

# The Future for Chromite

Consolidated Mines has what is undoubtedly the largest single mass of chromite ore known today; it is comparatively low grade, however, and the future of the property depends upon the development of a market and upon the discovery of a direct reduction process by which the ore can be made useable.

That's the meat of the annual report of the Consolidated Mines issued early in March. Information regarding the metallurgical and technical problems facing the company with regard to its Masinloc chromite is given by A. F. Duggleby and George O. Searle, two of the most prominent and most conservative mining engineers in the Islands. The former is chief engineer and vice president of Benguet Consolidated and of Balatoc; the latter, formerly chief geologist for Benguet Consolidated, is now consulting engineer for Consolidated Mines. Benguet Consolidated took over the development and operation of the Masinloc property on July 9, 1934, on a profit-sharing basis.

A conservative estimate of the Masinloc deposit is 10,000,000 tons; its value, \$10 a ton, or P200,000,000. This makes the deposit a remarkable asset, to quote Mr. Duggleby. It is, however, an asset which will have to be developed over a period of years.

While there are other chromite deposits in the Islands, that of Consolidated Mines is by far the most important. It is more than likely that the other companies will face the same problem which Benguet Consolidated is experiencing, both metallurgical and economic. There may be sales in comparatively small quantities of chromite to Japan, and to other countries. The future of the chromite industry thus seems dependent upon the future of Consolidated Mines.

Before going into further discussion of the chromite situation, it might be well to report on the other activities of Consolidated Mines. The company is undertaking the exploration

of the Tumbaga Gold Mine in the Paracale district, under a contract with the owners on a royalty basis. It has a profit-sharing contract with Equitable Exploration, and a geological investigation of the Capucian gold prospect of Equitable is under way. It is examining and exploring a large group of manganese claims in Antique province, the mapping of the geology of the area is partially completed and it is expected that active underground exploration will be started in the near future. It is examining and exploring the Maucassy group of gold claims in the Paracale district under the terms of a profit-sharing contract.

A number of prospects have been examined for gold, chromite and manganese; a considerable knowledge of the geology and mineral possibilities of the Islands was obtained.

Consolidated Mines is planning the systematic exploration of the Islands for mineral deposits. A large amount of geological and other data have been accumulated, the nucleus of a competent staff secured, and plans formulated to carry on the work aggressively.

Mr. Searle heads the Consolidated Mines technical staff; William Donaldson, formerly general superintendent of Ipo Gold, will arrive in Manila March 29, after a vacation to the States, to assist Mr. Searle.

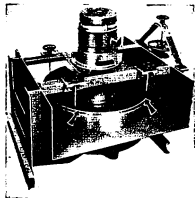
And now for the detailed information regarding the chromite deposit in Zambales, the *Journal* will give condensed extracts from the reports made, so that the general situation will be made clear.

## MR. DUGGLEBY'S REPORT

Benguet Consolidated started work at Cato, Masinloc, in July, 1934. A large outcrop of chromite ore, approximately 1,000 feet in diameter, had been well demonstrated by means of trenches. Samples ran from 37% to 53% Cr<sub>2</sub>O<sub>3</sub>, while a

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The Future for Chromite

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numerical average of 125 samples ran 41.08% Cr. While this ore appeared a little low to enter the metallurgical field, which accounts for the major part of chrome ore used and has a low limit of about 45% Cr in its specification, the presence of occasional higher grade samples of 50% Cr and over led to the belief that in a mass of this size there might be segregations of higher grade material, particularly in the lower part of the lens.

There were two main problems, then: to investigate the possibility of higher grade ore which could meet the specifications of electrometallurgical users; to determine the depth, tonnage, shape, and average grade of the ore.

The ore reserves, after careful systematic development, with results checked and rechecked, gave some 10,000,000 tons of ore, which included several thousand tons of float or talus ore. The average grade of the ore varied from 29% Cr to 36% Cr<sub>2</sub>O<sub>3</sub>; from 14% Cr to 16% FeO; the average ratio of chromium to iron being 2:1.

Laboratory work resulted in the conclusion that the mixture of chromite is too intimate to permit of concentration; that even of the chromite mineral could be isolated as such, it would still be low in Cr<sub>2</sub>O<sub>3</sub> due to the fact that it is nearer the lower end of the magnetite chromite series, as shown by the chrome iron ratio of 2:1.

Flotation tests brought about a 42% concentrate from 33% heads, but this was below commercial requirements and it is not readily saleable unless briquetted. Moreover, the high cost of grinding to the degree of fineness necessary to liberate the chromite would probably take up all of the profit.

The obvious solution to the metallurgical process is some direct reduction process. Consolidated Mines, though advantageous connections in the United States, has been able to start work along these lines which has so far given encouraging results. Samples are being submitted to another inventor

of a direct reduction process, asking him to determine the amenability of this ore to his process on a large basis.

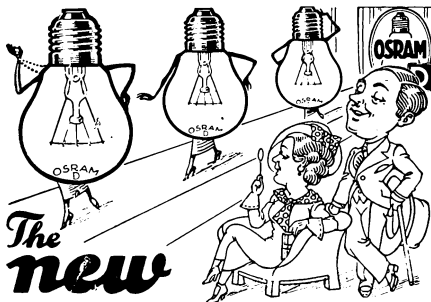
The question of transportation was next taken up, and it was decided that a railway should be built whenever truck haulage proved insufficient. Preliminary work on the roadbed has been started: a 600-foot pier will be built in a well sheltered harbor open to vessels of any size.

Mr. Duggleby's conclusions: While a limited amount of ore of this grade can always be sold for use as a refractory, the hope of the mine is in the rapidly growing electro-metallurgical field which takes by far the greatest part of chromite ore consumed.



"This body is undoubtedly the largest single mass of chromite ore known today and it is so situated that production costs can be obtained, which will more than offset any differential in freight to the United States. The only question is to develop a market. We have, for the past several months, been in touch with chrome consumers in all parts of the world and have shipped them substantial samples for testing purposes to see whether this ore can be adapted to their needs, pointing out that with the assured uniform supply which a deposit of this size offers, they can afford to spend considerable amounts in metallurgical research. Inquiries are constantly coming in, showing that knowledge of the ore is now rather generally disseminated among chrome users, and with all the research work now going on in the United States, Europe and Japan, and with the stimulation of a rapidly increasing demand for ferrochrome caused by the stainless steel industry, it is reasonable to assume that in the near future a successful direct reduction process will be solved.

"By that time, we hope to have the mine in a position to deliver ore in any quantities and to gradually, through low production costs, secure a substantial part of the world's business. The ore is today worth about ten dollars (\$10.00) a ton at tidewater, so even at today's prices the Coto ore deposit is a remarkable asset. It will be a long pull, however, by gradually building up the business and will probably be some years before it will gain the volume of business which a deposit of this size warrants. However, so far I consider

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that our investment has been well merited and will prove to be a real asset.

"Up to December 31, 1935, the investment of the Benguet Consolidated Mining Co. in this contract amounted to two hundred ten thousand, five hundred thirty-two pesos and fifty-four centavos (\$210,532.54).

MR. SCARFEN REPORT

In calculating the value of the Masinloc chromite deposit, the two most important factors to be taken into consideration are the amenability of the ore to metallurgical treatment and its marketability. There is no doubt as to the great quantity available nor the low cost of production. The ore is comparatively medium-grade—in fact heretofore material containing 32% Cr<sub>2</sub>O<sub>3</sub> was considered non-commercial although during the World War high prices were paid for comparable ore. Up to six months ago our thought, in common with Benguet, was that it was a reasonable expectation to find high grade concentration within so large a mass but as development progressed it became evident that such was not the case in this particular instance. Realizing the importance of learning definitely the actual physical and chemical characteristics of the ore, together with its reaction to metallurgical treatment, your engineers decided on an independent investigation of these points.

Initially a small electric furnace was constructed at the Bureau of Science and a commercial grade of ferrochrome successfully pro-

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Camote Bill

By W. JAMES PIKE

Camote Bill's head's way up in the air,  
And his feet don't touch the earth;  
He's struck it rich, he's free from care,  
And he's bubbling over with mirth—  
He's wondering how he'll spend the dough,

As soon as it comes to his mitt,  
And he'll greet all the gang with a sonorous no,  
When they ask for the loan of a bit.

A silk suit he'll wear on a Sunday,  
And he'll buy him a new Stetson hat,  
And though he'll wear overalls Monday,  
No welcome will appear on the mat—  
His old time friends will get the frozen face,

And the bums the marble court,  
For with Bill they're all out of the race,  
And Bill and his dough won't part.

At Camotes now he turns up his nose,  
He eats Irish potatoes au gratin,  
And wears on his feet fine silken hose,  
And dresses his wife in black satin—  
No more on his plate will you find a pig's head,  
Bill says it's only fit for a dog,  
His munching away on pork chops,  
instead,  
And eating farther back on the hog.

The old corn cob now lies on the shelf,  
It's hardly the thing to smoke

When a fellow is really rolling in pelf,  
It makes him feel like a moke—  
The gramophone now lies out in the yard,  
A loud speaker functions instead,  
The old wheezy records in the discard,  
Bill tunes in on London, in bed.

He's left his old haunts, he's gone to the Pines,  
Where he sits with both feet on a chair,  
And loudly he talks of the wealth of his mines,  
And sweetens 'em up with hot air—  
A cowpuncher was Bill in a youthful day,  
He'll never play golf you can bet,  
He knows a sheepherder invented the play,  
An affront he will never forget.

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## Men D o w n t o w n

The throng heading for the American Chamber of Commerce shortly before 10 the morning of March 7 were on their way to the ninth Republican national convention. E. E. Soph was the chairman. Chief business was the choosing of delegates to the Republican convention to be held at Cleveland, Ohio, in June. Kenneth R. Day and John R. McFie, Jr., were unanimously elected. They intend to demand recognition of the Philippines in the person of themselves, the delegates. Alternates are E. E. Elser and E. E. Wing. The convention's business moved quickly under the efficient committee chairman: P. D. Carman, Judge L. D. Lockwood, G. H. Fairchild and C. M. Cotterman. Of the 115 prominent business men (and a sprinkling of the fair sex) present at this insular convention, 42 were from Cebu. These welcome visitors were generally feted in Manila during the last fortnight.

Because Mrs. Cotterman's health will not allow of their leaving the Islands this year, as they had long planned to do, and because National Committeeman C. M. Cotterman believes the committeeman should attend the national convention, he resigned and suggested the man who was unanimously elected his successor, Judge John W. Hausermann; and a resolution in appreciation of Cotterman's work as national committeeman since the death of Judge A. S. Crossfield about 8 years ago, was spread upon the record. H. B. Pond, chairman of the insular committee, proposed the resolution. Refreshments followed the convention's adjournment.

They met down at the railroad station, forty or more of them, and went for an air-cooled and jubilant ride to the official opening of San Mauricio's new mill. Guests of J. H. Marsman, the directors and prominent shareholders spent three days in making the Paracale trip and viewing the actual mine operations.

O. S. Orrick of General Paint company arrived in Manila from the States to survey possibilities in the Islands.

More airway facilities are foreseen with the arrival in the Philippines of W. D. Pawley of Shanghai. He represents the Intercontinental Aviation company.

N. J. Perrin, manager of Thomas Cook and Sons, Hongkong, spent a couple of weeks in Manila.

The China clipper carried from Manila J. A. Zalduendo of Pan-American Airways New York office, who made many friends before his departure. He was the first official passenger on the Pacific hop.

Simon Feldstein of Manila has left the Islands for the annual vacation trip to the States that the Feldsteins customarily make.

From Paracale to meet the steamer came C. A. Heiber whose wife and daughter disembarked to join him in residence in the Philippines.

R. H. Parker of States Steamship, Iloilo, was in Manila for a time before boarding the *Scharnhorst* to Japan.

After vacationing in the States, Captain and Mrs. W. A. Reddish returned to Davao following their year's absence.

Movie people in Manila have been many, the last month. Bonny Powell, Fox cameraman, and S. Yamanouchi, his assistant, made quite a stay. The yacht *Athene* brought J. B. Schackelford, Paul Schweigler (towering former University Washington All-American), Robert Kerr, Sidney Burlap, garnering scenic studies. Then none other than petite Anna Mae Wong was a happy guest, having made her first trip to her ancestral home, China.

Al Ehrman of Calamba Sugar Estate was visited by his brother Sidney from San Francisco, and there was great argument about which climate is the better.

From Shanghai with the Mrs. on a holiday trip came A. B. Park of American International Underwriters to Manila.

J. B. Worcester, well known travel writer, left Manila for a quick trip to southern islands. Then he fell in love with Zamboanga, as every traveler does, and decided to stay there as long as possible.

And a Zamboangan coming up to the metropolis was F. L. Zimmerman.

Chrysler visitors were two company officials, C. F. Cress and M. J. Riker.

Ed Cooper was given a despedida by Rotary with much fun and frolic as becomes a hearty farewell and *Auf Wiedersehen*.

Employees of Philippine Long Distance feted Major J. H. Stevenot, vice president and general manager.

Benjamin P. Lukens, long of Meralco, and Mrs. Lukens, retired teacher, said goodbye to a host of friends in the Philippines before sailing off to California. After visiting the home folks on the Atlantic coast, they plan to seek out sunny San Diego for permanent residence.

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duced on a small scale. Following this a large sample of the ore was sent to a high class metallurgist in the United States, personally well known to the writer, with instructions to make tests, or have tests made under his direction, which would definitely answer the questions at issue. His conclusions are as follows:

1. The ore is easily smelted by standard methods to produce a commercial grade of high-carbon ferrochrome which finds ready sale on a rapidly expanding market.
2. The physical and chemical characteristics of the ore are such that it is excellent refractory material.
3. The ore can not be economically beneficiated to produce a high-grade concentrate. (This checks Benguet's conclusions.)

The foregoing report was accompanied by complete estimate of the cost of production of ferrochrome and of the capital expenditures necessary to construct metallurgical plants. The estimates indicate a good profit for processing, assuming a price for the ore in line with Benguet's estimate of its value at tidewater and selling ferrochrome under the present market price.

You must remember that this is a new business with tremendous possibilities which must be carefully planned and thought out. The great reserves justify painstaking research in the initial stages to insure against mistakes. Large capital investments are required to secure the maximum profit from the ore which necessitates the acquisition of positively accurate data on which to base the details of plant construction.

In the manufacture of ferrochrome, power is a large item in the cost of production. It has been ascertained that there are several projects now under construction, favorably located as regards transportation of ore to possible metallurgical plants and of the finished product to consumers, where power will be sold at ap-

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"But we now here only," some intermediate point along the stick. March found this was accurate information.

With such directness the American régime began, that the subject of this sketch had a gallant part in it at the outset, a useful part since. When Banguel was to elect a mayor, March called all voters to his headquarters and told all who wanted to vote for Isidro Paroles, Quintín's father, to step to the right. If anyone wanted to vote for Isidro's opponent, if anyone did, they could step to the left. As this, while simpler, differed only in detail from the Spanish elections, it was at once understood and accepted; and of course, Isidro was all but unanimously elected the town mayor.

So the story runs on, adventure after adventure. Yet there are young men who suspect that when oldtimers get together and recount the past, the days of the empire, they depart from strict accuracy and draw

the long bow! Nothing of the sort. In the instant case, I have had the help of the history of the 33rd Volunteers, by the regimental historian, Guilford C. Jones; my own memory as a carpentering school teacher, and the chapters by Benton himself, published in *The American Oldtimer*. Often indebted to Benton for trade data, the *Journal* wishes him and Mrs. Benton many years of continued happiness together. They have been good folk to know. W. R.

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proximately one-third the figures used in making the estimates referred to. As regards marketing, chromite, unlike gold, must be sold in a competitive market. Consumption and cost of production play important roles in producing profits. Statistics show that chromite consumption is expanding. New uses are constantly being discovered for its utilization. As an example, the last few months have seen an increasing demand for ferrochrome in the automobile industry due to the discovery that the addition of a small amount of chrome to the iron in the engine—a small amount added to the material formerly used to make forgings such as the crank-shaft, permits the casting of these parts instead of forging. The addition of chromium to steel plays an important part in adding strength and decreasing weight—a characteristic which is increasingly being recognized and utilized by various industries. There is no doubt but that consumption is increasing and that we are in on the ground floor of a comparatively new and growing industry. With the acquisition of the data now being compiled it will be possible to intelligently negotiate contracts for ore and decide on the feasibility of constructing metallurgical or other plants to produce a saleable product to actual consumers. As previously pointed out, estimates of the cost of producing ferrochrome from Masinloc ore are decidedly favorable to that deposit.

No far no mention has been made of the use of Masinloc ore in the chemical industry. Exhaustive tests have been made in our laboratory which show conclusively that sodium bichromate can be produced at a cost which compares favorably with that of other producers.

Mr. Searle's conclusions regarding your Masinloc chromite deposit may be summed up as follows:

1. There are a minimum of 10,000,000 tons of commercial ore positively in sight with possibilities of a considerably greater ultimate tonnage.
2. Exhaustive tests show conclusively that the ore:
  - a. Is amenable to metallurgical treatment;
  - b. Is excellent material for refractory purposes;
  - c. Can be used in the production of sodium dichromate.
 All at a cost of production low enough to permit successful competition if necessary.
3. Once into production a long life is assured with an ultimate probable profit to be realized from these reserves far in excess of that which may be expected from other ore reserves now under development by the mining industry of the Islands.
4. We are on the ground floor of a rapidly expanding market and the development of new industry.

## Improvement . . .

(Continued from page 20)

dry mining and in cheap adequate air conditioning for great depths. These will render reciprocating electric rock drills immediately popular with a great saving in power and reduction in the cost of breaking. We may yet see the piping of liquid air instead of compressed air to the working faces in hot and deep mines, but for cooling and ventilation purposes instead of for power. Further improvements in scraper loading and more particularly in mechanical loaders are to be expected. Cheap light portable ready-made metal belt conveyors would find useful application for gathering ore—the locomotive has inherent disadvantages. Present types of ropes and hoists do not appear to offer scope for any great improvement, although pumps and fans are still the subject of interesting innovations.

Many ore-dressing processes, particularly the crushing or disintegration of ores, offer a wide scope for technical advance.

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