The Venezuelan El Dorado

A progressive Government Favours New Mining Enterprise

*By. J. C. Davey**

THE SOUTH American republics are receiving rapidly increasing attention from their northern neighbours particularly as a result of the war time need of metals. Canada's trade with these Republics since the outbreak of war has shown a sharp increase and amongst them Venezuela has been prominent. Increased sales of Canadian products depends mainly on Venezuelan purchasing power which in turn depends on, and can be stimulated by means of, foreign credits, capital investments or by increased foreign trade. Venezuela is a noted producer of petroleum but very little reliable information has appeared in the mining press regarding the very extensive auriferous areas which still await development. Several deposits of strategic base metals such as iron, nickel and mercury are also being developed and will lead to increased mining activity in the near future. This article however, deals only with the auriferous and diamondiferous areas in the State of Bolivar. This information is presented with the hope that it will give a clear and comprehensive picture of current mining conditions in Venezuela and is based on information obtained from various official publications and from the writer's own observations during several years employment in the country as a mining engineer.

The progressive governments of recent years have been responsible for many improvements calculated to stimulate development of the country and to improve the physical and cultural standards of the mass of the people.

Venezuela enjoys several great advantages over most other South and Central American Republics in that it has had more than 30 years of freedom from any serious revolutionary disturbances, and it has no foreign, and practically no internal, debt. The official monetary unit is the Bolivar (equivalent to 0.2903 grams fine gold) which is divided into 100 centimos.

The following are the coins and notes commonly in circulation in this part of the country:

Silver Bs5.00, Bs2.00, Bs1.00, Bs0.50 & Bs0.25 in Nickel.

Notes: Bs500.00, Bs100.00, Bs 50.00, Bs20.00 & Bs10.00.

As regards weights and measures the metric system is used.

Foreign banks having branches in Venezuela are the Royal Bank of Canada and the National City Bank of New York. Towns in the interior of the country maintain contact with each other, and Caracas, by means of wireless telegraphy, and with foreign countries by means of cable, wireless telegraphy and wireless telephone.

All the gold produced is found in the State of Bolivar (figure 1) an area known since Raleigh sailed up the Orinoco in the last decade of the 16th century to locate the source of the gold brought to him by the Caribbean Indians. In more recent times (1870-1890) the phenomenal riches of the renowned Old Callao Mine again brought this part of Venezuela into prominence.

Little is known of the early history of mining in this region but alluvial gold has been found in very ancient graves in other parts of Venezuela. It is also recorded that the Spanish priests (capuchinos) who were the first foreigners to settle here, were aware of the rich gold alluvials and many stories were current of their rich stores of the precious metal.

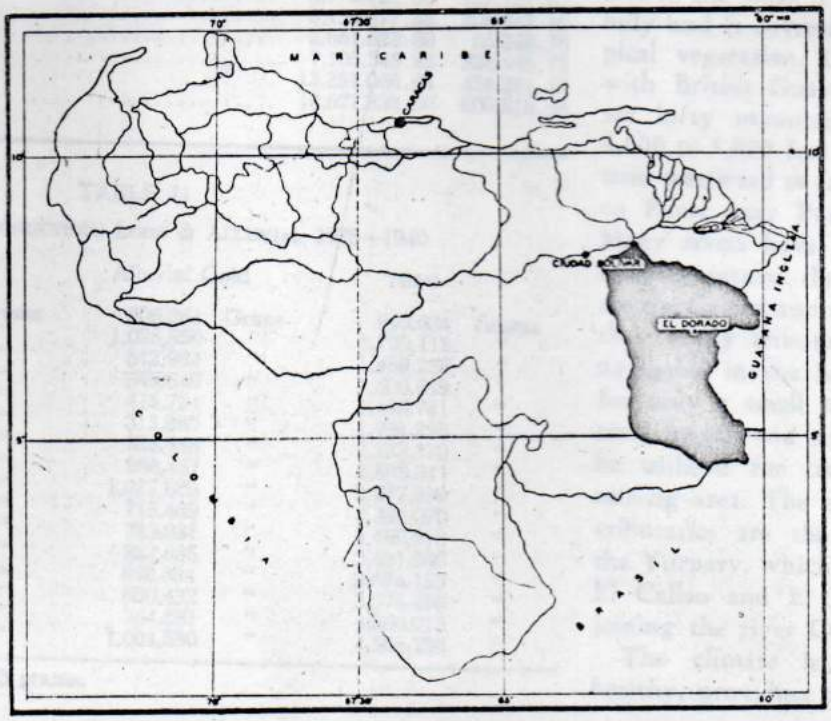

Figure 1.

* M. C. I. M. M., El Callao, Venezuela

It was not until they were driven out that other people became interested in these deposits.

In 1829, it was officially reported that 468,630 grams of alluvial gold were recovered but this was followed by a period of slight activity lasting several years. By 1885, production was at its peak with a total of 8,193,510 grams for the year and the Old Callao mine accounted for much of this. The first quartz lode mine is said to have commenced operations in 1845 at Nueva Providencia.

The official record of gold production is given in the following graph and tables I & II which show the big increase in output during the last 5 years. As will be seen from the table, alluvial gold, which once exceeded the lode gold output, is now less than 30% of it.

In addition to the above production considerable quantities of gold are recovered by native miners who through the dry season wash the alluvial dirt in all the rivers of the area. Some of this is sold in Brazil as under prevailing exchange rates a premium of about 20% is obtained on all gold sold in the neighbouring republic.

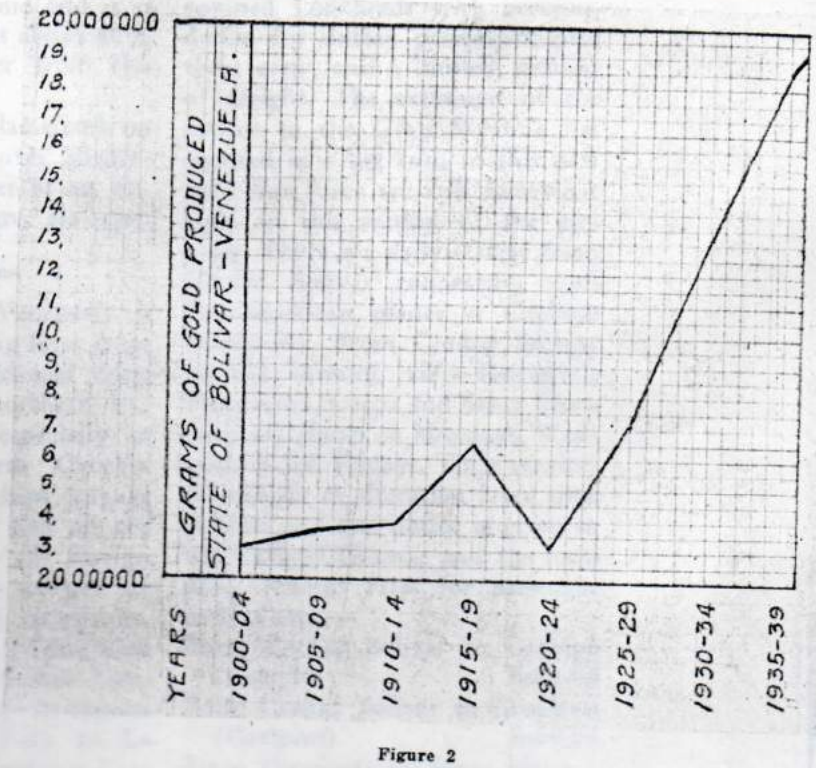

Figure 2

The State of Bolivar is situated in the south-eastern portion of Venezuela bounded on the north by the Orinoco River, on the east by the mountain ranges of British Guayana, on the south by the Brazilian highlands and on the west by the River Orinoco and the Territory of Amazonas. This region is often referred to as the Venezuelan Guayana, as it was once part of the old State of that name. The central part consists of the "Ilanos", fairly low-lying, gently undulating country covered by coarse grass and stunted "chaparro" (evergreen oak) trees, whilst the topography of the remainder of the area to the south is somewhat more hilly and is covered by thick tropical vegetation. On the borders with British Guayana and Brazil are lofty mountain ranges some 4,000 to 5,000 feet high which extend westward as far as the Orinoco River near Puerto Ayacucho. Many rivers have their source in these mountains, the chief of which are the Caroni and the Cuyuni and their many tributaries. These are navigable in the State of Bolivar for only a small section of their total length and normally cannot be utilized for transport in the mining area. The most important tributaries are the Paragua, and the Yuruary, which flows through El Callao and El Dorado before joining the river Cuyuni.

The climate is tropical, but healthy, providing reasonable pre-

TABLE I

GOLD PRODUCTION OF VENEZUELA (State of Bolivar)

Years	Quinquennial Output 1900—1940 Grams	Ounces
1900—1904	3,059,670.00	98,372.18
1905—1909	3,658,440.00	117,623.38
1910—1914	3,972,720.00	127,727.87
1915—1919	6,495,617.85	208,842.16
1920—1924	2,651,523.60	85,249.75
1925—1929	7,105,348.88	228,445.77
1930—1934	13,257,066.64	426,231.12
1935—1939	18,677,838.50	600,515.66

TABLE II

ANNUAL GOLD PRODUCTION, LODE & ALLUVIAL 1925—1940

Year	Lode Fold		Alluvial Gold		Total	
1925	443,370	Grams	506,264	Grans	949,634	Grams
1926	721,168	"	1,028,950	"	1,750,118	"
1927	616,274	"	842,962	"	1,459,236	"
1928	1,150,979	"	349,640	"	1,500,619	"
1929	1,030,107	"	415,724	"	1,445,741	"
1930	1,479,015	"	312,280	"	1,791,295	"
1931	1,904,382	"	328,988	"	2,233,370	"
1932	1,876,604	"	986,437	"	2,863,041	"
1933	1,950,001	"	1,027,289	"	2,977,290	"
1934	2,676,601	"	715,469	"	3,392,070	"
1935	2,772,882	"	723,031	"	3,495,913	"
1936	2,538,575	"	882,685	"	3,421,260	"
1937	2,781,259	"	842,894	"	3,624,153	"
1938	2,976,066	"	600,433	"	3,576,499	"
1939	3,795,482	"	764,531	"	4,560,013	"
1940	3,561,228	"	1,004,530	"	4,565,758	"

One ounce Troy equals 31.103 grams.

cautions are taken. The savanna areas are generally free of mosquitoes but a mosquito net is recommended in the rainy season to prevent annoyance by numerous nocturnal insects. The maximum recorded day temperature is 97°F and the lowest at night 60°F (mean 88°F), the nights are cool, and a fairly constant breeze prevails throughout the year. The average annual precipitation is 56 inches and the heaviest rainfall ever recorded in the El Callao district in one month 20.23 inches (June 1933). There are two rainy seasons, the heaviest rains falling in May, June, July and August though the average precipitation is less than 8 inches in each of these months. In November, December and January there are occasional heavy showers, know as "los Nortes" accompanying thunderstorms, but the rainfall in this period is less than 4.5 inches per month. Prospecting may be done throughout the year though the dry months from January to April are the best for cutting bush and travelling across country. There are occasional periods of drought when in the El Callao area the population has to obtain its drinking water from the River Yuruari which is reduced to a very small stream but at flood times the Yuruari can be used for transporting freight from El Callao to El Dorado although this is possible on an average of only one year in four or five. Drinking water is obtained by catching rain water whenever possible and storing it in sectional, or galvanized-iron, tanks.

The soil is generally fertile and an ample supply of vegetables and tropical fruits can be produced. The cost of living is high as most foreigners, and many of the natives, prefer imported canned goods to local products. However, a Venezuelan labourer can live on an income of Bs3.00 per diem. Amongst the native population during December and January there is often an epidemic of grippe and numerous cases of influenza. Beri-beri is not uncommon especially in the areas where there are no permanent camps and where an adequate and good food supply is difficult to obtain. Ankylostomiasis is endemic and it is officially reported that about 60% of the workers suffer from this debilitating disease.

The town of El Callao stands on a level stretch of country bordering the Yuruary River at an elevation of 525 feet above sea-level.

Communication

In normal times Venezuela is well served by shipping lines from all parts of the world and boats call at most of the northern Venezuelan ports and especially at La Guaira and Puerto Cabello. Venezuelan owned ships engage only in coastal trade and on the Orinoco River and all foreign freight and passenger services are controlled by foreign companies. Amongst them are the Grace Line and the Royal Netherlands Line. The Grace Line supplies an express service from New York to La Guaira while the Netherlands Line operates a passenger-cum-cargo service direct from New York to Ciudad Bolivar. Ships of the Canadian National Line run regularly from Halifax and Boston to Port of Spain (Trinidad) and call at most of the West Indian islands.

The Orinoco River is little used above Ciudad Bolivar although it is navigable by small boats to Puerto Ayacucho and the Columbian frontier. The Compania Venezolana de Navegacion runs a regular service from Ciudad Bolivar to La Guaira calling at Port of Spain en route. The service is fairly good and handles most of the freight coming from Great Britain and European countries to Venezuela, via Trinidad.

No railways exist in this part of the Country although surveys were made between 1880 and 1890 for two projected lines between Los Castillos and Santa Catalina (on the Orinoco) and the mining town of El Callao. Neither came into being as the amount of possible traffic and freight could not defray the capital outlay within a reasonable period of years. Splendid aerial services are in operation between North American cities and Venezuela and the Compania Aeropostal Venezolana maintains a very regular and safe service in the interior. Their planes are twin-engined Lockheeds with accomodation for sixteen passengers, plus three crew, and a limited amount of freight. The extension of the service to the Gran Savanna has resulted in a big rush to this new field but fares are still somewhat high on this section of the air-route. There is a daily service from Ciudad Bolivar connecting with Pan-American planes at Cachipo (Caripito). From Ciudad Bolivar to the interior viz:—Guasipati, Tumeremo, Luepa and Santa Elena there are 'planes on Mondays, Wednesdays and Fridays. These services are subject to alteration from time to time and due notice is given in the Official Gazette and the local press. Present rates for passenger service are:—

From Ciudad Bolivar to Cachipo (Caripito) Bs80.00
From Ciudad Bolivar to Guasipati (Caripito) Bs80.00
From Guasipati to Santa Elena (Caripito) Bs165.00
There is a 10% reduction an all return tickets.

Passengers for, or from, Trinidad should book their seats on Pan-American planes well in advance, if possible.

An engineer leaving Canada can now reach by air the most distant mining camp in the interior of Venezuela in six days. The total cost in fares at present rates would be approximately $500.00 (U.S.). No doubt when the need arises the Government will be willing to consider further extensions of the present air-service and some are now under consideration. All of the bullion produced from the mines of El Callao area is now sent out by plane to Caracas or to the United States.

Transportation

As regards the land communications from Ciudad Bolivar to the south it is pleasing to report that the Government is constructing a broad highway from this city to pass through Guasipati, El Callao and Tumeremo to take the place of the existing routes. About half of this distance has been completed and is in use and the remainder is expected to be completed in the near future. At present private

cars can make the trip from Ciudad Bolivar to El Callao in 5 hours and to Tumeremo in about 6½ hours. Trucks take from 7 to 8 hours to reach El Callao and 10 hours to Tumeremo. The time will be reduced still more when the road is completed and is sure to have a beneficial effect on transport costs. At present all supplies are taken into the interior from Ciudad Bolivar by trucks of 1 to 3 tons capacity; the cost of freight varies from Bs70.00 to Bs90.00 per ton, the local merchants pay about Bs4.00 per quintal (46 kilos) but the mining companies usually obtain somewhat better terms. From El Callao to Carabobo the cost is Bs16.00 per quintal, which is a good indication of the high cost of freight as soon as the main highway and thickly populated areas are left behind. Previous to 1940 the bad condition of the roads militated against the use of tank trucks but now mining companies operating Diesel Units could employ 2½ ton tank trucks with a capacity of about 660 gallons. The reduction in cost would be considerable as at present it amounts to Bs31.00 per drum of 50 gallons delivered at the Mines in the El Callao area; this breaks down to Bs10.00 for the oil and the remaining Bs21.00 for transport from the oil depot to agent's warehouse, agent's commission and freight to the mines. The cost using tank trucks should not exceed Bs15.00 for 50 gallons of oil.

The charges at the Caroni and Yuruary ferries account for Bs36.00 on the round trip and might well be reduced once the new highway is completed. There is a big field for the development of aerial transport and as soon as mining development calls for a freight service there is little doubt that the Government would consider the provision of an adequate one, or permit companies to operate services under suitable Governmental control. The rapid development of the gold mining industry in New Guinea following the use of freight carrying planes (despite very unfavourable weather conditions) need only be mentioned as a striking instance of what can be accomplished with the co-operation of a far-seeing Government. No doubt as a result of the present war aeroplanes will be constructed to carry much heavier pay-loads so that the present limit of about 4 tons need be no obstacle to the equipment of a mine in the most remote part of the State of Bolivar. The Venezuelan Government's aeroplane service is used for the transport of small articles in passenger 'planes but the rates are somewhat high and no freight carrying 'planes are at present in use.

TABLE 3

Year	Ciudad Bolivar to El Callao — 282 kilometres
1925	Bs400.00 per ton Ford truck 4 days (175 miles)
1930	Bs300.00 per ton 1 to 2 ton trucks 2 days
1935	Bs200.00 per ton 1 to 2 ton trucks 2 days
1940	Bs110.00 per ton 1 to 2 ton trucks 1 day
1942	Bs 70.00 per ton 1 to 3 ton trucks 7 to 8 hours.

Truck freight rates between Ciudad Bolivar and El Callao have dropped enormously in the past 17 years as may be seen from table III.

Timber

There is an abundant supply of timber available for all purposes. These are mostly hard woods such as purple-heart, greenheart, roble (oak) etc. However, there are several soft woods which are especially useful for making furniture and building houses such as pardillo, morea and kartan. A knowledge of local timber is useful as there are many (mostly white) woods which are not suitable for underground use but which are frequently offered by timber contractors as they are easier to cut and trim. There is also plenty of "cord-wood" for use in gas plants where such may be used in preference to oil driven Diesel, or steam, units.

Government and Exchange

The Venezuelan Government headed by its President, General Isaias Medina Angorita, welcomes foreign capital in the development of natural resources. The Department for Industrial Development (Ministerio de Fomento) under its able minister Senor Eugenio Mendozah and his very capable staff of foreign-trained mining engineers and geologists in the Department of Mines, are very anxious to do all in their power to assist the representatives of mining companies. Information, records, plans and even drilling equipment are at the disposal of persons, or companies genuinely interested in developing mining properties. Speculators and doubtful promoters are definitely not wanted.

The exchange rate is controlled under the terms of the Presidential Decree of July 23rd 1941. This decree established two markets for foreign exchange:

1. A controlled market by means of which the Banco Central buys all the exchange resulting from the operations of the oil companies at the rate of Bs3.09 to the U. S. dollar, selling only for specified imports and payments are made through Government licences at Bs3.35 to the U. S. dollar. The Banco Central further buys the coffee, cocoa and cattle at exchange rates varying from Bs4.50 to Bs4.30 to the U. S. dollar and:

2. There is also a free market which applies to the rest of the foreign exchange coming from sales of gold, some other exports, remittances, etc., and anyone can buy or sell at rates fixed by supply and demand.

The Banco Central however intervenes to regulate this market if the rates flutuate too widely and it is believed that the Bank will endeavour to keep rates between Bs3.17 & Bs4.00 to the U. S. dollar. Much depends however, on the strength of the U. S. dollar itself. Exchange rates have fluctuated in the past nine years between Bs3.00 and Bs4.00 to the $ U. S. and at present the rate is Bs3.35 to the $U. S.

Geology

Unfortunately there are at present no topographical plans of the State of Bolivar or of the mining

areas and the geology of the region has not yet been closely studied. However, an outline of the principal geological features can be given. The country south of the Orinoco River to Guasipati consists mainly of granites and gneisses and outcrops are plentiful in the Ciudad Bolivar area as well as on the savanna. Many large quartz veins also outcrop in this granite mass but the numerous samples taken indicate values less than 2.00 dwt/ton.

South of Guasipati the country becomes thickly wooded and a marked change in soil is noted. The formation here consists of andesitic lava flows which lie above the granite gneiss basement series and exhibit frequent amygdaloidal and pillow structure. The thickness of this complex is not known but it probably extends to several thousand feet. Regional matamorphism has produced extensive shearing and schisting and it is in these shear zones that the main orebodies are found. The vein system consists of numerous lenses and quartz stringer lodes parallel to the planes of schistosity. All these rocks are considered to be Pre-Cambrian and in many respects the geology of this region resembles that of the Porcupine area.

Following the formation of the quartz orebodies came numerous dykes of diabase which faulted some of the lodes and in places appear to have caused an enrichment of gold values near the contact with the dykes. Ore deposition appears to have been more concentrated in the basic than in the siliceous, or acid, rocks. This is markedly shown by a comparison of gold values in the so-called "Savanna" lodes in the granite complex as compared with values of quartz lodes in the shear zones of the andesite complex. Dykes of aplite and quartz porphyry are also found as intrusives in the andesites and in some cases these are auriferous and their decomposition has resulted in the formation of commercial deposits down to the water level of the mine.

Gold is found as free gold and in association with pyrite. The orebodies are remarkable for the absence of other minerals. Chalcopyrite, pyrrhotite and zinc blende are very rarely seen in addition to the two principal minerals. The gangue minerals are mainly quartz, chlorite, calcite, ankerite and sericite. The amount of pyrite in the primary zone varies from 1% to 5%. In the zone of oxidation the gold occurs mainly in the quartz but as the workings extend into the sulphide zone the gold is more and more locked up in the pyrite and the amount of pyrite tends to increase. There is very little post-mineral faulting and such faults as are known are of minor proportions.

Only an infinitesimal amount of silver is present in the bullion and the fineness of the gold ranges from 760 to 900. Values in the orebodies are generally very irregular and sampling has to be done at close intervals. The strike of the most productive lodes is between N-E and S-W though the strike of a few lodes is in the form of a crescent as in the case of the Laguna and the Old Callao Mines. The dip generally is to the South and varies from 35° - 80° from the horizontal.

So far the mines have proved to be shallow and only one has continued production to a vertical depth of 1,000 feet below the outcrop. The indication is that none of these orebodies is likely to extend to any considerable depth as erosion has played a big part in the history of the region. They vary greatly in length and width and it is impossible to give an accurate average in view of the lenticular nature of most of them. However, it may be said that some lenses have exceeded 70 feet in maximum width and 400 feet in length. The lateral extent of stringer lodes in the shear zone also varies greatly the longest being approximately 3,500 feet and the widest known shear zone about 410 feet in which there were several parallel orebodies and these tend to form one major ore channel in a narrower shear zone in depth. So far only one mine (Laguna) has produced more than one million tons of ore and the Old Callao Mine comes second with 700,000 tons averaging 2 ounces of gold per ton. The average value of the ore produced from mines in this region since the commencement of mining operations is approximately 12.0 dwt/ton. This figure is obtained from reports published since 1912 and does not include the phenomenal values reported from the Old Callao Mine.

Mining

The richest mineral zone in the State of Bolivar lies in the south and east, and comprise an area of about 13 million hectares (50,000 square miles). This is probably the largest and richest virgin auriferous area in the Western Hemisphere.

The State of Bolivar is divided into five districts (distritos) of which the three following are highly auriferous viz: Piar, Roscio and Heres. The capital towns of these districts are respectively, Upata, Guasipati and Ciudad Bolivar, each of which has an air-field.

The Distrito Roscio is the most productive and most developed at the present time. It is equally rich in diamonds and gold. The chief gold mining centres are El Callao, El Dorado, Alto Cuyuni (Carabobo) and Botanamo whilst the Gran Savanna area is predominantly a diamond field.

El Callao has for nearly a century been the centre of the most productive gold mines of the State of Bolivar and with it are associated most prominently the names of the Old Callao, Remington, Chile, Panama, Laguna and Columbia mines. The Old Callao Mine during a period of 24 years (1870 - 1894) produced 700,000 tons yielding 43,000 kilograms of gold (1,382,636 ounces), or approximately two ounces of gold recovered per ton of ore. It is reported that when the rich pay shoot (which averaged 4 ounces of gold to the ton) was being worked the amount of gold stolen was at least equal to the amount recovered. It is probable that some ore still remains in the northern section of the mine where the lode runs under the Yuruari River and it may well continue on the north side of it.

The two biggest companies operating in this area at the pre-

sent time are the New Goldfields of Venezuela Ltd., and La Compania Francesa de la Mocupia. The former has a mill capacity of about 20,000 tons per mensem and the ore is obtained from five producing mines within a radius of three miles from the mill. These mines vary in capacity from 50 to 350 tons per diem. The two most extensive and biggest producers are La Laguna & La Union which account for about 75% of the total production.

The total area of the numerous concessions held by this company is about 53,000 acres (21,000 hectares).

The report of the New Goldfields of Venezuela Ltd., for the financial year to June 1941 showed that 225,794 tons had been milled averaging 9.88 dwt/ton and the amount of gold recovered was 103,846 ounces, equivalent to slightly more than 93% recovery. The ore reserves at that date were estimated to be 411,170 tons of an average value of 9.88 dwt/ton.

The Mocupia Company has a milling capacity of 120 tons per diem and is working the old Columbia Mine in addition to two smaller properties, viz, the El Tigre and La Santa Rosa Mines. Columbia first commenced operations in 1873 and since that time about 320,000 tons have been milled averaging 12.5 dwt/ton. This mine is still producing daily from 90 to 100 tons of rich sulphide ore. The Santa Rosa Mine lies north of the Yuruary River and can only be worked during the period when the river is low as the cost of ferrying the ore across the river is prohibitive. The sulphide ore is very fine grained and averages about 10.0 dwt/ton.

All the mines in this area are comparatively dry whilst most of those in the Carabobo (Alto Cuyuni) region are wet. They are well equipped in every respect and a safety programme has helped considerably in reducing the number of minor accidents and absenteeism. The men wear safety boots and hats; goggles and gloves are supplied where necessary.

The Mocupia company has sufficient Edison battery lamps for all under ground workmen and these have proved an aid in reducing accidents in addition to lowering the cost of mine lighting as compared with carbide lamps.

Two Venezuelan owned lode mines are also producing small tonnages of high grade ore from time to time and this ore is milled at La Experiencia.

Only one foreign owned property has been worked in the Carabobo area in recent years but this ceased operating early in 1938 mainly due to exhaustion of the capital before the mine reached its full development stage. This was the Amarilla Mine which did some work on two ore bodies known as the Cuyuni and Cruz Roja, each of these lode concessions having an area of 200 hectares. A small cyanide mill was erected and about 5,500 tons of ore were treated yielding 4,265 ounces of gold. In this same area there are two alluvial concessions totalling approximately 5,000 hectares (19 square miles) and these appear to merit further attention. Many other lodes are known in this area containing high gold values in the outcrops and near surface workings but lack of capital and communications have so far prevented their development.

In the Botanamo area there are also a number of rich ore bodies but most of these are too distant from the main highway to encourage exploitation until communications are improved. However, one mine, the Botanamo, was worked from 1927-1935 by an American Company which milled 170,000 tons of ore averaging 16.0 dwt/ton and showed a good margin of profit. At present a Venezuelan syndicate is working a small lode mine in the same area with ore averaging about 2½ ounces per ton.

In the other districts of Piar & Heres there are at present no lode mines in operation but there is evidence of high grade quartz lodes at various places.

Old mines are located at Cicapra, Mapurite, Orotuima and San Luis Caroni, to name a few. A rich deposit has recently been sampled at Catacumba (near Manteco) and a few tons were crushed at a mill in the El Callao district the average grade being 18.0 dwt/ton. There are also several small alluvials which seem to be worth working in this area.

The oxidized ore-bodies are almost invariably rich, the ore is free milling and up to 65% of the gold can be recovered by amalgamation.

Diamonds are also found in the portions of the Caroni and Paragua rivers which traverse these two "distritos" of Piar & Heres.

Diamonds

In the southern part of the districts of Roscio and Piar lies the Gran Savanah covering some 12,000 square miles. This is an immensely rich diamondiferous area in which no company has yet operated. It is open to prospectors but so far no concessions have been granted as the Venezuelan Government is taking every precaution to see that national interests are fully safeguarded; however, concessions may be granted to properly qualified applicants. At present the selected area is being worked under the system locally known as "libre aprove-chamiento". This means that the exploitation of minerals and precious stones in the alluvial deposits of this limited area is free to all comers provided that the work is done by panning or any other primitive means and not by machinery. The work may be carried out by individuals, or small parties of workers, by sinking pits in an area of ten metres square to any depth. At present more than one thousand men are employed at three "diggings" and there are three diamond buyers resident on the field.

All the rivers having their origin in the Sierra Pacaraima are said to contain diamonds and the source of these precious stones is reported to be the conglomerate formation lying on top of the igneous complex of these mountain ranges. The diamonds vary considerably in size but the largest yet reported weighed 23 carats.

At least six extensive alluvial valleys are known and this virgin aera can only be worked to its maximum advantage by a company with considerable financial

resources. It certainly presents a wonderful opportunity for North American mining interests that can satisfy the requirements of the Venezuelan authorities.

The nearest air-field, at Santa Elena, is some 60 kilometres from the diggings and freight has to be taken in to the camp by mules for which the present charge is Bs1.75 ($0.50 U.S.) per kilo. Other landing grounds can no doubt be selected nearer the big alluvial areas whenever these are leased for exploitation.

There are a number of falls in the Gran Savanna area and some could be harnessed to furnish hydro-electric power.

The diamond output for the past 4 years is given below:—

Diamonds	1939	1940	1941	1942
Carats	5,636	15,352	29,399	34,048

It must be stressed that these figures give no indication of the extent and potential value of the diamond field because by Governmental Decree the working area has been limited to two small tributaries of the Rio Surukum. Production in this area first started in 1925 and more than $700,000 worth of diamond have been sold.

In addition to the above diamond field there is another on the Rio Pao, a tributary of the Caroni river. During the past year a well planned campaign of sampling has been carried out by an American engineer in the employ of Senores Casalti and Battistini, owners of the largest concessions in this region. The diamonds in this area are found in a hard pan, or ferruginous conglomerate, between surface level and bed rock.

Diamond prices have fluctuated very little and during the past year averaged as follows:—

Carats	Bs/Carat
Below 0.50	35.00
0.50—0.99	70.00
1.00—1.49	105.00
1.50—1.99	127.00
2.00—2.99	175.00

In the case of bigger stones prices were negotiated. The official exchange rate at present (December 1942) is Bs3.35—$ U. S.

Mining Law

The Mining Law of August 1936 embodies all mining regulations now in force and Article 1 states that "Mines and all matters relating to them are governed by the provisions of this Law, by special Laws referring to specific mineral substances, and in default thereof by the General Laws of the Nation".

The Mining Law is clear and liberal in its provisions. The right to exploit mines may be obtained only by means of concessions granted by the Federal Executive according to the provisions of the Mining Law and mining titles must be registered in the respective Registry Offices but do not require approval by the National Congress. A mining concession confers the right to exploit all minerals which may exist in it, without any further requisite than giving notice to the Minister of Industry (Fomento) for purposes of dues payable thereon. All persons or Corporations legally qualified, whether natives or foreigners, may obtain mines in the Republic except certain Government officers specified in the Law.

Mines must be determined on the surface by fixed points or lines, taking the hectare, equivalent to an area of ten thousand square meters, as the unit of measure. The area of lode, or vein, mines must not exceed 500 hectares, demarcated in the shape of a square or a rectangle. Concessions on lodes are granted for a period of ninety years and all other deposits for periods of fifty years. Lode gold mines producing not less than 100 tons per diem and alluvial deposits treating not less than 500 cubic metres per diem are exempt from surface taxes and pay only the exploitation tax.

Owners of mines located on lands over, or along, which flow waters of the Public Domain may use them for developing hydraulic power for working their plant.

All machinery, dredges, utensils and accessories for the working of mines, as well as accessories for motors, lighting and ventilation, machines, instruments, utensils and accessories for metallurgical plants and the chemical products for assaying and refining minerals are free from import duties. Explosives are likewise free from import duties but their importation is subject to special Resolutions as well as to local Police Laws.

Labour

In the existing mining districts there is no scarcity of labour but there is a shortage of skilled men especially for the mechanical workshops and the mines. Most of the mechanics, fitters and pumpmen at present employed are West Indian negros, or children of West Indian parents. This is the first generation of Venezuelan miners for it is only in the past 15 years that they have been extensively employed in underground operations. Before that time practically all the mine force was recruited from the West Indian islands of Trinidad, Barbados, St. Lucia, St. Vincent, etc. However, following the restrictions placed by the Venezuelan Government on the free importation of labour and with the growth of mining operations about that time necessitating also the gradual replacement of hand-labour by machinemen more and more Venezuelans were employed and trained until today the natives of the country comprise about 95% of the total labour in the industry. The Labour Law states that at least 75% af all workers, both salaried employees and labourers, shall be Venezuelan and all orders and instructions must be given in the Spanish language, though quite a number of the workers speak English.

The men are of fairly good physique but lack stamina and a sufficiently balanced diet.

There are no organized Labour Unions on the mining camps but the Venezuelan Labour Law governs the rights and obligations of employers and employees with regard to work. The National Labour Office is responsible for the administration of the Law and establishes Labour Offices in charge of district Labour Inspectors whose duty it is to see that proper compliance is given to the dispositions of the Law. So far this provision for the settlement of differences between mining com-

panies and their employees has operated smoothly and satisfactorily. Foreign companies in engaging staff for their properties should give especial care to their selection and whenever possible they should give preference to men with Venezuelan experience and with a knowledge of Spanish, for considerable tact and patience are required in handling Venezuelan miners.

Rates of pay are fairly well standarized in each district and naturally the mines operating in the El Callao district have a lower scale than those operating in more inaccessible areas. On certain National holidays, specified in the Labour Law, the employers must pay their labour the usual wages, or double the normal daily wage if for any reason they work on these days. In the El Callao area the minimum rate is Bs6.00 per 8 hour shift for surface labourers and rises to Bs16.00 for skilled fitter-mechanics with several years experience. Most of the underground force such as muckers, trammers and machinemen are employed on a contract, or task, basis and naturally their earnings vary considerably. Muckers are paid a minimum of Bs6.50 and Machinemen Bs9.00 per 8 hour shift. Most of the mines operate on a 2 shift basis and in development drifts the round is drilled and blasted on one shift and mucked out on the following shift. Development and mining contract rates vary somewhat, but, for standard drifts and cross-cuts, 7′ x 6′ in section, a common price is Bs25.00 per foot, the machineman paying for the explosives.

To sum up, the State of Bolivar has big reserves of untapped wealth in gold and diamonds. The Gran Savanna area especially merits the attention of North American capitalists. The lode deposits are numerous and high grade but generally of limited tonnage so that individual mines of 60-150 tons per diem should best repay investment. However, in some localities one company might well operate a group of such mines within a small radius as the New Goldfields of Venezuela Ltd., is doing at the present time. More than half of the titles to concessions in the State of Bolivar have lapsed and with the improvement in communications many of these should prove worthy of further investigation. Freight costs are still somewhat high but should fall further with the completion of the new highway and the continued development of aerial services should give a tremendous impetus to the mining industry in this region. Labour costs are also high and are not likely to be lowered until the cost of imported food supplies is also lowered. Despite these adverse factors it is still possible to operate at a reasonable profit as the ore deposits are high grade. Many gold alluvials appear to warrant the attention of small operators, but are not extensive, or deep enough, to justify the interest of big mining companies.

After the war rapid development of hitherto inaccessible areas is expected and the mining industry should be the first to benefit.

A second article on the ore-deposits of the base metals will be presented in the near future.

Brazilian Manganese Ore

THE manganese-ore industry in Brazil is again as busy as during the peak period of the last war, the chief cause being the heavy demand for ore from the United States following the cessation of exports from Soviet Russia. In pre-war years, Russia covered between 40 and 45 per cent of manganese ore imports of the United States, her share in 1940 being still 25 per cent. In the inter-war period, Brazil lost her hold on the manganese-ore market and became relegated to a very subsidiary position, mainly owing to the high transport costs imposed on Brazilian ore. Only the removal of competition from producing countries better placed than her and which dominated the pre-war trade, has enabled a resuscitation of the industry in Brazil. The benefits derived from the inability of Soviet Russia to deliver ore are reflected in recent export figures; Brazilian exports of manganese ore were 222,713 tons in 1940, of which 215,601 tons went to the United States; in 1941 437,402 tons were exported, as much as 423,682 tons going to the United States.

It is obvious that the immediate future of the Brazilian ore industry is dependent on United States requirements, and to permit healthy development of the industry an agreement has been made between the two countries under which nearly the whole of Brazilian production will go to the United States for the duration of the war. Under this fillip, Brazilian exports continue to expand, and will soon reach the 500,000 tons mark, a figure which was, however, exceeded in each of the three years from 1916 to 1918. While the current agreement provides a safeguard for the war period, it is the post-war outlook which causes most concern in Brazilian mining circles.

After the last war, the industry was able to maintain its ground for a few years, until Russian production had developed to the exporting level; then, shortly after 1931, the export trade virtually collapsed, and had almost completely disappeared by 1934. A slight recovery took place in 1937, when demand for manganese ore rapidly expanded.

Zirconium Dust

INVESTIGATIONS by the United States Bureau of Mines have shown that zirconium dust is particularly dangerous and will ignite spontaneously and exploded at ordinary room temperature. It is therefore suggested that zirconium dust be handled only as a sludge or in special containers.

Corrigenda

IN THE September issue of the *Canadian Mining Journal*, page 576, last paragraph, the United States production of palladium for 1940 is given as 14,773 metric tons and the recovery by refiners as 4,564 tons. Troy ounces should have been read for metric tons and tons respectively.