

DECEMBER 24, 1921.

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MY DEAR SIR:

In response to your request of December 21st, I submit herewith a summary and description of the properties of the Anaconda Copper Mining Company as follows:

Butte, Montana, is the most productive individual American mining center for copper and silver; and in the last two years has attained equal prominence in zinc. It therefore furnishes vast quantities of both the component metals of brass. The Anaconda Company possesses almost all the copper properties in Butte, and is in addition the owner of a large part of those yielding zinc. All the ores carry silver and minor amounts of gold. When working at capacity the Anaconda Company can produce in a year 4,500,000 to 5,000,000 tons of ore, which yields some 275,000,000 pounds of copper, 11,000,000 ounces of silver and 40,000 ounces of gold. In addition from purchased ores, the Company ordinarily increases its copper output by 25,000,000 lbs. additional, with a corresponding increase in silver. The more recently added electrolytic treatment of zinc furnished in 1920 over 100,000,000 pounds of this metal with a by-product yield of about 12,500,000 pounds of lead, 2,173,000 pounds of copper and 2,073,000 ounces of silver. As by-products in normal years, the smelter at the City of Anaconda saves some two and one-half million pounds of white arsenic; and manufactures over 52,000 tons of sulphuric acid, which amount can be greatly increased if needed. The acid is employed to leach the last available vestiges of copper from the tailings of the concentrators of former years, and for converting phosphate rock into a rich fertilizer. Although this latter branch of the enterprise is only in its beginnings, 3,666,938 pounds of treble superphosphate have been made in an experimental plant.

HISTORY

Butte had its small beginnings in 1864 when gold was discovered in the gulches which still cross the City's streets. Later in the same year the first vein locations were made, because of their silver values—and although some copper was detected as early as 1865, copper smelting was of small importance until the advent of the railroad from Salt Lake City in 1881. The Anaconda claim was located in 1875, and was believed to be on a silver vein until, in 1881, at 100 feet the shaft revealed copper. With the coming of the railroad the real copper industry became possible. In 1888 connections by an independent line were made with the Northern Pacific at Helena, and in the early nineties by its own branch from Three Forks, now a part of its main line to the coast. The independent line from Helena ultimately was extended to Great Falls and became the Great Northern connection. Within the present century the main line of the Chicago, Milwaukee, and St. Paul R. R. has been constructed through Butte and runs to Puget Sound cities, so that now Butte is on four great transcontinental railways, two direct and two with branches.

In the closing years of the last century and the opening ones of the present, mining litigation over the veins of Butte became so serious as to practically force the combination of large

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interests in order to avoid it. Accordingly in 1910 the Anaconda Co., the Boston and Montana Co., the Red Metal Co., the Parrot Co., the Washoe Co., and the Colorado Smelting Co., with some smaller interests were combined in the present Anaconda Company. A few years later the Stewart and several adjacent claims and a local smelter were purchased from W. A. Clark. The united holdings cover in a connected way the main area of copper producing ground, and make a compact group. They extend about three miles from east to west and at the maximum are about a mile wide.

At the time of the principal consolidation, electric current was brought in from several important water powers; and since then the hoisting, air-compressing and haulage have been almost entirely done by this form of power which is furnished by the Montana Power Co., an independent organization. Important economies have thereby resulted.

Despite the great extent of the veins, there is some decided encouragement to anticipate further productive ground on the west and northwest, in territory not as yet much opened up.

THE VEINS

The veins are in three successive series. The oldest is a set of nearly east and west fractures, often called the Anaconda system. They are the most productive. Following the East-west series came the northwest and southeast fractures called the Blue Vein series and highly productive. Lastly a series running northeast and southwest were formed called the Stewart Fault Vein series, also important producers. Several belts of strong east and west veins are known, of which the Anaconda vein is the most important. Because of multitudes of small fissures spreading out like the hairs on a horse's tail from the main vein, and the impregnation of the general mass of the rock with ore in these small fissures, the minable ground is at times several hundred feet across.

GRADE OF ORE

The ores are of all grades from a general mining minimum of about 3.0% copper to percentage of 10-15. The ore is carefully taken so as to use lower grades in times of high copper prices, and higher grades in times of low prices. In this way the available supply is, and has long been, carefully conserved. This average quality has been maintained for 10 or 15 years. All the ore as mined, richer and poorer together, so as to form a general payable average of about 3.3% copper, is sent to the mill, crushed and concentrated by oil flotation. The recovery is 96% of the values, an exceptionally favorable showing. Allowing for further unavoidable losses in smelting and refining the recovery over all is 91.5% of the values in the crude ore—a showing that is rarely, if ever, equaled for any similar tonnage.

IMPORTANCE OF COMBINED OWNERSHIP

The centralized ownership and operation of the formerly separate companies have greatly increased economy and stability as compared with smaller or small individual enterprises. If a large company operates on twenty or thirty veins with over twenty shafts and hundreds of working points, the failure of ore in any one or several places is lost in the general permanence of others and in the constant development and discovery of new supplies. In its operations the Anaconda Company has opened over 2,200 miles of workings and in normal years operates 23

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different mines or shafts. Each normal year from 35-40 miles of drifts and cross-cuts, i. e., small tunnels, are excavated in further development of the veins already known or those for whose discovery the work is prosecuted.

Both exploration and mining are carefully planned and systematically carried on with the aid of geological maps, on which day by day the results of the new developments are platted. Every precaution is thus taken to forecast the future and let no accessible ore body escape discovery.

CONTINUATION OF VEINS IN DEPTH—ORE RESERVES

The continuation of the veins and of their values in depth is a fundamentally important question. The individual mines of the Anaconda Company are of all depths from 500 to 3,200 ft. The deepest exploring shaft has penetrated over 400 feet below the deepest present working level. The rich copper-bearing minerals continue unchanged in character, to the lowest depth reached and the silver shows no decline, but if anything a slight improvement in its ratio to copper. Estimates which have been carefully made indicate an ore-reserve of sufficient quantity to support operations on the normal scale for fifteen or sixteen years to come. Such a period of time is unusually long for a mining enterprise. Past experience shows that the development in advance of mining indicates more ore blocked out today than was known to be blocked out ten years ago, ahead of the stage of mining then existing. There is reason to think this experience will continue to characterize the future for some years to come. With increasing depth, however, a practicable limit will ultimately be reached for hoisting at one step, and a second electric hoist will be necessary to shorten the excessive length and weight of cables.

Broadly viewed the best test of a great enterprise such as the Anaconda Copper Co. is its continuous and profitable operation over a long period of years. This test the Company fully meets. No apparent change is anticipated in the physical conditions of production, essentially differing from those of the present, for fifteen years to come. The valuation of the mining properties, as disclosed by the published balance sheet in the annual reports, seems to me to be conservatively and justifiably made on the large facts of past results, on recent or present performance and on the reasonable assurances for the future.

SMELTERS

THE ANACONDA SMELTER

The Anaconda Company owns one great works for the concentration and smelting of the ores at Anaconda, 26 miles west of Butte. The smelter and town of Anaconda are connected with Butte by the Butte, Anaconda and Pacific R. R., a controlling interest of whose stock is owned by the Anaconda Company. The road is electrified, and is properly equipped to handle the huge traffic which passes over its rails.

All the concentration of the ore is now centered at Anaconda. The product of the mines is crushed and by oil-flotation the copper bearing minerals are separated from the barren rock. The copper is then smelted and cast into anodes containing also the precious metals and is shipped to Great Falls, Mont., for refining and manufacture into wire, bars and cables, up to 16½ million pounds per month, the capacity of this plant. Any excess is sent to the Raritan

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refinery at Perth Amboy, N. J. The zinc ores are also concentrated at Anaconda and given a slight preliminary roast before being sent to Great Falls for electrolytic reduction.

Since all the ores are compounds of sulphur, vast quantities of sulphurous gases are driven off in the roasting and smelting. From these there is now a large, and in the future there will be an increasing manufacture of sulphuric acid. Large quantities of arsenic are driven off as oxide in the smelting of the copper ores and are condensed in chambers as white arsenic oxide. In time it is anticipated that still more can be saved and marketed.

A growing industry depending on the output of sulphuric acid in the production of high grade phosphate from the rock-phosphate of the mines at Conda in southeastern Idaho to be later described.

THE GREAT FALLS REDUCTION WORKS

A second large works belonging to the Company is situated at Great Falls, Mont., 175 miles from Butte. The location has the advantage of an important water power, right at its site, and of being near to the very large installations of the Montana Power Co. at the Great Falls of the Missouri River, six miles down stream. Although formerly used for concentrating and smelting, the Great Falls plant is now devoted to the refining of copper and to the manufacturing of a large part of the output into wire, bars and cables.

The capacity is 200,000 pounds of rods and 80,000 of wire—daily. It contains also the electrolytic installation for zinc, and has an auxiliary series of electric furnaces for the production of ferromanganese from Montana ores. During the war period, over seven million pounds of ferromanganese were made.

TIMBER LANDS

All vein mines in the West are insatiable consumers of timber. Foreseeing this need, many years ago the officials of the Anaconda Co. purchased at favorable terms, a large block of the timber contained in the land grants of the Northern Pacific R. R. The Company now owns 1,150,000 acres in western Montana, containing standing timber estimated at 6,000,000,000 ft. The logs are prepared for mine-timber and for sale as lumber in a new and entirely modern saw-mill at Bonner, six miles from Missoula, Montana. 75-80,000,000 ft. of the output of the mill are taken by the mines when mining at capacity. The balance of the output is sold as commercial lumber. When lumber is measured in feet as above, a square foot of a one-inch board is the unit.

COAL LANDS

The Anaconda Co. early recognized that an assured coal supply was essential to successful and economic operation. Formerly steam power was used for hoisting, air-compressing and haulage at the mines and on the railroads. Coal for this purpose has largely been supplanted by electricity. But for smelting by the modern process using pulverized fuel, a low ash, low sulphur, long flame bituminous coal is requisite. For this special purpose the Company owns and operates some excellent coal lands at Diamondville, Western Wyoming, on the Oregon Short Line. The tract contains 4,480 acres with two seams varying from 4 ft. to 12 ft. in thickness. Besides the coal sent to the smelter, a large amount is sold to the railway. The Anaconda smelter uses about a thousand tons a day.

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For miscellaneous steaming purposes and for custom sale to railroads and others the Company owns at Bear Creek, South of Billings in southeastern Montana, 1,760 acres of coal lands, which are operated under the name of the Washoe Coal Co. There are three workable seams, ranging from 5-9 feet in thickness. The coal is a steam coal, and the mines have a capacity of 1,000 tons daily. They are equipped with modern coal cutting machinery for the most economical practice.

In Northern Montana, 13 miles from Great Falls in what is known as the Sand Coulee District, the Company has a tract of 558 acres, with two mines at Lochray, and containing one seam about 9 ft. thick. Three miles from Lochray, the Company also owns the, as yet, partially developed Spring Creek tract of 1,436 acres with a seam running from 9-12 feet. The Spring Creek tract will be further equipped and in operation in eighteen months. All these are important for the use of the Great Falls plant from which they are distant 20 miles.

In estimating coal reserves a production of 100 tons per acre, per inch of seam is a safe estimate. Allowance is thereby made for coal necessarily left in pillars in mining.

PHOSPHATE ROCK

In all smelting operations of sulphide ores, vast quantities of sulphurous gases are yielded and in most works of necessity are allowed to escape into the atmosphere. Thus not only are vast quantities of a substance useful for sulphuric acid lost, but the real or inferred injury to neighboring vegetation and agriculture is also a fruitful subject of injunctions and litigation. In an endeavor to save the gases the Company has introduced at the Anaconda smelter the manufacture of acid and has developed a "tower" process peculiar to itself. The acid has been used to leach the tailings discharged from the concentrators of former years when the recovery of the copper was relatively low; and more recently for the conversion into high grade phosphate fertilizer of the natural rock phosphate upon a tract of 610 acres owned by the Company at the new camp of Conda, near Soda Springs in Southeastern Idaho. The mines for phosphate rock are now being opened up and equipped and will soon be prepared to ship on a commercial scale. The phosphate bed contains 7-8 feet of rock averaging 32½-34% phosphorus pentoxide, P_2O_5 . In the preliminary way, over 3½ million pounds of treble superphosphate have been manufactured successfully in the experimental plant.

INTERNATIONAL SMELTING CO.

The Anaconda Copper Mining Co. owns the International Smelting Co. whose works are situated at Tooele, Utah, 40 miles from Salt Lake City and just north of a narrow divide which separates it from Bingham Canyon. It possesses both copper and lead furnaces. In addition to custom ores, it treats the output of the Utah Consolidated Mining Co., with which it is connected by a cable tramway. The International Company owns another smelter at Miami, Arizona, which reduces the ores of the neighboring Inspiration Copper Mining Co. and of the Miami Copper Co.

The International Smelting Co. owns a controlling interest in the Walker Mining Co., whose property, the Walker Mine, is situated 24 miles from Portola, on the Western Pacific R. R. in eastern California. The International Co. also has a long time smelting contract for the smelting of the ores. The mine is developed by shafts from the surface and by a tunnel about

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2,000 feet long, which intersects the vein at a depth of 800 feet. While only partially developed, the mine has disclosed about one million tons of 4% copper ore, with values in gold and silver. A concentrator with a capacity of 200 tons per day is erected and connected by cable tramway with Spring Garden station on the Western Pacific R. R., 8 miles distant.

The International Lead Refining Co. owned by the Anaconda Copper Mining Co. has its plant at East Chicago, Ind. It refines the base bullion, i. e., the pig lead with the precious metals, which is produced by the International Smelter at Tooele, Utah.

Neighboring to the International Lead Refinery at East Chicago is the plant of the Anaconda Lead Products Co. of which the Anaconda Copper Mining Co. owns a controlling interest. This plant is at present in full operation and produces by an electrolytic process twenty tons of white lead daily, using the refined lead of the International Lead Refining Co.

The Raritan Copper Works is located at Perth Amboy, N. J., and is owned by the Anaconda Copper Mining Co. It has a capacity of 38,000,000 pounds of copper per month. In addition to refining the portion of the copper from the Butte mines, which exceeds the capacity of the Great Falls Refinery, it treats copper on toll for other producers.

SOUTH AMERICAN PROPERTIES

With the successful mining and concentration of relatively low grade so-called "porphyry coppers" in the last twenty years in the United States, the Anaconda Company has been interested to secure such holdings in South America and now owns a predominant interest in four. The one in the most advanced state of development is at Potrerillos, Chile.

THE POTRERILLOS MINE

The nearest Chilean seaport is Chafaral and the Andes Copper Mining Co. by which this enterprise is known, has placed its dock and warehouses in a small embayment neighboring to Chafaral. The Andes Co. avails itself of 64 kilometers (38.4 miles) of the Chilean State R. R. to Pueblo Hundido and has trackage agreements. From Pueblo Hundido the Company has constructed its own road 82 kilometers or about 50 miles to the mine at Potrerillos back in the foothills of the Andes.

An ore-body lying above the tunnel level has been proved by drilling to contain over 128,000,000 tons of ore running 1.49 in copper. The mine is already developed and the ore lies in such a way that as broken it will all drop downward to the cars—no hoisting being required. The town site is already laid out and dwellings have been erected, but the concentrator and smelter remain to be constructed as does the pipe line by which water will be brought in for the concentrator and other works, from a distance of 37.8 miles. Allowing for losses in concentration and smelting there is roughly and safely about one and a half million tons of available copper in this huge ore-body.

The Santiago Mining Co. owns Lo Aguirre and Africana mines. The Anaconda Company owns all but a small fraction of the Santiago stock.

Lo Aguirre Mine. About 15 miles from Santiago, Chile, is the Lo Aguirre property in which development has shown 8,000,000 tons of 1.98% copper ore. The work at present is essentially that of development by drill holes and tunnels, but enough has been done to prove a promising deposit.

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Africana Mine. In the same general region and six miles from Lo Aguirre Mine is the Africana, in which development has shown some 2,000,000 tons of $3\frac{1}{4}\%$ copper ore.

Cerro Verde. In Peru the Anaconda Company has also a predominant interest in a low grade property called the Cerro Verde, near Arequipa 60 miles northeast of the port of Mollendo, with which there is rail connection. 20,000,000 tons of 1.92% copper ore have been shown by the explorations, but except for this development, further utilization remains for the future.

I have gone over in detail the values assigned to the various properties of the Anaconda Copper Mining Co. and its subsidiary companies in its balance sheet. I have checked them as well as I could from knowledge of the mines and works in Butte and elsewhere in Montana; and from general experience in matters of this sort. Ten or eleven years ago at the time of the consolidation of the Butte mining companies to the present Anaconda Company, I went into the assets of the then Anaconda Co. in great detail, mines, timber lands, coal properties and smelters. The values then approved have been justified in subsequent experience. I have been frequently in Butte since then. In my opinion the present valuations which have been the basis of negotiations with The American Brass Company have been fairly and conservatively determined.

Trusting that this covers the chief points of interest, I am,

Respectfully,

JAMES F. KEMP.

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