

is the principal one; one at each of the cities of Guanajuato, Zacatecas, and Culiacan, the last being the capital of Sinaloa.

Besides the mint or coinage duties, silver was taxed in Mexico with an export duty which sometimes was as high as twelve per cent. on the value of the silver, which, together with the mint duty, amounted to seventeen per cent., not taking into account other taxes and local duties. Only the rich character of the Mexican mines could stand that burden.

The duties on silver have been readjusted and reduced considerably, until now they only amount, as established by the law of March 27, 1897, to a coinage duty of two per cent. and a stamp duty of three per cent., which are paid at the Assay Office of the Mint when coined, or at the custom-house when exported in bullion, ores, or other compounds. When exported in ores in their crude condition, the duty has a rebate of ten per cent. A small duty representing the cost of the operation is also charged for assaying, refining, smelting, and separating the metals.

SMELTING PLANTS.

The Tariff Act of October 1, 1890, having levied a duty upon lead ore, which prevented that Mexican product from coming into the United States in the shape it had come before, the American companies, who had been developing the lead ore in Mexico, established smelting plants in the country for the purpose of treating there the lead ore, and sending it as pig-lead to the United States.

The smelting plants that have been established in Mexico, and their capacity and output, taken from official data received from the Mexican Government, up to December 31, 1896, are the following:

Mexican Metallurgical Company.—This company, of which Mr. Robert S. Towne is president, obtained a charter from the Mexican Government on March 20, 1890, to establish five smelting plants in Mexico, two with the minimum capacity of 200 tons a day, two of 150 tons, and one of 100 tons. The first one is located at Morales, five kilometres west of the city of San Luis Potosi. During the fiscal year 1895 to 1896, this plant received 62,370 and 020/1000 metric tons of ore from the States of Chihuahua, Coahuila, Durango, Guanajuato, Jalisco, Mexico, Michoacan, Nuevo Leon, Queretaro, San Luis Potosi, and Zacatecas. This plant yielded during the same year 16,019 and 070/1000 metric tons of base lead bullion, with 3,198,924.14 troy ounces of silver, valued at \$4,882,177.50; and 8268 and 37/100 troy ounces of gold, valued at \$161,338.63.

National Mexican Smelter at Monterey.—This company, whose president is Mr. Daniel Guggenheim, obtained a charter from the Mexican Government on October 9, 1890, to establish three smelting plants in Mexico, two with a minimum capacity of 300 tons per day,

and one with 100 tons. The first plant is located in the outskirts of the city of Monterey, has ten furnaces of the water-jacket system, and seven smelting furnaces for lead ore. From July, 1892, to June, 1896, this plant has smelted 521,809 and 769/1000 metric tons of ore, yielding 78,067 and 141/1000 tons of lead, with 515,382 kilograms of silver, with a value of \$21,824,597.93, having used foreign coke to the value of \$1,474,385.81, and Mexican coke to the value of \$73,268.08.

Central Mexican Smelter.—The second smelter of the Guggenheim Company is located at Aguascalientes. It has a department for concentrating copper ores, one for smelting the same ores, consisting of three furnaces, and another with four furnaces for smelting lead ores. This plant smelted from the 26th of December, 1895, 606 and 190/1000 tons of lead, containing 6502 kilograms of silver and 28 and 71/100 kilograms of gold, with a value of \$341,091.

Velardeña Mining Company.—This company, whose president is Mr. Edward W. Nash, obtained a charter from the Mexican Government on May 15, 1893, for the construction of two smelting plants in Mexico, with a capacity of 200 tons a day each. From November 30, 1893, to June 30, 1896, this plant smelted 110,000 tons of ore, yielding 9069 and 680/1000 tons of lead containing 1,850,685 troy ounces of silver and 6192 ounces of gold.

The Chihuahua Mining Company.—This company, whose president is Mr. John B. Shaw, obtained a charter from the Mexican Government May 26, 1893, and is located near the city of Chihuahua. Up to July 28, 1896, it had smelted 28,555 tons of lead ore, yielding 3761 tons of lead and 529,450 troy ounces of silver.

The Mazapil Copper Company, Limited.—This company established a plant at Concepcion del Oro, Zacatecas, and has smelted 5000 tons of lead ore containing silver.

Sabinal Mining and Smelting Company, Chihuahua.—This company owns the mines of Santa Juliana and Santa Inez, which yield 30 per cent. of lead, with a mixture of silver, and smelts their ore, notwithstanding that the cost of a ton of coke amounts to \$37.50.

La Preciosa.—A smelter under that name has been established at Tepeyahualco, State of Puebla, but I do not have any data about the company owning it, and the date of its contract with the Mexican Government, nor the amount of ore smelted there.

The Boleo Smelter.—I have already spoken of this plant, which smelts copper ores at Santa Rosalia, Lower California.

OROGRAPHY.

Mexico is traversed by two cordilleras or high ranges of mountains running almost parallel to the coast, one along the Gulf of Mexico and the other along the Pacific Ocean. The former runs from ten to

one hundred miles from the coast, leaving an imperceptibly inclined plane from the sea to the foot of the mountains; while the cordillera on the Pacific side runs, on the whole, very near the coast, leaving a very narrow strip of land between the same and the sea, and from this run several branches in different directions. The most continuous range is the Sierra Madre of the Pacific, which may be traced, at a mean elevation of over 10,000 feet, from Oaxaca to Arizona. Parallel to this is the Lower Californian range (Sierra de la Giganta) 3000 feet, which, however, falls abruptly eastwards, like the Atlantic escarpments. The California peninsula seems to have been detached from the mainland when the general upheaval took place which produced the vast chasm now flooded by the Gulf of California. Corresponding with the Sierra Madre on the west are the more interrupted eastern scarps of the central plateau, which sweep around the Gulf of Mexico as the Sierra Madres of Nuevo Leon and Tamaulipas at an elevation of about 6000 feet. These are crossed by the routes from Tula to Tampico, the highest pass being 4820 feet; from Saltillo to Monterey 3400, and at several other places.

Of the central cross ridges the most important orographically and historically is the Cordillera de Anahuac, which surrounds the Mexican (Tenochtitlan) and Puebla valleys, and which is supposed to culminate with Popocatepetl and Ixtacihuatl. But these giants belong to a different or rather more recent system of igneous upheaval, running from sea to sea between $18^{\circ} 59'$ and $19^{\circ} 12' N.$ in almost a straight line east and west, consequently nearly at right angles to the main axis of the central plateau. The line is clearly marked by several extinct cones and by five active or quiescent volcanoes, of which the highest is Popocatepetl, lying south of the capital, nearly midway between the Pacific and the Atlantic. East of the central point of the system are Citlaltepétl, better known as the peak of Orizaba, on the coast south of Veracruz, to which correspond on the west the recently upheaved Jorullo in Michoacan, Colima (12,800) near the coast in Jalisco, and the volcanic Revillagigedo group in the Pacific. South of this line and nearly parallel, are the sierras of Guerrero, and south-east of the Tehuantepec Isthmus those of Oaxaca and Chiapas towards the Guatemala frontier. In the same direction run the islands of Cuba and Hayti, which probably belong to the same Central American system.

In the course of centuries these high mountains have become disintegrated by the rains and other natural elements, and a great many spaces between them filled up, forming a series of valleys and other spots quite delightful in climate and very rich in agricultural resources. This series of valleys, which we call the central plateau, runs from about one hundred and fifty miles east of the City of Mexico, traversing all of Mexico in a northwesterly direction. So level is the plateau

that even when there were no wagon roads in Mexico one could travel in a carriage from the City of Mexico to Santa Fé. Baron Humboldt and other geologists considered the cordilleras of Mexico as a portion of the Andes of South America, which originate in Patagonia, extending over the whole of that continent; but researches were made specially by a corps of engineers, who surveyed Mexico during the French Intervention, arrived at a different conclusion, and consider that the Andes proper end in Panama, and that the Mexican cordilleras are entirely independent from that lofty chain of mountains.

In contrast with the plains and at times barren districts of the central plateau, it is occasionally broken by depressions of the soil, known as barrancas, descending sometimes one thousand feet and measuring several miles across, which are covered with a luxuriant vegetation of trees and shrubs, and watered by small streams running through the middle of the valley. Among the most remarkable ones are the barranca de Beltran descending the western slope from Guadalajara to Colima, and the barranca de Mochitilte from Guadalajara to Tepic.

One of the pre-eminently interesting features of Mexico is the mountain of Jerullo, in this section, which has been born within recent times. The natives described to Alexander von Humboldt the convulsions of the earth during its birth, and the frightful spectacle of the huge mass thrusting its giant shoulders among its neighbors, making room for itself in their ranks.

The best way to illustrate the broken surface of Mexico is to give the altitudes of some of the principal localities, both from the coast to the interior and from the interior back to the coast, taken from the measurements made by the railroad companies and by the engineers of the Mexican Government in the national wagon roads where railroads are not yet running. I append to this paper a list of such altitudes, with their distances, whenever I have been able to find them, which I consider the best illustration that could be presented on this subject.

MOUNTAINS.	STATES.	ELEVATION IN FEET.
Popocatepetl.....	Mexico.....	17,540
Orizaba.....	Veracruz and Puebla.....	17,362
Toluca.....	Mexico.....	15,019
Ixtacihuatl.....	Mexico and Puebla.....	16,076
Colima.....	Jalisco.....	14,363
Zapotlan.....	Jalisco.....	12,743
San Martin or Tuxtla.....	Veracruz.....	4,921
Tancitaro.....	Michoacan.....	12,467
Jorullo.....	Michoacan.....	4,265
Tacana or Soconusco.....	Chiapas.....	7,436
Guarda.....	Federal District.....	9,731
Ajusco.....	Federal District.....	13,628
Cofre de Perote.....	Veracruz.....	13,415
Zempoaltepec.....	Oaxaca.....	11,141
Pico de Quinceo.....	Michoacan.....	10,905
Veta Grande.....	Zacatecas.....	9,140

The above are the principal mountain peaks of Mexico, the first ten being volcanoes, with their heights according to the most recent measurements :

HYDROGRAPHY.

The eastern Mexican coast, washed by the Caribbean Sea and the Gulf of Mexico, is low, flat, and sandy, except near the mouth of the Tabasco River, where at some distance from the coast appear the heights of San Gabriel, extending northeast and southwest for several miles ; but the majestic mountains of Veracruz, especially the volcano of Orizaba, visible for many leagues to seaward, form a picturesque background which relieves the monotony of the shore region of that State. On the Pacific side the coast, although generally low, is here and there roughened by spurs extending from the cordillera to the ocean.

The principal gulfs are those of Mexico, California, and Tehuantepec, the first of which ranks among the largest in the world.

We are not blessed with good harbors on the Gulf coast. Veracruz is an open roadstead, and we are now spending large sums of money in trying to make it a good port. Our best harbors are on the Pacific coast, as Acapulco, which is a large one ; Manzanillo, a very fine although a very small one ; and La Paz, on the Gulf of California. By artificial means we expect to improve our harbors considerably.

The development of the harbor of Tampico is remarkable. A short time ago the depth of the bar roadstead was only eight or nine feet. Now steamships drawing twenty-four feet of water enter the port. The deepening of the entrance to the harbor has been accomplished by means of jetties, just as the mouth of the Mississippi was deepened by the Eads jetties. A very large part of the imports of Mexico enter now by the port of Tampico.

The more noteworthy bays are those of Guaymas, Santa Barbara, Topolobampo and Navachiste, in the Gulf of California ; Concepción, La Paz, and Mulejé, on the west coast of the same gulf ; San Quentin, Magdalena, and Amejas, on the Pacific coast of Lower California ; and San Blas and Valle de Banderas, on the coast of Tepic.

We have no lakes as large as those with which the United States is favored, and the Lake of Chapala, a beautiful spot where country houses are now being built, is the largest lacustrine basin in Mexican territory. The Valley of Mexico has six lakes, two of fresh and six of salt water. The other lakes in Mexico are Catemaco, in the State of Veracruz ; Cairel and Carpintero, in the State of Tamaulipas ; Encantada, in Tabasco ; Bacalar, in Yucatan ; Alcuzague, in Colima ; Cuitzeo, Tacasquaro, and Patzcuaro, in Michoacan ; Yuriria, in Guanajuato ; and Meztitlan, in Hidalgo.

Mexico has a great many islands, situated near the coast, although not any of very great area, the greater number being uninhabited, although some of them are very fertile, and could be the seat of a large population. Among the most important are : El Carmen, the largest in the Gulf of Mexico ; San Juan de Ulua and Sacrificios, opposite the port of Veracruz ; Mujeres, in the Caribbean Sea ; Guadalupe, about seventy-five miles from the west coast of Lower California ; the Tres Marias group, about thirty miles from the same coast ; the Revillagigedo group, not far from the coast of Colima ; and adjoining the coast of the State of Michoacan, the Alcatraz Island.

As I have already stated, Mexico has a very broken surface, with high mountains, causing streams to run down a very inclined plane, forming torrents with rapid cascades, which contribute to embellish the natural features of the country. These conditions, however, prevent us from having large navigable rivers, and furnishing a cheap way of transportation, which is one of the greatest advantages the United States enjoys, and which so largely contributed in its early days to the development of the country, making transportation to long distances both easy and cheap. While the torrents descending from the mountains afford an immense water-power—which, in the course of time, may be used as a motor for industrial purposes—they meet when they reach a valley and run smoothly there through a ravine until finally they reach the coast, and it is therefore only at a comparatively small distance from the sea that they can be made navigable.

Our principal rivers, measuring their positions from north to south, are the Rio Grande—which from El Paso, Texas, to the sea, is the boundary line between the two countries, and which used to be a large river ; but as it rises in Colorado and passes through New Mexico, and the inhabitants of both have taken for irrigation purposes most of the water that it carries, it becomes entirely dry during the dry season after the freshets, very much to the distress of the inhabitants of its borders from El Paso to Ojinaga, especially on the Mexican side, which has been inhabited for three hundred years, the people using the water for irrigation—on the other side there being hardly any population,—and now they find that their farms are entirely worthless for want of water. After passing Presidio del Norte, now called Ojinaga, the Conchos River and other tributaries of the Rio Grande River supply it with water, although not to the extent it had before the water was taken in Colorado and New Mexico. The Mescala, or Balsas River, rises in the central plateau near the Valley of Mexico, passes by the State of Puebla to the southwest, by Mixteca of Oaxaca, and finally empties into the Pacific at Zacatula. As indicated by its name, it is, to a limited extent, navigable along its lower reaches ; above the bar it is accessible to small craft, which, higher up, are arrested by rapids,