Some Utah Mineral Deposits and Their Metallurgical Treatment.

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THE following paper by Prof. R. H. Bradford was read before the sessions of the American Mining congress in session at Pittsburg, Dec. 2 to 5. It is in condensed form, a resume of the subject of minerals and mining in every phase of the field:

In the comprehensive paper on the "Mining and Mineral Resources of Utah," read at the Denver meeting of this congress two years ago, by our esteemed director from Utah, Mr. John Dern, the mining resources of the state were fully outlined. It will be the aim of the present paper to give briefly the present status of Utah's mining and metallurgical industries, with especial stress upon the developments of the last two years.

UTAH'S STANDING AMONG THE STATES.

In the production of the four important metals—lead, silver, gold and copper—during last year, 1907, Utah stood third in lead, third in silver, fourth in gold, and fourth in copper, among the states of the Union, having made a decided advance in copper output over former years, with an advance also in lead and silver.

Her copper output for 1908 will be far in advance of last year with the promise of greater increase for other years yet to come. The rapid development of the mines of Bingham has brought our state rapidly to the front as a copper producer, and further exploitation in this camp bids fair to place her in the ranks as first instead of fourth in copper.

BINGHAM.

MINERAL DEPOSITS.

As a preface to the consideration of some of the larger mines of Bingham, I quote from the summary on the geology of this area in the monograph on Bingham by the United States geological survey. "Between carboniferous and late tertiary time monzonite intrusives invaded sediments in the Bingham area, metamorphized them, and introduced metallic elements, which replaced marbelized limestone with pyritous copper sulphides. After the superficial portions of the intrusives had cooled to at least partial rigidity, they and the enclosing sediments were rent by persistent northeast-southwest fissures."

"Heated aqueous solutions from below then ascended, producing alterations, and introducing metallic minerals. Later the original sulphide ores, altered by surface waters, were oxidized in the upper layers, and secondarily enriched below by changing to black copper sulphides with the addition of gold and silver."

As a result of this process of mineralization there is found in the camp three types of deposits, namely, (1) the disseminated ore of the monzonite laccolith and the contiguous quartzite, (2) the sulphide lode or vein ores, and (3) the replacement or bed ores in limestone. The first type is known in the strict as "porphyry ore," and the others as the sulphide ores, since they contain pyrite or iron sulphide as the predominating mineral. Important mines are now producing from each of these classes of ores.

THE UTAH COPPER COMPANY.

THE ORE DEPOSITS.

This company owns about 200 acres of ground in the heart of Bingham besides 1,000 acres near the mouth of Bingham canyon and 2,400 acres at Garfield. The ore bodies of the property in central Bingham consist of an altered sellcious porphyry containing small grains of copper minerals, very uniformly disseminated throughout the mass both in fracture seams and in the body of the rock. The ore averages about 2 per cent copper, .15 of an ounce silver, and .015 of an ounce of gold. The primary copper mineral is Chalcopyrite, but as a result of secondary enrichment from above practically all of the copper sulphide minerals are now present, the principal one being chalcocite. The developed area covers 72 acres of ground, and although the thickness of the ore body has not been fully determined, yet existing developments show an average depth of at least 310 feet. This area and depth of ore figures up to the equivalent of 1,000,000 tons of ore per acre. Below the depth included in the above estimate is a zone of lower grade ore averaging about 1.5 per cent copper and containing about 40,000,000 tons of ore as indicated mainly by diamond drill holes.

Besides these 72 acres now developed or partially developed, there are 88 additional acres of mineralized porphyry in the company's property that is undeveloped, although a portion of this area is known to contain ores of profitable grades.

METHODS OF MINING.

Open cut work with steam shovels is employed in the extraction of 80 per cent of the tonnage of 6,000 to 7,000 tons of ore per day; the remaining 20 per cent being taken out by the underground caving system, although costing slightly less than 60 cents a ton of ore produced, is being abandoned wherever possible in favor of steam shovel work. In great part the benches of ore need but little shattering by blasting, as much of the ore is already loose enough for direct shovel work.

EQUIPMENT.

At the mine the company has in operation 15 locomotives mostly of 100,000 pounds weight; 125 stripping dump cars of six yards capacity; two 40,000 pounds electric locomotives; three smaller electric locomotives and the necessary cars for underground haulage; six steam shovels; and about ten miles of standard gage railway laid with 65 pound rails; a 300 horse-power compression plant; a completely equipped machine shop, capable of handling and repairing the heavy locomotives and steam shovel work; besides the commodious offices and quarters for employes.

About 75 per cent of the ore produced by the caving system is transported by the Copper Belt Railroad to the Utah Copper company's concentrating mill at Copperton about three miles down the canyon. This mill has a capacity of 900 tons per day. It was built originally for the purpose of developing the best process of concentration, but has been, trebled in its capacity and now is an important unit in the company's commercial mills. The mammoth concentrating mill is located at Garfield where the company has an abundant supply of water.

ORE CONCENTRATION.

The ore is transported 15 miles northward by the Rio Grande Western Railroad company to the Garfield mill on the shores of the Great Salt Lake, and there concentrated, 20 tons of crude ore into one ton of concentrates. The object of concentration is to get rid of the siliclous waste material which is expensive to smelt and to collect the values into less than 5 per cent of the orginal tonnage. It is then only necessary to pay for the smelting of one ton instead of 20; and it costs a lower price per ton for it also because of its higher iron content, than for the original monzonite rock with its high percentage of silica.

The process of concentration consists in crushing all the ore fine enough to sever the valuable minerals from the waste particles. With this ore it is necessary to crush every thing to 40 mesh before the separation of the heavy valuable particles from the waste material is commenced. Concentration is carried on with jigs, shaking tables and vanners and the concentratis average 28 per cent copper 15 per cent iron and 30 per cent silica, a very desirable smelting mixture. The losses in concentration occasioned in great part by sliming caused by the fine grinding through which all the ore is carried, are considerable, amounting to 25 to 30 per cent to total copper. But since under the present smelting conditions the crude ore could not be smelted direct, concentration even with its attendant losses is absolutely necessary.

SMELTING THE CONCENTRATES

The concentrates from the monzonite ore form a very desirable smelting mixture. It may be smelted direct in the reverberatory furnace or roasted preliminary to smelting. The fine concentrates containing high sulphur values are roasted in pot furnaces or in mechanically rabbled furnaces for the partial elimination of the sulphur. If the pot furnace is used the roasted product is in a sintered but porous condition, hence in good condition for the copper blast furnace. Mattee and slag are run from the blast furnace continually and these separate from each other by gravity in a large settler. The slag with less than .5 per cent copper is discarded and the matter is further treated to obtain metallic copper. When the fine ore is roasted in the mechanically rabbled furnace (the McDougall) and taken out in a loose powdery condition, the reverberatory furnace is employed to smelt the roasted material. Furnaces with upwards of 2,000 square feet hearth area are employed at the Garfield smelter on this fine, powdery material and 300 tons of this roasted ore is sent through each furnace per 24 hours. The products of the reverberatory furnaces as the products of the blast furnaces are slag and copper-iron matte.

The slag from both kinds of furnaces is run into large pots arranged on trucks and transferred by locomotive on tracks to the slag dump where it is run in a molten state as waste.

The matte from the settler of the blast furnace or from the reverberatory furnace is run into ladles of 10 tons capacity operated by electric traveling cranes which span the converter house. At the Garfield works there are two such cranes each of 60 tons capacity which run the full length of the converter building. The ladles of molten ore are quickly carried to the converter and the contents poured in and the ladle returned for more matte. When the converter has received its charge of ten tons the air under a pressure of 12 pounds is turned on and the shell it tilted back to position. When the blow begins there is a rapid oxidation of iron and sulphur the iron having the stronger affinity for oxygen is finally all oxidized forming with the silicious converter lining an iron silicate slag. The slag is then skimmed and the remaining copper sulphide after being replenished by the addition of molten sulphide of the same copper content from other converters, is again blown to oxidize the remaining sulphur and produce metallic copper, 98 per cent pure, known as blister copper, carrying the gold and silver that were in the original ore. The bars of copper bullion cast from the conventer are 24 inches long by 18 inches wide by 2 inches thick and weigh 300 pounds.

The metal is shipped away to the refineries in this crude condition. As the centers of consumption of the refined products are at a great distance from the smelting plant, and as the cost of transportation of the refined metals is much greater than that for crude bullion, no effort is made at refining the bullion of Utah.

THE BOSTON CONSOLIDATED.

THE PORPHYRY MINE.

Adjoining the Utah Copper mine on the south is the Boston Consolidated. The porphyry mine of this company covers about 156 acres of territory. A portion of this area is underlaid by mineralized monzonite porphyry, similar to the Utah Copper ore, but running slightly lower in copper content. This ore is estimated by the company's engineers to average about 1.5 per cent copper. The capping or overburden to be removed in order to mine the deposit by steam shovel is about 100 feet in thickness. The profitable ore over this area as indicated by extensive sampling and assaying is about 300 feet deep. Very extensive equipment employed for stripping and disposal of the capping, and for the mining of ore for the concentrating mill, has been in operation for three years. This equipment is said to be ample for handling 15,000 tons of rock daily.

The Boston Consolidated's concentrating mill is located at Garfield, 15 miles by air line or 27 miles by railroad to the north. When all the units that are now commenced are in commission the mill will have a capacity of 3,000 tons of porphyry ore per day. At present but 8 units are in operation. The concentrates are somewhat lower in copper and higher in iron than those from the adjoining property. They make a very desirable smelting material and are contracted for by the Garfield smelter on very favorable terms.

Besides the porphyry mine, this company operates an extensive sulphide mine covering 103 acres of the limestone belt. The ore carrying a high precentage of iron pyrite is not susceptible to concentration but is sold to the smelter. The mine is fully equipped for the production of 750 to 1,000 tons of ore per day by square set stoping.

THE OHIO COPPER COMPANY.

DISSEMINATED QUARTZITE.

This property adjoins the Utah Copper on the east and the Boston Consolidated on the north, and covers an area of 120 acres. The ore is quartzite mineralized with copper and iron sulphides. The quartzite merges into the laccolithic mass of monzonite porphyry of the two adjoining properties. The ore is much shattered and broken. Disseminated throughout the shattered rock, and especially along the cleavage planes is the copper ore in the form of a clean chalcocite, associated with chalcopyrite and pyrite. Many crevices in the shattered quartzite have been filled by the metalliferous minerals forming stringers and veinlets of rich copper sulphide.

Larger fissure veins traverse the deposit and these contain much ore of higher copper content, due to secondary enrichment. In these veins along with the predominant chalcocite, there is found much red oxide as well as some metallic copper.

From careful and conservative calculation of ore reserves there is estimated to be 13,500,000 tons of ore in the mine above the present transportation tunnel, through which the ore is to be hauled to the concentrating mill. The average copper content of the ore as obtained from abundant sampling is 1.6 to 1.75 per cent copper, with some ten cents in gold and three cents in silver per ton

The concentration of this ore is a simple matter as the copper minerals are not so finely disseminated through the rock as they are in the porphyry of the neighboring properties. The absence of any clay or talcy decompositive products of the rock make this quartzite an exceedingly favorable ore for concentrating. The mill tests have given an extraction of 75 to 80 per cent of the values.

A concentrating plant of 2,400 tons per day capacity is now built at Lark three miles to the east for treating this quartzite. The main features of difference between this plant and those of Utah Copper and Boston Consolidated plant are due to the difference in the ores. This mill will crush all ore to mesh only, and will make its principal savings with the copper minerals in larger prices, using jigs and shaking tables, but no vanners: it has, however, provided slime plant with settling tanks, slime tables, and puddles. The ore is extracted by the caving system and dropped through winzes to the ore bins 400 feet long, built 1,000 feet underground just above the transportation tunnel, which reaches the property 1,000 feet below the bottom of the Bingham canyon. This tunnel runs eastward 13,000 feet to daylight on the east base of the Oquirrh mountians, where the concentrating mill is located. The ore is transported at a cost of 15 cents per ton; mined for 50 cents, and concentrated for 50 cents per ton. With copper at 15 cents the net income per day on 2,400 tons of ore is estimated at $3,864, or an income of $1,400,000 per year.

The company has built the present mill with the idea of enlarging its capacity to 4,000 tons per day in the future.

THE UTAH CONSOLIDATED.

The Highland Boy mine of the Utah Consolidated company was one of the early producers of the high grade sulphide ores. The ores of this company were smelted for a number of years at their own smelter at Murray, Salt Lake county. The ore averages high in copper and the cutput of the smelter in copper bullion was large for the ore tonnage treated. The high grade ore and the favorable conditions of mining and smelting were indicated by the dividends disbursed. These amounted to more than one million dollars per year. Since the closing of the Murray plant by the injunction by the farmers of the valley, the ore has been treated by the American Smelting and Refining company's plant at Garfield.

The Utah Consolidated has let a contract for smelting its ore for the next 10 years to a private party who will immediately begin operations of building a modern copper smelter at Pine canyon, just over the Oquirrh range to the west in Tooele county. The smelter is to be ready to treat the ores of the company by April, 1910. Te mining company in the meantime will construct an aerial tramway from the mine over the mountain range and down Pine canyon to the smelter a distance of six miles. Eight hundred to 1,000 tons of ore per day will be transported from the mine over this aerial tramway when completed.

THE YAMPA MINE AND SMELTER.

One of the large producers of the sulphide ores of Bingham is the Yampa mine. The ore is practically self fluxing with the exception of needing a small amount of limestone. The mine is now putting out a tonnage of 700 to 800 tons of ore per day which is transported about one and one-half miles to the Yampa smelter in Bingham canyon, the cost of transportation being seven cents per ton.

The smelter treats the total tonnage of the mines besides about 200 tons daily of custom ore. The furnaces of the plant consist of nine McDougall roasters, three reverberatory furnaces, —two having dimensions 17 feet by 55 feet, and one 17 feet by 45 feet,—three blast furnaces, two 42x160 inches and one 42 by 184 inches,—two converter stands with six converter shells of 84 by 136 inches dimensions. The production of metallic copper by the Yampa smelter with its present capacity is slightly over 10,000,000 pounds per year.

THE UNITED STATES PROPERTIES

The extensive properties of Bingham canyon owned by the United States Mining company are producing a large output, that is all smelted at the United States smelter at Bingham Junction, in Salt Lake county. Their ores are transported by aerial tramway to the Rio Grande Western railroad cars at the Bingham terminus and then hauled to the smelter 12 miles away.

The properties described are the most important from the standpoint of present development; nevetrtheless there are many other important producers of copper as well as of lead ore in the West Mountain district in which Bingham is situated.

THE TINTIC DISTRICT.

Tintic has achieved and still holds the enviable distinction of having more dividend paying mines than any other district in Utah. Eighteen of her mines are credited with having paid dividends of $17,000,000. The exact figures of bread money distributed are hard to ascertain as many of the mines have been operated by individuals and close corporations, concerning whose income the public has learned little or nothing. The Centennial Eureka, one of the richest mines of the United States Smelting, Refining and Mining company, has of late years been the heaviest shipper. The Bullion Beck, one of the oldest producers of the district has recently gone over into the hands of the United States company and will be exploited even more actively in the future. The Eureka Hill leasers have been very active during recent years and have produced large quantities of good grade ore. The Mammoth and Grand Central seem to show limit to the depth at which they obtain very profitable ore.

East Tintic around Godiva mountain has shown greatest activity during the last two years. The May Day and Uncle Sam have both benefited by the union they effected during 1907. During 1908, there have already been paid out, by these companies near $150,000 in dividends. The Knight properties consisting in the main of the Colorado, Beck Tunnel, Black Jack, Crown Point, and Iron Blossom, controlled by Mr. Jesse Knight of Provo, Utah, have made a phenomenal record since their exploitation commenced some three years ago. The Colorado has taken the lead by producing nearly a million dollars worth of ore in 1907, and paying an aggregate of nearly $600,000 in dividends. The ore carries values of $75 to $100 per ton in lead, silver and gold. The Beck Tunnel has been a close follower with ore values averaging somewhat less, but with a total dividend record near the $500,000 mark, but distributed over a considerably longer period of time. As evidenced by the miniature dumps at the shafts of these two mines there has been very little dead work. Practically everything taken out has been shipping ore. This lime formation of East Tintic has responded so abundantly to the efforts of the miner that now a circle of dividend paying mines is found around Godiva mountain, including the above mentioned properties, the Yankee Consolidated, the Gemini, the Sioux Consolidated, and some others.

Tintic suffered considerably by the closing down of the Salt Lake county smelters and a consequent cutting off of the market for her ores. At present since an amicable agreement between the farmers and the lead smelters has been entered into, relief has been furnished. Mr. Jesse Knight and his associates have organized the Tintic Smelting company and have started up during the present year a lead smelter of 350 tons capacity. This plant is located right in Tintic, and furnishes a ready outlet for the products of many of the nearby mines.

PARK CITY.

Owing to the recent very unfavorable metal market this lead and silver camp for the first half of the present year marketed practically no ore. But during this period much development work was done, which opened up ore bodies that make it possible for some of the largest companies to ship, when metal prices improve even better ore and larger tonnage than ever before. Little stir is made as the development opens up new bonanzas, but that such are opened up is always shown as the metal market warrants big tonnages. The persistence of the rich ore in the Park City mines as depth increases makes it important to provide proper drainage.

The caving in of this drain tunnel a few years ago for the lower levels caused the lower levels of some of the large mines to become flooded. By intelligent and untiring effort this tunnel has, during the last year, been again opened. It has also been extended back under the Daly and Daly West mines. The tunnel will cut the Daly West shaft at the 2,100 feet level, giving this mine 600 feet additional vertical depth. The Daly West main shaft is being deepened to meet the tunnel and is now near the 1,700 feet level.

The Silver King mine has made important strikes of high grade ore during recent development that puts it in possibly better condition than ever before. It is with the Daly Judge, and Daly West are shipping fair tonnage at present.

The new developments of the Park City district have been made recently in Thaynes canyon toward Brighton. Prospects that are showing great activity there are the Copper Apex, Keystone, Uintah Treasure Hill, New York, Wabash and Silver King Consolidated.

MERCUR.

Utah's famous gold producer, the Consolidated Mercur Gold Mines company, is the leading gold producer in the state. During the past 15 years there have been many millions in gold produced by the properties of this company. The total dividends to date paid by the present company and by the old DeLaMar and Mercur companies runs up to the handsome sum of $3,385,312.97. This amount shows the success that has attended the persistent efforts of Mr. John Dern and his associates.

The ore was early known to contain gold although the prospector was unable to even get colors by the use of the gold pan, and the prospector often had difficulty in interesting the investor in the properties of the company because no gold showed up in the pan. Mr. Dern and his associates from Nebraska took hold of much of this ground but found great difficulty in extracting the gold values, for the ore refused to give up its wealth by any metallurgical methods. Although the owners systematically and persistently experimented with all the commercial methods of extraction then known. At that time the cyanide process was just being developed and the Mercur operators quickly took up with this new progress and had their ore carefully tested. The results showed but meager success at first. The oxidized ore gave fair extraction, but much of their higher grade sulphide ores gave little promise of ever responding. By careful work with the roasting furnace under the efficient direction of Mr. D C. Jackling, now general manager of the Utah Copper company, the sulphide and arsenide ores were brought into a condition for effective cyaniding. Still another difficulty remained to be solved. The slimes were large in amount and method for successfully treating them had been perfected. This problem the present owners have solved and the tailings of sands and slimes now carry over the dump but slightly over 50 cents in gold per ton. The Consolidated Mercur mill has a capacity of 800 tons per day, and the Holderman Filter Tank company is now operating by sliming and vacuum filtering as a daily tonnage of 200 tons on the Manning dump of the early Mercur tailings.

The Boston Sunshine Gold Mining company has reconstructed the mill of the old Sunshine mine of Mercur and is adding much new equipment preparatory to cyaniding the very clayey refractory ores of the once famous Sunshine mine. The mill will have a capacity of 200 tons per day and will be put into commission during the coming month of January.

OTHER IMPORTANT MINING DISTRICTS.

Time will not permit of more than passing mention of other important mining districts of the state. Alta, Big Cottonwood, American Fork, Beaver county, Kimberly, Park Valley, Gold Springs and others have produced much ore to increase the yearly output of the state.

NON-METALLIC MINERALS.

I desire to make brief mention of a few of the important non-metallic minerals of the state.

SALT.

The waters of the Great Salt lake are furnishing yearly about 40,000 tons of salt, supplying most of the states west of the Missouri river. The saturated brine of this great body of salt water contains an almost unlimited supply of this mineral so essential to human life.

There has recently been explored a most important salt deposit in the form of an immense salt bed in the Great American desert, about 110 miles west of Salt Lake City and 15 miles east of the Utah-Nevada state line. The Western Pacific railroad has built its track directly through these beds. This salt covers an area of 60 square miles. The deposit varies in depth from six inches to seven feet or more, in places where poles were set. It is almost perfectly white, and absolutely free from dirt, rubbish or growth of any nature. Providing the deposit only averages one foot thick, the amount of salt to the square mile will amount to more than 1,000,000 tons, or 60,000,000 tons in the whole deposit.

The United States Congress by the provisions of the enabling act for Utah gave to the University of Utah all saline lands of the state. Notwithstanding this fact prospectors have staked out their claims over the deposit, and are contesting their rights in the courts.

The supreme court of Utah during the past week gave its decision in favor of the state university; but the case may not be finally disposed of until the United States supreme court gives its decision. With this immense deposit of pure mineral as an asset the university will be well provided for.

COAL.

There are four extensive coal fields being operated at present in the state of Utah. These include the Book Cliffs, the Weber River, the Sanpete, and the Iron county fields. The Utah Fuel company operating all the mines of the Book Cliffs field, produced in 1907 near 2,000,000 tons of coal. Their product is of excellent quality, remarkably homogeneous, with low ash and sulphur content. The coal from the Sunnyside mine burns to a superior grade coke which is used in large quantities by the large smelting plants of the state.

HYDROCARBONS.

The asphalt deposits of eastern Utah are world famous for their extent and purity. The principal minerals consist of Uintahite, wurtzilite, elaterite, ozocerite, and maltha besides a variety of asphaltic limestones, sandsones and shales. Uintahite, or the Gilsonite of commerce, is the most important. It occurs in true veins cutting the sedimentary rocks of the region. In extent and purity these deposits far surpass any other recorded occurrence.

The limitation of the present paper will not allow of but passing mention of other mineral deposits of great promise in the state. These include deposits of fire-clay, gypsum, phosphate rock, sulphur, antimony, limestone, cement rock, petroleum, building and ornamental stone, uranium, vanadium, and radium minerals that up to date have been but partially developed.

IRON ORE.

But a description, though brief of Utah's mineral deposits would be incomplete without mention of her enormous iron ore deposits. One out of a number of occurrences will be referred to. The deposit in Iron county in southern Utah occurs as a mountain of ore, 15 miles long and three miles wide. Hundreds of acres of this mountain of ore will require no stripping, and in greater part will respond readily to the steam shovel. Analyses of numerous samples by United States geological survey officials show averages of from 59 to 65 per cent metallic iron.

SALT LAKE CITY AS A SMELTING CENTER.

Salt Lake City is at present the most important smelting center in the world. The tremendous ore supply of the three great mining camps so near at hand, namely, Bingham, Park City, and Tintic, giving a combination of easily smelted mixtures; and the unlimited confidence in the continuance of the supply has justified the building of exceedingly large smelting plants in Salt Lake valley. The favorable position of Salt Lake as a railroad center enables the smelters to draw large supplies of ore from all parts of Utah, from Idaho and Nevada and even from California.

With the galena and lead carbonate ores from Park City, Tintic, the Cottonwoods, from Idaho and Nevada; the copper iron sulphides of Bingham, and Beaver county; the silicious copper, gold, and silver ores of Tintic and scattered camps and from Nevada, the ore supply is more diversified than anywhere else in the United States. Large custom copper smelters and lead smelters with their competition for custom work have brought very favorable smelting rates to the ore producer. Nowhere else in this country can the producer dispose of his ores at so favorable figures.

The smelters with their capacities are as follows:

	Tons.
Murray plant, American smelting and Refining company, lead	1,500
Garfield plant American Smelting and refining company, copper	3,000
United States Smelting company, Bingham Junction, copper	1,500
United States Smelting company, Bingham Junction, lead	1,000
Yampa Smelter, Bingham canyon, copper	1,000
Utah Smelting company, Ogden, copper	250
Tintic Smelting company, Tintic, lead	350
Total capacity	8,600

SMELTER SMOKE.

The decision of United States District Judge Marshall in favor of the farmers of Salt Lake county against the smelters of Murray and Bingham Junction, whereby the smelters were not allowed to smelt or roast any ore containing over 10 per cent sulphur, seemed a severe blow to the smelters. The decision did not affect the plants at Garfield or Bingham canyon. Two of the smelter companies abandoned their plants. These were the Highland Boy and Bingham Consolidated copper smelters. The former immediately took options on land about 20 miles west, just over the Oquirrh mountains, in Tooele county, and the latter negotiated for land somewhat further west.

The American Smelting & Refining company came to an agreement with the farmers whereby they would remain at Murray, by installing a bag house to filter all solids from their smoke, and by instituting some minor changes.

The United States Smelting company, as a result of untiring experiments with its smoke to determine a method of abating the nuisance, apparently succeeded, and now is able to run all the smoke not only from its lead furnaces but also from their copper furnaces through bags and collect all solid particles. As a result of this success it has been given opportunity to resume its entire plant and continue so long as no bad effects are suffered by the farmers. The company seems to have perfect confidence that they shall be able to go on in the future undisturbed, for they are remodeling its plant and increasing the capacity of its bag house at a very great expense. It is anticipated that no further trouble will ensue between smelter and farmer.

UTAH'S STEADY ADVANCE.

Utah's prominence as a mining state has been gained gradually as a result of the extensive development of enormous medium and low grade deposits. There have been no spasmodic and temporary gains in her metallic output neither has there been serious losses as the years of prosperity or adversity in mining arrived. No decline in lead and silver or slump in copper has caused collapse. Her advance has been rapid but regular. The prospects are brighter now for increased output in future years than they ever were before.

The dividends from her mines and smelters indicate the substantial nature of these industries. For 1907 the reported dividends amounted to more than $5,000,000, and this was no exception, as the bread money distributed for a number of years has hovered around this flattering figure.

SECURITY OF INVESTMENTS IN UTAH.

There have been fewer labor troubles in Utah than in any mining state in the west. Seldom have the mining and metallurgical operations in the state been interfered with by conflicts between capital and labor. The sentiment of the people of Utah is against strikes and lockouts. Laborers have never demanded exorbitant wages. Mine and smelter managers have acceded to the request for increased pay during especially prosperous years, and the workmen have allowed this increase to be taken off at times of depression. "Capitalists are now appreciating this favorable relation between capital and labor in Utah, and are showing a preference for our state as a place to invest their money."