pérez.
Luz y Julieta.	Parral.	6	Ramón Hernández y socios.
La Libertad.	„	10	León Reyes.
Ampl. Sta. Elena.	„	6	León Reyes.
Almirante Togo.	„	6	Santos Molinar.
Ruth.	Huejotitán.	12	J. W. Konotts.
Trinidad.	Parral.	8	Telesforo Velázquez.
Nuevo Cigarrero.	Zaragoza.	12	Jesús Sáenz Armendáriz.
Protectora.	Parral.	3.44.	Everardo G. Escárcega.
Cuadras.	„	5.55.	Id. id.
Togo.	„	1	Santiago Hambleton.
Garibaldi.	„	15	Epigmenio Ayarzagoitia.
El Tibet.	Santa Bárbara.	97	Narciso Baca.
Hidalgo y Costilla.	„ „	10	Francisco Orozco Gámez.
Last Chance.	Parral.	54	Guillermo C. Beckmann.
La Esperanza.	„	5	Felipe Santiesteban y socio.
Las Demasías.	„	2.58.	Santos Molinar.
La Chiripa.	Olivos.	38	Jesús Lugo.
La Reina Azteca.	Parral.	9	Felipe G. Schaefer.
Santa Elena.	Balleza.	25	Ernest F. Ayton y socio.
La Ventura.	Parral.	6	Pedro Alvarado.
Rayón.	„	4.64.	Everardo G. Escárcega.
Las Paralelas.	„	4.64.	Everardo G. Escárcega.
La Unión.	„	19	Frank Berg.
La Piedad.	Rosario.	9	Matías G. Prieto y socio.
La Palmera.	Parral.	5.35.	J. M. y Manuel Amparán.
El Aguila.	„	3.63.	Enrique Braden.
Carmencita.	„	9	Francisco Orozco Gámez.
Puerto Arturo.	Santa Bárbara.	12	Julio Sandoval y socio.
San Antonio.	„ „	16	Leocadio Soltero y socio.
El Carmen.	Parral.	6	Felipe Aguirre y socio.
Virginia.	El Tule.	6	L. W. Knotts.
Pairo.	Parral.	11.10	Carlos Flohr.
Iowa.	„	9.20.	L. W. Knotts.

La Confianza.	Santa Bárbara.	10.22	Filemón A. Schaefer.
Mariscal Oyama.	Minas Nuevas.	50	José M. Sánchez.
Las Maravillas.	Las Cuevas.	21	Cástulo Oaxaca y socios.
San Cayetano.	„ „	4.53.	José R. Gutiérez y socio.
La Esperanza.	Santa Bárbara.	8.30.	J. Frendenstein.
Liliam of Washington.	El Tule.	80	A. B. Murdoch.
Dos Estrellas.	Parral.	10	J. J. Brazón y socio.
San Antonio 3.	Minas Nuevas.	1.21.	United States Mg. Co.
2a. Dems. Constancia	M. Nuevas.	0.8.	United States Mg. Co.
Josefina.	„ „	1	„
Santiago núm. 2.	„ „	0.5.	Santiago Mg. Company.
Santiago núm. 3.	„ „	0.3.	„
Anex Tres Reyes.	Parral.	2.82.	Rodolfo Sostmann.
Santa Fe.	Zaragoza.	31	Pablo Nitchmann.
Zaragoza.	Las Cuevas.	20	León Reyes.
La Salvadora.	Parral.	4.92.	Felipe Santiesteban.
La Igualdad 2.	Santa Bárbara.	31	R. D. McCausland.
Las 3 Marías.	Minas Nuevas.	6	José Alcalá y socio.
Kuroki.	Parral.	0.64.	Filemón A. Schaefer.
La Montaña.	Santa Bárbara.	10	Fernando Fernández.
La Casualidad.	„ „	8	Feliciano Zermeño y socios.
Gran Zona y Corregidora	„	43	Everardo G. Escárcega.
El Eclipse.	„ „	10	Paul Gerhardt.
La Fortuna.	Zaragoza.	20	José M. Guevara.
San Patricio.	Santa Bárbara.	29	Everardo G. Escárcega.
Aldama.	„ „	10	Samuel Rhoda.
El Refugio.	Parral.	6	Juan Gutiérrez Salas.
Veta Roja.	„	5	Francisco Morales.
La Fierrosa.	„	4	José M. Aguire y socios.
El Tunal.	Minas Nuevas.	10	Peón Reyes.
Nueva Almoloya.	Zaragoza.	30	Everardo G. Escárcega.
Nicolás Bravo.	„	21	„
Juárez.	„	15	„
Los Angeles.	„	14	„
Tres Señores.	Las Cuevas.	1.90.	Cayetano Benítez y socio.
Las Estrellas.	Zaragoza.	10.29	Pablo Nitschmann.
Yawatha núm. 3.	Santa Bárbara.	0.64.	J. W. Dougharty.
Laffayette.	Parral.	10	José Girnesen y socios.
Ayack.	„	0.57.	Filemón A. Schaefer.
Palmira.	„	5.20.	Rafael D. Tarín.
Santa Elena.	Santa Bárbara.	4	Felipe Arellano hijo.
San Lorenzo.	Las Cuevas.	2	José Flores Aizpuru y socio.
Los Dos Amigos.	El Tule.	45	L. W. Knotts.
Almirante Togo.	Minas Nuevas.	100	José M. Sánchez.
Bertha.	Las Cuevas.	0.32.	Cayetano Benítez y socios.
Vizcaya.	Parral.	6	Félix Gómez.
La Nueva York.	Minas Nuevas.	3	Manuel M. Martínez.
La Luciérnaga.	Zaragoza.	10	Narciso Baca.

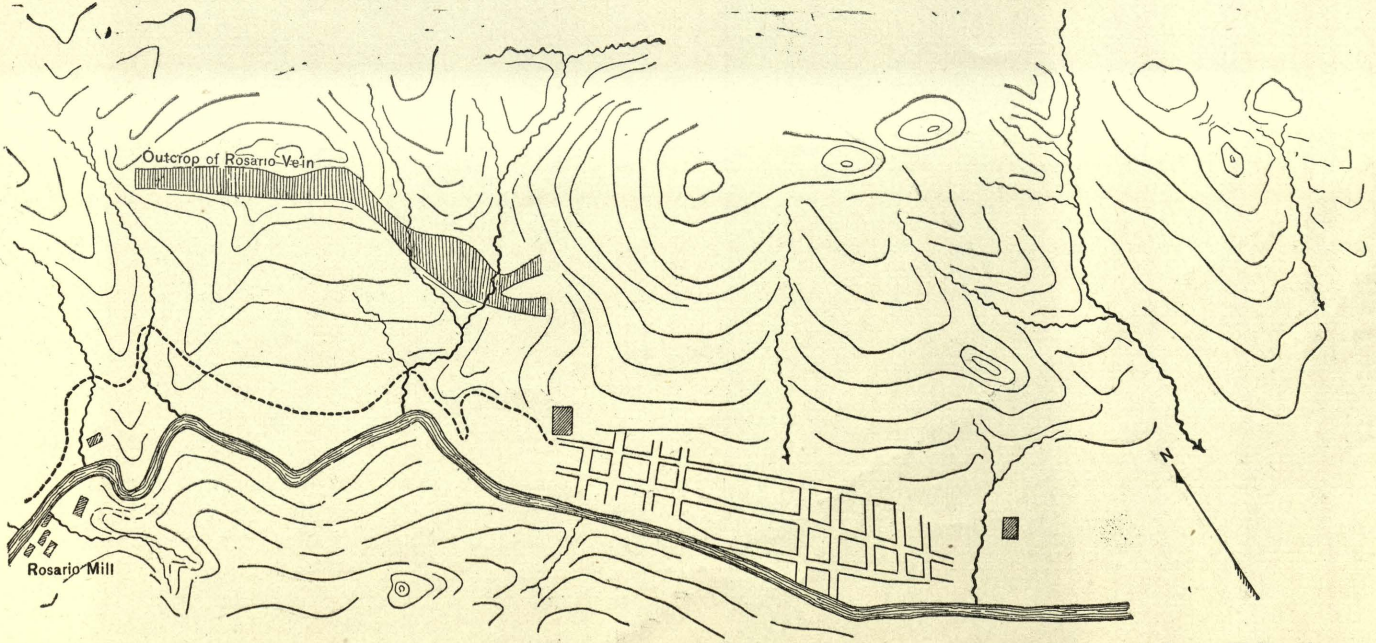
Roma.	Parral.	5.37.	Antonio Decannini.
La Mascota.	Minas Nuevas.	4	Sóstenes Herrera y socios.
Carmen.	Zaragoza.	10	C. H. Keller.
Santa Eduwiges.	„	10	Carlos Tornesi y socios.
Yawatha núm. 2.	Minas Nuevas	6.51.	M. C. Fay.
Damasco.	„ „	5.94.	Francisco Chávez H.
Adela.	„ „	8	Francisco Baca.
Elvira.	Parral.	4	José Griensen y socios.
Tres Hermanos.	„	4	José M. Aguirre y socios.
Paleros.	Minas Nuevas.	4	Everardo G. Escárcega.
Ampl. del Norte.	„ „	22.24.	Cía Soledad y Anexas del



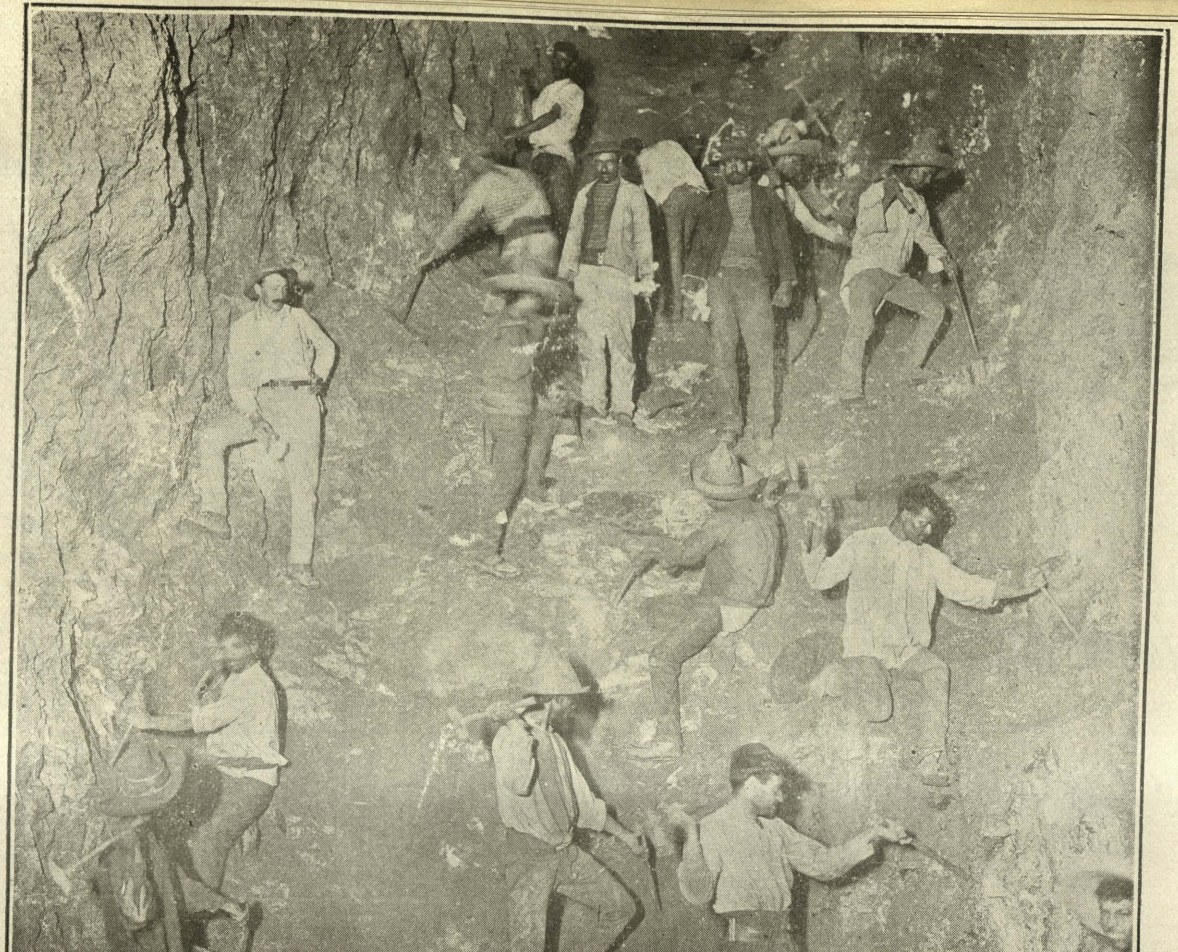
El Potosi Mine. Santa Eulalia, Iturbide District.

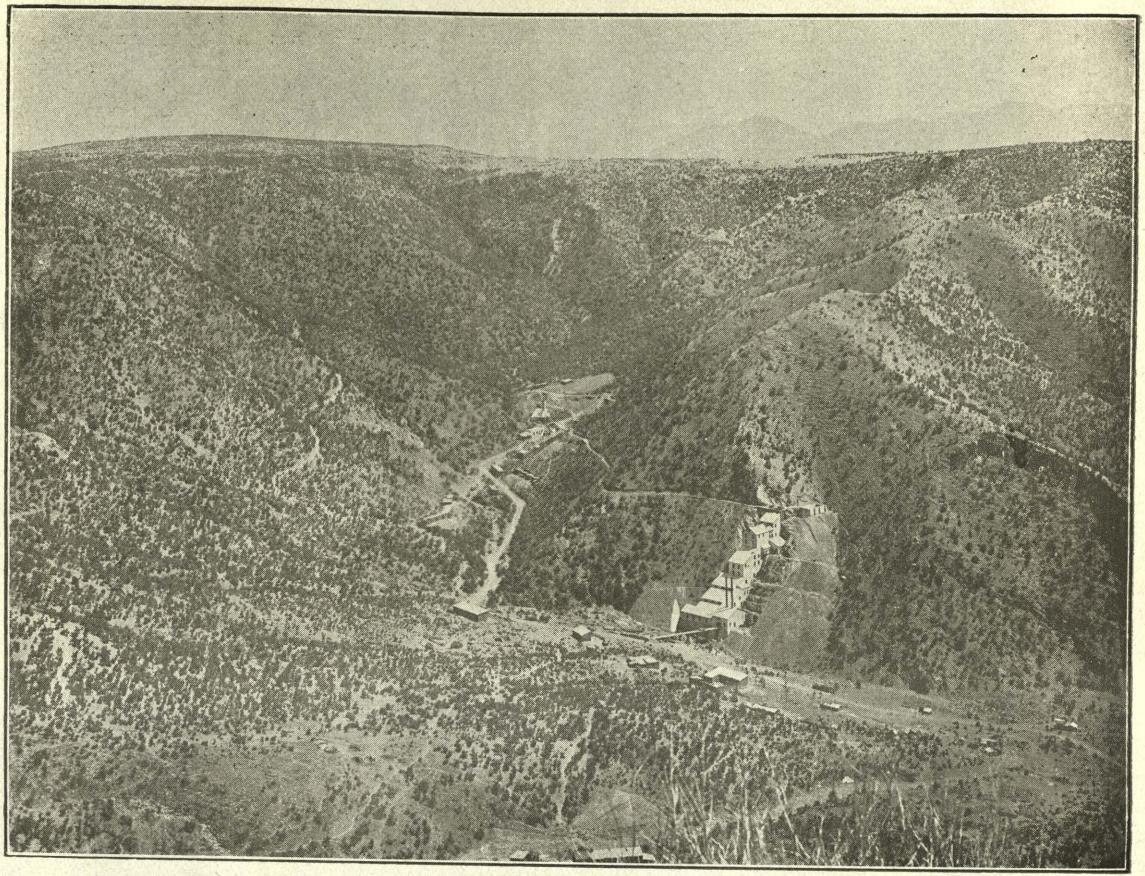


Miners at Work San Francisco d el Oro, Mines Santa Barbara).

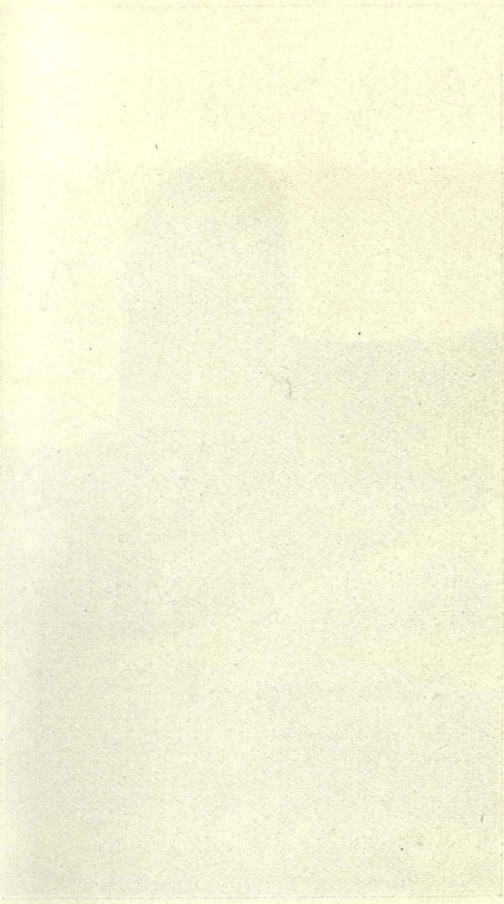


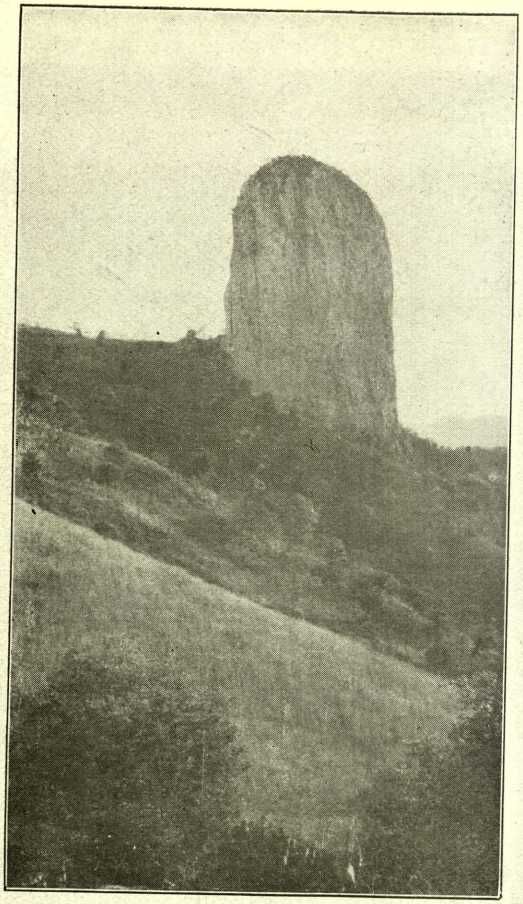
Topographic sketch showing outcrop of Rosario vein and its relation to town, Guadalupe y Calvo, Chihuahua.



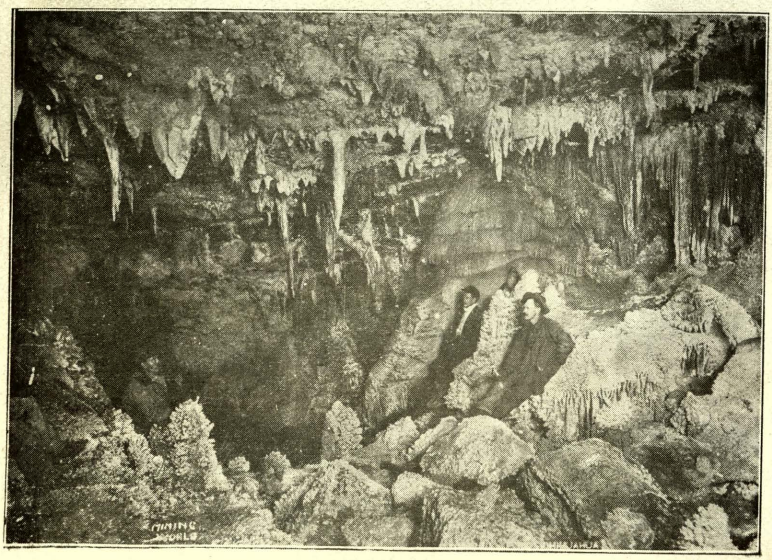


Granadeña Mine and Mill. Santa Barbara, Hidalgo District.

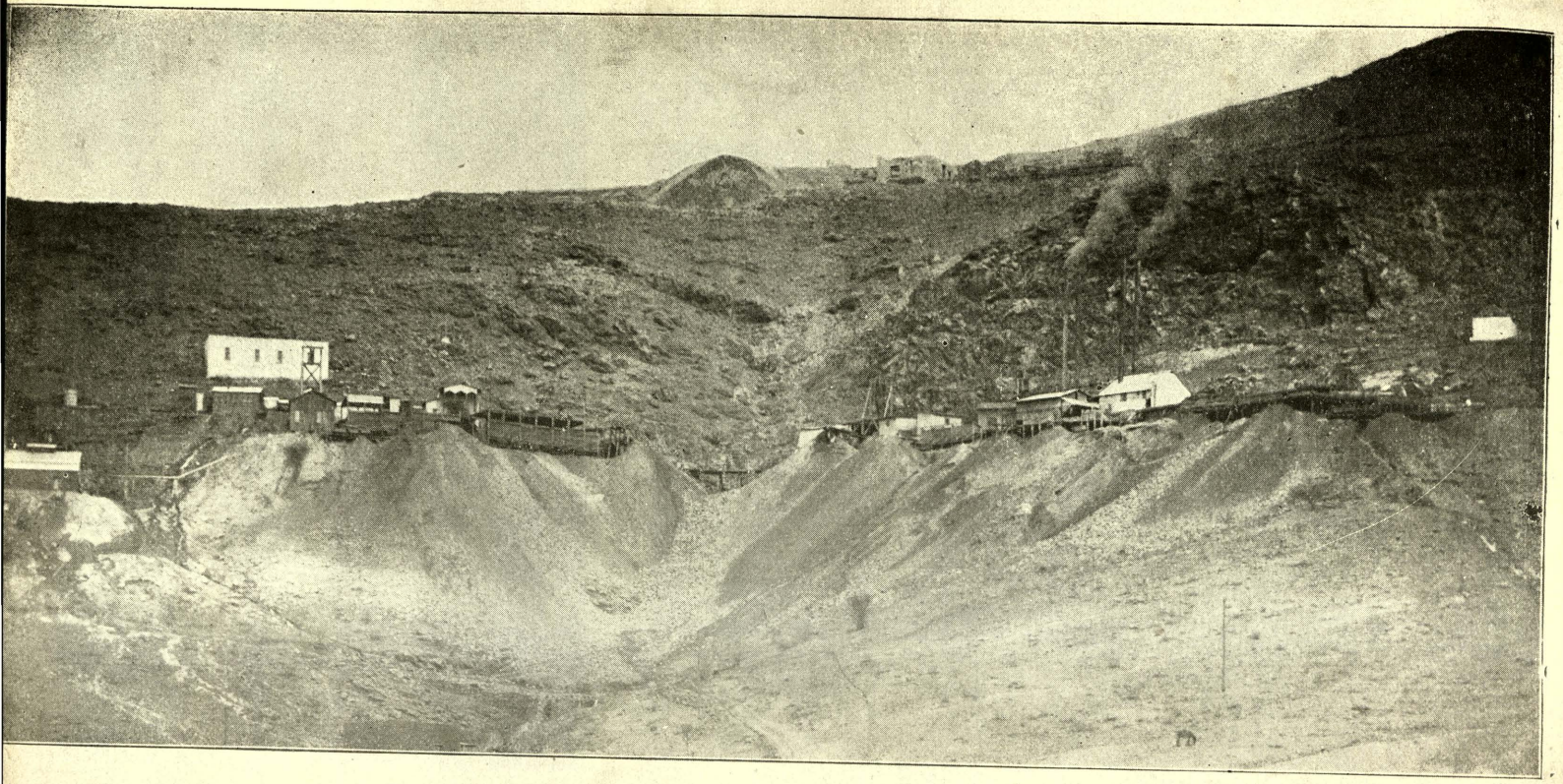




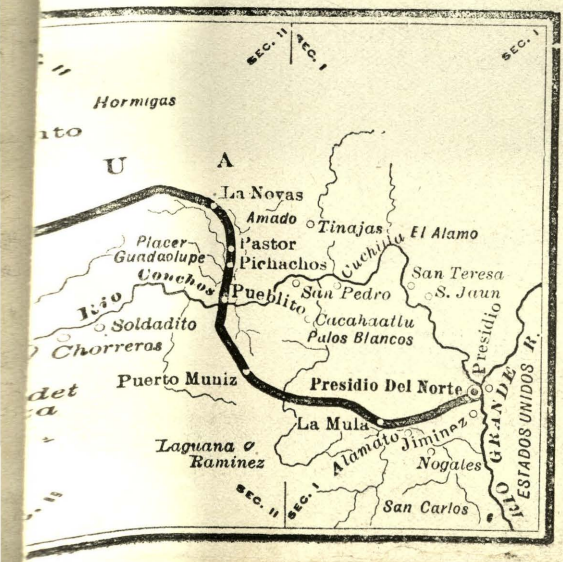
El Pilar. A Natural Phenomenon



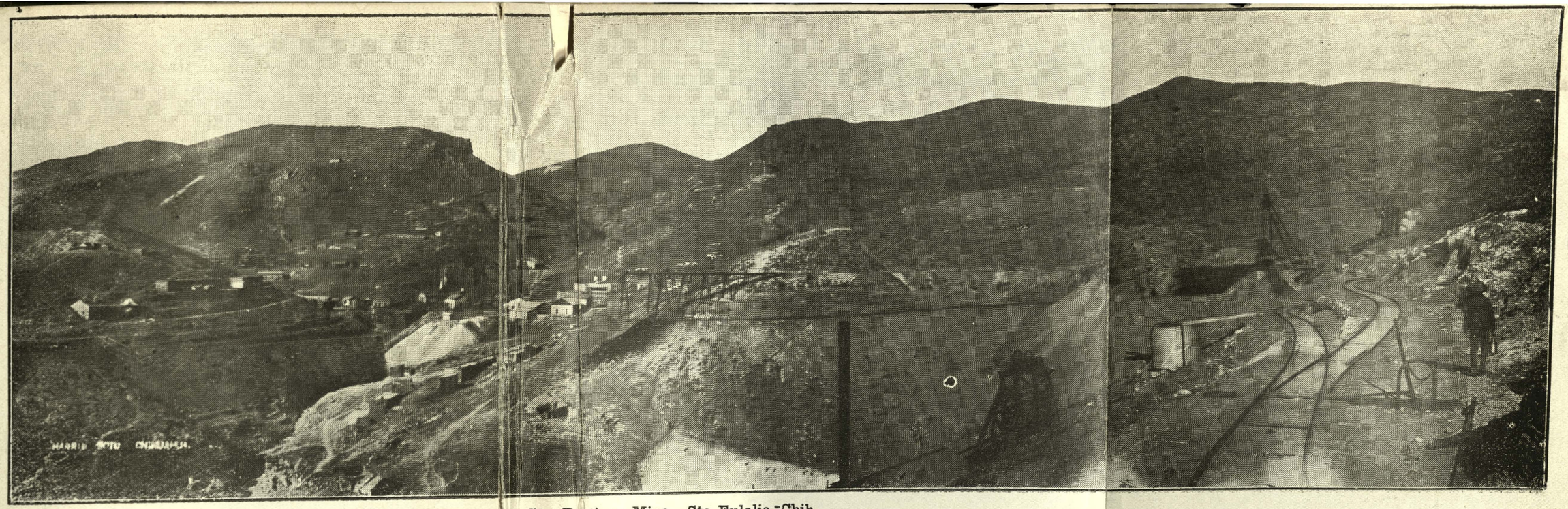
Parcionera Caves. Santa Eulalia.



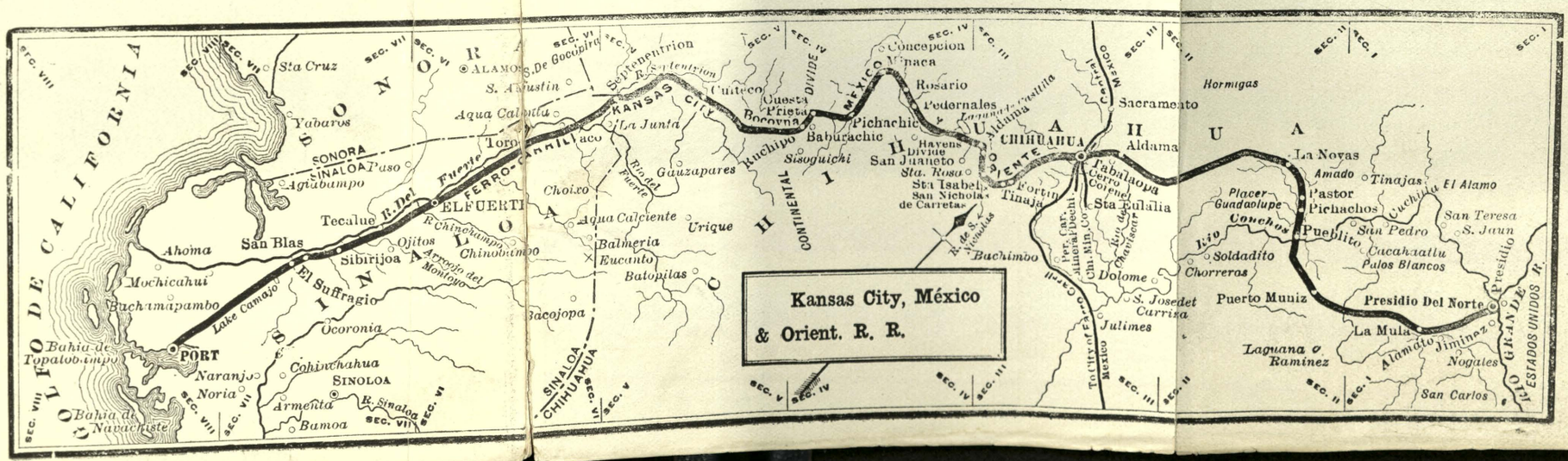
Bird eye view of Quebradilla Mine. Parral Chih.

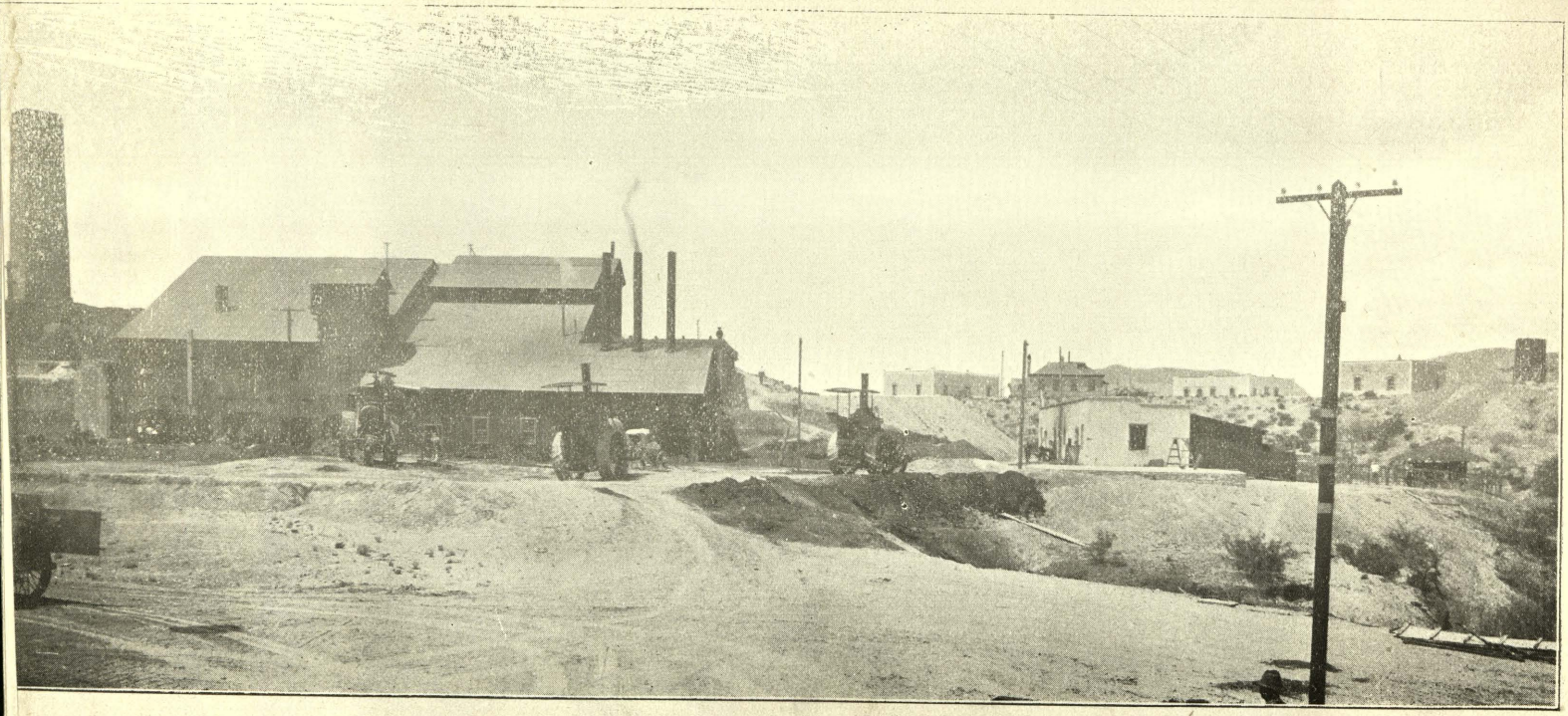

SEC. II
SEC. I
SEC. I
Hormigas
U
A
La Noyas
Amado
Tinajas
El Alamo
Placer
Guadalupe
Pastor
Pichachos
Cuchilla
Conchos
Pueblito
San Pedro
San Teresa
S. Joun
Soldadito
Cacahuatlu
Palos Blancos
Presidio
Chorreras
Puerto Muniz
Presidio Del Norte
La Mula
Laguana o
Raminez
Alamito
Jiminez
Nogales
RIO GRANDE R.
ESTADOS UNIDOS
SEC. II
SEC. I
San Carlos

SEC. VII
SEC. VI
Paso
R. Del
Fuerte
FERRO
ELFUEL
R. Chinchampo
Ojitos
Arroyo del
Montoya
Chinob
birijoa
Sinaloa
SEC. VII
SEC. VI

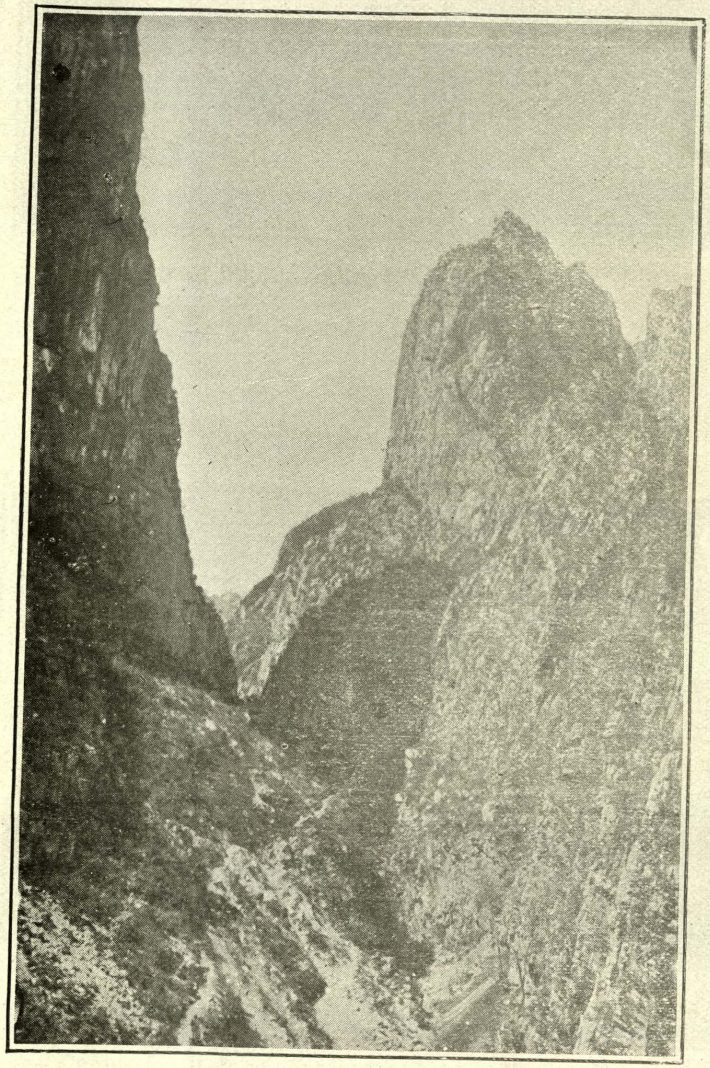


Sto. Domingo Mine, Sta Eulalia, Chih.



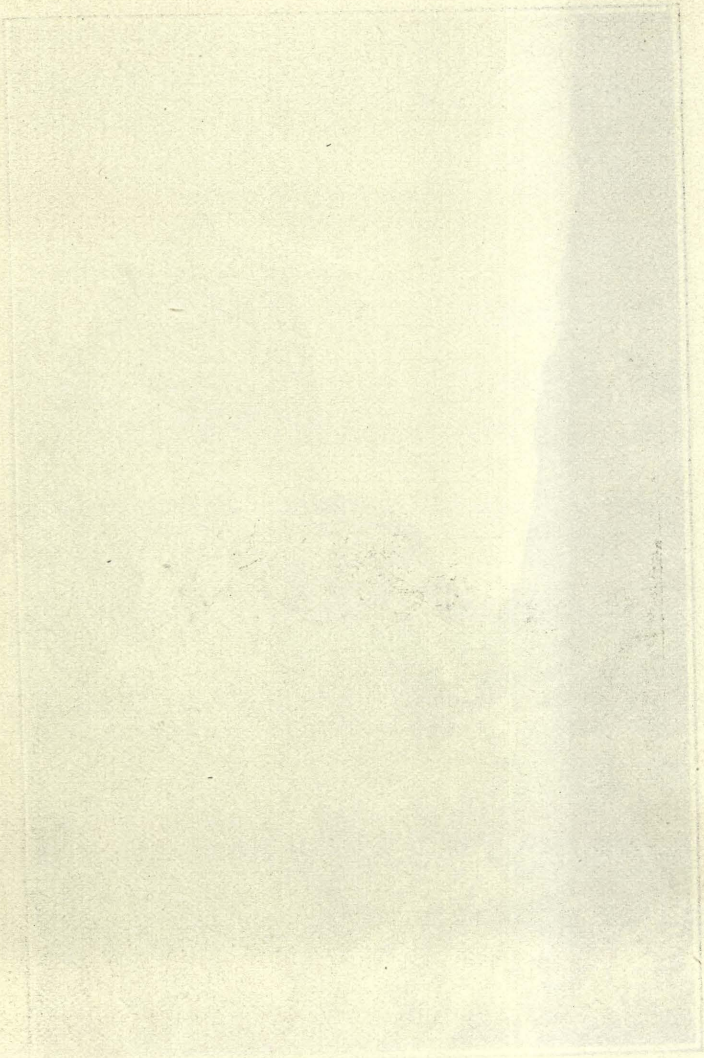


Encinillas Smelter. Santa Rosalía, Chih.

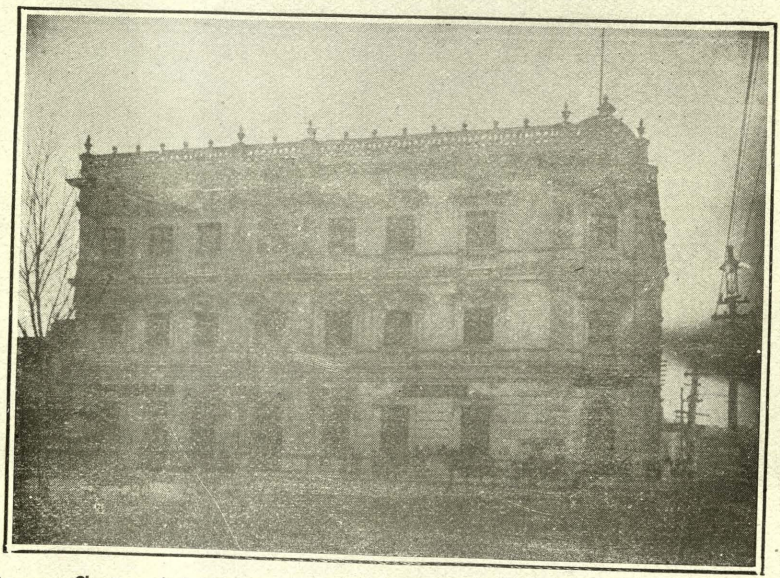


BARRANCA DE TARARECUA.

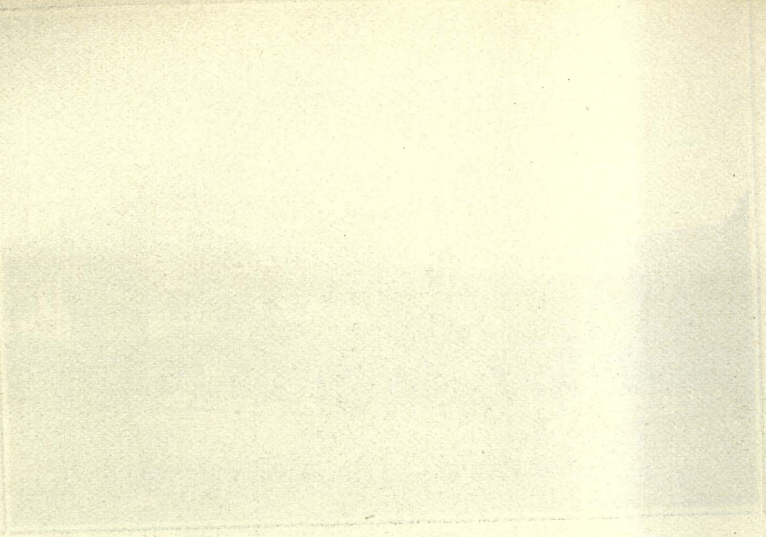
(Known also as Cobre, Batopil as, Urique & San Carlos.)
5,000 ft. in Depth.

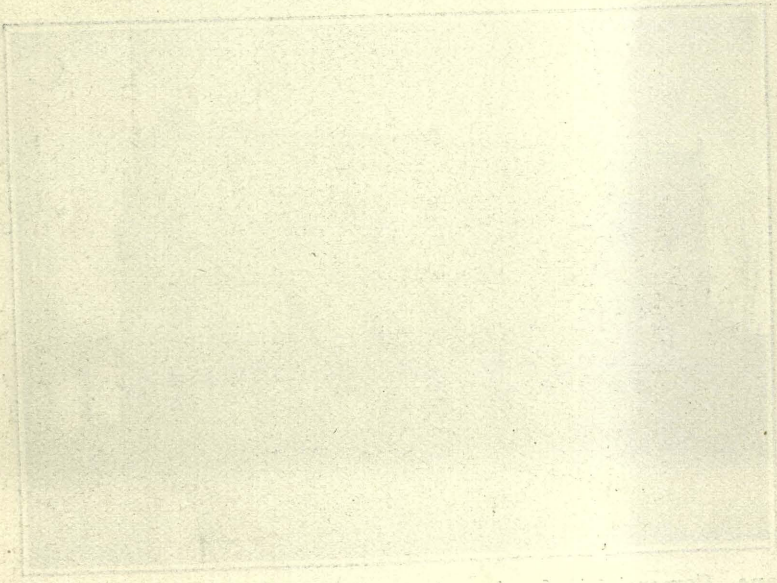


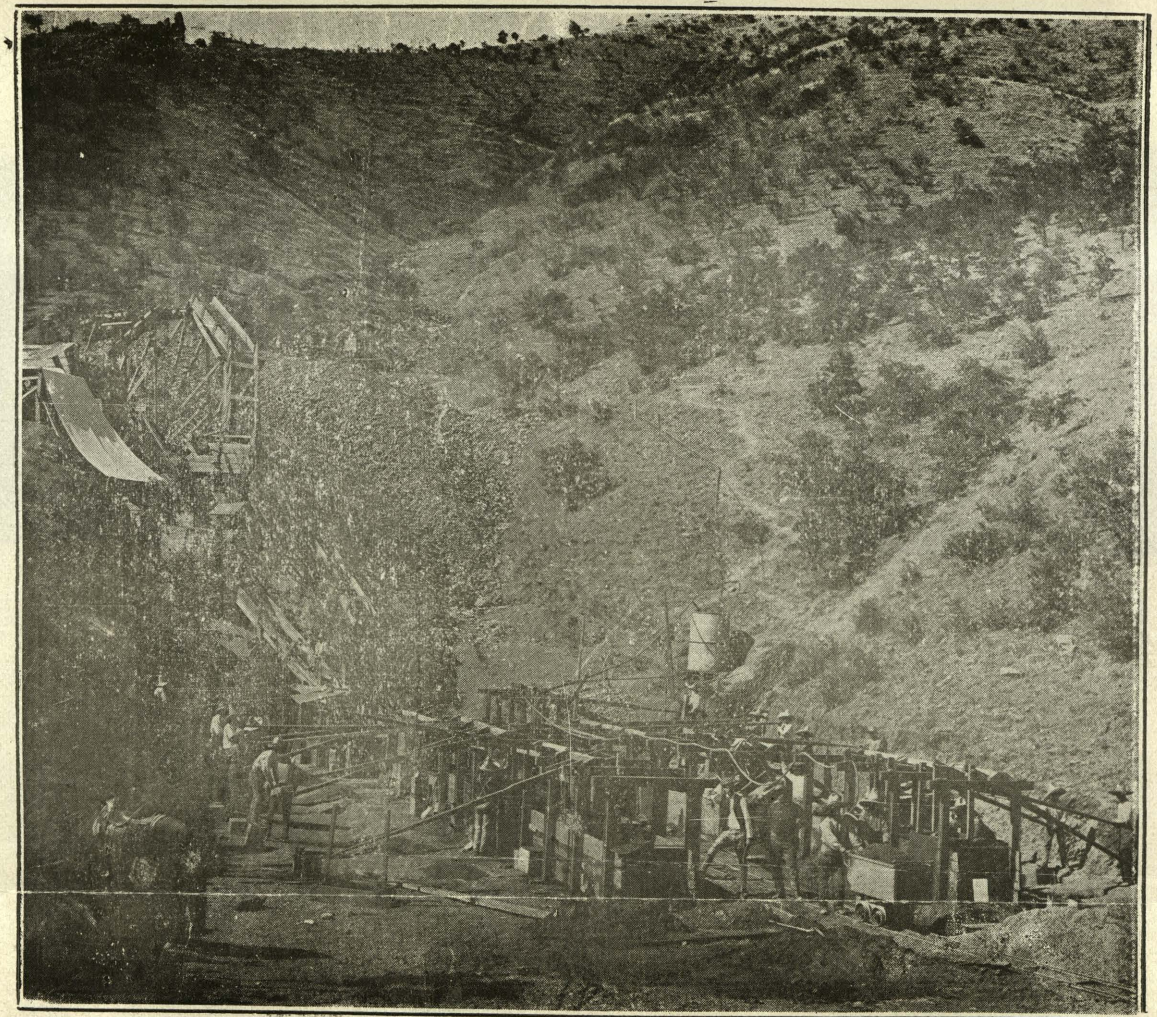
View of Plaza Hidalgo. Chihuahua.



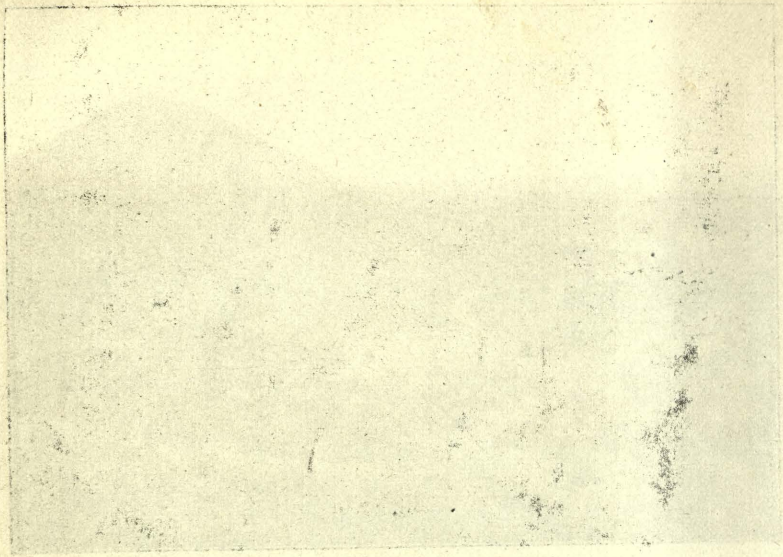
Banco Comercial Refaccionario. Guillermo Muñoz Gen. Mgr.

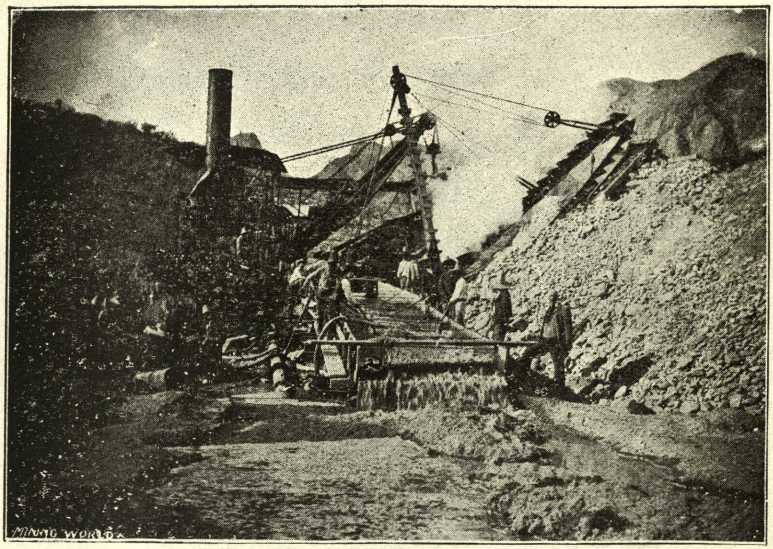




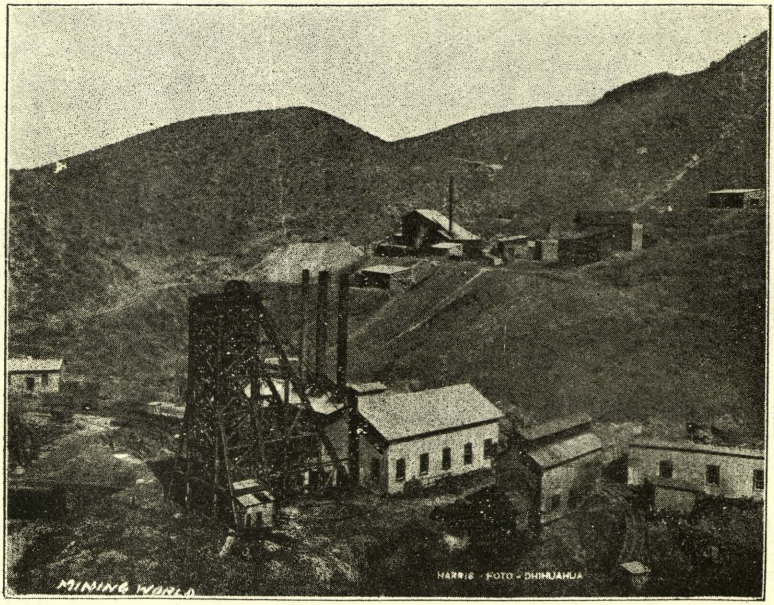


Clarines Mine at Santa Barbara Hidalgo District (Concentrating with hand jigs)

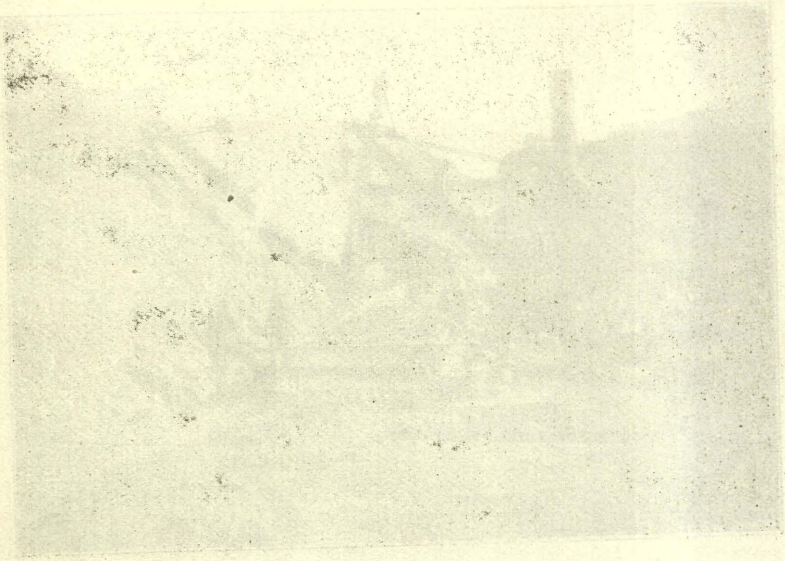




Santo Domingo placer, Showing Dredger at work.
Iturbide District



Santo Domingo Mine. Santa Eulalia. Iturbide District. 6



COMPLETE LIST OF MINES

IN THE

ITURBIDE DISTRICT.

Las Mercedes Grdes.	Sta. Eulalia.	11.20	Enrique C. Creel.
Merceds Chicas.	„ „	3	Jesús Ma. Carrasco.
La Vieja.	San Lorenzo.	11	Cía. Minera El Magistral.
Santa Rita.	Aldama.	2	Eleuterio y Roque Hermosillo
Santa Rita.	Santa Eulalia.	5	Chihuahua Mining Company
Sto. Domingo.	„ „	5	„
La Leona.	Chihuahua.	5	Jesús Aguirre y Nevárez.
Las Animas.	„	8	„
La Mascota.	„	8	„
La Sorpresa.	„	8	„
Providencia.	Aldama.	6	Amado Porras.
La Esperanza.	„	3	Jesús de la O.
La Reina del Oro.	„	8	Henry Brown.
La Virgen.	Aldama.	27	Cía Minera La Virgen, S. A.
Dolores.	Santa Eulalia.	6	Lorenzo J. Arellano.
La Aurora.	Cuchillo Parado.	3	L. de la Garza Cárdenas.
La Purísima.	Aldama.	2	Amado Porras.
La Cruz.	„	1	Melquiades González.
S. Ignacio ó Guadalupe.	S. José	10	Josefa y Jesús Benitez.
Anex. Sto. Domingo	Santa Eulalia	10	Rolando Anderson.
Anex. Sto. Domingo	Santa Eulalia	6	„
Las Cocineras.	Chihuahua.	4	José J. Durán y socios.
Parcionera.	„	4	Joseph S. Qualey.
Bustillos.	„	2	San Toy Mining Company.
Bustillos.	„	2	„
Descubridora.	Aldama.	2	Cía Fundidora de Chihuahua
Bolivia.	Santa Eulalia.	6	R. Anderson y F. G. Follansbe
Montecristo.	Aldama.	6	Amado Porras.
El Refugio.	Aldama.	1	Cía. Minera El Refugio.
La Aurora.	Chihuahua.	4	Jesús Aguirre y Nevarez.
El Potosí.	Santa Eulalia.	76	Stephens J. Sullivan.
Providencia, Tajos, Guadalupe y Refugio.	Santa Eulalia.	3	Joseph S. Qualey.
Santa Ana.	Santa Eulalia.	4	Stephens J. Sullivan.
Escondida.	Chihuahua.	9	Guillermo C. Moye y socios.
Ampl La Leona.	„	11	Jesús Aguirre y Nevarez.
15 de Mayo.	Santa Eulalia.	2	Stephens J. Sullivan.
El Perú.	Chihuahua.	10	José Durán Maceyra y socios
Eureka.	Santa Eulalia.	15	„

La Nueva Santander	Chihuahua	9	Chihuahua Exploration Co.
San Antonio.	„	27	„
La Fortuna.	„	12	„
La N. Sta. Eulalia.	„	12	„
Carolina.	„	15	„
Buena Tierra.	„	30	„
Mina Nueva.	„	5	Rolando Anderson.
Las Tres Mercedes.	„	4	Enrique C. Creel.
Anex. S. Andrés.	„	20	Mercedes Mining Co.
Dems. de Bustillos.	„	1	La San Toy Mining Co.
Anex. Reina del Oro	Aldama.	23	Henry J. Brown y socios.
Juárez.	„	6	Cía Fundidora de Chihuahua
Promontorio.	Chihuahua.	3	Mercedes Mining Company.
San Francisco.	„	2	Enrique C. Creel.
Ampl. La Sorpresa.	„	19	Jesús Madrid.
Ampl. de Bustillos.	Sta. Eulalia.	7	San Toy Mining Co.
La Convencional.	Chihuahua.	2	Jesús Aguirre y Nevarez.
Descubridora.	„	25	Rolando Anderson.
La Americana.	„	1	The American Mining Smlt.
Santa Teresa.	„	3	Ignacio J. Justiniani.
Ampl. de Las Animas.	„	10	Jesús Aguirre y Nevárez.
Ampl. La Mascota.	„	5	„
San José.	Aldama.	4	Francisco Jaquez y socios.
La Justicia.	„	2	Stanley Hartway.
San Antonio y Santa Eduwiges.	San Lorenzo.	4	Cía. Minera El Magistral.
No Tiene.	Chihuahua.	6	Joseph S. Qualey.
Anex. S. Antonio y Sta. Eduwiges.	San Lorenzo.	6	Cía Minera El Magistral.
Baltimore.	Chihuahua	50	Rolando Anderson.
La Corregidora.	„	8	M. Gameros y J. Jaurrieta.
Santa Eulalia.	„	14	Las Mercedes Mg. Co.
La Unión.	„	25	Enrique C. Creel.
La Providencia.	„	10	Agustín Aubray y socios.
La Oriental.	„	6	Enrique C. Creel.
La Occidental.	„	6	Enrique C. Creel.
Esmeralda.	„	8	Manuel Gameros.
Anex. Promontorio.	„	12	Las Mercedes Mg. Co.
La Esperanza.	„	6	Fortunato García.
El Concho.	Aldama.	90	The Mex. Sindicate Incopt.
Aurora.	Chihuahua.	20	Jesús C. Varela.
La Página.	„	12	Jorge N. Howell.
Santa Juliana.	„	9	Eureka Mining Co.
Las Vigas.	Coyame.	10	Nocker y E. Johnson.
El Grito de Dolores	El Carrizal	6	J. Durán y Dan Rodríguez.
Las Orientales.	„	9	„
Anex. de Coronel.	Chihuahua.	4	Chihuahua Mining Co.
El Porvenir.	San Lorenzo.	21	Cía. Minera El Magistral.

Zubiate.	Chihuahua.	1	Chihuahua Mining Co.
Santa Elena.	Aldama	2	Amado Porras.
Anex. al Concho.	Chihuahua.	107	The Mex Sind. Incorporated.
Anex de Velardeña.	„	3	Jorge N. Howell.
Santa Alicia.	„	22	Félix McDonald.
Santa Rita.	Chorreras.	4	Alberto Terrazas.
Anex. del Porvenir.	S. Lorenzo	9	Cía. Minera El Magistral.
La Fierrosa.	„	1	„
La Castilleña.	„	4	„
La Justicia y Anex.	Aldama.	20	Francisco Díaz.
Buena Vista.	„	2	José Jesús y R. Oaxaca.
Dems. del Porvenir.	S. Lorenzo	18	Cía. Minera El Magistral.
Simón Bolívar.	„	50	„
Florencia.	Chihuahua.	15	Enrique C. Creel.
Ampl. Sto Domingo.	„	5	The Chihuahua Mg. Co.
Ampl. Sta. Rita.	„	10	„
El Coronel	„	20	„
Independencia.	„	20	Alfred S. Withebee.
Lola.	„	20	W. C. Rollins y socios.
Mina de Solís.	Aldama.	10	José J. Durán y socios.
Bilbao.	Chihuahua.	20	Cía. Minera El Magistral.
San Salvador.	„	20	Félix McDonald.
Las Codereñas.	S. Lorenzo.	3	Cía Minera El Magistral.
Morelos.	„	4	„
Vizcaya.	„	6	„
Ampl. La Fierrosa.	„	10	„
Juanita.	Chihuahua	6	Enrique C. Creel.
España.	„	6	Enrique C. Creel.
Brasil.	„	3	Enrique C. Creel.
La Mexicana.	Aldama.	12	José de Jesús Oaxaca.
Arroyo de los Veinte.	Aldama.	2	José de Jesús Oaxaca y s.
Benito Juárez.	San Lorenzo.	40	Cía. Minera El Magistral.
Alicante.	„	15	„
Anex. Santa Fé.	Chihuahua.	7	Rolando Anderson.
Dinamita.	„	10	José M. Enríquez y socios.
El Carmen.	San Lorenzo.	8	Cía. Minera El Magistral.
La India.	„	8	„
Santa Marina.	Chihuahua.	122	The Helena Mg. Co.
Humboldt.	„	10	Manuel Gameros.
La Judía.	Aldama.	1	J. Ramón Oavaca y socio.
San Rafael.	Chihuahua.	22	Félix McDonald y socio.
Río Tinto Mexicano.	„	30	Enrique C. Creel.
La Libertad.	„	21	Cía. Minera El Magistral.
Anex. á La Oriental.	Chihuahua.	10	Enrique C. Creel.
La Purísima.	„	8	Amado Porras.
El Oroche.	„	6	Manuel Iturbe.
Anaconda.	San Lorenzo.	30	Cía. Minera El Magistral.
Orizaba.	„	14	Cía. Minera El Magistral.

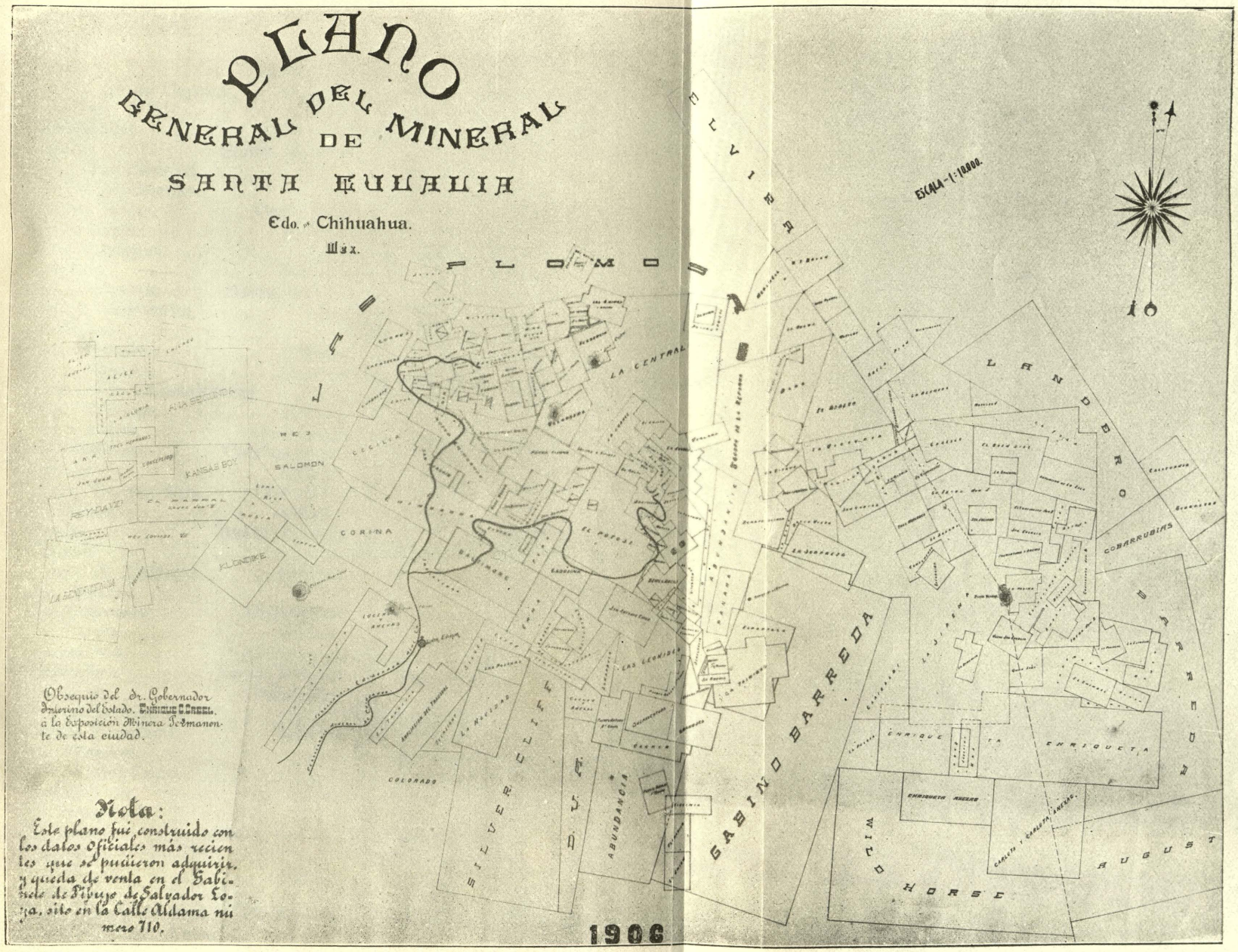
La Alianza.	Chihuahua.	20	José T. Lemus.
Candelaria.	San Lorenzo.	4	Cía. Minera El Magistral.
Cleopatra.	„	10	„
Lucrecia.	„	8	„
Teruql.	„	3	„
Ampl. de Anaconda.	„	16	„
Las Codereñas.	Chihuahua.	19	Enrique C. Creel.
La Unión.	San Lorenzo.	31	Cía. Minera El Magistral.
Dems. de La Unión.	„	3	„
El Potosí.	Chihuahua.	36	Alberto Terrazas.
La Inglesa.	Aldama.	7	J. Ramón Oaxaca.
Catas de San Andrés.	Chihuahua.	3	Enrique C. Creel.
La Josefina.	„	4	Enrique Muller h. y socios.
Guadalupe.	„	6	Pedro Lazo y socios.
El Aguila.	„	0.9	Jesús Aguirre y evárez.
Bismark.	„	7	Enrique Nocker.
Anexas de las Vigas.	„	6	„
Desdémona.	San Lorenzo.	2	Cía. Minera El Magistral.
Huecos de Anaconda.	„	8	„
Dems. La Aurora.	Chihuahua.	9	Alberto Terrazas.
Gloria.	Chihuahua.	10	Lorenzo J. Arellano.
Dems. Anaconda.	S. Lorenzo.	5	Cía. Minera El Magistral.
San Antonio.	Aldama.	4	Longinos Carrasco y socio.
Concepción y S. Joaquín	Chih.	28	José Durán Maceyra.
La Esperanza.	Coyame.	10	Amado Porras.
La Sorpresa.	„	6	„
La Paz.	„	6	„
Dems. de Morelos.	San Lorenzo.	11	Cía. Minera El Magistral.
Ampl. de Morelos.	„	64	„
Diana.	„	2	„
La Triunfal.	Chihuahua.	28	La San Toy Mining Co.
Nueva Chihuahua.	„	44	Price McKinney.
Colombia.	„	20	Jorge N. Jacobs.
San Agustín.	„	16	The American Mg Smlt. Co.
Lucía.	Coyame.	12	Enrique Nocker.
Guadalupe.	Coneto.	10	„
Markilda.	Aldama.	10	Enrique Faivre.
Santo Domingo.	„	6	José J. Oaxaca.
Santa Sofía.	Aldama.	30	Ignacio Cuilty y socios.
San Antonio.	Nogales.	4	Tomás Ewing y socios.
Guardia.	Coyame.	7	Enrique Nocker.
Buena Suerte.	Aldama.	6	José Rivas Gabaldón.
Gioconda.	Coyame.	64	Belisario Jiménez y socios.
Las Carolinas.	Chihuahua.	13	Enrique Muller h.
Parcionera Anex.	„	7	Joseph S. Qualey.
Purísima Concepción.	Ojinaga.	12	Gilberto Dueñas.
La Democracia.	„	12	Manuel Gameros.
Juárez.	Chiuahua.	50	San Toy Mg Co.

La Fortuna.	Aldama.	16	Enrique C. Creel.
Anex de la Fortuna.	„	25	Alberto Terrazas.
La Cobriza.	Coyame.	20	Lorenzo Aceve y socios.
Arroyo de Sánchez.	Aldama.	2	Demetrio Oaxaca.
La Alianza.	Chihuahua.	19	Jesús Aguirre y Nevárez.
San Juan.	„	6	The American Mg Smelt. Co.
La Constitución.	„	8	Manuel Gameros.
Mina Vieja.	Aldama.	2	Enrique Nordwald.
La Insurgente.	Chihuahua	4	Jesús Aguirre y Nevárez.
Mercedes, Sta. Brígida y la Esmeralda.	Coyame.	16	Francisco Díaz.
La Concepción.	Chihuahua	12	Luis G. Terrazas y socios.
Transvaal.	„	8	Rosalío Room y socios.
La Filipinas.	Coyame.	20	Tomes Ewing.
El Santo Niño.	Aldama.	12	José Rivas Gabaldón.
S. José del B. Retiro.	Chihuahua	8	Manuel Gameros.
El Año Nuevo.	Aldama.	4	Jesús Oaxaca.
La Concepción.	„	4	Ramón Oaxaca.
Sam Miguel.	Chihuahua	20	Fred H. William y socios.
El Salvador.	Aldama.	4	José Rivas Gabaldón.
La Fortuna.	Chihuahua.	22	La San Toy Mg. Co.
La Esperanza.	„	2	Pedro R. Prieto.
Santa Marina.	Aldama.	20	Andrés García.
El Carrizalillo.	„	20	Gustavo Wichtrich.
Santa Eduwiges.	„	10	Martín Chabre y socios.
La Novedad.	Chihuahua.	40	José M. Durán y socios.
San Carlos.	„	23	Carlos E. Minck y socios.
La Purísima.	„	10	Antonio Cabello Siller.
Puerto Rico.	„	24	„
La Situación.	„	24	„
Las Pléyades.	„	12	Longinos Balderrama.
Eureka.	Aldama.	38	Ignacio Flores.
Nady.	„	33	Emilio Ketelsen.
Purísima.	„	9	Enrique Muller h. y socios.
Colón.	Chihuahua.	12	Lorenzo y Salvador Arellano
La Sorpresa.	„	32	Cía. Minera El Continente.
El Perú.	Aldama	20	Francisco Díaz.
La Victoria.	Chihuahua.	31	Othón Sartorius.
La Sirena.	„	184	José Lago.
Bernardo Reyes.	„	10	Othón Sartorius.
Pedrueza Anexa.	Aldama.	8	William Dale Hnos. y Cía.
Pretoria.	Allende.	6	Carlos Pérez.
Justicia Tercera.	Aldama.	8	Stanley Harthway.
Estrea.	Chihuahua	10	Pedro R. Prieto.
Limantour.	„	20	Othón Sartorius.
El Buen Díaz.	„	43	José Lago.
El Buen Díaz.	„	31	Antonio Cabello Siller.
El Lago.	Aldama.	38	José Lago.

San Juan.	Chihuahua.	10	W. J. Jones y socios.
Prosperidad.	Aldama.	875	The American S. Incorp.
La Amistad.	„	32	Christian Gottschalk.
Adela.	Chihuahua.	16	Juan Ramonfaur.
Minerva.	„	14	José Lago.
La Ibera.	„	68	José Lago.
La Ibera.	„	46	Cía. Minera El Continente.
La Ibera.	„	7	Antonio Cabello Siller.
La Gitana.	„	40	José Lago.
Wisconsin.	„	33	The American Mg. Smt. Co.
Guadalupe.	„	21	„
La Sultana.	Aldama.	12	Antonio Mesgoard y socios.
La Esmeralda.	„	42	Juan A. Creel.
Cont. Sta. Rita.	Chihuahua.	6	Manuel Gameros.
Contiguas del Carmen	„	12	„
Donato Guerra.	„	27	James P. Hutchinson.
Minas Nuevas.	„	45	Federico Hagelsieb.
La Cruz.	„	15	Thomas Williams.
Shamrocks.	„	15	Félix McDonald y socios.
Matilde.	„	15	Wiliam White.
Anaconda Mex.	Aldama.	2	Francisco Díaz.
La Septemtrional.	Chihuahua.	15	Salvador Arellano.
La Oriental.	Chihuahua.	9	„
Bismark Anexas.	Coyame.	15	J. H. Nishan.
S. Rafael Anexas.	Chihuahua.	48	George W. Boice y socios.
Maid Erin.	„	11	F. C. McDonald.
San José.	Chihuahua.	94	F. C. McDonald.
Chihuahua.	„	30	Geo W. Boyce y socios.
Campo Viejo.	„	30	Geo W. Boyce y socios.
Tres Hermanos.	„	13	Charles Alleman é hijos.
Emma.	„	21	Wiliam Dale y socios.
Enriqueta Anexas.	Sta. Eulalia.	50	José Elías.
Oregon.	Chihuahua.	8	Félix McDonald y socios.
Palmira.	Aldama.	12	Dale Hermanos y Cía.
Pedrueza.	„	13	„
Chicago.	Santa Eulalia.	20	José A. Bermudez.
Mariana.	Chihuahua.	8	John Johnston y socios.
La Independencia.	Sta. Isabel.	5	Everardo Serrano y socios.
Walkiria.	Coyame.	18	Wiliam White.
Ojinaga.	Ojinaga	25	Manuel Gameros.
El Azufre.	Aldama.	100	„
La Reforma.	Chihuahua.	4	Félix McDonald .
La Fortuna.	„	8	„
Anex. la Americana.	„	14	The American Mg. Smt. Co.
El Rey.	Aldama.	2	Francisco Díaz.
Ayudante.	„	10	Stanley Hathaway.
Anita.	Chihuahua.	18.5	George H. Arlitt y socios.
Tekamah.	„	12	George W. Boyce y socios.

Shamrock Segunda.	Chihuahua.	60	George W. Boyce.
Enriqueta.	Santa Eulalia.	231	José Elías y socios.
Garibaldi.	„ „	117	Próculo F. Macía.
La Estrella.	„ „	24	Antonio Cabello Siller.
La Mascota.	Aldama.	2	Juan Ramón S. Aldana.
La Encantada.	Chihuahua.	15	W. H. Kraft y socios.
Babicora.	„	20	„
Teresa.	Santa Eulalia.	16	José Marín.
Colón.	Chihuahua.	40	R. J. de Morambert.
El Lucero.	Santa Eulalia.	4	Félix Moreno y socios.
Lafayette.	Chihuahua.	29	R. J. de Morambert.
Anex. Zubiate y Coronel.	Santa Eulalia.	4	La Chihuahua Mg. Co.
Benconsil.	Aldama.	56	José C. Collinson.
Maine.	„	3	J. H. Moulton.
La Sallada.	Coyame.	80	C. G. Scobell y socios.
Nebraska.	Chihuahua	18	G. W. Boyce y socios.
Ojo de la Sendradita.	„	18	„
Last Chance.	„	8	„
Lima.	Aldama.	12	Carlos E. Minck.
John Calvin.	La Trinidad.	8	June A. Hunt y socios.
La Reina.	Santa Eulalia.	18	Carlos E. Minck.
Killerney.	Chihuahua.	6	American Mg. Smt. Co.
Laura.	„	4	W. F. Lamp.
Yankee Boy.	„	25	G. W. Boyce.
Isleta.	Santa Eulalia.	6	Salvador Arellano.
Green Montain.	Chihuahua.	25	G. W. Boyce.
San Vicente.	„	25	G. W. Boyce.
Bella Vista.	Santa Eulalia.	26	Abraham Luján Zuloaga.
Wiscomsin Anex 2a.	Chihuahua	2	Félix McDonald.
Zacatecas.	Santa Eulalia.	12	Francisco R. García y socios.
Anex á El Crucero.	„	22	Francisco Armendáriz y s.
La Incógnita.	„	2	Salvador Arellano.
Las Canarias.	Aldama.	43	José Elías.
San Jacobo.	Santa Eulalia.	8	Jacobo Touche.
Gioconda Anexa.	Coyame.	8	Manuel Colome y socios.
Señorita.	Chihuahua.	60	George H. Arllitt y socios.
Baltazar.	„	3	Juan J. Shupe y socios.
Inglaterra.	Santa Eulalia.	35	Félix McDonald y socios.
Buruhan.	Chihuahua.	13	George W. Boyce y socios.
Dora.	„	13	José Marín.
El Hueco.	„	0.5	Chihuahua Mining Co.
Ana.	„	20	Félix McDonald y socios.
Guadalupe.	Santa Eulalia.	7	Francisco R. García y socios.
Corpus.	„ „	9	„
Enriqueta.	Satevó.	16	Cía. Minera Sta. María, S. A.
Salvador Anexas.	Chihuahua	20	Félix McDonald.
San Juan.	„	18	José E. Stevenson.

El Picacho.	Chihuahua.	6	G. H. Arlitt y socios.
Hamakelt.	„	30	Geoge W. Boyce y socios.
San José.	Santa Eulalia.	30	Rolando Anderson.
Noche Buena.	Coyame.	14	John Baskin y socios.
Anita Anexas.	Chihuahua.	2	G. H. Arlitt y socio.
Quién Sabe.	Santa Eulalia.	14	José Elías y socios.
El Asalto.	Chihuahua.	50	Othon Sartorius.
Berta.	„	6	Rolando Anderson.
Corina.	Santa Eulalia.	63	Roberto Emerson y socios.
Anex Isleta.	„ „	8	José Marín.
San Francisco.	Chihuahua	40	O. S. Osborn y socios.
Ventura.	„	24	„
San Esteban.	„	32	„
Magdalena.	Aldama.	12	Magdaleno Acosta y socios.
Elena.	Chihuahua.	13	Magdaleno Acosta.
La Reynera.	Santa Eulalia.	46	Juan F. Treviño y socio.
Ana.	Chihuahua.	12	Ana Garrison
Las Urracas.	„	8	José Lago y socio
Gonzalo.	Aldama.	4	Jesús J. Oaxaca.
El Fierroso.	Chihuahua.	2	José Martínez.
New York.	Aldama.	4	Alberto Jones.
Reina de Coyame.	Coyame.	30	Henry Thompson y socios.
Semaan Santa.	Aldama.	36	Carlos F. Gosch.
La Gloria.	Santa Eulalia.	17	Luis Salas y Porras.
Los Pirineos.	„ „	9	Francisco R. García y socios.
Cecilia.	„ „	48	José Marín.
Kansas Boy.	Chihuahua.	48	W. J. Jones é hijo.
María Luisa.	Santa Eulalia.	0.5	Manuel L. Luján.
Olga.	„ „	51	Cía. Minera El Continente.
Cuatro Señores.	„ „	9	Alberto M. del Campo.
Inglaterra Anex.	„ „	38	Dale Hermanos y Cía.
Anex. S. Juan.	„ „	6	Santiago Gameros y socios.
María.	„ „	20	„
Noche Buena.	Chihuahua.	2	Jorge A. MacManus.
El Oro.	Aldama.	10	Carlos E. Minck.
Alice.	Chihuahua.	17	Roberto Emerson y socios.
Wisconsin Anex.	„	5	Félix McDonald.
Ana Segunda.	„	100	Ana Garrison.
Rey David.	Santa Eulalia.	43	W. J. Jones.
La Judía.	„ „	12	José Lago.
La Peruana.	„ „	36	José Elías y socios.
Rey Salomón.	„ „	100	W. J. Jones y socios.
San Juan.	Aldama.	9	Severiano Luján y socios.
Anex La Prometida.	S. Lorenzo.	6	Francisco M. Mendoza y s.
Palmira.	Chihuahua.	8	Sailvador Millet y socios.
Guadalupe.	Aldama.	2	Elena Moye de Lowere.
Provecho.	Chihuahua.	48	George E. Voorhees jr.
La Propagadora.	„	12	Longinos Balderrama.



Obsequio del Sr. Gobernador Interino del Estado, Enrique C. Creel, á la Exposición Minera Permanente de esta ciudad.

Nota:

Este plano fué construido con los datos oficiales más recientes que se pudieron adquirir, y queda de venta en el Gabinete de Dibujo de Salvador Loya, sito en la Calle Aldama número 710.

SANTA EULALIA. Mining Claims.

Loma Rica.	Chihuahua	18	W. J. Jones y socios.
La Afortunada.	„	28	William Adams.
Isabel.	Aldama.	16	William White.
Ramón.	Chihuahua.	25	Juan Rivera.
Anex Reina Coyame.	Coyame.	37	Félix McDonald y socios.
Alfonso XIII	Aldama.	9	Carlos E. Minck.
Asunción.	„	30	José Marín.
Jesús.	Santa Eulalia.	9	Daniel Rodríguez y socios.
Las Excedencias.	„ „	16	José Lago.
Las Excedencias.	„ „	2	Joseph S. Qualey.
Santa Julia.	Chihuahua.	20	Santiago Camberos.
Guadalupe.	Rosario.	10	Martín Mariñelarena y socios
San Antonio.	„	10	Martín Mariñelarena y socios
Emilia.	Ojinaga.	58	Rafael Elías.
Los Angeles.	Santa Eulalia.	14	Rosalío Romo y socio.
Santa Gertrudis.	„ „	1	Manuel Prieto.
Carlota.	„ „	20	Carlos F. Gosh.
San Patricio.	Aldama.	28	Félix McDonald.
San Marcos.	Saucillo.	50	Victoriano Gandara y socios
Almaden Chihuahuense.	„	50	Victoriano Gandara y socios
San Patricio.	Aldama.	40	Henry Johnson y socios.
San Jorge.	Chihuahua.	40	Roberto Emerson.
La Patrona.	Cusihuiriáchic	3	Francisco Ramírez.
María	Aldama.	18	Juan Ramonfaur.
Anex Corregidora.	Chihuahua	2	Julio S. Jaurrieta.
El Faro.	Aldama.	4	Juan C. C. Hill.
Lucía.	Santa Eulalia.	7	J. H. Nishan y socios.
Elvira.	„ „	100	Juan Mitchell.
Anex S. Patricio.	Aldama.	12	Félix McDonald.
La Reina.	„	8	Adolfo Steyner y socios.
La Borrusia.	Chihuahua.	6	Roberto Schneider y socios.
El Pirata.	Aldama	4	Rafael Martínez.
Roosevelt.	Chihuahua.	20	Félix McDonald y socios.
Leonidas.	Santa Eulalia.	47	Salvador Arelano.
Chicago.	Chihuahua	18	William White.
La Constitución.	„	20	Guillermo C. Moye.
Santo Domingo.	Aldama	8	Enrique C. Creel.
La Merced.	„	10	José María Diaz.
Ampl. del Lago.	„	30	José Lago.
Armstrong.	Chihuahua.	20	Roberto Emerson.
El Sinclinal.	„	16	G. B. Jacobs.
Morelos.	Santa Eulalia	12	Manuel Gameros.
Panamá.	„ „	18	G. C. Harding.
La Negra.	Aldama.	10	Melquiades Rico.
Cuevitas.	„	12	Gustavo Wichtrich.
San Jorge Anexas.	Chihuahua.	6	Enrique C. Creel.
Noche Buena Anex.	Aldama.	15	S. Jorge Minillas Mg. Co.
Monserrat.	Chihuahua.	4	John I. Baskin y socios.

Kansas City.	Aldama.	6	Rosendo Raig.
La Esperanza.	„	10	José A. Yáñez y socios.
Gibraltar.	„	46	Rafael Horcasitas.
Srita. Anex. 1.	Chihuahua.	10	Enrique C. Creel.
Virginia.	Aldama.	6	G. H. Arditt y socios.
El Continente.	Chihuahua.	54	Daniel Rodríguez y socios.
La Isla.	„	54	Francisco Hernández.
Ampl. Esperanza.	Aldama.	118	Lorenzo J. Arellano.
Anex. La Aurora.	C. Parado.	2	Jesús de la O.
Villagrán.	Santa Eulalia.	12	L. de la Garza Cárdenas y s.
Alma de María.	Chihuahua.	2	Eduardo Urueta y socios.
Santa María.	„	21	Federico Schmith y socios.
Aldama.	Santa Eulalia.	15	B. F. Maurer y socios.
Recompensa.	„ „	9	Manuel Gameros.
Santa Elena.	Chihuahua.	9	José Porras Ugarte y socios.
San Antonio.	Rosales.	4	W. W. Graham.
29 de Febrero.	„	34	Ignacio Mariñelarena.
Puerto Arturo.	Santa Eulalia.	9	Ig. Schmet y socios.
2a. Ampliación.	Aldama.	79	José Elías.
Alice Anex 2a.	Chihuahua.	24	José Lago.
Contigua Sta. Fé.	„	7	Santa Eulalia Mg. Co.
Nigromante.	Aldama.	16	Manuel Gameros.
Nueva Escondida.	„	11	Ignacio Irigoyen.
La Rosita.	Allende.	12	G. C. Harding.
Huetamo.	Aldama.	4	José Lago.
Cont. 2a. Anex. de Alfonso XIII.	„	12	G. C. Harding.
Pepa.	Chihuahua.	44	José Marín.
Belknap.	„	11	Agustín Moye y socios.
La Trinidad.	Aldama.	44	John I. Baskin y socios.
La Recompensa.	„	3	Francisco Meléndez Mendoza
D. Carlos Anex.	Chihuahua.	110	Chihuahua Investment Co.
La Judía.	Aldama.	2	Carlos F. Alleman.
Cont. Anexas de Alfonso XIII.	„	15	Melitón Ordaz.
Chicago.	Coyame.	68	José Marín.
Virginia.	Santa Eulalia.	16	Henry Johnson y socios.
La Guapa.	Chihuahua.	10	„
Aldama. núm. 2.	Aldama.	12	Cirilo Guyon.
Mala Suerte.	„	10	Juan A. Creel.
Anexas á Laura.	„	36	Gabriel Pando y socios.
Las Posadas.	Santa Eulalia.	18	Ignacio Irigoyen.
Laura.	Aldama.	14	Manuel G. Auilar y socios.
La Ibera.	Chihuahua.	15	Ignacio Irigoyen.
Asunción.	Aldama.	3	Benzon M. Caldwell.
Rey Eduardo.	Chihuahua.	5	José Marín.
Cinco Señores.	Coyame.	166	Roberto Emerson.
W. J. Bryan.	Santa Eulalia.	12	José Castelo.

El Sr. Capitán.	„	„ 25	J. O. Fisher y socios.
Aldama No. 3.		Aldama. 11	José Marín.
Aldama No. 4.		„ 10	Juan A. Creel.
Dos Señores.		Chihuahua. 5	„
San Angel.		Aldama. 20	G. H. Arlitt y socios.
La Norma.		„ 9	Emeterio Acosta.
D. U. A.		Santa Eulalia. 10	Julián Robles y socios.
Anex. Demacías.	„	„ 60	Ana Garrison.
Tayopa.		Chihuahua. 9	Telesforo Castañeda García.
Zada.		„ 4	A. H. Holmes y socios.
Aldama.		Aldama. 15	William T. Tuxlow.
La Pelota.		Santa Eulalia. 22	Juan A. Creel.
Anita.		Chihuahua. 19	José Marín.
La Sonámbula.		Santa Eulalia. 15	George H. Arlitt y socios.
Anex Democracia.	„	„ 9	Telesforo Castañeda García.
Reyes.		San Lorenzo. 17	Manuel Gameros.
Consuelo.		„ „ 4	José de la Luz Trivizo.
Elisa.		Aldama. 8	„
Florencia.		Allende 40	Federico Sáenz y socios.
San Carlos.		Aldama. 30	Domingo Gutiérrez.
La Concepción.		„ 82	Charles Qualey.
La Gloria.		„ 43	Demetrio Oaxaca.
La Sorpresa.		„ 6	David Oaxaca.
Carlota.		Chihuahua. 1	Rafael Horcasitas.
Sara.		Aldama. 9	J. H. Williamson.
La Llave.		Chihuahua. 22	Carlos P. Halter y socios.
Soledad.		San Lorenzo. 5	Cecilio Guijón y socios.
Cerro Colorado.		Coyame. 8	José de la Luz Trivizo.
Santa Ana.		Aldama. 25	Henry Johnson.
El Carmen.		Santa Eulalia. 10	Alberto Goldschmidt.
Santa Rita.		Coyame. 20	Celestino Dufau.
Juanita.		Chihuahua. 40	J. Wallace Guik y socios.
Las Plomosas.		Aldama. 12	Geo H. Arlitt y socios.
Wenona.		Chihuahua. 24	Juan Ramonfaur.
La Judía.		Santa Eulalia. 15	John Johnston.
Don Carlos.		Chihuahua 10	Cía. Minera El Continente.
La Ibera.		„ 6	Charles F. Alleman.
El Bote.		Santa Eulalia. 46	Cía Minera El Continente.
María Luisa.		Aldama. 10	Gabino Cisneros y socios.
La Central.		Santa Eulalia. 15	Longinos Balderrama.
Las Capillas.		Aldama. 146	Manuel Gameros.
Colón.		Chihuahua. 24	Félix McDonald.
Guadalupe.		Coyame. 25	Roberto D. Jackson.
Rusia	Chih. y	Sta. Eulalia. 30	J. W. Guik y socios.
San Francisco.		„ 15	Luis Hermann.
Anex. La Merced.		Aldama. 33	J. H. Wiliamson.
Jesús Ma. y La Estrella		„ 10	Henry F. A. Biebling.
Jaztek.		Chihuahua. 3	Juan López y socios.

San Jorge.	Chihuahua.	32	Harvey B. Lawrence.
Chicago ampl.	„	21	Edward Francis Armstrong.
Santa María.	Santa Eulalia.	6	Chicago Mg. Co.
San Antonio.	Aldama.	10	Guillermo C. Moye.
Tip Top.	Santa Eulalia.	16	Francisco Orozco Gámez.
Uncle Sam.	Chihuahua.	10	W. J. Jones y socios.
San Dimas.	Aldama.	12	W. P. Dikerson.
Mina Frank.	C. Juárez.	5	Andrés López y socios.
María.	Allende.	18	Henry Faivre.
La Protectora.	Chihuahua.	18	Manuel Uranga Arriola.
La Concepción.	Coyame.	13	Longinos Balderrama.
Cristal de Oro.	Aldama.	18	Carlos P. Halten.
La Escuadra.	Chihuahua.	19	George D. Meiklejohn.
Maggie.	Aldama.	15	José Griego y socios.
Elena.	„	36	Juan Ramonfaur.
Santa Francisca.	„	5	Lucy Panley.
La Fortuna.	Chihuahua.	8	E. Muñoz de la Cámara.
Provecho.	„	1	E. F. Armsburg.
"Q. K"	Aldama.	18	Carl. P. Halter.
Santa Eulalia.	Urique.	11	Richard H. de Bergue.
Nápoles.	„	16	Federico Moye.
Fuente de Plata.	Sta. Eulalia.	26	„
Alfonso XIII.	Aldama.	42	E. S. Plumb.
El Refugio.	„	137	Carlos E. Mink.
La Casualidad.	„	3	Manuel Uranga Arriola.
Chicago.	Chihuahua.	6	Melitón Ordaz.
La Mina.	Coyame.	28	W. J. Jones y Cía.
Margarita.	Chihuahua.	6	Antonio Stéfano y socios.
El Portillo.	Aldama.	9	J. H. Wiliamson.
Placer de S. José.	Chihuahua.	4	Arthur Coleman.
Sin Nombre.	Santa Eulalia.	10	C. G. Kruse & Co.
Anex. No. 2.	Aldama.	3	Int. de P. R. Prieto.
Anex. de Markilda.	„	18	Ambrosio Díaz.
El Saucillo.	„	12	Henry Faivre.
Klondyke.	Chihuahua.	10	Andrés Lefevbre.
Anex. Cerro Colorado.	Coyame.	49	W. J. Jones y Co.
El Pastor.	Aldama.	10	Henry Johnston y Co.
Buena Fé.	„	16	Telesforo García Castañeda.
Anex. Recompensa 2.	„	8	Charles H. Addis.
Anex. Recompensa, 2.	„	158	Chihuahua Investment. Co.
Anex. Recompensa 3.	„	105	„
Remember.	Santa Eulalia.	121	„
La Mina Conchos.	„	12	Manuel F. Guerrero.
La Fortuna.	Chihuahua.	2	Chihuahua Mining Company
San Agustín.	Morelos.	2	„
La Australia.	„	2	„
La Barrenos.	„	2	„
San Antonio.	Aldama.	5	Anto. Franco y J. Taboada.

Colorado.	Santa Eulalia.	74	Leonard Worcester jr.
Washington.	San Lorenzo.	10	Ignacio Irigoyen.
Continental.	Chihuahua.	6	William F. Richardson y co.
Luján.	Santa Eulalia.	30	Telesforo García Castañeda.
La Fortuna.	Aldama.	3	A. C. Nash.
México.	Santa Eulalia.	30	J. M. de la Vega.
El Parral, Grupo 2	„ „	32	C. E. Delno y socios.
El Continente.	Chihuahua.	15	Cía. Minera El Continente.
La Isla.	„	40	„
29 Febrero Anex.	„	2	J. A. Yáñez.
Oaxaca.	Santa Eulalia.	45	J. M. de la Vega.
Consuelo.	Chihuahua.	9	J. H. Wiliamson.
Joya.	„	25	T. García Castañeda.
Recompensa.	Aldama.	126	Chihuahua Invest. Co.
Septentrional.	Chihuahua.	8	J. H. Wiliamson.
Alicia.	„	24	„
California.	Santa Eulalia.	20	J. A. Prieto.
Montones Fierro 1.	Aldama.	10	Charles E. Mink.
Beatriz.	Chihuahua.	9	J. H. Wiliamson.
Roosevelt.	Santa Eulalia.	56	W. J. Jones y Co.
Emilia.	Aldama.	16	Francisco A. García.
S. José de Santa Rita.	Chihuahua.	4	Perfecto Carlos y M. Barrio.
Santa Rita.	Chorreras.		Alberto Terraazs.
El Arco Iris.	Temósachic.		Consuelo Min. & Mill. Co.
Washington.	„		„
Recompensa.	Aldama.	126	Chihuahua Investment Co.
Generosa y Ampl.	„	20	Procopio Oleo y Co.
Anex. Buena Suerte.	„	6	Roland Anderson y Co.
Hidalgo.	„	3	Trinidad Salazar y Co.
Zazá.	„	10	Juan F. Prieto.
Gral. Bravo.	Ahumada.	14	Francisco A. García y socios.
Benito Juárez.	„	166	„
Labrador.	„	52	„
Estela.	Chihuahua.	10	Alberto Villarreal y socios.
S. José de Sta. Rita.	„	4	Porfirio C. y M. Barrios.
Los Lamentos.	Ahumada.	99	Ignacio Acosta.
La Candelaria.	Aldama.	40	Demetrio Oaxaca.
María.	Hidalgo.	20	Ana Garrison.
Abundancia.	Santa Eulalia.	314	Alberto Terrazas.
El Angelus.	Aldama.	16	Manuel L. Luján y socios.
Gloria Escondida.	Chihuahua.	20	„
Ampl. Merced, Sta Brígida y Esmeralda.	Coyame.	24	Enrique C. Creel.
Anex Rey del Fierro.	„	56	Wilbur L. Libby.
Id. id. núm. 2.	„	2.	„
La Paloma.	„	12	L. A. Dockery.
Anexa Filipinas.	„	5	Richard M. Dudley.

Anexa Colón.	Chihuahua.	31	R. D. Jackson.
Victoria.	Aldama.	30	Mauricio Hazán.
Rey del Fierro.	Coyame.	99	Wilbur R. Libby.
El Carmen.	Chihuahua.	20	Enrique C. Creel.

To March 25 1907.

KINDNESS OF SR. JUAN NAGERA, ADMOR. DEL TIMBRE

COMPLETE LIST OF MINES

JIMENEZ DISTRICT.

S. Pascual las Adargas.	Jiménez.	22	Adolfo Brominann.
Guadalupe y Anexas.	Allende.	9	Anastacio Porras.
La Gibosa.	Jiménez.	15	Guggenheim Exploration.
Guadalupe.	Allende.	6	Juan B. Baca y socios.
El Cibolo.	Jiménez.	4	Guggenheim Exploration.
Vulcano.	„	10	Santiago Stopeli.
Minerva.	„	6	„
Hércules.	„	4	Guggenheim Exploration.
Santa Teresa.	„	4	Gregorio G. Rueda.
La Almanceña.	Allende.	6	Francisco Jurado.
La Reynera.	Jiménez.	20	Eduardo Russek y socios.
La Escondida.	„	10	Gregorio G. Rueda.
San Juan.	„	8	Gerardo P. Mackey.
La Esperanza.	„	5	Gregorio G. Rueda.
Ampl. Guadalupe.	Allende.	3	Juan B. y José Baca.
Ampl. Porfirio Díaz.	Jiménez.	18	Adolfo Bronimann.
La Soledad.	Coronado.	5	Rafael Tarín y Cía.
La Ventura.	Allende.	4	Marcos Russek.
La Sultana.	„	6	Cía. Minera Almoloya.
Santa Ana.	Villa López.	15	Sta. Ana Mg. Co.
La Fortuna.	Allende.	2	Tiburcio Baca y socios.
Ampl. 2 Porfirio Díaz.	Jiménez.	23	Adolfo Brominann.
Ampl. 3 Porfirio Díaz.	„	140	„
Ampl. Guillermo Tell.	„	30	„
El Chaparral.	Allende.	4	Wl Knotts y G. P. Mackey.
Guadalupe.	„	6	Tomás Torres.
Los Placeres.	„	6	Janie Mining Company.
Guillermo Tell.	Jiménez.	147	Adolfo Brominann.
Concepción.	Coronado.	8	León Sánchez.
La Marsellesa.	Allende.	1	Amador Avila y socio.
La Purísima.	Jiménez.	6	Felipe Acosta.
Copper Prince.	„		Juan Mitchell.
Ampl. 4 Porfirio Díaz.	„	12	Adolfo Brominann.
La Palma.	Allende.	10	Juan Beltrán.
Transvaal.	Jiménez.	8	Marcos Russek.

El Rosario.	Allende.	10	Romualdo González y socios
San Miguel.	„	6	Herminio Mendoza y socios.
La Centella.	„	12	Guadalupe Galván.
Nicaragua.	Jiménez.	9	Jesús Esparza.
Honduras.	Allende.	6	Jesús Esparza y socios.
Pablo Ochoa.	„	47	Diego M. Durán.
Pablo Ochoa.	„	18	Santiago Rodríguez.
La Blanca.	„	3	Carlos Bravo.
La Unión.	„	20	Romualdo González y socios.
Concha.	„	8	W. W. Mills.
Benevolencia.	„	6	Manuel Armendáriz y socios
Porteña.	„	6	Eduardo Rigaud y socios.
La Cumbre.	„	18	Francisco Jurado.
Barradón.	Jiménez.	4	„
La Unión.	„	24	Guggenheim Exploration.
La Filibustera.	„	48	Gregorio G. Rueda.
Lucina.	Coronado.	8	Adolfo Reyes y socio.
La Estrella.	Jiménez.	26	Gregorio G. Rueda.
25 de Mayo.	Allende.	15	Diego M. Durán.
Barón de Humboldt.	„	12	Adolfo L. Garza y socios.
2a. Ampl. Julieta.	„	24	Adolfo Bronimann.
Julieta.	„	30	„
La Constancia.	Coronado.	15	Miguel Domínguez.
La Providencia.	Allende.	8	Rafael Galán.
La Paz.	„	30	José de la Luz Soto.
La Huérfana.	„	20	„
Ampl. de Julieta.	„	15	Adolfo Bronimann.
Siglo XX.	„	10	Modesto Sandoval y socios.
Insistencia.	„	6	Francisco Galván.
Romeo.	„	16	Adolfo Bronimann.
Cuauhtemoc.	„	8	Santiago Rodríguez.
Catus.	„	15	E. O. Mathews.
Cuauhtemoc. 2.	„	8	Santiago Rodríguez.
Mina de Agua.	„	2	Juan Weissel.
La Reserva.	„	3	Juan J. Weissel.
Conchita.	„	10	Jesús Esparza y socios.
La Exploradora.	„	6	Enrique Braden.
La Independencia.	„	10	L. Barreda y socios.
San Enrique.	„	78	Enrique Braden.
Ampl. Exploradora.	„	4	„
Altamirano.	„	50	Cía. Minera Almoloya.
La Iguana.	„	14	„
Anex Argentina.	„	6	Domingo Gutiérrez
Ampl. Guadalupe 2.	„	3	Saturnino González.
Amistad.	„	17	F. Zermeño y socios.
Libertador.	„	20	Félix Nauger.
1a. Reduc. S. Eligio.	„	97	Miguel Mazatlán.
2a. id. id.	„	57	„
3a. id. id.	„	22	„

Ampl. Mirador.	„	6	E. O. Mathews.
Los Angeles.	„	75	David W. Shanks.
San Expedito.	Jiménez.	20	Juan B. Baca.
Michoacán.	Allende.	16	Antonio R. Ortiz.
Tres Amigos.	„	20	Ramón Alvarez y socios.
Nicolás Bravo.	„	40	Aureliano de León.
Concha.	„	6	Juan L. Bergé.
La Susanita.	„	9	Oliver W. Krull y socio.
Adolphus Gustavus.	„	12	Washington L. Mandell.
La Favorita.	„	9	Martín G. Gutiérrez.
Enriqueta.	„	60	Adolfo Bronimann.
Ocampo.	Jiménez.	5	Rafael I. Urías.
Hidalgo.	„	6	„
Rosicler.	Allende.		Domingo Gutiérrez.
Mariano Arista.	„	19	Aureliano de León.
Marsellesa.	„		Amador Avila y socios.
Centauro.	„	20	Antonio R. Ortiz.
Argentina.	„		Domingo Gutiérrez.
Chihuahua.	„	84	Antonio R. Ortiz.
Durango.	„	52	„
Morelos.	„	12	„
Querétaro.	„	18	„
Zacatecas.	„	20	„
El Salvador.	„	8	José Murillo y socios.
Baja California.	„	186	Antonio R. Ortiz.
Oaxaca.	„	127	„
Veracruz.	„	75	„
San Luis Potosí.	„	35	„
México.	„	77	„
Aguascalientes.	„	8	„
Hidalgo.	„	37	„
La Fortuna.	„	13	Norberto Seañez y socios.
Justicia.	„	37	Domingo Gutiérrez.
Rosicler.	„	3	„
Mirador.	„	12	E. O. Mathews.
Carlos Tripler.	„	28	Filemón A. Schaefer.
El Vaticano.	„	8	Felipe Aguirre y socios.
La Germania.	„	8	Bruno Friese.
Hércules.	„	14	Jorge Himinghoffen y socio
Benito Juárez.	Coronado.	10	Alberto Soto.
Alejandría.	Huejuquilla.	10	Luis M. Salas.
Guerrero.	Allende.	72	Antonio R. Ortiz.
Edith Holmes.	Escalón.	20	Edith Emmerson.
Yucatán.	Allende.	48	Antonio R. Ortiz.
Puebla.	„	23	„
Guanajuato.	„	30	„
Colima.	„	43	„
Sinaloa.	„	28	„

La Rosita.	„	4	José Lago.
El Papa.	„	8	José A. Mendoza y socio.
Amalia.	„	8	Washington L. Madell.
La Sirena.	Huejuquilla.	8	José M. Arrufat.
Tlaxcala.	Allende.	1	Antonio R. Ortiz.
Florencia.	„	30	Domingo Gutiérrez.
Tamaulipas.	Allende.	16	Antonio R. Ortiz.
Jalisco.	„	49	„
Las Camelias.	Villa López.	20	Francisco Valdés.
Gophir.	Allende.	19	Antonio R. Ortiz.
Hidalgo núm. 4.	„	7	Carlos Iwonsky.
Hidalgo núm. 3.	„	2	„
Hidalgo núm. 2.	„	11	„
Hidalgo núm. 1.	„	14	„
Ophir.	„	2	Aureliano González.
Little Emma.	„	22	Jorge J. Wanless.
San Vicente.	„	16	Felipe Aguirre y socio.
Florencia.	„	30	Domingo Gutiérrez.
Chiapas.	„	57	Antonio R. Ortiz.
Campechie.	„	44	„
Tabasco.	„	21	„
Tlaxcala.	„	5	„
Sonora.	„	171	„
Nuevo León.	„	51	„
Ampl. Little Emma.	„	5	Jorge J. Wanless.
María.	„	6	Jorge B. Colmann.
Las Atalayas.	„	19	Reynaldo Gallardo y socios.
La Primavera.	„	22	Jonie Mining Co.
María.	„	59	Manuel Uranga Arreaga.
El Salvador.	„	8	Felipe Martínez y socio.
Las Margaritas.	Villa López.	12	Daniel Ogaves.
Puerto de Tampico.	Allende.	19	Carlos Guimbarda.
Altamira.	Huejuquilla.	14	Narciso D. Dávila.
S. Antonio la Partida.	Allende.	4	Bernardino Murillo.
La Central y Anex.	„	21	Carlos Guimbarda.
El Vaquero.	Villa López.	9	Daniel Chávez.
S. Francisco de los Reyes.	Huejuquilla.	40	Jesús Muela.
Alejandría.	„	25	Ramón Alvarez y socios.
Laura.	Villa López.	12	Telesforo Castañeda G.
Cuba.	Allende.	23.40	Antonio R. Ortiz.
La Gran Cuadra.	„	16	Cía. Ignacio R. Ramos.
Ampl. de Aurora.	Huejuquilla.	20	Enrique Egidy.
Florida.	Coronado.	22.34	C. L. Baker.
América, grupo 1.	Allende.	30	Aureliano de León.
América, grupo 2.	„	10	„
América, grupo 3.	„	15	„
América, grupo 4.	„	16	„

Edith Holmes Anex. Escalón.	Jiménez.	40	Edith Emmerson.
Tarpon.	Allende.	32.93	Juan F. Johnston.
La Maravilla.	Coronado.	14	Felipe y Adolfo Carrasco.
La Coahuilense.	Villa. López.	14	Antonio L. Contreras.
S. Juan de los Lagos.	Allende.	6	Felipe Ornelas y socios.
La Constancia 3.	„	0.80.	Marcos Russek.
La Constancia 4.	„	2	„
La Esperanza.	Villa López.	4	Refugio González y socios.
La Cavilla.	Escalón.	8	José Lightbourn y socios.

COMPLETE LIST OF MINES

IN THE

JUAREZ DISTRICT.

Cusihuiriáchic. (Head Seat).

Mina Grande (Buenos Aires)	Cusihuiriáchic	10	Juan Burns.
La Extensión.	„	10	Juan Burns.
Chicago.	Carichic.	14	Pratt McDonald.
El Refugio (El Ojito)	Satevó	10	Cía. Minera El Refugio.
La Prieta.	„	6	Test. de Félix F. Maceyra.
Dulces Nombres.	„	6	Cía. Minera de Chihuahua.
Santo Niño.	„	6	„
San Juan.	„	6	„
La Mascota.	„	6	„
Marte.	„	4	Robert Makee.
Santo Muriel.	Cusihuiriáchic.	10	R. Rollins y socios.
El Promontorio.	„	1	Melesio Delgado.
Cuba Libre.	„	6	José Durán Maceyra y s.
Hortensia.	„	6	Helena Mining Co.
Cornelia.	„	6	„
Candelaria.	„	8	„
La Reina.	„	15	Francisco Ramírez.
San Miguel.	„	20	Helena Minig Co.
Helena.	„	12	„
Ampl. de Durana.	„	3	Abel y Jesús Arana.
Juárez.	„	72	Laureano Holguín.
La Aurora	„	10	Ramón Anchondo y socios.
La Lolita.	„	10	„
La Negrita.	„	10	„
Anex Esperanza.	Satevvó.	0.5	Federico Hagelsieb.
Santa María.	„	6	Gaspar B. Grower.
San Antonio.	Cusihuiriáchic.	10	Manuel de Herrera y G. Rico
El Progreso.	Satevó.	6	Francisco Porras y socios.
Sagunto.	„	10	J. Eduardo Navarro.
San Salvador.	„	5	Federico Hagelsieb.
Ampl. S. Agustín.	Cusihuiriáchic.	9	Julio Márquez.
San Agustín.	„	1	„
Cortés.	„	4	James Carr.
El Campanario.	„	10	Luz Silva y socios.
El Arcángel.	„	6	Santiago Gameros y R. Rod.
La Fronteriza.	„	2	Francisco J. Márquez.
Cornelia.	Satevó.	18	José Sánchez.
San José.	Nonoava.	3	Félix McDonald.
Santa Rosa.	Satevó.	12	Félix McDonald.
Bolívar.	„	10	A. F. de Smith y socios.

La Recompensa.	„	15	Ramos, Bauche y P. J. L.
La Luz.	„	6	José de la Luz Trivizo.
Dulces Nombres.	Cusihuiriáchic	5	Manuel M. de Herrera y s.
La Intermedia.	„	1	Anastacio Holguín y socio.
Saturno.	„	8	Jorge A. Macmanus.
El Refugio.	„	15	Pánfilo Zubirán.
Kruger.	„	42	Jorge A. Macmanus.
La Concepción.	„	10	Rafael Soto y socios.
Royal y La Gloria.	„	10	W. C. Rollins.
La Protectora y Encanto.	„	15	Concepción Torres y socios.
El Buen Pastor.	„	3	Jorge A. Macmanus.
La Escuadra.	„	1	Tomás Esquer.
El Gallo.	„	3	Jorge A. Macmanus.
Ciro.	„	3	Juan B. Bárcenas.
Erin.	Satevó.	12	Jorge A. Macmanus.
La Independencia.	„	24	Jesús Larragoyti.
Phoenix.	Cusihuiriáchic.	44	José E. Stevenson.
Anex S. Salvador.	„	12	Federico Hagelsieb.
La Vencedora.	San Borja.	14	Juan Rico.
La Sorpresa.	Nonoava.	8	James Carr.
San Juan.	Satevó.		José E. Stevenson.
Teresa.	„	10	Pastor Flores Alvarez.
San Carlos.	„	24	Eugenio D. Paires y socios.
Malta.	Cusihuiriáchic.	5	Pastor Flores Alvarez.
La Patrona.	„		Francisco Ramírez.
Corona.	„	4	José Marín.
Purísima.	„	5	Baltazar Ramírez.
Josefita.	„	2	Francisco F. Delgado.
San Ignacio.	„	3	Juan Acuña.
La Minerva.	„	3	Eduardo Delgado.
Tres Amigos.	Satevó.	21	José I. Villarreal y socios.
Tres Marías.	„		José E. Stevenson.
San Francisco.	San Borja.	26	Miguel González y socios.
Providencia.	Satevvó.		Juan C. Marshall y socios.
Santa María.	„	30	Santiago Carr.
Calumet.	San Borja.	35	James Buchanan.
Don Juan.	Satevó.	5	James Harper y socio.
La Unión.	Cusihuiriáchic.	20	W. L. Saye y socios.
Consolidada.	„	20	W. D. Pearce y socios.
San Jorge.	Satevó	3	Rafael Rodríguez.
El Encanto.	Cusihuiriáchic		Concepción Torres y socios.
La Gloria.	„	5	W. C. Rollins.
El Refugio.	„	14	A. F. Kensinger y socios.
La Aurora.	„	5	Francisco Márquez.
Durana.	„		Abel y Jesús Arana.
Esperanza.	Satevó.		Federico Hagelsieb.
La Reeelección.	„	10	Martín Ramos y socios.
La Sorpresa.	„		A. F. de Smith y socios.

San Francisco.	Nonoava.	14	American Mg. Smelting Co.
San Rafael.	„		Nicolás Larran.
Conde de Monte Cristo.	„	24	Agustín Ruiz y socios.
Elisa.	„	5	Francisco Hinojos y socios.
El Carmen.	Satevó.	8	James Carr.
Guadalupe.	„	23	„
El Santo Niño.	Cusihuiriáchic.	4	José R. Salazar y Co.
Santa Teresa.	„	6	Jesús Rodríguez.
La Unión.	Satevó.	10	Lauro Mariñelarena y Co.
El Destino.	Cusihuiriáchic.	8	José J. R. Chávez y Co.

COMPLETE LIST OF MINES

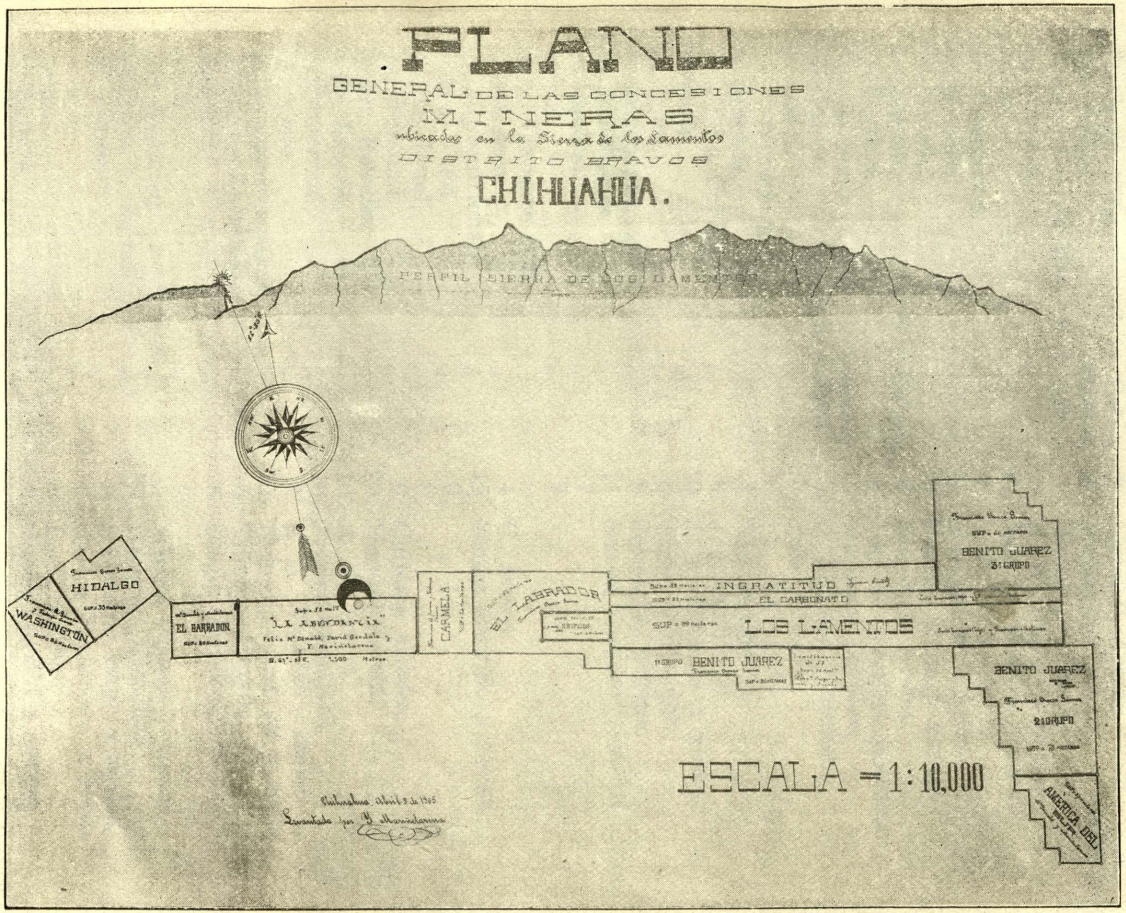
IN THE

MINA DISTRICT.

La Reforma.	G. y Calvo.	24	Tiburcio García.
Ntra. Sra. del Rosario.	„	24	The Rosario Mg. Co.
Ntra. Sra. de Loreto.	Morelos.	8	Manuel Solano.
San Gonzalo.	„	8	Manuel Solano.
Tentaduras.	G. y Calvo.	2	Cherokee and Mexican.
Ceniza.	„	2	Gold and Silver Mg. Mill. Co
San Francisco.	„	3	„
Torres.	„	2	„
Barnes.	„	2	„
Sena.	„	3	„
Todos Santos.	„	3	„
San Pedro.	„	5	„
El Refugio.	„	2	„
Almeda.	„	2	„
La Rusia.	„	4	„
Santa Rita.	„	6	„
Chicago.	„	6	„
San Felipe.	„	2	„
Cherokee.	„	5	„
Santa Elena.	„	5	„
La Blanca.	„	3	„
Eureka.	„	4	„
Emma.	„	4	„
San Nicolás.	„	4	„
San José.	„	2	„
México.	„	3	„
El Carmen.	„	4	„
Lonceña.	„	4	„
Dulces Nombres.	„	4	„
Chávez.	„	4	„
Clarence.	„	2	„
San Atanasio.	„	2	„
San Luis.	„	2	„
San Julián.	„	8	„
Esther.	„	2	Angel P. Araiza.
San Josecito.	„	2	E. B. Tolman.
Coscomates.	Baborigame.	2	„
La Guitarra.	„	2	„
La Gloria.	San Juan.	2	„
Guadalupe.	G. y Calvo.	4	Carlos Escárcega y socios.
Luisa.	Baborigame.	3	Tiburcio García.

Santos Varones.	„	2	E. B. Tolman.
Rosario de los Tarros.	„	2	„
Socavón.	San Juan.	6	„
Rosario.	„	2	„
Las Juntas.	„	7	„
Guijosa.	„	2	Justus M. Stevens.
El Manto.	G. y Calvo.	2	„
Chinacas.	„	4	„
Plomosa.	„	1	„
Bancos.	„	1	„
Trigo.	„	1	„
Trinidad.	„	2	„
Ramos.	„	5	„
Sierra Mojada.	„	1	„
San Miguel.	„	2	„
Santa Juliana.	„	1	„
Sta. Cruz de Sta. Ana.	„	4	„
Tarros.	„	8	„
Mala Noche.	„	1	„
La Esperanza.	„	1	„
La Dura.	Piedra Larga.	5	Lemarch La Dura.
Guadalupe.	G. y Calvo.	8	M. La Chica y socios.
La Esmeralda.	„	2	George M. Holmes.
Santa Cruz.	Morelos.	4	Ignacio Rocha y Coronel.
La Democracia.	G. y Calvo.	3	Conrado Loya y socios.
Viola.	„	7	Tiburcio García.
La Plomosa.	„	6	C. Gooduarth.
Alicia.	„	4	Carlos Escárcega.
Cuauhtemoc.	„	4	J. W. Yards.
Isabel.	„	1	Angel P. Araiza.
La Estrella de Oro.	„	7	Tiburcio García.
San José.	„	4	Juan Carrillo.
San Eduardo.	„	8	J. W. Yards y socios.
La Libertad.	„	4	Angel P. Araiza.
San Francisco.	„	3	„
San Pedro.	Morelos.	5	Nicolás Pérez y socios.
La Libertad.	G. y Calvo.	4	J. W. Yards y socios.
Dios Padre.	Morelos.	2	Juan E. Portillo y socios.
San Nicolás.	„	3	Francisco Larriva y socios.
San Gerónimo.	„	5	Tiburcio García.
San Pedro.	„	2	José Gutiérrez.
Clemencia.	San Juan.	1	Ramón R. R. Escárcega.
San Pedro.	G. y Calvo.	3	J. J. Tapia y socios.
El Refugio.	Morelos.	2	Fernando Rembao y socios.
El Rosario.	G. y Calvo.	4	H. F. Tapia y socios.
Jefferson.	„	7	Tomás F. Dale.
Santa Ramona.	„	9	Gustorgues y socios.
San Juan de Dios.	„	4	Tiburcio García.

Colón.	San Juan.	6	A. P. Araiza.
Dulces Nombres.	G. y Calvo.	3	J. J. Tapia y socios.
Porfirio Díaz.	„	7	Tiburcio García.
El Carmen.	„	8	Angel P. Araiza.
Coscomates.	„	2	Mexican Exploration Co.
San Francisco.	„	6	I. J. Tapia y socios.
La Esmeralda.	„	18	George M. Holmes.
El Rosario.	„	2	„
Maceo.	S. Juan Nepomuceno.	4	Bazonopa Mining Co.
Elvira.	G. y Calvo.	2	Angel P. Araiza.
La Cubana.	„	3	Bazonopa Mining Co.
San Antonio.	„	3	J. J. Tapia y socios.
San Guillermo.	„	3	Tiburcio García.
La Independencia.	„	28	I. W. Yards.
Monroe.	„	1	„
Victoria.	„	1	„
Fred Stone.	„	5	Fred Stone y socios.
Big Fuor.	„	5	„
Hendy.	„	14	Tiburcio García.
La Providencia.	„	10	George M. Holmes.
W. W. Kitchen.	„	5	F. Stone y socio.
El Chile.	„	2	Tiburcio García.
La Concordia.	„	4	„
Roncesvalles.	„	2	„
Cebadilla.	„	6	„
Eva.	„	2	„
Vinie.	„	3	„
Santa Matilde.	„	5	„
Good Nigth.	„	16	„
Mollio Dier.	„	6	„
Santa Isabel.	„	3	„
Miguel Ahumada.	„	6	„
El Occidente.	Baborigame.	4	Pedro Larquier.
Nankin.	G. y Calvo.	8	The Mill & Mining Co.
Río Tinto.	Baborigame.	4	Tomás M. Seli.
San Rafael.	„	3	„
Oro Fino.	„	4	„
Alameda.	„	3	„
El Cordón Chico.	„	2	„
El Cordón.	„	6	Francisco B. Young.
El Hilo.	„	2	Francisco Tohog.
Anex á la No. 1.	San Juan.	9	Alberto Ataide Naredo.
Número Uno.	„	7	„
La Exploradora.	Baborigame.	12	La Exploradora Hgo., A. S.
Santa Ramona.	G. y Calvo.	4	Samuel W. Knotts y socios.
La Reforma.	„	3	Francisco L. Mascareña.
San Pedro.	Dolores.	2	Tiburcio García.
La Cubana.	G. y Calvo.	8	Evaristo García y socios.



SIERRA DE LOS LAMENTOS. Mining Claims.

El Santo Niño.	„	2	Jesús W. Sánchez.
Aurora.	„	2	M. Loya y Mascareñas.
San Agustín.	Morelos.	2	W. H. Schaefer y socios.
El Carmen.	G. y Calvo.	4	Refugio Palma y Durán.
S. José de Ocampo.	„	3	Hilario Pérez y socios.
Anex. á S. Miguel.	Baborigame	6	The Mexican Exploration Co
El Santo Niño.	G. y Calvo.	2	Angel P. Araiza.
San Felipe.	Morelos.	11	Alejandro Larriva y socios.
Nuestra Sra. de Mat.	G. y Calvo.	4	Macedonio Rocha.
La Fortuna.	„	3	H. W. Higley y socios.
Josefa.	„	20	José M. Franco y socios.
El Presidente.	„	8	L. T. W. Ilson.
La Soledad.	Galeana.	34	Mariano M. Larriva.
La Gemela.	„	20	Fortino Peña y socios.
La Bastilla.	G. y Calvo..	8	Angel P. Araiza.
La Fortuna.	„	4	José M. Gamboa y socios.
Fin de Siglo.	Galeana.	16	Mariano Lachica.
La Rosilla.	G. y Calvo.	5	C. Allinson y socios.
El Colón.	„	5	Julio Orozco.
La Exploradora 2.	„	20	La Exploradora Hidalgo.
La Nevada.	„	4	Miguel Chávez.
Ampl. La Cubana.	„	6	J. I. Sandoval.
Minerva.	„	10	J. A. Calzada y socio.
El Ojito.	„	5	Atton Ventworth.
La Esperanza.	„	8	Jaime M. Givens.
La Americana.	„	114	Simón Carrillo y socios.
La Central.	„	7	„
Loreto.	„	7	„
Anex Clarence y S. Atanacio.	„	4	C. Alison.
La Septentrional.	„	12	Simón Carrillo y socios.
Buena Vista.	„	6	„
La Sin Igual.	„	8	„
La Trinidad.	„	6	Culburn Allison.
Nueva Estrella.	„	20	Manuel García.
Bella España.	„	10	A. P. Araiza.
El Transvaal.	„	16	Franco Sutuntril.
La Anita.	„	4	A. H. Whatley y socio.
La Fortuna de las A.	„	12	Nemecio Sandoval y socio.
Ampl. de Ahumada.	„	5	Tiburcio García.
Reforma.	„	6	Simón Carrillo y socios.
La India.	„	6	„
San Federico.	„	5	Miguel Chávez y socios.
La Onza.	„	6	Gregorio González.
El Porvenir.	„	3	Saturnino Lugo y socios.
Delirio.	„	6	Carlos Escárcega y socio.
Laura.	„	6	L. T. Wilson.
Laffayette.	„	6	Simón Carrilo y socios.

Buena Vista.	G. y Calvo.	9	Jorge M. Holmes.
Anexas al Rosario.	„	4	Evaristo García.
La Azteca.	„	10	Esteban Rubio y socio.
San Loreto.	„	12	L. T. Wilson.
La Predilecta.	„	6	Simón Carrilo y socios.
Checotah.	„	2	„
Oro Libre.	„	18	Francisco Loya Mascareñas.
Amalia.	„	3	Bazonopa Mg. Co.
Mine Love.	„	7	Calderón A. Foster.
La Bufa Colorada.	„	12	George M. Holmes.
La Regeneración.	„	5	Martiniano Holguín.
La Morolense.	„	8	Manuel Díaz y socio.
La Protección.	„	8	Hilario Rocha y socios.
Adela.	„	5	Inocente Ochoa y socios.
El Rosario.	„	8	Nemecio Sandoval y socio.
San Fernando.	„	14	W. H. Cowan.
Don Pedro.	„	20	Tiburcio García.
San Salvador.	„	6	George M. Holmes.
San Dionisio.	„	10	José Gutiérrez y socio.
María.	„	6	Angel P. Araiza.
El Chile Ampl.	„	2	Tiburcio García.
Ampl. de Viola.	„	7	„
El Chivero.	„	16	L. F. Wilson.
El Lucero.	„	10	„
Malda.	„	6	Carlos S. Colemann.
The Hidden Fressma.	„	5	„
Anexas á Colón.	„	3	Tiburcio García y socios.
La Encerradora.	„	11	Fied E. Stone.
La Cenicera.	„	10	Angel P. Araiza.
Orión.	„	28	G. Wsudler.
Tiro Central.	„	35	„
Cometa.	„	4	„
División.	„	8	Francisco Casares.
Guadalupe.	„	6	„
Mariquita.	„	3	W. H. Cowan.
Nueva Exposición.	„	6	La Mexicana Exp. Co.
La Unión.	„	2	Chas. S. Coleman y socios.
Díaz.	„	8	Arnold D. Higgins.
San Juan.	„	10	Francisco L. y Mascareña.
Anexas á Clemencia.	„	2	J. E. Irey y socios.
La Encerradora.	„	6	L. T. Wilson.
La Abundancia.	„	20	„
Maravilla.	„	20	D. B. Freman.
Llave de S. Pedro.	„	1	Tiburcio García.
San Antonio.	„	9	La Mexicana Exploration Co
Anexas al Rosario.	„	13	The Rosario Mining Co.
El Poche.	„	17	George M. Holmes.
El Tesoro.	„	6	Charles S. Coleman y socios.

La Aurora.	G. y Calvo.	4	Marcos Russek.
La Estrella.	„	8	Simón Carrillo y socios.
Vedema.	„	20	José B. Knotts.
Margarita.	„	18	Albino García.
Margarita.	„	18	Albino García.
El Pabellón.	„	6	Angel P. Araiza y socios.
El Tránsito.	„	4	S. H. Cowan y socio.
Don Porfirio.	„	4	Arnold D. Higgins.
La Soledad.	„	8	Enrique Hirirt.
Los Angeles.	„	5	C. H. Cowan y socios.
La Cobriza.	„	8	German Wendler.
La Mexicana.	„	2	Francisco Cásares.
Mary Eleven.	„	8	José D. Knotts.
Isis.	„	22	„
Extensión de Dolores.	Morelos.	14	Tomás R. Schanhan.
Mamie.	G. y Calvo.	8	José D. Knotts.
Illas.	„	10	„
Helen.	„	6	„
La Herrada.	„	10	„
El Madroño.	„	15	„
San Francisco.	„	24	Francisco P. Martínez.
Concha.	„	4	Angel Santustun.
La Realidad.	„	4	Angel Santustun.
Calabacillas.	„	19	Julio Orozco.
S. Manuel de la Blanca.	„	6	F. Loya y Mascareñas.
Santa Rosa.	„	5	Julio Orozco.
Socavón de Fortuna.	„	6	German Wendler.
Magistral.	„	8	J. R. Wilson.
La Trinidad.	„	5	F. Loya y Mascareñas.
Dos de Abril.	„	10	Julio Orozco.
Terry.	„	3	José D. Knotts.
Santa Teresa.	„	2	Miguel García.
El Cimatario.	„	12	Angel P. Araiza y socios.
El Triunfo.	„	6	Juan B. González.
San Miguel.	„	6	L. T. Wilson.
El Santo Niño.	„	3	Julio Orozco.
Carmen.	„	15	Miguel Chávez.
El Santo Niño.	„	5	Francisco García y socios.
El Benemérito.	„	11	Romualdo Sepúlveda.
Anex. á M. Ahumada.	„	2	Tiburcio García.
América.	„	4	Angel P. Araiza.
Viva México.	„	4	Sufy Hnos. y socios.
La Mexicana.	„	8	Jesús B. Sánchez.
Santa Matilde.	„	6	Miguel Chávez.
San Miguel.	„	10	Celso Durán y socios.
San Joaquín.	„	4	Ignacio Orozco y socios.
La Madrépora.	„	30	Angel P. Araiza.
María Luisa.	„	12	Rafael Ochoa Andrade.

La Providencia.	G. y Calvo.	16	Abelardo Yeres y socios.
La Concepción.	„	3	Darío Peinado y socios.
Xochitl.	„	2	José M. Tavizón.
La Palmilla.	„	4	Miguel Chávez.
El Santo Niño.	„	4	Federico Loya y socios.
Dolores.	„	6	„
María Luisa.	„	12	Francisco Larriva.
La Palma.	„	22	Simón Carillo y socios.
La Paz.	„	3	Manuel García.

COMPLETE LIST OF MINES

IN THE

RAYON DISTRICT.

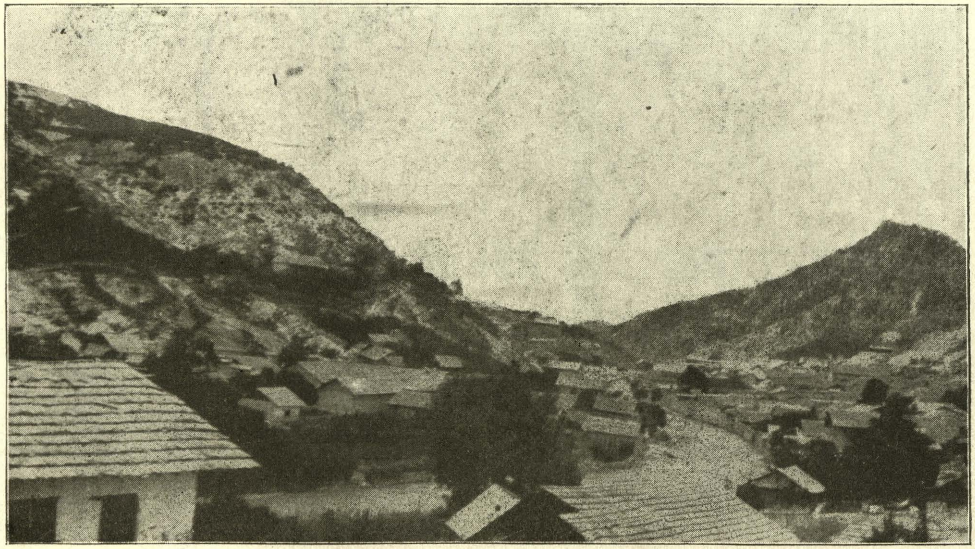
Ocampo. (County Seat).

San Luis.	Ocampo.	3	Ig. Elías y F. Rascón.
Santo Domingo.	Uruáchic.	2	Bartolomé Rascón.
El Carmen.	„	2	Richard C. Flawer.
El Manto.	„	3	Abraham R. Ortiz.
La Catarina.	„	3	Abraham R. Ortiz.
Providencia.	„	3	Juan Trejo y socios.
Animas.	„	2	Rascón Hermanos.
S. Martín y D. Nomb.	„	8	Juan J. Waterson.
San Timoteo.	„	6	S. R. y Emilio Ortiz.
San José.	„	2	Rascón Hermanos.
La Cubana.	Ocampo.	4	„
Negoc. la Luz.	Uruáchic.	5	La Cascada Mining Co.
La Armonía.	„	2	Nicolás Monjarres y socios.
San Andrés.	„	2	Bartolomé Rascón.
Santa Rosa.	„	2	Daniel Rascón.
San Martín.	„	2	Richard C. Floyer.
Miguel Hidalgo.	„	3	Victoriano Sáenz.
San Pedro.	„	4	Luz y Manuel Quesada y s.
San Pedro.	„	10	Enrique Peterson.
El Transvaal.	„	10	C. Nieto y A. Escobar.
La Virgen.	„	4	L. Lucero.
Despreciada.	„	10	Juan F. Zaldívar.
Las Tres Gracias.	„	3	Salvador y L. J. Arellano.
El Consuelo.	„	15	Agustín Escobar y socios.
La Independencia.	„	5	Miguel N. Parra.
La Abundancia.	„	5	Ramón Campos.
Concordia.	„	1	Bartolomé Rascón.
La Mexicana.	„	14	Krakauer Zork y Moye.
La Despedida.	„	6	Luis R. Avitia.
La Unión.	„	3	Bartolomé Rascón.
Montecristo.	„	3	Ezequiel y Gabriel Rascón.
El Porvenir.	„	4	Gabriel Rascón y socios.
El Porvenir.	„	2	Bartolomé Rascón.
San Juan.	„	16	Jesús Solís.
Resurrección.	„	3	Germán Trejo.
Los Insurgentes.	„	7	Victoriano Sáenz.
Los Azules.	„	3	Gabriel Carrasco y socios.
La Florida.	„	5	José Córdoba
Nelly B.	„	10	J. E. Carnahan.
El Siglo XX.	„	4	Juan C. Trejo.

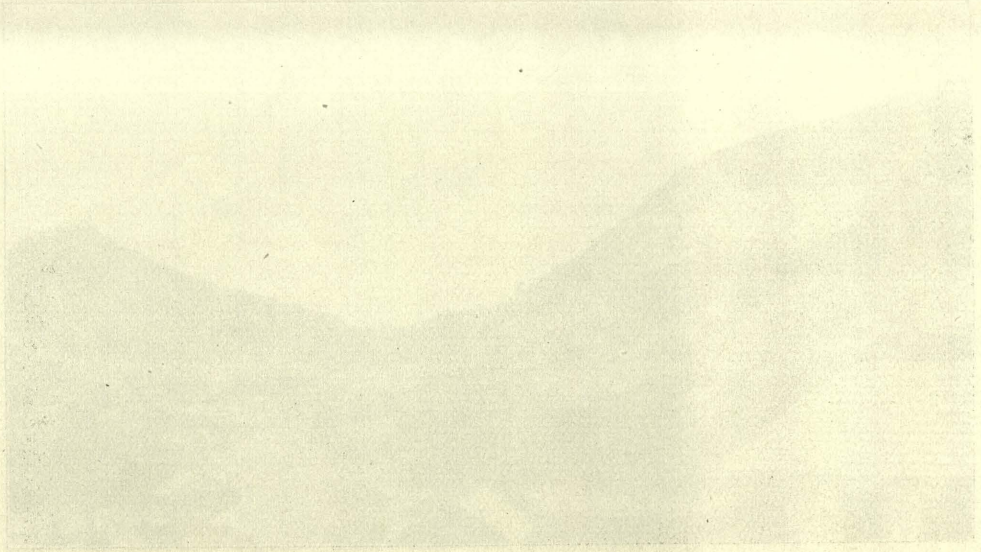
Polo Norte.	„	1	Amado Rascón.
El Sigarrón.	„	5	J. E. Carnahan.
Dos de Abril.	„	10	Cecilio Patey.
La Mary.	„	3	J. E. Carnahan.
Cuatro Amigos.	„	4	Mariano Gramillo y socios.
Asunción.	„	5	J. E. Carnahan.
S. Fco. de Boreachic.	„	3	José Ma. Contreras y socios.
J. E. C.	„	5	J. E. Carnahan.
Buenaventura.	„	3	„
Santa Ana.	„	6	Joaquín Solís.
El Durazno.	„	3	Benjamín Rascón.
Grace.	„	3	Charles Smith.
Restauradora.	„	4	Amador Rascón.
El Palmerito.	„	5	Miguel Rascón Hno.
Corea.	„	12	Federico R. Seyfert.
Las Violetas.	„	6	Benito Krieb.
Los Polos.	„	6	Benito Krieb.
Montenegro.	„	40	Benjamín Rascón.
La Perla.	„	5	J. E. Carnahan.
San Juan.	„	49	Juan J. Waterson.
La Eva.	„	10	C. E. Delno.
Santa Bárbara.	Ocampo.		Theo A. P. Bronn.
Sta. Bárbara anex.	„		„
Veta Grande de Navidad.	Ocampo	7	Federico Seyfert.
San José.	„	24	El Refugio Mining Mill. Co.
El Refugio.	„	23	„
Santa Teodora.	„	4	„
San Vicente.	„	14	„
La Trinidad.	„	8	„
Cont. S. No. 1. Trinidad.	„		„
Dolores.	„	6	„
Cont. E. Dolores. 1	„		„
Cont. O. Dolores 2.	„		„
Santa Teresa.	„	9	„
Cont. 1 Sta. Teresa.	„		„
Estanislao.	„	8	„
Cont. 1 Estanislao.	„		„
Candelaria.	„	8	„
Cont. 1 Candelaria.	„		„
Cónico,	„	12	„
Cont. 1, Cónico.	„		„
Belén.	„	9	Juan R. Durroch.
La Cruz.	„	14	Guillermo Denton y socios.
Moctezuma.	„	12	
Santa Ana.		10	
Isabel.	„	12	Samuel Hendy p. M. Gaytán
Santa Rosalía.	„	10	J. F. Dickens y socio.

La Soledad.	Uruáchic.	8	William Pearson y socios.
El Progreso.	Ocampo.	24	Cía. Nueva Nevada.
San José.	,,	5	Juan J. Waterson.
Santa Teresa.	Moris.	19	José Gutiérrez y socios.
Guadalupe.	Ocampo.	16	Cía. Minera El Potrero.
San Francisco.	Yoquivo.	8	Cía. Minera de Yoquivo.
Santa Teodora.	Uruáchic.	11	T. A. P. Bronn.
San Ciriaco.	Ocampo.	22	Compañía El Concheño.
Gracia de Dios.	,,	14	,,
Santa Virginia.	,,	24	Gerente M. de Herrera.
Roncesvalles.	Moris.	4	Encarnación Chairs y socios
Santa Juliana.	,,	12	Cía. Minera Sta. Juliana.
Guadalupe y San Juan	,,	16	,,
Capitán Ronquillo.	,,	8	,,
Veta Grande y S. Matías.	,,	35	,,
San Nicandro	,,	23	,,
Túnel Ronquillo.	Ocampo.	12	Cía. Minera Sta. Juliana.
Verónica.	Moris.	9	Cía. Minera de Sahuayacán.
N. de Dios Matulera.	Ocampo.	11	Luis Siqueiros.
San Amado.	,,	11	F. Siqueiros é hijos.
La Abundancia.	,,	4	Rosario Estrada.
Santa Teresa.	,,	4	Ignacio Rodríguez.
Guadalupe.	Moris.	8	Jesús Royval y socios.
San José de la Verde.	Uruáchic.	4	Fidel Rodríguez.
El Pilar.	Moris.	4	Rafael Monroy.
Providencia.	,,	4	Rafael Monroy.
La Mariposa.	Ocampo.	1	Francisco Siqueiros é hijos.
El Santo Niño.	,,	4	Jesús Porras.
Siete Estrellas.	,,	24	H. G. Danhesty y socios.
El Rincón.	,,	3	Santa Juliana Mining Co.
La Gran Señora.	,,	10	Tadeo Pérez.
Boston.	Moris.	4	Harvey B. Lawrence.
Juárez.	Ocampo.	10	Luis Siqueiros.
La Soledad Ja. Ma. y Vascongada.	,,	3	Juan J. Waterson.
La Bronzuda.	,,	8	Silviano Siqueiros.
San Miguel.	,,	6	Gaspar Neageli y socios.
Cont. de Rincón.	,,	5	Cía. Minera Sta. Juliana.
Santa Ana.	,,	7	Francisco Siqueiros é hijos.
Teocalli.	,,	2	Ignacio Rodríguez.
San Juan.	,,	5	Juan J. Waterson.
La California.	,,	5	Manuel P. Rascón y socios.
San Manuel.	,,	4	Federico Reuter.
Santa Cecilia.	,,	10	Cía. Minera Sta. Eduwiges.
Veracruz.	,,	13	Jesús Ochoa.
Orizaba.	,,	27	Luis C. y R. Hernández.
La Paz.	,,	1	J. J. Waterson y Co. S. José
La Humildad.	,,	6	Francisco Siqueiros é hijos.

Ampl. Verónica.	Moris.	8	Cía. Minera Sahuayucan.
Sta. Librada 3.	Ocampo.	12	Leece Kermode.
Zaragoza.	,,	5	Federico Reuter.
Porfirio Díaz.	,,	16	Leonardo Pérez.
Dolores.	,,	5	Jesús Orozco.
Esperanza.	Moris.	8	Rafael Monroy.
La Unión.	,,	4	,,
Santo Niño.	,,	4	Rafael Córdoba y socios.
Chicago.	,,	12	Harvey B. Lawrence.
La Cruz.	Uruáchic.	7	Rafael Córdoba y socios.
Mojarachic.	,,	4	Juan Manuel Rodríguez.
Santa Elena.	Moris.	6	Graciano Siqueiros.
Oregón.	Ocampo.	12	Carlos A. White.
La Esperanza.	Moris.	8	Vicente González Pérez.
Buenaventura.	,,	15	Harvey B. Lawrence.
Santa Julia.	Ocampo.	5	Teodoro A. P. Braum.
Cuba Libre.	,,	4	Geo. Forges y socios.
Noche Buena.	,,	4	Antonio Luevano.
Standard.	,,	2	Carlos A. White.
Santa Margarita.	,,	16	Juan J. West.
San Miguel.	,,	5	Juan J. Waterson.
Escondida.	,,	8	Carlos A. White.
San Antonio.	Moris.	4	Pedro Vega.
La Paz.	Uruáchic.	3	Montecristo Mg. Co.
Argentina.	Moris.	4	Luis Siqueiros.
La Cruz.	Ocampo.	5	Francisco Siqueiros é hios.
La Pródiga.	Moris.	2	Daniel Rascón.
El Fakir.	,,	6	Tomás Andrew.
Santa Anita.	Ocampo.	1	Marciano Chávez.
La Grandeza.	,,	5	José R. Mariscal y socios.
María.	,,	2	Carlos Morales.
Cont. Sta. Cecilia.	,,	8	Cía. Minera Sta. Eduwiges.
San Benjamín.	,,	5	Francisco Villalpando.
San Francisco.	,,	6	Enrique Peterson y socios.
La Purísima.	,,	1	Manuel R. Vidal.
Lady Smith.	,,	8	Henry Peterson.
La Dura núm. 2.	Moris.	5	Procopio Olea.
San Joaquín.	,,	4	Silviano Siqueiros y socios.
Montecristo.	Ocampo.	6	Jesús Bustamante.
Santa Bárbara.	,,	8	Manuel R. Vidal.
Virginia.	,,	8	H. Peterson.
La Protectora.	,,	7	Juan J. Waterson.
La Purísima.	,,	6	Leandro Anchondo.
Benito Juárez.	Moris.	3	Miguel Prado.
San Eugenio.	,,	7	Carlos A. White.
La Luz.	Ocampo.	10	Luis Siqueiros.
Virgen María.	,,	10	Manuel R. Vidal.
Santa Teresa.	,,	12	Leandro Anchondo.



View of Guadalupe y Calvo. District Mina.



CENSUS OF PRINCIPAL TOWNS AND MINING CAMPS OF CHIHUAHUA.

ARTEAGA DISTRICT.

Chínipas.	2500	Milpillas.	218
Loreto.	206	Chimacas.	123
Chaichiaco.	134	Basorcachic.	183
San Agustín.	188	Millonaria Mill.	100
Guarasemo.	104	Espiritu „	107
Corral de Piedra.	151	Verónica „	132
Cieniga.	142	Uruapa „	450
Palmarejo (mine). —	1500	**Guazapares.** ——	800
Gavilanes.	151	Monterde Mill. & Mine.	186
Durazno.	101	Guachacure.	290
Galvaldon.	197	Mineral.	114
Gerogachic.	218	Temores.	448
La Caña.	131	Batoságachic.	146
El Zapote.	195	Santa Matilde.	416
San Rafael.	105	Tepochique.	409
Agua Caliente.	378	Guadalupe.	800

ANDRES DEL RIO DISTRICT.

Batopilas. —	3327	Papagichic.	898
Colima.	220	**Urique.** —	2313
Tierra Prieta.	223	El Realito.	518
Chilicotes.	195	Cerrocahuese.	410
Rodeo.	118	La Cieneguita.	375
San Gabriel.	188	Huachara Mill.	505
Guachochic.	147	Guadalupe.	358
Arenal y Palomas.	439	Guapalaina.	449
San Ignacio.	420	Los Táscates.	387
Yoquivo.	635	Quintero.	730
La Sonora.	137	Guagueino.	521
Loreto.	160	**Morelos.**	789
Rancho Jesús María.	314	Potrillos.	994
Teloreachic.	154	S. Antonio de las Huertas.	123
Casas Viejas.	154	Norogochic.	278
Munérachic.	430	La Dura Mill.	210
Rancho Viejo.	241	Los Laureles.	222
La Descubridora Mill. —	797	Tohayana.	643
Camuchin.	157	San Miguel.	523
Alisos.	315	**Zapuri.**	239
San Rafael.	351	Las Lagunitas.	244
Norogachic.	1619	Temochic.	604

Pasiguarachic.	205	Santa Anita.	684
Paguichichic.	125	Aboreachic.	918
Tetoguichic.	484	Caloreachic.	562
Cusarave.	621		

BRAVOS DISTRICT.

Ciudad Juárez.	8218	Gallego (ranch).	270
Samalayuca.	174	Guadalupe.	680
Zaragoza.	302	**San Ignacio.**	407
Villa Ahumada.	657	**El Carrizal.**	746
Santa Rosa.	156	Alamos de Peña (ranch)	104

CAMARGO DISTRICT.

C. Camargo, Sta. Rosalía	4709	Las Delicias.	352
San Diego.	139	S. Pedro de Conchos.	567
Rancho Viejo.	150	Casa Blanca.	163
La Enramada.	642	**La Cruz.**	1510
Labor del Rosario.	338	S. Francisco de Conchos	512
El Porvenir.	209.	San Ambrosio.	238
San Leonardo.	115	Pagarito.	217
S. Francisco de Paula.	226	**Julimes.**	2415
Río del Parral.	198	La Reina.	200
Rosales.	1724	La Labor Nueva.	1894
Saucillo.	2100	Guadalupe.	1674
Pascualero.	171	**Meoqui.**	1800
Naica.	1500		

GALEANA DISTRICT.

Casas Grandes.	4000	Sibnal.	138
Mina San Pedro.	1079	Las Palomas.	123
Candelaria Mine.	298	**Galeana.**	350
Sin Nicolás Mine.	370	**Janos.**	672
Collalitos.	320	**San Buenaventura.**	2787
Leon Mine.	538	Carmen.	878
Ancon del Burro.	181	San Lorenzo. (ranch)	342
Colonia Juárez.	989	San Luis (ranch)	237
Colonia Dublán.	578	San Miguel. (ranch)	334
Colonia aPicheco.	198	Espindoleña.	286
San Diego (ranch).	108	Bocas (ranch).	263
Srita. de León (ranch)	158	San Isidro.	456
La Peña (ranch).	124	San Antonio. (ranch)	187
Ascensión.	1578	San Joaquín. (ranch).	187
Colonia Díaz.	578	N. Casas Grandes.	500

GUERRERO DISTRICT.

Guerrero.	3578	Ariseachic.	649
Santo Tomás.	648	Yepomera.	335
Santiago.	876	Tepolacachic.	577
Rosario.	433	Colorado.	504
San Antonio.	233	Matachic.	929
Basuchil.	1050	San Luis.	165
S. José Alburquerque.	180	**Bachiniba.**	539
San Isidro.	554	San Miguel.	365
Palmírachic.	665	La Cruz.	156
Fermechic.	572	San Gerónimo.	278
Pachera.	485	El Carmen.	181
Guadalupe.	288	**Namaquipa.**	1590
Tomochic.	520	Las Cruces.	1009
Concepción.	420	Yepachic.	137
Miñaca.	232	Tutuaca.	175
Temósachic.	1363		

(Ranches less than a hundred omitted.)

HIDALGO DISTRICT.

Parral.	17789	La Jabonera.	200
Santa María.	157	El Charco.	264
Gomera y Primera.	234	Nuevo Luis.	516
San Julián.	322	Nolerio.	394
Cordero Mine.	191	La Boca.	101
Cuevecillas.	197	El Palomo.	301
Las Animas.	215	Ancon del Burro.	324
Santa Rosa.	324	**Balleza.**	564
Olivos.	745	El Potrero.	198
Guadalupe.	328	El Cerrito.	144
San Nicolás.	290	Las Agujas.	287
San Javier.	345	Baquiriachic.	456
San Ignacio.	631	Alamos.	240
Santa Bárbara.	3406	San Rafael.	164
Santa Ana.	854	Los Baños.	234
Santiago.	1345	Cristóbal (ranch)	134
Buena Vista.	62	San Esteban.	416
Huejotitán.	445	San Juan.	193
Balsequillo.	286	San Juan (ranch)	175
M. Nuevas. (V. Escobedo).	2606	Teconchic.	962
Almanceña.	258	**San Isidro Las Cuevas.**	1275
Las Playas.	353	Roncesvalles.	653
El Ojito.	239	Peinado.	854
S. Antonio del Potrero.	242	Sombreretillo.	333
Terroncillos.	307	Durazno.	112

Estanzuela.	111	Mirador.	240
Sauceda.	148	El Potrero Mill.	203
Velasco.	149	San Mateo.	877
Noria de S. Ignacio.	111	Guarachic.	610
San Cristóbal.	178	San Nicolás.	396
Velázquez.	230	Baqueteros Mill.	302
Zaragoza.	1304	Salitre.	127
San Felipe.	449	**El Rosario.**	395
Talamantes.	112	San José de Gracia.	465
La Laborcita.	249	Rosotilla y Alamitos.	235
S. Francisco del Oro.	1100		

ITURBIDE DISTRICT.

Chihuahua.	35000	La Laborcita.	145
Guadalupe.	1889	Cienegüilla Ranch.	132
Nombre de Dios,	1446	San Gregorio (ranch)	156
La Cañada.	364	Rancho Viejo.	100
El Cañejón.	528	Aguaje (ranch).	456
Charco.	525	San Toribio.	272
Fresno.	148	Nopallera (ranch).	204
Las Escobas.	109	Cuates de Abajo.	105
Chuviscar.	748	La Herrera (ranch).	171
Agua Nueva.	334	San Juanito (ranch).	199
Encinillas Mill.	1109	Majalcas (ranch)	132
Sauz.	296	San Juan Chubiscar.	103
Sacramento.	163	Santa Cruz de Mayo.	454
Torreón.	178	San Bernardino.	103
Corral de Piedras.	268	**San Lorenzo.**	1043
Mápula Mill.	686	Magistral Mine.	336
Dolores Mill.	506	San José de Gracia.	256
Tabalaopa.	698	Capotes.	325
Santa Eulalia.	1344	**Villa Aldama.**	3100
San Antonio.	178	San Diego.	685
Mina Vieja.	245	El Placer de Guaadlupe.	226
Santo Domingo.	290	El Pastor.	198
Coyame.	1210	Santo Domingo.	352
Cuchillo Parado.	490	Chorreras.	368
Las Vigas Mine.	101	El Pueblito.	466
Coyame Mina.	100	**Ojinaga.**	2100
Josefina.	75	Mayjoma.	1001
Santa Isabel.	888	El Mulato.	1033
Rancho Palacio.	901	San Carlos.	1057
Baeza Ranch.	207	San Francisco.	305
Rosario.	315	San Antonio.	547
Granillas Ranch.	208	La mula.	287
San Miguel Hacienda.	410	San Juan.	248
Carretas.	1070	Santa Bárbara.	154
Cienega La joya.	202	Los Remedios.	404
Blanco (ranch).	148	Cuevecillas.	434

Las Lajas.	222	Sta. Rosalía de Cuevas.	74
Tutuaca.	345	Sta. María de Cuevas.	465
Las Vigas.	210	25 de Marzo.	820

JUAREZ DISTRICT.

Cusihuiriáchic.	755	Humariza.	288
San Juan Bautista.	848	**San Borja.**	858
La Quemada.	404	Cieneguita.	211
Cayachic.	361	Teparachic.	261
Ranchos.	579	El Porvenir.	140
San Juan de la Junta.	232	La Suceria.	120
Ciénega.	214	Saqurachic.	178
La Reina.	234	Santa Rosa María.	269
Bustillos.	413	Santama.	166
Buenos Aires.	395	Guadalupe.	214
Rubio.	336	Santa Rita.	144
San Diego del Monte.	290	**Satevó.**	987
Naparechic.	257	San José de Gracia.	270
Santa Catalina.	218	S. Nicolás de la Joya.	228
El Mortero.	412	Tres Hermanos.	576
San Antonio.	196	Babonoyava.	421
Real de Abajo.	188	La Joya.	395
S. Francisco de Milpillas.	141	San Antonio.	1088
La Soledad de Coyotillos.	105	Cieneguita de Vaquita.	256
Huisachic.	102	Molina y Sosa (ranch).	382
San Andrés.	1840	San Juan Veracruz.	387
San Juan.	313	Ojo de Agua.	359
Piñonero.	261	Boca del Río.	287
Rancho de Beltrán.	209	Casa Colorada.	260
Saucito.	171	San Agustín.	260
San Andrés.	327	San Onofre.	171
Guadalupe.	397	Guadalupe.	163
Ciénega de Ortiz.	838	La Cantera.	156
Talamantes.	225	Sombreretillo.	130
El Terrero.	140	**Carichic.**	1453
Blanco.	310	Ojos azules.	586
Sandoval.	513	Carichic (ranch).	765
San Miguel.	144	Majimachic.	144
Cerro Prieto.	567	Panalachic.	380
Alamos.	228	Sisoguichic.	415
Carbajal y Atio.	155	Bocoyna.	260
San Rafel.	101	Pasigochic.	517
Holguín.	287	Torigochic.	308
Nonoava.	1034	Boqueachic.	1160
San Andrés.	234		

JIMENEZ DISTRICT.

Cd. Jiménez.	10312	El Carmen (ranch).	145

Escalón.	616	Iturralde.	126
Remedios (ranch).	133	Talamantes (Factory).	652
Rayano (ranch).	131	Balsequillo.	436
Salinas de Palomas.	131	Corrales (ranch).	190
Presa de Zabalza.	277	S. Cruz de Ancira.	175
Villa de Allende.	1876	Punta de Agua.	107
El Pueblito.	516	**Villa Coronado.**	1608
Porreña.	150	Barrio de España.	210
Labor de Garruica.	145	San Isidro.	403
San Gregorio.	175	Guadalupe.	368
Zapata (ranch).	113	San Andrés.	238
Concepción (ranch).	244	Buena Vista.	150
Catarinas.	283	Marteleña.	105
S. Diego de Corrallejo.	464	**Villa López.**	1204
Ciénega.	495	Salaices (ranch).	386
San Ildefonso.	411	La Comunidad.	108
Corrallejo de Arriba.	144		

MINA DISTRICT.

Guadalupe y Calvo.	2976	Guachochic.	1384
Dolores.	1265	Piedra Larga.	1454
San Simón.	1586	San Julián Mine.	563
San Juan Nepomuceno.	1687	Calabacillas.	1342

RAYON DISTRICT.

Ocampo (Jesús María).	3245	San José de Prival.	335
Concheño Mine.	1067	Agua Caliente.	196
Pinos Altos.	785	Los Otates.	195
Yoquivo.	544	Gosogachic.	210
Candameño.	360	Sepaivo.	212
Barcarachic.	288	Santísimo.	186
Baborigame.	245	Rancho la Joya.	128
El Refugio.	439	Gecopaco.	115
Santa Eduwiges.	106	**Moris.**	423
El Rosario.	278	Sahuayacán.	448
El alta Mine.	132	El Pilar.	236
Nueva Orleans.	175	Trampa.	216
Huajuman.	123	El Socorro.	208
Los Alisos.	132	El Durazno.	180
Uruachic.	623	La Junta.	175
Huacuivo.	778	El Cajón.	101
San Lino de Babaore.	1060	Santa María (ranch).	125
Maguarichic.	1011	Río de Ocampo. (ranch)	101
Batopillas. (ranch)	465	Galera III	111
La Unión.	467	La Ciénega.	116
Jijamarachic.	317	Agua Caliente (ranch).	100

WHAT POETS HAVE SAID ABOUT CHIHUAHUA AND WEALTH OF MEXICAN MINES.

....Aquí, donde concuren las naciones
A mostrar sus productos y Riqueza,
Ostentar puedes los valiosos dones
Que pródiga te dió Naturaleza....
(Ignacio Pérez Salazar. "A la Patria" Inauguration Ceremonies of Mexican Pavillion, París Exposition.)

II

Yo amo el valor, la fuerza y el aliento
Que al héroe, al mártir y al apóstol fragua.
Adoro á Cuauhtemoc en el tormento,
y á Hidalgo en el cadalso de Chihuahua.
(Juan de Dios Peza, México. Inauguration of Monument to Indepp-endence.)

III

Tú, ¡Oh Chihuahua! la fuente de mil huertos.
Que bulles en inmensas soledades!
La Gacela dormida en los desiertos.
Liza de bravos, ramo de beldades!
Blanca garza que animas la llanura.
Junto á las aguas del alegre río,
A tí la gratitud y la ternura,
En estas horas de dolor impío!
Dormido está á tus plantas el desierto,
Como manso león, linda matrona,
A tí se llega, cual se llega al puerto.
Alegra de tus montes la corona.
Ven, le dijiste á Juárez! ven y lucha.
Ven y tu nombre ¡oh Juárez! eterniza.
Ven, guardaré tu gloria, que yo guardo
De Hidalgo y los suyos la ceniza!
(Guillermo Prieto, Chihuahua. March 21, 1865.)

IV.

Hasta en la escena ha de rendirse culto,
Eso fué bueno para el siglo de Oro.
En que el Oro mostrábase doquiera,
Del Gas y del Vapor el siglo es este.
(Manuel Paredes. "A Ignacio Altamirano.")

V.

Levantar el oro que en las minas canta....
(Pedro Henríquez Ureña. "Ibsen." 'Revista Moderna." Méx.)

VI.

De Vulcan quisiera la ardiente fragua
Para forjarle ritmos á mi Chihuahua.
.. ..
Es una tierra rica, tan rica como noble;
Sus muros, de escarlata tiñeron sus guerreros
Con exótica sangre de francos y de iberos
En épocas aciagas. Ella vió en sus aduares
La olímpica figura del gran Benito Juárez.
.. ..
Pacheco el mutilado, Terrazas Trias han sido
Aguilas invencibles que allí tienen su nido.
.. ..
Para el hábil financiero rebosante de energías,
Va mi aplauso más ruidoso.
A vos dedico, que sois modelo
del buen gobernante. De mi natal suelo.
(G. Artalejo del Avellano. "Para Enrique C. Creel.")

VII.

Dolores y Chihuahua, extraña suerte,
cuna y sepulcro que jamás se olvida.
Si tu vida en Dolores te dió muerte,
En Chihuahua tu Muerte te dió vida.

José T. de Cuellar.

VIII.

Tus inmensas cadenas de montañas,
Hendidas por hondísimas **Barrancas**....
.. ..
El magnífico Dios de las Naciones
Al repartir al mundo su tesoro,
"Tenga México," dijo '**Plata y Oro.**"
Y en tí vertió sus opulentos dones.
.. ..
La Africa rica á quien el sol abruma,
La Europa y Asia henchidas de grandezas
No tienen las espléndidas riquezas,
Que la patria que fué de Moctezuma.

Manuel Carpio, México, 1850.

TELEPHONES IN THE STATE OF CHIHUAHUA

ARTEAGA DISTRICT. Palmarejo, El Zapote, (Chínipas) Carrizo. There are (30 kilometers of wires 3 aparatus.)

BRAVOS DISTRICT. C. Juárez to El Paso Texas, Guadalupe, Hacienda San Agustín, etc. (There are 85 aparatus)

CAMARGO DISTRICT. Cd. Camargo (Sta. Rosalía), Santa Rosalía Springs, Concho, Naica, Saucillo. (39 Ks. 35 aparatus.)

GALEANA DISTRICT. Casas Grandes, Nueva Casas Grandes, Dublán, Colonia Juárez, Santo Domingo, San Pedro, Corralitos, Estación Terrazas, Pratt's Ranch. (266 Ks. 16 aparatus.)

B. JUAREZ DISTRICT. Cusihuiriáchic, Carichic, La Reina. (78 Ks. 6 aparatus.)

ITURBIDE DISTRICT. Chihuahua, Santa Eulalia, Hacienda Robinson, Hacienda Avalos, San Sóstenes. (95 Ks. 375 aparatus.)

GUERRERO DISTRICT. Cd. Guerrero, Miñaca, San Antonio, San José de Alburquerque, San Isidro. (56 Ks. 11 aparatus.)

HIDALGO DISTRICT. Parral, Santa Rosalía, Villa Escobedo, (Minas Nuevas), San Isidro de Las Cuevas, Sombreretillo, San Francisco del Oro. (163 Ks. 105 aparatus.)

RAYON DISTRICT. Ocampo, (Jesús María), Moris, Sahuayacán, Potrerito and Pinos Altos. (50 Ks. 35 aparatus.)

TELEGRAPH LINES.

	Ks.
Federal Government.	2,884
State Lines.	180
Mexican Central R. R.	834
Río Grande, Sierra Madre & Pacific.	200
Kansas City Mexican & Orient.	117
Chihuahua & Pacific.	288
C. C. C. R. R. Temosachic to Madera.	55
	4,058

TELEGRAPH LINES IN THE STATE OF CHIHUAHUA.

The Service is quite perfect reaching nearly every City of Importance and Principal Mining Camps.

No. 1.—This line is From Chihuahua to Ocampo.
No. 2.—Chihuahua to Coyame & Ojinaga.
No. 3.—Chihuahua to Jimenez, Parral, Balleza, San José de Gracia, Guadalupe y Calvo: thence to Sinaloa.
No. 4.—Chihuahua, Cd. Juárez, Palomas, Ascensión; thence to Agua Prieta, Sonora.
No. 5.—Cd. Guerrero to Uruachic, Chínipas; thence to Alamos, Sonora.
No. 6.—Parral, to Santa Bárbara, Guadalupe la Rueda; thence Guanaceví, Durango.
(Above are Government lines.)
Following is the Tarif to principal towns and **Mining Camps.**

Ascensión per 10 words.	40	Miñaca.	45
Agua Caliente vía Parral	55	Moris (vía Ocampo).	65
Batopilas (vía Chínipas	1.45	Ojito (vía Parral).	60
Balleza.	40	Ojinaga.	40
Chínipas.	40	Ocampo.	40
Cd. Juárez.	60	Parral.	40
Cusihuiriáchic.	45	Pinos Altos.	40
Coyame.	40	Palomas.	60
Carichic.	70	San Sóstenes.	18
Camargo (Sta. Rosalía)	40	San Andrés.	15
Casas Grandes.	60	San Antonio.	21
Concho (vía Camargo)	60	Temósachic.	20
Corralitos.	90	Tecolotes (vía Parral).	60
Escalón.	80	Tepolocáachic.	65
Guerrero.	20	Terrazas Station.	20
Guadalupe y Calvo.	60	Urique (vía Chínipas).	115
Jiménez.	20	Uruáchic.	60
Ocampo (Jesús María.	40	Santa Bárbara.	40
Mesa Sandia (vía Parral)	40	Villa Ahumada.	40
Minas Nuevas.	40	Allende.	40

PRODUCTION OF GOLD AND SILVER BULLION

First half of the fiscal year 1906-07:

Silver.	1.096,365.43
Gold.	535,371.12
Total.	$ 1.631,736.55

(Chihuahua Federal Assay Office.)

RAILROADS IN THE STATE.

		Klms.
1	Mexican Central. (C. Juárez).	834.0
2	Rio Grande, Sierra Madre & Pacific. C. Juárez to Terrazas	200
3	Chihuahua & Pacific. Chihuahua Miñaca & Temósachic.	288
4	Kansas City, Mexico & Orient. Chihuahua, Aldama, San Sóstenes. Miñaca, Aguatos.	275
5	Parral & Durango.	56
6	F. C. Mexicano del Norte. Escalon to Sierra Mojada.	56
7	Naica Mining Co. Naica to Conchos.	28
8	Cananea Consolidated Copper Co. Railway System. Temosachic to San Pedro Spgs. (constructing).	55
9	Pittsburg San Jose Reduction Co. S. Jose del Sitio to Gavilana.	26.7
10	Chihuahua Mining Co. Chihuahua to S. Eulalia.	22.5
11	F. C. Mineral de Chiuahua. „	21.1
12	Palmarejo Mining Co. Chínipas to Palmarejo.	18.9
13	Moctezuma Lead Co. Santa Bárbara.	9.
14	Calera Mining Co. Calera to San Isidro.	8.
15	Batopilas Mining Co.	9.
16	Concheño Mining Co.	8
	Cía Minera Y. R. Ramos S. A. Station Baca to Cigarrero Mine Almoloya.	8

Street Railways.

Cd. Juarez to El Paso Texas. (Electricity.)	3.2
Chihuahua City Railways. (Animal.)	9.
Jimenez Street Railways. „	2.0
Aldama Street Railways. „	2.
Parral Streets Railways (concession).	0
Camargo Sreet Railways (concession).	0.

PRODUCTION OF ORES IN THE STATE.

During the last twelve months, there were shipped from the following Station:

	Tons.
Chihuahua.	219,525
Parral.	136,350
Jiménez.	28,965
Ciudad Camargo.	57,273
Villa Ahumada.	187

A total of 442,000 tons at a minimum price of $25.00 amounts to $11.070.000.—(El Economista Mexicano.)

Of this amount 20,000 tons of zinc were included.—(Chihuahua Federal Assay Office.)

PRODUCTION OF MINES IN 1904.

No.	Name of mine.	Owner.	Municipality.	Hect.		
—	—	—	—		GS	6,000
1	San José.	Waterson Gold Ld.	Ocampo.	5	„	800
2	San Amado.	Francisco Siqueiros é Hijos.	„	11	„	7,000
3	Belén y otras.	Belen Mining Co.	„	115	„	33,819
4	Gracia de Dios y otras. . .	Compañía Beneficiadora del Concheño.	„	75	GSL	3,000
5						
6	Santa Teresa.	Compañía Minera Sta. Teresa.	„	91	„	6,000
7	Verónica y Anexas.	Cía. Minera Sahuayacán.	„	19	„	23,000
						1,840
GALEANA DISTRICT.						
8	Congreso y León.	Candelaria Mining Co.	Casas Grandes.	63	„	161
9	Candelaria.	„ „ „	San Pedro.			
10	San Librado.	„ „ „	„	26	„	224
11	San Pedro.	„ „ „	„			
12	Santo Niño.	„ „ „	„	30	„	304
13	Wallace.	„ „ „	„		„	73
14	Hennesy.	„ „ „	„	12	„	112
15	San Albino.	„ „ „	„	26	„	15
16	San Nicolás.	„ „ „	„	12	„	962
17	La Cortada.	„ „ „	„	5	„	20
18	Mills.	„ „ „	„		„	20
19	Pedro Peña.	„ „ „	„	891	„	111
20	Buenos Aires.	„ „ „	„		„	110
21	Noventa y Nueve.	„ „ „	„		„	„
22	Fortuna.	Fortuna Mining Co.	Casas Grandes.	8	SCGL	80

	Owner.	Name of Mine.	Municipality.		Metric Tons.
23	América.	Palmer y Berg.	Casas Grandes.	5 SCGL	5
24	Aventurera.	Aventurera Mining Co.	Ascensión.	80 LSG	2,800
25	Santo Domingo.	„	„	„	
26	Mapimí.	„	„	„	
27	Dos Hermanos.	„	„	„	
28	Tiro Alto.	„	„	„	
29	La Gloria.	„	„	„	
BRAVOS DISTRICT.					
30	Palmillas.	Guillermo Daily y Co.	Villa Ahumada.	29 SL	900
31	Klondyke.	Ramón Luján.	„	40 „	60
JIMENEZ DISTRICT.					
32	El Rayo.	Ca. Minera I. Rodríguez R., S. A	Allende.	29 GSLCT	12,000
33	El Cigarrero.	„	„	„	
34	Las Carolinas.	„	„	„	2
35	Cuauhtemoc.	„	„	„	25
36	La Jibosa.	Guggenheim Exploration Co.	Jiménez.	37 C	4,481
37	Julieta.	„	„	30 G	1,371
CAMARGO DISTRICT.					
38	San Francisco.	Compañía Minera de Naica, S A	„	4 „	
39	Dolores.	„	Naica.	1 SLT	16,810
40	Toledo.	„	„	4 „	
41	Lepanto.	Compañía Monterrey, S. A.	„	74 „	
42	Ramón Corona.	Francisco Armendáriz Sucs.	„	18 SLG	12,590

ARTEAGA DISTRICT.

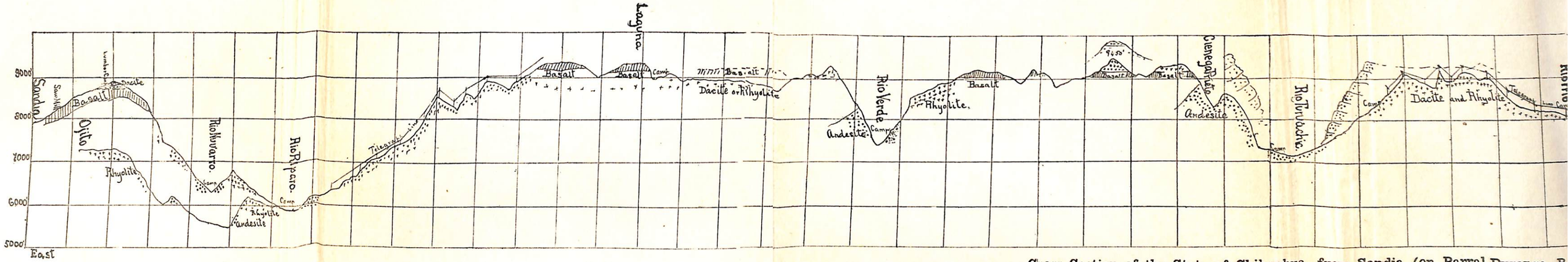
	Name of Mine.	Owner.	Municipality.		Metric Tons.
43	El Rosario.	Palmarejo and Mex. G. F.	Chínipas.	5 SLT	4,220
44	El Socorro.	,,	,,	6 GS	30,000
45	El Carmen.	,,	,,	11 ,,	
46	Dios Padre.	,,	,,	3 ,,	
47	El Presidente.	,,	,,	24 ,,	
48	Protectora.	,,	,,	3 ,,	
49	La Patria.	,,	,,	4 ,,	
50	Todos Santos.	,,	,,	4 ,,	
51	Guera al Tirano.	,,	,,	7 ,,	

ANDRES DEL RIO DISTRICT.

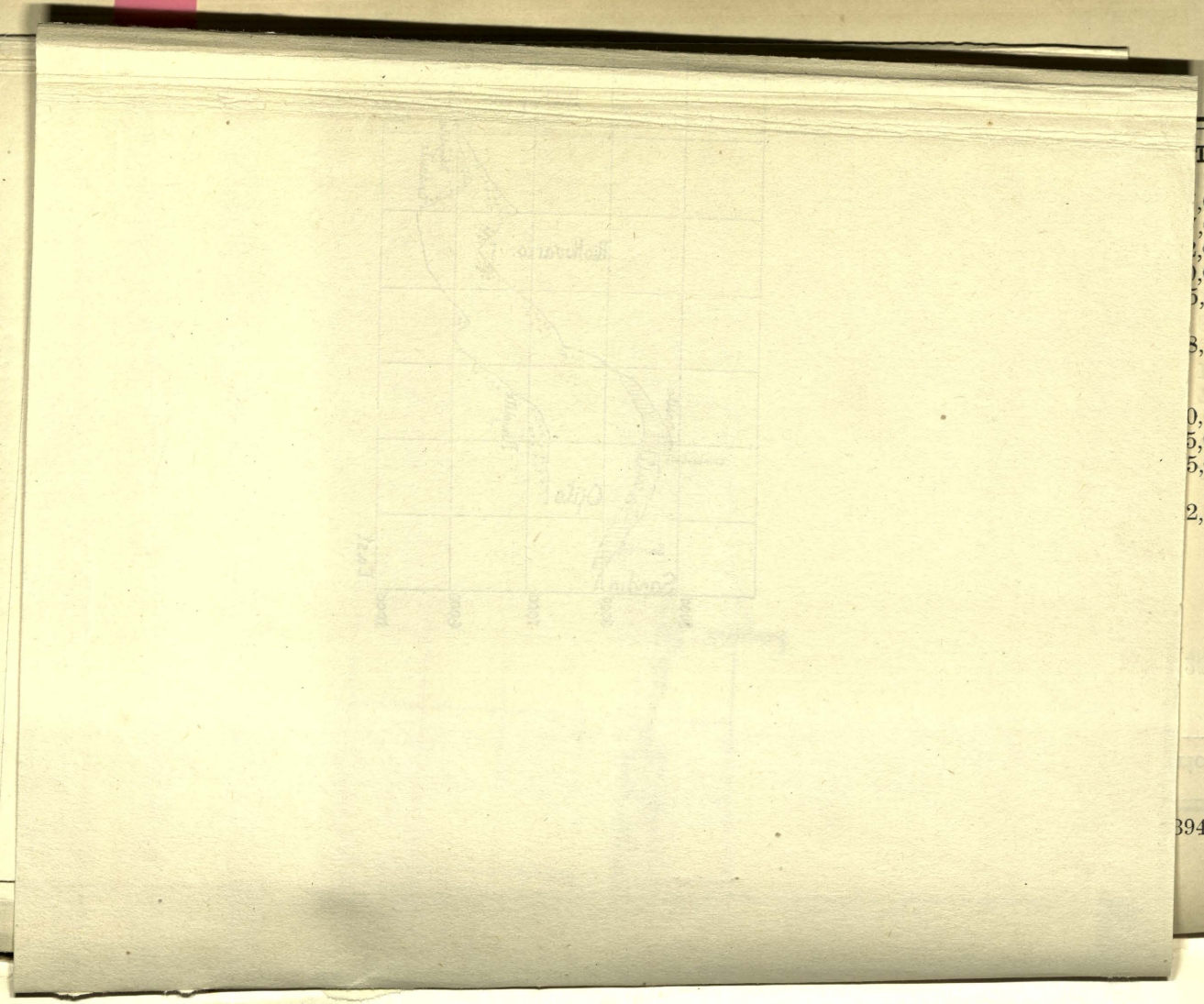
52	San Gil.	Enrique C. Creel.	Morelos.	41 S	15
53	Dolores.	Southern Mining Co.	Morelos.	8 SG	414
54	La Dura.	J. H. Milleken.	,,	2 ,,	200
55	Lluvia de Oro.	Bernardo García y Socios.	Urique.	40	1,920
56	Cuauhtemoc.	,,	,,	,,	
57	La Purísima y Anexas nú-				
58	meros 1, 2 y 3.	Mendoza y Compañía.	,,	SC Falta dato.	
59	Bahuérachic.	Arnulfo Vega.	,,	56 ,,	
60	Hidalgo.	Buenaventura Becerra.	,,	20 ,,	
61	Porfirio Díaz.	,, ,,	,,	4 G ,,	
62	El Cobre.	,, ,,	,,	17 ,,	
63	Guadalupe.	Hermenegildo Gutiérrez.	,,	3 S ,,	
64	Santos Reyes.	,, ,,	,,	5 ,,	

	Name of Mine.	Owner.	Municipality.			Metric Tons.
65	San Rafael.	Pablo Olivas.	Zapuri.	5	S	27
66	San Martín.	,, ,,	,,	5	,,	
67	Todos Santos.	Batopilas Mining Company.	Batopilas.	16,000	S. & sulf.	25,965
68	Roncesvalles.	,, ,, ,,	,,		,,	
69	Túnel Porfirio Díaz.	,, ,, ,,	,,		,,	
70	San Miguel.	,, ,, ,,	,,		,,	
71	Camuchin.	,, ,, ,,	,,		,,	
72	Descubridora.	,, ,, ,,	,,		,,	
73	Santo Domingo.	Santo Domingo Mining Co.	,,	52	S	200
74	La Gloria.	Compañía Minera "La Gloria."	,,	30	,,	
75	La Esmeralda.	,,	,,	30	G	5,290
	HIDALGO DISTRICT.					
76	La Palmilla.	Pedro Alvarado.	H. del Parral.	4	GSL	7,200
77	Cerro Colorado.	Gorham Manufacturing Co.	S. Isidro de las Cuevas.	20		1,221
78	El Refugio.	Angel García.	Villa Escobedo.	8	SL	10,000
79	Preseña y El Salto.	Hidalgo Mining. Co.	,,	11	,,	6,000
80	Morena y San Francisco. . .	,,	,,	17	,,	3,000
81	San Antonio y Constitución.	United States Co.	,,	17	,,	6,000
82	Sierra Madre.	Arturo M. Davis.	,,	2	,,	600
83	Los Muertos.	Terrenatos Mining Co.	,,	6	,,	800
84	Los Angeles.	Moctezuma Lead Company.	,,	12	P Z Ag Au	18,000
85	Mina de Agua.	,,	Santa Bárbara.	12	,,	36,000
86	Novedad.	,,	,,	16	,,	18,000
87	Tecolotes.	Guggenheim Exploration Co.	,,	33	,,	1,000
88	Alfareña.	Pedro Elizague.	,,	20	,,	10,000

	Name of Mine.	Owner.	Municipality.		Metric Tons.
89	Los Clarines.	B. W. M. Constand y Sucs.	Santa Bárbara.	6 P Z Ag Au	7,000
90	San Diego y Anexas. . . .	Cía Metalúrgica de Torreón.	„	40 „	7,000
91	Perros Bravos.	Pittsburg Manufacturing Co.	„	41 „	2,000
92	San Francisco del Oro. . .	San Francisco del Oro Mg. Lt.	„	44 „	20,000
93	Descubridora y Anexas. . .	Descubridora Mg Dev. Co.	„	336 SG	15,000
JUAREZ DISTRICT.					
94	La Reina.	Francisco Ramírez.	Cusihuiriáchic.	15 SL	8,000
95	La Escuadra.	Tomás Esquer.	„	2 S	80
ITURBIDE DISTRICT.					
96	Buena Tierra.	Sta. Eulalia Exploration Co.	Santa Eulalia.	30 SL	20,000
97	Santo Domingo.	American Sltg. Rg Co.	„	6 „	25,000
98	Mina Vieja.	„	„	7 „	15,000
99	Santa Juliana.	Eureka Mining Co.	„	9 „	200
100	La Esmeralda.	Ing. Manuel Gameros.	„	13 „	12,000
101	Las Vigas.	Geo. E. Varges.	Coyame.	74 C	60
102	San Patricio y Anexas. . .	Henry Jhompson Sucs.	„	25 „	1
103	La Marquilda.	Henry Taives.	„	10 L	70
104	Chicago.	Plactt Mc Donald.	Carichic.	8 S	10
MINA DISTRICT.					
105	Nuestra Señora del Rosario.	The R. Mand Co.	Guadalupe y Calvo.	24 GS	
106	La Independencia.	Tiburcio García y Sucesores.	„	28 „	1
107	Dulces Nombres.	The Cherokee Co. Limited.	Piedra Larga.	112 „	1
108	Los Angeles.	The los Angeles Gold Mines.	Baborigame.	80 „	1
109	Miguel Ahumada.	Tiburcio García.	Dolores.	114 „	1
110	La Esmeralda.	George M. Holmes.	San Juan Nepomuceno	S	
111	San Gerónimo.	Comp. Minera San Gerónimo.	Calabacillas	„	
				Total	394,075



Cross Section of the State of Chihuahua, from Sandia (on Parral Durango, R



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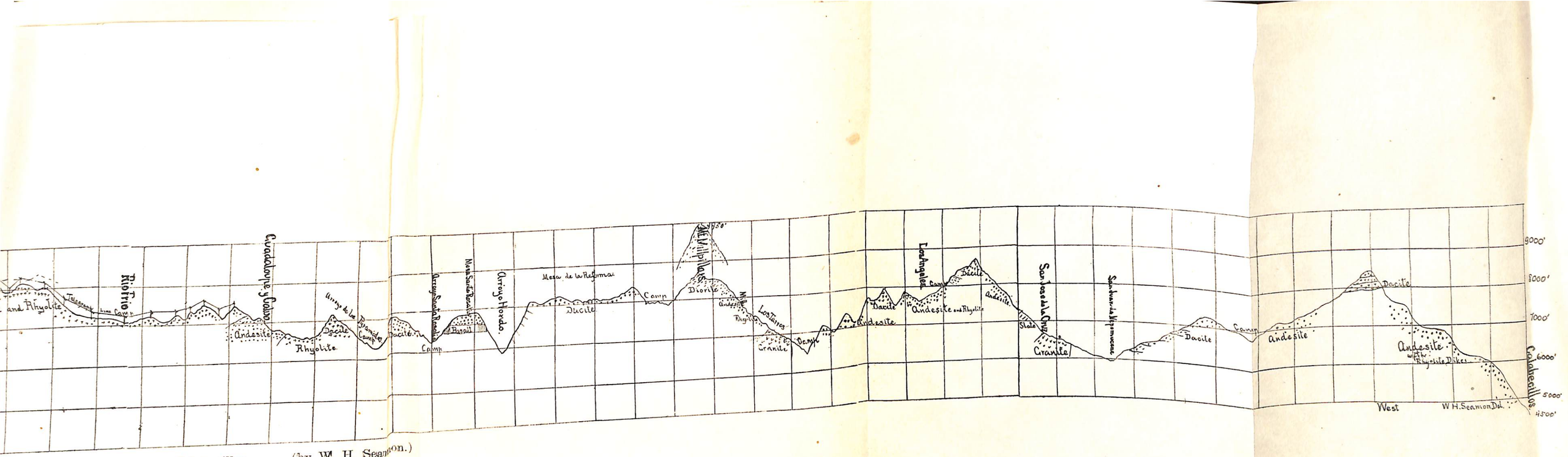
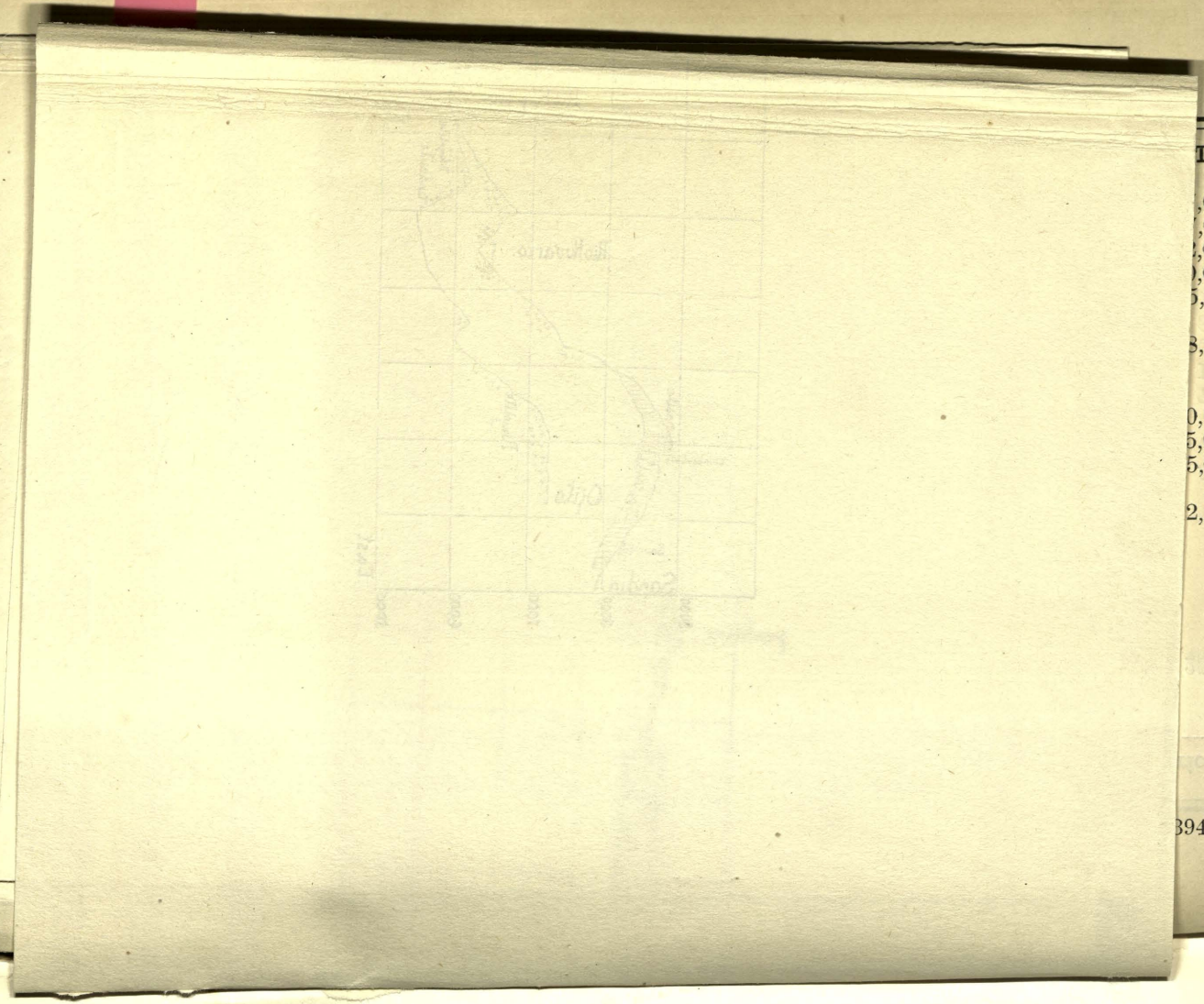


Parral Durango, R. R.) to Calabacillas. (by W. H. Seamon.)



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OBSERVATIONS IN SOUTHWESTERN CHIHUAHUA.

By W. H. Seamon.

In 1905, I traveled from Parral to Guadalupe y Calvo, from there to Calabecillos in the extreme western part of southern Chihuahua, visiting many camps and prospects within a radius of 40 miles. While riding, I made aneroid observations at every apparent change of 25 feet in elevation and noted the changes in rocks and geology so far as possible to do from horse back.

The accompanying maps represent the profile of the trail and the rate of progress, together with the geology and locations of camps for the dry season of the year. Horizontally, the squares show the advance each hour, an average of about 3 miles per hour; or measuring in a straight line, horizontally each square represents an average advance of 2 miles an hour, except when going up, or down the very steep portions of the trail. Some who have had experience in the mountains will criticize my estimate of 3 miles an hour progress as too small. For 30 years I have estimated hourly progress on trails and roads, walking, riding and driving; in a number of instances surveys made have enabled me to ascertain the value of my estimates and I know they are close. Traveling with packs, the animals carrying 200 pounds each and depending mainly for subsistence on the grasses found, 3 miles an hour for 8 hours a day is rapid progress and usually some of the animals will "play out" in less than 10 days and require a long rest.

In outfitting for this trip the groceries should be purchased in Parral. At Sandia, Guadalupe, and Calabecillos supplies may be renewed, but at high costs. Sugar, flour, beans and coffee can be had elsewhere at irregular intervals.

Camp Equipment.—All who have traveled in the Sierra Madres have experienced the difficulty of sleeping warm at night in camp. It is usual to carry from 40 to 50 pounds of blankets per man and even then one feels cold toward morning. A cot increases the coldness, as well as the weight of the pack, and a mattress does not improve the warmth sensibly. In recent years I have used a fur robe weighing but 8 pounds, and sleep warm by placing the fur next to my body, even in zero weather and with, or without, a cot, mattress and tent. My full camp equipment and cost is as follows: Fur robe made of lynx, weight 8 pounds, $65; one folding canvas cot, weight 18 pounds, $3.50; one poncho for rain in riding and to shelter tent, weight 7 1-2 pounds, $20. This forms the individual outfit, which weighs but 33 1-2 pounds. An army cooking outfit, weighing 16 pounds, cost

$5; a 9-foot by 10-foot tent, weight 20 pounds, $9, and 2 wagon sheets, 8 feet by 10 feet to cover packs, will comfortably provide for 4 men. Groceries and eatables, as well as personal conveniences, will vary with individual tastes.

I use one apparejo for unwieldly and badly setting packs and the regulation army pack saddle for other packing. The army pack saddle cannot be bought in Mexico.

The Sierra Madre is a plateau region, average elevation about 8,000 feet A. T. The plateau is so much eroded and cut up into canyons that a distant view makes it look like a series of mountain ranges. In addition to the mountains of erosion there are uplifts to a height of 10,000 feet. This plateau begins west of Parral and the eastern approach is gradual; after crossing the Continental Divide the plateau drops off to the west and erosion increases. The western boundary follows the boundary line between Chihuahua and neighboring states.

The railway may be left at Ojito, or Sandia. There is a hotel at Sandia and it is easier to purchase stock here for the trip. Pack saddles cannot be had at either point and they must be brought from Parral. The freighters generally start from Ojito, as it is a shorter road to Guadalupe. Leaving Ojito, better in the morning, the trail passes over a rolling mesa, with small lagunas, grass covered slopes and some timber. Most of the timber has been cut since the advent of the railway and much of the former beauty of the region is lost. Leaving the mesa region the traveler descends through a long valley in which rhyolite and dacite are the prevailing rocks, to the Nuvarro river; then up a steep slope in which andesite may be seen, over a rough dacite ridge and down to the Riparo river, where the trail from Sandia joins. Leaving Sandia the traveler follows a good wagon road to the lumber camp on the top of the mountain; basalt is the most frequently observed rock. Passing over the crest the trail is steep and rocky until the oak trees are passed when it becomes gradual, continuing until the Nuvarro is crossed. Ranches are found along the Nuvarro river. The trail out of the Nuvarro is rough and the descent to the Riparo gradual, through a long canyon, until the ranches of the Riparo are reached, when the trail goes up the valley, almost level. The ford at the Riparo is generally safe and freighters are apt to be encountered who will cheerfully give information. The river should be crossed and camp made on the west bank, where wood and grass may be had; if it is in the rainy season the day's travel can be advantageously extended across the Riparo farms to an eleva-

tion of about 7,000 feet, where better grass and wood, with ample water can be found.

I always follow the trail along the telegraph line, which is encountered after crossing through the fields, on the Riparo mesa. This trail is rocky, but is much shorter than the one up the Riparo to Rosario springs, which travelers usually follow. Rosario springs are about 10 hours' ride from Ojito, too far for a first day's journey. During the dry season it is necessary to go by Rosario, as no water is found on the telegraph trail between Riparo and the Lagunas. The telegraph trail follows hogbacks of dacite and volcanic tuffs and unites with the Rosario trail at about the point where the telegraph line leaves the trail and the basalt is seen.

The Laguna region is a plateau a little over 9,200 feet A. T., covered with basalt and numerous old craters, many of which are filled with water. The trail passed close to one of the largest of these Lagunas and I have visited 5 others close at hand. The second night's camp can be made in the arroyo just after passing Laguna, where good water, grass and wood will be found. The country about the Laguna is well timbered with pine and oak.

There is a very large lake in an old crater worth turning aside to see. It may be easily found by following these directions: After leaving the camp at Laguna one reaches, in 20 minutes' ride, a corral and some Indian cabins; passing them and crossing the meadow beyond, just before the slight ascent begins, a trail branches off to the right and goes up a narrow arroyo; in 25 minutes' ride from this point the large Laguna is seen. It is about 3 miles long and 1 1-2 miles wide, at the widest point. It seems to be very deep, and wild ducks are usually seen on its surface. The pines come down close to the waters' edge and several rocky islands are scattered over the surface. The regular trail to the Verde is in the next arroyo to the south.

The Laguna country is the most beautiful portion of the trip. The pine forests, open and with little undergrowth, with grass growing beneath attract the eye and rest the body. Meadows occur, surrounded with pines, and their surface masses of varying color from the different flowering plants at each season of the year. In May they will be white from daisies; in June pink from wild geranium, and in July and part of August they will be crimson with a species of wild verbena, followed by a species of rudbeckia, which covers them with a carpet of gold. The pine trees are often 90 feet high and 2 feet in diameter at the base. During the rainy season water

is plentiful in the Laguna country and good camping places may be found when needed. The rim of the Verde is 9,250 feet A. T. and the Verde 7,400 feet; this drop is made in 1 hour. Dacite is at the top and andesite near the bottom, by passing a little off the trail. A conglomerate composed of water-worn boulders of rhyolite, dacite, and andesite is found along the banks of the Verde. There are some hot springs near the top of the rim and again, near the bottom, on the east side, just above where the trail cuts across the little creek that empties into the Verde, near the ford.

There is usually a shortage of grass at the Verde and camp is best made on either bank, about 500 feet above the river, where the grass is usually better and water exists. It is a bold stream, very dangerous to ford after a heavy rain and the traveler may be detained several days waiting for a calm. Salmon trout are in its waters, but they do not rise well to the fly; they respond to bait. Bear and deer may be found if one cares to hunt. Dogs are necessary to seek out the bear.

The scenery along the Verde is grand; the light colored rhyolites of the rim, covered with the dark pines makes a pleasing contrast. The climb out of the Verde is not so steep as the descent from the east, and when the top is reached the trail for 5 hours passes through pine forests and oaks, in beautiful narrow valleys. A cedar tree 5 feet in diameter occurs close to the trail. The highest point on the trail, 9,450 feet A. T., is passed on this jornada. The drop down into the ranch of Cienega Prieto is steep and rough in places. Andesite is found at the ranch and is seen at intervals down the valley of the Turuachic river. The ranch houses at the Cienega are well built of stone and are the only occupied habitations to be encountered after leaving the Riparo.

Indian ranches occur at the Turuachic and camp should be made about 30 minutes from or beyond the Turuachic. I have been delayed by high waters at the Turuachic more than at any other stream.

The rocks along the Turuachic are massive, and have a conglomerate composition. The Arroyo del Muerto, which is traveled west of the river is rough and in places dangerous; it is very picturesque. When near the summit the telegraph line comes in from the east and then to just outside of Guadalupe the trail is never far from it. Crossing the divide a long drop is made into the valley of the Rio Frio. Numerous ranches are found along the trail and several bars have to be taken down. A good camping place exists at the Frio, if one does not care to push on into Guadalupe. From the Frio west

the trail is hard, passes over bedded dacites. Andesite cut by and covered with rhyolite and dacite are the characteristic rocks about Guadalupe y Calvo. The town contains about 500 people who lead a dull life, living I should judge off the recollections of the past glories of the mines; not very fattening, nor satisfying, but they seem contented.

The profile from the railroad to Guadalupe follows a westerly course; from Guadalupe to Los Angeles it is N. N. W.; from here to Calabecillos it is again nearly west.

A hotel exists in Guadalupe, where accomodations may be obtained. At the hacienda of the Rosario mine, after passing through the town, good accomodations may be had.

As its name implies, the Arroyo de los Pyramides contains obelisks and other forms of sculptured rocks. Pine and oak trees abound, and Indian ranches are frequent until near to the drop into Calabecillos. Mt. Millpillais is the highest point in this section. I found it to be 9,950 feet A. T., but it is believed by the residents to be much higher. Diorite occurs in its mass. After passing through the bars at the crest of the trail near Mt. Millpillais, the trail divides, the right hand leading to the town of Baborigame, and the left down the Los Tarros arroyo. The trail is generally good down the Los Tarros arroyo; ranchitas abound and corn may be bought in season The trail passes through the camp of Los Tarros by the mill and the old Rosario mine, said to have once rich in gold, but now poor in pyrite. Diorite, andesite, rhyolite and granite occur in the arroyo, and there are numerous quartz veins, but none have value.

The attractive camp of Cebollitos is about half an hour's ride to the north of the trail, just before reaching the turn off to Los Angeles mine.

The Los Angeles basin has the appearance of a well mineralized country and the traveler is prepared to see a good mine there. Pine and oak abound. Los Angeles is about 30 minutes south of the trail to San Jose and Calabecillos. The drop into San Jose is long and winding with the trail generally good. San Jose, once prosperous, is a decaying hamlet, with weeds growing in the only street.

The trail to San Jose goes down the barrancas through oaks and brush of a jungle aspect. Granite occurs between San Jose and San Juan. The latter place contains about a dozen well built adobe houses covered with tiles. The climb out of the San Juan valley is a little rough until the pines are reached, when the trail becomes easier until the Calabecillos divide is attained, when it is again quite rough.

A drop of 4,000 feet from the divide down into Calabecillos takes one into the hot country, where insects are plentiful.

GUADALUPE Y CALVO.—There are two groups of mines here, the Rosario on the west of the town, and the Independencia to the east. The Rosario is a big reef beginning near the top of the mountain and extending down the canyon, a vertical distance of 800 feet, and a shaft goes down on the vein about 400 feet. This shaft is now filled with water, but the pumping plant there can unwater the property in 3 weeks. The vein is 60 to 150 feet wide; the values being chiefly in 4 large ore chutes. The canyon cuts through the vein, but little ore has been extracted from the south side of the creek. The Rosario was discovered in 1835 by an Indian. Its palmy days were from 1836 to 1848 when it was worked by English companies, who extracted more than $40,000,000 in gold and silver. They worked only high grade ore, and owing to a scarcity of water established many small haciendas on various creeks and arroyos in the neighborhood, to which they transported the ore on pack mules for beneficiating. Ruins of these plants still exist. The same people erected a mint, just above the mine, where they made gold and silver coins, some of which may be picked up in the vicinity. The walls of the old mint, unroofed, still stand. The English people leased the mine, for in those days foreigners were prohibited by law from owning property in Mexico. They suspended work in 1848, because they could not renew the leases on satisfactory terms, and also, perhaps, because of the water in the shaft. Their old dump, except parts which have been washed away or have been picked over, still stands with 150,000 tons in it that averages 0.36 ounces gold and 7 ounces silver to the ton, as shown by runs of 1,000 to 2,000 tons. There is an open-cut on the top 1,800 feet long, 135 feet wide, and 7 feet in average depth. Since the English abandoned the mine it has had various owners. It is still a valuable property, and may some day be worked successfully.

The Independencia mine has a number of small veins. The ores are quartz with pyrite, and contain little free gold. The ores average 1.22 ounces gold and 17.51 ounces silver. This property is owned by local people, and I know of no satisfactory reason why it remains idle. Further down the arroyo occur other veins, some of which have been prospected. Stupefying dullness prevails in the vicinity of the town and there is no promise of awakening in the near future.

LOS TARROS.—This arroyo rises on the northwest slope of Mt. Millpillais and runs for a distance of about 7 miles. A strong stream

of water flows all the year, and the fall is sufficient for large power. A broad dike of porphyry cuts across the canyon and is filled with iron pyrite, carrying small amounts of gold. The Rosario vein in past years has been worked extensively and it is claimed that pockets of high-grade gold ore were found. This dike crosses into a small arroyo to the southwest, in which is located on the same dike the old mine of San Miguel. Several hundred feet of irregular workings and a tunnel 300 feet long penetrate the dike. The irregular openings have followed hilos of chalcopyrite which assay $5 to $70 per ton in gold. The hilos are not numerous and it is doubtful if it would pay to work the mass as a whole. The large dump on the mountain side contains many thousands of tons of material, but the values average only $1 per ton. I saw 15 other veins in this and the adjacent orroyos, but they have only been scratched. They show small amounts of gold, and promise fair returns with proper development. A 10-stamp mill, run 2 to 3 days, stands in excellent order, a silent monument to the blighted hopes of former enthusiastic owners. In the dump of an old mine on the Cascomates arroyo I picked samples of ore that ran 50 ounces in gold and 200 ounces silver. A tunnel 300 feet long, partly caved, is still accessible, but I saw no ore in reserve. This tunnel and 2 big pits were made by the English who worked the Rosario mine at Guadalupe y Calvo.

CEBOLLITOS.—This camp dates back to the time of the English and about 3,000 feet of work has been done on the 28 groups of claims, which are held by various persons. No work was in progress at the time of my visit in 1905: The country is andesite with quartz stringers, assaying from 0.01 to 7 ounces of gold to the ton. A large quartz vein, which I sampled, proved to be nearly barren. Considerable bullion has been taken in years gone by from several of the workings, and I am of opinion that if the groups could be united under one management and the same systematic and intelligent development employed as at the Los Angeles mines, results would be favorable. A dilapidated 2-stamp mill is on one of the claims. Ruins of 14 arrastras with their dams tell of former prosperity. The camp is in a well watered basin, surrounded by timber covered mountains, and makes a very attractive proposition for a development company.

LOS ANGELES.—These mines lie in a basin covering about 12 square miles; all are held by one company. The average elevation is about 7,200 feet A. T.; there is sufficient water available for a 30-stamp mill and plenty of good timber for all mining purposes. About

400 people live in the comfortable shacks erected by the company, and about 75 persons are constantly employed at the mines. The country rocks are andesites, with porphry dikes coming up from below. The rim is topped with dacite. Quartz veins traverse the basin. Those running from east to west are strong and carry values where prospected; there are 7 of these east and west veins which are connected by hilos, winding, but with a general northeast course. All of the veins have been surveyed, staked at the surface, and prospected slightly with crosscuts and shafts, at intervals of about 100 feet apart. One vein is developed by shafts, tunnels, drifts, crosscuts and winzes to a depth of about 400 feet from the highest point. No ore has been stoped, except for a short distance on the vein at the time of its discovery. For the past two years the property has been systematically developed by F. W. McConnell. The mine has been sampled every 6 feet. At each point, in shaft, tunnel, winze and raise, boards properly numbered are located on the walls, or are marked with paint on the walls. The gouges made in sampling are visible, being renewed and resampled whenever necessary. In the assay books of the company the results of the assays may be seen, with the width sampled. The vein averages 5 feet in width, is nearly vertical, with a slight dip to the north; it widens slowly with depth and there is a gradual increase in values with depth. There are 66,390 tons of ore blocked, sampled every 6 feet, standing in the mine, with a gross value of $773,203 and net $524,000. The vein is developed for about 1,300 feet; its easterly extension has been superficially prospected with promising results. The lowest level is nearly at the level of the surface water in the creek and a small amount of water is now forming which is easily handled by buckets. The average value of the ore above the 3rd level is $10.32 per ton; on the 4th, $14.48, and for a distance of 750 feet consecutively the vein averages on this level $17.72. About 80 per cent of the value is gold, the remainder being silver. Of some 213 assays I examined the lowest gold value was 0.08 ounce, and the highest 2.7 ounces; while the silver ranged from 0.3 to 4.25 ounces. When the mine was discovered, about 7 years ago, a 2-stamp mill was erected and some ore stoped. All stoping was stopped when Mr. McConnell took charge, and the mill has been running since only on the ore taken out during development work. About 18 months ago a cyanide plant was erected, and it has been run at intervals on the tailing pile at the mill. The extraction on the plates is 47.7 per cent, and the cyanide treatment has added 42.6 per cent, making the total saving 90.3 per cent. Cyaniding costs

only 65 cents per ton, and recent experiments show that ore can be treated without plates, with a saving of 95 per cent. The bullion and cyanide residues are incompletely treated on the spot and bars shipped have given the following results:

		Cyanide residues.
Gold	522.04	688.4
Silver	224.40	288.3
Dross	153.6 —1,000	23.3—1,000

SAN JOSE DE LA CRUZ.—This is an old camp with most of its buildings fallen into decay; its streets grass covered and without saloons, the strongest evidence that prosperity has departed. In the schists, or slates, are old workings from which have been extracted large bonanzas of high grade silver and lead ores. Higher up on the mountain side are some prospects on quartz veins in andesite. Englishmen secured a 3 years' concession for several hundred square miles of territory and the local people are disposed to resent their invasion, consequently the company is reluctant to give information. There are a number of old silver properties in the neighborhood and within the zone, whose ores were formerly worked in old vasos, which still stand in a more or less dilapidated condition.

CALABECILLOS.—This mining village is at the foot of the Sierra Madre plateau on the Pacific coast, near the headwaters of the Sinaloa river, at an elevation of about 4,500 feet. The climate is warm and healthy. The San Geronimo is the principal mine; it was discovered about 6 years ago, and has produced in the neighborhood of $500,000. It was sold last fall to a St. Louis syndicate, which is now operating it successfully. The working shaft is on the top of a small hill, about 300 feet above the mill; it is an incline shaft about 400 feet deep which brings it to near the level of the valley, and water is beginning to collect in the shaft. The shaft is suitably equipped with hoists and pumps, and at the time of my visit the workings were in good order. Most of the ore has been stoped out down to the water level. The average width of the vein, or ore shoot, was about 6 feet. The ore body is fractured andesite, without visible quartz, the gold occurring in iron streaks filling fracture planes. The average value of the ore was $14 per ton. A rhyolite dike is near the andesite, but there are no visible quartz veins, or, at least, I saw none and was told that none had been observed. There is a 30-ton mill on the property; the ore being trammed from the mine about a quarter of a mile away. Two Bryan mills and 2 plates recover about 80 per cent of the values, and the tailings are cyanided,

increasing the total yield to approximately 95 per cent. Steam was the motive power; the buildings were in good shape and everything indicated prosperity. The only drawbacks observed were the growing scarcity of fuel and water for milling purposes.

MINING IN WESTERN CHIHUAHUA.

By W. Spencer Hutchinson.*

Ocampo, known for many years as Jesus Maria, is the seat of mining records for the district of Rayon. It is the most populous town in western Chihuahua and has many substantial stone buildings. Its mines have been noted for many decades and the ruins of old *haciendas,* with their solid cut-stone settlers, bear evidence of former activity. In recent years the ores have been worked in stamp mills, followed by pan amalgamation, with or without subsequent concentration. Very recently some of the mills have applied the cyanide process to the further treatment of the tailings.

Ocampo is situated in the heart of the Sierra Madre, 90 miles west of Miñaca, the nearest railroad station. It is reached by a broad, much traveled pack trail. All the supplies for the western Chihuahua country go in over this road on the backs of mules and the meeting of pack trains is a matter of almost hourly occurrence with a traveler on the read. The packers use the very best mules obtainable, travel five or six hours daily and then camp to turn their animals out to feed.

Costs of packing from Miñaca are quoted at $6.50 Mex. per *carga* (300 lb.). This is the rate of ordinary freight, which is of convenient bulk and put up in packages suitable for packing. Much complaint is heard of the seeming indifference of some American manufacturers to the requirements of this mountain trade. They either fail to inform themselves of the requirements, or, knowing them, find compliance too troublesome. A good mule will carry 300 lb. of freight, but the pack must be divided into two or three packages of equal weight. If it is in one package the load will ride too high and tire the mule; if not properly divided, the mule cannot take a full load, and the packers must make extra charges. For bulky goods the rate is also higher, and the average for all freights is estimated at $7 Mex. per *carga.* This is equivalent to $23.33 U. S. per short ton, or $0.259 U. S. per ton-mile, a cost which compares favorably with the cost of wagon freights in mining districts of the western United States.

*Mining Engineer, Boston, Mass.

Special freight, difficult to handle on account of unusual weight or awkward shape, is carried by special contract at rates sometimes five or six times that of ordinary freight. This makes the shipment of machinery very costly and adds greatly to the cost of installation of mining plants. Wagon roads are now being built, which, when completed, will make the shipment of machinery much easier.

OCAMPO'S MINES have been worked so long that the timber close to the camp has been pretty well cut off, and wood and lumber have to be packed some distance. In the outlying camps timber is generally plentiful. Cord wood is cut 2 1-2 or 3-ft. lengths, convenient for mule packing, and cords are piled variously; 2 1-2-ft. wood is piled 10 ft. long, 5 ft. high (125 cu. ft.); 3-ft. wood is piled 8 ft. long, 5 ft. high (120 cu. ft.). The cost of oak fuel for steam, piled in the yard varies from $5 to $6.50 Mex. per cord, to which may be added $1 to $1.50 Mex. for stumpage.

The ores of the Rayon district, so far as observed, are chiefly of quartz with a small proportion of heavy minerals, the concentration sometimes running as high as 1,000:1. In some cases, where concentration precedes amalgamation, coarse free gold may be seen in a beautiful yellow band, running off the head of the Wilfley table. The other minerals noted are native silver, argentite, pyragyrite, proustite, tetrahedrite and pyrite.

The gold value is always important, usually forming more than one-half, while in some cases it constitutes three-quarters of the output. The mill saving of the gold is generally high, 80 to 85 per cent of the assay value; while the saving of the silver is poor, often no more than 40 to 50 per cent. The silver extraction is usually better when the mill tails are cyanided.

EL POTRERITO camp is 50 miles west of Ocampo and its 10-stamp mill is working on typical ore. This mill was built in 1902 and is a good example of the type of mill in use before the introduction of cyanide. An outline of the process (April, 1905) is as follows:

1. Ore floor to which tramway buckets dump; a man shovels the ore to 2.

2. Blake-type crusher, thence to 3.

3. Bins; thence by automatic feeders to 4.

4. Ten stamps, 850-lb; 40-mesh wire screens, wet crushing, no amalgamation; the pulp flows by launders to 5.

5. Settling tanks; the slime and water overflow by launders to 6; the sand settles and is shoveled to 7.

6. Settling reservoirs; the water overflows to the creek, the slimes settle and shoveled to 7.

7. Four amalgamation pans, 5 ft. diameter, to 8.

8. Two settlers, 8 ft. diameter; the amalgam goes to the strainer; the pulp overflows by launders to 9.

9. Two Wilfley tables; the heads are shipped to the smelter; the tails flow by launders to 10.

10. Tail sluice; this is broad, with riffles in which the coarse sand settles; it is shoveled thence to hand-barrows and carried to 7, while the overflow goes to the creek.

CONCHENO camp is about 25 miles northeast of Ocampo. One mine is working and treating its ores in a 60-stamp mill. This property is owned and managed by Americans, who have displayed unusual enterprise in seeking for improvement in the treatment of the ore. They discarded the pan-mill a number of years ago and by the application of cyanide to the treatment of sand and slimes they have brought their mill to a high degree of efficiency. The ore is typical quartz, containing a very small proportion of heavy minerals. It contains a rather unusual amount of slime-making material, which complicates the milling treatment. This mill today is undoubtedly one of the most efficient in the district. An outline of the process of Concheño mill (May, 1905) is as follows:

1. Ore floor, to which mine tramway cars dump; men pick out boulders to 2 from mud and fines which are shoveled to 3.

2. Blake-type crushers, thence to 3.

3. Bins; thence by automatic feeders to 4.

4. 60 stamps, 90 to 950 lb.; 40-mesh screens, wet crushing, no amalgamation; the pulp flows to 5.

5. Six Wilfley tables; the heads are shipped to the smelter; the tails flow by launders to 6.

6. Settling tanks; which are stirred by boys with poles to promote separation of the slimes. The overflow of the water and slime flows by launders to 8; the settled sand is shoveled to a car, which is dumped to 7.

7. Cyanide leaching tanks, each 25 ft. diameter, 5 ft. deep; the tails are sluiced by launders to the creek; the solution flows to 14.

8. Five settling ponds in which the slimes are settled and shoveled to a car which is hoisted to 9.

9. Bin for slimes; thence to 10.

10. Four slime agitators; thence to 11.

11. Two steam Montejus; 90 lb. pressure; these force the pulp to 12.

12. Three filter presses; the cake, after washing, goes to 13; the solution flows to 14.

13. Agitator with a stream of water; this breaks the cake up, forming a pulp which flows to the creek.

14. Extractor room.

PILAR DE SOCORRO is an extraordinary natural monument in the district of Rayon, about 40 miles west of Ocampo. The *pilar* presents the same symmetrical outline from every point of view and is said to be 800 feet high. No opportunity was presented to examine the rocks thereabouts, as we got no nearer than the point from which the pictures were taken. The topographical features are full of suggestion for the imagination, and one cannot doubt that geological study would be fruitful of interesting fact.

Pictures suggest, but cannot express, the imposing grandeur of this wonderful landmark. Although in the heart of the mountains, it overtops all the surrounding hills and lifts itself into full view from every elevation for 50 miles about. The fringe of trees on the top seems very small and affords some idea of its size. The trees on the sky-line of the adjoining hill are oak and of good size.

CYANIDING SILVER-GOLD ORES OF THE PALMAREJO MINE, CHIHUAHUA, MEXICO.

(Extracts.)

The Palmarejo mines are located in the southwestern part of the State of Chihuahua, Mexico, on the foothills of the Sierra Madre mountains, at an elevation of 3,200 feet. The mills, 12 miles distant, are situated on the Chinipas river, near the town of Chinipas, which is about 150 miles northeast of Agiabampo, on the Gulf of California. Supplies are shipped via this port as this route is the best and most direct to the property.

The ore-bodies in the Palmarejo mines have been deposited along a series of rock-fractures, caused by an intrusion of eruptive rock. The most important of the fractures or fissures, both in width and value, are the Prieta and Blanca veins, which intersect each other on the surface, at a point called the Descubridora, or discovery; and underground, in the main working tunnel (Socorro) about 800 ft. from its entrance.

From the junction of the two veins, the Prieta strikes almost due east, and the Blanca, south, 51 degrees 30 minutes east, dipping at an angle of 50 degrees to the west.

The Prieta veins in places is fully 75 ft. wide between walls. The ore, however, is frequntly in two sctions known as the foot-wall and hanging-wall sections of the vein, with a horse of country-rock from 10 to 30 ft. thick, between them.

Stoping has been done on both the foot-wall and the hanging-wall sections on the course or strike of the vein, for 2,000 ft. in length, and while the values are continuous the better grades of ore makes in chimneys of shoots, verying from 75 to 300 ft. in length. The Blanca veins which is from 4 to 12 ft. in width has been mined for a distance of 800 feet. At the junction of the veins the bonanza of the mine was found, which has been worked for more than 800 ft. in depth, and has yielded an enormous amount of money.

The records in the office of the company show that these mines have been worked for more than a century.

The ore delivered to the mill consists essentially of a siliceous matrix, throughout which is disseminated a small percentage of pyrite. Black manganese oxide and calcite are present in varying proportions, and very small quantities of antimony and arsenic, together with traces of bismuth, also occur. Occasionally traces of copper and zinc are found.

The major portion of the silver occurs in the form of argentite, though a certain amount of stephanite is present and occasionally small patches of chlorobromide and native silver.

The main storage-bin of the Palmarejo group of mines is connected with the mill by means of a narrow-gauge rairoad, 12.5 miles long. The mill is about 1,300 ft. lower than this ore-bin, consequently the entire road is on a moderately heavy grade; the heaviest slightly exceeding 4.5 per cent. The gauge of the road is 30 in.; two weights of rails are employed, one being 35 lb. and the other 25 lb. per yard. Two English locomo—the other, an 18-ton engine, hauling 9 cars. Each ore-car has a carrying capacity of 4.5 tons. Under normal conditions, from 4 to 4.5 hours are required for making a round trip.

MILL AND CYANIDE PLANT.

The 50-stamp mill and cyanide plant is situated on the edge of the Chinipas river, about 1.5 miles eastward of Chinipas, at a place known locally as "El Zapote." Water-power furnished by the Chinipas river is used to run the mill, slime-plant and machine-shop. A masonry conduit, about 11 miles long, conducts the water to a pen-

stock a short distance above the mill, thence through a steel pipe, about 1,100 ft. long, tapering from 48 in. in diameter at the penstock, 22 in. in diameter in the wheel-pits, to four 6-ft. Pelton wheels under a 97.50-foot head.

The predominating value of the ores now being treated by the Palmarejo and Mexico Gold Fields, Ltd., is silver, although some gold also is carried.

The present method of treatment consists of wet-crushing and concentrating, followed by the cyaidation of the unroasted sand and slimes. The sands are treated by leaching, and the so-called "accumulated slimes" by a system of agitation and decantation.

It is only within recent years that the cyanidation of unroasted silver ores has been commercially successful. In fact, at the time operations were begun at the cyanide plant at Chinipas, February, 1902, I knew of no other leaching-plant treating similar ores successfully. The cyanide treatment of the Palmarejo ores differs but little from ordinary practice in cyaniding gold-ores; perhaps but little, if any, new information concerning the metalurgy of silver is to be gleaned from it.

—T. H. Oxman, Chinipas, Chihuahua. May, 1906.
Transactions American Institute Mining Engineers.

CHRONOLOGY OF MINING IN MEXICO.

1522. Discovery of ore in Taxco, state of Guerrero.
First silver that conqueror sent to Spain.
1524. Pachuca, state of Hidalgo, being worked.
1540. Zacatecas mine discovered.
1548. Silver found at Guanajuato.
1557. Invention of El Patio system for treating ores by Bartolome de Medina at Pachuca.
1565. Discovery of ore at Santa Barbara, Chihuahua.
1600. Parral founded.
1628. Guazapares founded.
1630. Urique founded.
1632. Batopilas founded.
1666. Cusihuiriachic founded.
1704. Santa Eulalia founded.
1773. Charles decrees the famous mining ordinances.
1778. Mines found at Catorse, San Luis Potosi.
1783. Discovery of mines at Cuarisamey, Durango.
1783. School of mines founded.

1793. For the first time horses and mules are used to mix slimes by the Patio system; men were employed formerly.
1802. March 31 Baron Humboldt arrived. He prophesied Mexico's mineral wealth.
1810. Refugio mines discovered.
1820. Mineral Rosario.
1821. Ocampo (Jesus Maria) discovered; likewise the following mines, San Antonio, Sta. Eduviges, etc.
1822. Santa Juliana.
1824. Palmarejo mines discovered.
1824. Fresnillo mines in Zacatecas opened.
1826. Morelos.
1828. Discovery of the following mining camps: Cuchillo Parado, Santa Rita and Escondida.
1829. Sierra Rica.
1853. Practical school of mines founded at Fresnillo, Zacatecas.
1871. First artesian well at the Mexican mint.
1877. Compressed air used for first time at Catorse, San Luis Potosi.
1880. Discovery of coal beds at Sabinas, Coahuila.
1883. Centennial of foundation of school of mines.
1884. Unification of mining legislation.
1888. Construction of mining machinery at the shops of Compania Industrial, Chihuahua; also at Mazatlan.
Discovery of Concheño mines.
1890. Mining Exhibit at the Municipal Palace of Zacatecas.
The existence of anthracite in Sonora is proved by borings with diamond drill.
1891. Geologic commission of Mexico founded.
1892. Consolidation of mining property.
1893. First electric plant for working mines at Santa Ana, San Luis Potosi.
Antimony mines first worked.
The MacArthur-Forrest cyaniding system is established.
1895. Rescinding private contracts for lease of mints.
1897. Discovery of La Reina mine, Cusihuiriachic, Chihuahua.
Resumption of work on large scale of copper mining at Inguaran, Michoacan.
1898. Resumption of work at Tepazala, Aguascalientes.
1899. Bonanza El Oro, Mexico.
Contract signed for establishing a dynamite factory at Gomez Palacio, (Chihuahua, capital).

1903. Artesian well at Ciudad Juarez. This being the first the government gave a reward.

1904. Governor Creel on Sept. 12 introduced bill in congress for the founding of a permanent mining exposition.

1906. March 21, anniversary of the Juarez centennial, the mining exposition is inaugurated before the representatives from all the districts.

NOTES ON CERTAIN MINES IN STATE OF CHIHUAHUA, MEXICO,

By Walter Harvey Weed, Washington, D. C.

The notes given in this paper, the result of observations made during recent brief professional trips to the northern States of Mexico, are offered as a slight contribution to the geological knowledge of a region little known, but long famous for its rich gold and silver mines. They are not detailed geological studies, but they contain, I believe, the salient facts.

The following districts were visited: 1. Santa Eulalia (silver-lead); 2. Parral (silver-lead); 3 Las Vigas (copper); 4. Jiminez (copper); 5. Guadalupe y Calvo (gold); 6. La Cumbre (gold).

1. The Santa Eulalia Silver-Lead Deposits.

Seventeen miles SE. of Chihuahua is the mining district of Santa Eulaila, to which that city owes its origin and long prosperity. Discovered in 1703, this district has been, and still is, one of the great silver-lead producers of the world. For 86 years after its discovery, the total output upon which the crown tax was paid amounted to $112,000,000. Worked until within the last 20 years by the most primitive methods, without machinery of any kind, the deposits continued to yield a vast treasure of silver; at present the yearly tonnage far exceeds that of former times.

A broad-gauge road runs from Chihuahua up the valley of a small creek to the village of Santa Eulalia, which is situated within the borders of the mountains of that name. A few miles out of Chihuahua a narrow-gauge railway, owned by the Chihuahua Mining Co., branches off to the mines. This road ascends a smooth but steeply-rising plain to the bast of the mountains, and winds about the slopes until the mines are reached. The same company owns extensive reduction-works 3 miles from Chihuahua; but in 1900 the ore from all the mines was shipped to the custom smelters.

The principal mines have been operated for the past decade by Americans, and are fully equipped with modern hoists and engines, and all the accessories of a first-class plant.

The Santa Eulalia district embraces about 5 sq. miles of rugged, mountainous, but not very high, country, forming part of a NE.-SW. range, separating the Conchos and Toyoba valleys.

Geology.

"The *Mesa Central*, near Chihuahua, consists of folded limestones covered and largely concealed by dacite rocks, mostly cemented volcanic ejectments covering granite intrusions. The hills rising above the plain are mainly of the dacite tuffs. The Santa Eulalia range is said by J. P. Kimball, who described the district in 1870, *to be composed of folded Cretaceous limestones, the ore-deposits being in a local dome-shaped uplift, now deeply trenched by numerous narrow gorges radial to the slopes." The age of these rocks, determined by Kimball from the fossils he collected, is confirmed by similar evidence gathered by myself. "The limestones are massively bedded, and form steep slopes and abrupt cliffs comparable to those of the Carboniferous 'Mountain limestones' of the Rocky Mountain region. The deeply eroded and hilly surface of these rocks is overlain by a mantle of dacitic tuff, filling the old gorges and hollows, and completely obliterating the old topography except where it has been bared by later erosion. This dacitic rock, called *Cantera* by Kimball, from its local name as a building stone in Chihuahua, is clearly shown by its field-relations, and by the microscopic study of thin sections, to be a volcanic breccia." It is mentioned in a paper on the Sierra Mojada mines, SE. of Santa Eulalia, by Mr. Malcomson, who notes the similarity of the formations at both places. According to him, the breccia is 1,800 ft. thick at the latter place.

The presence of feldspar crystals and limestone fragments is very common in breccias formed of the rock-fragments and ash-showers ejected by volcanoes, and either swept down by rains or moving as mud flows down the slopes and filling the hollows. Where the volcanic vent has broken up through limestone, the fragments of limestone torn off by the outbreak (and rounded, perhaps, by frequent falling back into the crater and consequent attrition) are finally ejected, mixed with lava fragments, by more violent outbursts. Such feldspar fragments and crystals are usual constituents of most volcanic breccias.

*Am. Jour. Sci., 2d series, vol. xlviii, p. 379.

Character of the Ores.

"The ores consist mainly of lead carbonate (cerussite) with nucleal masses of galena. Rich bonanzes of chloride and sulphides of silver, and (more rarely) of embolite and iodyrite have been found. All the ore-deposits occur in the limestone, and are similar, in many respects, to those of the Sierra Mojada; but hitherto, so far as I have been able to learn, no valuable contact-deposits have been discovered." At the Santo Domingo mine, Kimball has described* a vertical fissure or feeder, and the outcrops of other but barren fissures may be seen nearby. This Santo Domingo fissure appears to have been the feeder or pipe for the solutions making the greater ore-bodies which are found along the bedding-planes of the limestone, and are, to a lesser degree, controlled by the jointing of the rocks. "The main ore-bodies consist of loosely-textured cerussite, resulting from the alteration of galena, of which residual masses are frequent."

Santo Domingo.

This is the most famous mine of the district. The ore-body is an almost ideal example of the metamorphic replacement of limestone. The limestone rocks are well-bedded, and contain occasional fossils, several inches across,† with chert-balls and concretions, commonly arranged along planes nearly parallel to the bedding. The ore shows the fossils and chert-bands in their original and undisturbed position, corresponding closely to those of the unreplaced parts of the limestone having the same structure that are seen in the walls. The upper and lower limits of the deposit are unusually regular for deposits of this kind, and in places are plainly seen to be determined by stratification-planes. Such planes were observed to be the surfaces of layers of more earthy or less easily replaceable lime-rock. The side-boundaries of the deposit present in places all the pitted and "pot-hole" structure which I have frequently observed to be characteristic of such replacement deposits. While there is sometimes a very abrupt change from ore to limestone, with no intermediate products, there is often a thin shell of iron oxide and silica; and stringers of such material lead from one ore-body to another. The ore is also abruptly limited at times by joint-planes. Boulders of unreplaced limestone occur in the ore; but as a whole the limestone is not shattered, and, where it is broken, this is the result of move-

*Am. Jour. Sci., 2d series, vol. xlix. (1870), p. 165.

†Especially Ostrea carinata Lam, which is characteristic of the Washita division of the Comanche group of the Lower Cretaceous.

ment since the vein has been worked. Open caves occur, but, in the cases observed, are due to the later circulation of waters that changed the ore from galena to cerussite. A slight secondary enrichment by these waters produced the rich sulphides, chlorides and iodides of silver found on the walls of the caves. The old workings were sparingly timbered; and spaces large enough to hold the Chihuahua cathedral are mentioned by Kimball. By reason of a disastrous cave, which took place a few years ago, these old workings are now inaccessible.

2. The Parral Mines.

Santa Barbara.

The old camp of Santa Barbara, 8 miles from Parral, is reached by a branch of the Mexican Central railroad. In November, 1900, this line had been completed, but no trains were yet running, and the town was reached by a drive over the low, rolling hills near Parral, and across an open, black valley-bottom to the mouth of the gulch in which the town is situated. Santa Barbara offered a fine example of a mineral district just being extensively opened by strong corporations. The old town, at one time the capital of the State, lies close under the mountains and just within the foot-hills, which separate it from the beautiful broad meadows of the Santiago ranch. The mines were as yet undeveloped; the only previous work having been the "gophering," characteristic of all Mexican properties, which had resulted in irregular openings seldom more than 50 to 75 ft. deep, extended by cuts or drifts to strike richer portions of the veins. The expenditure of much money in developing the mines for a regular production, and in erecting reduction-mills, warrants the expectation of a large output hereafter. There is a striking contrast between the squalid *adobe* buildings of the town and the modern machinery and newly-laid railroad tracks of the new enterprises. Several old Mexican *adobe* furnaces still exist; and in the center of the valley a slag-dump, said to carry over 40 oz. of silver per ton, forms a valuable asset of one of the mining companies.

The rocks in which the veins occur are indurated gray shales, the ready splitting of which along bedding-lines has caused them to be called slates. They carry little, if any, interbedded quartzite, and no limestone was observed. The rocks are folded, but in general dip W., towards the mountains.

The veins show rough brownish outcrops, forming walls rising several feet above the general surface, but seldom continuous for any

considerable distance. The veins are clearly true fissures with irregular rolling walls and contain much crushed shale. The vein-quartz, cementing the fragments and forming breccia, shows marked banding and crustification. Fluorite and stilbite were observed at the Primrose property, at the lower end of the valley, but were not seen in the big veins of the Moctezuma Co. Near the town, dikes of rhyolite cut the shales. A large one was observed on the crest of the ridge north of the town; another comes down the lower ridge which encloses the valley, and appears on the southern slopes, where its high and brown outcrop resembles those of the two veins seen east of it. The largest dike appears back of the *Arroya de Vacu.* where it is crossed by another dike showing as a big reef near the Alfereina mine. The fact that the ledge, varying from 15 to 20 ft. in width, of the *Mina de Agua* is called "small" by the superintendent of the Moctezuma company, indicates the great size of the veins cutting the slopes at the head of the *Arroya de Vaca.* These veins are said to be from 50 to 100 ft. in width. The veins are all traceable for long distances, certainly for a mile or more, and the *Mina de Agua* vein shows a large outcrop 15 or 20 ft. high (a so-called blow-out of quartz), which is most prominent where two veins cross one another. The ores consist of galena, with a little pyrite, and some zinc in a quartz gangue. In general the veins follow a north and south direction, crossing parallel to the porphyry dike already mentioned. This dike is certainly faulted at the *Canada Vaca*, and another fault was observed near the railroad track. Whether these faults throw the veins as well as the porphyry dikes could not be ascertained. To one fresh from the mines of Montana, the ores appear to be base and the values rather low; but the zinc is largely eliminated in milling, and by reason of the cheap labor of Mexico and the favorable conditions existing at the smelters, the properties yield great profits.

The Guggenheim Co. owns a 60-ton mill, just below the old town of Santa Barbara, on the *Capia* ledge, supposedly the same as the *Alfereña.* The ores from the *Palo Blanco* and the *Tecolotes* mines are treated in this mill, the product of the latter property being transported more than 3-4 mile by a tramway. This is the mine for which $700,000 is reported to have been paid when the vein was practically undeveloped, save by open-cut and "gopher" holes of the Mexicans.

The Kansas City Smelting and Refining Co., operating as the Moctezuma Mining & Milling Co., owns two important parallel ledges outcropping at the base of the slopes north of the valley, a little be-

low the town. These veins were recently purchased for $110,000, and the rapid development of the district is shown by the fact that for years the property had been offered for sale and found no bidders at $10,000 Mexican money. In November, 1900, when I visited the property, the ground was being graded for a new 250-ton mill and an extensive mining-plant. The ore of these veins consists of galena with pyrite and zinc-blende in quartz. The average composition is: Lead, 7.5; zinc, 6.5; copper, 0.27; iron, 5.0; lime, 8.0; and silica, 50.0 per cent; silver, 6 oz., and gold, $1.40 per ton.

The ore occurs in defined pay-streaks and shoots in white quartz. The quartz shows a banding due to a linear arrangement of grains of the metallic sulphides, and sometimes (though rarely) a crustification, with quartz-lined vug-lines, or drusy cavities lined with calcite. The vein is encased in dark-gray slates, supposed to be cretaceous, which dip SW. 20° to 30°, and fragments of which occur in the vein-filling. The vein appears to have been formed by the filling of open fissures; the dull amorphous-looking conchoidal-fracturing quartz of replacement-deposits not being abundant nor conspicuous. The vein is about 20 ft. wide, averaging, it is said, 10 ft. of ore. It dips at first 85° W.; changes to nearly vertical between 100 and 200 ft. in depth, and to an east dip below that.

3. The Las Vigas Copper-Mines.

These mines are about 1 1-2 m. N. of the Conchos river and 70 m. NE. of Chihuahua, the nearest town being Coyame, a village some 40 m. from Presidio del Norte. The mines are at present remote from a railroad, though the survey-line of the Chihuahua & Pacific passes near them.

The country between the Rio Grande and Chihuahua, a part of the *Mesa Central,* shows numerous narrow isolated mountains ranges with intervening pocket-valleys or wide expanses of undulating plain. The flora reflects the aridity of the climate; *yucca, sotól, mesquite* and other arid-land plants being the only vegetation. The ranges consist of folded limestones, usually in defined anticlinical folds. These rocks occasionally show also in the plains, but are more commonly concealed by soil or *débris.* Occasionally the mountains are capped or flanked by masses of dacite porphyry, rarely massive, commonly tufaceous, and showing a rude bedding such as characterizes the deposits of fragmental ejectmenta from volcanoes. So far as known from the evidence of the fossils actually seen, the limestones are Cretaceous and the tuffs of later age.

FIG. 2.

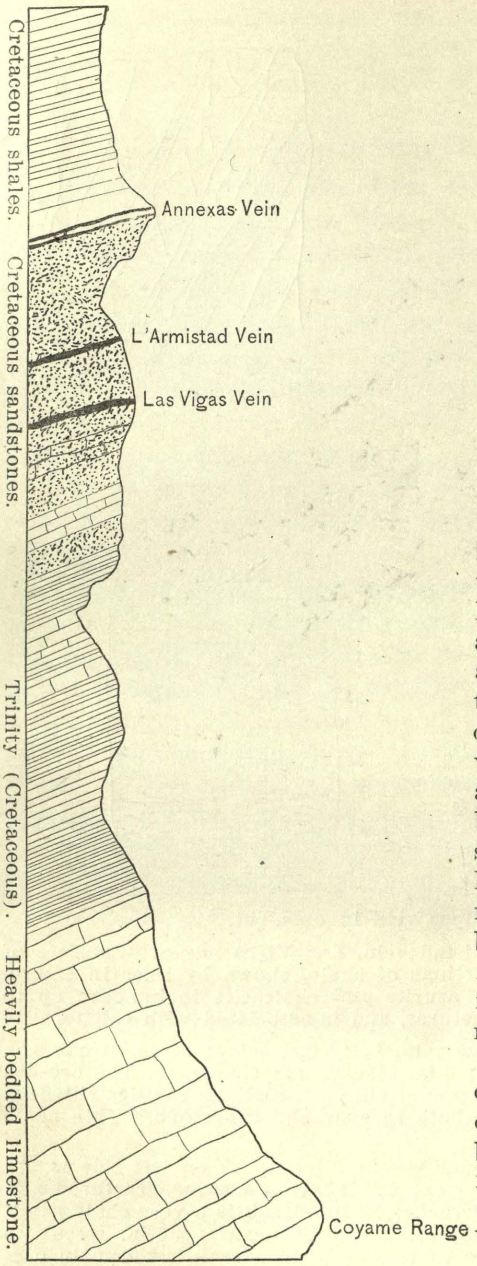


Fig. 2.—Ideal E. and W. cross section through Las Vigas veins, near Conchos river and Coyame, Chihuahua, Mexico. Looking north. Veins in solid black.

The copper-veins occur in the SW. foot-slopes of a mountain ridge composed of steeply dipping, massively bedded limestones. The veins are impregnated sandstone strata, forming a part of a continuous series of Cretaceous rocks, several thousand feet thick. The beds are on edge (Fig. 1*), dipping very steeply, and are well exposed, so that a good section could be easily obtained. Between the base of the limestone mountain range on the east and the ore bearing strata there is a belt of shale carrying fossils. Specimens from this bed were determined by Mr. R. T. Hill to be of Comanche, *i. e.*, Lower Cretaceous age. The sandstones above this shale belt are pure quartzose rocks that alternate with soft argillaceous shales and rarely with limestone; but a mile to the north the sandstones are replaced by limestones, the beds of each rock showing in their imbrication- and transition-forms that when they were formed the sea lay to the north.

Three definite ore-seams occur (Fig. 2). Though called veins, they are really beds of sandstone and shale from 4 to 7 ft. wide and coursing N.-S., impregrated with copper carbonates, ox-

*See illustration in appendix.

FIG. 3.

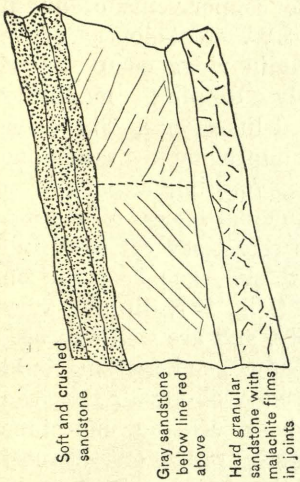


FIG. 4.

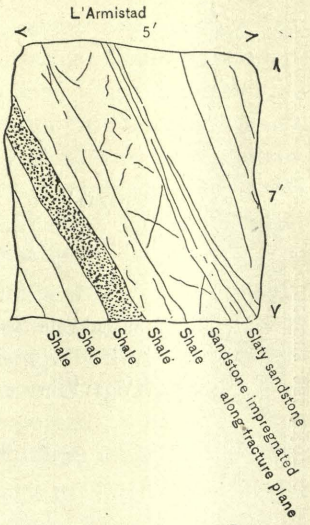


FIG. 5.

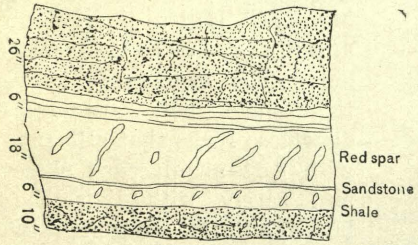


FIG. 6.

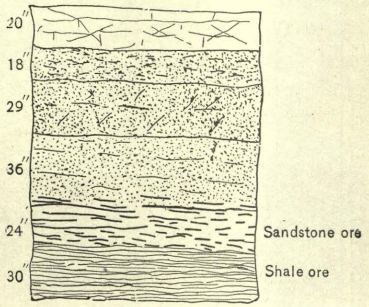


Fig. 3.—Section of Las Vigas vein in open-cut.

Fig. 4.—Section of L'Armistad vein, Las Vigas mines. Consists of sandstone layers, with thin partings of shale, shown by lines in figure. The ore consists of malachite, azurite and chalcocite in bunches up to 3-in. diameter and films on fractures, and is associated with calcite.

Fig. 5.—Section of Annexas vein, Las Vigas mine; 26-in. streak (on left) of hard barren sandstone; 6-in. black shale (barren). The ore-bed is a sandstone cracked by differential slipping, and the cavities filled by red calc-spar. The ore occurs both in spar and sandstone. Thin shale bands separate the ore-layers.

Fig. 6.—Section of Las Vigas vein; 20-in. streak on left side is unaltered gray sandstone; 18-in. streak is a shaly sandstone, fractured and showing films of copper-ore in cracks; 29-in. streak is a very shaly sandstone, with ore in fractures shown by black dashes; 36-in. streak is massive sandstone carrying very little ore; 24-in. streak is the main ore-layer, consisting of sandstone impregnated with copper-ore (glance). The richer ore occurs in streaks shown by black lines; 30-in. band is shale, with films and nodules of ore.

ides and sulphides. In addition to the three main ore-carriers, there are several cross-fractures and veins which fault the beds and carry little bunches of copper-ore in calcite gangue. The "vein-walls" are sharply defined by shale; but bands of shale included in the vein are mineralized. There is little true gangue mineral, so far as observed; the silica being merely that of the original sandstone.

A mixture of 18 samples of ore and gangue from a large number of cuts across the vein gave: Silica, 74.4; iron, 8.5; lime, 2.0; copper, 5.2 per cent.; gold, 0.6, and silver, 1.45 oz. per ton.

The outcrops of the veins usually show some green staining or malachite in a laminated sandstone reef. The surface-ores consist mainly of malachite, but at a depth of 35 to 50 ft. "glance-ore" is encountered—a black sandstone in which the quartz grains are coated and cemented by rather earthy-looking copper sulphide. It is impossible to say whether any replacement of the quartz has taken place; but the ore carries from 20 to 30 per cent. of copper. That it will pass into chalcopyrite in depth is indicated by occasional specks of that mineral in it.

Origin of Veins. These ore-bearing strata are impregnated because the rocks were extremely porous. Hot springs existed near by and formed deposits of tufa; and there may be some genetic connection between this and the copper-seams though it appears to me more probable that the springs are of very recent origin. The fault-veins of gypsum, calcite and copper that cross the main ore-beds are clearly of later age. They cannot be, as was at first believed, the feeders for the main veins, carrying the mineral-bearing solution out into the porus beds crossed by the fault, for the gangue of the two sets of veins is essentially different; moreover, the ore-veins are, if anything, poorer near these cross-fractures, and maintain high values far from them which would negative the hypothesis mentioned. These faults throw the strata from 8 to 30 ft. to the west, *i. e.*, on the north side of the fault.

The main veins (Figs. 3, 4 and 5) consist of sheeted or fractured sandstone, with malachite, azurite, and more rarely cuprite films, along the fractures. The ore fades into the sandstone. The shale belts between the sandstone layers of the vein carry much ore in films and nodules. Though there is little apparent brecciation of the rocks, and no slickensides or clay selvages, it is evident from the occurrence of the ore along the fractures of the vein-fissures that there has been some movement and shattering of the rocks. Commonly the veins show a plating or sheeting of the sandstone. Below

the influence of surface-waters, at a depth of 42 ft., the vein carries glance. It is here crossed by flat fractures—mere films, partly of gypsum and partly of calcspar, which occur 5 to 7 ft. apart vertically and delimit the ore; that is, they show that the glance is the result of descending waters. The interruption caused by such films is only temporary; for rich ores occur below, but the sandrock immediately below each fracture is relatively lean. The vein (Figs. 3 and 6) is sheeted by vertical fractures into slabs 1-2 in. to 4 in., but mostly less than 1 in. thick, and the gypsum films or fracture-planes are from 1-4 to 1-2 in. thick.

4. La Cumbre Mines.

West of Guadalupe y Calvo the Sierra Madre region differs in topography and geology from the region east of the town, where it is a slightly dissected plateau of bedded rhyolite and dacite porphyries. Westward, the Sierra plateau is dissected into a maze of mountain ridges and peaks in which the older igneous rocks, the granites, diorites, and the andesites constitute the lower part of the mountains; the younger lavas cap the summits and cover relatively small areas. This region contains many mineral-bearing areas, that of San Jose de Garcia being the best known. Los Angeles, San Fernando and the Trigo silver mines are a few of the places nearer to La Cumbre. This village, situated on a mountain-top west of the Bazonopa river, is supported by the Fortuna and Guadalupe mines. The country is extremely rugged, the mountain-tops having an elevation of nearly 8000 ft., the village of 6800 ft., and the river of 3200 ft. above sea-level.

The older rocks are andesites, altered breccias and lava-flows, baked and recrystallized near the diorite intrusions which cut through them. These diorites are coarsely granular, and in appearance are dark-colored granites. Both diorite and andesite were eroded, at the period when the rhyolite-dacite eruptions began, into a mountainous country as rough as that now seen, so that these recent rocks now covering the summits form the mountain spurs, and are cut into deep canyons by the Bazonopa river. Before the rhyolite intrusions occurred the country was extensively fissured, and quartz-veins were formed traversing the andesites and granites. These veins are particularly large and well-developed in the Guadalupe and Fortuna properties at La Cumbre; and though they pass under the rhyolite caps, and their absolute identity is lost, the group of veins of which the Fortuna is a part can be traced for several miles. Their course is nearly east and west (N. 70 degrees E. mag.), and the dip is

toward the south. The Fortuna vein shows from 8 to 32 ft. of quartz, but the hanging- and foot-walls show decomposed rock, and cross-cuts show much alteration for many feet on each side of the vein. This alteration has caused the complete disappearance of the dark-colored minerals of the rock whose iron has united with the sulphur of the circulating water and formed pyrite, partly in little veins, but mainly as disseminated crystals.

The vein outcrops are well-defined reefs, which usually stand in relief above the slopes. The vein-filling consists of white and blue quartz, with pyrite scattered through it, together with some chalcopyrite and zinc-blende. The capping of oxidized ore is very thin, the sulphides being encountered but a few feet below the surface. Bunches of very rich ore sometimes occur, and usually with a green quartz, colored by a mica, whose appearance strongly suggests the vanadium-mica, roscoelite, which, according to Lindgren, is commonly associated with the richest gold-ore of California. This ore and the rosy ore of somewhat lower value often occur as shells encasing nodular masses of zinc-blende.

The character of the quartz, the lack of comb-structure, and the evidence of replacement of fragments of the crushed granite and andesite, indicate that the vein is largely formed as the result of replacement. The decomposition of the country-rock confirms this, and in the coarse-grained granite the character of the vein is identical with the copper-veins of Butte, Mont., which are typical examples of replacement-veins.

5. The Guadalupe y Calvo Mines.

The mines at and near Parral and Santa Barbara occur in veins encased in slates or the dacite tuffs and porphyries which overlie or break up through them. West of the Parral district the Sierra Madre is made up of dacitic and rhyolitic rocks. Later basalts rest, in some places, upon these rocks, but no earlier formations are seen for many leagues. The country is a great plateau, deeply incised by the Rio Verde and other streams, whose cañon walls show good sections of the succession of tuff beds and breccias with later lava flows that form the summit of the plateau. Throughout the region traversed this dacite plateau shows no mineral veins; it is only where erosion has revealed the underlying andesites or the granitic rocks that ore-deposits are seen. The first rocks of this nature are encountered at Turache gorge, but no veins are seen until the town of Guadalupe y Calvo (Fig. 9) is reached. This settlement is famous in the mining

annals of Mexico for its production of gold. The town has a population of 300 or 400 people; it was at one time the site of a Government mint and had a population of several thousand. Geologically it is on the western slope of the Sierra Madre, and is one of a number of prosperous mining settlements found along the western margin of the Sierra Madre plateau.

The gold occurs in fissure-veins traversing altered and fractured andesitic rocks. These quartz-veins are older than the rhyolitic rocks, and only show where the light-colored chalky-white or pink porphyry tuffs have been removed by erosion or mine workings. In part the ores occur in andesitic gangue, but more commonly in true quartz-veins. The amophous or crypto-crystalline nature of some of the quartz suggests replacement, but comb quartz also occurs. The veins are only exposed on the east side of the creek, the west slope being composed of the dacitic rocks. There are two principal mining properties here,—the Rosario and the Independencia.

The Rosario Vein.

This vein (Figs. 10, 11 and 14) is one of the largest producing quartz-veins in the world. It varies from 60 ft. to 150 ft. in width, and dips with the hillside so that it forms a great reef fronting the valley, and its exposed wall forms a very conspicuous object (Figs. 12 and 13). It is said to average over 100 ft. across, and where I measured it the thickness was 110 ft. The great open-cut on the vein is 1800 ft. long, 7 ft. deep, and 130 ft. across. Four distinct ore-shoots, separated by low-grade quartz, have been worked. The low-grade ore now forms the enormous dump-heaps seen at the mine; and, despite the fact that the people of the town have largely obtained a living by picking over this dump, it is said to be all good cyaniding ore, "averaging better than $10 per ton." The vein has a NW. and SE. course, and dips west. The vein has been worked on one hill to a depth of 430 ft., but a vein of this magnitude will probably not play out at such shallow depths.

The Rosario vein was discovered in October, 1835, by a Tarahumar Indian from Nobogarne, when it was shown to some miners from the Refugio mine, 30 miles south of the Rosario. The extraordinary size and richness of the vein caused a rapid influx of miners to the locality, and two months after the discovery there were 2000 people encamped about it. The vein was located by various individuals, but soon passed, by purchase and debt of the owners, into the hands of the Ochoa family. In 1836 the Ochoas leased the property, in two parcels, to two companies organized with English capital,

and known as the Guadalupe Co. and the Zorilla Co. respectively. The Guadalupe Co. worked the western part and the Zorilla the eastern part of the property. These companies were obliged to work under lease, as the former Mexican law did not permit foreigners to hold real estate. The terms of these leases are said to be in the mining records, and provided for a royalty of 25 per cent. for four years and $50,000 for eight years. The lease expired in 1847 or 1848.

Under these companies the vein yielded enormous amounts of gold and silver, so that in October, 1842, a decree was secured from the Government permitting the erection of a mint (Fig. 15) at the mine. The records of this mint have been destroyed by fire, but custom-house records show that coinage began in July, 1844, and that steam-power was introduced in 1847.

The recorded output of the Rosario for the years 1838 to 1846 is $16,000,000, but owing to the heavy tax upon bullion and the ease with which the tax was evaded, reliable estimates place the total output from the discovery of the vein to the closing down in 1847 at $40,000,000. The mine was, during these years, worked by the most primitive methods, and the tailings show that a large part of the value was lost. The ore was, of course, carried on men's backs to the surface and then packed on burros to the various crude reduction works located many miles down the creek, where it was treated in *tahonas,* with an overshot water-wheel furnishing the power.

In 1847 large quantities of water were encountered, and, the working expenses being greatly increased, the English companies attempted to renew the lease for a rental of $30,000 a year, a proposal that was indignantly refused by the owners. Personal differences, added to the refusal, led to the abandonment of the property by the English company who removed to the silver mines of Guanacevi. From this time to 1883 no development work was done. Various Mexican miners robbed the pillars of rich ore left in the workings, "gophered" the rich streaks of ore, and sorted the dump.

In 1883, Judge Flipper, representing the Guadalupe M. and M. Co. organized at Memphis, Tennessee, secured the property under an agreement with the Ochoa family, who reserved a one-fifth interest and were to receive one-fifth of the gross output of the mine. This company operated the mine until 1887,—erecting a ten-stamp mill, and sinking a new shaft, from which a crosscut was driven to the vein and drifts run out from the old shafts. In one year this company shipped $113,000 in gold; but the manager was robbed of nearly $20,000 while taking the bullion across the mountains, and, as

a consequence, the property was abandoned by the company in 1887 and reverted to the Ochoas. At that time the Mexican mining laws required properties to be worked by six men for six months of each year; this the Ochoas failed to do, and in 1889 the property was denounced by four Americans, who obtained title from the Federal Government. With three Mexican merchants, admitted as equal partners, the property was operated and the ore treated in a stamp-mill with pan amalgamation. In 1892, operating under lease, two of the partners cleared over $100,000 in 22 months, working on ore from the dump-heap and from the rich pillars left in the workings. Meanwhile the ownership of the property passed into the hands of Tibucio Garcia, and was sold by him, in 1895, to the Rosario Mining and Milling Co.

The Independencia.

The Independencia property includes a group of claims situated east of the town of Guadalupe y Calvo. The claims cover a complexity of veins shown in Fig. 16. The main workings are entered by a tunnel near the mill, and include shafts and drifts on the Independencia ledge. The vein outcrop consists of porus white quartz, which is rusty and drusy in some places. The ledge runs a little north of west, and has been quarried by open-cut and stoping from below. These workings show the vein to be 8 or 10 ft. wide with a pay streak from 1 to 5 ft. across, showing a well-defined sinuous wall. The ore consists of white quartz and red pasperoid carrying pyrites, and rarely free gold. Some of the ore carries high values in silver, but no recognizable silver minerals were seen, the richest ore showing a black clouding of the quartz. The vein-filling is finely crystalline, and shows none of the coarse texture and comb-structure of a filled fissure, its nature being that of replacement quartz. Where crystalline quartz is seen, it is secondary, and cement fragments of shattered original vein-filling. A banded structure is rarely seen, and occasionally the vein-filling shows fragments of an andesitic breccia, the rock being altered and of a greenish-yellow color. So far as seen, the vein is nearly vertical. Its surface continuity is interrupted by a patch of rhyolite tuff, as shown in Fig. 16.

The workings consist of three tunnels with drifts, and expose the vein for a vertical depth of 220 ft.; two winzes of 26 and 30 ft. depth, respectively, prove the vein below the lower tunnel. The following assays show the general character of the ore on the Cuauhtemoc vein: gold, 0.04 oz. to 5 oz. per ton; silver, 3.20 oz. to 167 oz. per ton. An average of 24 assays from the various faces gave: gold,

1.18 oz. per ton; silver, 16.62. oz per ton. The ore varies in appearance. The pyritic ore is commonly reddish quartz, with veinlets of white and gray quartz. The silver-ore contains finely disseminated galena, with zinc-blende, and occurs in a mixture of dark gray, white, and amethystine quartz. Chalcopyrite occurs in minute specks. The rich gold-ore shows dull greenish secondary quartz, often in botryoidal forms, filling cavities; the primary ore often shows rusty gold, suggesting decomposed telluride ores. It also occurs associated with minute specks of copper pyrite and zinc-blende. The rocks are altered porphyritic andesites.

6. The Jimenez Copper-Deposit.

These deposits occur a few miles SW. of Jiminez, where the Parral branch of the Mexican Central railway leaves the main line. The region is part of the *Mesa Central,* which here has an altitude of 4500 ft. The general surface (Fig. 7) is diversified by isolated hills and low mountains, many of which show bedded dark gray limestones. The group of hills in which the copper-deposits occur consist of limestones and shales cut by igneous intrusions. The northern ridges are largely formed of massive rhyolite porphyry; but further south the hills terminate in a nearly circular ridge of eroded limestones and shales, which seem to dip away on all sides from a central mass of coarse-grained granite eroded into a basin or amphitheatre.

The copper-ores occur in a typical contact-deposit of the Kristiania type. As indicated in the accompanying diagram, Fig. 8, the limestones once arched over and covered the granite. The deposit follows the line of contact between limestone and granite, and the contact phenomena vary somewhat. Most frequently the limestone is converted into a massive garnet rock, more rarely (where the original limestone was purer) into coarsely crystalline marble. At the south end the deposit shows much black biotite and specular iron (hematite) and magnetite, with some epidote. The outcrop is often a mass of iron-stained quartz, rather hard and dense, and devoid of the honeycomb-structure of gossan. The mine-workings show the ore in irregular bodies (some being 200 ft. thick and twice as long, while others are too small for exploitation) of rudely oval cross-sections, lying in a mass of gypsum, calcite and silica, between the partly altered limestone and the granite. The granite is altered in successive regular shells or layers, seldom exceeding 5 ft. in thickness, which show varying degrees of oxidation. Nowhere were ore-bodies found in immediate contact with the granite. The irregular

limestone walls of the deposit show plainly the effect of solutions upon the rock, which is pitted, exhibiting on a large scale the etching produced by an acid solution of limestone. Clay walls, slickensides, and other evidences of faulting, are wanting. There is, therefore, no vein-structure. The ore-bodies consist of copper carbonate and oxides, and occur in a gangue of gypsum and calcite with much iron oxide. It appears probable that the original copper and iron sulphides were oxidized, and, reacting with limestone, formed the copper carbonate and iron sulphate now seen.

Such contact copper-deposits, found at or near the contact between granitic rocks and limestones, are of very common occurrence. They may be of the Kristiania type described by Lindgren, like those of Hornitos, near Mapimi, or they may show later fracturing with definite walls and vein structure, accompanied by enrichment of the deposit. In the former, the ores do not extend into the granite, but appear to be replacements of the limestones. In both forms there is a very general association of the copper-ore with mosaic rock, of garnet, calcite, etc., formed by the alteration of impure limestones. Within my own experience this association has been very marked. Where the deposit or vein, if vein-structure be present, occurs in garnet rock, it is cupriferous; where it is in contact with pure limestones or marbles, the lode is composed of pyrite or barren lode matter.

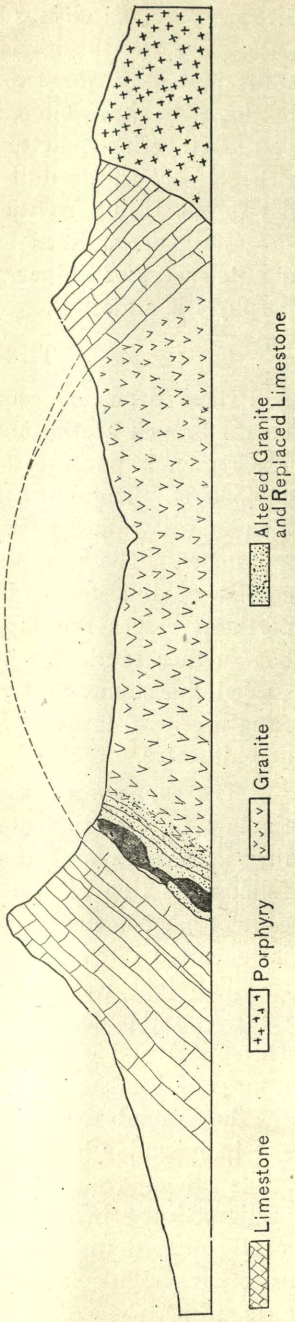
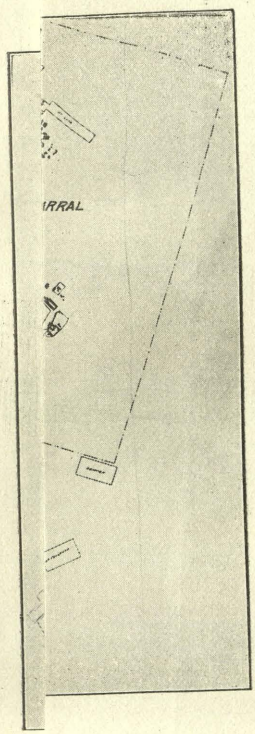


FIG. 8.

Fig. 8.—Ideal cross section through Jibosa mine, and granite boss, Jimenez, Chihuahua, Mexico. Solid black represents copper-ore bodies.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7. Palmarito Mine in Sinaloa.

The western part of Mexico in the Tierra Caliente of Sinaloa and Sonora is a costal plain diversified by isolated mountain ranges and groups of hills. The higher parts of this plain show folded slates and sandstones covered by fragmental volcanic accumulations of andesitic tuffs and conglomerates. These rocks are cut by granitic intrusions, while the higher hills and mountainous areas are commonly composed of dacito-rhyolites or rhyolite-porphyries. Near the little town of Palmarito, about 30 miles north of Culiacan, and as many miles from the shore of the Gulf of California, there is a sharp crested hill that rises 300 ft. or more above the plain. The hill is covered by angular blocks of reddish rock, and shows a steeply inclined wall as the side of a great reef of silver-bearing porphyry. This reef is a dark, purple-gray porphyry, with rather chalk-like texture. It is clearly a breccia, and the quartz of the reef shows distinctly, by variations of color, the replacement of the angular fragments, as well as their more or less complete decomposition. The ore also shows a conglomeratic structure, in which rings or shells of quartz enclose pebbles of altered porphyry. A study of thin sections of these rocks has been made by my friend Prof. Alexander N. Winchell, of the Montana State School of Mines. He finds that the foot-wall is a trachyte, carrying some plagioclase and pyroxene. The main body of the hanging-wall is a quartz-syenite of finely granular texture, showing a little pyroxene. The ore itself is a decomposed trachyte carrying wagnerite, hematite and a little pyroxene; the more siliceous ore consists of granular quartz carrying the minerals last mentioned.

The ledge is said to be 135 ft. to 150 ft. across. It has an east and west trend, and dips at 30° N. This ore-bearing reef is underlain by solid blocky porphyry, of different texture and appearance from the ore-bearing breccia. The values occur in pay-streaks of rich ore, and only those carrying silver were worked through the entire thickness of 135 ft. The ore is mostly dry, the silver occurring as silver sulphide and its decomposition products, but there are bunches of lead-ores which are sorted and shipped to Mazatlan. The entire reef is said to average 15 oz. per ton in silver, and is certainly well mineralized, though no samples were taken. There is no question but that water will be encountered below the level of the plain, and that the ore will change to a sulphide.

The workings, in December, 1900, consisted of an open quarry and of two drifts of 15 to 20 ft., with an upraise of 100 ft. or so

on a flat pay-streak. The ore is mined by hand and packed down on the backs of burros to the mill at the foot of the hill. The five-stamp-mill crushes the ore dry, and no screens are used in front of the mortar, the discharge being through a slit 1 in. wide under a board placed where the screen is usually found. The discharge passes over a gently inclined screen, the finest going directly to the roasting-furnace and the screenings back to the stamps. By this simple device 12 tons of ore are crushed each day, although the stamps are small and in bad condition. The ore is dried in a brick reverberatory furnace before crushing. The pulp is roasted and then leached with hyposulphite, the silver sulphide filtered through cloth, and the resulting mineral sun-dried and roasted to free it from sulphur before shipment. The ore milled carries 28 to 31 oz. of silver per ton, with an extraction of 80 to 85 per cent, as shown by the company's books. The output is 4,700 to 6,000 oz. per month, the shipments for sixteen months aggregating 125,000 oz. (December, 1900).

Summary.

The ore-deposits described herein embrace several distinct types. The gold types occur in distinct fissure-veins in andesitic and granitic rocks. From information derived from various mining engineers and from specimens of the ores, the gold-veins of San Jose de Garcia, and, in general, of the gold-belt northward to the border line, are confined to these andesitic rocks and the granite intrusions in them. The veins are younger than the dacites and rhyolites that compose the Sierra Madre Plateau.

The Santa Eulalia lead-deposits are metasomatic replacements of limestones, partly along fractures and mainly along bedding-planes. They show siliceous concretions and fossils in the ore in the undisturbed original position in which they were in the limestone before replacement.

The copper-deposits are of four classes:

1. In impregnations of upturned porous sandstone strata, resembling the deposits of Corocoro, Bolivia.*

2. Contact deposits between a granite intrusion and limestones, a very common type in Mexico. These deposits are not veins, but are due to mineralized vapors and gases given off by the igneous magma reacting upon the limestone walls. They are often characterized by garnetiferous rocks with specular iron. The ores are

*Lock, "Economic Mining," p. 416, London, 1895.

primarily chalcopyrite, altered to carbonates with the production of gypsum. They occur in large and small masses, and are of irregular and uncertain distribution.

3. The Cananea type of copper-deposits closely resembles the last. They are tilted beds of sedimentary rock, altered and impregnated with chalcopyrite, and sparingly with galena and blende by contact metamorphic agencies.

4. The copper-deposits of the Porvenir vein, Sierra Azul, Sonora, are closely allied to the contact metamorphic deposits of the two preceding classes, but formed, like the well-known tin-veins of Cornwall, by pneumatolytic action (mineralizing vapors above the critical point and pressure, given off by igneous magma), and deposited in fissures in the consolidated portions of such magma.

The Palmarito silver-deposits are of a type common in Mexico, the vein consisting of a breccia of altered rock, with walls of massive, unbroken rock. The fragments are cemented by quartz carrying silver sulphides and occasionally masses of galena.

The Santa Barbara and Parral deposits are true fissure-veins cutting shales (slates) and the porphyries that break through or overlie them. The presence of fluorite indicates the presence of gases from igneous magmas in the vein-forming waters. (Pneumato-hydatogenetic deposits.)

—Transactions of the Am. Institute Mining Engineers. 1902.

MEXICO'S MINERALS.

Greatest in Silver, Increased in Gold, Copper and Lead.

A review of mining in Mexico during the past year makes it clear this country is rapidly forging to the front in the production of gold, copper and lead, with good prospects that within a few years it may assume as commanding a position in the production of these metals as it now holds in the production of silver. While maintaining its position as the greatest producer of silver, Mexico, during the year 1906, advanced from sixth to fifth place in the production of gold; from fifth to fourth in the production of lead, and is second to the United States in the production of copper. Only in the last two or three years has any particular attention been paid in Mexico to zinc, but in the past year the exports of zinc to the United States aggregated 30,000 tons, while nearly as great an amount was exported to England, France and Belgium. This year, it is predicted, the exports will exceed 12,000 tons per month.

Mexico's gold production for 1906 was $15,430,000 as against $14,526,855 in 1905, an increase of $903,145. In silver, the production shows an increase in value in dollars, but the actual facts are that the output showed a reduction of 6,156,000 ounces of metal. This was due to a rise in the value of silver, the average price of the metal during 1906 having been 66.791 cents per ounce, as compared with 60.352 cents per ounce in 1905.

Mexico's copper output for 1906 was 135,800,000 pounds as compared with 144,350,962 pounds in 1905 and 114,117,000 in 1904. It is estimated that the production for 1907 will be 200,000,000 pounds. The reduction in the production of copper, which was occasioned by labor troubles at Cananea, was more than made up by the increase in the price, which for 1906 averaged 19.278 cents per pound as against 15.590 cents in 1905.

—L. Q. TAYLOR. "Chihuahua Enterprise."

NOTES ON A SECTION ACROSS THE SIERRA MADRE, OCCIDENTAL OF CHIHUAHUA AND SINALOA, MEXICO.

Walter Harvey Weed, Washington, D. C.

The Republic of Mexico is traversed by many mountain ranges, and presents a great diversity of climates, soils and geographical features, yet its grander geographic provinces are few and peculiarly well defined. The Gulf plain, the Central plateau, the Sierra Madre, and the lowland or Tierra Caliente of the western coast are the main features of the geography of the Republic, and in the northern half these proviinces are particularly well defined. The Sierra Madre separates the Republic into eastern and western parts, ,and from the City of Mexico north to the Texas line presents an almost impassible barrier to east and west travel. On the north the first wagon road pass from east to west is at El Paso del Norte, the site of the Texas city of El Paso. Southward for many hundreds of miles, which all travel from the west coast to the interior must pass, is a stupendous barrier to social and commercial intercourse.

The Sierra Madre is commonly described as a range or congeries of mountain ranges. In fact, it is, in Chihuahua at least, a great plateau fringed by mountains on the east, trenched by deep canyons in its center, and bordered by a wild and rugged complex of mountains carved out of the plateau on the west.

Professional duties took me across this region from Parral westward to the Gulf of California via Guadalupe y Calvo. As it includes some of the great ore-deposits of Mexico, and its geo-

logical features have never, so far as I am aware, been described, I have prepared a diagrammatic section made from my observations on a horseback trip across the Sierra, and added such notes as seem to be of general interest.

The Central Plateau Region.

From the Rio Grande at Presidio del Norte westward to Chihuahua, the central plateau presents a broad expanse of rolling, arid table land, with grass and Spanish bayonet, sotol, yucca and cacti. Detached and usually serrated mountain ranges rise abruptly from this open country. The rocks are mainly limestones, blue, gray or white, and commonly devoid of fossils, though certain beds abound in them. These fossils, wherever seen, were of Cretaceous age; but older rocks have been found by other observers. The rocks are folded in domes as well as the more common synclinal and anticlinal folds, and in places intrusive masses of rhyolite-porphyry and extrusive rhyolite-tuffs occur. Many of the ranges seen along the line of the Mexican Central consist of such rocks, and the silver-mines at Santa Eulalia are in Cretaceous limestone, eroded and partly covered by rhyolite-tuffs. Near Chihuahua the limestones are concealed largely by rhyolite-tuffs of varying texture and color. Southward along the Mexican Central railroad the isolated ranges contain intrusive masses of granite and other coarsely granular rocks, which, breaking through the limestones, are often characterized by contact-deposits of copper-ores, as, for example, those at Jiminez and Mapimi.

The branch line of the Mexican Central railroad running to Parral and Santa Barbara traverses a plain rising gently westward, and terminating in the hills about Parral, which are outliers of the main Sierra Madre, and are composed of dacite and rhyolite resting upon steeply dipping argillaceous shales, so hard as to be commonly called slates.

The Sierra Madre.

Sierra Madre is a common name on the maps of Mexico, but the only region properly so designated forms the central ridge or backbone of the Republic. It is fittingly named; for it is indeed the mother Sierra, since a great mountain-region has been carved out of it. The elevation west of Parral is about 7,000 feet, the summit of the plateau rising gradually to 10,500 feet near the Continental divide, and gradually falling to about 6,800 feet, where the plateau breaks into the bordering mass of mountains. As already observed, the Sierra Madre is a plateau, cut by canyons and dissected along

its borders. It is built up of successive flows of eruptive lavas, light-colored dacitic and rhyolitic porphyries, the result of great volcanic outbursts and accompanying fissure-eruptions, such as formed the great rhyolitic fields of the western United States. On the east these rocks rest directly upon the folded slates, but on the west upon andesitic and rarely upon the granite rocks. Ore-deposits occur in the fragmental igneous rocks (rhyolites and tuffs) along the eastern border and in similar rocks west of the Sierra; but, so far as my observation goes, the rhyolite flows of the Sierra Madre proper are later than the ore-deposits, and cover and conceal them. It is only where the underlying andesitic rocks have been revealed by erosion that the mines have been found. In general, these andesitic rocks are of direct volcanic origin, forming an irregular plateau comparable to the range east of the Yellowstone Park, and deeply dissected before the period of the rhyolite eruptions.

ITINERARY. (See Illustration.)

Outfitting at Parral, I took the trail leading direct from the city to the town of Guadalupe y Calvo. A narrow-gauge railroad runs some 20 miles west of Parral; and at the time of my visit, in December, 1900, was being rapidly pushed west of the summit of the mountains. This road will carry great quantities of firewood and mill-material to Parral. Before it was built all of the firewood of the city was packed on burros. On the first day of my trip at least 1,500 burros were passed. A stick of wood as large as one's wrist is worth a cent at Parral, and as this wood has all been packed 20 miles from the mountains, it may readily be seen that the railroad will find considerable traffic in firewood alone.

The country for 5 miles west of Parral shows rough hills, having outcrops of dacite and dacite-stuffs, and intermediate grass-land dotted with bushes. Beyond this broken country there are smooth grass-lands with fine pasture, while the bottom-lands of the river are planted in corn. Distinct outcrops of rock are rare, and the underlying material could only be observed in railroad cuts, where tuffs showed and conglomerates and breccias were also observed. West of this fine pasture-land the foothills show smooth slopes covered with bushes of scrubby oak, which increase in size as the trail ascends. The first foothills are low, rounding, and show smooth slopes; the rocks are slates whose ready weathering has produced this smooth surface. The slates are much folded, however, and westward, near the pass through the mountains, are covered with rhyolite-tuffs and lava-flows, which form bold pillars, cliffs and peaks. As the altitude

increases, pine trees are observed, and the oaks are no longer mere bushes, but measure from 6 to 15 inches in diameter and 10 to 20 feet in height. The accompanying diagrammatic section, drawn en route, shows the general relations of the rocks. At the close of each day's journey the observed facts were added to the diagram, which therefore represents both my observations and my interpretation of them. Teh country between Parral and the crest of the mountains is underlain by dark gray shales and slates. These rocks are folded, but seem to have a general easterly dip. At Parral they are covered by dacitic breccias and tuffs, which form the prominent hills near the city, and are cut by the veins of silver-lead ores which support the industry of that busy town. These rocks all show widespread decomposition.

The dacitic rocks occurring at Parral are described by Ordoñez as dark green to dull green rocks, containing scattered crystals of transparent feldspar, together with hornblende, dark green to the naked eye, and *lamellae* of dark green mica. The magma is in part microfelsitic and in part microlitic, with disseminated particles of yellowish-green hornblende, which gives to the rock its color, and the crystals of hornblende are in part decomposed, and altered, either centrally or peripherally, to calcite, chlorite, or, sometimes, epidote.

Judging by the plenocrysts which it sometimes contains, this rock bears some similarity to the felso-dacites of prophylitic appearance, of Rosenbusch, and may correspond in part to the dacites, as well as to the porphyrites, of Foqúe and Levy, which are likewise analogous to some of the prophylites described by Zirkel from the Virginia range of Nevada. Here, these rocks sometimes have a lighter color and a more marked porphyritic appearance by reason of an abundance of disseminated feldspar crystals. There also may be observed with the naked eye, and in variable quantity, grains of pyrite disseminated in the paste.

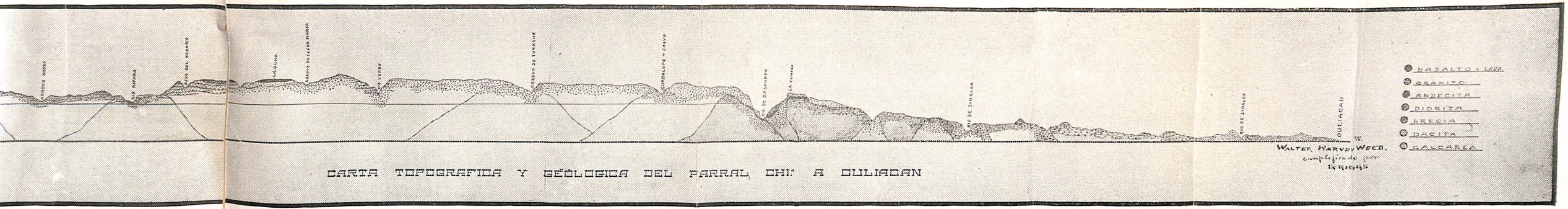
Four miles west of Parral an eroded rhyolite lava-flow was observed, the rock being distinctly vesicular in places, and holding abundant small lithophyses. In the mountains the rocks are mainly tuffs grading into coarse breccias. In general they are dense in texture, and but rarely show phenocrysts of sanidine and quartz. The rocks mainly weather in pale shades of brown, sometimes reddish, often gray. The new railroad-grade, which is largely a rock-cut in the steep slopes, shows excellent exposures; this fresher rock being commonly chalk-white, sometimes brick-red. The trail and railroad grade both follow up a clear headwater branch of the Parral

river to the low gap in the mountains north of Santa Barbara. From the summit, a chain of bold peaks is seen to the south, while less lofty and rugged heights continue the line northward, and the mountain slopes extend west to a broad plateau.

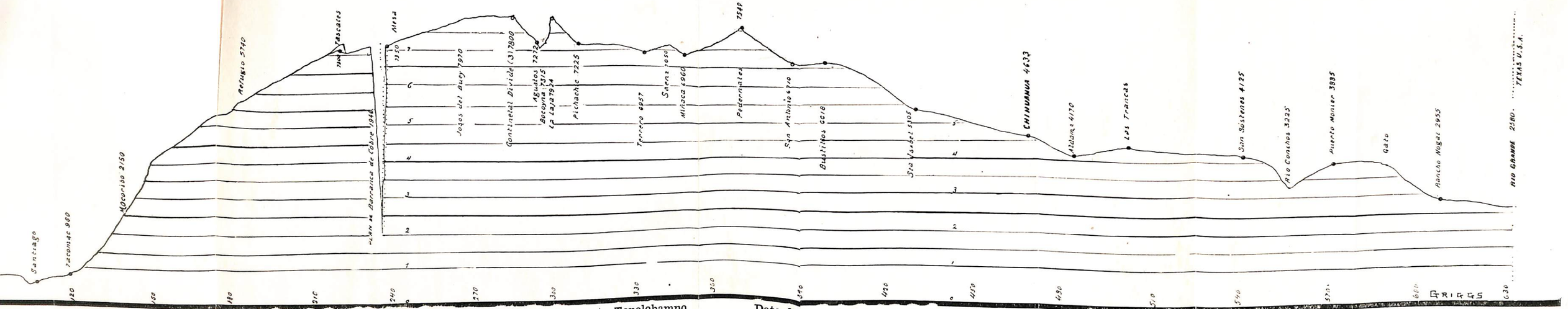
From the divide westward the trail crosses a basalt flow from 100 to 300 ft. thick, which rests upon the eroded surface of rhyolite. These rocks form an open, grassy basin and rough slopes of very low gradient, bearing scattered oaks. The mesa, standing above the rhyolite-slopes on the west side of the basaltic area, shows that the basalt has suffered some erosion. The basalt itself shows abundant feldspar phenocrysts a half-inch across, with large yellow olivines. The rock varies in texture, but is commonly vesicular and often slaggy in form.

After leaving the basalt, the trail descends a very gentle slope over flows of rhyolite, exhibited as a succession of cliffs with intervening terraces, to a depression in the plateau known as the *Arroyo Hondo.* The country is exactly like the plateau of the Yellowstone Park, save for the oak-groves which dot the hillsides, and look much like the apple-orchards of New England. The rocks are both massive and tufaceous, and appear to be typical rhyolites, showing a ground-mass thickly crowded with sanidine, quartz and biotite. The *Arroyo Hondo* is a deep trench in the plateau, containing the only water for many miles about. West of this *arroyo,* the country is clearly a dissected rhyolite plateau, with rolling surface and an average relief of about 200 ft., embracing a succession of open meadows alternating with low oak-covered hills. Occasionally low ledges of rhyolite are seen on the more rugged slopes, with occasional bossy outcrops bearing pine-trees which greatly resemble the "long-leaf" pine of the northern Rocky Mountains (Pinus Ponderosa). A small species of "two-leafed" pine, resembling the P. Murrayana or "lodge-pole pine" of Montana, is also seen.

On this rhyolite plateau, water is relatively scarce; the few streams being shallow, and showing, in the dry season, merely isolated pools of water. Westward, the plateau breaks off suddenly toward the great north and south trench of the Nivarra river. The trail gradually descends the incised front of the plateau which has been cut back by a branch of the Nivarra. The view from the summit, looking west, shows a succession of terraces with what appears to be a high, rough range beyond, having a nearly continuous crest. The aspect is that of a typical rhyolite plateau region. The rocks are mainly massive lavas on the upper part of the plateau, and rest upon tufaceous material in well defined beds, and composed of various



Cross Section of the State of Chihuahua from Parral to near Culiacán. Walter Harvey Weed.



Cross Section of the State of Chihuahua from Río Grande to Topolobampo. Data from K. C. M. & O. R. R. Griggs Del.

colored fragments in a very pale gray, or light buff matrix. The Nivarra river cuts in the plateau a narrow gulch, 1,000 ft. deep, with practically no valley. At the point where the trail crosses it, the river is but a few miles above its junction with the Riparra river, and a branch of the trail follows down the picturesque canyon to the main stream. The trail which we took, however, ascends the steep slopes and crosses a narrow divide about 800 ft. above the stream-level, between the two rivers. The section exposed along the slopes shows that the lower rocks are all dacites and dacitic breccias and conglomerates, the fragments being often but 2 ft. in diameter.

The valley of the Riparra is about 0.5 to 0.75 miles wide, and contains occasional ranches and well-cultivated fields of corn. The bottom is dry and arid, except where cultivated and irrigated. The trail turns abruptly up the valley and follows its eastern margin for about 3 miles, passing the hot springs, which are used for irrigation. The water, at a temperature not exceeding 120 degrees F., oozes from caves in the volcanic tuffs, the water-course and the pool being lined with bright green *algae*.

According to my barometer-readings, the Riparra valley has an altitude of 5,700 ft. West of it the trail ascends to a broad, open, ssy terrace, corresponding in altitude to the well-marked terrace on the eastern side, the front having an elevation of about 800 ft. above the valley, and the rear being about 400 ft. higher. Looking up the stream, the bedded dacite lava-flows are seen to dip N., or down stream, while near by and north of the trail the flows have an eastward dip, which probably accounts for the slope of the terrace. This terrace is open and grassy, save where it has been cultivated in extensive corn fields by the Indians of the valley. To the westward, a depression in the terrace is filled with basalt. Across this terrace, which is about 3 miles wide, the trail ascends extremely steep slopes of light-colored dacite porphyries in successive flows. The typical rock is a dense lavender-colored dacite with scanty crystals, and chalk-white to tufafaceous in appearance. From the summit (about 8,500 ft. high), the trail follows a succession of deeply-incised gulches to the Rosario spring; the rocks being chalk-white volcanic tuffs which weather readily. West of the spring, the slopes ascend gradually to the summit of the plateau, 9,200 ft. high. It is evident that the supposed mountains seen west of the Riparra river are in reality merely the rugged and incised front of the plateau. The trail crossed the *arroyo,* an intervening region cut in banded rhyolites, often plated in structure, and follows up a little gulch to another (9,200 ft.) summit which seems to mark the general

average of the plateau top and then descends about 100 ft. to a basalt-covered area, timbered with fine pines and showing park-like areas containing shallow lakes or lagunas. The largest of these, known as the *Laguna Grande,* is a handsome body of water, about 1-4 of a mile wide. Several dry basins, observed in the basalt, are believed to mark hollows in the original lava-flow. The summits crossed between the Riparra river and the lagunas showed the first good pine-trees seen; and the pine-growth reaches its culmination on the basalt area near the *lagunas.* Here the trees average perhaps 2 ft. in diameter, and many were seen 3 and 4 ft. through at the butt, and over 100 ft. high. The oaks also are larger, often 2 ft. through, straight in growth, and 30 to 40 ft. high. *Madroñas* and cedars also occur.

The basalt itself is both vesicular and dense in texture, and varies in color from dark steel-gray to chocolate-brown and shows occasionally glassy feldspars and much iddingsite. The basalt-area is an ideally beautiful timber-country. The pines are tall and straight, grown relatively far apart, and the intervening space is covered by a fine growth of grass. There are no hills worthy of the name, the average elevation being about 20 or 30 ft. above the *laguna* meadows. This ideal country ends at the *Arroyo de Cueva Blanca,* where the basalt terminates abruptly, thinning out over the dacite; the latter rock forming great cliffs and huge angular masses, which are not plated, but show great conchoidal fractures, and the lava-flow being exposed in a cliff along both sides of the *arroyo,* and undercut by a small stream, making the cave that gives the place its name. The trail, which passes westward along the grassy bottom of the creek, is much traveled. At the time of my visit, numerous pack-outfits, loaded with oranges from the western slopes of the Sierra Madre, or with merchandise for the interior, together with herds of goats going to Parral were passed at short intervals.

West of the *Arroyo de Cueva Blanca,* the trail ascends steep slopes made by the incision of the headwaters of the stream in the main summit of the dacite plateau. The average elevation of the *Laguna Grande* country is 9,200 ft., and, according to barometer-measurement, the summit of the plateau west of the *arroyo* has the same altitude. The country is a typical dacite plateau dissected by numerous trenches running N. and S., or approximately transverse to the trail. Westward, the elevation decreased gradually toward the Rio Verde. The deepest depression passed is the *Arroyo Muerta.* Here the rocks are bright-red rhyolites, underlying ledges of gray rhloyite breccias, which form the lower part of some 600 ft. of white

rhyolite-tuffs. There is a sharp ledge between the *Arroyo Muerta* and the walls of the canyon of the Rio Verde. This canyon shows broken walls with numerous projecting points, as the river has a tortuous course and the rocks are soft and readily yield to erosion. The gorge is about 2,000 ft. deep, though the actual walls are much less high, as the slope is quite gradual, and it is only near the river that cliffs are seen. The barometer-reading at the river-crossing was 7,300 ft. Looking westward across the gorge, the front of the plateau is seen as a black, straight profile, having no resemblance to the mountain?region, although it is commonly called the summit of the Sierra Madre. The rocks exposed in the gorge are sheeted, the lavender-colored dacites of the lower 500 ft. being overlain by chalk-white tuffs, which extend to the summit. The trail followed up a tributary gulch running at nearly right angles to the canyon and showing walls 200 ft. high, of rhyolite, eroded in very striking picturesque forms. The resemblance to the Yellowstone Park country is also noted in this little gulch, the rock-outcrops, the spruce and fir timber on the walls, and the willow and the red-bud brush in the stream-bottom furnishing the exact counterparts of similar places in the northern Rocky Mountains. The creek also, like the streams in the Yellowstone Park, heads in a shallow depression, on a summit which shows an elevation, accodring to the barometer, of 9,350 ft., while the main summit of the plateau is 150 ft. higher. The rocks encountered appear to be normal Yellowstone rhyolites, varying from an extreme density to a rough texture. Quite rarely, black rhyolite-grass, having the structure of pearlite, is seen. West of the divide the rocks are denser, and often have the structure of porcelain. They occasionally contain spherulites, which are commonly silicified.

Westward, the trail follows for about 3 miles a beautiful willow park, and then crosses rugged hills and intervening gulches to the meadows on the eastern side of the deep depression of Turache creek. It does not descend abruptly into this valley, but follows a stream running SW., cutting through the rhyolite cap, and exposing a bedded basic andesitic breccia. These rocks, indeed, extend to the very top of the plateau; but they have evidently been deeply eroded; since, at numerous places along the stream followed by the trail, rhyolitic or dacitic tuffs are seen resting on the breccias. The altitude of the plateau where the trail begins to descend is 8,800 ft., and that of the Turache valley is 6,800 ft. The Turache creek joins the real Rio Verde 40 miles from the point where the trail crosses.

Beyond Turache the trail ascends the steep slopes of the valley to the summit of the rhyolite plateau. The rocks are massive, with a platy structure. The basalt breccias do not appear west of the range, although the trail follows a steep little gulch, and the rocks are well exposed on the cliffs above. Beyond the Turache ranch and the Guadalupe y Calvo the elevation reaches about 9,500 ft. The steep descent to Guadalupe y Calvo shows good exposures of rhyolite-tuffs of the same character as the rock seen at the town; and the basaltic rocks are not exposed until the town itself is reached.

Guadalupe y Calvo is picturesquely situated in a deep basin surrounded by the steep slopes of the Sierra Madre plateau. This basin is about 1 mile wide and 2 miles long, but there is no bottom-land, the creek cutting a little gorge through the sloping shallow shallow basin-bottom, extending back to the steep slopes. The glaring colors of the place are in marked contrast to the plateau country about it; for the removal of timber and washing away of soil has bared the pink, white and gray rocks. Seen from the east, the indurated rhyolite-tuffs or breccias form massive exposures, looking like granite, and weathering in picturesque crags, cliffs, etc., which extend continuously along the southern side of the stream past the town. This rock is in turn covered by from 100 to 300 ft. of earthy rhyolite-tuffs, resting upon the unevenly eroded rhyolite, and so soft that they weather readily and form smooth slopes with no rock-exposures. No veins or mines are seen on the south side of the town, where these rocks prevail. On the north, the rhyolite-tuffs, are seen to rest upon and cover the veins—a conclusive evidence that they are more recent than the ore-deposits. Where the rhyolites have been removed by erosion the underlying andesitic rocks are exposed, forming the dull brown slopes seen about the mines. It is evident from the occurrence of this rhyolite that the andesitic rocks were carved into a hilly country, as rugged as that seen today, which was completely covered and buried beneath later eruptions of rhyolite as lava-flows and ash-showers. It is evident that these hills sloped SW., down to a lowland, for the andesites do not show south of the town, while tuffs are piled up to great heights on every side of it. These andesites are bedded, and show, near the Rosario mine, a dip of 80 degrees E., and a strike of N. 70 degrees W. They are mainly of fragmental origin, are well indurated, much altered, and appear to have suffered from contact-metamorphism. They show varying tints, but are thought to be part of a complex similar to that which is seen forming the foundation of the plateau E. of Turache. They are netted with fractures and veinlets of quartz, as well as

cut by the great veins of the Rosario, and the group of veins on which the Independencia mine is located.

The town is situated in a little basin cut by the head-waters of Dolores creek in the rhyolite, near the western border of the Sierra Madre plateau. A few miles W. a very rugged, mountainous country begins, the mountains being carved out of the plateau, the summit-level of which their summits approximately reach.

The andesitic rocks are traversed, especially at the E. end of the basin, by a large number of large and small quartz veins. The diagram (Fig. 11) shows the larger veins only; the intervening areas present small minute quartz-streak traversing the rocks. The second diagram (Fig. 16), showing the Rosario outcrop, represents an area where many of the smaller stringers have probably united in the big Rosario vein. The shattered condition of the andesite is well seen, however, in the exposures along the trail cut in the cliffs below the old mine.

A few hours' travel west of Guadalupe y Calvo, the great Sierra Madre plateau suddenly ends, and the sea of mountains formed by the erosion of the western border of the plateau begins. This fringe of mountains, perhaps 15 miles wide, is bordered by rolling foothill country, which gives place to the broad, flat strip of coastal plain extending to the Gulf of California. Isolated mountain ranges occur, however, in both hills and plain tracts, but they trend N. and S., are relatively low, and are not eroded parts of the plateau. The mountain border E. of the Sierra Madre is narrow, and more like a rim about the table-land. On the contrary, the western mountain tract is generally lower than the plateau, is made up of lateral spurs and ridges running transverse to its border, and, in general, shows clearly the branching system due to the dissection of the plateau by the streams. From the Guadalupe y Calvo westward, the andesitic rocks are exposed along the trail to Dolores, but are capped by the rhyolite forming the higher ground. The plateau shows very moderate dissection northward and westward to Baborigame; but the direct trail to La Cumbre goes westward; and as one approaches the plateau edge a V-shaped gap shows a wide stretch of lower mountainous country. The descent is very abrupt. The trail winds about from side to side of a lateral ridge, and descends fully 1,000 ft. in each mile traveled.

At this point the west slope of the plateau is composed of well-banded, highly-indurated basaltic tuffs and breccias, dipping downstream, 20 to 30 degrees W., and capped with rhyolite flows, not only on the plateau, but on varying lower elevations in the ridge

to the west. Evidently the Sierra Madre is made up of a basement of these andesitic rocks, eroded and covered by rhyolite, and the flows have filled up an extremely rugged country. This mountainous tract is the dissected border of the plateau, and bears the same relation to it that the "bad-land" areas do to the flat mesas from which they are derived. These mountains, therefore, show the substructure of the former plateau, and, as their evidence accords well with that afforded by the Turache valley and at Guadalupe y Calvo, it is presumed that the andesites were eroded into very mountainous tracts before the rhyolite eruptions began.

Compared with this western border, in which cuts of 3,000 to 5,000 ft. prevail, the Rio Verde canyon is shallow. The summit of the plateau is probably 9,500 ft. high east, and not less than 7,000 ft. high west of Guadalupe. The altitude of the orange-ranches of Rio Domingo is 2,900 ft. less. The Rio Domingo has cut down through the andesite breccias to slaty rocks, of which I unfortunately have now no specimens. I do not feel confident that they are not metamorphosed igneous rocks; no quartzite or limestone being observed. The latter rocks are seen only in the main valley of the Rio Domingo; the mountains and small valleys show only the andesites and rhyolite-porphyry caps. Along a branch of the Bazonopa (a branch of the Sinaloa), the river-drift shows boulders of granite and various andesitic rocks, as well as rhyolite.

The abrupt descent from the plateau summit to the Rio Domingo valley is accompanied by a corresponding change in the vegetation. Where the narrow ravines widen and a little strip of alluvium occurs, fields of sugar-cane are found, and orange groves appear. The rank vegetation of the tropics is, however, absent and only suggested along the stream bottoms.

The Bazonopa river, a large branch of the Sinaloa, cuts a horseshoe canyon, some 60 miles long, through the heart of the western mountain tract, furnishing excellent sections of the rocks. In general, true rhyolitic rocks prevail, forming mountain-summits and canyon-walls. These rocks are plainly seen to consist of nearly horizontal flows, in part of massive lavas, but chiefly of indurated tuffs and ashes, the *ejecta* of old volcanoes, filling deep hollows in the andesitic porphyry. Intrusive masses of granite and diorite also occur, and are shown by included fragments of andesite and their jagged contents to be later in age than the andesites, though older than the tuffs. At La Cumbre, a little mining town nestling in a hollow on the summit of the mountains and sustained by the product

of the Guadalupe and Fortuna mines, an opportunity was afforded for a detailed study of the structure and nature of the rocks.

The river gorge is in part cut through all the three varieties of rocks mentioned. The oldest rocks—the andesites—are well bedded, have a prevalent dark-gray or purplish-red color, and vary from coarse breccias, with fragments a foot or more across, to fine tuffs and hasper-like rocks. They appear to be horizontally bedded, and are capped by dacitic rocks. These andesitic rocks form the slope where erosion has removed the rhyolite. They are cut by a granite intrusion on the river-bank; by a larger mass on the summit, at the village of La Cumbre; and by a third mass of granite, three miles farther west. In each instance the andesite tuffs have been somewhat baked and metamorphosed by the heat and vapors of the granite intrusions, so the recrystallization masks the original nature of the andesite porphyry, and gives it a more uniform, almost diabasic texture. Massive andesite-porphyry is also seen below the Guadalupe mine; it has distinct phenocrysts of black augite and white plagioclase, and occurs in blocky masses, forming large, approximately rectangular outcrops, devoid of prominent shooting or joining.

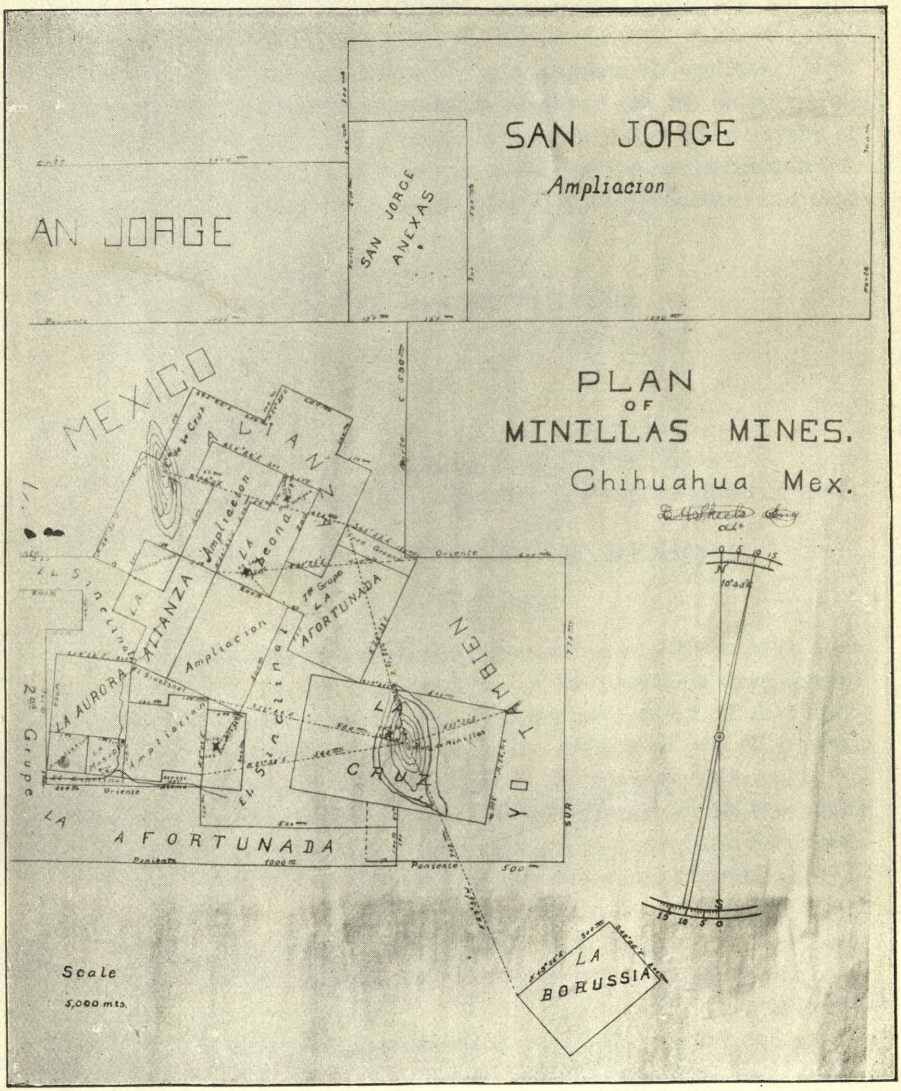
The granitic rock is a quartz-monzonite, deeply disintegrated, as might be expected in the tropics, so that fresh samples can only be obtained from mine-workings or places where streams keep a fresh surface exposed. In general the rock is deeply decayed, and disintegration boulders occur, mostly small, and showing a pitted or horizontal surface. It apparently shades into a dark basic rock, carrying hornblende crystals an inch long. The rock is cut by veinlets, and closely resembles the quartz-monzonite of Butte, Montana.

The rhyolitic rocks appear identical with the dacitic, seen farther east. They occur at all elevations, and show plainly that a rugged mountainous district, even more deeply cut than that now existing, was filled up and leveled to a plateau by immense flows of rhyolites and dacitic rocks. The basalt beds of this series, as seen near the mine, are at least 1,000 ft. thick, and consist of well-bedded tuffs, carrying fragments of rhyolite and boulders of andesite, with distinct alteration-crusts—one pebble, 4 by 5 in. in size, having an alteration-crust 1 in. thick. The rich gold-veins of La Cumbre are well defined quartz ledges, cutting andesite and granite, but covered and concealed by the rhyolo-dacitic rocks. In this district the mountain slopes are very steep, averaging nearly 30 degrees, Bazonopa river having an elevation of but 2,900 ft., while the mountaintops vary from 6,500 to 7,000 ft. West of La Cumbre the route pursued

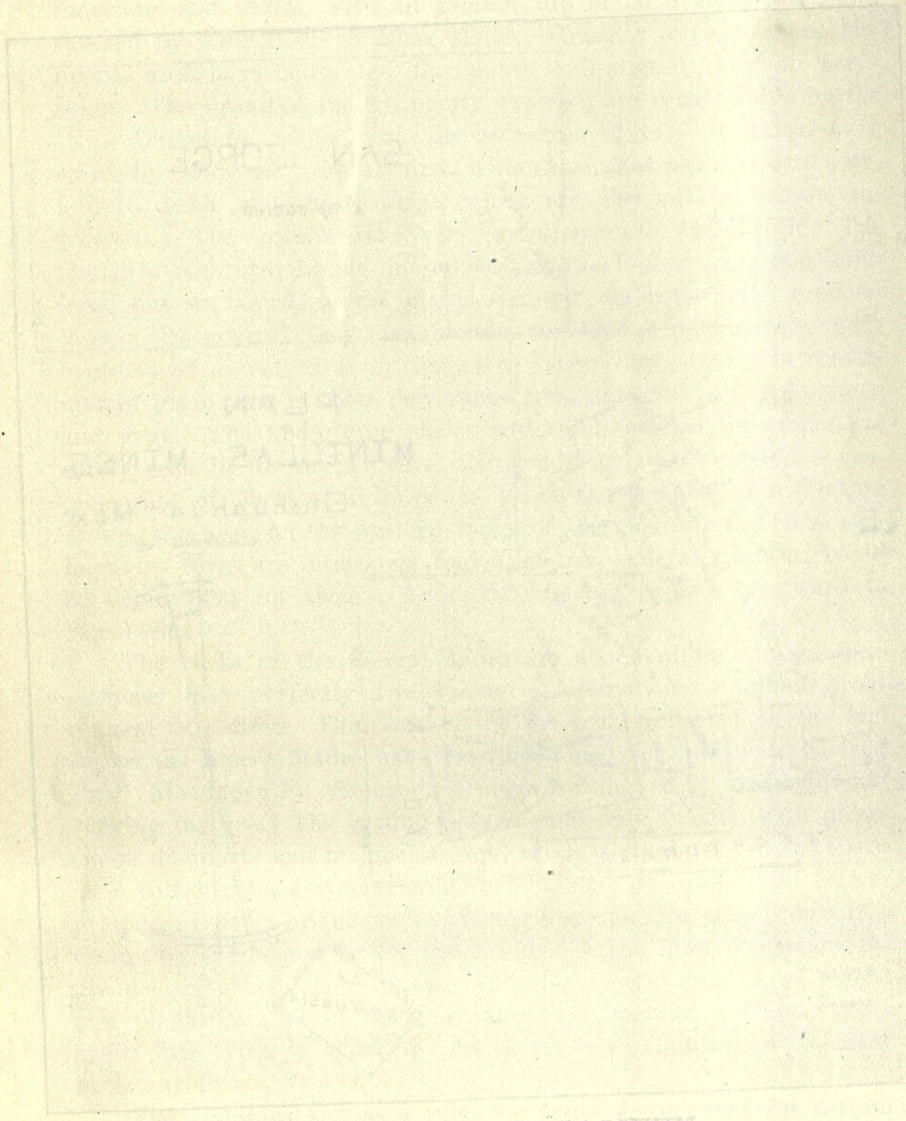
to the coast follows down the deep cut of the *Arroyo Naranja,* the walls of which show bedded andesites, cut by acidic granitic intrusions, which give place farther west to impure, thinly-bedded limestone and shales, with an average dip of 20 degrees NW., and covered by dark-green schistose slates. Granitic intrusions are frequent, and have indurated the slates and altered them to hornstone. The granites, though poorly exposed, are recognizable by the soil. Limestone, which occur in beds from 2 to 6 ft. thick, were carefully searched for, at first without success. They are overlain by basic andesite breccias, which are also cut by granite intrusions. The granite is a very coarse-grained white rock. The rhyolitic rock still occurs in patches on the higher mountain summits, but westward, to the plains country, andesitic rocks predominate. In general they are breccias or true conglomerates, with boulders of a foot or so in diameter. They vary greatly in coarseness of grain, and in color they range from dark-red to purple, green and gray. The underlying shales and thinly-bedded limestones are rarely seen in the deeper cuts. No sandstone was seen, but a conglomerate of chert and limestone pebbles, resembling our Dakota group, was seen on the western range of the mountains. These sedimentary rocks are intricately folded, and no general structure could be determined for them. Andesitic covering extends westward to Bacubirito.

The rocks of the Sierra Madre are all so altered by surface-agencies that perfectly fresh material cannot be obtained from natural exposures. Thin sections of the rocks collected on the trip across the Sierra Madre have been examined for me by my friend Prof. Alexander N. Winchell. The prevailing rocks are dacites of varying texture. The ground-mass is commonly felsitic, with plenocrysts of quartz and plagioclase, and rarely orthoclase. In the specimens collected the ferromagnesian minerals are gone; but their former presence is shown by the nests of hematite, magnetite, etc. Spherulitic textures are common in the ground-mass. The most common rocks are dacites, which show crushed and re-cemented crystals of quartz and plagioclase. True tuffs are also very common. These dacites grade into types in which the orthoclase is so abundant as to make basic rhyolites.

The andesites are, as a rule, too badly decomposed for careful study. Those at Guadalupe y Calvo are rather acidic, resembling trachyte in some slides. The rocks on the Bazonopa river the typical augite-andesites, as are also those of the foothills W. of the Sierra Madre. The granular rocks on the W. margin of the Sierra plateau



MINILLAS. Mining Claims.



are quartz-diorite, later than the andesites and certain of the dacites. This rock shows basic facies at the contact with angite-andesites, the rock being a quartz-olivine gabbro. Quartz-diabase also occurs. Trachytes occur with the andesites, and in the field were not distinguished from the latter.

True granite occurs farther W. at a number of localities. Near La Cumbre the andesites and andesite-porphyry are the oldest rocks; and they are augitic, and sometimes contain large phenocrysts of plagioclase, though commonly they have the nominal andesitic habitus. They are cut by quartz-diorites, covered in turn by dacites, and then by rhyolites.

The order of succession is, therefore:

6. Basalt, the youngest rock of the region.
5. Rhyolite.
4. Dacite.
3. Granite.
2. Trachyte.
1. Andesite, the oldest igneous rock of the region.

—Transactions Am. Institute Mining Engineers. 1902.

THE MINERAL WEALTH OF MEXICO.

By E. H. Talbot.

In no other respect has Mexico advanced so rapidly or with such marvelous results in the last decade as in the profitable development and operation of rich mines, many of which have attracted the cupidity of discoverers and pioneers since the coming of the Spaniards. For this advancement, which is still in its infancy, Mexico is indebted, first to the capital, energy and intelligence of the thousands of enterprising Americans who have invaded her mountain fastnesses, and, second, to the wise laws and to the encouraging protection extended by the strong hand of the government.

To have advanced so far in a quarter of a century, in the transformation from the most antiquated methods to those which represent the latest developments of science and practical experiment, as to rank first in the list of nations as a producer of silver and second as a producer of copper, is indeed an achievement deserving special recognition.

This advance, which has added $35,000,000 gold and 65,000 tons of copper to the world's wealth in a single year, with the certainty of a heavy and unchecked gain for an unlimited period of time, amply justifies all that has been claimed by the most sanguine re-

garding the fabulous riches buried under the picturesque surface of the mountain ranges of Mexico.

The reports of Mexico's bureau of statistics show exports of gold in the 8 months from July, 1905, to February, 1906, amounted to $22,208,440, or $3,290,325 more than for the corresponding period in 1904-05; exports of silver reached the enormous sum of $85,037,609, or $33,251,828 more than in 1904-05.

Think for a moment what it signifies for any country, however broad its territory, to send out to the markets of the outside world, in the brief period of 8 months, precious metals to the value of more than $107,000,000, almost one-half of which represents a gain over the previous period.

The relative importance of gold and silver over all other articles of commerce exported by Mexico is shown by the excess of $34,039,514 in the eight months ending with February, this year.

During a recent visit to the PERMANENT EXHIBIT OF MINERALS IN THE CITY OF CHIHUAHUA, which has been collected and is maintained by the state of the same name, my attention was called to a posted statement giving the number and character of the mines of the republic and their average monthly product of gold and silver for the fiscal year 1904-05, from which it appears that there were:

Mines of gold and silver	5,208
Silver	5,153
Silver and lead	2,924
Gold	1,478
Gold, silver and lead	913
Gold, silver and copper	861
Copper	796
Silver and copper	671
Iron	351
Silver, copper and lead	254
Gold and Copper	234
Copper and iron	176
Quicksilver	160
Sulphur	105
Lead	67
Antimony	45
Tin	30
Copper and lead	21
Total	19,447

The total number of mines of all kinds in the 11 leading states, worked or located, is given as follows:

Chihuahua	3,319
Durango	2,827
Sonora	2,670
Zacatecas	1,502
Oaxaca	1,273
Jalisco	1,039
Sinaloa	866
Guanajuato	784
Hidalgo	753
Lower California	641
Guerrero	629
Total	16,303

The average monthly product of 13 states for the year mentioned was:

Chihuahua	$1,122,995
Hidalgo	1,023,143
Nuevo Leon	953,154
Mexico	641,777
Zacatecas	516,743
San Luis Potosi	494,752
Guanajuato	348,618
Sonora	329,673
Durango	245,313
Coahuila	175,941
Michoacan	171,567
Jalisco	102,763
Sinaloa	60,512
Total	$6,186,951

Why certain states appear in one of the above lists and not in the other is not explained.

Besides the 3,319 mines credited to Chihuahua there are in that state important deposits of magnesite at Batopilas, bismuth at Ojo Caliente, aluminum at Guasaparez, arsenic at Rayon, gypsum at Camargo, coal at Coyame and Ciudad Juarez, mica at Rayon, asbestos at Bocoyna, salt at Julimes and Jaco, alum at Santa Rosalia, tunstan at Coyame, vanadium at Tres Amigos and Guaynopa, and molybdenum at Corralitos.

In 1905 Mexico produced $12,605,300 gold, $35,000,000 silver, and 65,000 tons of copper.

Twenty-one Mexican states and territories are producers of copper, and according to the last report issued by the Department of Fomento, contain copper mines as follows:

Aguascalientes	49
Chihuahua	53
Coahuila	5
Colima	12
Durango	51
Guanajuato	4
Guerrero	44
Hidalgo	5
Jalisco	102
Mexico	3
Michoacan	95
Nuevo Leon	3
Oaxaca	5
Puebla	5
San Luis Potosi	14
Sinaloa	25
Sonora	239
Tamaulipas	11
Zacatecas	14
Lower California	65
Tepic	2
Total	806

GREAT MINING RESOURCES OF CHIHUAHUA.

The Rich and Famous Mines.

There has been many a "line of type used to describe, with and without the rich embellishment of truth, which is sometimes employed to make a questionable theme readable, the individual luck or fortune of the mining king of the moment. There is a romance connected with the effort to wrest from mother nature's innermost vitals the precious ores and metals she seems to begrudge her human children, a romance that appeals to the man on the farm or at the bench, as well as to the man of affairs. The usual course through which each succeeding bonanza passes before an admiring public is to stand in the limelight for a sufficient time to bring the man and mine into prominence.

The calm judicious investor looks the matter over from his viewpoint, present value and future possibilities are weighed carefully, and an offer is made which if accepted, will suddenly relieve the original finder of his bonanza, and at the same time rob the situation of the general interest always attracted to the individual.

The largest consolidated capital now known to the mining world used almost wholly in the development of mines and treatment of ores, is being very generally invested in the many Mexican properties that increasing railroad facilities are making possible. However the small investor has found many opportunities to invest in properties and has added to his money, his time and labor. It is a well demonstrated fact that the man who stays with his investment until the different conditions, manners and customs are thoroughly mastered, is the man who realizes most from his property rights in the Republic of Mexico.

There are notable instances of the present when the individual owner of a rich and prosperous property would not dispose of his holdings, one of the most notable of these is the case of the much displayed Pedro Alvarado.

PARRAL DISTRICT.

G. A. Burr, M. E., Parral, Chihuahua.

Some idea of the importance and magnitude of this district may be gained from the statement that any six of the best known mining districts of Mexico could be laid down within its limits and there would still be room for more.

The importance of its ore bodies may be appreciated when it is stated that within its limits are found the largest discovered fissure veins of the world and that the mines of the district are capable in their present state of development of producing from 5,000 to 6,000 tons of ore per diem approximating in value $120,000, Mexican money or of $43,800,000 per annum and that during the last 15 years there have been invested in the mines of the district approximately $30,000,000 gold. There are denounced within its boundaries over 2,200 separate properties of which number less than 20 per cent have as yet been exploited, the balance awaiting the quickening influence of capital.

The heaviest capitalist as well as the poor man have here found their "El Dorado" and it may be truthfully stated that there has been less money lost in mining in the Parral District than in any other.

This has been due to two principal causes. First to the almost total absence of "wild cat" speculation and second to the strength and mineralization of the veins and almost invariable increase in the value of the ore as depth has been attained. This is the undisputed reputation that this district has enjoyed for three centuries.

Barring the inevitable results of incompetency and riotous living, no one who has stayed with the district and worked, can say that he has not made money and is not satisfied, and there are numerous instances where common workmen, have through the agency of their claims, reached positions of enviable opulence.

Until a few years ago Parral was handicapped from lack of transportation facilities, and all machinery and supplies had to be freighted from Jiminez in wagons a distance of 90 kilometers, and all ore not treated on the ground by the most primitive of methods had to be carried out in the same way, but now the district is traversed by two lines of railroads, giving it direct communication with the rest of the world.

Until a year ago the majority of the ores were shipped to the various smelting companies for treatment but on a review of the situation prompted by undue increases in the treatment charges made, by the smelters, the miners have almost as a unit decided that the ores of the Parral District shall be treated within her limits, and as a result, there are today either under construction or under contract to be constructed within the next 18 months, reduction works aggregating capacities for the treatment of between 4,000 and 5,000 tons of ore per diem.

These works added to the present milling capacity which amounts to about 2,090 tons per diem, will barely take care of the present producing capacity of the mines, hence further development of the mines will call for still further extension of reduction facilities.

The Parral District has suffered from lack of attention to provisions for the treatment of her own ores and has depended too much on shipping her ores to outside reduction works, with the result that for years the miners have deprived themselves of the benefits of their medium and low grade ores, and the ores that have heretofore been daily discarded as being of too low a grade to ship, have been equal in value to the combined daily production of the Homestake, Tamerack and Atlantic Mines, three of the greatest dividend payers in the world.

The mining men have met this situation and when the plants now under construction or contract are completed, the Parral district

will be the greatest producer of precious metals in Mexico, if not in the world.

The varieties of ore mined in this district and their ameanability to the mining processes opens the way for the utilization of the cheapest known processes, and no better field for the skilled metallurgist exists.

This district has been celebrated as the largest producer of silicious silver ores in Mexico, but gold has been mined in the district since 1547 and gold placering may be seen in numerous camps within 15 miles of the City of Parral.

The gold production is constantly increasing, not only on account of the discovery of distinctively gold bearing ores, but through the increase of the amount of gold found associated in the silver ores.

There are two principal mineralized zones in the district that have been thus far developed, these parallel each other, striking approximately North and South and are separated from each other by a supposedly barren zone 10 kilometers in width.

The Eastern zone in which are located the Refugio, San Patricio, Palmillas, Quebradillas and a score of other famous producers, may be rightfully termed the Parral Zone, while the Western zone runs through Santa Barbara and takes in the Tecolotes, Mina del Agua, San Nicolas, Saynas and other prominent producers and covers the Camps of Buena Vista, San Francisco del Oro, Santa Barbara, La Union, Ronces Valles and Cerro Colorado and may be called the Santa Barbara zone.

It is in the latter zone that most of the lead and gold ores are produced, the Stearn zone being the greater producer of silicious silver ores.

Aside from the above mentioned zones there are important isolated camps such as Cienega de Olivas, Zaragoza and Concepcion, the former of which is rapidly coming to the front as a gold producer.

The thickness of the ore that has been developed throughout the district is as phenomenal as the vast extent of mineralization, and shoots of pay ore 20, 50 and even 100 feet in thickness are not of infrequent occurrence.

Parral has the ore in sight and is now in the midst of the work of bringing the capacity of her reduction works up to the capacity of her mines. When that is completed no more prosperous mining district will be found in the world.

The deepest mining that has yet been done in the district is on the famous Red Vein, which is from 300 to 450 feet wide, where the deepest workings are in the vicinity of the 1,000 foot level.

A deep level company is now being organized to cut this immense fissure vein, on which are located a score or more of the principal producers of the district, at the 1,500 foot level. Parral's greatest future undoubtedly lies in deep level mining where still larger bodies of still richer ore may be expected.

The field for investment here is broad and safe, so long as the ordinary principles of business are adhered to. There are 80 per cent of the discovered properties still to be developed and there are reduction works to build for the treatment of the ores already developed.

Parral has an ancient and honorable history, she has met and conquered every obstacle, and has before her a brilliant and promising future.

MINING IN MEXICO.

During the year there has been an immense influx of American capital to Mexico, due to several causes. The labor troubles in several of the principal mining camps of the United States, the fact that mine prospecting and development in Mexico requires less capital than in the regions north of the Rio Grande, and that there is a large area of territory still remaining unexplored, are some of the reasons. Most of the newer enterprises are in process of development.

PARRAL.—In the north of Mexico a great deal of capital has been invested in the silver mining camp of Parral; the main producers are the Quebradillas, Refugio, Santa Ana, Tajo, Los Muertos, Terrenates, Caldas and Palmillo. The well-known mine of Pedro Alvarado, El Palmillo, has maintained its production during the year, but the mine has never given more than a fraction of the wealth popularly estimated. During the past three years the Palmillo mine has produced 1,200 tons per month of ore assaying between 40 and 50 oz. silver per ton, and 0.2 oz. of gold per ton. This was worth $1,000,000, United States currency, after deducting freight and treatment charges. The net profits, after deducting cost of mining, were probably $500,000, United States currency, for the three years. Operating expenses on this property have always been higher than would have been the case had the mine been conducted as an ordinary commercial enterprise. This mine has now been worked to water level, 600 ft. from surface. The Parral district, which affords the chief supply of silicious ores for the smelters in the north of Mexico, has suffered toward the latter

part of the year, on account of an over-supply of silica, caused to a large degree by the re-opening of the Tombstone mines in Arizona; as a consequence, treatment rates have been raised throughout the district. The re-opening of the lixiviation mills is under consideration.

Many of the principal mines of Parral have now been worked down to the water-level, and require pumping machinery on a large scale to maintain production. The mines so affected are the Preseña, La Prieta, El Tajo, San Juanico, Cabardeña, Jesus Maria, Sierra Madre, and many others. The district is an old one and maintains its reputation and output. The San Francisco del Oro mines have been transferred to an English company. Extensive development and a large installation of machinery is under way to put the mines on a dividend-paying basis.

SANTA BARBARA.—In this district the Tecolotes Company controlled by the Messrs. Guggenheim, has operated two units of the concentrator, besides shipping a good deal of low-grade lead carbonate. This mill is operated by gas-engines, using producer gas, and is a good example of a plant with a large capacity using Bartlett and Wilfley tables. The mill of the Montezuma Lead Company was worked to full capacity most of the year. This mill uses Hartz jigs, removing most of the lead; and the gold-bearing tailings are re-ground in seven Monadnock Chilean mills. The capacity of the mill is 450 tons per day. The magnetic separation of a zinc-blende free from precious metals has been satisfactorily effected here. The mill middlings, containing 25 per cent zinc, are made into a 50 per cent zinc product, while the lead, iron and copper from the magnetic separation are shipped to the San Luis Potosi smelter. The Alfereña Mining Company is now grading for the erection of a 150-ton concentrator. A main adit, the El Toro, is being pushed to open up the ground acquired by the No. 2 smelter of Monterey. During the year the Torreon smelter has secured mines in Santa Barbara, and the erection of a concentrator is now under consideration.

AMALOYA, the Cigarrero mine is producing 2,500 tons monthly of high-grade silver-lead carbonates, carrying some gold. This ore was found only a few months ago, but there is already a large tonnage in sight. This is a new district and is now being rapidly developed. The silver-lead carbonate deposits in the Cretaceous limestones of northern Mexico are steadily increasing in importance and nearly every year finds a new mining camp to its credit. Prospecting in these northern deserts is difficult on account of the absence of water, supplies

and labor, but there is no doubt that many more deposits will be found. Among the districts now being exploited may be mentioned the Sierra Mojada, Santa Eulalia, Mapimi, Monterey, Villaldama, Terrazas, Minillas, Naica, Muzquiz, Cerralvo, Carmen, Valardeña, Amaloya, Vacas and Norias de Bajan.

SANTA EULALIA.—In the Santa Eulalia mines, near Chihuahua, a uniform output of leady ores has been maintained during the year. The ore shoots of this district are of enormous size, being over 1,000 feet long, 200 to 400 feet wide, and over 900 feet in vertical extension, and still continuing downward. The problem of supporting the ground has always been a difficult one, and a number of very disastrous caves have characterized the history of ore extraction in this camp. During 1903 the caving of many thousands of tons of lead carbonate ore in the old Santo Domingo mines caused some uneasiness, but, happily, occurred without loss of life. One of the largest ore-bodies in the camp is being mined without any supports at all for the roof, and the hole which is gradually being opened out is one of the sights of the district. This camp has always suffered from lawsuits regarding titles and side-lines, and 1903 has been no exception to the rule.

OCAMPO.—A typical illustration of the old method is still to be seen in the Jesus Maria, or Ocampo, district, in the State of Chihuahua, a camp which railroads have not yet benefitted. In this district there are dozens of good mines carrying high values in gold and silver, and when the camp is reached by railroad it will become one of the most profitable in the country, as most of the ore now being indifferently treated in local mills will be shipped to the smelters. In the Sierra Madre range the gold-silver properties are steadily receiving more attention. The purchase of the Dolores mine by the Mines Company of America, in conjunction with English capital, will probably stimulate development in the surrounding country. At the Dos Cabezas mine, north of Dolores, a concentrating plant has just been introduced, but the owners are apparently still hesitating as to the method of handling their high-grade gold-silver tailings.

LLUVIA DE ORO.—Along proposed route of the Kansas City, Mexico & Orient Railway a very remarkable gold prospect, the Lluvia de Oro, has been taken up by Los Angeles capitalists. The ore is found as a series of quartz outcrops in limestone, without any very well-marked strike or dip, except for short distances.

The gold content of these quartz enrichments is very high indeed, being in some places as much as 11 oz. per ton. A general average

sample of all the quartz exposed when the company started work showed 3 oz. gold per ton. This property has been described as the best prospect in America, and the present operators have a chance to open up one of the great gold mines of the world if the outcrop values are maintained in depth.

BAQUERACHIC.—Near the Lluvia de Oro property, and in the same limestone formation, a copper deposit, the Jesus Maria de Baquerachic, only needs railroad facilities to make it a producer of importance. The ore is copper sulphide, carrying 5 oz. of silver and 0.1 of an ounce of gold per ton. The property has been known for many years and figured in the war of the French intervention. Several thousand feet of development work has been done in the decomposed contact matter where the deposits are found, but until quite recently the workings have been inaccessible, owing to rotten timber and consequent caving ground.

—"Mining in Mexico." By JAS. W. MALCOMSON.

MOST NOTED MINERALS OF CHIHUAHUA.

BY THE AUTHOR.

(Most of them at the Mining Exposition.)

Argentite. Batopilas, "San Gil," Morelos.
Anglesite. Naica (Camargo), Sierra de Lamentos (Bravo).
Alunite. Hot Springs, Santa Rosalia.
Amphibole. Santa Eulalia, "Boltime Mine," Pichachic.
Antimony. (See Stephanite).
Apatite. San Pedro, Corralitos.
Aragonite. San Padro.
Arsenic (native). Uruachic District, Rayon, "San Timoteo Mine."
Arsenopirite. Uruachic, "Las Animas" Mine.
Argentite. Batopilas, Morelos.
Auricalcite. Almoloya, Jimenez District.
Azurite. Terrazas, Magistral, Camargo, Mineral de los Reyes, etc.

Bismuth and Bismite. Ojo Caliente, District Bravos.
Beryllium (?). Found at Magistral.
Blende. (See Sphalerite).
Bornite. Las Vigas, Mineral de los Reyes, etc.

Calamine. Santa Eulalia (Potosi Mine), Los Plomos, San Sostenes, Coyame, Almoloya, Cd. Juarez.
Calcite. Various.
Cassiterite. Small specimen from Uruachic.
Cerargyrite. Otates, Rayon District, Monterde, etc.

Cerussite. Santa Eulalia, Naica, Parral.
Chalcopyrite. Terrazas, Dolores, Guaynopa, Rayon District, etc.
Chalcanthite. Almoloya, Cuchillo Parado.
Cobalt. With nickel near Chinipas, District Arteaga, Almoloya, Jimenez.
COAL. At Orientales, near Ojinaga and Cd. Juarez.
Copper. (See varieties).
Cuprite. Jimenez, Magistral, Santa Rita.
Cinnabar. Encinillas, Rayon District, "Nuevo Almaden," Santa Eulalia (Cocineras Mine).
Covellite. Almoloya.

Dolomite. Santa Eulalia, etc., etc.
Dog-teeth spar. Santa Eulalia, "Las Animas," Ojo Caliente, etc.

Electrum (gold with quartz). Ocampo (Jesus Maria), "San Jose Mine."
Embolite. "Sierra del Carrizo," Julimes, "Mina Purisima," Ojo Caliente, "Willis Mine," Cusihuiriachic, "Santa Eduvigues," Santa Eulalia, "Galdeano Mine."

Fluorite. Guazaparez, Arteaga District, etc.

Galenite. Parral, Santa Barbara, Santa Eulalia, San Francisco del Oro, San Pedro, Naica, etc. (in every district).
Garnet. Near Cusihuiriachic, Casas Grandes, Carrizo.
GOLD (native). Placer Santo Domingo, Placer Guadalupe, Cerro Colorado, Batopilas, "Palmarejo," "Las Hundidas," Ocampo, Sahuayacan, Uruachic, etc., etc.
Gypsum. Naica, Santa Rosalia, Camargo, San Sostenes, etc.

Halloysite. Terrazas, Magistral, etc.
Hematite. Uruachic, Sierra de las Bolas, Coyame.
Hubnerite. (Tungsten) found near Coyame (?).
Horn Silver. (See Cerargrite).

Iron. See Hematite.
Iron Meteoric (aerolite). Found near Temosachic. 100 kilos.
Iodyrite, with polibasite. Guasaparez.

Jamesonite. Candamena and Uruachic, Rayon District.
Jasperized Wood. San Jose, Ojo Caliente.
Jade. Found in mounds at Casas Grandes, Galeana District.

Kaolin. Batopilas and Urique, Andres del Rayo District.

LIGNITE. See Coal.
Limonite. Uruachic.

Magnesite. Cerro Colorado, Batopilas, Andres del Rio District.
Magnetite. Uruachic, Rayon District.
Melaconite. Mineral de los Reyes, Magistral.
Marcasite. Uruachic.
Martite (psuedomorphus after pyrite). From Uruachic, San Martin.
Mercury. See Cinnabar.
Meteorites. See Iron (meteoric).
Mica. Candamena, Rayon District.
Mispickel. With Stepnite at Carrizalio, Coyame District.
Molybdnum. Found as Wulfnite, at San Pedro and Cuchillo Parado.
Muscovite. See Mica.
Manganese. See Psilomelane and Pyrolusite.

Niter. Santa Rosalia Hot Springs.

Olivenite. San Jose del Sitio, Juarez District, Terrazas, Rio Tinto.
Oolite. Rayon District, Las Animas.
Opal. Carichic District, Juarez, Zapuri, Mesa Guachochic, Rayon.

Psilomelane and Pyrolusite. Cusihuiriachic, Chihuahua, Coyame, San Sostenes.
Proustite. Batopilas, Morelos, Andres del Rio.
Pyrite. A perfect cube from Terrazas, "Rio Tinto Copper Mining Co.," also Uruachic.
Polybasite. Guasaparez.

Salt (nace). At La Cruz near Santa Rosalia.
Sartorite. Uruachic, "Las Animas" Mine.
Siliceous Wood. Norogochic, Guerrero.
Selenite. Naica, Camargo, Santo Domingo.
Silver (native). Batopilas, Morelos, Urique, Dolores, Parral, San Francisco del Oro, Ocampo.
Sphalerite. Parral, San Francisco del Oro, Santa Barbara, Coyame, Calera, San Isidro, San Sostenes.
Stalactite. Caves at Santa Eulalia, Coyame, etc., etc.
Stalagmite. Caves at Santa Eulalia, Coyame, etc., etc.
Steatite. With gold from Cerro Colorado, Batopilas.
Stephanite. Guasaparez, San Pedro.
Stibnite with Valentanite. Parral, Chinipas, Coyame, Carrisalio.
Stilbite. Zapuri, Rayon District.
Stromeyerite. Terrazas, Santa Rita, Almoloya, Mineral de los Reyes.
Sulphur. Barraganes, Terrazas, etc., Santa Rosalia Hot Springs.

Tenorite. Magistral, Mineral de los Reyes.
Tufa (Cantera). Chihuahua, etc.

Turquois. Specimen from mounds at Casas Grandes.
Tetrahedrite. Santa Barbara, Guasaparez, Guaynopa, etc.
Tin (Cassiterite). Uruachic.
Tellurium.
Thompsonite. Las Animas, Santa Eulalia.

Vanadium (?). With Wulfnite at Cuchillo Parado, Guaynopa.
Wulfenite. Cuchillo Parado (property of Mr. Evaristo Madero), "La Aurora" Mine and San Pedro.

Zinc. (See Calamine Sphalerite), Calera, Almoloya, Plomos, San Sostenes, Coyame, Santa Eulalia, Santa Barbara, San Francisco del Oro.

ZINC MINING IN CHIHUAHUA.

The zinc industry in the State of Chihuahua is still in the prospective stage. Until a very short time ago the prospectors did not realize that there might be a profit obtained from the mining of zinc ore, and many of them, especially the Mexicans, do not realize it yet, still considering zinc only a detrimental element in ores of other metals. A large majority of prospectors are not familiar with the appearance and manner of occurrence of zinc ores, particularly of those in the oxidized condition. Principally for these reasons it has been generally believed that there is little, if any, valuable zinc ore in this region, and prospectors have almost entirely neglected to look for it until very recently.

The first zinc mine in the state, La Calera, was opened four years ago, and has been vigorously operated for two years past by a company of New York and Denver capitalists, with Charles A. Pringle as manager. An enormous body of ore carrying a high percentage of zinc and lead, with considerable values in silver, has been developed, and is said to be the largest body of zinc ore in Mexico. La Calera is located near Minaca, about 125 miles west from the city of Chihuahua, and connected with the Chihuahua & Pacific railroad at San Isidro by a narrow gauge railroad. Several thousand tons of ore have been shipped to the United States from this mine, but owing to its complex character it has been thought best to separate the zinc, lead and iron sulphides of which it is composed before shipment, and a mill of large capacity is now in process of erection for that purpose. There are indications of the presence of other very large bodies of ore of the same character in the vicinity of La Calera mine, but the holders of the ground have done little exploration work as yet.

The first shipment of zinc ore from the eastern section of the State of Chihuahua was sent to the United States in June of last year by Felix McDonald, and consisted of 30 tons of carbonate ore which gave returns of 40½ per cent zinc. This shipment came from the Wisconsin mine, situated in the camp of Terrazas, 20 miles north of the city of Chihuahua.

Soon after this, Mr. McDonald and some others began shipping carbonate ore from Las Plomosas, near San Sostenes, the present terminus of the Kansas City, Mexico & Orient railroad, east of Chi-

huahua about 75 miles. This ore was quarried from a ledge which rises to a considerable distance above the surface of the ground, and shipments have been continued with more or less regularity up to the present time.

These shipments aroused interest in the matter of zinc mining and some little prospecting was done in the eastern section, with the result that a number of good prospects were soon discovered over a widely scattered territory, one of which, called Los Alfonsos, the property of Othon Sartorius, of Chihuahua, has shipped more than a thousand tons of good grade carbonate ore. The Empire Zinc company has recently taken a bond on this property and is working it under the management of W. H. Paul, of Denver, and it is expected to be a steady and heavy producer from now on.

The old and famous camp of Santa Eulalia, near the city of Chihuahua, has been worked for more than 200 years for silver and lead exclusively, and the existence there of zinc ore of payable grade was never suspected until very recently, but a large body of zinc carbonate has been developed at a depth of 1,600 feet from the surface in El Potosi mine of the Chihuahua silver mines, and since last December has been producing at the rate of about 1,000 tons a month, returning a handsome profit. In Almoloya camp, in the southern part of the state, there has been opened within the past year a body of zinc carbonate ore in the Iguana mine, belonging to the Almoloya Mining company, of other metals, and it has been developed into a steady producer of good zinc ore. In the neighborhood of Coyame, east of the city of Chihuahua, a number of promising prospects show an alomst pure white oxide-carbonate ore, sometimes with concentric iron-stained lines, assaying in some instances over 60 per cent zinc. Some of these prospects also show a peculiar, massive, fine-grained red carbonate-oxide ore, with white concentric lines, assaying above 50 per cent zinc.

The ores of the eastern section, so far as developed, are mainly carbonate, with a little oxide; but the writer has lately seen a sample of zinc-lead sulphide carrying considerable silver value, said to come from a large vein in the extreme eastern part of the state which was worked many years ago for the silver, but probably abandoned because of the high percentage of zinc. There is also some zinc-lead sulphide farther north in this section, not far from the line of the Mexican Central railroad, which may prove valuable in the near future. The oxidized ores of the eastern section are remarkably free from objectionable elements, an addition to the treatment charge on account of such elements being seldom required by the smelters. While developments have not reached such a point as to justify an estimate of the future of the eastern section, the latest information would seem to indicate that the deposits of carbonate ore opened on the surface will be found to persist to considerable depth and maintain their size and value; and in the eastern section there are, without doubt, large deposits of zinc-lead sulphide awaiting exploitation.

On the whole the prospects seem good that mining of zinc ores will become in the not distant future a considerable factor in the already great and rapidly increasing mining industry of this state.

Parral ships beween 35,000 and 40,000 tons of ore per month. No ore can be shipped with a value of less than $40 per ton, because it will not pay. Reckoning 35,000 tons, at $40 per ton, we have a value of $1,400,000, which is taxed 1.5 per cent for the state. This produces to the state $21,000 per month, or $252,000 per year from this district alone.

There are other districts in the state which produce ores of a higher average value than those of Parral. Naica, Santa Eulalia, Almoloya, Guadalupe y Calvo, Batopilas, Urique, Cusihuiriachic, Santo Domingo and other ore camps of importance. It is a low estimate to assume that these eight camps produce three times as much as Parral; so that they will pay toward the maintenance of the state at least $756,000. This, added to Parral's contribution of $252,000, will give to the state from the mines alone $1,000,000 per year. The total expenses of the state per year are about $950,000.

THE SAHUAYACAN MINING DISTRICT, MEXICO.

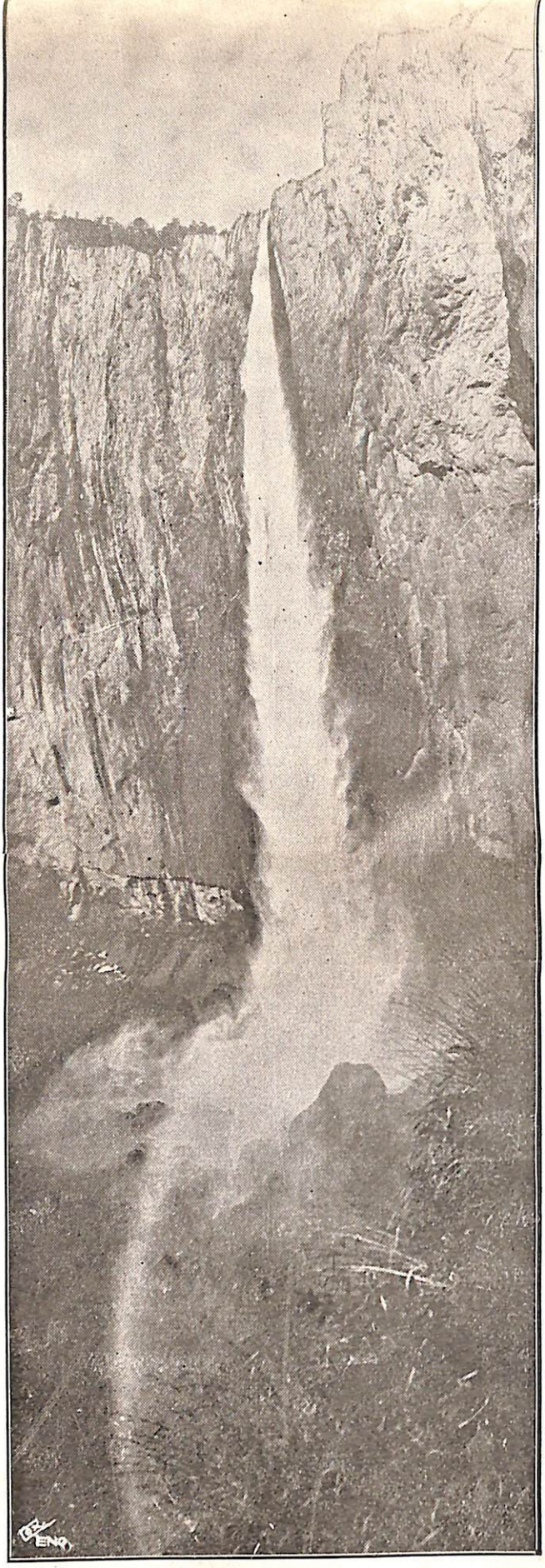
By John C. Treadwell.

The Sahuayacan Mining District, comparatively a new one, is located in the State of Chihuahua, about two hundred and fifty miles west of the city of Chihuahua, and one hundred and twenty-five miles from Minaca, which is the nearest railway station and from which point all traffic, passenger as well as freight, is carried on mule back. Freight requires from twelve to twenty days, while a passenger can make the journey in four or five days. A telegraph line reaches as far as Ocampo, from whence a telephone service is in operation to Santa Teresa and Sahuayacan.

The route from Minaca to Sahuayacan leads through the mining town of Jesus Maria (Ocampo). This place is about one hundred years old and has produced many millions of silver from its several large mines, which are now, however, for the most part dormant, only two mines being in operation. From Ocampo westward, the country becomes very much broken and is characterized by precipitous mountain slopes and deep gulches, the evidences of great erosion, extending over long periods of time, being here shown in a striking manner, Sahuayacan lying in a cañon which presents a most pronounced example of the results of erosion.

The differences in elevation vary between two thousand feet at the river levels to four and six thousand feet at the peaks and tablelands. Along the low-lying valleys the climate may be considered as tropical, producing bananas, oranges, lemons, etc., frost being unknown. At elevations of above four thousand feet snow falls are sometimes experienced, but never the heavy freezing of the higher altitudes.

Precipitation is confined principally to the months of July, August and September, during which time the rain descends in torrents, the streams swell to abnormal sizes sweeping the debris from the mountain side with irresistible force. During these three months the hill sides become covered with verdure and heavy undergrowth, which in turn dies down and is washed away by succeeding rains, ex-



Falls of Baseachic, near Pinos Altos. 970 feet.

Parral ships beween 35,000 and 40,000 tons of ore per month. No ore can be shipped with a value of less than $40 per ton, because it will not pay. Reckoning 35,000 tons, at $40 per ton, we have a value of $1,400,000, which is taxed 1.5 per cent for the state. This produces to the state $21,000 per month, or $252,000

posing the formations, thus admitting of easy prospecting. The temperature for nine months of the year is delightful, averaging, perhaps, seventy-five degrees F., while during the remaining three months the climate is hot—in the day time, though always pleasant at night, with an average temperature of probably eighty-five degrees F.

The mountain tops in the district, as indeed the whole northern portion of the Sierra Madres, from the western foothills to and including the great Mexican Plateau, are composed for the most part of a tuff (locally known as "cantera".) Locally this capping might be termed a dacitic andesite, being often finely brecciated and carrying quartz as stringers and veinlets. In the Sahuayacan-Moris vicinity the country has been capped by a true conglomerate, which, according to Bagg, is of volcanic origin, the component parts including boulders of large size. At Sahuayacan this capping has been almost entirely removed by faulting and erosion, but at Moris much of the conglomerate still exists as capping, though much faulted and tilted.

The recent geology of the district may be partially summarized as follows:

1. Formation of shale by deposition as mud and clay, and by compression.
2. Deposition of volcanic breccia, which upon hardening, produced andesite, and this in turn by alteration, the "green stone" (or meta-andesite) of the district.
3. *a* Tilting and crumpling of these formations,
   b Intrusion of rhyolitic flows, faulting and
   c Formation of veins.
4. Capping of conglomerate.
5. Erosion, exposing the older tilted rocks, and laying bare the veins which otherwise must have remained blind.

The shale occurs as a narrow band tilted to the northeast at about fifty-six degrees from the vertical, striking with the general trend of the country at about NW-SE. On the surface it is much altered, and is traced by a band of red, which marks its course quite distinctly. It is impregnated with pyrite, which, when clean, carries values to the amount of $200.00 Mexican currency, but aside from this impregnation of pyrite ore has never been uncovered in the shale. It no doubt, however, plays an important part in the speculations as to the origin of the ore. Lime in small amount accompanies the shale and it is undoubtedly a member of the "Marine sedimentary series" referred to by Hill.*

The andesite occupies a position to the northeast of and conformable both in pitch and strike to the shale. This rock exhibits joint planes lying at an angle of about forty-five degrees to the strike of the country, and they are probably attributable to the intrusion of an immense porphyritic dyke which occupies a more or less parallel

*E. & M. Journal, March 2, 1905.

position with the shale, but removed from it about two thousand feet, to the eastward. To the intrusion of this dyke in all likelihood may be attributed the fissuring and metamorphism which initiated the formation of the veins of the district.

In connection with the mention of this dyke, and as having some influence on vein formation, it is well to note the presence of numerous buttes which occur throughout the district in the form of immense columns of rhyolite, prominent among which are two examples, one at El Pilar and its companion, Pilar de Vigia, at La Cienega. The "Pilar" is noted for its perfect symmetry. It is nearly circular in section, about four hundred feet in diameter and rises to a height of six hundred feet above the surrounding country.

Various modes of formation have been proposed for these columns none of which seem to be conclusive. One theory advanced is that they are the filling of ancient volcanic vents, which cooling more slowly than the surrounding country, became toughened and crystallized, thus resisting the action of the elements to a greater degree. As a partial proof of this hypothesis is the presence of volcanic ash around the base of the Pilar, as noted by Bagg. — See Cut V p 148

The andesite which lies in close proximity to the veins has become altered and quite generally impregnated with pyrites. Some exhaustive tests have been made with the object of determining the possible value of these pyrites. In the Sahuayacan mine, a cross-cut two hundred feet long in the "green stone" was sampled every few feet and concentration tests made. The results showed that with a concentration of 1000 to 1 a product assaying $100.00 per ton Mexican currency in gold and silver, equally divided, could be produced. These conclusions, while economically valueless, present an inviting theme for speculation on the ore deposition of the vein proper.

The veins of the district are numerous, well defined and probably extend to great depths. They may be classified under two heads, viz.:

1. Free milling.
2. Refractory.

The more valuable mines occur in the veins of the first class, and are the only ones that at the present time are being extensively exploited. The veins occur in "green stone" (andesite), as contact with shale as a foot wall and as fissure veins in the green stone proper. The free milling ores carry varying amounts of gold and silver, and in some cases, as at the Sahuayacan mine, the gold predominates to such an extent that silver is almost an inconsiderable factor.

The ore contained in the veins of the second class are largely antimonial and carry their principal value in silver to the almost absolute exclusion of gold. On account of the difficulties of treatment there are no large mines in the refractory belt, but work is carried on in a desultory manner by the native miners or "Gambucinos," who treat the ore in Mexican vasos, a very wasteful and unsatisfactory method.

The principal mine in the district is the Santo Niño, property of the Sahuayacan Mining Company, which has attained a depth, by

means of an inclined shaft, of six hundred feet, with a lateral extension along the vein of one thousand three hundred feet.

Next in importance is the Santa Teresa at El Potrerito. This mine is two hundred and fifty feet deep, with levels each fifty feet. Very little stoping has been done, the obvious intent of the owners being to develop the property for sale. They have on the ground a ten stamp mill, employing pans and settlers with Wilfley concentrators handling the tailings. They have extracted with this mill $300,000.00 Mexican currency and are said to have 25,000 tons of $40.00 ore blocked out and in sight. They employ at the mine and mill seventy men. The vein is a well defined contact vein with shale as a foot and green stone as a hanging wall. The vein is about 20 feet in width, the pay streak averaging probably seven feet and lying close to the hanging wall. The major portion of the values extracted are in gold, the bullion assaying about .120 gold and say .840 in silver. The gold is free and could be easily caught on copper plates. The silver occurs principally as sulphide, and at times beautiful specimens of ruby silver are encountered. The distance between the mines of these two companies is something less than a mile, the Santa Teresa lying about five hundred feet lower than the Santo Niño.

At El Socorro, seven miles to the southeast of Sahuayacan, the Templar has been worked steadily on a small scale for five or six years. The vein is a true fissure, varying from a few inches to four feet in width and standing almost vertical. This mine is noted for the rich specimens of free and crystallized gold which it produces, and with careful management would make a good producer. There is on the ground a ten stamp mill with pans, settlers and concentrators.

The San Antonio, which is distant from Sahuayacan about three miles, has in the past produced some very rich silver ore but is at present practically abandoned, although still containing small amounts of rich antimonial and sulphide silver ores.

The Candelaria at El Carmen is about 12 miles distant and is also an old property. Lately there has been some rich sulphide ore taken from there, but like the San Antonio it is at present inoperative. It is the general opinion that this is an excellent mine.

About three miles south of Sahuayacan some stringers of galena have been located, which have proven of value in treating the rich but rebellious silver ores of the vicinity.

Nine hours' ride to the south is located the Otatas silver mine, and while not in the Sahuayacan district proper deserves mention in this connection. The mine has been worked on a small scale for twenty years. At present the ore is treated by means of a five stamp mill, roasting and hypo-sulphite lixiviation.

The latest strike in the district is at El Sauz, about 10 miles to the west, where a vein of rich surphide silver ore was discovered dipping into the gulch, with the hanging wall conveniently washed away. This property has lately been shipping ore which assays five or six hundred ounces silver per ton. Some very beautiful specimens of native silver have lately been exhibited from there.

About six hours to the southwest there are some narrow veins which have not been exploited, as they are antimonial and therefore difficult to treat.

Minerals Encountered in the District.

Gold.—Native, with galena, with pyrite, as petzite, as nagyite. The latter two in small amount.

Silver.—Native, argentite, pyrargyrite, with galena, with pyrite, with chalcopyrite.

Lead.—As galena (unimportant), fine grained galena in the gold veins is an invariable indication of rich ore.

Copper.—In the gold veins, native as small shot, chalcopyrite, etc. In small amount.

Bismuth.—In minute traces, with galena.

Antimony.—In veins as stibnite and cervantite, in veins barren of precious metals. As impurity in the gold and silver veins.

Iron.—As pyrite, carrying in the veins valuable amounts of gold and silver. In the meta-andesite in close proximity to the veins the contained pyrite can be concentrated up to a value of $100.00 Mexican currency per ton.

Manganese.—As a loose black powder, probably Wad, not valuable as ore, but is considered a good indication of high gold values in the vein.

Considering the remoteness of the district expenses of operation are comparatively light, as will be evidenced by a glance at the attached cost sheets, which may be considered as representative of the work done by the Sahuayacan Mining Company. This concern operates the Santo Niño mine, treating the ore in a twenty stamp amalgamation mill. The mine is operated by means of an incline, and ore is hoisted by a single drum, fifty horse power, sectional hoisting engine and a one-ton, self-hoisting skip. The ore bodies are developed by means of levels and raises. Chutes are placed about thirty feet apart in the levels and overhand stoping is almost exclusively employed. The broken ore is allowed to accumulate in the chutes, only the surplus being drawn off, thus allowing the miners to work on top of the ore. This method is employed as the most economical in timber, which is not abundant and is costly.

The vein is ordinarily twenty feet wide, but in places expands to a width of sixty feet. The whole body of the vein is mineralized and will assay from $1.00 to $7.00 per ton. Constant sampling is necessary, and is carried on with a great deal of care. Each face is carefully sampled every day in such a manner that each distinct streak will be shown in the results. These samples are crushed down and divided into two parts, one of which is "horned" and its companion assayed.* In addition to this the powder from the drillings of each pair of men is horned twice daily, or after each shift.

The valuable ore is encountered in shoots, which occur at quite regular intervals, with spaces of the general vein intervening. The ore shoots never occupy the full width of the vein but will probably

average seven feet, in places widening to twelve or fourteen feet. The values are frequently separated from the hanging wall by a band of poor ore four or five feet thick, which in most cases is not broken. Only in a few instances has good ore been mined on the foot wall. In one case a chimney of ore approximately barrel shaped was taken out, whose vertical axis measures seventy feet and its lateral dimension thirty feet. This body was composed of a large mass or net work of stringers, and was extremely rich.

The principal values are in gold, and to such an extent that silver is almost a negligible quantity, the ratio approximating 1 : 40 silver to gold. This gold is practically free milling, the major portion being gathered on silvered copper plates.

The labor is all native, fairly efficient and easily handled, strikes being entirely unknown. The drillers earn $2.25 Mexican currency per day, working in pairs, and are required to drill ten feet of holes. This task is accomplished in about six hours, when they are allowed to leave the work. Laborers and car men inside work eight hours, and top men ten hours.

Scale of Wages (Mexican currency).—Drillers, $2.25; car men, $1.75; muckers, $1.50; pump men, $3.00; top men, $1.50; hoist men, $3.00.

The ore is delivered to the mill by means of a Hallidie tramway, 2,700 feet long. The difference in elevation is 1,200 feet, and the tramway runs by gravity. Four men and one boy are employed in its operation

The mill was made in sections approximating three hundred pounds and transported from Miñaca on mule back and erected under instructions of Fraser Chalmers. It consists of twenty stamps of 850 pounds each, dropping ninety-five drops per minute, and crushing with water fifty tons of ore per day to pass a thirty-five mesh screen, No. 26 wire. The pulp is passed over silvered copper plates, ten feet long, where ninety per cent of the values extracted are caught. The tailings from the plates are led into hydraulic classifiers and from there are passed over two Bartlett concentrators. Formerly four of these tables were in service but it was found that by the use of classifiers and only two tables more satisfactary work could be accomplished. The concentrates assay about $600.00 per ton, and are shipped to Chihuahua for sale. From the concentrators the tailings are run to waste or treated in eight pans and four settlers, according to whether the tailings are high enough to pay for such treatment or not. The middlings from the concentrators are treated in pans and settlers, by amalgamation, and a satisfactory extraction is made from them. The amalgam from the plates and pans is retorted once a month and the sponge made into bars, which are shipped to the United States. This bullion averages .550 fine in gold and .440 in silver. The total production of the Sahuayacan mine has been $1,000,000.00.

Scale of Wages at Mill (Mexican currency).—Laborers, $1.75; crusher, $2.00; battery, $3.00; battery helpers, $2.25; pan man, $3.50; firemen, $2.50; engine men, $2.00.

All men in the mill work twelve hours. The work is superintended by one American on each shift and an American amalgamator on the day shift.

All values referred to in this article are in Mexican pesos.

HIDALGO DEL PARRAL.

"Established in 1600. First records in archives existing in the Town Hall bear date of 1612. The first official register of mines, in the year 1632, is a volume of 485 pages.

"The general formation of the Parral district is porphyry, and the veins are very strong and well-defined. The greatest depth so far attained, despite the age of the camp, is about 1,000 feet, and this in but one instance, where the vein not only shows strong, but the values continue about as on the upper levels. The ores of the Parral district immediately surrounding the city are siliceous, carrying a small amount of lead.

"Among the bits of comparatively modern history that are told by the older residents of the place can well be classed as ranking in prominence that of the copper coin 'tlaco.' Early in the 60's of the past century the government of the State of Chihuahua secured authority to issue one million copper coins of the value of three cents each. These coins were called 'quartillos' (a quarter of a real—12 1-2 cents). The contract for the minting of these coins was let to a foreigner, who, realizing his opportunity, minted two million of the coins, floating the extra coins on his own responsibility. Later this was discovered by the State and the value of the coin reduced one half. The coin was then dubbed 'tlaco' by the poorer classes. It is also interesting to note that in those times all day labor was paid in copper, and many interesting stories are told of laborers who carried home, weekly, from six to ten pounds of copper coin for their week's labor, and even then earning less than one dollar per day.

"Apropos of this is a story told of one of the principal business houses at the time taking advantage of the decline of the copper coin. The passage of the bill was anticipated by them and a special messenger stationed at the palace in the city of Chihuahua. The bill was passed on Nov. 9, 1869, and the messenger, riding posthaste, arrived in this city several hours in advance of the government messenger. The house, in the meantime, had invested their surplus copper—about $30,000—in sugar, coffees and other substantial merchandise, at par.

"It is claimed that Parral was the last town in the northern part of the Republic to surrender to the Diaz authorities in 1876.

"Before the advent of the railroad, ores were hauled by wagon to Jimenez, and from there shipped to Socorro, N. M., El Paso, Texas,

or Mapimi, for treatment. With the road came foreign capital; and seeing the opportunity, heavy investments were made and elaborate developments begun, with the result that within the past two years mills have been completed (or are now under construction) for the treatment of over 1,200 tons of ore daily. Tramways and overhead cables have been put in, and every advantage taken of the natural surroundings, not only for the convenient handling of the ores, but for the reduction of expense, in order that the large bodies of low grade ores may be advantageously handled.

"*Parral's Railroad Facilities.*—Within the past year the Mexican Central has been extended south-west of Parral to the Rio Flores, a distance of 44 miles. A branch has been built to Santa Barbara, thus opening a new point of shipment for many of the large camps south and west of Parral.

"The Parral & Durango railroad, connecting Minas Nuevas with Parral, and running on west over the mountains, a distance of 65 kilometers, taps one of the largest virgin timber belts in this part of the Republic, and if, as intended, it is carried on, will open a valuable mining and agricultural section to the west. A sawmill was recently completed on this line, and square and round mining timber of a very fine quality is now being placed at the different mines at a much less cost than formerly.

"*Mining Camps Supplied by Parral.*—Guanaceví, Indé, Magistral, Guadalupe y Calvo, El Carmen, El Oro, Allende, Cusihuiriachic, and many smaller camps."

Reduction Works in the Parral District.

	Process.	Daily Capacity. Tons.
Hidalgo Mining Co.'s Mill No. 2	Lixiviation	80
Hidalgo Mining Co.'s Mill No. 3	Lixiviation	75
Parral Milling Co.'s Mill No. 1	Lixiviation	50
Parral Milling Co.'s Mill No. 2	Concentrating	40
F. Stallforth Hnos, Sucrs. y Cia.	Patio	40
Angel Garcia (constructing)	Lixiviation	75

Present Production of the Mines of Parral District (*Nov.*, 1901).*

	Description.	Tons Mill.	Tons Export.
Quebradilla	Silver	....	500
Preseña			
Alfareña	Silver	2500	400
Morena			
Los Muertos	Silver	1200	1000
Refugio	Silver	....	800
Sierra Madre	Silver	600	...

*The production of this District in 1906 was 116,049 metric tons, valued (?) at $3,700,000.—Tax Collector Report, Parral.

Santa Ana	Silver	....	250
Palmilla	Gold	800	800
Sayñas	Silver	....	...
Buena Vista	Silver	....	500
Cerro Colorado	Silver	500	200
Mary	Silver	....	...
Jesús María	Silver	800	400
San Patricio	Silver	500	...
Rebariche	Silver	200	...
Iguana	Silver	300	...
Trinidad	Silver	250	...
Tajo	Silver	....	800
San Antonio Caldas	Silver	200	...
San Cristóbal	Silver	400	...
San Vicente	Silver	500	...
La Union	Silver	1800	...

MINAS NUEVAS.

"The first mine located (by Diego Rodrigo in 1645) in the district was the Veta Grande, on the Veta Colorado, which is the strongest and most important vein in the district, and most probably the largest vein in the Republic of Mexico as to dimensions, and is plainly traceable for a distance of 10 miles over the mountains, averaging, so far as disclosed from present development, about 300 feet wide. The greatest depth reached on this vein, in the Veta Grande, is about 1,000 ft. vertical, or 1,250 ft. on the incline; the bottom of the shaft shows a good strong vein 15 to 18 ft. in width and assaying from 45 to 50 oz.

"Among the older mines on this vein are the San Francisco de la Moreña, worked to a depth of 700 ft. on the incline; the Nopal, worked to 700 ft.; the Preseña and Alfareña, now at a depth of 900 ft. on the incline; Bizcayna, to a depth of about 600 ft.; El Verde, to a depth of about 1,100 ft. on the incline. There are also on this vein the Quebradillas, worked on the southern extension to a depth of 550 ft., while the north end, which has been opened in the past ten years, and is now proving a bonanza, is worked to a depth of 725 ft.; Los Muertos, to a depth of 680 ft.; Pachuqueña, to a depth of 700 ft. The ores from the mines located upon this vein carry red oxide of iron, giving them a red color—hence the name 'Veta Colorado,' or Red Vein."

SANTA BARBARA.

"At one time the capital of the Province of Nueva Viscaya, comprising at that time the States and Territories of Chihuahua, Texas, New Mexico, Arizona, California, and part of Sonora and Coahuila. The first mineral discovered in Northern Mexico was the gold-ore of this place, in the year 1547.

"After a comparatively few years of most vigorous production the mine owner of this immediate district found it impossible to keep miners employed, for at this time the discovery of the famous Veta Colorado was made in the district then known as San Diego de Minas Nuevas—now Minas Nuevas—and a general exodus of miners seems to have taken place. But little mention is made in the records of Santa Barbara after the first flush of discovery had faded until in the early part of the nineteenth century, when mention is made of the advent of foreign capital and of extensive work on the Mina del Agua, which was abandoned after reaching a depth of 60 ft. below the water-level. In the year 1892 it was again opened up; and, with the aid of a very small capital, a foreign exterprise extracted from this mine in less than one year over $80,000 net.

"Mention is made of large and extensive 'gambucino'—gopher—working on all of the large veins, which, from general records, have proved profitable to the operator, but most ruinous not only to the mine but the camp in general.

"The general formation is slate and shale, the trend of the veins being from north to south, the large and more plainly traceable of which are the 'Tecolotes' and Mina del Agua, which can be traced for distances of 3 or 4 miles over the mountains, the incline on the veins being from 45° to 75°.

"Near the surface were found pockets of very rich gold-ore below the oxidized ores, however, the grade is much lower, yet more regular and in larger quantities.

The old method of assaying is most interesting, and goes to show that while the records are exact, so far as the primitive method of assaying was able to prove, yet they were no doubt far short of showing the real value of the ores. Three hundred pounds of ore was taken as a sample and treated by the patio process, and the silver, after retorting, showed the number of 'marcos' per 'carga.' Thus the value of the ore was based upon the actual extraction by quicksilver only. In smelting a similar method was followed, except that lead-ores were smelted, and the lead oxidized off, the bar of silver bullion showing the value per 'carga.' Many of the slag-piles of smelters that were operated in the olden times have of recent years been bought and shipped to outside smlters, netting the purchasers a handsome profit. Another method of assaying, and that is used in many of the more primitively worked mines to the present time is that of 'blistering' in the blacksmith's forge.

"The allotment of space of approximate plazas was by no means overlooked by the fathers of the olden time, as the well regulated plazas of the present will verify.

"About two years ago a California company secured an electric light and telephone concession from the city, and at once erected a modern plant on both systems. About a year ago they extended their telephone system to Santa Barbara, and are now extending to the different mines surrounding the camp. This company holds

a concession for the construction of a water system, active work has been commenced and it is expected to have the system in operation by February 12th of the coming year, 1902.

"The altitude of the city is 5,500 ft. making the climate most delightful in summer and mild in winter.

"The Parral river, a small yet permanent stream, affords the city the very best of sewerage outlet.

"Figuring quite nicely in legendry is the church, which still stands in a state of good preservation—that of Nuestra Señora de Guadalupe—which was completed about the year 1780, being constructed by an Indian who, at that time was working a gold mine of fabulous richness, the whereabouts of the same being known to no one but himself, and each Saturday evening he would bring a brick of the yellow metal, with which he would pay the workmen. All efforts of recent date to locate the mine from which the church was built have been unsuccessful.

"In the year 1867 labor miners were receiving from 50 cents to 75 cents per day; peons, from 25 cents to 37 cents per day. At the present time the former earn from $1.25 to $1.50 per day and the latter from $1.00 to $1.25 per day.

"The advent of steam machinery dates from the early 50's of the past century, when a boiler and engine were put in the 'Huertas' to operate a large number of 'arrastres' and sixteen Castilian furnaces in use at that time. The total output of the sixteen furnaces was about nine tons per day running at full capacity.

"After this came the patio process mill, which is now run with addition of steam and with the aid of modern machinery.

"The first lixiviation plant in the camp, ruins of which still remain, was erected by the Hidalgo Mining Co., on 'Cerro de la Cruz,' in the year 1886.

	Process.	Daily Capacity. Tons.
Montezuma Lead Co.'s Mill	Concentrating	375
Guggenheim Exploration Co.'s Mill (under construction)	Concentrating	400
San Francisco del Oro	Lixiviation	40
Parral Mine, Limited	Amal. and Con.	40

HISTORICAL MINES.

"Alfareña, San Francisco del Oro, San Albino Group, Quebradillas, Los Muertos, Terrenatis, Tecolotes, Mina del Agua, Coyote Group, Franqueña, Veta Grande, El Verde, La Union, Cerro Colorado, Esperia, Hisperides, Caballo, El Toro, Tajo, Prieta, Jesús María, Aguilereña, Palmilla, San Juanico, Cabadeña, San Cristóbal, San Patricio, Las Cruces, Refugio, Nopal, La Morena, Preseña, Novidad."

—Transactions American Institute Mining Engineers.

CX

The production of the Mint at Chihuahua from the year 1811 to 1888 was $43,824,480.00 in gold and silver. The production at Guadalupe y Calvo (Chih.) in the years 1842 and 1850 was in gold, $2,311,104; silver, $2,063,958; total $4,375,062.

The mining camps were the following: Santa Eulalia, Torreon (now Terrazas), Ojinaga, Minillas, Guadalupe, Refugio, San Jose de Cruces, Durazno, Tenoribo, Dura, Potrero, Morelos, Charcas, Cusihuiriachic, Gavilana, Carichic, Nonava, Jesus Maria (Ocampo), Moris, Uruachic, Pinos Altos, Yepachic, Candemena, Yoquivo, Mahuarichic, Batuchichic, Parral, Minas Nuevas, Villa Escobedo, Santa Barbara, Sierra del Carrizo, Sierra de Naica, Pena Gorda, Agua Zoquete, Encenillas, Batopilas, Urique, Realito, Guasaparez, Uruapa, Topago, Palmarejo, Chinipas, Barranca de Cobre, Galeana, Corralitos and Sabinal.

—DICCIONARIO DE GEOGRAFIA Y HISTORIA.
Antonio Garcia Cubas. Page 471, Vol. II. 1888.

CXI

The Chihuahua Mineral Exhibit, established through the energy and activity of the present Governor Don Enrique C. Creel. * * * Through the personal efforts of the director specimens of rare value were collected. * * * The City of Chihuahua is a most fitting place to establish this mineral exhibit. It is the first city of importance as one enters the Mexican Republic. * * * The exhibit is worthy of attracting the attention of all mining men and visitors of Mexico.

—MODERN MEXICO. July, 1906.

CXII

MINING the fountain from which CHIHUAHUA derives its great wealth and from which its future is assured. In the 120 mining camps of the State there are 575 mines that have been worked (according to records) since the time of the conquest. But great numbers of them have been abandoned where some of these have produced as much as 16 ounces to the carga of 300 pounds; this is due to the treachery of the Indians. But General Luis Terrazas, the actual governor, is infatigable in their persecution. He has the advantage of being well posted in their art of warefare, having commanded several campaigns against them. * * * It is not difficult that the day will come when the State will be rid of such plague.

* * * According to a noted expert the camps can be classed in the following manner: first, Batopilas; second, Parral; third, Santa Eulalia; fourth, Jesús María (now Ocampo); fifth, Cusihuiriachic; sixth, Morelos; seventh, Guadalupe y Calvo; eighth, Urique; ninth, Uruachic; tenth, Corralitos (or San Pedro); eleventh, Zapuri; twelfth, Topago (now Rialito).

In the year 1718 the wealthy Don Felipe de Orosco got the permit from the King of Spain to change the name of "Real de Minas" to that of "Villa de San Francisco de Chihuahua." * * * The new Villa had increased wonderfully from fifty to seventy thousand inhabitants; 63 "Haciendos de Beneficio;" 188 "Hornos de Fundicion;" 112 Centradas;" and a great number of "Patio." (System of amalgamation.)

—OROSCO Y BERRA. "Diccionario de Historia y Geografia."

CXIII

The Mexican Central does more mining business than any other railroad in the Republic because it taps nearly all of the ore producing camps. * * * Kansas City Mexico and Orient R. R. will do much towards opening up mining country which has been held back by lack of transportation facilities. The road has now been completed from Chihuahua east 130 kilometers. From Minaca west the first 100 kilometers have been graded and track completed to Bocoyna 92 kilometers (since article was printed 15 more kilometers are completed). Contracts have been let for the next 100 kilometers. The section in Mexico east of Chihuahua, west of Minaca and on the west coast are all making ACCESSIBLE VERY IMPORTANT MINING REGIONS.—Harry E. Maule. "The Railroads of Mexico."

CXIV

Mexican geology may be said to have been born through the ideas collected and preserved in the hieroglyphic inscriptions by the indigenous tribes of Anahuac, whose conceptions called Atonatiuh (Sun of Water), Ehecatonatiuh (Sun of Air), Tletonatiuh (Sun of Fire), and Tlatonatiuh (Sun of Earth). They explained, by ideas that related to a rude and imperfect cosmogenic hypothesis, the signification of great catastrophes, cataclysms, and gealogic phenomena, and these rough descriptions created a profund terror in the imagination of the primitive races.

—Jose G. Aguilera, Director General Geologic Institute, Mexico.

CXV

Padre Martinez, knowing that near the Mission of "Nombre de Dios" there lived some Indians that same from the neighboring mountains known as "Cerro Grande" and "Cerro Coronel," went there to see them (in 1705) and after giving them food and a piece of flannel he pessuaded them to settle near the border of the Chuviscar River. Up to this time the Indians had been living under the oak trees (encinas) which were very abundant at La Junta and on Cerro Coronel. Three years afterwards there same some Spanish families. * * * In the year 1733 the fabulous production of silver had increased the population to 20,000 inhabitants; the main street was half a league in length and not a single vacant lot.

—GARCIA CONDE. Hist. Mex.

THE ARTEAGA MINING DISTRICT.

Spain's Gruesome Regime. $30,000,000 Gold as Crown's Royalty.

By S. L. Pearce.

In the southwestern part of the state of Chihuahua, and bordering on the states of Sonora and Sinaloa is the district of Arteaga, which comprises the municipalities of Chinipas and Guasaparez, the town of Chinipas being the Cabecera or county seat of the district. The district has an extreme length of about 75 miles along the western border, and an average width of about 50 miles, and lies principally between the 27th and the 28th parallels of latitude, and between 108 and 109 degrees west of Greenwich.

Though but little has been heard of this district in recent years, it has a history more interesting, perhaps, than any other section of northern Mexico—a history which is startling in the vastness of its mineral production, and the effect which it had upon the financial system of old Spain, and which bought Spanish titles, and obliterated, through its demands for labor in the mines, a whole nation of Indians, and was finally almost abandoned, while the United States was yet a smaller nation, both in point of territory and in population than Mexico is today.

It is said that the first mining done in the district was about 250 years ago, at a place then known as Gloria Pan, the exact location of which is not known. The enterprising Spanish miners were attacked by a tribe of Indians called Cocoyames and were all killed. Later the Cocoyames were defeated by the Tarahuamares in a great battle fought near Cerocahui, from which fact that place takes its name, the word signifying "Mountain of the war," or more literally, Battle Mountain. The tribe of Cocoyames withdrew to Durango and it is said, have become extinct. It is believed that the Spaniards who were massacred, left bullion to the value of over $3,000,000 in the mine which they were working, and needless to add, great efforts have been made to locate this old mine, but so far without success.

The oldest authentic record now to be found concerning this district is a royal decree designating the old town of Topago as a "Real," and from this fact we may assume that there were in the place at that time, thirty male citizens who were able to read and write, as that was one of the requirements in the establishment of a "Real," or judicial district.

The district is traversed by two large streams, the Chinipas and Septentrion Rivers, which unite at its southern boundary. These streams flow through deep gorges, from 1,000 to 3,000 feet in depth, which in places look as if they might be great fissures in the earth's surface rather than the result of erosion.

The town of Topago was located on the east bank of the Chinipas River, near the southern boundary of the district, and the important mining camps surrounding it, so far as we now know, were Septentrion, Guasaparez, Batosegochic, Guerra al Tirano, Huruapa, Pal-

marejo, Urique and Batopilas, the last two named, having been later included in the new district of Andres del Rio.

The history of the district, up to the time of the Mexican war of independence, is mostly legendary, owing to the destruction of the records, by people who wished to lay claim to practically all the district. Many of the legends are substantiated by perfectly reliable evidence and existing conditions and circumstances, however, so that most of them are regarded as reliable history. Out of the many of these old stories, space will permit us to mention only the few which follow. It is related that upon one occasion the Spanish government, wishing to greatly increase its revenue, considered the advisability of increasing the royalty on the output of the Mexican mines from 10 per cent to 20 per cent, but such a protest was made against this measure that a commission was sent to Mexico to investigate the conditions of the most important mining districts. It was represented to this commission that the proposed increase of royalty would cause nearly all the mines of the country to close down. The commission reported, however, that the mines of the Topago district would not close on account of the increase, and that should all the balance of the mines close, the revenue would not be decreased by the change. The increase from 10 per cent to 20 per cent in the royalty was accordingly made. The old records found among the archives at Batopilas a few years ago by Don Martin Salido show that royalties paid on gold bullion alone amounted to over $30,000,000, while the silver must have been of much greater importance, for the "antiguas" silver mines that were worked at that time are very numerous all over the district.

Topago grew to be a mining center of great importance, and the old ruins indicate a population of several thousand people. The supervisor of the mines of the district was given most unusual authority over the Indians and was even allowed to inflict the death penalty at his own discretion, especially in cases where the interests of the mines were jeopardized. It claimed that the extinguishing of an entire tribe of Indians, at one time a strong nation, was due to the cruelty of these operators.

The Spaniards worked three properties near Topago very extensively. These are now known as the Moctezuma, Millionario and Billionario. The last two are on immense quartz veins which are cut by the cañon of the Chinipas river to a depth of about 2,000 feet. Some of the old workings on these veins can still be seen as open cuts from 40 to 70 feet in width. Other extensive workings are known to have extended below the surface, but they are now covered over, caved or filled with water, and can not be examined. The Moctezuma group was worked by open cuts, shafts and tunnels. Open cuts which have caved and filled with soil almost to the surface, and in which large trees are growing, can be traced on the property for nearly a mile, while immense dumps show that the underground workings must have been extensive. The ore from these mines was nearly all free milling gold, and was treated along the

arroyos and river banks by grinding arrastres and tounes and amalgamated in great stone pans or vats cut from large boulders. A great many of these vats are still to be seen, while the ruins of the tounes, are to be found at almost every available point. There is not a single house of the old town of Topago left standing. The operators of the mines are said to have been loyal to Spain, even to a man, and destroyed everything before leaving, after the independence of Mexico was assured. After the establishment of the Mexican government, the county seat or Cabecera was moved to Batosegochic, where it remained for many years, leaving Topago to its fate and the wiles of the Apache Indians, and no more work was done there until about 20 years ago when the veteran miner, Don Martin Salido, brought in an old worn out stamp mill which he erected on the Millionario, and operated it, it is claimed at a profit, until his death about three years later. A little work was also done by the Torres brothers about eight years ago on the Moctezuma and Santa Maria groups, and they claim to have taken out gold to the value of $20,000, besides specimens of gold ore to the value of several thousand dollars. These specimens were on exhibition at the First National Bank in Los Angeles, Cal., for several months and attracted a great deal of attention among mining men.

The Septentrion mines are on the Septentrion River about eight miles east of Topago, and 20 miles southeast of Chinipas. The early history of this property is not known, but the ruins of a town, a large stone castle, of tounes, stone bridges and other evidences of Spanish operation are to be found at every available point along the banks of the river. Perhaps the most interesting of these old relics are the stone carcels, of which there are two. Each of these consists of a single room about 14 feet square, by seven in height, which has been hollowed out in the center of an immense boulder of solid rock. The floors were left rough and jagged, and there are no openings for light or ventilation except the narrow doors, and these were closed with iron shutters. Rings and shackles attached to the walls and iron stocks nearby indicate the treatment the prisoners received, even for so slight an offense as the failure to complete the daily task of work assigned to him, though his failure may have been due to lack of food or strength to accomplish it. It is said that the bars of silver bullion were stored in these vaults for safe keeping, and that these were the only relief from the rough stone floor, no bedding of any kind being furnished the prisoners.

The Septentrion mines are all on one vein. The ores carry both silver and gold, the silver usually constituting about 70 per cent of the value except in the Zaragoza mine, which is principally gold. The vein is quartz, and is about 15 feet thick, dipping about 42 degrees to the southeast. The hanging wall has been eroded away leaving the vein exposed over an area of about 50 hectares, or 125 acres, while on a still larger area, the vein is only partially covered, and that mostly by loose soil. There is estimated to be over 3,000,000 tons of ore practically in sight in this group, with an average of 16

ounces silver and $3 gold per ton. The river which crosses the property will afford water power to mine and mill 1,000 tons of ore per day.

After the Spanish evacuation, the mines were worked by different parties, using water power arrastres for crushing the ore, until about 20 years ago, when a Mexican erected a 10-stamp steam power mill, using at first the patio process and later adding pans and concentrators. He operated this mill for eight years, acquiring what he considered a fortune, purchased a fine ranch and retired, abandoning both mine and mill and allowing his titles to lapse. Since that time the property has been located by another party who has never been on the ground. As before stated, the Cabecera was moved form Topago to Batosogochic. At this place are located some old Spanish mines, the early history of which was not learned. The San Miguel which was evidently the most important is now caved in so badly that access cannot be had. The dump at this mine is estimated to contain 15,000 tons of ore carrying $20 per ton. This camp was so productive at one time that the Mexican government established an assay office, and purchased and received the bullion on the ground. Later, Guasaparez which is only three miles from Batosegochic, become a more important producer, and everything was moved over to that place.

The authentic records of Guasaparez are very meager. Dahlgreen gives 1628 as the date of discovery of the mines at the place, and it seems probable that work was carried on continuously from that time until the expulsion of the Spanish operators in 1811.

There are the ruins of two old towns here besides the present village, which is very old, the church, it is claimed, having been built in 1774. The first town was built on the summit of the mountain to the east of the present site, and was fortified. The ruins of this place indicate that most of the inhabitants were of the tribe of Cocoyame Indians, but the ruins of an old church is proof that the Spaniards also occupied the place. The ruins of the Cocoyame villages are easily recognized from the round domelike form of their buildings, which were constructed of rough stones and boulders. There are several ruined villages of these people in the vicinity of Guasaparez, and indications that the tribe was once a very strong one, but they are believed to be entirely extinct at this time.

Midway down the side of the mountain, between the original town and the present one, a second town was built and the ruins indicate that it had a population of both Spaniards and Indians, numbering a few thousand.

The present village of Guasaparez, having a population of about 1,000 is beautifully located in a kind of park surrounded by mountain peaks, which rise from 1,000 to 2,000 feet above the town. These mountains are all of volcanic origin and everywhere give evidence of high mineralization, which fact readily accounts for the presence of the Spaniards at so early a date, for it is rarely that an important mining region can be found in Mexico, which was not

known to and exploited by these intrepid explorers, and searchers after the precious metals. Judging from the dumps of slag and waste, and from the ruins of their old teunes, arrastres, and vasos, the operations of the Spaniards must have been very extensive at Guasaparez.

There is a very large quartz-porphyry vein passing from southeast to northwest, through the town along which the "antigua" workings are found for a distance of about three miles. At places, this mother lode is intersected by numerous smaller veins, nearly all of which carry gold and silver values. The ores of this camp are of various classes, some being self fluxing, and easily smelted, while others are free milling. Some carry gold only, some gold, silver and lead, and others only silver, but none of them are refractory. The values average higher than in any other camp in the district, yet with the expection of a small amount of "gambocino" work, which keeps three or four vasos (adobe reverberatory furnaces) running, there is no work being done, and has not been for a number of years. There was at one time a large reduction plant operated by steam on the El Carmen mine, which is said to have produced several million dollars, but this was destroyed by fire about 1892, after which the owner went to England for the purpose of financing a large company to operate the mines on a much larger scale, but his death soon after reaching London, put a stop to the plan, and nothing has been done since. It would seem to be only a question of time, when this historic old camp will be reopened, and again become one of the largest producers in the state. Some very fine specimens of native and ruby silver have been taken from these mines.

Huruapa and Guerra al Tirano are two more camps that have been of great importance in the early days, and will doubtless be again revived at no distant date, and again become important producers. They are located about eight miles south and southwest of Guasaparez.

At Huruapa the largest reduction works in the district was operated by the Spaniards, and later by the Mexicans who greatly improved upon the earlier methods of treating the ores. These mines were operated up to about 20 years ago, when they were closed owing to the death of the owner, Don Martin Salido. Ores were brought in from the Guerra al Tirano mines, two miles away, and several millions of dollars are recorded as from these mines. The Huruapa properties were sold to the Palmarejo company soon after the death of Sr. Salido and have since been idle.

At Guerra al Tirano, the Oxman Development Company have sunk a new shaft to a depth of 500 feet, and developed large bodies of good ore, and they are now building a cyanide plant of 100 tons capacity, which is to be completed by Jan. 1st. Some very high grade gold ore has been encountered in this property, and though it is a very old mine, the indications are that its bonanza days are just beginning.

The Palmarejo camp is located about midway between Guazapares and Chinipas, and is the best known property in the district. The company records show this mine to have been a daily producer for the past 109 years, and it is now furnishing ore for the continuous drop of a 50 stamp mill, crushing from 125 to 150 tons of ore every day in the year. The property is owned by a strong English company, who built a railroad from the mine to their mill at Chinipas, a distance of 16 kilometers. All the material for the construction and equipment of this road had to be carried on mule back over mountain trails from Alamos, Sonora, and the greater part of the roadbed was cut from almost perpendicular cliffs of solid rock. This is the only piece of railroad in the state using steel cross ties. A ditch and flume line, nine miles long furnishes water power for the mill. The company's improvements, including the mill, railroad and flume, are said to have cost over $6,000,000, and the property has produced during the past 16 years from $75,000 to $150,000 per month, and now, under the management of Mr. Pomeroy, the new manager, is giving better results than were before obtained. This mine, like many others of the district, was at one time worked by Don Martin Salido, and the ore was carried to Justiniana, 15 miles, for treatment, for many years. The story is told that at one time a prospector found a piece of float from this mine and after extracting the gold and silver from it, purchased the mine with the proceeds. It is stated that when the English company took charge of the property, they found nearly a carload of shackles and instruments of torture which had been used by the Spanish operators of the mines as persuaders to get all the work possible out of the Indians and peon miners. The Palmarejo company owns over 100 mines in the district, but so far have only developed the Palmarejo group, as that has always furnished sufficient ore for their 50-stamp mill. The process is wet crushing, Wilfley concentrators and cyanidation. The tailings from the cyanide plant are now being impounded and will be subjected to some other treatment.

Adjoining the Palmarejo, and on the same vein is the Juan de Dios group which has several hundred feet of development work which indicates that it will be equally as good as the Palmarejo, if it ever falls into the hands of parties able to properly develop it.

At Agua Caliente, four miles up the river from Chinipas, the White Chief Mining Co., a California corporation, is running a 15-stamp mill, and cyanide plant, with excellent results. They paid for their property out of 50 per cent of the product of the mine in just six months after commencing work.

There are extensive "antigua" workings at a great many places throughout the district that have never been touched since they were abandoned by the Spaniards nearly 100 years ago, and many of these no doubt were valuable properties. At Loreta, San Augustin, Limon, Santa Ana, Guadalupe, San Antonio, La Guerra, San Jose, Santa Fe, La Caña Gorachic and other points there are the ruins of old towns, of Spanish reduction works and old mines that have

been worked extensively. The district has been neglected by investors on account of its remoteness from transportation, but now that the Southern Pacific Company's Guadalajara branch will reach Alamos early next spring, and the Orient line will pass very near the eastern border of the district, much interest is centering there, and several parties are securing options and properties. There is not a property in the district, to which water power could not be conveyed, either direct or by electricity, while timber of all kinds is plentiful. The climate is excellent. Oranges, lemons, bananas and other semi-tropical fruits thrive along the rivers and low valleys, while in the mountains the air is always cool and bracing.

IN WESTERN CHIHUAHUA.

David W. Shanks.

BACA, State of Chihuahua, Mexico, April 18, 1906.—Probably no part of Mexico is so little known, even to the people of the Republic, as the western part of Chihuahua. Hitherto almost inaccessible, it is now opened up by the building of a great transcontinental railroad. This railroad—the Kansas City, Mexico & Orient, although bitterly fought by the combined power of all the other interoceanic lines, has been financed by the exhaustless efforts of the man whose brain conceived the project and whose matchless faith and ability have made its final realization certain. Stretching out toward the Pacific its rails have already entered the unbroken forests of magnificent pines that cover the Sierra Madre for a width of two hundred miles.

Bocoyna, one hundred and seventy miles from Chihuahua, will be reached about May first, and Tascotes, seventy miles farther, sometime during the year. The old trail that dates back to the first Spanish search for the treasures of the New World, will soon be relegated to the past; so full of memories of that period in Mexican history, when Spanish greed and Spanish superstition held the unfortunate country in bondage, exacting a tribute that astonished the world.

Between Bocoyna and Tascotes there is scarcely a place where the trail does not lead through forests of stately pines. It reaches at its highest point an elevation of 9,600 feet, where March suns are just dissipating the last traces of winter's snows. The waters on one slope flow to the Atlantic and on the other to the Pacific. The total lack of underbrush gives to the whole country the appearance of a grand park, whose grassy slopes are watered by pure cold streams from snow-clad peaks, and are shaded by giant trees of the evergreen pine. Here still roams the naked Indian as with bow and arrow he stalks the deer or follows it for days in an untiring chase.

At one point a little clearing is reached, and almost without warning you are gazing into the "Barranca de Tararecira," a canyon that for grandeur rivals that of the Colorado, and for beauty surpasses it. Four miles wide and three thousand feet deep, its walls

are formed by a succession of vertical cliffs and the intermediate benches are covered with grasses and trees, while just a glimpse is caught of the clear river in the bottom, which, though broad and swift, appears to be a tiny brook. Even the naked Tarahumara Indian will pause for minutes on the brink of the chasm and gaze upon it as if entranced. From this point you can see a tributary canyon in whose depths is located the town of Batopilas, where the wonderful silver mine was opened by Governor Shepherd twenty years ago and with a record of $18,000,000, is still producing $125,000 per month.

This Sierra Madre plateau is covered with a gray volcanic tufa, which coming later than any vein formation has effectually hidden any mineralization except where canyons have cut through the capping exposing the older rocks.

Passing Tascotes, still traveling through the pines, still enchanted with the never-ending bits of beautiful scenery, you drop down into the canyon of the Septentrion River and reach the settlement of Cuiteco, with its little chapel hundreds of years old and its primitive tannery. It is well worth the stop to see the curious method pursued in making leather. The hide is first soaked in a preparation which removes the hair. It is then sewed up leaving only one opening. Through this opening is poured the tanning extract obtained from the bark of a tree, until the hide is full and looks for all the world like the original beast. As the extract oozes through the pores a man is continually going from one to the other of perhaps a hundred keeping them full, until at last the hide is tanned and the leather ready for the market.

From Cuiteco you cross and recross the river twenty times in a distance of ten miles. On one side of the trail are clear deep pools and rushing water, overhung with the melancholy cypress; on the other are pine-clad slopes and frowning cliffs.

Leaving the river you are once more in the pine timber, and a day's ride takes you to a point where you again look into the Septentrion as it courses through a narrow canyon 2,000 feet below you. A small tributary makes a break in the canyon walls and you follow a zig-zag trail which drops you down to the river.

A little ranch occupies a few rods of level land at the mouth of the tributary, and here you may gather oranges and cut sugar cane as a change from the snow of the day before. For several hours you have been passing through a country where erosion has removed the tufa and mineralization is plentiful. Twelve miles away is the Palmarejo mine, where Mr. T. H. Oxnam is paying dividends from an ore running $25 Mexican per ton.

To the north is the Dolores, a silver mine with a 20-ton plant, paying $100,000 per month; and thirty miles south is the Lluvia de Oro (rain of gold) paying $100,000 monthly, while just below you in the canyon is the Santa Barbara, just purchased by the Rio Plata Mining Company, from which eighteen tons of ore netted $30,000. This sum paid for all development work and put in sight $2,000,000. The ores are high grade, and on completion of the plant now being

installed, this mine will take its place as one of Mexico's big producers. The canyon has cut the vein at right angles, and so steep is the face that a man slipping at the mouth of the highest tunnel would fall three hundred and ninety feet into the river below. Chicken ladders were used by the former owners to scale the bluff from one level to another.

The Septentrion River flows into the Fuerte, and the Fuerte empties into the Pacific at Topolobampo, one of the finest natural harbors in the world, and the Pacific Coast terminus of the Kansas City, Mexico & Orient Railroad. Trains are now being operated out of Topolobampo for a distance of fifty-six miles.

Western Chihuahua is a beautiful country, a rich country and a coming country. American capital will soon make known to the whole world a section that is blessed beyond most with natural resources, and which lies awaiting the magic touch of American money.

NOTES ON THE GEOLOGY OF CHIHUAHUA, MEXICO.

By James P. Kimball, Ph. D.—Am. Jour. Sci.

The road from San Antonio, Texas, to Presidio del Norte on the Rio Grande, by way of Fort Clark, Camp Stockton and Fort Davis, traverses the elevated Cretaceous table-land of western Texas which incidentally has been described in the reports of several government expeditions. Following this road, a belt of country reaching some fifty miles on either side of the 30″ parallel comes under observation. As far westward as the Limpia Mts. there is a gradual acclivity of the surface, which at short intervals is channeled by water courses, causing numerous valleys bounded by bold escarpments of the Cretaceous limestone strata. The approximately level attitude of this formation gives rise to the mesa-top as seen from the valleys, while the mesas themselves, thus separated, rise successively from an altitude at San Antonio of 579 feet above the sea to 4688 feet at the head of the Limpia. In the case of the wide valleys, the streams have repeatedly changed their beds, most of which are dry except in times of heavy rain. The grassy table-lands all have a basin configuration, there being toward the center a depressed portion usually containing drainage water. From the Limpia Mts. to the Rio Grande there is a gradual descent—the altitude of Presidio del Norte being 2779 ft.; but, unlike the eastern slope of the divide thus formed by the Limpia Mts. or Sierra Diavolo, between the Rio Grande and Pecos basins, the declining surface has no conformability with the stratification.

Orographically, it is true that the Limpia Mts., as described by Mr. Arthur Schott, form a part of a great dividing range between the Pecos and Upper Rio Grande, including the Guadaloupe and Sacramento mountains to the north, and the continuation south of the Limpia Mts. to form not however the Sierra Rica Mts. in Chihuahua, but the Sierra del Carmen, a range farther to the east, and through which the Rio Grande passes farther down near Presidio

de San Vicente. My own observations do not justify the assertion that this range is characterized by *igneous* rocks, nor the inference that it is an axis of elevation.* At least on the Presidio del Norte road, the rocks are of a metamorphic aspect where not plainly Cretaceous—their topography being that of erosion. It was upon the evidence of specimens that Prof. Hall asserted the igneous nature of the Limpia range. These he characterizes as compact quartz, "derived doubtless," he says, "from the gelatinous silica produced by volcanic waters, reddish brown porphyry and a coarse granitic aggregate of which adularia forms a large part.†.

However it may be the case of the Guadalupe and Sacramento mountains to the north, the Limpia Mts. near the 31st parallel are, as I shall proceed to explain, the last easterly development of what appears to be a metamorphic zone next overlying Cretceous fossiliferous limestone, and probably included with the Cretaceous series, and known in Mexico as *cantera;* and quite overspreading a large portion of the state of Chihuahua—that portion, at least, to the north of the 28th parallel, and as far west as the Grand Sierras. Within this area it is the surface formation of the eastern slope of the Cordilleras, except where local elevations have lifted, or erosion has bared, lower rocks. I traced it west beyond Cusihuiriachic whose altitude, determined by Dr. Wislizzenus, is only 2181 feet less than that of the Cumbres de Jesus Maria—reputed to be the culminating point of the north Mexican Cordilleras (8375 ft. The peak of Cusihuiriachic, rising 1,643 feet above the village, and which is made up of this formation, thus exhibits its development so high up the Grand Sierras, as to leave a difference of less than 439 feet of summit altitude between the point where my observations ceased, and the highest point in the Cordilleras of this latitude, 100 miles farther west, which a bad state of the road rendered it impracticable to reach. Its continuation this whole distance indeed, is reported to me as a fact by Mr. John Potts of Chihuahua; as well as by Mr. W. S. Keyes of San Francisco, who entered the sierras from the Pacific side. The late Mr. Rémond described a series of what he distinguished as volcanic rocks, disposed in beds, and overspreading the Cretaceous argillaceous shales represented at Arivechi in Sonora, and which he found "extending from the Gulf of California, up to the very summit of the Sierra." The lithological characters and position of these rocks, briefly indicated in the valuable account of his explorations, prepared by Prof. Whitney, bear numerous striking analogies to the so-called cantera of the eastern slope.‡

Near Hackberry Ponds, Texas, (about 26 1-2° W. long. Wash.) where the rocks which form the body of the Limpia Mts. are first seen on the Presidio del Norte road, the configuration of the country suddenly changes, the arid Cretaceous table land east of that point

*Mex. Bound. Surv., i, Pt. II, p. 4.

†Ibid, p. 107.

‡Notice of Geological Explorations in Northern Mexico made during the years 1863-65. Proc. Cal. Acad. Sci., iii. (Extract, p. 5).

giving way to grassy plains, bounded by rugged rocks. The gray Cretaceous limestone here passes out of sight, and is covered with a reddish brown, hard, compact rock, presenting the anomalous condition of a dense quartz matrix, colored by brown oxyd of iron, apparently *not felspathic* itself, but containing minute translucent orthoclasic crystals; and minute irregularly shaved cavities filled with crystalline quartz, and coated with brown oxyd or iron which sometimes colors the quartz segregations. Thus we have the characters, not of a porphyry, but what may be called a *porphyritic quartzite.* It occurs in strata, which are gently undulating, and which rise toward the west by accumulation rather than by elevation, and thus form the Limpia Mts. Wild Rose Pass, by which the road crosses the mountains, and which mainly follows the eroded valley of the Limpia, a tributary of the Pecos, presents bold escarpments of this rock softer than where at first seen, and weathering excessively. This weathering or disintegrating action, due to the ferruginous character of this rock, goes far to produce its peculiar topography throughout its wide development. Nowhere to greater advantage can it be witnessed than in this pass, where the faces of the bluffs are weathered into massive columns, reaching in many cases from their base to top, and, more or less perfect, fluting their whole surface which is of a dark ochreous color. A similar effect is to be seen in the bluffs back of Fort Davis. The lithological characteristics above noted here likewise prevail, but the rock is still softer than in Wild Rose Pass, and its sedimentary character more positive. A quarry opened by Maj. Gen. Merritt in the base of a high cliff of this rock, exhibits it to great advantage. Here the interior proves an earthy, or soft, fine-grained, alumino-silicious aggregate, containing scattered grains of quartz and minute crystals of pyrites. It is of light reddish and gray tints, quarries soft, and hardens on exposure. Of this material the officer's and other quarters are built. Thus, within a short interval, we find the same formation presenting the two lithological extremes, between which in its wider development it affords numerous varieties. The softer variety has all the characteristics of the *cantera,* of which the better structures of Chihuahua are built, and *which is found in all parts of the state under conditions similar to its occurrence at Fort Davis.* Hence I have adopted the Mexican term, and, as common, applied it to the whole formation. In this connection I may venture to mention, without attempting at present to support, the impression which these and correlative facts have forced upon me, namely, that the metamorphism of this formation consists of chemical and molecular changes under the influence of the atmosphere and percolating waters, and that the range of alteration will be found to be limited to the exposed portions.

The relation of the cantera at Fort Davis to the underlying Cretaceous limestone is rendered clear by the fact that a quarry for the supply of a lime-kiln has been opened by Gen. Merritt just below the level of the plain.

The disintegration of the surface formation seems to depend on the degree that it is ferruginous—the broadest plains and thickest

soil always being found at the base of ochreous colored cliffs or ridges. This is best illustrated west of the Rio Grande. But by contrast with the neighboring topography of the limestone table-land such phenomena near Fort Davis are unusually marked—especially the distribution of the detritus of ferruginous rocks, and the action of rainwater in the leveling of expansive valleys, or the great grassy plains of this section, and causing the obliteration of former channels, scored out before the water-system had been altered by changes in level of the whole eastern slope of the Sierra Madre. By the rapid drainage of the skirting highlands in heavy rains, the plain is suddenly flooded by a sheet of water, which in its subsidence, carries with it toward the depressed or middle portion the fine sediments. These are continually being renewed, while the plain is widened, by the disintegration of the bordering rocks. Gen. Merritt relates that the parade ground of the post is sometimes suddenly flooded to a depth of a foot, the water subsiding almost as quickly as it comes. The gardens of the post require protection against the loss of their soil by such floods.

Leaving Fort Davis to the north, the road in a few miles begins to descend into the Rio Grande basin, passing through a succession of wide champaign valleys skirted by table-land, capped with the *cantera* of a greenish tinge, as if colored by a silicate of iron—the ochreous coloration, and columnar weathering disappearing near Fort Davis. The prevailing dip, though scarcely appreciable, is toward the northeast, and hence the road, going southwest, is continually getting deeper in the geological section. Passing the water-hole of San Estevan at the base of a cliff of *cantera,* here also a porphyritic quartzite, a conglomerate is seen in the gullies. This is probably a cemented rubble common in Chihuahua at the base of the *cantera,* the cementing material, a carbonate, appearing to be derived from soluble ingredients in superincumbent strata which often are vesicular on weathering. Before reaching the Alamos the road has passed below the cantera, the lower portions proving very ferruginous and coarse grained. It disintegrates greatly—hills in all stages of dissolution being seen to have been composed of it. Between the Alamos and Presidio del Norte the road comes down to limestone, in some places saccharoidal and fossiliferous. Some twelve miles from the river, the valley proper of the Rio Grande is reached. In it five or six terraces of gravelly material, varying from 20 to 100 feet in height, may be counted on either side. The town of Presidio del Norte* is situated on the last one of the west side, or that nearest the present flood-plain of the river. Its altitude, according to the Mexican Boundary Survey, is 2,779 feet. The true valley of the Rio Grande here is from twenty to twenty-five miles wide, its western boundary—the limestone bluffs of the Sierra de las Cuestas.

This range is the continuation to the north of the Sierra Rica. At the base of this range near Nugal, which is twenty miles from Presidio del Norte on the Chihuahua road, and therefore incorrectly

*Now Oginaga.

laid down on Fluery's map, are good exposures of heavy bedded calcareo-aluminous sandstone, dipping 15° N. W.—intercalated with impure calcareous shales. The former is exceedingly fossiliferous, furnishing the following Cretaceous, forms known in Texas: *Exogyra plicata, Scalaria Texana, Natica Texana, Lima Wacoensis,* together with species of *Ostrea, Inoceramus, Caprina* and *Ammonites,* and fish teeth. The Sierra Rica is made up of (1) lower calcareous shales and fissile slates; (2) blue limestone containing *Inoceramus;* (3) upper fissile calcarceous shales; (4) arenaceous limestone, also containing *Inoceramus,* and probably the continuation of the more sandy beds seen at Nugal. This fossiliferous series is conformably capped on the highest mountains by a hard reddish rock of a bed structure, and forming mesa or flat tops. It is characterized by a granular or aggregated quartz matrix, densely filled with rounded orthoclasic amygdules. Although thus conforming to the qualitative type of the crystalline *cantera,* and occupying its constant position with reference to the fossiliferous series, this rock forms a marked deviation from its common appearance. Local dips in the Sierra Rica are variable, though a prevailing one to the S. W. seems to be marked within a range of my observations, which were limited to a brief stay on account of the presence of hostile Apaches. The Sierra Rica lode, in which the mine of the same name has been opened to a depth of some 400 feet, is encased in the fossiliferous series, its highest outcrop being on the crest of a prong from which the summit quartzose rock of the neighboring mountains has been denuded. The lode has yielded rich sulpherts of silver, associated with sulphurets of the base metals, in a quartz veinstone enclosing breccia from the walls.

On passing out of the Rio Grande valley the acclivity of the surface again becomes appreciable. The Chihuahua road crosses the limestone range by the Cuesta de Gato, a depression in it some four miles beyond the Mula,* thirty-six miles from Presidio del Norte.

Here the limestone is pure, blue and brittle, with a conchoidal fracture. From this elevated pass the road descends immediately to the *jornada*—a great barren plain with a basin configuration, but without water or visible water-courses, and bounded by the mountains as indicated on Fleury's map. In the neighborhood of the road, it is covered with fine limestone detritus, overspread with a thin deposit of silt. The range of mountains to the west, including the Cuchillo Parado, and the Sierra del Chupadores, rises some 450 feet above it. This range elevates the same limestone series as the Sierra Rica. But it consists mainly of heavy-bedded white and gray limestone, the upper shales only coming occasionally to view in the road-bed, on entering and leaving the *jornada.*

Passing around the base of the Chupadores, over a slight divide into another, smaller champaign valley beyond, a reddish diluvium is met with, some four miles north of the Gallina pass, the source of which is immediately traced to the development again here of the ferruginous summit rock (*cantera*) which comes in by the sudden

*Incorrectly laid down on Fleury's map.

pitch to the east of the underlying limestone in the gap, and caps apparently all the mountains to the east of the road, bordering the great *jornada,* viz.—the Sierra del Esclusero, Sierra de Encenillas, and the Sierra de las Masteñas, while the limestone range west has undergone no change of aspect. The same stratigraphical conditions prevail all the way to the Conchos. To the east of the road is seen a prominent development of the ferruginous *cantera,* while west the Choreras range, including the Amargosa Mts., preserves the limestone series in heights of 400 to 600 feet. Within the range of the development of the *cantera* the usual remnants of hills in advanced stages of degradation are seen—a circumstance already indicated as common to this formation, and as going far to produce the peculiar conformation of the surface throughout its development.

The difference between the vegetation of the limestone soil and that resulting from the disintegration of the ferruginous *cantera,* is here marked the same as in the neighborhood of the Limpia Mts., Texas. The former produces the *mesquite* shrub, together with the *mesquite* variety of grass, while the latter is covered with *gramma* grass, and is destitute of mesquite.

The Conchos river flows close to the base, and seems to occupy an anticlinal axis, of what I have designated as the Choreras and limestone range, which extends from near Julimes N. E. to Presidio del Norte. Under the additional erosive influence of its two affluents—the Rio Sacramento, which joins it at San Diego, and the Rosales at Julimes—great expanse has been given to the bottom of the Conchos. From the Choreras, east, to the Santa Eulalia range, west, it is some twenty-five miles broad. It is covered with a fine, and somewhat ferruginous, calcareous alluvium, which, thoroughly irrigated, is under high cultivation. It contains several populous towns, and a number of fine ranches. Fuel from the root of the *mesquite* is yet comparatively abundant. The limestone bluffs of the Choreras are the most westerly prominent outliers of the Cretaceous fossiliferous limestone, yet bosses of the same formation along the prolongation of the same axis of elevation, occur at intervals in the sub-structure of mountains for some seventy miles further—as near Carretas and in the Sierra de Magistral.

The famous silver mines of Santa Eulalia are in the midst of the long narrow N. and S. range, of the same name which bounds the great outspread Conchos bottom near Julimes, an intermediate range which marks its valley below having been here obliterated. In the body of the range, the limestone has given way to the *cantera,* except in the mining district of some five miles, where on a prolongation, as above described, of the Choreras axis, a single boss elevates with quaquaversal dips, the limestone again. The limestone, the same as at Sierra Rica, is the seat of the silver deposits, which are of an irregular description, and probably unique. These will be described in a future number of this Journal. Suffice it to notice at present the frequent occurrence in the silver-bearing beds, of *Radiolites, Pecten, Inoceramus,* and a characteristic mesozoic coral.

All along the limestone range mineral deposits are known. In the Chenati Mts.—its prolongation into Texas—argentiferous galena and stibnite occur. The Cuchillo Parado and the Choreras are both reputed mineral localities, as likewise the Sierra de Magistral, as its name implies.

In the Dolores pass, by which the road crosses the Santa Eulalia range, no limestone occurs, the elevations being entirely of *cantera* of various tints, and distinctly stratified. The cemented rubble, to which allusion has been made, is seen in this pass, varying from a coarse to a fine breccia. Such deposits are found throughout central Chihuahua under the diluvium of the plains, and in low places among the mountains. In some places it is indurated, and in this condition might easily be mistaken for a regular, instead of a recent deposit, and be thought to enter into the stratification which it never does.

From the Conchos to Concepcion the mountains and river system are approximately north and south. And the same may be said of the whole eastern slope of the Cordilleras all the way to the Rio Grande, except where the presence of limestone elevations has served to modify the uniform topography of the *cantera.* This uniformity consists in the succession of narrow and continuous north and south rigdes and foot hills, separating broad and, longitudinally, remarkably continuous valleys. The whole surface, thus characterized, rises toward the west, while the mountains gain somewhat in height and the valleys in breadth in the same direction. Such is the configuration quite to the summit of the Cordilleras in this latitude, and it is thus almost insensibly reached. The term, Sierra Madre, is for this reason seldom heard in Chihuahua. The western slope in Sonora is rugged and steep.

The cantera of the mountains, while conforming to one qualitative type is presented under various conditions of color, aggregation and structure. Though generally occurring in pretty level beds, it is much jointed, and sometimes exhibits oblique cleavages so continuous as to resemble stratification under a high dip. Such an appearance is produced in the range directly east of the city of Chihuahua, where the Sacramento river passes through it. The champaign valleys, which are filled with the detritus of the more ferruginous *cantera,* generally contain, west of Chihuahua up toward the humid belt, small running streams, or shallow lakes, which fit them for cultivation. Some of these valleys are over a hundred miles in length.

Between the city of Chihuahua and El Paso del Norte* the physical and lithological features of the *cantera* still prevail. The road lies over the plain of Encinillas—one of the typical valleys above described, extending, together with its bordering mountains, within twenty miles of the Rio Grande where limestone hills are again met with, forming the bluffs of the valley. This limestone seems to bear the same relation to the *cantera* as the Cretaceous beds at Presidio del Norte below. Hence I must take exception to the

*Now Cd. Juarez.

determination of this limestone by Dr. Wislizenus as Silurian, especially as this was upon the inadequate evidence of an "injured and imperfect" coral which he refers to *Calamopore,* and a bivalve shell of the genus *Pterinea.* I did not stop to collect fossils at this locality, no question having been present at my mind on the spot as to its equivalency with the Cretaceous as elsewhere observed, and as I was not then acquainted with Dr. Wislizenus's report. The discrepancy between the lithological terms employed by Dr. Wislizenus and myself proceed from a difference of observation and reasoning. The *cantera,* (which term I have employed for short) whose characteristic and varying qualities have been detailed, and which has been described as a surface metamorphic formation, horizontally bedded and comparatively undisturbed, attaining a thickness of over 1,700 feet, where found within the range of my observation least reduced by denudation (at Cusihuiriachic), and overspreading the middle and northeastern part of Chihuahua, and probably also the western part, Dr. Wislizenus designated generally as porphyry, and sometimes as granitic, and again as trachytic. That what he thus terms is really the so-called *cantera,* under its various aspects, is clear from his specifying the building stone used in the city of Chihuahua, from which I have taken its local name, as white porphyry, as well as from the fact that he distinguished as granitic and porphyritic its continuation on either side of the El Paso road. He similarly characterized the rock which forms the mountains of Cusihuiriachic, seventy-nine miles west of the city of Chihuahua. Thus it will be seen that in this respect our observations agree as to the extent and identity of the mountain formation, but that we differ as to its origin and lithological character. The orographic features of the country as phenomena of denudation have not been noticed by this traveler. And the determination of the limestone twelve miles N. E. of Chihuahua (Santa Eulalia) as Silurian upon the insufficient evidence of a simple specimen, received at second hand, containing "some chambers of an Orthoceras," cannot be accepted in the light of the significant evidence above brought forward to prove the Cretaceous age of the same limestone. In the geological sketch given by Dr. Wislizenus, the formations are laid down according to his description.

The number of Cretaceous fossils collected by myself west of Presidio del Norte, quite disproves the position of Dr. Parry, viz., that the "natural boundaries of this basin (near Presidio del Norte) consist of irregular mountain ranges composed principally of carboniferous limestones similar to that seen above" (near El Paso). But Dr. Parry in this matter seems to follow Prof. Hall who referred the limestones of this section to the carboniferous exclusively on the ground of the lithological analogy with the Carboniferous limestone in numerous western localities, of a simple specimen from the rapids of the Rio Grande, in which no fossils could be recognized. With regard to the "compact and vesicular lavas, and volcanic and friable breccias, etc.," thus termed by Prof. Hall, in the collection of Dr. Parry, it is proper to suggest the former to be referable to the

cantera in some of its aspects of coloration, aggregation, and weathering, and the latter to be the cemented rubble above noticed. The limestone back of Presidio del Norte, unmistakably Cretaceous, is brought to the surface by the Conchos axis of elevation, which is so prominent till cut through at the bend of that river, and which does not finally expire for yet a distance of some seventy miles to the southwest. Topographically as well as stratigraphically, this is the lowest part of the state which I visited, and the only part I found either not overspread with, or bearing on its heights, the *cantera,* which even along the easterly development of this axis, it will be understood, has disappeared but from a narrow belt.

The extension of the fossiliferous Cretaceous so far up toward the summit of the Cordilleras, has an important bearing upon the occurrence of Texas Cretaceous fauna in Sonora, where they were found by the late Mr. Rémond. Prof. Gabb, to whom we owe this identification, calls attention to the discovery as going to show a "water communication between the great Cretaceous sea that covered so much of what is now the central portions of our continent, on the one side, and the Pacific, on the other." The recognition of the Cretaceous near Arivechi in Sonora, according to Mr. Gabb, proved only the second reported locality of its occurrence in the whole area of Mexico, the other being in the State of Puebla.*

So important a discovery as the occurrence of rich silver deposits in the *fossiliferous,* as well as the metamorphic Cretaceous of Chihuahua, cannot adequately be treated without the scope of a general article; and I therefore reserve for a subsequent number of this Journal, descriptions of the interesting silver mining localities of Santa Eulalia, Cusihuiriachic and Cieneguilla, of which incidental mention has already been made.†. Although the metamorphic Cretaceous is, through the labors of the Geological Survey of California, well known in numerous localities in the Coast Ranges, as a seat of gold deposits; and the Jurassic, east of the High Sierras within the territory of the United States, as a seat of silver deposits, the instances above given of the unequivocal fossiliferous Cretaceous, as well as a probable metamorphic and later zone of the same series, as sources of silver ores, are the first in North America yet reported. The only parallel occurrence yet brought to light, so far as I am aware, is in Chili, where according to Mr. Rémond, calcareous fossiliferous Cretaceous strata carry silver deposits, evidently much in the same way as at Santa Eulalia.‡

New York, Aug. 10, 1869.

*Geol. Surv. of California, Palaeontology, ii, p. 257.

†These three localities have produced during the last 150 years from 200,000,000 to 300,000,000 of dollars, mainly during the last century.

‡Proc. Cal. Acad. of Sci., iii, 1866; Phillip's Mining and Metallurgy of Gold and Silver, p. 318; Domoyko, Ann. des Mines (4), ix, 28.

THE MINES OF CHIHUAHUA BY DISTRICTS.

W. D. Pearce—April 12, 1907.

ANDRES DEL RIO DISTRICT.

The district of Andres del Rio is immediately east of the district of Arteaga. The two principal camps are Batopilas and Urique and these are among the oldest in the state. Urique having been discovered in 1630 and Batopilas in 1632.

Batopilas became famous for its native and ruby silver at a very early period and is still one of the best known districts in Mexico, both for the quality and quantity of its minerals. The mines are said to have been discovered by an Indian, who in swimming the Batopilas river took hold of a bush that was growing on the edge of the water, and the bush giving way exposed a piece of rock containing native silver. As early as 1730, the mines were producing bonanzas, and it is said that the Pastrana mine produced $48,000,000 from that date to 1750, and San Antonio $10,000,000 from 1786 to 1800. From 1790 to 1820 the Carmen mine is said to have produced $30,000,000 and the Las Tajos mine $20,000,000 in the same period. While the accuracy of these figures cannot be vouched for, it is certain that Angel Bustamente took out great bonanzas from the Carmen and Tajos mines at the periods mentioned, and on his return to Spain with his immense fortune he was created Marquis of Batopilas in recognition of services rendered his country in paying royalties on the silver treated from these mines. Strict records were kept of the production of all mines of importance at that time, but unfortunately the records of Batopilas were destroyed by fire so that the figures cannot be verified, but it is certain that the district has been a great producer since its discovery, with the exception of the inevitable periods of idleness after each great bonanza was extracted.

About 1880 these mines, or at least the principal ones, were purchased by the late Alexander R. Shepherd of Washington, D. C., who developed them on the broad gauge lines for which he was noted, and built up a solid and substantial city of 5,000 people, besides one of the most complete and efficient reduction works in the state. Under the management of Governor Shepherd and his sons, who succeeded him, the mines have produced over $20,000,000, and the annual output is still increasing from year to year.

A feature of the mines of Batopilas is the magnificent specimens of native and ruby silver produced. When in bonanza, it often happens that the masses of native silver will hold the rock together after it has been shattered by the explosion of dynamite, while the specimens of ruby silver are among the finest found in any country.

Urique is about 20 miles northwest of Batopilas and has been noted for its rich ores, which, unlike those of Batopilas, carry good values in gold. The production in late years has fallen off con-

siderably, owing to the remoteness of the section and lack of facilities for working the same. Foreign capital is now being attracted to the district and it will undoubtedly be producing heavily again in the near future.

The Lluvia de Oro mine which has come into great prominence during the past four years is located about 25 miles southwest of Urique. This is undoubtedly the richest gold mine ever developed in this state. It is equipped with a mill and cyanide plant and is producing at the rate of about $60,000 gold per month, though the mill is entirely inadequate for the handling of the ore. It is stated that there is as much as $9,000,000 in sight in the mine. The property was bought as a mere prospect by the present owners about four years ago, the bond price, it is said being $2,250,000, which has been paid up in full. During the past year the extensions of this mine were taken over by a very strong company, at a price probably equal to that paid for the Lluvia de Oro.

At Barranca del Cobre, 40 miles north of Urique, a New York company controlled by the National Metal company is operating a good copper property. This mine is equipped with a 25 stamp mill and concentrating plant and is soon to add a leaching plant for the treatment of the tailings. The machinery is operated by water power, of which there is an abundance for all purposes.

In the vicinity of Baguarichic near the line of Sinaloa, there are several old Spanish copper mines which were worked rather extensively, and for lack of the proper machinery, were abandoned while yet undeveloped. At Piedras Verdes, an American company has recently bonded one of these old mines and is now developing it at Cinguita, Cerocahui and other points in that section; there are old gold and silver mines that will probably be reopened within the next few years, as none of them are believed to have been worked out.

DISTRICT OF ARTEAGA.

The district of Arteaga lies immediately west of Andres del Rio and along the line of Sonora. The most important points in the district are Guazapares, Palmarejo and Rialto. Guazapares is said to have been discovered in 1628. The mines have been worked rather extensively, though no great depth has been reached. There are a number of parallel veins and some of them are of great width and can be traced for several miles on the surface. At Batosegochic, which belongs to the Guazapares system of veins, the government once established an assay office on account of the large amount of silver that was being produced by the mines of that place. An American built a 30 ton lixiviation plant at Guazapares and its property has been extensively developed. The ores of the camp are often very rich, the values being in sulphides and chlorides.

At Palmarejo, an English company has been operating for 15 years or more. The vein is 70 feet wide and the ore of medium

grade gold and silver. The company has built and equipped 12 miles of narrow gauge railroad from the mines to the mill, which is at Chinipas, also ten miles of stone aqueduct to take water from Chinipas river to run a 50 stamp mill and cyanide plant. This company is said to have spent 1,000,000 pounds sterling before receiving a dividend, but it is now on a solid dividend paying basis.

An American company is operating a mine and 15 stamp mill at Aguas Calientes, on the river five miles north of Chinipas.

The section known as Huruapa has been a great producer of gold under the old Spanish regime, but has been practically idle for many years. It is now being prospected and the mines reopened, and gives promise of good results.

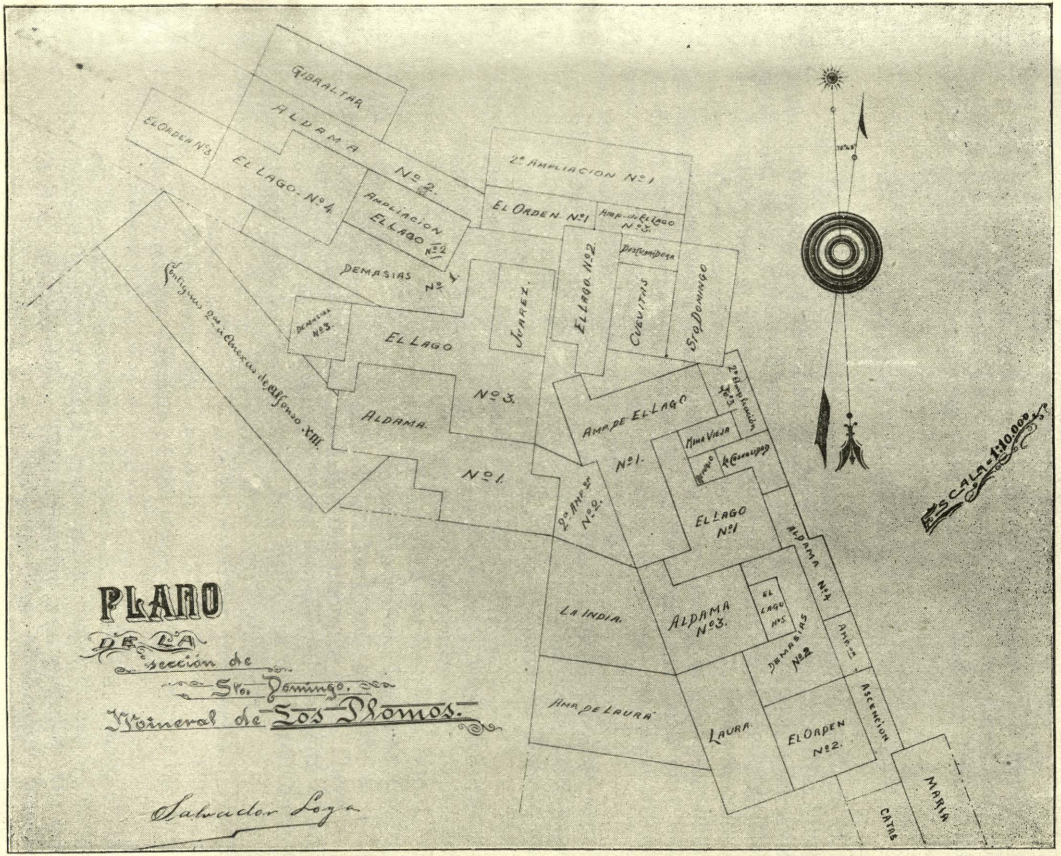
An English company has recently completed a 100 ton mill on one of these old Spanish mines and others are under option to an American company.

At Santa Barbara, five miles south of Guazapares, the Rio Plata Mining Company is building a 25 stamp mill and developing one of the richest silver veins ever discovered in the Sierra Madres. The mill will be operated by water power, and the process will be concentration and pan amalgamation.

Four miles below Santa Barbara are found the ruins of some old Spanish reduction works where the ores from the Septentrion mines were treated. These mines were extensively worked during the early part of the last century, and again some twenty years ago, but are at present idle, with the exception of a few "gambucinos" who are treating a small amount of ore in the primitive way of a century ago. These mines have the making of one of the largest properties in the state. The vein is at least fifteen feet thick, and owing to the erosion of the hanging wall, it is estimated that at least 3,500,000 tons of ore are practically uncovered and ready to be quarried out. The ore is of medium low grade, but well within the limit of profitable operations. The Septentrion River, upon which this property is located is one of the most magnificent power streams in the state, and can be made to furnish power for the numerous mines along its banks.

Twenty miles south of Chinipas is the old Topago mine that was discovered in 1734 and was worked for about 45 years, and was finally filled with water during a raid of Apache Indians. The old records show that the operators of this mine paid royalties to the Spanish government on $1,800,000 extracted in one year. The ore is free milling gold and the vein is 80 feet wide.

San Agustin, located 12 miles northwest of Chinipas, and on the border of Sonora is another important old Spanish mining camp. It is said that no records are in existence as to when and by whom these mines were first worked nor as to the amount they have produced, but the 200 or more old arrastras show that the works were extensive in that section. Most of the old workings have caved in, and have not been reopened, but are believed to still contain large



PLOMOS. Santo Domingo. Mining Claims.

bodies of ore, as there are indications that the mines were hastily abandoned, probably owing to a raid by hostile Indians, and the possible massacre of the operators. A short distance south of San Agustin, another old mine, now known as the Banco Nacional has recently been partially cleaned out, and at a depth of about 200 feet, mining tools of the old Spanish type were discovered, showing that this mine had also been hurriedly abandoned.

At Monterde, 25 miles northeast of Guazapares, is another old Spanish mine that was discovered more than 100 years ago. The ores are very rich, carrying gold and silver and are free milling.

DISTRICT OF BRAVOS.

The district of Bravos occupies the northeastern portion of the state beginning on the line of New Mexico down the Rio Grande southeast of El Paso to Presidio de Pilares, and is the largest district in the state, but at present the least important from a mining standpoint. There are silver and lead in many places, and even gold, but as the greatest part of the district is very arid or is generally thought to be, it has not been prospected nor developed and it is only within the past few years that the attention of miners has been attracted to this part of the state to any great extent.

In the vicinity Ojo Caliente on the Mexican Central railroad, a number of gold, silver, lead and copper veins have been located. Small quantities of native silver have been found in some of them. Little development has been done in this section.

Near Ahumada, also on the Central some very rich silver ore has been shipped and development work has proven very encouraging. Also about Ojo Caliente some rich bismuth ore has been found. Gold and copper have been reported at Tasesiqua, Lagunas Coloradas, Pilares and other points, and silver, lead and graphite at Pilares, but it is not known how extensive the deposits are. There is coal west of Pilares, so it is said. There are several deposits of salt in that section close to the railroad, but little has ever been done with them.

The district offers a splendid field for prospecting, especially in the low hills near the Mexican Central railroad. The same is true through all the districts of the state, through which the Mexican Central passes.

Los Lamentos mountain, located about 40 miles east of Moctezuma station is a new silver, lead-copper district that is attracting a great deal of attention. The formation and detail of the ore deposits are said to very closely resemble those of the now famous Almoloya camp in this state. Several ore bodies have recently been located and at least two companies have been organized to operate the mines.

DISTRICT OF CAMARGO.

The district of Camargo is in the east central part of the state and south of Iturbide. Its mineral, although important, has not been developed to any great extent until within the past few years, but there are several new camps coming into prominence and the district will undoubtedly soon be a large producer.

The Encinillas Mines, Ltd., a French-English concern has a 100 ton smelter at Santa Rosalia on the Mexican Central. It is understood that the English stockholders have now taken the active control and will increase the capacity to 600 tons daily. If this is done, which is very probable, it will give an impetus to mining and will furnish competition to help preserve reasonable smelter rates.

Of the new camps that have sprung into prominence within the past four years, Naica, 15 miles west of Conchos station leads. The camp is producing fully 4,000 tons of fine grade silver-lead ore of a splendid fluxing quality per month, and several companies are doing development work. This camp seems destined to be another Santa Eulalia on a smaller scale. A narrow gauge railroad has been built from Conchos station to the camp.

There is quicksilver near Encinillas, 65 miles northeast of Santa Rosalia and at Saucillo north. Very little has been done in the way of prospecting the property. In the extreme northeast corner of the district there are some immense deposits of iron ore but nothing can be done without railroad transportation. They are about 70 miles from the Mexican Central.

About 20 miles northeast of Ortiz station on the Mexican Central, several mines of lead and copper have been worked on a small scale, and one has produced a considerable tonnage of lead carbonate ore. There is some development and exploration work going on in that vicinity at present.

The iron deposits on the eastern and central portions of the district promise to develop into important properties as soon as the demand for such ores becomes sufficient to justify their opening. It is claimed that there are over 30,000,000 tons of hematite and magnatite in sight on the surface. Little or no development has been done on these properties.

At Jaco, near the southeast corner of the district there is an immense salt marsh which will be valuable some time with railroad transportation.

DISTRICT OF GALEANA.

The Galeana district is situated in the northwest corner of the state, bordering on New Mexico on the north and Sonora on the west.

At San Pedro on the Rio Grande, Sierra Madre & Pacific railroad, the Candelaria Mining Company of New York is operating a large group of mines, the principal of which are the Candelaria, San Nicolas, San Pedro, Leon and Congreso. Some of these mines

were first opened up in the eighteenth century, and are reputed to have produced over $20,000,000. The Candelaria has a shaft down over 900 feet and is still being worked. The ores of this and the San Pedro and San Nicolas mines are high grade sulphides which are found in a series of narrow fissure veins in intrusive porphyry, while those of the Leon and Congreso are lead carbonates in a contact vein between limestone and porphyry.

A large pumping plant of the air lift type is being installed to handle the water which has given considerable trouble in these two properties. The first unit of 1000 gallons capacity is now in operation and the second unit of the same capacity is nearing completion.

The present output of the mines is about 1500 tons per month, but will be greatly increased as soon as the unwatering is completed.

At Guaynopa in the western part of the district there are several old Spanish mines and the great quantities of slag found in that vicinity show that the old workings have been very extensive. These old mines have not yet been reopened to any great extent and the authentic history of them is but meagre.

The formation is principally limestone and diorite with occasional intrusions of andesite and the ore bodies are usually in contact veins between the limestone and diorite though there is a second system of veins crossing the former at an angle of about 45 degrees. The values are in gold, silver and copper, and some very high grade ores are shown in each of the three metals.

Guaynopita, situated some five miles down the Arros river from Guaynopa is on the same mineralized zone as the latter place, and presents the same general features and detail of ore deposits. Both points show considerable activity at present and the outlook is considered very promising.

There are several mines being worked at Ascencion, north of Casas Grandes and some of them are regular producers. These mines have opened up since 1899.

There are two American companies working silver mines in the San Joaquin mountains, 30 miles south of Nueva Casas Grandes. The ore is found in large fissure veins and the mines are very promising.

The district has many good silver prospects, especially in the western part and is sure to become a large producer as it was one time under the old Spanish and later regimes. A large portion of it is practically undeveloped and has not been prospected to any great extent at least in recent years, but as the capital of the state was at one time located at Janos, in this district, it is very probable that mining was the main industry. This is borne out by a book of statistics published by the federal government in 1834, in which it is stated that in that vicinity some very old mines had been found and that immense piles of slag and the ruins of old hornos, (adobe smelting furnaces) and arrastras indicated that the mines had been very productive and had been abandoned on account of Indian depredations.

These and several other old mines were rediscovered in 1810 and were worked for several years, but were again abandoned on account of the raids of the Apaches. Immense slag dumps still remain as evidence of the former activity.

DISTRICT OF GUERRERO.

On the north of the district of Rayon and south of Galeana and extending west to the Sonora line is the Guerrero district. The western part of this district has until recently been very much neglected, owing to its remoteness from transportation, but the extension of the Chihuahua & Pacific and the projected extension of the Rio Grande, Sierra Madre & Pacific is causing capital to seek investment in that section. Col. W. C. Greene has recently purchased 3,000,000 acres of timber land in this and adjoining districts and extending over into Sonora, and he has a federal mining concession for two years covering all this land. He is preparing to develop both the timber and mineral resources on a large scale. He has work commenced on a number of mines, has a concession to build a smelter at Dedrick. He has also secured a concession to utilize the water power of the Aros river to develop electric power for use at the mines, quartz mills, saw mills and even to be transmitted to the Cananea copper mines in Sonora, 150 miles or more distant.

The great mine of this district is the Dolores gold-silver mine about 60 miles west of Temósachic. This mine was bought by the Dolores Mining Company, composed of American and English capitalists about four years ago for $1,250,000 gold, and today, according to its stock is rating well up toward $4,000,000 gold. This wonderful mine developed itself from grass roots for a mile of workings out of the high grade ore from development work alone, and this ore had to be packed to the Chihuahua & Pacific railroad at Minaca on mules, a distance of about 125 miles. The mine is being equipped with a 15 stamp mill and cyanide plant, and at the present rate with the five stamps in operation, should be producing very soon a total of $75,000 in gold values per month. The Dolores section is a most promising one and there are a number of fine properties around it. Timber and water power are at hand.

Some good copper prospects are being developed at Guaynopita and some good gold properties near Yepachic. There are some good silver properties at Namiquipa and other places.

Five kilometers from San Isidro station on the Temosachic branch of the Chihuahua & Pacific railroad, with a narrow gauge railroad running to it, is the Calera zinc mine owned by an American company.

This is almost certainly the largest producer of zinc ore in the republic at the present time, and the indications are that it can easily maintain this position for years to come. The company has recently completed a large concentrating plant for separating the lead sulphides from the zinc blende, and are now making heavy

shipments of the ore and concentrates both to the United States and Germany.

At Dios te Guie, in the western part of the district, the Dios te Guie group of mines has been very extensively and systematically developed, and very large ore reserves blocked out. The mines appear to have a bright future, and being in safe and conservative hands, the ore has practically all been left in place, though upward of 6,000 feet of development work has been done.

The Greene Gold-Silver Co. is operating the Santa Brigada group of mines at Santa Brigada, near Dios te Guie, and one or two other groups of properties in the district, and will soon commence the erection of a large reduction plant at Santa Brigada.

HIDALGO DEL PARRAL DISTRICT.

This district, the famous Parral, as it is commonly called, is next to Iturbide, the most important in the state. It is the "American camp" of Mexico, there being many million dollars of American capital invested there and American methods almost entirely.

GEOLOGICAL FORMATION.

The general formation of the district of Parral is of porphyry, and the veins are very strong and well defined. In spite of the age of the camp, little depth has been attained—about 1,200 feet—and up to date little attempt has been made to locate, much less explore, the great mineral deposits, that under geological laws must be found if sought. This is a feature that is particularly alluring and has in the last few years attracted so many foreigners to the camp. As far as the district is known in depth, the veins continue to be strong and always carry their upper values. There is a decided tendency to believe—based solely on scientific laws, backed up by the few practical results—that they will improve. Under similar geological conditions, they have done so elsewhere in the Republic and there is no reason that Parral should prove an exception. The ores in character are silicious, sometimes carrying a small amount of lead.

Up to three years ago the district was the heaviest producer in the state, but at that time the smelters increased smelting charges to such an extent that many of the mines could not stand the charges and suspended work, and the tonnage has decreased to less than one third of what it was a few years ago. There are said to be millions of tons of ore just below the limit of present treatment charges, which can be mined at a profit just as soon as equitable rates can be obtained. The mine owners are alert to their interests, and a movement is now on foot, with every prospect of success, for the establishment of an independent smelter at Jimenez, and should this be obtained the mines of Parral and Santa Barbara will soon be producing more ore than ever before in the history of the district.

Another factor that will be of great benefit to the mines of Parral, is the establishment of a large electric power plant which will furnish power to the various mines. The same company that

is operating the power plant are contemplating the installation of a large mill and cyanide plant for custom work.

Several important sales of mines have been made in the district during the past three years, among which were the Quebradillas and Guadalupe in Parral proper; Los Muertos, Veta Colorado and Refugio in Minas Nuevas; and the Grenadeñia, Clarines, San Diego and Alfareñia in Santa Barbara.

Adjacent to Santa Barbara are the very promising camps of San Francisco del Oro, Los Azules and Ronces Valle, all of which are now producing.

There are several parallel veins in Parral, and all of them are very strong and well defined. The famous "Veta Colorado" upon which a great many of the largest mines are located, is the principal one. It has an average width of 300 feet and can be traced on the surface for 10 miles from north to south. The San Patricio and Refugio veins are also of unusual size and have been and are still heavy producers of valuable ores. In the way of mine equipment and reduction works, this district easily surpasses any two other districts in the state, there being a number of very fine mills. Concentration and lixiviation are the processes employed and at Santa Barbara; where the ores carry a large percentage of zinc, magnetic separators have been put in use. When the new plants for which concessions have been granted have been put in, Parral will surpass any camp in the republic for equipment along these lines. The tonnage of low grade ore already on the dumps of numerous mines and which will not bear the long haul to the existing smelters is sufficient to keep all these plants in operation for several years, and in addition to that there are immense quantities of the same grade of ore blocked out in the mines which is simply awaiting the installation of plants that will treat it and leave a fair margin of profit.

The ores of this district are all silicious, some carrying as high as 84 per cent silica while there are others as low as 30 per cent. The ores which contain lead are usually very low. A few mines give 2.5 to 6 per cent copper. Most of the ores are low in sulphur, the average being perhaps not over 5 per cent. About Santa Barbara the ores nearly all carry from 10 to 30 per cent. The silver contents varies generally from 250 to 1,500 grams and the gold from 3 to 50 grams to the ton.

Wood and timber are brought from the mountains principally by the Parral & Durango railroad, but with the utilization of the water power in the mountains to the west of Parral will greatly cheapen operations.

In the Parral camp is the far famed Palmilla mine of Sr. D. Pedro Alvarado about which so much gush and nonsense has been published in the United States. It has been a wonderful mine, but a more than liberal estimate of its production would be $3,000,000. It is again in bonanza, and good authority gives the net production at $85,000 gold values per month. The values are silver and gold.

DISTRICT OF ITURBIDE.

This district lies south of Bravos, occupies the central part of the state and extends to the Rio Grande on the east. Chihuahua, the capital of the state is situated in this district. In point of production both past and present, it is by far the most important in the state.

Santa Eulalia, the greatest silver-lead camp of Mexico and the greatest producer the world has ever known, is situated about 15 miles southeast of Chihuahua in a low range of limestone hills which rise some 1,500 feet above the surrounding plains. The ores, which are usually carbonates, are found in the limestone, generally along or near fault planes or porphyry dikes which cut through the lime in many places. All the larger bodies of ore, so far as known, are replacements of the limestone, and in many instances are of enormous size, being several hundred feet in every dimension. Some of the mines have been worked to a depth of 1,700 feet, are entirely dry and still produce enormous quantities of "sand carbonates" at that depth. Water has to be pumped from the river below Chihuahua, a distance of 12 miles, for the steam hoisting engines.

The mines of Santa Eulalia were discovered in 1704 and the total output since that date is estimated as high as $900,000,000, the greatest of any camp in Mexico, having exceeded the famous Guanajuato with an estimated production of $800,000,000, and Zacatecas with about $650,000,000. The Santa Eulalia mines are producing now at the rate of from $12,000,000 to $15,000,000 Mexican money per year. Yet all experts agree that the camp is still practically in the early stages of development.

Two narrow gauge railroads have been built from Chihuahua to Santa Eulalia to haul the ores from the mines.

During the past year more interest has been manifested in this famous district by American capital than at any previous time in its history. This interest has been greatly stimulated by the entrance of Chas. M. Schwab, the Pittsburg capitalist, into the field, and the purchase by him of properties to the total value of over $2,000,000 gold. His company, the San Toy Mining Company, is now constructing an aerial tramway four and one half miles in length from the mines to the plains below, where it will connect with a third line of railway from Alberto station on the Mexican Central. There are rumors to the effect that he will soon build a large smelting plant at the junction of the tram and the railroad for the treatment of his ores, and to do a general custom smelting business.

Several other large operators have entered the field, and it is estimated that not less than $6,000,000 of new capital have entered within the past twelve months.

At Terrazas station on the Mexican Central, 25 miles north of Chihuahua, there are a number of very promising silver-lead properties which produced about 3500 tons of good grade lead carbonates

during 1903 and 1904. There are also several copper properties in the same locality, among which are the Rio Tinto on which there is a copper smelter and which has produced a great deal of copper. Operations have been resumed on this mine and the smelter has been enlarged and is now in operation, doing a general custom business, as well as smelting their own ores.

The Columbia copper mine adjoining the Rio Tinto property shipped several thousand tons of ore to El Paso a few years ago, and it is stated will soon resume operations on a large scale.

At Victoriano, 10 miles west of Terrazas, several silver and lead mines have been partially opened up with encouraging results. Some of the veins are very wide and outcrop for long distances.

From 30 to 50 miles east of Chihuahua out on the Kansas City, Mexican & Orient railroad there are low grade lead and some good grade zinc properties, showing vast quantities of ore. Considerable interest is being taken now in this section, and one of the zinc mines is shipping 600 tons per month.

During the past few months, several other zinc mines have commenced shiping in a small way, and others are now being developed. The discovery of a large vein of high grade zinc silicate just south of the Conchos river in this district is creating new interest in the zinc industry of the state, as this is the first large body of silicate ores discovered in the state.

Along the line of this railroad clear to the Rio Grande there is lead and copper but the remoteness and lack of transportation has held that section back. The building of the road will undoubtedly develop a splendid mining section. Near Ojinaga, on the Rio Grande is coal and good oil indications extending over a very large area. Prof. M. B. Phillips, of Texas, says there is coking coal there, and that he made an oven on the ground and coked it. There has been no development to show quantity or quality of this coal.

In this same section, W. R. Hearst the noted journalist, and Jas. R. Keen the great Wall street operator, and associates have acquired fee simple titles and leases over 165,000 acres of land which they propose proving for oil. They now have a steam drilling outfit near Ojinaga proving the ground which has been pronounced by oil experts as most encouraging.

Quicksilver has been found on the Mexican side of the Rio Grande and there is no doubt but that this is but a continuation of the famous Terlingua quicksilver fields of Brewster county, Texas. These dsposits have had no work done on them however.

Nitrate of soda has been found in that section close to the line of the Orient railroad but nothing has been done to prove the deposits. It is claimed that a good quality of natural cement has been found west of the Conchos river along the Orient railroad.

The Placer de Guadalupe is 60 miles east of Chihuahua and four miles from the Kansas City, Mexico & Orient railroad at San Sostenes

station. This place is noted for the rich placers which were discovered 25 or 30 years ago and for the many beautiful and rare specimens of wire and crystallized gold found in veins nearby which have evidently fed these placers for ages. The principal vein is a limestone adobe. The ore is very rich, free milling but is often extremely pockety. These mines, neither the veins nor the placers, have received the attention they deserve and have not been developed on any kind of a reasonable scale. The Kansas City, Mexico & Orient railroad will reach the Conchos river August 2nd.

The placer de Santo Domingo is located on the Conchos river about 20 miles east of the Placer de Guadalupe. The placer ground consists of about 1,000 acres of gravel which contains good values in coarse gold and nuggets. The property has recently been purchased by a company of Chicago people who are preparing to exploit it.

About 12 miles southeast of Santo Domingo there are several copper properties one of which has produced some high grade ore.

At Las Vigas, 100 miles east of Chihuahua, there is a very promising copper property that has shipped several hundred tons of ore carrying an average of 20 to 25 per cent copper. The occurrence of the ore is rather unusual, being bornite and chalcopyrite in a matrix of sandstone, the walls being sandstone which has been tilted upon edge and stands almost perpendicular. The mines are owned by Americans who have developed them quite extensively and now have in operation on the property a mill and concentration plant.

A few miles northeast of Las Vigas there is a salt deposit which will probably be valuable in a short time.

In the Eastern part of the district the Sierra Rica and San Carlos districts were well known producers of silver-lead ores in the early part of the past century. The mines have not been worked for many years, but it is believed they still contain large bodies of good ore and that they will again become heavy producers.

At Minillas, located about twelve miles northwest of Chihuahua, a strong company has recently taken hold of the silver lead mines and is doing extensive development work. The mines were extensively worked many years ago, but practically abandoned until reopened by the present operators a few months ago. A concentrating plant is now being built, and shipments of the high grade ore are now being made. The ore bodies are of the Santa Eulalia type, and are found in limestone, on or near a porphyry dike.

DISTRICT OF JIMENEZ.

The district of Jimenez is located in the southeast corner of the state. The district disputes with Parral the honor of being the oldest district in the state, some old mines near Allende being claimed by some as the oldest in "Nueva Viscaya." These mines were abandoned at a very early date and there is no authentic history of them.

Five miles south of Baca station on the Parral branch of the Mexican Central railroad, in the Sierra Almoloya, the Cigarrero mine has during the past four years developed into one of the best paying mines in the state, and is now the heaviest producer of copper ore in the state. The district is one of the typical limestone formations for which the state of Chihuahua is becoming famous. Prof. Robt. T. Hill, the noted geologist, who recently made a thorough study of the district identifies the limestone as the Edwards limestone found over a wide area from a point in the Indian Territory in the United States to the state of Guerrero, Mexico, and belonging to the Comanche series of the lower cretaceous period. The ore bodies are typical replacements of the limestone and are for the most part found along or near vertical fractures or faults, but in some cases at least following horizontal strata in the form of "mantas." Besides the copper values, the ore contains from 20 to 30 per cent of lead and good values in gold and silver, while the gangue is composed principally of lime and iron, thus making it one of the best fluxing ores to be found. The Cigarrero mine is said to have paid over $4-000,000 in dividends during the four years of active operations. The mine is now being connected with the Mexican Central railroad by a standard gauge railroad, and the indications are that a long era of prosperity is ahead of it. The Iguana mine is also a large producer of ore, the principal value of which is zinc, but which like the Cigarrero ore contains good values in gold and silver. The Mina de Agua and Julieta mines are also producing and bid fair to develop into good paying mines. The latter property is essentially a gold mine and produces some very high grade free milling ore. Very beautiful specimens of crystallized gold are frequently taken out.

Among the most promising properties now being developed are the Placeres, Ventura, San Enrique, America, Fragua, Zacatecas and Coahuila.

With the prospects of a smelter being built at Jimenez within a short time this district would seem to have a very bright future, and its development being in the hands of strong companies will probably be rapid.

Five miles south of Baca station on the Jimenez-Parral branch of the Mexican Central in the Sierra Almoloya, the old Cigarrero mine has developed into an immense bonanza within the past three years. Near the surface the ores were lead carbonates carrying gold and silver, but with depth the lead appears to be replaced by copper, the gold and silver remaining constant. A Los Angeles company has recently made a splendid strike. Numerous properties are in course of development and some are shipping. The Cigarrero is shipping over 3000 tons per month. The Mexican company which owns it has decided to build a railroad from Baca Station to the bins at the foot of the mountain where the ore is brought by gravity train from the mine. Sierra Almoloya is very similar to Santa Eulalia and Naica.

Near Jimenez some copper mines are being worked with good results. The mines are producing about 5000 tons per year. The Las Adargas mine situated about 25 miles from Jimenez is being operated by the Cia. Metalurgica de Torreon, and it is from this mines that a large part of the lead fluxing ores at its smelter at Torreon have been obtained. Silver-lead ores have been obtained at two or three other places, notably in the Rio Florido company and great hopes are had for them.

JUAREZ (BENITO) DISTRICT.

This district occupies the central portion of the state, immediately west of that of Iturbide.

Cusihuiriachic is the most important and the oldest camp in this district, having been discovered in 1666, and it is estimated that it has produced about $100,000,000. According to the old Spanish records, taxes, or royalties were paid on $47,000,000 up to 1810, and it is believed, that including the large amounts that must have been smuggled out without paying the heavy royalties demanded by the Spanish government, the total production to that date was from $60,000,000 to $80,000,000 and yet there is only one mine in the camp that has been worked to a depth of over 400 feet. The Santa Marina has been worked to a depth of 1,056 feet, and shows good ores at the bottom of the deepest workings. This mine is equipped with a large hoisting and pumping plant and 25 stamp mill.

The veins of Cusihuiriachic are wide and persistent and the ores are very rich in silver, considering the great quantity.

This camp is but 12 miles from San Antonio station on the Chihuahua & Pacific railroad.

The Burns mines are situated about 15 miles southeast of Cusihuiriachic. These have produced about $1,500,000, but are not being operated at present. They are well equipped with an amalgamating mill.

The Reina mine of which Gov. Creel is the principal owner, is five miles west of the Burns mines. It was discovered in 1896, and since that time has paid almost $1,000,000 in dividends. It is developed to a depth of 416 feet. The ores are treated at the mill of the Burns mine at Buenos Aires.

The country in the vicinity of the Reina mine has been rather systematically prospected during the past two years, and several very promising properties have been located.

Milpillas is about 15 miles south of Cusihuiriachic. There are several large strong veins of silver-lead ore at this place and one or two showing good values in copper. There is only one mine in Milpillas that has been developed to any great extent and that shows a vein of from six to ten feet in width and carrying a high percentage of lead and from 10 to 40 ounces silver to the ton. Taken in con-

nection with the silicious ores of Cusihuiriachic this should make an excellent smelting proposition, as all the elements would be found in the ore required in successful smelting.

Northeast of Cusihuiriachic several lead and copper prospects have been partially developed during the past two years, and the indications are that some of them will develop into good properties. One or two of these were worked during the early days of Cusihuiriachic, and long since abandoned, but are believed to still contain large bodies of ore.

At Gavilana, 60 miles south of San Isabel, a station on the Chihuahua & Pacific railroad, there are several silver properties, one of which has a small mill in operation and is a regular producer. Six miles east of Gavilana, there are several silver-lead properties, one of which has over 1,000 feet of development work on it. The ore is high in lead and carries good values in silver. That section is well mineralized and a Pittsburg, Pa., company has equipped a 40 stamp concentration mill which it proposes running as a custom plant.

A new silver-lead camp is being opened up about five miles below San Jose del Sitio where a large number of claims have been located. Some very fine samples of ore have been shown, and the new camp is said to be a promising one.

At Nonoava, west of San Jose del Sitio, are several old Spanish mines, and one or two of these are again being opened up with good results. The veins which carry high grade silver-lead ores, are said to be small, but well worthy of development.

At Tajirichic in the western part of the district an old Spanish mine is being opened up by Americans, and some very high grade ore has recently been shipped from there.

The Magistral copper mines of Gov. Creel are situated 15 miles south of San Isabel station. The mines have been extensively worked and are well equipped with a smelter and all the machinery required for their successful operation. The ores are found in an irregular contact vein between an eruptive hanging and limestone foot wall.

Preparations are now being made to reopen the mine which has been idle for several years, and the smelter is being overhauled and put in order to smelt the ores. The owners hold a concession for a railroad from San Isabel to the mines, and may decide to build the line.

DISTRICT OF MINA.

This district, the most neglected in the state by reason of its remoteness on account of railroad transportation, is probably the most promising in gold. It is in the great "gold-silver belt" of the Sierra Madres and is noted for its immense veins of low grade gold ores. The district now has a good chance of a railroad; already

surveys from the Parral & Durango railroad to Guadalupe y Calvo, a distance of 100 miles and the railroad named is now being extended 20 kilometers southwest.

The district is bounded on the south by the state of Durango and on the southwest by the state of Sinaloa and is south of the districts of Andres del Rio and Hidalgo del Parral. The two oldest and best known camps are Guadalupe y Calvo and Morelos, but there are many other highly mineralized sections where mining is carried on and which will soon be brought to the notice of mining men.

A $500,000 gold deal is now pending on a group of large gold properties.

Guadalupe y Calvo is one of the oldest camps in the state and has a record of production of $60,000,000. The mines were worked in the early part of the past century by an English company who developed them in a regular way and extracted large quantities of high grade ore. Some of the principal mines are now held by Americans and are producing, though not heavily.

The famous mine of the camp is the great Rosario silver mine in Guadalupe y Calvo, which has produced many millions of dollars worth of ore, showing in its workings.

The general formation of the district is porphyry and andesite. The ore is silicious carrying both gold and silver. The district is very rough and broken, but fine timber is abundant and water power can be had in many places.

Morelos is located in the western part of the Mina district and about 40 miles south of Batopilas. The mines were discovered in 1826 and yielded several bonanzas of native silver. The formation is very similar to that of Batopilas, the principal veins being in diabase and exactly like that at the latter place, and it is said that the same belt can be traced from one place to the other.

The mines were generally in the hands of improvident owners who, when a bonanza was exhausted, spent all the proceeds before commencing to look for another. Finally, when Gov. Shepherd commenced to work the Batopilas mines, the workmen left Morelos and flocked to the bonanza workings of that place. Some properties are falling into better hands. The sons of the late Gov. Shepherd are developing ore on the best mines in the district and some work is being done on a few others. Some gold mines are being worked at Santa Ramona in the eastern part of the district and a mill and cyanide plant has been built at that place.

Mala Noche and Las Yedras are two important sections and operations with small plants are scattered through the district.

Mina is one of the gold camps of the future and there is no more encouraging prospecting territory in Mexico.

DISTRICT OF RAYON.

In the extreme western part of the state and west of the Guerrero district, is Rayon, which has been the great gold district of the state, although the ores are almost uniformly silver bearing as well. This district with a portion of Guerrero, Arteaga, Andres del Rio and Mina are properly in the great gold-silver belt, hereinbefore mentioned. Rayon includes Ocampo, Pinos Altos, Concheño, Otates, Socorro, Sahuayacan, Yoquivo, Maguarichic, Uruachic, Candemania, and others of less importance.

In this district and that of Guerrero, the Greene Gold-Silver company, capitalized at $15,000,000 gold, of which Col. W. C. Greene of Cananea is the head, is operating extensively.

This company has purchased several of the best known properties at Ocampo, including the Santa Juliana, Refugio, Belen and Rosario. They have also purchased the properties of the Compania Beneficiadora del Concheño, including the 150 ton mill and cyanide plant at Concheño and several other large properties in this and adjoining districts, and have recently completed a wagon road from Temosachic to Ocampo, Pinos Altos, Concheño and other points, and are expending a vast amount of money in developing and equipping their various properties.

As this article goes to press it is learned that the company has just secured a concession from the state government, granting them certain valuable rights, in return for which the company agrees to spend the sum of $1,000,000 within six years in building reduction works, railroads and other improvements, within the borders of this state.

Ocampo (formerly Jesus Maria) was discovered about 1821 and has produced more than $100,000,000. The general formation is porphyry and the ores silicious carrying gold and silver. The veins are numerous, and some of them are very large and persistent. There are seven mills in the camp, having a combined capacity of about 250 tons daily. The process employed in all the mills is amalgamation, but at the Waterson Gold Mining company the cyanide process has just been put in to treat the tailings. This will undoubtedly be done throughout the camp for nothing but the high grade of the ores would ever have allowed a profit, and the mines have been producing at a profit ever since their discovery, notwithstanding the enormous loss of 30 to 35 per cent with the amalgamation process alone.

The mills are not all operated regularly owing to the great difficulty of obtaining wood for fuel. All the wood used has to be carried in on pack animals and costs $6 to $7 gold per cord, delivered at the mills. There is an abundance of timber in the mountains for all purposes, and an aerial tram would easily get it down the mountains at a moderate cost.

There is also an abundance of undeveloped water power throughout the district which could be utilized in mining and reducing the ores of this and other camps.

The deepest workings in the camp at present are in the Santa Juliana, which are said to be about 1,300 feet deep. It is understood that the Greene Gold-Silver Co. is planning to drive a tunnel about one and one half miles in length which will cut the ore bodies at least 1,000 feet below the deepest workings on the Santa Juliana and effectually drain the whole camp.

Pinos Altos is only a few miles north of Ocampo, of good grade in the aggregate of gold and silver. This property is one of the largest in the state. By tunnels on the vein a depth of 2,500 feet can be obtained. This property has been a good producer for years. It was sold about three years ago for a price said to have been $1,000,000 Mexican money, to an American company. The old 60 stamp mill is being overhauled, 20 stamps are in commission and concentration is to be the process probably supplemented by cyanide for the tailings. It is the plan to put in ultimately a 1,000 ton plant.

Concheño is located a few miles northeast of Pinos Altos. The Greene Gold-Silver company is operating a 150 ton mill and cyanide plant here and is developing a group of claims and shipping in a 300 ton mill which will also be a custom plant which should be in operation early in next year.

At Sahuayacan, 30 miles west of Ocampo, a Pittsburg company is operating a 20 stamp mill on high grade gold-silver ore and at Potrerito, two miles from Sahuayacan, a 10 stamp mill is in operation. The vein at this property is large and the ores of good grade.

A very rich silver mine has been developed during the past two years only a few miles west of Sahuayacan and was sold recently to El Paso and Kansas City people who are building a mill and cyanide plant on the property.

At Socorro, 20 miles west of Ocampo, an American company has a 10 stamp mill. The veins are small but rich in gold and silver and are free milling. This part of the Ocampo district which includes the camps named and the Sahuayacan country clear to the Sonora line needs only the projected continuation of the Chihuahua & Pacific or the Rio Grande, Sierra Madre & Pacific railroad to develop one of the richest gold sections of Mexico. Yoquivo is 20 miles from Ocampo. The mines have produced several millions in the past but all are idle now. The principal property, which belongs to Gov. Creel, was worked until recently under lease. There are some very promising gold bearing veins here. At Candemania, a few miles south of Ocampo, there are a number of very promising rich silver properties, only one of which has been developed to any great extent. It is a good producer. The ores from this mine are treated in a small lixiviation plant. There is water power here for several large mills.

At Otates there are two small mills operating on high grade silver ores. The mines bear a good name and will probably be heard from in the near future. Near this place are some quicksilver mines on which considerable development work has been done and

some rich ore taken out. The ore and general formation are said to be very similar to those of New Almaden, California.

Maguarichic is 40 miles southeast of Ocampo. The veins are in gray andesite, are numerous, rich in silver and some of them carry good values in gold. Before the railroads entered the state the high grade ore running $2,000 per ton was packed on mules to Mazatlan on the Pacific coast. This camp is now idle, but the opening of the K. C., M. & O. railroad will bring it to within 30 miles of the road and Uruachic, 20 miles to the west, within 50 miles. The latter is one of the historic silver camps of Mexico. The San Martin mine was recently purchased by John J. Waterson.

Development work has been going on in this property for the past two years and a mill and 50 ton furnace are now being built. Another company is preparing to build a reverberatory furnace to treat some old tailings dumps in the same camp, and will also probably develop and work several mines nearby.

Some very promising copper veins have been discovered near Uruachic, but have not yet been developed.

A large copper property is being developed a few miles north of Ocampo by St. Louis capital. A compressor plant and air drills have been installed, and it is said that a large body of good ore has already been opened up.

At present the total output of the district is approximately $2,000,000 Mexican money per annum, and there is reason to believe that this will be doubled within two years.

THE SILVER MINES OF SANTA EULALIA, STATE OF CHIHUAHUA, MEXICO.

By James P. Kimball, Ph. D.—Am. Jour Sci.—Second Series, Vol. XLIX, No. 146.

The silver mines of Santa Eulalia were among the earliest mineral discoveries of the Spaniards in northern Mexico. Don Jesus Inocente Irigoyen of Cusihuiriachic, a good antiquarian authority, states that the year of discovery was 1591. The only available official register of their performance, however, goes back no further than 1705, but mentions their discovery in 1703—twelve years after the city of Chihuahua was founded, according to the date given by Dr. Wislizenus. From 1705 to 1737, they produced 6,583,500 marcs, or an average of 1,938,903 dollars of silver per annum. Up to 1791, during a period of eighty-six years, their acknowledged production of silver, of which the *quinto,* or king's fifth, was paid to the royal exchequer, was 11,903,126 marcs, or nearly *one hundred and twelve millions of dollars,* and their entire production from one-fifth to one-third more. At this period the district had a population of 6,000, and supported sixty-three reduction establishments with one hundred and eighty-eight smelting furnaces of the type known as the Mexican *horno,* and sixty-five cupelling furnaces; while a number

of similar establishments in the city of Chihuahua were also kept running on ores from this district. The depredations of the savages, which until comparatively quite recently have always seriously interfered with industrial pursuits in Northern Mexico, became so grievous during the last five years of the past century that the district was gradually abandoned.* Indian hostilities were soon followed by political troubles, including a war with Spain and the proscription of the Spaniards. During the present century, operations at the hands of the Mexicans have never been fully resumed. Yet shallow workings have continued to furnish ores to a small number of furnaces, which to a considerable extent have also made use of the débris of former operations. At present ten blast furnaces, each of a capacity of 2,500 to 3,000 lbs. of ore per day, are in operation, their small supply of ore being drawn from the older as well as the newer mines. The fresh ore from the mines as charged to the furnace, is eked out with the settlings of the old slag heaps, and coarse refuse from old workings, extracted from the dry bed of the creek which in time of rain, courses through the mining village of Santa Eulalia. As in old times, for the sake of mutual protection, the reduction works of the district are still all collected here, along with the dwellings of the miners and smelters, who number with their families some 700. Recollections with the old, and traditions with the young, still fill the minds of the dwellers in this narrow valley with dread of the Apache, who, even now is occassionally found lurking among these mountains, and of whose hiding all have been taught to be wary when moving about alone.

The village of Santa Eulalia is fifteen miles east of the city of Chihuahua, across the expansive champaign valley of Tabalopa. This city, the capital and social center of the state of the same name, and containing some 20,000 inhabitants, attained its importance mainly through the silver industry of Santa Eulalia, in the period of whose prosperity it had a population of 70,000. Chihuahua afforded—what have ever been lacking at Sta. Eulalia—water and space for the dressing and reduction of ores; and to the city therefore was brought and smelted a large portion of them. Immense heaps of slag, twenty in number, on the outskirts, attest the extent of work done there during the last century, while the imposing, and in some respects admirable, cathedral of the city is a monument to the mines of Santa Eulalia, it having been built out of a fund raised by the tax of one real per marc of silver coined, and which, continued for sixty-two years, ending in 1789, amounted to 800,000 dollars.

The Sta. Eulalia mountains are a portion of a long range trending N. E.—S. W., one of a system of parallel ranges, which, separated by champaign valleys or valley-plains, characterize the topography of the sloping margin of the Grand Sierras, and as much at least of the state of Chihuahua as lies north of the 28th parallel, and east

*Manuscripts and certificates in No. 65, folio 26, state archives. See also Ward's Mexico, 1st edit., vol. ii, p. 129 (2d edit., i, p. 454).

of Concepcion—beyond which limits my experience does not extend. The range lies between the broad and fertile valley of the Conchos on the east, and the narrower valley-plain of Tabalopa on the west. Access to the village and mines of Sta. Eulalia is from the latter. The village lies two-and-a-half miles from the plain up the mountain stream of the same name, at the foot of the higher hills, in which, at distances of two to five miles, the mines are situated, and which are crossed only by bridle paths. The mining ground is embraced within the area of an uplift of the Cretaceous fossiliferous limestone, imparting toward the center of it gentle quaquaversal dips. This is a prolongation of the narrow continuous elevation of this formation, reaching to the Rio Grande in an axis parallel to the Conchos river, and a part of the same formation which in Texas comes to the surface in the Rio Grande basin, at least, between the 28th and 31st parrellels, except in mountainous localities, or in the case of stratigraphical depressions, where an upper and metamorphosed member of the same formation (a porphyritic quartzite) known in Mexico as *cantera*, caps the summits. In Mexico, under similar conditions of superposition of the latter, the Cretaceous fossiliferous limestone, with local lithological differences, is the prevailing formation of the Rio Grande and Conchos basins, where, as seems likewise to be the case in Texas, within the development of the cantera it sustains throughout a metalliferous character. The mineral deposits of Sierra Rica, Cuchillo Parado, the Chupaderos, and the Chorreras in Chihuahua are all contained in it. In the Santa Eulalia mountains is its most westerly development in any great prominence above the valley plains, though seventy-five miles still further west, a limestone is said to form the low base of the Sierra de Magistral, where it is likewise metalliferous, and where, going west, it is last seen. In the Santa Eulalia mountains, the same as in other localities named, the *cantera* caps the higher elevations. This name is applied in Northern Mexico to the bleached portion of an essentially alumino-siliceous rock, generally more or less metamorphosed and ferruginous, and occurring in a great variety of colors.* As elsewhere explained, it is to the disintegration of this rock that the accumulation of soil in the valleys is due, as well as their peculiar conformation.†

Allowing for erosion, the mines of Santa Eulalia may strictly be said to be grouped in a single great boss of the Cretaceous limestone strata, gullied or scored by water-courses which impart to all portions of it a rugged and precipitous configuration. There, as elsewhere throughout the development of the fossiliferous limestone, the water-courses have cut bold, almost perpendicular, escarpments in which the stratification is very plainly marked. In this district the dips are from 5° to 15°, and from a point near the Vieja mine are quaquaversal. The ravine, Arroyo de Dolores, which takes its

*This Journal, xcviii, p. 380.

†Ibid, p. 381.

name from the old mine of Dolores, at its head, has been cut through the crest of the limestone uplift, and thus exhibits in steep mural escarpments a partial thickness of the formation of 400 to 500 feet. Its true thickness, however, has never been revealed. The oldest and most extensive mines are in this ravine, including the deep ones of Dolores, Vieja, Aguada, and the shallow or cavernous workings of Parcionera, San Jose and San Matias. The distance of Arroyo de Dolores from the village is some three miles, horizontal, from four to five topographical.

As the limestone uplift or boss expires, the summit cantera, a few remnants of which cap the limestone hills, sets in, and within a couple of miles, becomes the main formation, and forms the body of the range. No limestone appears in the Puerto de Dolores, seven miles to the north, where the San Diego and Chihuahua road crosses the Sta. Eulalia range; and in the village of Sta. Eulalia, it has already declined below the surface. The overlying cantera presents a greater development in the surrounding hills, which rise to the height of some 800 feet above the plain.

A curious lithological phenomenon, though in a less conspicuous way not uncommon in other localities which I visited in Chihuahua, is a formation of conglomerate which is found on all the slopes of the district, and which incases the lower and middle portions of the hills like a shell.* This has evidently been formed by carbonated calcareo-magnesian infiltrations, springing from the summit cantera; and, penetrating the fine and coarse detritus of the surface alike have cemented it, and thus produced all the gradations from a fine friable sandstone to a coarse breccia. The village rests upon it. In the main street it is distinctly bedded, and cleaved by joints. Nowhere is it found entering into the interior structure of the hills, and no traces of it are found in steep places. Yet cursory observation might dispose the traveler to assume the main body of the mountains to be made up of this formation.

The mineral deposits of Santa Eulalia are unique. The only instance of a vein formation brought to my notice in the region is in the Santo Domingo mine. All the rest of the deposits are more or less irregular, and in a variety of modes of occurrence, are contained in the nearly horizontal fossiliferous strata (Cretaceous). All the strata above water level are exceedingly cavernous. In nearly all of the workings, caves, entirely shut off from the surface have been encountered. Some of these are of enormous size. The great cave of Parcionera and San Jose mines, is said to be large enough to hold the cathedral of Chihuahua. Though unable to explore its height, or to illuminate its roof, I am disposed to believe this. Drusy cavities or vugs of all sizes, are the smaller exhibitions of the same prevailing cavernous character. These latter yield excellent pockets of ore. Rich *bonanzas* have been got from chambers in the walls of the large caves. The ores which are mainly the

*This Jour., xlviii, p. 382.

chlorid and sulphids of silver, argentiferous galena and salts of lead, together with, (though of rarer occurrence,) the chloro-bromid (embolite) and iodid (iodyrite) of silver, are very ferruginous, to which circumstance they owe their friable character, and also, to a considerable degree, the spaces in which they have been deposited. Courses of ore are always marked by ferruginous stains, which, properly considered, are segregations of mineral matter, sometimes following cleavages and joints, and sometimes planes of bedding, and, again, sometimes reticulating solid beds, and in all these modes of occurrence, without order or defined limits. A bed, or a number of beds, of the limestone, in places may be thoroughly webbed with such segregations of so decided a character as to impart a concretionary appearance, or, as if limestone breccia were cemented by ferruginous ore. In such places the beds, are *not* brecciated, but thus strikingly indicate the energy of disintegrating and segregating action under the decomposition or oxydation of iron salts (probably protocarbonate) originally contained in the limestone, together with diffused salts of silver. These ferruginous portions always afford good mining ground. As some of them are very extensive, and as their distribution is irregular, their excavation results in large and rambling chambers, generally ranging through a number of the heavy beds of limestone. Such chambers are often continuous with natural caverns, together forming underground spaces scarcely less imposing than the most noted caves that excite the wonder of tourists.

The mines of Santa Eulalia are scattered all over the great limestone uplift, and along the deep ravines which have scored it. All are comprised within an area of some five square miles. In the hillsides they consist mostly of horizontal workings, and occupy different strata from top to bottom. Shafts and deep workings, which are few and ancient, are located both in the hills and ravines. Accessibility of the mines is determined by the topographical configuration of the mining ground, the primary form of which, before modified by erosion, it is important to keep in view. As they are reached from the village by three different trails, I will describe them is as many separate groups as, follows: the *Santo Domingo group,* comprising the workings in the same cañon as the Santo Domingo mine, and of which this mine is the principal; the *Dolores group,* or those in the cañon, at the head of which is the old Dolores shaft; and the *Guadalupe group,* comprising the workings on the summit and S. W. flank of the limestone ridge, which forms the divide between the Dolores Cañon on the northwest, and on the southeast—the waters of the *arroyo* in which is the village of Santa Eulalia.

Santo Domingo Group.—The Santo Domingo and neighboring mines are two miles north of the village, up near the head of a deep ravine, in both sides of which, at different elevations, they have their entrances. As this locality is about one-and-a-half miles to the southeast of the axis of the boss, the dip of the formation is seen rapidly declining in the ravine toward its mouth, and the overlying cantera is thus brought down so as to form the body of the hills. The

limestone altogether disappears from above the bed of the ravine within a few hundred yards south of the Santo Domingo mine, where the cantera sets in and forms the surface. The town is really on the horizon of this formation, though the surface is immediately overspread by the cemented rubble above described. The hills on either side of the defile in which the village is situated, rising as they do some 700 feet above it, are both topographically and stratigraphically the highest elevations in the district. They are made up wholly of cantera distinctly and nearly horizontally stratified, and in different zones weathering with a variety of colors. They have mesa tops, and present to the broad valley-plain of Tabalopa bold escarpments flanked by low foot-hills.

The *Santo Domingo,* old and present, are deep workings entering the limestone boss on the west side of the ravine. The old mine, now abandoned and dismantled, consisted of a shaft located so high on the hillside that it must have pierced one hundred feet of cantera before striking the limestone. The present mine is some 500 yards further up the ravine, and, at an elevation above its bottom of some 120 feet, goes down in a bed of fossiliferous limsetone some 30 feet from the top of the formation, the division being plainly indicated by a ledge of cantera above the entrance of the mine. Its depth is about 400 feet. This is reached by an irregular descent, the only thoroughfare, in which passage is laboriously effected partly by means of ladders, and partly by footholds in the rock. This mainway occupies a vertical crevice in the limestone, or a series of cavernous partings more or less filled out with workable ores. The widest portions are some 12 feet, the most contracted, not more than six inches. Many of the former are of the nature of drusy cavities lined with quartz and gypsum. The narrower portions have generally yielded apying ore of a decomposed and ferruginous character. The vertical crevice, which has been followed westerly into the hill has been pretty thoroughly wrought. The most extensive workings, however, follow rich partings between planes in the limestone beds, thus giving rise to lateral excavations opening into the main-way. Rich pockets of galena are found both in the crevice and in the horizontal deposits, and these seem to be increasing in depth. Indeed it is chiefly for galena and other plumbiferous ores (*plomosos*), that this mine is at present wrought; and it appears that its ores of all grades (*ayudas*) have always been prized less for their argentiferous qualities, than for the property of facilitating the smelting of the more refractory ores (*resecos*) of the district.

The other workings of this group are on the east side, and further toward the head of the ravine, occupying different beds in the limestone and pursuing productive courses of ore. The principal are *Chiquihuite, Rosario, Gertrudis* and *S. Lazaro.*

Dolores Group.—The cañon of Dolores is a deep gorge cutting almost perpendicularly the axis of the limestone uplift or boss. The cliffs thus formed, expose on either side a perfect section of bare

limestone strata. Its course is very nearly westward, and its head opposite and very near that of the Santo Domingo arroyo. Together the two water-courses describe a triangle, and as they border the mining area impart this shape to it. A lofty ridge capped with the summit cantera divides the two waters. Owing to the comparatively rapid declination of the limestone strata in this direction, the workings toward the head of the cañon are by means of shafts going down just above its dry bed. They are the Tiro Dolores, present Dolores, the "Gauo" (Aguado) and the Vieja shaft.

The *Tiro Dolores* is a vertical shaft starting in the cemented rubble, but soon striking the fossiliferous limestone which, from 200 to 300 yds. below, is uncovered in the bed of the cañon. The shaft is 327 ft. vertical—at which depth a slanting passage, now flooded with rain-water, carries it some 100 feet deeper.

The *Aguado*, like the Dolores, is now inaccessible. It is an irregular sinking of about the same age and depth as the latter, and communicates with it by deep workings. Its mouth is near the top of the limestone formation.

The *Dolores*, present working, is a sinking of the same description as the Aguado, with the lower workings of which, and thereby with those of the older Dolores, it connects. The upper and more accessible workings are still wrought in a small way for plumbiferous ores. The *Vieja*, some 200 yards still further down the arroyo is also an irregular sinking carried to the depth of about 165 ft. It still affords desirable silver ores.

All these mines were formerly diligently wrought—the shafts by means of horse-whims. From a watch-tower on the highest point overlooking the whole district, timely warning of the approach of the savages could be given. Ruins of stone dwellings built strong for defense, indicate a former settled establishment in the bottom of the defile, which, as in the case of all the others in the region, contains water only during rains. The water in the mines appears to have got in from the surface, no percolation being sensible even in the deepest.

In the immediate vicinity of these old workings, near the head of the arroyo, the dip of the limestone beds to the southeast is near 45°. The vertical axis of the boss is in the eroded neighborhood of the Vieja, at the confluence of another arroyo from the southwest. From this point in every other direction the dips (quaquaversal) are gentle, coming down gradually to not more than five degrees. But the steeper dips towards the outside of the limestone boss have brought up a great thickness of this formation (400 ft.) above the arroyo, and thus west of the Vieja the same strata are above its bed, as could only be entered by shafts east of this point. This is an explanation of the fact that below the Vieja all the workings are above the bed of the ravine, their openings being in the bluffs. These workings are all approximately horizontal: that is, they follow the stratification which on either side being slightly inclined *from* the

ravine, gives them all something of a descent *into* the body of the hills.

The *San Jose* enters the south bluff a quarter of a mile below the Vieja, some 30 ft. above the bed of the arroyo. Its workings extend to several beds, the excavation of which has caused great chambers, while a number of natural caves also have been opened. The ores here are mainly diffused through the limestone strata in ferruginous and the more decomposed portions. They are also found in courses leading from stratum to stratum, but never in the form of a vein.

The Parcionera opens near the San Jose some 70 feet higher up the bluff—its workings, however, descending so as to connect with those of the latter, and thus excavating several beds. It may be described as a series of caverns, both natural and artificial, the largest in the district. It is here that is to be seen the immense one already mentioned. The openings extend about 500 yds. into the hill, in which distance they fall some 150 ft. The pursuit of courses of ore whither they might lead, has caused very irregular passages. The ores of the mine are highly prized, and at the time of my visit were being extracted by twenty miners for the supply of the furnaces of Don Emanuel Escobar. The ores then coming out were plumbiferous. Their mode of deposit does not differ from that of the San Jose ores.

The *San Matias* is in the north bluff, directly opposite to the San Jose and Parcionera, and going in on the same level. It is one of the more cavernous, as well as one of the largest and oldest, mines in the district, having been wrought southeastward so as to connect by descending passages with the workings of the Vieja, a quarter of a mile off. It is still wrought by Mateos & Co. Its ores are excessively ferruginous (*colorados*), their color being that of red hematite. According to the owner they are now yielding 12 ounces to the carga ($103 to the ton).

Several openings in the north bluff have been made at higher levels. One, the *Cuartillera*, is at the height of some 300 feet above the bottom of the cañon. It furnishes a non-ferruginous ore of a drab color.

GUADALUPE GROUP.—It is convenient thus to designate the numerous workings in the same hill with the Parcionera, situated, topographically speaking, some above these mines, and some on the opposite north and west sides, wherever the surface is not too steep to afford easy access.

The *Guadalupe* mine is directly over the Parcionera and San Jose, and opens from the plateau which marks the top of the limestone formation. Its workings progress southeasterly, descending through several very ferruginous beds in which silver ores seem to be concentrated in "pockets"—the average ferruginous courses being filled with segregated quartz, and generally barren. A drusy cavity is said to have been struck here in 1865 which gave in one day sul-

phids of silver worth $5,000; and five months afterwards another, yielding $1,200.

The *Aragon* is a similar working in still higher limestone strata, and very near the junction of this formation with the cantera, here a buff, porphyroidal quartzite, a fine outlier of which rises some 150 ft. above the limestone plateau. Both this mine and the Guadalupe steadily yield plumbiferous ores, carrying, mostly in an invisible form, chlorid, bromid and sulphids of silver.

The other mines of this group are all on the left flank of the limestone ridge. They are the Santa Rita, San Francisco, Purisima, Negrita Grande, Negrita Chiquita, and the Carmen.

The *Santa Rita,* one of the oldest and more reputable mines, is a shelving excavation, starting in fossiliferous limestone some 350 ft. above the bed of the Dolores arroyo. A large burrow of ferruginous material indicates the extent of former workings. The main opening is said to be asphyxiated, and is now closed, though containing, according to all accounts, ores running as high as four marcs to the carga ($250 to the ton).

The *Purisima,* occupies nearly the same level as the Santa Rita, going down some 60 ft. in heavy bedded limestone, fossiliferous at the surface. The fossils, as usual in this locality, are a coral, *Radiolites,* and fragmentary *Pecten* and *Inoceramus.* The mine, though now vacant, was worked three years ago, and is said to have proved satisfactory.

The *San Francisco* is a sloping excavation in the hillside, and some 100 ft. lower in the limestone than the Santa Rita. The workable portions of the limestone beds closely resemble those of the workings in the Dolores arroyo. The mine is now supplying highly prized ores to the Chihuahua Company's hacienda.

The *Negrita Grande* is an old, now inaccessible, shaft, more than 250 ft. deep, which depth about corresponds to the level of the arroyo immediately below the mouth of the mine, and from which it would be practicable to reach its workings. The shaft was formerly worked by horse-whims (*malacates*)—probably by the distinguished Bustatmente who is reputed to have had a bonanza from it of $60,000, said to have been in the form of concentrated chlorid of silver.

The *Negrita Chiquita* is a newer open working, now operated by Don Jesus Mateos, and occupying strata but a little lower than the mouth of the shaft of the *Negrita Grande.* The *Carmen* occupies beds somewhat higher, and is a similar cavernous excavation.

It will be understood that notwithstanding wide differences in topographical level, all the workings above mentioned are embraced within the same set of beds whose combined thickness does not exceed 450 ft.; that the shaft workings at the head of Arroyo de Dolores, the mines of the Santo Domingo arroyo, and the workings on the top of the plateau forming the surface of the limestone uplift, *all have their entrance at about the same stratigraphical horizon;*

that is, near the top of the limestone. And it is to be borne in mind that stratigraphically the lowest workings are *not* those which topographically are the lowest, but the San Jose and San Matias instead of the Dolores, Vieja and the Aguado.

Notwithstanding the number and size of the excavations in the mining ground of Sta. Eulalia, and the large returns which these have afforded, its future prospects seem scarcely impaired by the achievements of the past. By the modern scale of mineral industry, these might pass for only a thorough exploration—in its assurances worth all that it has yielded. The location of the mines has been determined by the accidents of the surface rather than by promising outcrops—a foothold upon the surface seeming to have been all that was necessary. Besides the great amount of unbroken ground left in and amidst the established mines, a large body of the limestone strata remains untouched, especially to the north of the Dolores arroyo, where the inner ends of the workings, proceeding from the bluff on that side, show no deterioration or diminution of the ores. It is not venturing too much to predict that the past record of Sta. Eulalia will be far surpassed at some future time by its development prosecuted by an enlightened practice.

Yield.—Extracted according to the judgment of the miners who are very expert in the detection of familiar ores, the ores after being spalled, run from 4 to 6 oz. to the carga ($34.46 to $51.60 per ton of 2,000 lbs). Four-ounce ores are abundant in all of the mines, but scarcely pay for working by the present smelting practice. By care in selection, this grade is easily brought up to five and six ounces to the carga. This is the lowest working yield of all the smelting operations—the average being something above this. Don Jesus Mateos, one of the most experienced operators in the district, by using a mixture of the 12 oz. ores from the San Matias and 6 oz. ores of the San Jose, obtains never less than 6 oz. to the carga, generally as high as 8 oz., and sometimes 9 and even 10 oz.

Cost of ore.—The cost of ore delivered at the mouth of the mine varies according to the expense of raising. At the Parcionera, which may be taken as the type of horizontal or sloping workings, this cost, which includes all mining expenses, is stated at $1.50 per carga. At the Santo Domingo, the cost is greater on account of the laborious raising. The ores are delivered at the furnace for 20 to 37 1-2 cents per carga, the donkey-load being one carga (300 lbs).

Reduction.—The furnace employed in the district is the common Mexican *adobe horno,* a blast-furnace 47 inches high, 18 in. wide at the top, slightly tapering toward the bottom, and 16 in. across. The blast is supplied by hand bellows, the nozzle of which is in the back, 8 in. from the bottom. In the better constructed establishment of the Chihuahua Co. the bellows are set in motion by mules. The charge of the furnace varies according to the notion of the smelter as to the requirements of the different ores. Mateos uses 75 lbs. of spalled ore to 20 lbs. of litharge, and 12 to 25 lbs. of old slag (*grasa*)

by way of flux. The charge of litharge varies with the ore. Plumbiferous ores, like those of Santo Domingo, Santa Gertrudis, Dolores and San Antonio, give an excess of litharge, and hence are in especial favor for mixture; while the excess of litharge obtained is sold out of the district at the rate of 8 to 16 dollars per carga ($2.67 1-2 to $5.32 1-2 per cwt). The cupellation is done in the ordinary *adobe vaso,* one serving three blast furnaces, or treating 20 cargas of argentiferous lead per week.

Fuel.—The question of fuel is one of paramount importance to the industry of the district. The *mesquite* root is the only indigenous fuel of the immediate section of country, forest trees being entirely unknown east of the humid belt, 50 miles to the west of Sta. Eulalia, except the cotton wood (*alamo*) which is cultivated for shade. Yet nothing could excel this root as a fuel, either as it comes from the ground, or after conversion into charcoal. A single shrub generally gives near a cord of heavy root. In the neighborhood of Sta. Eulalia, the *mesquite* has long been exhausted by the draft upon it from there, and from the city of Chihuahua. Oak charcoal is brought 30 leagues to Sta. Eulalia from Mapula, and sold at the rate of 75 cents to one dollar per quintal (100 lbs.)—the price prevailing whenever the roads are favorable. Oak wood is likewise brought thither, and sold at the rate of one dollar (copper) per carga (80 sticks, 28 by 4 in.). The same prices prevail in the city of Chihuahua. Mesquite charcoal from the east side of the Sta. Eulalia Mts. is delivered at the village for $1 to $1.50 (copper) per quintal. These prices, already high, would doubtless steadily advance under a larger and more pressing demand, such as would be created by an extensive smelting industry depending upon a *certain* supply and *limited* price of fuel, without control over either.

With a cheaper mode of reduction, the cost of production would be very considerably lessened by rendering available ores which, though cheaply and largely broken, are now rejected—ores yielding as high as $34 to the ton. This condition, rather than the introduction of mechanical appliances, would necessarily bring this cost below the cost of extraction of silver ores from the expensive workings in Nevada, though now far exceeding that of the most of the deep mines of the Comstock lode. But the cost of reduction is even more excessive and out of proportion to the value of the ores. Though the Mexican smelting practice is attended with a small loss of silver, the fact that Nevada ores returning no more than $15 per ton can be worked by amalgamation with some profit, more than offsets the loss of 20 to 25 per cent to which all are subjected, as a large and regular business generally depends upon the availableness of the ores of low grade—always predominating in extensive deposits. Yet the Mexican furnace by no means extracts the whole of the silver as may be seen by picking up from any ancient or fresh slag heap fragments containing numerous globules of argentiferous lead, and otherwise indicating imperfect reduction. Fuel is far more costly

at Virginia, Nevada, than anywhere in Chihuahua, but this difference follows from the higher price of labor there—the supply of fuel really being greater than at Santa Eulalia.

Thus will be seen the mistake of treating the ores of Santa Eulalia by a practice which is so costly as to render unavailable the great bulk of them, and to absorb almost the whole value of even the choice ores in their reduction, when by a cheaper practice the whole run of the ores could be treated with profit, and the industry improved and expanded in all respects. I allude to amalgamation as practiced in Mexico itself, and which the climate, labor and facilities of the country especially favor. In 1846, it was estimated by Mr. John Phillips, seven-eights of the silver produced in Mexico was obtained by amalgamation.

The lack of surface for *patios* at Sta. Eulalia, together with the scantiness of water, are circumstances sufficient to account for the prevalence there of smelting, notwithstanding the ores are of a nature to yield readily to patio amalgamation. That these difficulties have never been surmounted is to be ascribed to the isolated condition of this section of the country, and its lack of facilities for extralimitary supplies. In the last century, during the period of its prosperity, as I learn from a manuscript in the state archives, amalgamation both by *patio* and *cazo,* was carried on at Sta. Eulalia and Chihuahua to the extent of keeping in operation in the two places 72 drag-mills (*tahonas*), and 6 stamp-mills (*morteros de agua y caballerias*). The reduction works, just erected, of the new Chihuahua Co. have not in the least departed from ancient models. Nor would a change of practice be warranted by anything short of an extensive undertaking. In view of the scarcity of water and fuel at Santa Eulalia, it must be seen that present operations without modification can scarcely be extended beyond their present scope. As long as they are thus limited, they are favored by a choice of ores, and by cheap labor. By dispensing with mechanical appliances for dressing ores any considerable outlay is avoided.

The silver deposits of Santa Eulalia, however, are so superior and extensive as to warrant their extraction and reduction on a large scale. This will be practicable by having recourse to the facilities afforded by one or both of the two plains on either side of the Sta. Eulalia mountains.

West of the mountains, superior facilities for the dressing of ores, and for patios, are to be had at Tabalopa on the Sacramento river, at the distance of some eight miles from the mouth of the Arroyo Dolores. Ores could be delivered at this point by wagon at near the same rate that they are now freighted on mules over the mountains to Santa Eulalia. This way out to the plain would be by the ravine, and thence the whole way to Tabalopa by a down grade.

Having extended my observations but a little way east of this gorge, I am not prepared to determine the question of an exit on that side of the Sta. Eulalia range. Should it be found prac-

ticable to cheaply deliver ores in the Conchos valley, this side would, on the whole, present superior conditions for reduction works, provided a good water supply can be had, which is probable, as the plain is already thoroughly irrigated. Fuel (mesquite) is far more abundant here than on the Cihhuahua side, and the position is nearer by two days to all supplies drawn from Texas.

New York, Jan. 1, 1870.

MINING CONDITIONS IN THE MOUNTAINS OF CHIHUAHUA.*

The properties owned by the Dolores Mines Company are situated in an isolated section of the Sierra Madre, in the western part of Chihuahua, Mexico. The nearest mining camps, which are from one to two days' mule-back travel from the mine, are Soyopa, Ocampo and Pinos Altos. The property is reached by the Mexican Central Railroad from El Paso to Chihuahua, thence via the Chihuahua al Pacifico Railroad to La Junta, thence over the branch to San Isidro. From San Isidro a mule trail leads over the mountains in a general direction a little south of west, an estimated distance of about 100 miles to the Dolores mine. This trail is exceedingly rough in places; good riding time from San Isidro being 33 hours in the saddle. Owing to the roughness of the trail this requires, under ordinary conditions from three and one-half to four days.

Careful observations were made on my trip of the riding time between points and barometric readings of elevations. From these I prepared a profile based horizontally on riding time and vertically on altitude. This, of course, gives only an approximate idea of the character of the country, for it is readilly understood that the riding time on steep hillsides is not nearly so fast as on level mesas. Still the observations are of sufficient interest, as indicating the character of the country. The elevations vary from 3510 ft. at the pumping station on the Tutuaca river to 8500 ft. on the summit of the Cebadilla mesa. The variations in altitude present a range of vegetable growth from the palm trees of the upper tropicals to the pine trees of the temperate zones. At the pumping station at the Tutuaca river can be seen some few scattering palms, sycamores, aloes, willows, Maguey, and a scant growth of small scrub oaks. At an altitude of 4500 ft. junipers appear with a scant growth of scrub cedars. Here the oaks have materially increased in size. At something over 5000 ft. manzanitas and scrub madroñes appear. At an altitude of 5250 ft. the madroñes have increased in size, and the first scrub pines appear in the sheltered ravines. At 6000 ft. the oaks reach their maximum growth and development. At an altitude 500 ft. higher the pines produce good mine poles with some fair saw-logs. The best

*An illustrated article by Mr. John H. Farish will appear in Vol. II of "Chihuahua Mines."

saw-logs, and in fact the only ones that can be considered good, were seen at altitudes above 7000 ft.

TRANSPORTATION.

Over the trail described, all freight, supplies, laborers, and in fact everything going to Dolores, must be transported on mule-back. Supplies and machinery must be in broken packages of from 150 to 300 lb. each, as an average load for a mule is about 250 lb., while that for a burro is about 200 lb. Packages weighing in excess of 500 lb., or those of unhandy bulk or shape call for extra freight rates, which are greatly in excess of the regular rates for packing more convenient parcels. During the construction of the mill $25 was paid for packing a cam-shaft weighing 485 lb., while $37.50 was paid on a piece of a Cameron pump weighing 630 lb.

At the time of the organization of the company there seemed to be an abundance of freight animals, both mules and burros, to handle all material and supplies for the mine. The advent of the Greene interests in the Sierra Madre, the building of railroads and the opening of other new enterprises completely changed the situation. Animals are very scarce, and transportation has advanced in consequence from $3.50 and $4.00 per carga (300 lb. avoirdupois) at which rate most of our machinery was transported from the railroad, to the present ruling rate of $6.00 per carga from San Isidro. The probabilities are that the rate will be further increased, owing to the general activity and sharp competition that now exists throughout the State of Chihuahua.

The average time for a freight train from San Isidro to the mine is, in favorable weather, from 10 to 12 days. The average return trip from the mine to the railroad—the animals being without loads—is from five to six days. Both mules and burros then require considerable rest on pasture. Two round trips for animals under Mexican control in three months is a good average under present freighting conditions. During rainy or stormy weather the regular trip to the mine takes never less than 15 days, and from that up to several weeks, depending upon the severity of the rains or the snow storms, and the conditions of the rivers and trail. Often the freighters will stop with cargas at ranches in the valley, or lay off where the pasture is good in the mountains, for a week or more in order to rest their mules before proceeding. When the rivers are up the freight is often delayed for weeks.

In this connection, it will be recalled that the rainy seasons of the summers of 1904 and 1905, and the following winters, were two of the most severe that have ever been known in northern Mexico. During the past winter snow fell to a depth of 4 ft. on the Cebradilla mesa, and lay for a period of three months—a thing unheard of before. During the first summer of our operations the rainy season was so mild that the springs and arroyos surrounding the mine dried up, and water for domestic purposes had to be packed on burros from the Tutuaca river. The following winter was equally mild and only

two slight flurries of snow fell upon the trail, neither of which exceeded an inch or two nor remained on the ground more than a week.

BATOPILAS.*

Batopilas derives its name from the Indian *Bachotigon*, which means: by the river. It is situated 27 degrees and 50 minutes north latitude and 107 degrees and 26 minutes longitude of Greenwich. It is 318 miles southwest of the city of Chihuahua and only 2340 feet above sea level, although right among the high Sierra Madre mountains. This is accounted for by its peculiar location at the bottom of a cañon or barranca several thousand feet deep, so that its climate is really tropical and the orange and banana and other tropical fruits grow there abundantly.

The Real de San Pedro de Batopilas was discovered in the year 1632 and no authentic history of its progress is to be had up to 1840 when its archives were destroyed by fire. Tradition says that one day the river rose to an unprecedented height and at a certain point left uncovered a bare rock which turned out to be native silver and the mine was called "La Nevada," meaning "the snow." From this vein enormous specimens of the rich native silver were taken and sent to the Viceroy and in turn to the court at Madrid. They were greatly admired and there was a great rush of miners and adventurers to the new discovery. The Viceroy at the time, Don Diego Lopez Pacheco, Marquis of Villena, by order of the king, commanded the authorities to collect data and information of the mines. According to these reports the production of Batopilas, prior to 1790, was over $10,000,000, but a great quanatity was stolen or was carried out contraband and is not included in the amount.

Among the prominent persons who figured in the history of Batopilas was Don Rafael Alonzo de Pastraña. He worked with small results a claim called Nuestra Señora del Pilar, but after a considerable time he struck a vein of almost pure silver to cut which he had to have special tools made. He took out several millions of dollars. He invited the Bishop of Durango to visit him, and as it was occasion of the kind the people enroute gave the latter great ovations. Not to be outdone Pastraña caused bars of silver to be laid from the church of Batopilas to the house where his grace resided. The good Bishop was horrified at such a display and reproved the rich miner for his vanity. It is said that Pastraña took the reproof so to heart that from that time on he distributed much of his wealth to the poor and needy miners. Besides the before mentioned mine, Pastraña owned the San Pedro, N. S. de la Regla, Dolores, Animas, Ballinas, Consolacion, Escritorio, Arroyo de Tachos and others.

In 1792 Angel Bustamente, 21 years of age, came from Alced, Spain, and being a man of education, was employed in the courts.

*Articles on Batopilas by W. M. Brodie and Arthur Shepherd will appear in Vol. II of "Chihuahua Mines."

One day he commenced to work "El Carmen" mine where he struck a vein of native silver from which he took out a number of large specimens of native silver up to 500 pounds in weight. He was lavish with his wealth to the poor and to the city. In a letter to the subdelegate of Batopilas, dated April 8, 1813, the commanding general of the provinces, Don Bernardo Bonaria called upon the good citizens of Batopilas for a loan, with instructions not to accept anything from the already too generous citizen Sr. D. Angel Bustamente. The king conferred upon him the titles of Marquis of Batopilas and Grandee of Spain for making such a donation of silver to the royal treasury as no vassal had ever presented before. Besides El Carmen, Bustamente owned the San Antonio, San Pedro, La Cata, Martinez, and Purisima mines.

In 1861 Mr. John R. Robinson bought the San Miguel and San Pedro mines from Sr. Ramirez. In 1879 came Mr. Alexander R. Shepherd of Washington. He closed a contract for the famous San Miguel mine, then bought the Robinson properties and later on the Descubridora, Ballinas, Martinez, San Antonio de los Tachos, San Antonio del Rio, Roncesvalles, San Miguelito, Santo Domingo and Animas. The La Pastraña passed into the hands of Geo. Lebrun, likewise the rich Valencia mine and the Nevada tunnel passed to Becerra Bros.

A great deal of the country about Batopilas has not yet been developed on account of the extreme rugged character of the mountains. In some places it seems as though the overhanging walls of the gorges almost form a complete vault and shut out the sun, light and air.

DIRECTORY OF MINING COMPANIES.

G. means gold, M. manganese, L. lead, S. silver, Z. zinc, C. copper, I. iron.

The information herein given was obtained by 1,000 letters addressed to mine owners. Any omissions and errors observed are therefor due to their negligence which I will gladly correct.—GRIGGS.

DISTRICT OF ANDRES DEL RIO.—County Seat, Batopilas.

COMPANIA MINERA "LA GLORIA."—Cerro Colorado, Batopilas. Oficina principal, Capuchines 10, Mexico, D. F.; local, Cerro Colorado. Andres Bermijillo, president. Mines, La Gloria, Diamante, El Rubi, etc. 6 Huntington mills; motors, steam; Leffel turbine, etc. 105 men. Alberto Piazzini, manager. (Same company as Sierra Mojada, Coah.)

BATOPILAS MINING CO.—Head office, 45 Broadway, New York. Mines, Todos Santos, Roncevalles, Giral, Cabuchin, Descubridora, Santa Maria, Cinco de Mayo, Animas, San Miguel, Porfirio Diaz. Tunnel, etc. 9 Bartlett concentrators; 125 stamp mill; 250 ton cyanide plant. 1000 employes.

ARTHUR SHEPHERD.—Office, Batopilas. Mines, 25 miles N. E. of Batopilas, Emma, La Grande, Concepcion, San Pedro, Zaragoza (lead-silver). Mining camp, La Bufa, La Abundancia del Rio, Batopilas. 15 employes.

BARRANCA COPPER CO.—120 Liberty street, New York. Barranca del Cobre, P. O. Mine, La Purisima. 20 stamp mill; 2 Huntington 4 foot; 100 ton smelter. 250 employes.

CIA. METALURGICA MEXICANA.—(Same as San Luis Potosi.) Head office 82 Beaver street, New York. Mines, Piedras Verdes, Andres del Rio District. C. W. Geddis, general manager; W. J. Parker, manager, at Urique. (Mill in construction.) 159 men.

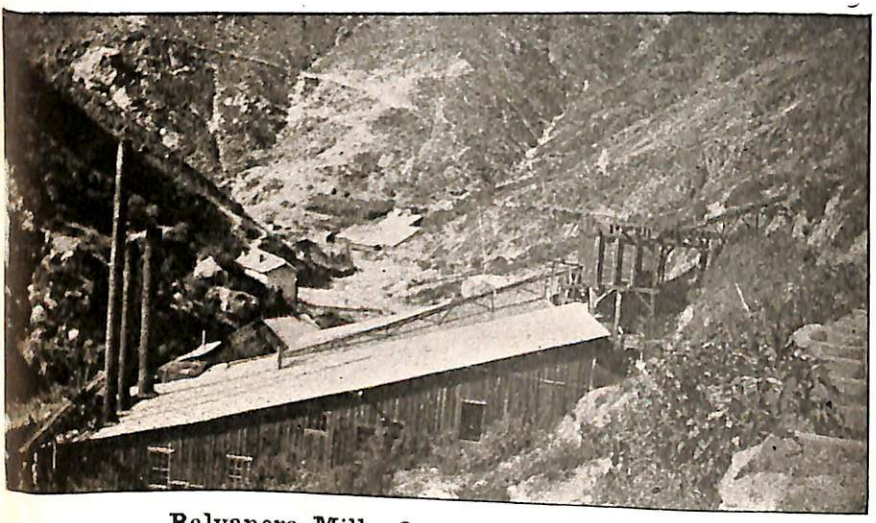
PRESIDENT MINING CO.—Head office Milwaukee, Wis., U. S. A. Mines at Carrizo, Urique, Andres del Rio District. J. B. Leuseder, manager; W. C. Allis, president. 50 employees.

MONTERDE MINING CO.—Head office, 717 1-2 State street, Santa Barbara, Cal. Mines at Monterde, Andres del Rio District. Mines Nuestra Sra del Carmen, Tres Garantias, Esperanza, Tres Garcias, Corona de Oro, (52 pertenencias). Henry S. Gane, president; Rufus M. Bagg, Jr., Ph. D., general manager; I. W. Breach, superintendent; E. W. Hayen, agent. Chihuahua address, P. O. Box 135. 50 employees.

SANTO DOMINGO MINING CO.—Philadelphia, Pa. Mines at Batopilas, Santo Domingo. Steam. 100 employees. Mines, Giral, Mendozena, El Carmen, San Antonio, Santo Domingo.

COMPANIA MINERA DE SAN GABRIEL.—Cerro Colorado, Batopilas. San Gabriel mine. 12 Huntington mills. 100 employees.

CHINIPAS MOUNTAIN SHOWING WINDINGS OF THE CHINIPAS RIVER.



Balvanera Mill. Ocampo District.

Ocampo (Jesús María) Rayon District.

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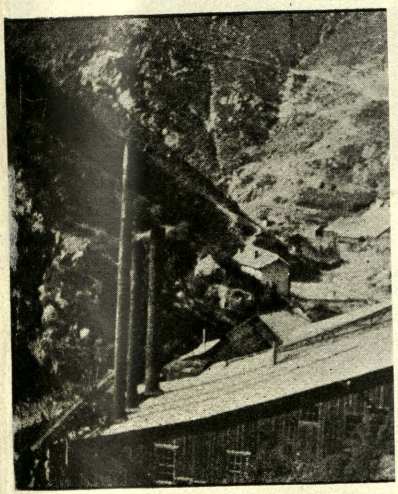


Balvanera Mill, C

SCHUYLER LAWRENCE, M. E.—Mines at Urique, Andres del Rio District. La Orosca, (S.-G.-L.), 300 feet of work done. Mine, Santa Eulalia, 1500 feet of work done, (S.-G.-L.), (11 pertenencias); Home office, Chihuahua, P. O. Box 3.

TRI-STATE DEVELOPMENT CO. and CHIHUAHUA SINALOA DEVELOPMENT CO.—Mines in this district are the following: near Urique; No. 44, Silvestre, (S.-L.); 45, Willson, (S.-L.); 46, Nathan, (S.-L.); 47, Monserrat, (S.-L.). Near Cerrocahui: 33, Randall, (S.-G.); 34, Pollack, (G.-S.); 35, Garside, (G.-S.); 36, The Woods, (C.-S.); 37, Peon, (S.-L.); 38, Baron Boxel, (G.-S.). See District Iturbide and District Arteaga. A. E. Stillwell, president.

BUENAVENTURA BECERRA.—Home office, Urique, Andres del Rio, also office at Chihuahua, corner Ojinaga and Third streets. Mines at Urique, San Navor, Sangre de Cristo, Guadalupe, Providencia, San Francisco, El Salta, El Nuevo Siglo, Bravo, La Corrigedora, Santa Maria, San Gildardo, Todos Santo, Santa Teresa, El Sufragio, La Padrona, El Gallo, El Rosario, etc., Porfirio Diaz, El Cobre, Hidalgo, El Pavellon. Reduction mill, 30 H. P.

MANUEL PEREZ.—La Dura, municipality of Morelos. Mines at San Pedro, San Pedro No. 2, etc. 20 employees.

LLUVIA DE ORO GOLD MINING CO.—Home office, Rialto Building, St. Louis, Mo. James Campbell, president, 505 Union Trust, Los Angeles, Calif. Mines, Lluvia de Oro, Cuautemoc, etc. at Lluvia de Oro, District Andres del Rio. Robert J. Coleman, manager. 20 stamp mill; 100 stamps and cyanide now being erected. 150 men at construction and road building.

SOUTHERN MINING CO.—Urique. Mines at Dolores, Andres del Rio District. Postoffice address, Urique.

MENDOZA Y COMPANIA.—Urique, Andres del Rio District. Mines, Purisima and No 1, No. 2 and No. 3. Amalgamation.

HACIENDA DE SANTA ROSA.— Morelos. Enrique C. Creel, proprietor. Address, Chihuauha, corner Libertad and Second streets. Mines at Morelos, San Gil, (S.). 41 hectares.

J. H. MILLIKEN.—Morelos, District Andres del Rio. Mines Dolores, La Dura. Mill, amalgamation.

A. H. MALANEY.—Morelos, District Andres del Rio. Mine, El Progreso. Mill, amalgamation.

HEMENEGILDO GUITERREZ.— Urique, Andres del Rio. Mines, Guadalupe and Santos Reyes. Mill, amalgamation and smelter.

ORO FINO MINING COMPANY.—Home office, Boston, Mass. Properties near Morelos, Andres del Rio District. Address, via Choix, Sinaloa. (S.-G.). 20,000 feet development work. George W. Bradley, superintendent. 10 stamp mill in construction.

DISTRICT ARTEAGA.—County Seat, Chinipas.

PALMAREJO & MEXICO GOLD FIELDS, LTD.—Head office, 32 Old Jewry, London, E. C. London. Mines at Chinipas, Palmarejo, District Arteaga. William A. Pomeroy, manager. Mines

Palmarejo Uruapa, etc. 59 stamp mill;200 ton cyanide plant; 10 Wilfley concentrators; Blake crushers, etc. 500 employees.

WHITE CHIEF MINING & MILLING CO.—Home office, San Francisco, 217 Sansome street. Chinipas, District Arteaga. L. T. Pockman, manager. Mines San Francisco, Chinipas, etc. 15 H. P. compressors, etc. 100 employees.

RIO PLATA MINING COMPANY, COMPANIA MINERA RIO DE PLATA, S. A.—Home office, Chihuahua, 212 Aldama street, P. O. Box 250. N. O. Bagge, president; D. W. Shanks, general manager; H. W. Edmondson, superintendent. Mines, Santa Barbara, Guazapares. 25 stamp mill; 60 ton cyanide plant; 200 H. P. hydraulic, two Pelton wheels, etc.

TRI-STATE DEVELOPMENT CO.—Chihuahua. Mines in this district are as follows: No. 17, Peso de Oro, (G.-S.-M.); 19, Veta Grande, (L.-S.); 39, El Ingeniero, (G.-S.); 41 El Licenciado, (G.-S.-M.); 89, Gambucino. (G.-S.); 90, Prospectador, (C.-L.-G.): 91, Barretero, (G.-S.-M.); 92, Ensayador, (C.-S.) ;93, General, (G.-S.); 94, Coronel, (G.-S.); 95, Mayor, (C.-S.); 96, Capitan, (L.-S.); 97, Teniente, (L.-S.); 98, Sargento, (C.-G.); 99,Cabo, (G.S.). (See District Iturbide). Address, Chihuahua, Calle Victoria, 312, Kansas City Mexico & Orient Railway office.

GOLD FIELDS, LTD.—Chinipas, Arteaga district. Mine, Proteccion, Arthur Nickson, (G. and S.).

THE OXNAM PROSPECTING CO., (NO. 1), LTD.—Home address, 32 Jewry, London, E. C. Mines at Guerra al Tirano. P. O. address,Guazapares. Mines, Gerrea al Tirana, La Patria, Bonanza. Oliver B. Finn, manager, Guazapares. 100 H. P. mill. engine, dry crushing, roll, cyanide, 30 H. P. hoist. 100 employees.

GUAZAPARES MINING & MILLING.—Guazapares, Arteaga district. J. R. Harbord, manager. Mines, Sangre de Cristo. 40 ton lixiviation plant, steam. (G, and S.). J. H. Husted, agent at Parral, P. O. Box 37.

KANSAS & MEXICAN PROSPECTING & DEVELOPMENT CO. —Home office, Sedan, Kansas. (Owners are from Kansas and Oklahoma and are also interested in the oil fields.) Chinipas, P. O. address. C. B. Foley, manager.

DISTRICT BRAVOS.— County Seat, Ciudad Juarez.

COMPANIA MINERA LA REPUBLICA, S. A.—Head office, Ciudad Juarez; office El Paso, Texas. (Capital $90,000) John J. Mundy, president; Benjamin F. Darbyshire, secretary; Morris B. Parker, treasurer and general manager. Mines at Uruachic.

THE HOBO MINING CO., S. A.—Office, Ciudad Juarez and El Paso, Texas. (Capital $20,000.) Thomas J. Woodside, president and general manager; Claude V. Baker, treasurer; Walter B. Randall, secretary; Raleigh Abernathy, director.

COMPANIA MEXICANA EXPLORADORA SONOYTIA, S. A.—Office Ciudad Juarez and El Paso, Texas. Jose A. Rodgers, president and treasurer; Raymundo Cano, vice president: Eduardo Montes de Oca, secretary.

COMPANIA CARBONIFERA DE CIUDAD JUAREZ, S. A.—Offices, Ciudad Juarez and El Paso, Texas. Max Webber, president and general manager. Properties at Ciudad Juarez, formerly of Manuel M. Bauche, 335,000 acres. Offices at Guaranty Trust building, corner San Antonio and South Stanton streets, El Paso, Texas.

PALOMAS MINING & DEVELOPMENT CO.—Patrick F. Brick, president; Joseph Brick, secretary and treasurer. Offices at Ciudad Juarez and El Paso, Texas. Mines at Palomas.

WILLIS MINING CO.—Head office, Colorado Springs, Colo. Mines, at Ojo Caliente. Mine, Willis, (Silver, gold, bismuth.) Constancia. 15 H. P. gasoline hoist. Agent, O. S. Osborn, Toltec Club, El Paso, Texas; J. H. Gasson, manager.

CHIHUAHUA COPPER CO.—Home office, Lowell, Mass. Address M. B. Parker, manager, El Paso, Texas. Mines at Rosario, Sierra de los Arrados, (20 miles west of Moctezuma), District Bravos. Mines, Rosario, Buena Vista. 22 H. P. gasoline engine, air compressor, hoist. 15 men.

SAN SALVADOR PLATA COBRE MINING CO.—Offices at El Paso, Texas and Ciudad Juarez. W. Thompson, president and manager; Thomas F. Day, treasurer; Claudio Riva Petit, secretary. Mine San Salvador.

INTERNATIONAL PORTLAND CEMENT CO. of CIUDAD JUAREZ, S. A.—(Under the laws of the state of Chihuahua.) Offices at Ciudad Juarez and El Paso, Texas. Properties purchased from the Compania Carbonifera de Ciudad Juarez, S. A. 1130 acres. Near the old dam across the Rio Grande. Bernardo Shuster president. Offices at Guaranty Trust building, corner San Antonio and South Stanton streets, El Paso, Texas.

CORNEA MINING CO.—Home office, El Paso, Texas. James F. Bennett,Jr., superintendent. Mine La Cornea, (G. and S.). H. F. Bennett general manager, El Paso, Texas.

DISTRICT OF CAMARGO.—Ciudad Camargo, (Santa Rosalia.)

COMPANIA MINERA DE NAICA, S. A.—Gerente, G. Ornelas, San Pedro, Coahuila. Mines at Naica, via Estacion Concho, District Camargo. Dolores, San Francisco, Toledo, San Vicente, etc. Two 40 h. p. electric hoists; one 34 h. p. gasoline hoist, etc. 280 employees. 3000 tons production per month.

COMPANIA MINERA CRUZ DEL SUR, S. A.—Head office, Camargo, (Santa Rosalia). Mines at Naica. Alfa. James E. Garrett, manager at Naica. Gasoline hoists.

COMPANIA MINERA LEPANTO, S. A.—Head office, Chihuaua, Paseo Bolivar. Jose de Stéfano, president. Mines at Naica, via Concho station. Two steam hoists, two engines. Mines, Lepanto, and Oriental.

COMPANIA MINERA SIGLO XX, S. A.—Home office, Chihuahua. Mines at Naica. Siglo XX. Victor Hecter, president and manager. 24 H. P. hoist.

THE ENCINILLAS MINES, LTD.—Home office, Billiter building, London. Joseph Constantine, president, Middlesboro, England. Directors, W. Pickering, W. Runciman and C. A. Yervelund. Smelting and reduction works, 200 tons capacity. (Not in operation at present.) The smelter is located at Camargo.

GUADALUPE MINING CO.—Address Vincente Visconti, P. O. Box 45, (Santa Rosalia) Ciudad Camargo. Mine, Guadalupe.

SAUCILLO QUICKSILVER MINING CO.—Mines and address, Saucillo, District Camargo. (Cinnabar.) General office, 71 Broadway, New York. Address Santa Cruz.

ANGELO-MEXICAN SYNDICATE, LTD.—Home office, London. Mines Walhalla, Garcia, Anexas de Dolores.

COMPANIA MINERA DE SAN ANTONIO.— Mines Xochlt, Marina, Amplivicacio. Two first at Santa Rosalia the last one at Rosales. Address, Camargo, (32 hect.)

COMPANIA MINERA SENSITIVA.— Naica, via La Cruz. Mine, Sensitiva. William Kraft, manager. Office, 240 Ocampo avenue, Chihuahua.

CIA. MINERA RAMON CORONA.—Naica. via La Cruz. Mine Ramon Corona. George Stinson, manager.

COMPANIA MINERA SAN PATRICIO.—Naica, via La Cruz.

COMPANIA MINERA CAROLINA DE NAICA, S. A.—Main office, Chihuahua. Ramon F. Lujan, president; Carlos Cuilty,secretary; Lic. Manuel L. Lujan, vice president; Jose Asunsolo, treasurer; Cristobal M. Ortiz, comisario. Mines at Naica.

COMPANIA MINERA SENSITIVA DE NAICA, S. A.—Main offices Chihuahua. Ramon F. Lujan, president; Manuel L. Lujan, secretary; Jesus Garcia Acosta. treasurer; Anselmo Lujan, comisario. William Kraft, manager. Mines, Sensitiva, etc., at Naica.

COMPANIA MINERA "SIGLO XX," S. A.—Home office, Chihuahua. Victor Hector, president. Mine at Naica, Siglo XX. 25 h. p. gasoline hoist. Mauricio Chavirra, manager, at Camargo.

GALEANA DISTRICT.— County Seat, Casas Grandes.

DOS CABEZAS MINING CO.—Head office, 29 Broadway, New York. Mine at Dos Cabezas, District, Galeana. Post office, Nueva Casas Grandes. 10 stamp mill, etc. 250 men. C. H. Kearney, manager.

AVENTURERA MINING COMPANY.—Head office, El Paso, Texas. Britton Davis, El Paso, Texas. Mines at Sabinal, Dis-

trict Galeana. Santo Domining, Aventurera, Antonette,etc. Three steam hoists, one 25 H. P. gasoline, etc. 25 men. 1000 ton production per month.

TRES AMIGOS GOLD MINING CO.— Office Colonia Juarez, via Casas Grandes. B. L. Croff, president and manager. Mines at Guaynopa, District Guerrero. Tres Amigos and Cinco de Mayo, (G.-S.-C.)

VIZNAGA MINING CO.—Sabinal, District Galeana. D. C. Sutton, manager. Mines, Viznaga, Nopal, Palo Alto, etc. Gasoline engines. 10 men.

MEXICAN GOLD- COPPER CO.—Head office, Los Angeles, Calif. Agent, Edmond Richardson, Colonia Diaz, via Ascencion, District Galeana. Mines Utah, etc. (200 pertenencias.) (G. and C.)

AZTEC MINING CO.—Sabinal, San Blaz, District Galeana. Mine, San Salvador. D. C. Sutton, manager. 10 employees.

SAN PEDRO MINING CO.—Address and mines at Leon, via San Pedro. (Rio Grande, Sierra Madre & Pacific R. R.) L. Bryant, manager.

COMPANIA MINERA FLOR DE MARZO.—Office at Ascencion, District Galeana. Mine, Flor de Marzo.

MEXICAN CONSOLIDATED MINING AND SMELTING CO.—Head office, 60 State street, Boston, Mass. Steam. (G.-S.-C)

COMPTON MINING CO.—Casas Grandes.

CANDELARIA MINING CO.—Home office 100 Broadway, New York. E. D. Morgan, president; C. I. Reeves, secretary and treasurer; N. C. Thompson, manager. Mines at San Pedro. Candelario, San Nicolas, San Pedro, Leon, Congreso, etc. 1100 pertenencias. 11 hoists, 2 air compressors. 800 H. P. steam and gas.

DISTRICT GUERRERO.— Ciudad Guerrero.

DIOS TE GUIE GOLD MINING COMPANY, LTD.—Head office, London; local, Dios te Guie, Yepachic, Guerrero district. Alexander Bonthrone, general manager. Mines, Regeneradora, Concordia, Providencia, Venturino Philadelfia, Anexas de Dios te Guie, Hondo, etc. 40 H. P. steam hoist. 25 employees.

DOLORES MINES CO., LTD.—Home office, 111 Broadway, New York; local, Dolores, District Guerrero. Mines Alma de Maria Bohemia, Dolores, San Francisco, etc. Stamp; 250 H. P. engine; tube mill; amalgamation and cyanide plant. W. H. Paul, manager; W. J. Faragut, assistant manager;Geo. H. Shroeter, engineer and manager. 500 employees. 2000 tons daily.

TRES AMIGOS GOLD MINING CO.—Office Colonia Juarez, via Casas Grandes, District Galeana. Mines at Guaynopa, District Guerrero. Tres Amigos and Cinco de Mayo. B. L. Croff, president and manager. (G.-S.-C.) Offices at San Francisco, Calif., and Seattle, Wash.

MEXICAN GOLD-COPPER CO.—Head offices 224 Douglas building, Calif. Alexander Graydon, president and general manager. Mine at Guaynopa, Guerrero district. 200 pertenencias. Edmond Richardson, agent at Colonia Diaz, District Galeana. C. H. Hadley, superintendent.

THE ERL SYNDICATE, LTD.—Home address, 9 Throckmorton avenue, London. Mines at Dios te Guie, Yepachic, Guerrero District. Alexander Bonthrone, manager. Mines, La Union, San Salvador, Confianza, San Felix, San Antonio, etc. 15 men on development work.

MINA DOS DE ABRIL MINING CO.—Home office, 32 Liberty street, New York. Mines, Dos de Abril, etc, at Huizopa, Temosachic, District Guerrero. John W. Piper, president and manager. Address, P. O. Box 181, Chihuahua.

VIRGINIA C. MINING & MILLING CO.—Mines at Mesa Correo, Philipe Shew, president. Mines at Temosachic; T. B. Rains, manager; mine at Hidalgo, on the Tetuec river. Steam hoist, 80 H. P. (Construction). T. B. Stevens, secretary.

COMPANIA MINERA "EL CONTINENTE," S. A.—W. K. Ryan, president; R. M. Dudley, manager. Address, P. O. Box 213, Chihuahua, Calle Cuarto, 179. Hidalgo zinc mine near Calera, District Guerrero. (See District Iturbide for other mines of this company.)

CALERA MINING CO.—Home office, New York. C. A. Pringle, manager, Calera, San Isidro, District Guerrero. Calera mine, (Zinc.) (100 ton concentrating Sutton-Steele mill costructing.)

LOS LETREROS MINING CO.— Mine, Los Letreros, via Temosachic, District Guerrero. Charles Boggs, president and manager. 230 foot shaft. George Griggs, agent, 182 V. Guerrero avenue, Chihuahua.

CONSUELO MINING MILLING & POWER CO.—Consuelo mine. Address, Temosachic, District Guerrero.

THE GUAYNOPA MINING CO.—Mr. Rice, general manager, El Paso, Texas; Howard Veidel, superintendent, Guaynopa, District Guerrero. Mine Guaynopa.

THE UTAH MINING CO.—(Organized under the laws of Arizona, Capital $3,000.00 gold.) Tunnel 100 feet. Office at Douglas, Arizona; El Paso, Texas; Los Angeles, California. J. C. Warrel, superintendent, Guaynopa, District Guerrero.

SAN ANTONIO MINES CO.—Office Dios te Guie. Alexander Bonthrone, general manager, Yepachic. Mines, San Antonio, at San Antonio. 12 men on development work.

DISTRICT HIDALGO.—County Seat, Hidalgo del Parral.

VETA COLORADO MINING AND SMELTING CO.—Head office, 111 Fifth avenue, New York. Mines at (Minas Nuevas), Villa Escobedo. John W. Connor, P. O. Box 145, Parral, manager. Mine, Quebradillas 300 H. P. plant (electricity). Two 50 H. P. hoists; 250 ton cyanide mill, (construction). 100 ton daily production. 350 men.

UNITED STATES MINING CO.—Philadelphia, Penn., U. S. A. J. W. Marshall, Villa Escobar (Minas Nuevas). Mines, San Antonio, Santa Gertrudis, etc. 500 H. P. Two engines, two hoists etc. 115 men.

SIERRA PLATA MINING CO.—(Minas Nuevas) Villa Escobedo. Austin L. Peay, manager. Mine Los Muertos. Hoist and engine, 50 H. P.; 100 ton production. 150 men.

MONTEZUMA LEAD CO.—Head office, 82 Beaver street, New York. G. H. Carnahan, Santa Barbara, manager. Mines Mina de Agua, Novedad, Cabrestante, Los Angeles, etc. 400 ton concentrator. 1600 H. P.

CAMPAGNIE MINIERE DE SAN FRANCISCO DEL ORO ET ANNEXES.— Head office, Bayonne. Paul Gaudin, Santa Barbara, apartment No. 1. Parral office, Victor Esperon M. E. Mines at Santa Barbara, Alfareña, La Paz No. 1, La Paz No. 2, San Martin. Concentrator, mill, electric hoist, two pumping plants (electric), gas generator, 100 H. P. 100 tons daily production. 100 men.

LA VENCEDORA MINING CO.—Los Solises, La Vencedora, Hidalgo District. George W. Dithridge, manager; E. L. Dithridge, secretary. Mines at Los Solises, La Vencedora. 50 H. P. Steam and gasoline. 100 tons production. 40 men.

THE HIDALGO MINING CO.—Parral. James I. Long, general manager; R. J. Long, general superintendent. Mines at Parral, Morena, Alfareña, Preseña, Las Cruces, Caldeña, Las Juanico, etc. Two mills (300 ton lixivation), steam hoist, etc (G.-S.-L) 500 employees.

LA CAROLINA MINING CO.—Los Solices, Vencedora. District Hidalgo. George W. Dithridge, manager. Mine La Carolina (beginning operations).

BUENA VISTA GOLD MINING CO., OF MEXICO.—Los Azules, municipality of Santa Barbara. Nominal office, New Jersey, U. S. A.. William V. Pettit, general manager, Box 60, Hidalgo del Parral. Mines, Adela, San Pedro, San Jose, Mary, Montaña, Cortez, etc. Complete machinery for perforators and compressors.

GEORGE W. DITHRIDGE.—Municipality of Santa Barbara. Mines, Esmeralda, No 3 Soledad, Inglesa, Molina, Vecendora, Esperanza, Santo Niño, Ethelwyne, Carolina, Insistencia, Porvenir. Recompenza No. 2, Standarte, Refugio, Las Vacas, Union, Aurora, Amplicacion, Aurora San Miguel, etc.

GLADYS PROPRIETARY GOLD MINES, LTD.—Home office, London, E. C. Mine, El Bronce, etc, Parral District.. 12 dip claims. Properties at Vencedora. Local address, office at Parral, A. Spencer Cragoe, consulting mining engineer and general manager.

EL RAYO MINING CO.—See the Rayo Mines Co.

DESCUBRIDORA DEVELOPMENT CO.—See the Rayo Mines Co.

AMERICAN SMELTERS SECURITIES CO.—(See District Jimenez) Parral, general office, P. O. Box 119. New York address, 1 Broadway. Mines Veta Grande and Verde Demacias at Minas

Nuevas, Verde and Sangre de Cristo at Parral, Segovia No. 4 and Marina at Santa Barbara. 600 H. P., steam and gasoline.

HUEJOTITTAN PLACER CO.—Home office, San Antonio, Texas. Mr. Dignowity, president, John Dignowity, manager. Properties on the Conchos river near Huejotittan. Hydraulic and developing quartz.

RED HILL MINING CO.—Stallfroth, District Hidalgo. Red Hill mine. 250 foot shaft. Steam; Krupp ball mill. 20 H. P.. Gorham Manufacturing Co., Nineteenth and Broadway, New York.

COMPANIA MINERA LA COAHUILENSE.—Office, Parral. Mines at Parral, Las Herspides, Allende, La Suiza; at Minas Nuevas, La Parena; at Santa Barbara, Helvercia.

PARRAL DEEP LEVELS CO.—Address Parral. Mines, La Isabela; at (Minas Nuevas) Villa Escobedo. Jas. F. Flynn, P. O. Box 95. 200 pertenencias.

COMPANIA MINERA EL REFUGIO.—Villa Escobeda (Minas Nuevas). Proprietor and manager, Angel Garcia, P. O. Box 20. 150 ton lixivation plant; steam; 3 rolls, 3 Blake Crushers.

CIA MINERA LA PAMILLA.—Pedro Alvarado, president; Jose Griensen, manager. Mine, La Pallmilla. Steam and electricity, hoists, etc.

COMPANIA MINERA SANTA ANA Y ALLASGO.—Parral. (S.-L.-G.). (Minas Nuevas) Villa Escobedo, Allasgo, Santa Ana, Ample de Santa Ana.

PARRAL MINING CORPORATION.—Parral. Mines, San Patricio and Annexas. Chas. W. Graham.

COMPANIA METALURGICA DE TORREON, S. A.—Head office, Torreon. Agencies at Chihuahua and Parral. Mines, Santa Barbara, San Diego and Annexas. 300 H. P.

PITTSBURG MINING CO.—Santa Barbara. Perros Bravos. 50 H. P. E. M. Ray, manager.

GORHAM MANUFACTURING CO.—Boston, Mass. Mines, (Minas Nuevas) Villa Escobedo, Cerro Colorado. 150 H. P.; amalgamation plant at San Isidro de las Cuevas.

PARRAL MINES, LTD.—Address, Parral. Mines at Santa Barbara, Las Vacas, Union, El Refugio. (London.) 30 stamp mill.

AMERICAN ZINC EXTRACTION CO.—Parral. Mine, El Tajo. Address, Parral, District Hidalgo.

BECKMAN MINES CO.—Address, Santa Barbara. Wm. C. Beckman, president, address, Parral. Mines at Santa Barbara, El Porvenir, Esperanza, Demasias.

CLARINES MINING CO.—Home office, Phoenix, Arizona. B. W. McCausland, president; R. D. McCausland, secretary and manager. Mine, Los Clarines. Hoists, etc. One 16 and one 22 h. p. gasoline engine. Address, Santa Barbara.

LOS BRONCES MINING CO.—Home office, Phoenix, Arizona; local, Santa Barbara. B. W. McCausland, president; R. D. McCausland, secretary and manager. Mines, Los Bronces, La Esperanza, Kru-

ger, (24 pertenencias). Steam; hoist; 25 H. P.. Address Parral, Mines at San Francisco del Oro.

SANTA BARBARA MINING & MILLING CO.—Home office,Bucyrus, Ohio. W. E. Matthews president; Grant G. Gillette, manager and director; R. D. McCausland, engineer. 110 pertenencias. Local office, Santa Barbara.

LOS COLORADOS MINING CO.— Home office, Atlanta, Georgia. (Capital $5,000,000). 156 mining claims at Santa Barbara, Los Trenes, Los Solises, (S.-G.-L. and Z.). M. W. McKenzie, president; Atlanta, Georgia; A. M. Dobbs, vice president and general manager; M. W. Stovall secretary; M. R. Wilkinson, secretary and treasurer; directors, J. W. Estes, C. W. McClure, M. M. Sessions, J. F. Johnston, manager, Parral.

THE PALMAR MINING CO.—D. W. Grubbs, president and Enrique C. Miller, vice president, directors. (Company organized in Indiana, U. S. A.) Mine, Palmar, Parral District. Manuel Aguilar, manager.

IGUANA MINING CO.—A. R. Grigsby, assistant manager. Iguana mine. 120 h. p. hoists, etc.

GUADALUPE MINING CO.—W. W. Phillips, manager.

THE MARINA MINES OF MEXICO.—Home office, England. Mines, Cuadras and Marina mines at Santa Barbara.

LA PAZ MINING CO.—Mines and address at Santa Barbara.

NORWAY MINE CO.—Adress Roncesvalles, via Santa Barbara. Mine, Norway.

PROVEDENCIA MINING CO.—Address Parral, District Hidalgo. A. A. Evans, manager.

CAPUZAYA MINING CO.—Address, Parral, Hidalgo District. Eugene Davis, manager, 512 Colorado building, Washington, D. C. Gas, 10 H. P. (S.-L.)

BIG FOUR MINING CO.—Address, Parral, Hidalgo District. D. M. Evans, manager, Parral. (Smelter constructing.)

COMPANIA METALURGIA DEL TORREON, S. A.—Head office, Torreon. Evaristo Madero, president. Agencies at Parral, Chihuahua, etc. James Hambleton, manager. Complete sampling works; 25 H. P.

VETA COLORADO DEEP LEVELS CO.—Home office, Parral. P. O. Box 95. James F. Flynn, president and general manager. 180 pertenencias. Mines, La Fortuna, Santa Fe, Rand.

VETA GRANDE Y ANEXAS MINING CO.—A. J. Anderson, subsuperintendent.

SAN NICOLAS MINING CO.—Parral. E. M. Parrish, manager. (S. and L.)

MEXICAN STANDARD MINING CO.—Burling Slip, New York. J. Bonham, manager. (G. S. Cu. L.) 5 stamp mill, etc.

REFUGIO MINING CO.—Villa Escobedo (Minas Nuevas). W. C. Beckman, president. Mines of Refugio (of Sr. Angel Garcia). W. J. Morril, manager. 450 h. p. steam; 2 dynamos, electric, etc.

SAGINAW LUMBER COMPANY.—Home office, Saginaw, Mich. Henry Gamble, manager, Parral. Mines, those owned by the Fourth of July (4 de Julio) Mining Company, of Parral. President of this company, J. H. Thomas; comisario, J. Y. Baskin.

THE SAN FRANCISCO DEL ORO MINES, LTD.—Home office, London, England. Earl of Denbigh, president, 65 London Wall, London; James Hyslop, manager. Mines at San Francisco del Oro, near Santa Barbara. 2 engines 500 h. p.; electric hoists, etc. Mines, Sto. Tomas, Zainas. 122 mining claims. (300 ton mill in construction.)

THE RAYO MINES CO.—W. S. Thompson, president, 30 Broad street, New York. (This company now comprises the old Rayo Development Co., or Rayo Mining Co., as well as the Descubridora Mining & Development Co., of Mr. J. F. Johnson.) The mines are Descubridora, Rayo, Alta, California, La Paz, Hidalgo, Independencia, Morelos, Sonora, Salvador (300 hectares). Reduction works being constructed at San Jose, via Santa Barbara.

FOURTH OF JULY (or 4 de Julio) MINING CO.—See Saginaw Lumber Co.

PARRAL-CHIHUAHUA MINES CO.—J. F. Johnston, president and general manager. Home office, Parral, P. O. Box 123. Mines, Santa Rosa, Amplificacion de Santa Rosa, Confianza, La Cruz No. 2, Sta. Eduvigues, Sta. Eduvigues No. 2, etc.

NORTH AMERICAN MINES & SMELTING CO.—J. F. Johnston, president. Address, Parral, P. O. Box 123. Mines at Rio Florida, Jimenez District, El Duke, Gemenes, La Higa, Samarastra, Trolly, Riscos (Cu, Mn, L, G).

CIA. MINERA VENECIA Y ROMA, DEL PARRAL, MEXICO, S. A.—General office, Mexico City. Sr. Pastor de Celis, president; Lic. Enrique Orosco, secretary; comisario, Jose Lopez Montezuma; Moran Tomas and E. E. Styner, alternates. Mines at Belleza, Roma (100 hectares); at Minas Nuevas, Villa Escobedo, Venecio y Anexas, Manguita, Prima, Prueva, Minero and Napoles.

THE UNITED PARRAL MINES COMPANY (Under the laws of Arizona).—General office, Los Angeles, Calif. Maj. Joseph Hardie, president; Sr. Manuel Aguilera, general manager. Office, Parral. 50 mining claims; La Palmira, etc.

THE DIAZ MINES, LTD.—Address, Parral. Mines, Amplificacion de Aurora.

GRAN FUNDICION MEXICANA DE MONTERREY.—Home office, Monterrey, Coahuila. Mine, Damasia, at Santa Barbara, District Hidalgo, Catarinas.

COMPANIA MINERA LA ESMERALDA.—Villa Escobedo (Minas Nuevas). Mines, La Esmeralda and San Maximo.

COMPANIA MINERA LA SOLEDAD.—Villa Escobedo (Minas Nuevas). Mines, La Soledad and Garantia, Damacias No. 2, San Expedito, Netzalmalcoyoc.

THE HIDALGO PLACER MINING & MILLING CO.—Parral. Mine at Las Cuevas, Delfina; at Parral, Florentina.

EXPLORADORA HIDALGO, S. A.—Address, Parral. Mines at Santa Barbara, La Indita; at Parral, Locomotoras; at Baborigame (District Mina), La Exploradora.

SAN SALVADOR MINING CO.—Address, Parral. Mine, San Salvador. H. E. Thompson, manager.

GRENADENA MINING CO.—Grenadena, via Santa Barbara. 100 ton mill; concentrator. Daniel Colyer, president; Kit Colyer, manager.

COMPANIA MINERA VESPER Y ANEXAS.—Parral. Mine, Amplificacion de Vesper, at Parral.

LA EXPLORADORA CO. DE BELLVILLE, LTD.— Santa Barbara. Mine, Cinco de Mayo, at Santa Barbara.

INDEPENDENCIA MINING & MILLING CO.—Santa Barbara. Mine, La Esmeralda, at Santa Barbara.

COMPANIA CONSUELO Y ANEXAS.—At Parral. Mines, Las Maravillas, Alaska.

COMPANIA MINERA EL MERIDIANO, S. A.—Villa Escobedo (Minas Nuevas) (166 mining claims). Mines, Boston, Atentas, Roma, Galveston, Orange, Las Parraleas, Baltimore, Gran Veta, Transvaal, Natal, Chicago, Intermedia, Londres.

INTERNATIONAL GOLD MINES COMPANY.—Of Parral. (We have no particulars as yet of said company.)

PARRAL & SANTA MARIA MINING CO.—Home offices, Villa Escobedo (Minas Nuevas). Offices, Los Angeles and San Francisco. Mine, Brittana. 320 foot shaft. Wm. Lund of San Francisco.

PARRAL POWER & REDUCTION CO.—Home office, New Jersey. John W. Griggs (ex-U. S. attorney general), president; Dr. Slocum, manager, Parral; H. L. Griggs, secretary. Power plant at Parral; 1,200 h. p. double line on steel towers to Minas Nuevas and Palmilla. Capital $5,000,000. Leopoldo Iwonsky and Morrison Fetzer, agents.

DISTRICT ITURBIDE.—Capital, Chihuahua.

SANTA EULALIA EXPLORATION COMPANY.—Head office, Mills Building, San Francisco, Cal., U. S. A.; local office, Chihuahua, Calle Victoria, 308. Dr. H. Nelson Jackson, manager director, P. O. Box 206. Mines, Buena Tierra, San Antonio Chico, Salander, etc., at Santa Eulalia. 250 h. p. steam hoist; headframe; 5 drill compressors; crusher; two 25 h. p. gasoline, etc.

JESUS AGUIRRE NEVAREZ Y CIA.—Chihuahua, Calle Aldama, 818. Mines, Las Animas and Patrocinio, in Santa Eulalia and in Minillas. Las Animas has two 25 and 30 h. p. motors, gasoline. 25 employes. Ciro Aguirre, manager.

AMERICAN SMELTING & REFINING CO.—Head office, 71 Broadway, New York. G. C. Kaufman. Mines, Santo Domingo, Mina Vieja, Velardeña, San Antonio, at Santa Eulalia. Steam, 125 h. p.; gasoline 44 h. p.; gasoline, 25 h. p.; gasoline, 22 h. p. and 12 h. p. gasoline. John H. Mitchell, manager, Mina Vieja. 230 employes. 3,000 tons per month.

JOSEFINA CONSOLIDATED MINING CO.—Head office, Chihuahua. President, Enrique Gosch; S. G. Burn, manager. Mines, Josefina, Carolina, Enriqueta, Anexa de Enriqueta, etc. (298 pertenencias). Gasoline, 12 h. p. hoist. 48 men.

SAN ANDRES MINING & SMELTING CO.—Head office, 141 Halburn, London. W. C. Walton, president; S. G. Burn, consulting engineer and manager, Box 24, Chihuahua. Santa Eulalia mines, San Andres (properties of E. C. Creel). 12 h. p. gasoline.

NEGOCIACION MINERA DEL NORTE.—Bernardo Garcia, president; Alejandro Erias, secretary. Office, Lluvia de Oro, Andres del Rio District. Joaquin Duran, manager, Chihuahua. Mines at Santa Eulalia, Cosineras, Concepcion, San Joaquin y Natividad; at Parral, Donato Guerra.

DESCUBRIDORA MINING CO.—Head office, San Francisco, Cal. F. G. Drum, president; W. H. Kraft, manager, Chihuahua, P. O. Box 98. Mine, Descubridora, near town.

AGUSTIN ESCOBAR Y CIA.—Head office, Chihuahua, 510 Libertad street. Agustin Escobar, manager; George Jacobs, secretary. Mina Dolores at Santa Eulalia. 4 crushers 25 h. p. gasoline; Huntington mill.

COMPANIA MINERA DE RIO TINTO MEXICANO.—Terrazas (Torreon). Principal office, Chihuahua. Juan A. Creel, gerente. Mines, Rio Tinto, Esmeralda, España, Brazil, Magistral, San Francisco, San Alberto, Promontorio, Bronce, Plomosa, La Verde, La Prieta, etc. Fundicion; three steam hoists, 100 h. p.; smelter. 300 men. 250 tons per day. David Goodale, manager, Terrazas.

TWO KINGS MINING & EXPLORATION CO.—Santa Eulalia. Texas mine. S. H. Worrel, manager. 200 foot shaft; 4 h. p. gasoline hoist.

DIAMANTE MINING CO.—Home office, 515 Capitol street, Charleston, W. Virginia. M. H. Straughan, president; W. L. Ashby, secretary; A. G. Sanders, manager. Mines, Diamante, at Santa Eulalia; Cuchillo Parado, Mariposa, Golondrina, Pablo Ochoa, at Alomoyoya. Owned by same company.

PARCIONERA MINING CO.—Santa Eulalia. Mines, Parcionera, 1260 foot shaft, 250 h. p. steam hoist; San Jose mine, 250 foot shaft, 12 h. p. hoist, steam. Carlos Qualey, manager. Chihuahua address, 5 Guerrero avenue. 60 men employed.

SAN JUAN MINING CO.—F. Chappellet, manager, Santa Eulalia. Mine, San Juan. 25 h. p. steam hoist.

SANTA EULALIA MINING CO.—Home office, San Francisco, Cal. Mine, 1500 foot shaft, 150 h. p. steam engine; shaft No. 2, 600 feet, 50 h. p. steam; and shaft No. 3, 1,500 feet, 150 h. p. engine. J. H. Williamson, agent, P. O. Box 226, Chihuahua.

OIL & COAL COMPANY.—Enrique C. Creel. Cruz Gonzalez & Co., Chihuahua, representatives. Properties at Orientales, via San Sostenes. 660,000 acres adjoining Hearst-Keene syndicate.

HEARST-KEENE SYNDICATE.—Wm. Randolph Hearst president; James R. Keene, secretary. Home office, New York. Properties, Ojinaga (eastern part of state.) Drilling for petroleum. 165,000 acres. Well No. 1, 1,400 feet; well No. 2, 3,200 feet. Power, natural gas from same locality. Home address, 15 Broad street, New York. J. G. Folansbee, general manager; Ed C. Clark, manager at Ojinaga; Lic. Francisco Prieto, attorney, Chihuahua. Steam scurn driller, 35 h. p.

PROSPECTING COMPANY OF NORTH AMERICA.—B. Laurens Jones, manager. Picachos, via San Sostenes, on Kansas City and Orient R. R. George W. Cool, president.

COMPANIA METALURGICA DEL TORREON, S. A.—Head office, Torreon, Coah. Evaristo Madero, president. Agencies at Chihuahua, Parral, etc. Agent at Chihuahua, Albert Goldschmidt, 210 V. Guerrero avenue. Sampling works opposite Ferrocarril Mineral. 25 h. p. engine.

TRI STATE DEVELOPING CO. (Chihuahua, Sonora and Sinaloa) —Kansas City, Mo., Bryant building; N. Y. Life building, Chicago, Ill.; 20 Broad street, New York; 31 Lombard street, London. A. E. Stillwell, president, pro., Cinco de Mayo 20, Mexico, D. F.; S. W. Rider, manager, P. O. Box 264. Mines near San Sostenes, Woodhouse (C.-S.); Webb (C.-S.); Lalella (L.-S.); near Salas, Fredburt (L.-S.-G.); Lombard (L.-S.-G.); Melville (I.); near Hormigas, Mertz (L.-S.); near Coyame, Sir Alfred (C.-S.); near Santa Eulalia, La Mascota (L.-I.); near Placer Guadalupe (86), Mulvane (G.); Taylor (G.); Neame (G.-S.); near Mapula, Gutmen (G.-S.); near Sacramento, Maria (G.-S.); near Sierra, Escondida, Rex (L.-S.). See District Arteaga. (15 other mines.)

GENERAL JUAN A. HERNANDEZ.—Home address, Oaxaca, local, Hotel Ahumada, Chihuahua. Mines at Mineral Huizopa, Municipality of Temosachic, District Guerrero. Mines, Mercedes, San Agustin, Libertad, Esperanza, Mas Esperanza, etc.; at San Pedro, District Galeana, Cinco de Mayo. Over 500 feet workings.

MEXICAN MINES SYNDICATE, LTD.—Home office, Plaza Bolivar, No. 16, Monterrey, N. L. Donald R. Morgan, president and general manager. Local office at Chihuahua, P. O. Box 230. Cable address, "Donmor." Bartow W. Van Voorhis, secretary. Mines, La Reina, Juarez, Buenos Aires, Mina Grande, at Cusihuirchic. Charles Muffat, superintendent, (37 hectares). Reduction mill at Buenos Aires.

COMPANIA MINERA LA COBRIZA, S. A.—Home office, Monterrey, N. L., 14 Plaza Hidalgo. Donald R. Morgan, president; W. T. C. Simpson, secretary. Local address Chihuahua, P. O. Box 230. Mines Minillas Group, D. Gordon Smith, manager; La Lagrima Group, Enrique Salas. La Lagrima 65 hectares, Minillas 144 hectares.

RICHARD H. LE BERGUE, M. E.—Home address, 118 Calle Allende, Chihuahua. Mines, Q. K. and Ena de Battenberg at Sierra Solis; Terrenos del Huerfano, Municipality of Aldama. 20 men.

FRONTERIZA COPPER MINING CO.—Office, 247 West 47th street, Los Angeles, Calif. S. O. Niely. Mine Fronteriza, in Sierra Rica mountains.

SANTA ANA MINING CO.—Alberto Goldschmidt, president and general manager, Avenue Guerrero, No. 210; R. J. Morambert, Paseo Bolivar, No. 284; R. Arbello and J. Arbistequi. Mines Santa Ana, Aldama Municipality.

EL CRISTO MINING CO.—Address, P. O. box 145, Chihuahua. Home office, San Francisco. Mine, El Cristo, Santa Eulalia. F. Chappellet, manager.

SAN JUAN GRANDE MINING CO.—Address, P. O. box 145, Chihuahua. Home office, San Francisco. Mine, San Juan. F. Chappellet, manager.

THE CHICAGO MINING CO. OF SANTA EULALIA, LTD.—Office at Chihuahua. Mine at Santa Eulalia, Amplificacion de Chicago.

COMPANIA MINERA LA VIRGEN, S. A.—Address, Aldama, District Iturbide. Mine La Virgen, at Placer Guadalupe. 2 stamp mills; 15 H. P. Luis Terrazas, president. avenue Ocampa, 416; Martin Falomir, vice president; J. Ramon Oaxaca, Paseo Bolivar. Placer de Guadalupe. Two 4 foot Huntington mills, also one 3 foot Huntington mill; a 35 h. p. and 25 h. p. engine. Mines Santo Domingo, Buena Vista, Inglesa, Concepcion.

PROVIDENCIA MINING CO.—Placer de Guadalupe, Aldama Municipality. 2 stamp mill. Othon Sartoious, president and general manager. Mine, Guadalupe.

COMPANIA MINERA CORRIGIDORA Y ANEXAS, S. A.—Principal office, Chihuahua. Prof. Carlos Cuilty, president; Dr. Ignacio Torres, vice president; Jose Asunsolo, secretary; Cristobal M. Ortiz, treasurer; Rosendo Romero, comisario. (Capital $24,000.) Mines at Cusihuirchic, Marta, Corrigidora.

CIA. CARBONIFERA DEL NORTE DE CHIHUAHUA, S. A.—(Northern Chihuahua Coal Company.) Main office, Chihuahua. Federico Siesniega, president; Lic. Manuel Prieto, secretary; Enrique C. Creel, vice president.

NEW YORK & MEXICAN GOLD CO.—(Capital $7,000,000) Home office, Saltillo, Coahuila, Villar Hermanos; Head office, New York. Angel Villar Roldan, Saltillo, manager; Alejandro

Chavero, Mexico, D. F., engineer; M. N. Morales, Saltillo; Leopoldo F. Martinez, Saltillo. Mining properties at Parral, Santa Eulalia, Dolores, Jimenez, (also at Mapimi and El Oro in Durango).

THE GRAND UNION MINING CO.—Home office, 30 Broad street, New York. Properties in Chihuahua, Sonora and Sinaloa. E. R. Tufts, president; Chas. Greenough, treasurer.

CIA. MINERA LOS LAMENTOS.—At Los Lamentos mountains, east of Montezuma. Louis Terrazas, president; Francisco Molinar; Ignacio Acosta and Cristobal M. Ortiz. Mines, Los Lamentos, Carbonato.

MINILLAS MINING CO.—Home office, Chihuahua. William White, M. D., president; J. Johnson, Aldama 4; Dr. M. F. Bauchert, 212 Aldama. Mine, La Rosa at Minillas.

WEST VIRGINIA MINING CO.—Home office, West Virginia. Properties at Santa Eulalia, Dinamita, Almoloya. Frank E. Wheeler, manager.

JOSE LAGO.—Calle Victoria 1007, Chihuahua. Mines at Santa Eulalia, Olga, Esedencias, Demacias, Gitana, Minerava, Chapultepec, La Reforma, (600 hectares), Plomos, Santo Domingo, El Lago, etc., Naica, La Zona, Almoloya, Rosita.

COMPANIA MINERA COMSTOCK, S. A.—William White, president; Percy Von Wagner, secretary; Louis de la Garza Cardenas, treasurer. Mines located in District Benito Juarez, near Gavilana. El Refugio, Mascota, Comstock.

COMPANIA MINERA LA NORMA.—General Jose M. de la Vega, president; Colonel Susano Ortiz, treasurer; Julian Robles, gerente. Mine, La Norma, via El Pastor, Aldama.

DRAGOON MINING CO.—G. M. Jacobs, president; Andrew J. Skinner, secretary; Leo C. Dessar, treasurer. Vocales; Pierre de Recketts. Geo. E. Fitgerald.

KRUGER COPPER & SILVER MINING CO.—Home office, Huron, Beadle Co., South Dakota (Under the laws of the same state). Gerry M. Spear, Boston, Mass; James H. Mahoney, Boston, Mass; Geo. W. Boyce, Chihuahua; Edgar Glines and Phillip A. Wagner, Vocales. Home office, 46 Chestnut street, Waltham, Mass. Mines at Bustillos; N. C. Newell, superintendent; F. C. Green, agent, 512 Juarez street, Chihuahua.

TRES AMIGOS MINING CO., S. A.—Chihuahua. Luis Terrazas, president, 416 Ocampo avenue. Charles Robinson Sewell, secretary.

LA CRUZ MINING & MILLING CO., S. A.—(Capital $100,000) Max. Krakauer, president; Gustavo Zork, treasurer; A. Moye, secretary; Adolfo Krakauer, manager. Offices, 204 Libertad street. Mines at Nobisagame, District Rayon. 50 H. P. steam engine; 5 stamp mill; concentrator, etc. 25 employees.

JANIE MINING CO.—Home office, Chihuahua. C. L. Graves, president and general manager, P. O. box 46; H. H. Hinkle, comisario; E. J. Ernest, superintendent. Mines, Los Placeres, La Primera, at Almoloya, District Jimenez.

COAHUILA MINING & SMELTING CO.— Mines in Coahuila, Chihuahua and Zacatecas.

THE MEXICAN GOLD DREDGING CORPORATION.—(Cia Explotadora de Placeres de Oro) (Mexican Gold Dredging Co., S. A.,) Property on the Rio Conchos at Santo Domingo. John R. Roslyn, president and general manager; James S. Johnson, treasurer and general counsel; Chas. H. Turner, secretary and manager; directors: the above named and Thomas and William Dale. Offices 15 Exchange Place, Jersey City, N. J. (1,260 acres). 35 Nassau street, New York; Calles Independencia and Victoria, Chihuahua.

CIA MINERA SANTA RITA.—Alberto Terrazas, president. Address, corner Ocampo and Ojinaga streets, Chihuahua. Miguel Horcasitas, manager. Mine Santa Rita at Chorreras. (Copper and street.)

CIA DE MINERALES Y METALES, S. A.—Home office, Monterrey, N. L. Euardo Villareal, General manager, Matamoros street 24, Monterrey, N. L.; J. P. Flynn and Pablo Carbajal, local agents, Hotel Palacio, Chihuahua.

LAS MINAS CORPORATION, LTD.—Of Washington, D. C. Directors; Grant Young, E. Schvaley, James R. Porter, Freeman Davison, Sarah Mechin.

ALICE SANTA EULALIA MINING CO., LTD.—London. Edward Francis Armstrong, general manager, Dr. Robert Emerson, manager, Chihuahua. Mine, Alice at Santa Eulalia.

SAN JORGE MINILLAS MINING CO., LTD.—London. E. Francis Armstrong, general manager; Robert Emerson, manager, Chihuahua. Mine, San Jorge at Minillas.

THE MEXICAN SYNDICATE INCORPORATED.—Home office, New Jersey, N. J., Exchange Place, (Under the laws of said state). Philip E. Dudley, president; Henry Bushnell, secretary.

SAN VICENTE & NEW ENGLAND MINING CO.—Offices at Augusta, Maine and New Bedford, Conn. Directors, Clarence H. Brownell, Lewis A. Burleigh, Albert B. Kenyon, A. M. French, J. Berry.

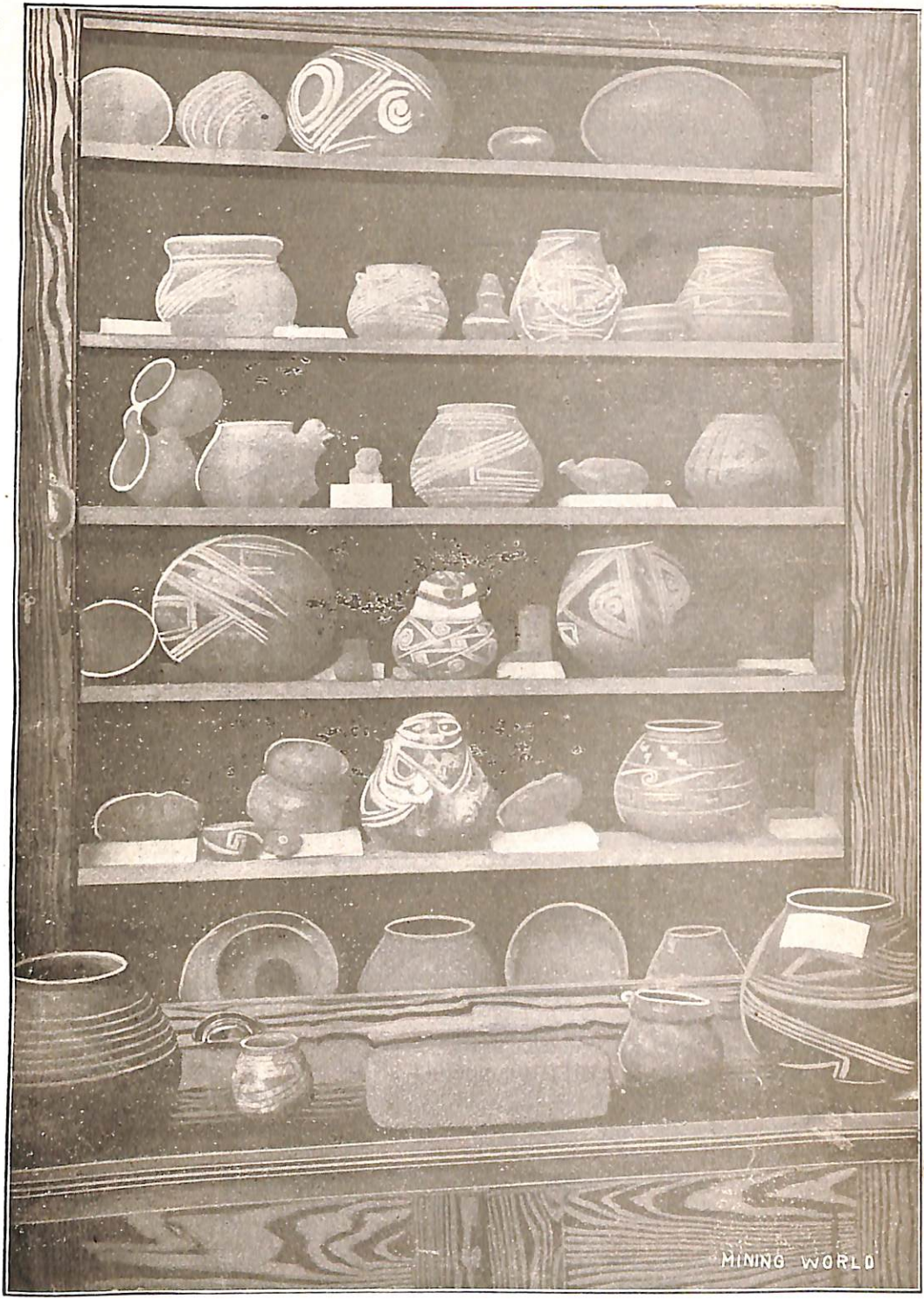
KANSAS BOY MINING CO.—Office, Chihuahua. W. J. Jones, Frank Collinson, Joseph R. Rollins, proprietors. Mine Kansas Boy, Santa Eulalia.

REFUGIO MINING CO.—Office, Placer, Santo Domingo.

COMPANIA EXPLORADORA DE CHIHUAHUA, S. A.—Office, Chihuahua. Francisco E. Torres, president; Charles A. Mink, vice president; Leopoldo de Silva, secretary, address Avenida Ocampo 259. Carlos A. Nieto, treasurer, address, Federal Telegraph office.

BOSTON & MEXICAN MINING CO.—Of Portland, Maine. W. Franklin Burnham, president; B. Marvin Fernald, secretary; Alfred B. Fuller, treasurer.

COMPANIA BENEFICIADORA DEL MAGISTRAL, S. A.—J. A. Creel, president and general director; Eduardo C. Cuilty, treasurer; J. A. Cortazar, Jr., secretary and John D. McKenzie, superintend-



Sr. Enrique C. Creel's Private colection of Prehistoric Pottery. 3
from Casa Grandes.

ent. Mines, Magistral, Benito Juarez, La Union, La Vieja, Bilboa, Povenir, Santa Eduvigues, Simon Bolivar, Desdemona, Lucrecia. 150 ton capacity mill.

THE CHICAGO MEXICAN CONSOLIDATED MINING CO.—Home office, Huron, Beadle Co., South Dakota (Under the laws of said state). Directors: Charles B. Reed, J. B. Myres, F. Laurence.

LA REINA DE PLATA MINING CO. —Chihuahua, address. A. McKenzie. Mine Santa Fe, at Santa Eulalia. Shaft 400 feet. 25 H. P. gasoline hoist. 25 men.

MCDONALD, DALE & ANDERSON.—Head office, Chihuahua. Dale Brothers; Roland Anderson; Felix McDonald, manager at Terrazas. Mine, San Rafeal. 12 H. P. steam; 250 foot shaft. (Copper, silver and lead.)

AMERICAN MINING AND SMELTING CO.—Head Office, Chihuahua. Thomas Dale, president; Felix McDonald, vice president. Mine at Terrazas, La Americana. 22 H. P. gasoline hoist. This mine is now leased to E. Simons of New York, who will shortly put in a 260 H. P. engine, etc.

REY DEL FIERRO MINING CO.— Head office, 2 Leroy street, Boston, Mass. Mine at Puerta de Bolas, Coyame. Mine, Rey del Fierro. Wm. Leroy Libbey, president, Hotel Robinson, Chihuahua. 212 pertenencias.

MEXICAN GOLD FIELDS CO.—Head office,714 Unity building, Chicago. G. Henry Lochr, president and manager. Local address and property at Placer Santo Domingo, District Iturbide. Steam shovel and dredging; 525 H. P. 90,000 cubic yards per month. (2955 acres.)

SAN SALVADOR MINING COMPANY.—Terrazas & McDonald. Terrazas, District Iturbide. Mine San Salvador. Gasoline engine, 2 H. P. Alberto Terrazas, Chihuahua, president; Felix McDonald, manager at Terrazas. Shaft No. 1, 135 feet; shaft No. 2, is 100 feet. 2 1-2 H. P. gasoline engine. (Zinc and copper.)

MINA DOS DE ABRIL MINING CO.—Head office, 32 Liberty street, New York; local address, Chihuahua, P. O. box 181. Mine Dos de Abril, etc, Mineral de Huizopa, Temosachic, Guerrera. John W. Piper, president and manager.

COMPANIA MINERA "EL CONTINENTE," S. A.—W. K. Ryan, New York and R. M. Dudley, manager, Chihuahua, Calle Cuarta 179, P. O. box 213. Mines at Santa Eulalia, El Continente, (16 pertenencias); La Isla (40); Buen Diaz (43); La Sorpresa (32); Olga (30); La Judia (12); La Ibera (47). 22 H. P. gasoline engine; shaft 400 feet. Hidalgo, (zinc mine) near Calera, District Guerrero.

RICHARD M. DUDLEY.—Office, Calle Cuarta 179, P. O. box 213, Chihuahua. Mine, Filipinos, near G. Voorhees' Las Vigas copper mines, (20 pertenencias).

GIOCONDA MINING CO.—Head office, Chihuahua. Mine Gioconda, Cuchillo Parado, Coyame, District of Iturbide. E. C. Glaine, president and general manager.

PROSPECTUS, LTD.—London. Working mines of Manuel Gameros at Santa Eulalia, Juarez, 12 H. P.; La Esmeralda, 13 H. P.. Gasoline hoists. Alfred McKenzie, manager.

EMPIRE ZINC CO.—Main office, Equitable building, Denver, Colo., U. S. A.;W. C. Witherill, A. R. Livingston, H. A. Wilkens,71 Broadway, New York; local at Chihuahua, Libertad street 519. W. H. Paul, agent. Mines, Las Plomosas, near San Sostenes; Alfonso XIII, etc.

LA CASCADA MINING CO.—Head office, Louisville, Ky.,U. S. A.; local office, Chihuahua, E. W. Hayen, agent, P. O. box 135. Mine La Luz, Maguarichic, District Rayon. Concentrator; steam. 50 employees. J. C. Cox, president; N. S. Good, manager.

BALTIMORE MINING CO.—Head office, Jersey City, N. J., U. S. A; J. F. Fielder at 15 Exchange, president; local office, Chihuahua, J. H. Williamson, manager, address, P. O. box 98. Mines Baltimore at Santa Eulalia. 44 H. P. gasoline. 1300 foot shaft.

SCHUYLER LAWRENCE, M. E.—Office, Chihuahua, Calle Aldama, 703, P. O. box 3. Mines at Urique, District Andres del Rio, La Orosca, (G.-L.), 3000 feet work done; Santa Eulalia, (S.-L.), 1500 feet work done.

DRAGOON MINING CO.—Station, Terrazas, District Iturbide. P. W. K. Robertson, manager. 16 H. P. gasoline hoist. Mine Columbia, (copper and silver.) Head office, New York.

EUREKA MINING CO.—Office, San Francisco, Calif., 1414 Post street. Richard A. Clark, secretary; local office, J. H. Williamson, manager, P. O. box 226, Chihuahua. Mine Santa Juliana at Santa Eulalia. Shaft No. 1, 600 feet; 22 H. P. gasoline hoist; shaft No. 2, 12 H. P. gasoline hoist.

LAS VIGAS MINING AND MILLING CO.—Head office, Santa Barbara, California. George M. Voorhees, Jr., general manager. Mine, Las Vigas, (copper), via San Sostenes, Iturbire District. Charles P. Halter, manager. 150 H. P. gas producer plant to operate mill.

COMPANIA EXPLORADORA Y EXPORTADORA DE MINAS CHIHUAHUENCES.—Office, Chihuahua, 607 Calle Libertad. Sr. Juan N. Faudoa, president; Lic. Carlos Sanchez Aldana, V. Guerrero 182, secretary. Mines at Naica, District Camargo.

CIA MINERA "LA AURORA."—Head office, Parras, Coahuila. Evaristo Madero, president. Mine, La Aurora, Cuchillo Parado, Coyame, District Iturbide. Engineer Vicente Arriola, general agent, Ojinaga 408, Chihuahua.

FELIX McDONALD.—Manager and owner of Shamrock Mining Company, Terrazas. Mine, Shamrock. 100 foot shaft; 6 H. P. gasoline.

COLON MINING CO.—Terrazas. Mine, Colon, 12 H. P. engine, gasoline, shaft 250 feet, (S.-L.); San Agustine mine, shaft No. 1, 100 feet; shaft No. 2, 115 feet; Maid of Erin, 16 h. p. gasoline engine, 150 foot shaft, (Z.-C.-S.); Guadalupe shaft 180 feet, Terrazas.

CHIHUAHUA MINING CO.—Head office, 747 Fifth avenue, New York. H. L. Terrell, president; Grant B. Schley, secretary; Wm. J. Quigly, general agent. Mine at Santa Eulalia, Santo Domingo, Santa Rita, Coronel, Zubiate, Fortuna, Leonides, etc, (90 pertenencias.) Santo Domingo shaft, 1850 feet; Santa Rita shaft, 1000 feet; Coronel, 300 feet. Steam hoists, etc.; 700 h. p. Hacienda Robinson, 500 H. P. pump. 28 miles of railroad; 7 locomotives, etc. B. L. Farrar, general superintendent.

EL POTOSI MINING CO.— Head office, 747 Fifth avenue, New York. Grant B. Schley, president; C. L. E. de Gangue, secretary and treasurer. Mines at Santa Eulalia, El Potosi, Cinco de Mayo, Santa Gertrudes, Santa Ana, (90 pertenencias). Shaft No. 1, 1800 feet, shaft No. 2, 1200 feet. Hoists; 500 H. P. Wm. J. Quigly, general agent; B. L. Farrar, general superintendent.

MERCEDES MINING COMPANY.— Head office, 747 Fifth avenue, New York. Grant B. Schley, president; C. L. E. de Gangue, secretary and treasurer. Mines at Santa Eulalia, Mercedes 20 H. P. Promontorio, 25 H. P. Shaft No. 1, 250 feet, tunnel 600 feet, 24 h. p. gasoline hoist. Wm. J. Quigly, general agent; B. L. Farrar, general superintendent.

COMPANIA MINERA LA FORTUNA.—At Carrizalillo, mine, La Fortune, (Cu), Jesus Nunez, president; Telesforo Castaneda Garcia, treasurer; Enrique Salas, secretary.

NATIONAL METAL CO.—Head office, Mexico City; local agent, Victor A. Cabrero (assayer), Chihuahua.

CINCO AMIGOS MINING CO.—Mines at Los Lamentos, (40 miles east of Ojo Caliente). Company organized under the laws of Maine. John R. Allen, New York; Carlos Robinson, Luis Terrazas, H. Charles Sewell of Chihuahua; and J. F. Johnston of Parral.

ILLINOIS ZINC CO.—Thos. F. Noon, general manager; J. A. Ede, engineer. Mines, Los Plomosos of Jose Lago.

CINCO SENORES MINING CO.—Capital $5,000,000. Properties in Santa Eulalia. Mines, Chiribel, La Peruna, Quien Sabe, Dolores, etc. W. K. Bellis, president; W. R. Zulick, secretary, both of Indianapolis, Ind.; J. P. Hutchinson, vice president, of Chihuahua.

ROYAL MORELOS.— Home office, Boston and San Francisco. Judge Aylett R. Cotton and S. W. Fergerson, directors.

SAN TOY MINING CO.—Home office, Pittsburg, Penn. Capital $7,000,000. R. R. Brown, president; John Sloan, vice president; F. P. Grafffin, secretary; Jas. E. Brown, treasurer; directors, Charles M. Schwab, L. C. Dillsworth, W. K. Bellis, W. K. Chase, Dr. M. R. Ward, D. B. Gillis, etc. Mines at Santa Eulalia, Galdeano, Bustillos, Independencia, Central, Donato Guerra, 8 Juarez, 8 Fortuna, etc. 150 h. p. steam hoists, etc.; 15 miles aerial tramway. J. P. Hutchinson, manager, Paseo Bolivar, No. 4.

NEBRASKA, CHIHUAHUA & MEXICAN MINING CO.—27 School street, Boston. 60 h. p. steam pump, (Cameron); gasoline hoist, etc. Mine, Americana at Terrazas. A. W. Colton, superin-

tendent; George W. Boice, general manager; F. C. Green, agent, 512 Juarez street, Chihuahua.

CIA MINERA Y BENIFICIADORA DE SANTA MARIA, S. A.—Valentin Terras, president; Jose Maria Sanchez, treasurer; Jose Altoline vice president; Carlos A. Nieto, secretary. Mines at Gavilana, District Juarez.

MINES CORPORATION, LTD.—Bridgeport, Conn. W. C. Bryant, president. Mines at Terrazas, Senorita, Campo Viejo, Ojo de Santillita, (108 pertenencias). Hoists, pumps, etc. George W. Boice, general manager: F. C. Green, agent, 512 Juarez street, Chihuahua.

CIA MINERA GARIBALDI, S. A.—Carlos A. Nieto, president; Alberto Vicarte, secretary; J. M. Nunez, treasurer. Mines at Santa Eulalia, (117 pertenencias.)

SANTA EULALIA MINES.—Home office, 50 Broadway, New York. Mines at Santa Eulalia, Buen Diaz, Ibera and Los Angeles. Directors: T. N. Barnesville, H. V. Foster and George W. Boice, general manager. 16 h. p. gasoline engine. F. C. Green, agent, Chihuahua; J. R. Ward, superintendent at Santa Eulalia.

THE SANTA EULALIA UNION MINING CO.—Home office, Anna, Ill. W. Henderson, president; J. E. Lufkin, vice president. Mines at Santa Eulalia, San Juan Mine of W. J. Jones and John Charboz.

DISTRICT JIMENEZ.

AMERICAN SMELTERS SECURITIES CO.—71 Broadway, New York. E. Percy Smith, manager, Jimenez, District Jimenez. Mines at Mineral de los Reyes, Jibosa y Anexas. Office of company also at Aguas Calientes.

COMPANIA MINERA Y. R. RAMOS, S. A.—Almoloya, Estacion Baca. Mines, Cigarrero, El Bajo. Head office, Mexico, D. F.; local, Almoloya. R. G. Aguirre, manager. Two engines, electric hoists, etc.; 100 ton production. 120 employees. 8 kilometers of railroad. Postal address, Jimenez, P. O. box 11.

ALMOLOYA MINING CO.— Head office, 65 Broadway, New York. N. O. Bagge, president. Mines at Almoloya, District Jimenez. D. W. Shanks, manager. 50 employees. Gasoline hoists.

COMPANIA METALURGICA DEL TORREON.—Home office, Torreon, Coahuila; local address, Jimenez, Charles Moser, manager mines at Las Adargas. Steam. (S.-L.). 200 employees.

ADOLPH BRONIMANN—San Pascual de Adargas, via Dolores Station, District Jimenez. Mines, Ventura, San Bernardo, Guadalupe, Soledad, Porfirio Diaz, etc. Pascual, Refugio, San Fernando, Tres Flores. Gasoline Hoists.

SANTA ANA MINING CO.—Address Santa Ana, via Troya station. F. E. North.

JANIE MINING CO.—See District Iturbide.

DISTRICT BENITO JUAREZ.

THE CHICAGO MEXICAN CONSOLIDATED MINES COMPANY.—General office, Chicago, 408 Tacoma building. Chas. S. Reed, president; T. W. Gilmore, vice president, W. W. Hinkley, secretary and treasurer; A. F. Kensinger, superintendent. Propteries at Tajirachic, P. O. address, Carichic.

KRUGER COPPER AND SILVER MINING CO.—See District Iturbide.

EL REFUGIO MINING CO.—El Ojiti, address Satevo, District Juarez. Mine El Refugio.

PITTSBURG-SAN JOSE REDUCTION CO.—Home office, Pittsburg, Penn. Mines at San Jose del Sitio, via Gavilanes. Mines Cerro Colorado, etc. M. B. Place, manager. Narrow gauge railroad; steam; 26 kilometers; 40 stamp mill, steam; 100 tons capacity. 300 men.

PLATT McDONALD.—Carichic, District Juarez. Mine, Chicago, etc

BUENOS AIRES MINING CO.—Cusihuiriachic. Mines, La Lola, Muriel. 40 ton smelter. W. C. Rollins, manager.

MEXICAN MINES SYNDICATE, LTD.—Home office, Monterrey, N. L.,14 Plaza Hidalgo. Donald R. Morgan, president and general manager; Bartow W. Van Voorhis, secretary. Local office, Chihuahua, P. O. address 230. Mines La Reina, Juarez, Veta Grande at Cusihuiriachic. Charles Muffat, superintendent Buenos Aires mine and mill. (65 hectares.)

HELENA MINING CO.—Address, Cusihuiriachic, District Juarez. Mines, Hortencia, Cornelia, Candelaria, San Miguel, Helena. 52 mining claims.

LA LUZ MINING CO.—S. Good, manager. Mine La Luz, (G.-S.)

NORTH MEXICAN SILVER MINING CO., LTD.—Cusihuiriachic. Mines, El Madrono, San Nicolas, Durana, San Saturnino, San Rafael, San Nicolacito, Esperanza, (49 pertenencias). Lixiviation plant. Otto K. Hoffman, manager.

CIA. MINERA EVANGELINA Y ANEXAS, S. A.—Telesforo Castaneda Garcia, president, P. O. box 111, Chihuahua. Jose de La Luz Soto, gerente; Jose de Sitio, director; Carlos A. Nieto, secretary and treasurer, Chihuahua; Abraham Lujan, vice president, Chihuahua. Mines at Gavilana, District Benito Juarez, La Prieta, Evangelina, Los Venados.

MINA DISTRICT.

THE CHEROKEE GOLD FIELDS, LTD.—Home office, 38 Broad avenue, London, E. C. Mines at San Julian, District Mina, Rienzi, W. McFarlane, general manager. Mines, Torres, San Julian, Refugio, Barnes, San Francisco, Sena, Todos Santos, San Pedro, Russia, Chicago, Santa Elena, San Felipe, Blanca, Eureka, San Nicolas, Mexico, Clarence, San Anastacio, etc. (500 mining claims.) Smelter; 2 steam hoists, concentrator, etc.

DOLORES MINING CO.—Tiburcio Garcia, president at Guadalupe y Calvo. Mine at Dolores, Miguel Ahumada. 10 stamp mill. 50 men. (S. and W.)

TIBURCIO GARCIA Y CO.—Guadalupe y Calvo. 28 claims. Mine, La Independencia. Mill; 60 h. p. steam; 20 ton concentrator; 20 ton cyanide plant.

LOS ANGELES GOLD MINES.— General office, Parral. Mines at Minas de Oro, via Guadalupe y Calvo. Mines, Los Angeles, Baborigame and Los Angeles Amplificacion. Two stamp mills; dynamo, 25 lights; 15 h. p. 35 men. F. W. McConnell, manager, Minas de Oro, District Mina.

SAN GERONIMO MINING CO.—Calabacillas, District Mina. Mine, San Geronimo (G.). Steam hoists, 45 h. p. 25 men.

MEXICAN INVESTMENT & DEVELOPMENT CO.—G. W. Holmes. Home offices, Memphis, Tenn. San Juan Neponuceno. Mine, Esmeralda. Address, Calabacillas, District Mina, (G.). 50 employes. 2 stamp mill and 25 ton cyanide plant. (In construction mill and wireless telegraphy.) Poche, Buena Vista, Providencia, Rosario.

LOS TAJOS MINING CO.—Mine, Los Tajos. Address, Las Cumbres, District Mina. 10 stamp mill.

THE R. MAND CO.—Mine, Nuestra Senora del Rosario. Address, Guadalupe y Calvo. 24 mining claims, (G. and S.). Steam hoist, 45 h. p.

CALABACILLAS MINING CO.—Address, Calabacillas, via San Jose de Garcia, Sinaloa. Mine, San Geronimo. 2 Bryan mills. 50 employes.

PIEDRA LARGA MINING CO.—P. O. address, Guadalupe y Calvo. Mines at Piedra Larga. 10 stamp mill. 50 mining claims, Angel, San Tustun, Concha, Realdad.

ROSARIO MINING CO.— Guadalupe y Calvo. Mines, Nuestra Sra. del Rosario, 24 claims. Anexa de El Rosario. 10 stamp mill, steam.

YARD & HASBACK.—Address, Guadalupe y Calvo. Mine La Libertad, Guatemoc, Independencia, Monroe, Victoria. 10 stamp mill.

THE MEXICAN EXPLORATION CO.—Address, Guadalupe y Calvo. Mines, Coscomotes, Nueva Exposicion, San Antonio, at Baborigame, Anexas, San Miguel.

BAZANOPA MINING CO.—P. O. Address, Guadalupe y Calvo. Mines, Amalia, La Cubano. At San Juan, Neponuceno, Maceo.

JOSEPH D. KNOTTS.—Address, Guadalupe y Calvo. Mines, Terry, Mamie, Mary Ellen, Iris, Madrono, Herrada, Vedema. 10 stamp mill at Piedra Larga.

ANGEL P. ARAIZA.—Guadalupe y Calvo. Mines, Ester, Libertad, San Francisco, Maderpora, Maria, Cenicera, America, Bella Espana, Santo Nino, Carmen, Colon.

THE GUADALUPE Y CALVO MINING CO.—Home office, Tennessee. Mines at Guadalupe y Calvo, District Mina. Jacob Thompson, president; T. H. Milburn, secretary.

PARRAL, MEXICO MINES COMPANY.—Henry A. Biossat, president. Mines 65 miles south of Mesa Sandia, District Mina. (No data as yet received from this company.)

RAYON DISTRICT.

VIRGINIA MINING & MILLING CO.—Home office, St. Louis, Mo., U. S. A. Mines at Ocampo, Hidalgo, District Rayon. 100 h. p. compressor plant; 3 air drills.

HACIENDA DE OCAMPO.—Ben Bowen, manager. Mines and mill situated on the head waters of the Mayo river. Post office address, Moris.

LA REPUBLICA MINING CO.—General office, Masonic Bldg., El Paso, Texas. M. B. Parker, president and general manager. P. O. address, Ocampo, District Rayon. Mines at Arroyo del Sauz. In construction, 150 h. p. capacity steam and cyanide plant.

SAHUAYACAN MILLING CO. (Compania Benefiaciadora de Sahuayacan).—Address, Ocampo. Mill at Potrerito. Juan A. Creel, president. Address, Chihuahua. 20 stamp mill. Mines, San Juan, Protectora, San Miguel, Soledad.

WATTERSON GOLD MINING CO.—Ocampo. Mine, San Jose. (Steam and W.) 20 stamps; 2 Bryan mills, 100 ton capacity. Wm. Thompson, manager.

SOCORRO MINING & MILLING CO.—P. O. address, Ocampo (Jesus Maria). Mines at Laureles, Municipality of Moris, El Socorro, San Antonio, La Dura, Templar. 10 stamp mill; 1 Bryan mill.

RASCON HERMANOS.—Uruachic. Mines, Animas, Alacran, Union y anexas. 10 stamp mill; lixiviation plant; Wilfley concentrator; Dodge crusher.

ANGLO AMERICAN MINING CO.—Address, Ocampo (Jesus Maria). Mine, Natividad.

LORETO & PROVIDENCIA MINING CO.—At Candemena. Mines, Loreto, Esperanza, Providencia, etc. 10 stamp mill. E. A. Bones, manager.

PAN-AMERICAN MINING & SMELTING CO.—Maguarichic. P. O. address and mine, Hernandez, La Lija, Recompensa, Sta. Camila. Home address, 905 Broadway, New York. (S.)

LA CASCADA MINING CO.—Head office, Louisville, Kentucky. Chihuahua address, P. O. box 135. E. W. Hayen, agent. Mines at Maguarichic, La Luz. J. C. Cox, president; N. S. Good, manager. Concentrator. (S.)

ROYVAL Y SOCIOS.—Candamena, District Rayon. Mines, Loreto, etc. 5 stamp mill, 10 ton capacity. Juan Royval, manager.

ZOLA MINING CO.—Address, Concheño. Mine, La Zola. W. Y. Soyer, manager.

CEREACHIC MINING COMPANY.—Cereachic, Municipality of Uruachic. Mines, La Cruz, Santo Nino, etc. Lixiviation and amalgamation plant.

COMPANIA MINERA PICHACHIC.—Juan Ramonfour, president; Jorge Griggs, secretary. Mine at Pichachic. (Arastras.)

SAN MARTIN MINING CO.—Head office, Chihuahua, Paseo Bolivar 407. John J. Waterson, president; John J. Clague, manager. Mines, Uruachic, San Martin, San Juan. Bryan mills, smelter and concentrator. 40 employes.

GREENE GOLD-SILVER COMPANY.—M. L. Sperry, vice president; E. J. Gates, treasurer; R. A. Jones, secretary; J. H. Martin, assistant treasurer. 25 Broad street, New York. W. C. Greene, president. Mines in Rayon and Guerrero Districts, Concheño, Ocampo (Jesus Maria), Santa Brigida, Cerro Boludo, San Jose, Colon, Guaynopita, etc. (1,000 pertenencias). C. C. Chase, general manager, Ocampo, District Rayon; N. J. Welch, manager, at Santa Brigida; F. F. Kip, manager, at San Jose; W. H. Hoffman, manager, at Colon; C. G. Ausburn, manager, at Mulatos; Edward H. George, manager, at Trinidad; Chas. Egan, manager, at Concheño; John Catron, manager, at Guaynopita, District Guerrero. 2,400 ton smelters (constructing); 35 stamp mill at Belen, also two Bryan mills; at Santa Eduvigues mine, 10 stamp mill; at Balvanera, a 40 stamp mill. 1,000 employes.

THEO. A. P. BRONN.—Mina Santa Barbara, Ocampo, District Rayon. Mines on Paragotes Cerro, Santa Barbara, anexas de Santa Barbara, Santa Fe, El Pavo (C., G. and S.). At Otates, Santa Teodora (S.). Lixiviation mill and 50 stamps. At Socorro, near Moris, Santa Rosa mine (S. and G.). At Jesus del Monte, Roncesvalles, Amplificacion de Roncesvalles and Santa Julia (G.). (Mines, total 87 pertenencias.)

FRANCISCO SIQUIEROS E HIJOS.—Ocampo (Jesus Maria). Francisco Siquieros, president. Mines, San Amado, Maripoza, Santa Ana, etc. 10 stamp mills, 4 pan process; hydraulic motor, 150 h. p. and 70 steam, 175 h. p. steam. 100 employes.

JESUS BUSTAMENTE.—Yoquivo, San Francisco, Pertenencia, Monte Cristo, Carmen, Dolores, etc. (Mill burnt.) 3 "tahomas," water process. 25 employes.

SAHUAYACAN MINING CO.—Ocampo. Head office, Pittsburg, Pa., U. S. A. Mines at Sahuayacan, Santo Niño, Apolonio, Helena, etc. 20 stamp mill; 50 h. p. hoist. 200 employes. 1,500 tons per month. Veronica mine, in Municipality of Moris.

FRANCISCO CARABEO & SONS.—Otates, Municipality of Uruachic. Mines, La Prieta, Santa Ana and Santa Ana anexas. Lixiviation and stamp mill.

NEGOCIACION DE PINOS ALTOS.—Mines at Pinos Altos. 17,000 mining claims. Principal mines are Santo Niño, San Eligio, Pro-

videncia, Victoria, Guadalupe, Patrocinio, Cerro Pelon, Frijolar, Palmer, Tanganillo, San Antonio. 800 h. p. engine; 4 Blake crushers; 11 Prarer & Chalmers batteries; 5 stamp mill; 7 Wilfley concentrators, etc., etc.; S. W. and electricity. B. Ray, manager.

MEXICAN MINES SYNDICATE, LTD. (This is a different company from that of same name in Benito Juarez District at Cusihuiriachic).—Willian Rutledge, president, Lewiston, Idaho. (Under laws of said state.) Tillman Bell, manager, P. O. address at Uruachic. Development work. Sorimoba river (25 ton water jacket lead smelting furnace.)

URUACHIC MINING AND SMELTING COMPANY, LTD. (Same as The Scotch Concessions, Ltd.)—Glasgow, Scotland. H. D. Bodington, president; George B. Jacobs, general manager, Chihuahua; address, Chihuahua, corner Juarez and Third streets. Mines at Uruachic (constructing smelter, 50 ton reverberatory.)

CONPANIA MINERA DE SANTA TERESA, S. A.—Sahuayacan, Municipality of Moris. Ignacio Rodriguez, president; Jose Gutierrez, secretary. Concentrator plant. 50 employes.

CIA. MINERA DE CHIRONERAS.—Address, Ocampo (Jesus Maria). Mine at Chironeras. 5 stamp mill; amalgamation. J. Varela.

JESUS SOLIS.—Address, Otates, Municipality of Uruachic. Mine, San Juan. 5 stamp mill; amalgamation.

NEW ALMADEN QUICKSILVER COMPANY.—Address, Uruachic, District Rayon. Mines, Nuevo Almaden, La Cruz, San Jose (Mercury).

MARY MINING CO.—Home office, Pittsburg, Pa. and Washington, D. C. J. E. Carnahan, president, Canton, Ohio; Mrs. Elizabeth Seamon (Nelly Bly), vice-president, New York; J. W. Carnahan, secretary, of Washington. Mines at Tojiachic, Arichuyvo, Nelly B, Mary, J. E. C. William M. Blicker, of Green Castle, Ind., vice-president; Dr. Leandro Routh, superintendent. (Mill is being constructed.)

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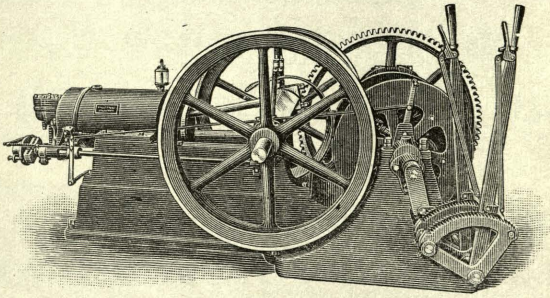

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EL PASO, TEXAS.

MINES IN RAYON DISTRICT. (Continued from page 280)

Anex. S. Ramón.	Ocampo.	0.6	Cía. Minera Gold Lmtd.
Los Triángulos.	„	2	Francisco Siqueiros é hijos.
Flor de Mayo.	„	2	Alberto Seyffert.
Ampl. Roncesvalles.	„	4	Teodoro A. P. Bronn.
Anexas de Matulera.	„	2	Luis Siqueiros.
La Trinidad.	„	4	Daniel Rascón.
Balvanera.	„	2	Francisco R. Vidal y Sta. Juliana M. C.
San Francisco.	„	6	G. W. Hollin.
Allegheny.	Moris.	6	Charles L. Walthers.
Pensylvania.	„	20	Charles L. Walthers.
Siglo XX.	Ocampo.	6	José María Contreras.
La Fortuna.	„	4	Francisco B. García.
San Ambrosio.	„	6	Tomás H. Anchondo y socios
Hidalgo.	„	4	Rafael Rocha.
Flor de Mayo.	„	3	Cristóbal y Adrián Rascón.
Sud Anexas.	„	8	Cía. El Concheño.
Morelos.	„	6	Anastacio Porras y socios.
La Protección.	„	10	Miguel Prado.
Extensión Belén.	„	4	Dionisio Minihan.
Oro Visto.	„	4	J. M. Quimbre.
San José.	„	8	Jesús Royval.
Sta. Margarita Grande.	„	4	Ignacio Rodríguez.
San Agustín.	„	6	Jesús Porras.
La Soledad.	Moris.	20	Graciano Siqueiros.
Veta Grande.	„	12	Luis Siqueiros.
Cristal.	„	4	A. H. Gisham.
La Bonanza.	Ocampo.	4	Enrique Peterson y socios.
Porfirio Díaz.	„	4	Rafael Córdoba.
Anex. de Allegheny.	Moris.	15	Charles L. Walthers.
Palestina.	Ocampo.	5	Jesús Ochoa.
Ampl. Penssylvania.	Moris.	20	Charles L. Walthers.
Cuyo Hoga.	Ocampo.	8	Price McKinley.
El Danubio.	„	7	Leese Kermode.
El Oro Libre.	La Trinidad.	8	Charles B. Brown.
El Alacrán.	Ocampo.	12	El Refugio Mining Co.
La Fuente.	„	13	Charles W. Holling.
Nebraska.	„	7	The Belen Mining Co.
Louisiana.	„	4	El Refugio Mg. Mill. Co.
Unión.	„	0.6	Leese Kermode.
La Martinica.	„	6	Agustín Uranga.
Cuatro Hermanos.	„	16	Lúcas Lanahan y socios.
Orion.	„	6	Jesús Ochoa.
San Rafael.	„	3	Jesús Ochoa.
Santa Eduwiges.	„		Green Gold-Silver Co.
Tenochtitlán.	„		Manuel Siqueiros.
San Ramón.	„		Green Gold-Silver Co.

Anex. S. Salvador 2.	Ocampo.		Angel Echavarría.
La Protección.	„		Enrique C. Creel.
Nuevo Almadén.	Uruáchic.		N. Almadén Quicksilver Co.
La Cruz.	„		„
San José.	„		„
Santa Gertrudis.	„		Antonio Medina y socios.
La Recompensa.	„		„
Mina Providencia.	Candameña.		Anastacio Royval.
Esperanza.	„		„
Nuestra Sra. de Loreto.	„		„
Tungurahua.	Moris.		Federico Reuter.
El Porvenir.	„		Federico O. Harris.
Pertenencias del Arroyo.	Rodeo.		Enrique Moritz.
Ampl. de Guadalupe.	„		„
Los Triángulos.	„		„
Santa Emilia.	„		„
Enriqueta.	„		„
María.			„
Victoria.	„		„
Anexas de S. Amado.	Ocampo.	1	Neg. Minera F. Siqueiros é h.
San Miguel.	„	2	Carlos Pérez.
El Perú.	„	12	Leandro Anchondo.
Ampl. Benito Juárez.	Moris.	6	Carlos Pérez.
Cont. S. Antonio.	„	4	Luis Siqueiros y socios.
Alaska.	Ocampo.	5	Leese Kermode.
Esperanzas.	Moris.	4	Leo. Reed.
La Profundidad.	„	8	Charles L. Walthers.
La Sultana.	„	9	Cía. Minera Santa Teresa.
Idea Libre.	Ocampo.	6	Domingo Banda y socios.
Dos Hermanos.	„	2	Lúcas Lanahan.
La Confianza.	„	3	The Belen Mining Co.
Sebastopol.	Moris.	2	Cía. Minera Sta. Teresa.
Savonarola.	„	4	W. H. Holcomb y socios.
Dems. de Belén.	Ocampo.	4	Federico Reuter.
Ampl. de Tomochic.	Moris.	4	W. H. Holcomb y socios.
Suerte de Elvira.	Yoquivo.	10	León Escobar.
Omaha.	Ocampo.	3	The Belen Mining Co.
Venturina.	„	8	Juan B. Walton y socios.
El Pueblo Boero.	„	18	G. Vázquez y socios.
La Independencia.	„	6	J. A. McKaskel.
Angela.	„	3	Jesús Porras.
Olivia.	„	10	W. B. Brooks.
Tres Hermanos.	„	6	Lúcas Lanahan.
Carmen.	„	8	Leandro M. Gutiérrez y s.
Nuevo Patrocinio.	„	8	Leandro M. Gutiérrez y s.
La Izola.	„	10	W. B. Brooks.
Las Coloradas.	„	12	Miguel Varela.
El Pilar.	„	6	Pedro Juárez.
Amada.	„	8	Cuthbert J. Burn.

La Libertad.	Moris.	2	Guillermo H. H. y socios.
Atena.	„	8	José Gutiérrez.
San Francisco	Candameña.	4	Jesús Royval y socios.
La República.	Moris.	28	Manuel Amado.
Siglo XX.	Ocampo.	5	Florentino González.
Mina Verde.	„	10	Federico Schoenfeld.
Dems. de Matulera.	„	4	The Belen Mining Co.
Catalina.	Moris.	12	Sahuayucan Mining Co.
La Potosina.	„	6	Lorenzo Domínguez.
La Unión.	Ocampo.	30	Raafel McKormic y socios.
Lluvia de Oro.	„	9	Leandro Anchondo.
La Japonesa.	„	10	H. C. Daugherty.
Nueva Sta. Eulalia.	Temósachic.	10	Henry Petrson y socios.
Chipiona.	Uruáchic.	3	W. H. Denton.
Santa Cesárea.	Ocampo.	4	Pedro Juárez.
La Cobriza.	Moris.	6	Procopio Olea.
El Corazón de Jesús.	Ocampo.	6	Graciano Siqueiros.
El Corazón de Jesús.	„	3	„
Maritana.	Moris.	10	George F. Ellis.
Dividendo.	„	10	„
Arista.	Ocampo.	30	Tadeo Pérez Campos y socio
La Bufa.	„	10	H. T. Braun.
Sierra Madre.	„	10	Leese Kermode.
La Cruz.	„	6	Jesús E. Márquez.
La Estrella.	Moris.	12	John C. Treadwell.
La Esperanza.	Ocampo.	6	Pedro M. Sierra y socios.
Vierne.	„	6	H. T. Braun.
Santa Clara.	„	8	Jesús Royval.
Canaan.	„	16	Leandro Pérez.
Placer Vuelta Larga.	„	7	Federico Schoenfeld.
El Rosario.	„	12	Ignacio Rodríguez.
Benito Juárez.	„	0.8	Jesús Luna y socios.
Anexas de Navidad.	„	8	Joaquín Chávez.
Argentaura.	Moris.	100	R. B. Hutchinson.
Trinitaria.	Ocampo.	3	Florencio González.
Dems. de Ronquillo.	„	6	Henry O. Flipper.
Dems. Sta. Juliana.	„	2	Henry O. Flipper.
Lolita.	„	8	H. C. Daugherty.
Quipurita.	„	14	John B. Walton.
Guadalupe.	„	9	Procopio Olea.
Corralitos.	„	8	Daugherty y Co.
El Capital.	Moris.	20	George F. Ellis.
Anex. S. Francisco.	Ocampo.	20	Jesús Royval y Co.
Montecristo.	„	12	Jesús Royval y Co.
San Pedro.	Moris.	10	José Rivero y Co.
San Francisco.	„	8	„
Dems. Zalvaneda.	Ocampo.	2	Henry O. Flipper.
Montecristo.	„	2	Henry O. Flipper.
Dems. Belvaneda.	„	8	Dennis Miniham.

METALS IMPORTED AT EL PASO, TEXAS, FROM THE STATE OF CHIHUAHUA, MEXICO, DURING THE CALENDAR YEAR 1906.

1906. Values of metals in ores

Mo.	Ore Lbs.	Gold.	Silver.	Copper	Lead	Zinc.	Calamine.
Jan.	39.652,379	$ 221,348	$ 200,368	$ 2,236	$ 55,059	„ 6,388	„ 12,492
Feb.	39.934,840	„ 158,762	„ 192,958	„ 2.849	„ 61,111	„ 6,563	„ 11,900
Mar.	53.408,610	„ 177,869	„ 238,260	„ 3,477	„ 74,066	„ 8,750	„ 53,134
Apl.	40.588,125	„ 103,828	„ 216,329	„ 3,279	„ 48,451	„ 2,590	„ 23,575
May.	41.372,774	„ 102,836	„ 178,823	„ 1,422	„ 52,057		„ 38,513
June	51.186.207	„ 114,360	„ 225,156	„ 3,960	„ 66,956		„ 25,360
July	44.242,284	„ 138,396	„ 212,499	„ 1,945	„ 46,550	„ 6,970	„ 36,726
Aug.	21.848,857	„ 66,149	„ 105,948	„ 2,457	„ 27,462	„ 63,907	„ 15,707
Sept.	29.718,441	„ 142,590	„ 157,328	„ 4,181	„ 32,098	„ 9,468	„ 20,000
Oct.	46.681,159	„ 185,292	„ 227,663	„ 2,316	„ 60,999	„ 5,886	„ 30,409
Nov.	30.557,491	„ 104,556	„ 138,037	„ 1,446	„ 53,590	„ 7,593	„ 19,000
Dec.	24.418,100	„ 65,193	„ 107,687	„ 1,740	„ 31,067	„ 20,037	„ 17,640
Totals.	463,609,258	$ 1,581,179	$ 2,201,050	$ 31,317	$ 609,466	$ 138,152	$ 313,456

Courtesy of the U. S. Treasury Dept.

PRODUCTION OF MINES IN 1905.

ANDRES DEL RIO DISTRICT..	Metric Tons.		Value.
Batopilas Mining Co. Batopilas	29,478	$	1.660.500
Santo Domingo Mg. Co. Batopilas.	234	„	62,700
La Gloria Mg. Co. Batopilas. . . .	3,000	„	146,880
Lluvia de Oro Mg. Co, Urique ..	1,900	„	1.500,000
San Gil Anexas, Morelos.	800	„	4,000
The Southern Mg. Co., Morelos. .	500	„	1,500
ARTEAGA DISTRICT.			
Palmarejo Mg. Co., Chínipas. . .	42,690	$	1.115,000
Sta. Bárbara Mg. Co, Guazapares.	8	„	40,000
BRAVO DISTRICT.			
Burroughs, Daily C., V. Ahumada	235	$	18,325
Eduardo Salinas. „	16	„	1,600
Llagas Cía. Minera. „	2	„	400
A. Wahnmond. „	50	„	4,000
CAMARGO DISTRICT.			
Cía. Minera de Naica, S. A. . . .	25,000	„	716,800
Cía Minera Lepanto, S. A.	3,200	„	50,000
Francisco Armendáriz Sucs. . . .	.....	„	40,432
GALEANA DISTRICT.			
Candelaria Mg. Co., San Pedro. .	9,354	$	237,000
Jesús Granillo, Ascensión.	50	„	11,000
Ignacio Chávez. Ascensión. . . .	80	„	33,000
Viznaga Mg. Co. Sabinas	290	„	61,000
W. E. Thompson, Sabinas. . . .	1,200	„	280,000
La Fronteriza Mg. Co., Sabinas..	60	„	10,000
Rufino Vega, S. Buenaventura. .	12	„	3,600
JIMENEZ DISTRICT.			
Ig. R. Ramos, S. A., Almoloya. . .	21,600	$	864,000
J. F. Johnston.	300	„	18,000
A. D. Bronimann.	3,300	„	180,000

A. D. Broniman.	700	„	8,000
Domingo Gutiérrez.	100	„	6,000
Am. Smelter Securities Co.	19,000	„	240,000
G. Baca. y Co.	130	„	3,000
G. Sheperd, Escalón.	340	„	5,000

RAYON DISTRICT.

Waterson Gold Mg. Co., Ocampo.	24,000	$	360,000
Belen Mg. Co., Ocampo.	5,000	„	108,000
Sahuayucan Milling Co.	.....	„	250,000
Cía Beneficiadora del Concheño. .	36,000	„	720,000
Rascón Hnos., Uruáchic.	82	„	13,800
James Clague.	15	„	3,800

ITURBIDE DISTRICT.

Chihuahua Mg. Co. Sta. Eulalia.	55,017	„	531,625
Sta. Eulalia Exploration „	20,000	„	260,000
Am. Semtl Refining Co.	31,000	„	538,400
Parcionera Mg C. (Developement)	.....	„	
A. Escobar (Dolores.)	400	„	40,000
B. M. Caldwell (Aurora).	63	„	1,111
Eureka Mg Co., Santa Eulalia. . .	1,693	„	95,435

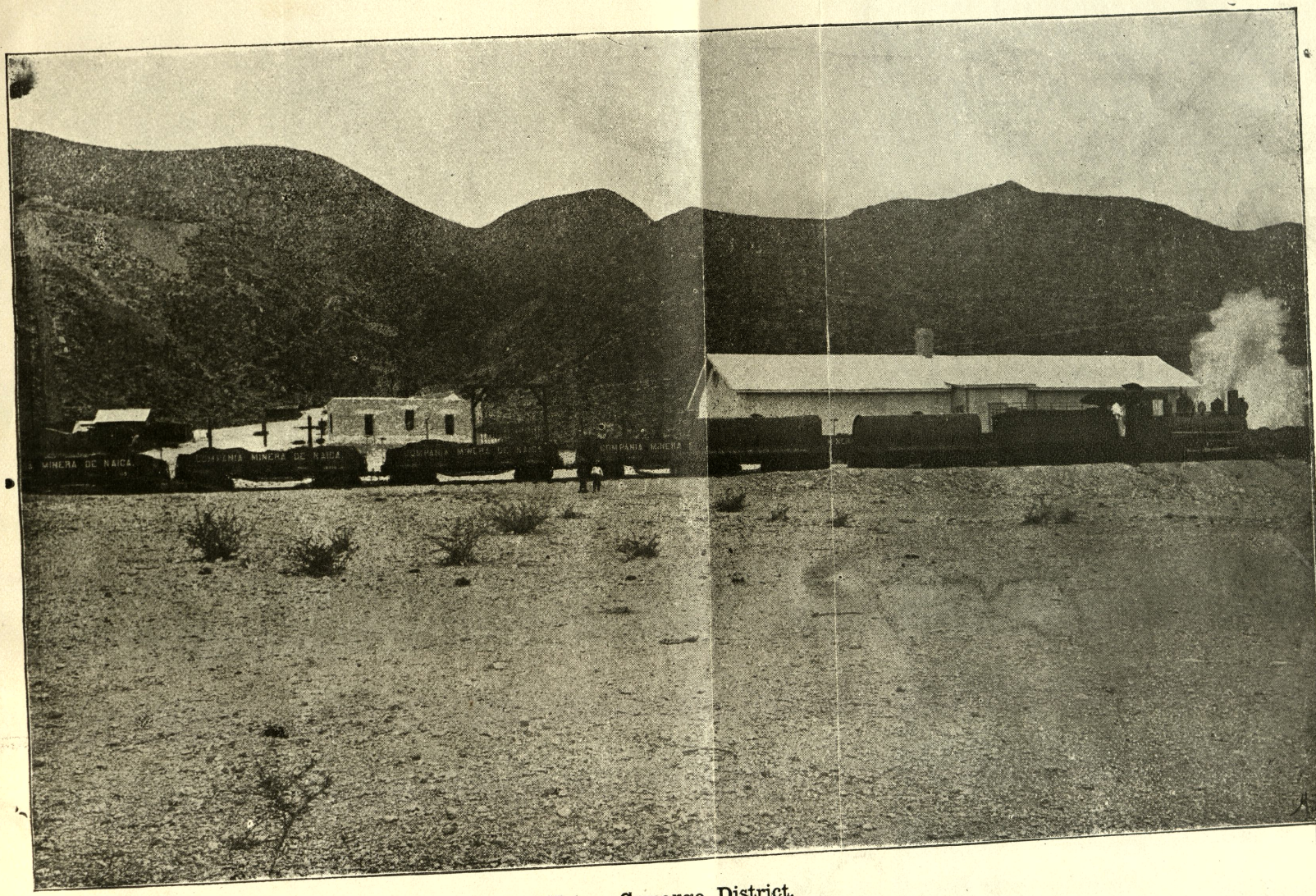
HIDALGO DISTRICT

La Palmilla, P. Alvarado.	15.000	$	150,000
El Tajo y Anexas.	7,200	„	80,000
S. Antonio Caldas, J. M. Botello.	5,268	„	22,742
San Antonio Peña, id. id.	5,896	„	23,742
Santa Brígida. id. id.	146	„	301
Alfareña, S. Fco. Sta. Bárbara. .	60,000	„	600,000
Moctezuma Lead Co.	28,745	„	214,155
San Diego y Anexas.	50,000	„	1.500,000
Guadalupe.	600	„	18,000
Clarinas Mg. Co.	3,500	„	52,500
Hidalgo Mg. Co.	21,000	„	735,000
Quebradillas Veta Colorada. . .	8,000	„	280,000
Los Muertos, Sierra Plata.	5,000	„	175,000
Sta. Gertrudis, U. S. Mg. Co. . .	4,121	„	144,205
El Refugio, A. García.	15,000	„	525,000

ELEVATION TOWNS IN STATE OF CHIHUAHUA, OVER SEA LEVEL.

	Meters.	Feet.
Aldama (K. C. M. y O.)		4,170
Aguachi, Distrito Juárez (Wislizenus.)	1,814.1	
Allende, San Bartolomé (García Conde)	1,552.0	
Aristachic, Distrito Guerrero. . .	1,854.0	
Bustillos, (Chih. al Pacífico). . .	1,848.8	6,618
Bachimba (Hda.) (Wislizenus)..	1,205.8	
Bernardo San, cerca Jiménez, (Wislizenus).	1,395.1	
Bocoyna (Kansas City M. y O.)..		7,315
Baborigame (peña) Town.		7,500
Carrizal Town Bravos District. . (Wislizenus).	1,252.7	
Callejo Springs Bravos Distrist.. (Wislizenus).	1,620.6	
Cerro Prieto Town Juárez District (García Conde)	2,124.0	
Chihuahua, Dist Iturbide, G. Cond	1,451.0	4,788.3
Chihuahua, Distrito Iturbide. (Wislizenus).	1,414.3	4,666 2
Chihuahua, Distrito Iturbide, (K. C. M. y O.)		4,605
Chiuahua, Distrito Iturbide. (Mexican Central.)		4,633
Cerro Coronel (near Chihuahua) García Conde.	1,608.0	
Cusihuiriáchic Town (Wislizenus)		
Cusihuiriáchic (Ch. al P.)	1,912.6	
Chínipas, (K. C. M. y O.)	1,973.0	
Cuiteco. Id.	1,839.4	6,586
Cerro Prieto. Id.	0.586.5	2,100
Cuesta Prieta. id	1,633.9	5.850
Cerrocahui.	2,007.6	7,188
Ciudad Camargo, Santa Rosalía (M. C. RR.)	2,198.0 1,395.8	7,870 4,875
C. Camargo, Sta. Rosalía (Wislizenus.)	1,122.7	4,020
Ciudad Juárez (M. C. RR.		
Escalón (M. C. RR.)	1,225.0	
Encinillas Lake Distrito Iturbide. (Wislizenus.)	1,132 1,310.6	3,717 4,300

	Meters.	Feet.
Enramada (Town distrit of Cam.)		
Espía, Galeana Distrit (W. H. Emory)	1,525.2 1,316.1	
Guzmán Lake (Grenz Commision)		
Guerrero (Chih. al Pacífico)	1,227.6	
Gallego (M. C. RR.)	1,340.0	
Guazapares. (K. C. M. y O)	2,010.0	6,595
Guadalupe y Calvo (Austin Grave	1,584.0	5,200
G. y Calvo, (Weed)	1,310.0	4,300
G. y Calco (W. H. Seamon)	2,323.0	
Horcasitas (M. C. RR.)	2,339.0	7,665
Jiménez (M. C. RR.)	2,334.7	7,660
Jesús María (Ocampo) (García Conde)	1.371.6 1,381.0	4,500 4,531
Jesús María Highest peak near said town.	2.572.8	
Jesús María, town (García Cubas.		
Miñaca (Chih. al Pacífico RR.)	2,577.0	
Mápula (M. C. RR.)	1,784.0	
Moctezuma (M. C. RR.)	2,121.0	6,960
Mesa (Highest point on G. C. M. y O) (A. Grave.)	1,466.0 1,280.0	4,810 4,200
Milpillas (Distrito Mina) W. H. Seamon).	2,240.3	7,350
Mesa de las Compuertas (Distrito Mina). (Austin Grave).	3,048.0	10,000
Mesa Seca (survey from Guadalupe y Calvo by Grave).	3,100.0	
Moris Town Distrit Rayon (one of lowest). G. Conde	764	
Médanos Sand hills. Distrit Galeana, North.	1,354.8	
Medanos South (Wislizenus)	1,312.5	
Noria Hda. Iturbide District. (G. Conde)	1,650.0	
Nabosaguaymé. Mina District. (Wislizenus)	1,031.0	
Ojo Caliente (M. C. RR.)	1,234.0	4.050
Ortiz (M. C. RR.)	1,219.0	4,000
Ojo del Buey (highest poin of K. C. M. y O.)	2,460.0	8,077
Parral.	5,701.0	
Pedernales (Ch. al P. RR.) (Continental devide).	2,300.0	7,549
Pichachic (K. C. M. y O)	2,202.0	7,225
Patos lake District Bravos (Wislizenus.)	1,245.0	
Pilar (ranch District Rayon)	1,553.0	



Naica, Camargo District.

Feet.
10,233
10,153
3,225
1,215
4,020
5,305
6,710
5,826
4,125
4.100
5,600
5,150
4.300
7,323
3,910

ORT.

r year

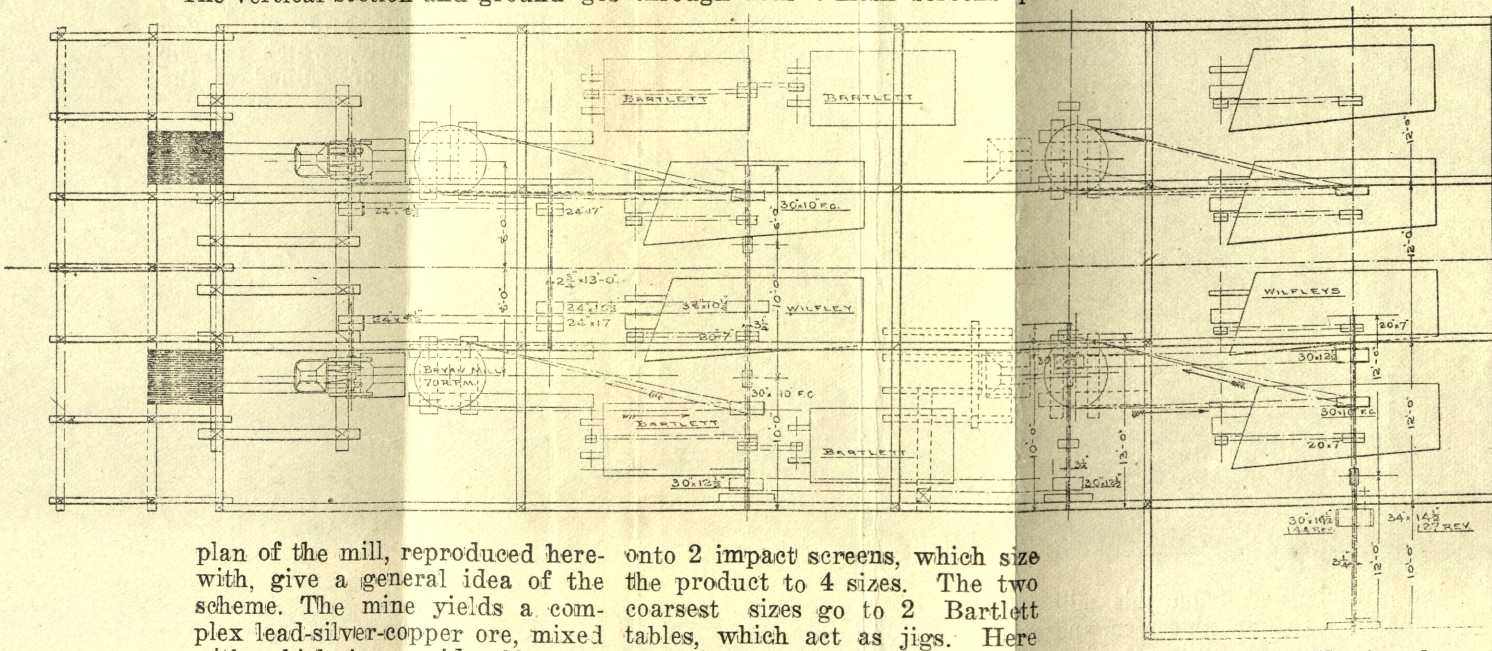
Kilos.
—
10
1,500
00.000
50,000

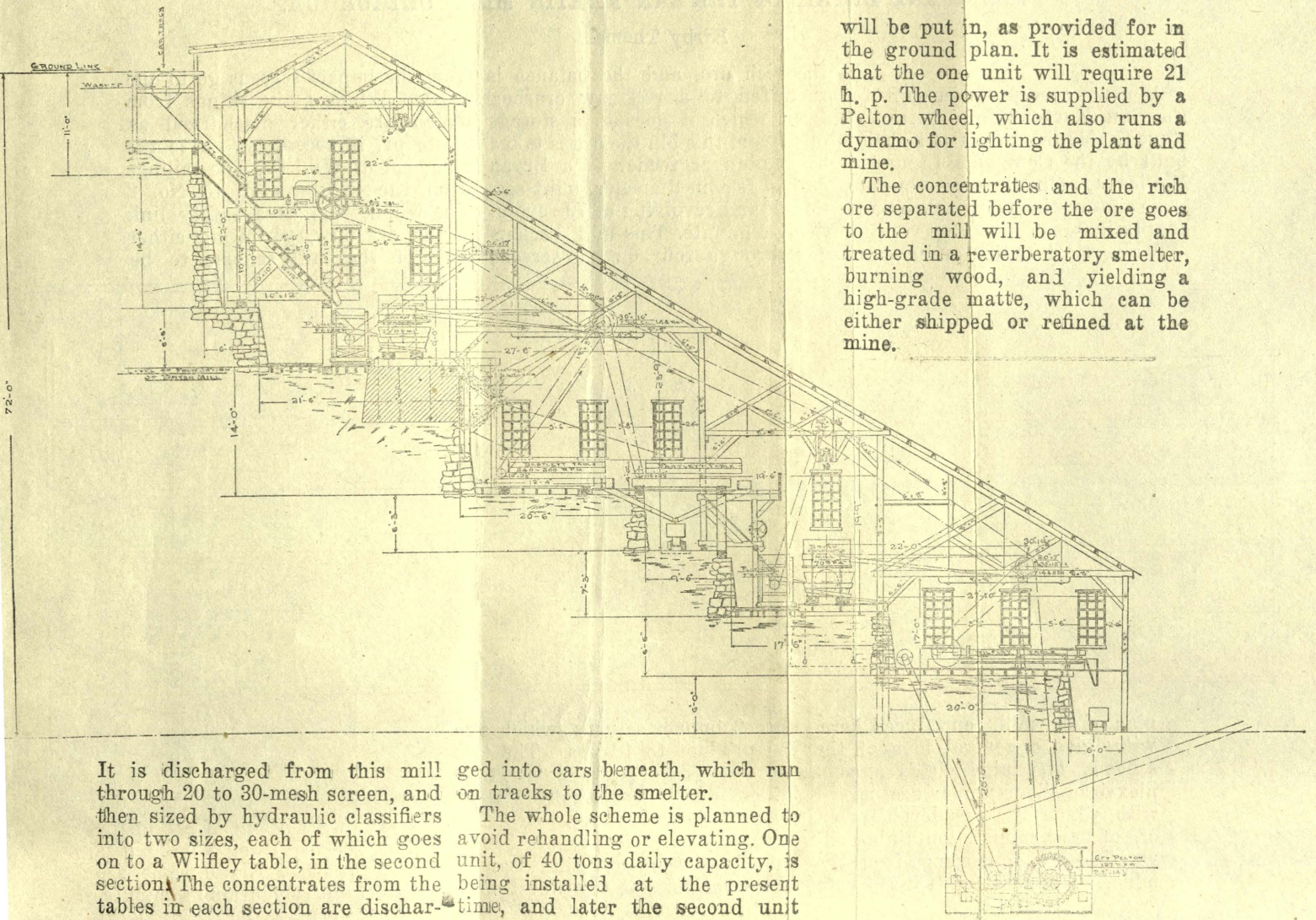
PLANS AND DETAIL OF THE SAN MARTIN MILL, CHIHUAHUA.

Kirby Thomas.

A new concentration mill for the San Martin mine, district of Rayon, Mexico, which is being built by the Compania Industrial Mexicana, Chihuahua, contains some interesting new ideas and adaptations.

The vertical section and ground plan of the mill, reproduced herewith, give a general idea of the scheme. The mine yields a complex lead-silver-copper ore, mixed with which is considerable rich ore of gray copper, containing silver. The ore, as it comes from the mine, is handsorted to separate the rich ore, and the balance is then fed to a roll jaw crusher, from which it goes to a storage bin. From this bin the ore is taken by a plunger feeder to a Bryan mill, 4 feet in diameter, built sectional, and revolving at 70 revolutions a minute. This mill discharges through four 6-mesh screens onto 2 impact screens, which size the product to 4 sizes. The two coarsest sizes go to 2 Bartlett tables, which act as jigs. Here some of the zinc is separated, but purposely the zinc separation is not close, thus avoiding loss of silver values. The two finest sizes from the impact screens go to one or two Wilfleys, the tilings from which are either discharged as waste or, if necessary, go to the other set of Wilfleys. The tailings from the Bartletts go to No. 2 bin, which acts as a safety link in the ore flow, permiting either part of the mill scheme to be closed down without affecting the other. The ore from No. 2 bin is fed to the No. 2 Bryan, same size as No. 1, 70 revolutions a minute.





It is discharged from this mill through 20 to 30-mesh screen, and then sized by hydraulic classifiers into two sizes, each of which goes on to a Wilfley table, in the second section. The concentrates from the tables in each section are discharged into cars beneath, which run on tracks to the smelter.

The whole scheme is planned to avoid rehandling or elevating. One unit, of 40 tons daily capacity, is being installed at the present time, and later the second unit will be put in, as provided for in the ground plan. It is estimated that the one unit will require 21 h. p. The power is supplied by a Pelton wheel, which also runs a dynamo for lighting the plant and mine.

The concentrates and the rich ore separated before the ore goes to the mill will be mixed and treated in a reverberatory smelter, burning wood, and yielding a high-grade matte, which can be either shipped or refined at the mine.

	Meters.	Feet.
Presidio del North (Ojinaga) . .	847.0	
Puerto de Piedra Bola (Grave) .	3,070.0	10,233
Puerto de Los Angeles (Grave) Cerca Golden)	3,046	10,153
Rancho Viejo, (K. C. M. y O). . .		3,225
Realito (Andrés del Río District)		1,215
Rosales (Sta. Cruz) (Willizenus)	1,200	
Santa Rosalía, Camargo.	1,193.0	4,020
Saucillo Hacienda (Wislizenus). .	1.205.0	
Santa Eulalia Town.	1,620	
Parcionera Mina.	2.200	
Santa Isabel (Wislizenus). . . .	1,578.9	5,305
San Pablo (Meoqui) G. Conde . .	1,223.0	
San Antonio (Chih. al P.) . . .	2,045.0	6,710
San Andrés.	1,775.0	5,826
San Sóstenes (K. C. M. y O). . .	1,267.0	4,125
San José (M. C. RR.)	1,249.0	4.100
San Nicolás Carretas.	1,706.0	5,600
Sandía (Durango y Parral RR.) .	2,763.0	
Tabacotes Peak, García Conde. .	2,359.0	
Tomochic, Guerrero District, (García Conde).	1,892.0	
Terrazas (M. C. RR.)	1,569.7	5,150
Temósachic (Chih. al P. RR). . .		
Trancas (K. C. M. y O).	1,300.0	4.300
Yoquivo (K. C. M. y O.)	2.232.0	7,323
Zabala. (M. C. RR.)	1,191.9	3,910

AMERICAN SMELTING & REFINING COMPANY'S REPORT.

Weights of Metals from State of Chihuahua during Calendar year 1906.

	Kilos.
Gold.	10
Silver.	1,500
Copper.	1.000.000
Lead.	50,000

(Kindness of Mr. William C. Potter.)

MINING AGENTS OF THE STATE OF CHIHUAHUA.

CHIHUAHUA (Includes the District of Iturbide). Manuel de la Vega, Agent.—J. M. Núñez, Substitute.

CUSIHUIRIACHIC. (Benito Juárez District.—Carlos Bernal, Agent.—Rafel Soto, Substitute.

HIDALGO DEL PARRAL. (Hidalgo District.)—Norberto Domínguez, Agent.—Francisco Gómez, Subst.—Manuel Chávez, 2nd Subs.

CIUDAD JUAREZ. (Includes the Municipality of Guadalupe, Janos S. Buenaventura, Vila Ahumada, C. Juárez).—Manuel I. Feria, Agent.—Espiridión Provencio, Subs.

CASAS GRANDES. (Includes Municipalites of Carrizal, Sabinal, Ascensión, Casas Grandes).—Julián Aguilar, Agent.—Higinio J. Sada, Subs.

CIUDAD GUERRERO. Guerrero District).—Patricio Salazar.

OCAMPO. (Rayon District).—Ambrosio Juárez, Agent.—Enrique Uranga, Subs.

C. CAMARGO (Jiménez & Camargo District).—Mauricio Chavira, Agent.—Matías Gabaldon, Subs.

BATOPILAS. (A. del Río District, except.—Municipality of Urique and Morelos.)—Refugio Salazar, Agent.—Alejandro B. Daniel, Subs.—Arnulfo Vega, 2nd Subs.

URIQUE. (Municipality of Urique).—Ramón R. Figueroa, Agent —Martín J. Nesbitt, Subs.

MORELOS (Municipality of Morelos, except Tahayana).—Manuel Pérez, Agent.—José María Echavarría, Subs.

GUADALUPE Y CALVO. (Mina District.)—Manuel Rodríguez, Agent.

Chihuahua, February 1 1907.

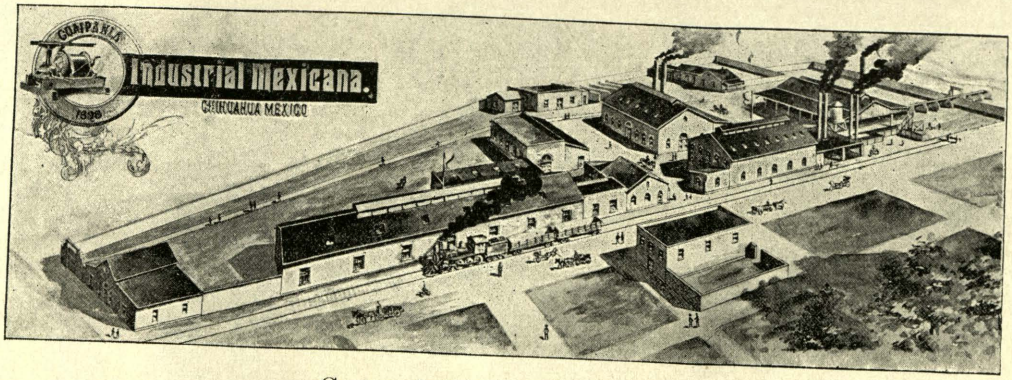
PRODUCTION OF METALS IN 1906.

	Value.
Waterson Gold Co. (Ocampo)	176,310.00
Cía. Beneficiadora del Concheño	37,278.00
Mexican Ore Co.	34,016.00
F. Stallforth y Co., Parral.	6,372.00
Benito Martínez (from y rious sources)	19,135.00
Various Mines.	408.637.00
Cía Minera de Belén. (Ocampo)	47,195.00
Miguel Prado.	1.302.00
Cía. Metalúrgica de Torreón.	113,813.00
Jesús Royval (Uruáchic) . . . .lalia.	160,675.00
Sta. Eulalia Exploration. (Sta. Euchic.	733,456.00
Dolores Mining Co. (Vía Temósa	1.138,381.00
Parcionera Mg. Co. (Sta Eulalia).opilas.	11,889.00
Sto. Domingo Silver Mg. Co. (BatCo. Santa Eulalia.	175,353.00
American Smelting & Refining	63.408.00
Chihuahua Mg. Co.	468,085.00
La Reina (Barbier y Ramírez). Cusihuiriáchic.	65,237.00
Banco Sonora. (Various).	11,739.00
Jesús Perea.	8,709.00
Palmarejo Mg. Co. (Chínipas).	45,321.00
Juan F. Treviño.	10,729.00
Lluvia de Oro Mg. Co. (Urique)	809,853.00
Cía. Minera de Naica (Naica).	1.155,106.00
La Gloria Mg. Co. (Batopilas).	60,776.00
S. Antonio Mine Sta. Eulalia.	44,974.00
Ignacio Ramírez.	20,749.00
J. D. McKensie.	103,987.00
Calera Mg. Co., San Isidro.	130,345.00
El Cristo, (Santa Eulalia).	8,614.00
Mexican Ore Co.	120,319.00
Río Tinto Mexicano Mg Co. Terra	176,887.00
National Metal Co. V. A. Cabrero.	15,106.00
Cía. Metalúrgica de Torreón.	112,504.00
Gold Green & Silver Co (Ocampo)	21,150.00
Gold Green & Silver Co (Ocampo)	3,910.00
Othon Sartorius.	11,131.00
Eureka Mg. Co. Santa Eulalia.	6,746.00
Markilda Mg. Co. (Henry Favre)	1,472.00
Potosí Mining Co. Sta. Eulalia.	1.975,288.00
Suma.	8.510,467.00
Hidalgo District.	$ 3.700.000.00
Total.	$ 12.210,467.00

PRODUCTION IN 1906.

Companies.	Location.	Weight Ks.
Negociación Minera de "La Palmilla.	Parral.	20,408,390
José María Botello.	„	5.989,426
Guadalupe Mining Company. . .	„	2.920,577
American Zinc	„	2.357,625
Cía. Metalúrgica de Torreón. . .	„	424,502
American Smeltin & Refining Co.	„	75,253
Providencia Mining Company. . .	„	69.277
Minas San Diego y Anexas. . . .	Santa Bárbara.	3.695,100
Negociación Minera de Clarines. .	„ „	1.620,500
San Francisco del Oro y Anexas. .	„ „	116,569
Negociación de Tecolotes y Anex.	„ „	30.000
Moctezuma Lead Company. . . .	„ „	540.000
Granadeña Mining Co.	„ „	50,000
Santa Bárbara Mining Co. . . .	„ „	357,500
San Francisco Mines Limited. . .	„ „	4.150,644
Hidalgo Mining Company. . . .	Minas Nuevas.	19.616,278
Veta Colorada Mining Co.	„ „	18.943,633
Sierra Plata Mining Co.	„ „	8.448,266
Long Brothers.	„ „	4.241,003
United States Mining Co.	„ „	5.610,890
Angel García (El Refugio) . . .	„ „	1.095,291
L. Villar.	„ „	988,485
G. Romemberg.	„ „	373,300
Descubridora Mining Company. .	„ „	56,050
Aerican Smelting & Refining Co. .	„ „	48,785
John F. Johnston.	„ „	12,810
Various.		13.809,346
Total.		116.049,500

H. del Parral, March 16 de 1907—El Recaudador, **M. Chávez D.**



Compañía Industrial Mexicana