

CANADA
DEPARTMENT OF MINES
HON. MARTIN BURRELL, MINISTER; R. G. McCONNELL, DEPUTY MINISTER.
GEOLOGICAL SURVEY
WILLIAM McINNES, DIRECTING GEOLOGIST.

Summary Report, 1918, Part G

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SUMMARY REPORT, 1918, PART G.

THE PLATINUM SITUATION IN CANADA, 1918.

By J. J. O'Neill.

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INTRODUCTION.

The prosecution of the war caused a sudden and increasing demand for platinum, particularly in the operation of munition plants, notably of those for the manufacture of nitric and sulphuric acids. This demand made great inroads on the available supplies, and in the year 1915 the value doubled. The price fluctuated during 1916, the average value of New York refined platinum for the year being \$83.40 per ounce Troy.

The situation in 1917 was very grave; the demand was increasing, and production was decreasing. Russia had been the source of more than 90 per cent of the world's production of platinum, and unsettled conditions in that country had caused the production to be cut in half; the final collapse of Russia cut off entirely the main supply of platinum from the Entente Allies and the problem of obtaining an adequate amount of the metal became one of acute importance.

To meet this situation, stringent regulations were enacted by the Entente countries regarding the use of platinum in non-essential industries: supplies of crude platinum were commandeered by the government; the public was encouraged to surrender any manufactured platinum in its possession, which was not serving a useful purpose; the price of platinum was fixed at \$105 per ounce Troy; and each country was urged to thoroughly test and develop any occurrence in mines within its borders.

GENERAL STATEMENT.

In Canada, platinum was known to occur in several parts of British Columbia and the Yukon, as the native metal associated with gold in placer

deposits; also in the nickel-copper ores of Sudbury district, Ontario, as the arsenide, sperrylite. Only a small amount was produced in western Canada, principally because no properties were worked on a large scale with proper facilities for recovering the platinum. No platinum was recovered in Ontario as all the matte was sent out of Canada for refining, the country thus losing the platinum content.

To further the production of "new" platinum, members of the Department of Mines were given instructions to examine carefully any deposits of platinum in the districts to which they were assigned for field work, and the services of G. C. Mackenzie were loaned to the Imperial Munitions Board to secure platinum for them from any possible source in British Columbia.

Since British Columbia apparently offered the best chances of an increase in the production of platinum within a reasonable time, efforts were concentrated on this province during the season of 1918.

The Dominion Assay office at Vancouver announced that it was prepared to purchase all offerings of platinum, and would make assays free of charge to the prospector; in this way a considerable stimulus was given to prospecting; samples poured in from all over the country, and any property that gave promise of a supply of platinum was investigated by an official of the government.

The history of the placers of Tulameen river, together with the results of preliminary tests, decided Mr. Mackenzie to undertake a thorough testing of the deeper gravels along that river. These gravels had remained undisturbed because of the expense of testing them, and of installing a dredging plant if the results warranted their exploitation.

The writer was instructed to make a complete investigation of the platinum situation in Canada, keeping in view particularly: (1) the present production of platinum in Canada; (2) localities from which production is secured; (3) the means by which the production may be increased; (4) an estimate of the future production to be expected.

The object was to bring together in one report all the information available on Canadian platinum possibilities, so that a definite statement could be made, and, if conditions warranted it, a comprehensive scheme outlined by which the platinum industry could be assisted in Canada, with all necessary facilities for the mining, concentration, smelting, and refining of any ores of platinum found in the country.

The summer of 1918 was spent in British Columbia, visiting the various smelters and the more important localities from which platinum had been reported. Records were obtained from the smelters of any ores which indicated platinum content. Information was also sought as to what conditions would have to be fulfilled before the smelter would be able to make a return to any shipper of platinum ore; what quantity of such ores would warrant turning over a complete unit of the plant for their continuous treatment; what quantity of accumulated ore would warrant a separate run of a complete unit; what classes of ore could be handled; and what the advantages or disadvantages of either arrangement would be for the treating of possible ore.

The thanks of the writer are due to the management of the smelters at Anyox, Ladysmith, Trail, Grand Forks, and Greenwood for their courtesy and assistance in securing information, and to those in charge of

the mines and prospects visited; particularly in the Cariboo and Quesnel districts.

PROPERTIES AND USES OF PLATINUM.

The metal platinum owes its value to a unique combination of properties, both physical and chemical, which it alone possesses. It has a whitish steel-grey colour which does not tarnish; it is malleable, remarkably ductile, and sectile, so that it can be easily worked into any shape required; it is considerably harder than gold, and is very tough; it will not melt except at very high temperatures, and it may readily be soldered to other metals; it readily forms alloys with metals of the same group so that its properties may be varied; it will not unite directly with oxygen, nor will it form an amalgam with mercury; it is strongly resistant to acids and no single acid will affect it.

A large percentage of the total production of platinum has been used in the manufacture of jewelry in the form of rings, chains, pendants, bracelets, mesh-bags, etc., but except in the actual setting of gems, the metal appears to have no advantage over many other cheaper metals, and the only reason for the demand is the costliness of the material. In dentistry, platinum was extensively used for pegs and bracings in the setting of false teeth; it served this purpose admirably, but an alloy has been discovered which is serviceable and much cheaper.

Large quantities of platinum are absolutely essential for the manufacture of nitric and sulphuric acids, which, besides their ordinary uses, are essential in all explosives. Platinum is needed in the manufacture of nitrates from atmospheric nitrogen and a great amount is absorbed in the general chemical industry. In electrical work platinum is alloyed with iridium in varying proportions up to 50 per cent of the whole. These alloys are extensively used and apparently no reliable substitute can be found. Each telephone and telegraph instrument has platinum contacts, and the multitude of contacts on telephone switchboards, and on the relay instruments of both the telephone and telegraph lines are of platinum. Every high grade magneto for aeroplane, automobile, motor-boat, or gas-engine, has from two to six contacts of platinum, and a considerable amount is used in thermo-couples for the electric control of heat in ovens and furnaces.

Among the special war uses of platinum, the following may be mentioned: it is essential in the composition of certain delicate gun mechanisms, in some necessary signal instruments, in the manufacture of special pyrometers (no gun can be made without the use of a pyrometer), and as a bridge between the two leads in an electric detonator. It is also said that without platinum all experiments in gases would be greatly handicapped.

Because of the great danger of a shortage in supply, and because of the high cost of platinum, intensive efforts have been made to discover some metal or alloy that is much cheaper, and will serve one or more of the above-mentioned uses in as efficient a manner as does platinum itself. These experiments have met with a certain amount of success, but there seems to be no immediate prospect of the supply of platinum exceeding the demand to such an extent as to cause a slump in the price to pre-war levels when platinum was already twice as valuable as gold.

GEOLOGICAL OCCURRENCES.

Although more than 99 per cent of the world's supply of platinum is obtained from Russia, Colombia, Australia, United States, and Canada, this metal is known to occur in a great many other countries. Professor J. F. Kemp published in 1902 a report on "Platinum and associated metals"¹ in which he reviewed all the known occurrences of platinum in the world.

Most of the deposits described are not commercial propositions, but are of interest in that they indicate the various ways in which the platinum metals occur in nature, and serve as guides in the search for, and development of, other properties in which these metals are more abundant. Kemp concluded that there are three distinct types of deposits in which the platinum group of metals may be looked for with some chance of success, i.e., in: (1) placers derived from peridotites, and in a lesser degree from pyroxenites, gabbros, and syenites, often gneissoid; (2) veins—gold-bearing veins with or without metallic sulphides, veins carrying complex antimonial sulphides of copper and other metals (i.e., tetrahedrite and bournonite); (3) disseminated deposits in eruptive rocks—with ores of copper and nickel, with chromite in peridotites, etc.

Kemp's forecasts have been borne out in that platinum is now known to occur in commercial quantities in certain vein deposits, notably in association with various ores of copper, and in disseminated deposits in igneous, and sometimes in sedimentary, rocks, also associated with ores of copper.

No workable deposits of platinum-chromite ore are known, but the widespread association of the two minerals makes it well worth while to keep this possibility in mind.

Platinum in gravels, etc. (placer deposits), should be looked for in those gravels which occur in or near streams draining areas of basic igneous rocks, i.e. those rocks in which quartz is absent, and in which dark coloured minerals predominate; the mere fact that such rocks are exposed at the surface is sufficient to show that a great amount of denudation has taken place in the region. If there was any platinum in the rock originally, no matter how small an amount, the total accumulation would be concentrated in relatively small space in the drainage channels, because, on account of its relatively great weight, platinum tends to work to the bottom of the gravels within a short distance of its source, and all lighter material is constantly being washed farther downstream. In this way the platinum from countless tons of rock may remain in the bottom of a stream, and the rock be passed on, finally, as sand to the sea.

A very interesting occurrence of platinum is in certain coals in Australia. The values in platinum and vanadium are very high, but no particulars are available as to the origin of these deposits.

PLATINUM OCCURRENCES IN CANADA.

In listing these occurrences it is thought advisable to group all the information concerning deposits in any one province; the deposits in each province are divided into lode and placer deposits, according as the platinum is found in the solid rock, or in gravels, etc.

¹ U.S. Geol. Surv., Bull. 193.

Proceeding from east to west across Canada, the following localities are reported to contain platinum:

Maritime Provinces.

So far as known, only one deposit of platinum, either lode or placer, has been reported from Prince Edward Island, Nova Scotia, or New Brunswick. There is always the possibility of it being found in association with other ores in veins, or in other lode deposits, but the chances of finding valuable platinum placers in these provinces appear to be remote. The deposit referred to is in the property of Scheelite Mines Limited, Moose River district, Nova Scotia. This is a prospect which is being developed for scheelite, and there is said to be 250 tons of 10 per cent ore on the dump. "A trace of platinum and gold estimated at 0.04 ounces per ton was found by an assay made at the laboratory of the Department of Mines, Ottawa, from heavy Wilfley tables fines. Sperry-lite is thought to be the mineral present in the ore."¹

Quebec.

Platinum in Solid Rock. Traces of platinum were found in chromite from St. Cyr by the Ore-dressing division², Mines Branch, Department of Mines, during tests in 1917. This is the only record of platinum occurring in place, but very few tests have been made and there are great bodies of serpentines in the province which offer conditions peculiarly suited to the occurrence of platinum metals. Platinum has been reported from placer workings on Rivière-des-Plantes and Rivière-du-Loup, and the rocks from which it was derived cannot be far distant. It would seem well worth while to test the chromite from the various mines in the province, and also the deposits of asbestos, to find if platinum does occur in important amount in them.

Platinum in Gravels, etc. Minute grains and scales of platinum and osmiridium were noted by Dr. T. S. Hunt³ in 1852, in the gold obtained from placers on Rivière-du-Loup, and on Rivière-des-Plantes, both tributaries of Chaudiere river; so far as is known no attempt was ever made to save these minerals commercially, and there is no record of the actual amount present in the placers. The serpentines found in Quebec from Gaspé to the Vermont border are apparently similar to those rocks which are the source of the platinum in the placers of Russia and of British Columbia; these serpentines carry considerable disseminated chromite, and, in places, workable bodies of that mineral, but they have never been given more than a casual examination for the presence of platinum. Loose, surface deposits were in most places considerably disturbed during or immediately following the Pleistocene, but it is possible that some placers may yet be found to contain platinum metals in sufficient amount to pay for working. In this connexion it is interesting to note that a nugget consisting of 46 per cent platinum and 54 per cent of chromite was picked up in glacial drift near Plattsburg, N. Y., and that in that vicinity the ice had a general southwesterly movement. In discussing this nugget, Kemp⁴ says: "A

¹Ann. Rept. on Mines, Nova Scotia, 1918, p. 50.

²Dept. of Mines, Mines Branch, Sum. Rept., 1917, p. 90.

³Geol. Surv., Can., Ann. Rept. 1851-52, p. 120.

⁴U.S. Geol. Surv., Bull. 193, p. 57.

Canada Department of Mines

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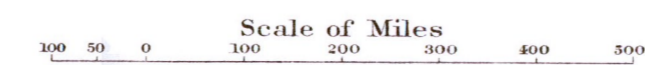


C.O. Senécal, Geographer and Chief Draughtsman

Base map from plate of the Department of the Interior
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OCCURRENCES OF PLATINUM IN CANADA

(Compiled from various sources)



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- LEGEND**
- ✱ Lode deposits
 - ✱ Placer deposits
- Yukon**
- 1 Stewart river and Scroggie creek
 - 2 Burwash creek
 - 3 Yukon river near Dawson
 - 4 Ferguson creek
 - 5 Teah river
- British Columbia**
- 1 Copper mountain
 - 2 Omineca mountains, etc.
 - 3 Franklin camp, Grand Forks, M.D.
 - 4 Roseland
 - 5 Greenwood (Sappho)
 - 6 Porteau claim (Lewis creek)
 - 7 Cable Mine, etc.
 - 8 Bridge river district
 - 9 Dease lake district
 - 10 Ingenika river
 - 11 Omineca river
 - 12 Manson creek
 - 13 Finlay river
 - 14 Peace river
 - 15 Willow river
 - 16 Government creek
 - 17 Quesson river
 - 18 Horsefly river
 - 19 Fraser river near Lillooet
 - 20 Fraser river near Yale
 - 21 Tulameen river
 - 22 S. Similkameen river
 - 23 Tranquille river
 - 24 Lardou river
 - 25 Tally creek
 - 26 Shattlemorth creek
 - 27 North Thompson river
 - 28 Franklin creek
 - 29 Mc Donald creek
 - 30 West Branch, North fork of Kettle river
 - 31 Rose point
- Alberta**
- 1 North Saskatchewan river
- Manitoba**
- 1 Star lake
- Ontario**
- 1 Sudbury district
 - 2 Reams township
 - 3 Ely township
- Quebec**
- 1 St. Cyr
 - 1 Rivière du Loup
 - 1 Rivière des Plantes
- Nova Scotia**
- 1 Moose River district

To accompany Summary Report, Part 6, 1918, and memoir by J.J. O'Neill, 1919.

southwesterly movement of the ice would have brought glacial material to Plattsburg from the great areas of serpentine which occur in Quebec north of Vermont, and which are commercially productive of chromite. There seems little reason, therefore, to doubt that the nugget has been derived from this source, but as yet no platinum has been announced in the serpentine region."

Ontario.

Platinum in Solid Rock. Platinum and palladium occur in the nickel-copper ores of the Sudbury district in important amounts. Using the figures given to the Royal Ontario Nickel Commission, it appears that the matte produced from these ores in the year ending December 31, 1916, contained platinum and palladium as follows:

Canadian Copper Company: 63,567 tons matte; 6,255 ozs. Pt; 9,382 ozs. Rd.

Mond Nickel Company: 16,443 tons matte; 16,246 ozs. Pt; 16,180 ozs. Pd.

Making a total of 22,501 ounces of platinum, and 25,562 ounces of palladium, or 48,063 ounces of the two metals.

The statement of the Canadian Copper Company shows that their refinery in New Jersey recovered less than 8 per cent of the total platinum and palladium content of the matte. No definite figures are available as to the recovery made from the ores of the Mond Nickel Company at their refinery at Swansea, Wales. Officially, there was no production of either platinum or palladium in Canada from either of these companies.

Platinum in place has also been reported from Reaume¹ township, Ontario; it occurs with chromite in a diamondiferous rock which gave an assay of 13.44 per cent CrO₂; 14.58 per cent Fe; 0.066 oz. Pt, ton of 2,000 pounds. It has also been reported that a large deposit of sulphide in the township of Eby carries about \$2 per ton in platinum, besides small values in gold and silver. No confirmation of the report nor details of the occurrence are at hand.

Platinum in Gravels, etc. (Placers). No placers carrying values in platinum are known in this province. There is, however, a possibility that they may occur, since there are important areas of chromite-bearing serpentines in northern Ontario, from one of which platinum has been reported. The readjustment and stripping of the superficial deposits during Glacial time destroyed most of the placer deposits then existing; any placers found in Ontario will occur in gravels so situated that they have been protected from glacial erosion, or in those which represent a reconcentration of glacial material which contained scattered values. There has not been sufficient bedrock erosion in Ontario, since Glacial time, to form valuable placers from this source alone.

Manitoba.

Platinum in Solid Rock. The only occurrence of platinum reported from this province was from the Star Lake district,² a picked sample which

¹ Ont. Bureau of Mines Rept., vol. XXIII, pt. I, p. 47.

² Geol. Surv., Can., Sum. Rept., 1917, pt. D, pp. 21-22.

consisted of quartz carrying pyrite and arsenopyrite in small quantities, assayed 2.30 ounces of gold and 0.10 ounce of platinum per ton. Other samples from this locality gave traces of platinum. This district was visited in 1918 by E. L. Bruce¹ who took twenty-one samples from the various deposits, channel-sampling those previously sampled; but the assays gave no platinum.

Platinum in Gravels, etc. (Placers). No platinum placers are known in this province.

Alberta.

Platinum in Solid Rock. None known.

Platinum in Placers. Native platinum has been found in association with gold on the bars of North Saskatchewan river, in the neighbourhood of Edmonton. In speaking of this occurrence Dr. Hoffmann stated:² "A sample of the material from this locality, received from Mr. Wm. Pearce, consisted of minute, rounded, and flattened grains of native platinum, the largest not exceeding one-fourth of a millimetre in diameter, with intermixed, equally minute scales of native gold. Mr. Johnston found a certain proportion, about one-fourth, of the platinum to be magnetic. No evidence could be obtained of the presence of iridosmine in the particular sample examined."

Drill tests of these bars made by the Imperial Munitions Board in 1918, did not yield satisfactory results, and no further work was done.

British Columbia.

Platinum in Solid Rock. Lode platinum has been found in three distinct type of deposits—first, in association with chromite in the peridotite-pyroxenite rocks and their derivatives; second, in association with chalcopyrite in various classes of deposits, often quite acid; it has also been found in shear zones in typical granite, apparently unaccompanied by other minerals except a development of chlorite.

In the first group of deposits the platinum and chromite are frequently found intimately mixed, but the presence of one is not sufficient to prove that the other is present; the chromite is usually disseminated through the rock, sometimes occurring in small bunches, but rarely in sufficient amount to pay for mining. The platinum is even more erratic in its distribution, for some chromite will be barren and another part, even of the same hand specimen, will give high platinum values; at other times the country rock containing very little chromite gives a higher assay in platinum than do the richer parts. No general rule can be laid down for the occurrence of platinum in these rocks and any systematic testing of them would be very expensive and of doubtful value. At certain points where peculiar geological features may have influenced the concentration, as in shear zones, in large segregations of chromite, in highly serpentized areas, in or near dykes which have been accompanied by some mineralization, etc., there are many more chances of success. Such lode deposits are the source of the platinum in the placers and this platinum is only rendered available

¹ Geol. Surv., Can., Sum. Rept., 1918.

² Geol. Surv., Can., Ann. Rept., vol. V, p. 65R.

through concentration by the processes of nature from millions of tons of the original rock.

In the second type of deposits the platinum is closely associated with copper, usually in the form of chalcopyrite. The platinum in this case must have migrated in solution, as it occurs in veins and in contact metamorphic deposits; the mineral form in which it occurs has not been determined for any of the deposits in British Columbia, but in similar deposits elsewhere it occurs as the arsenide, sperrylite, a mineral occurring in minute grains with brilliant crystalline faces, of a tin-white colour, specific gravity 10.6, and hardness about the same as quartz. Sperrylite in well-formed crystals commands a good price from mineral collectors as a rare mineral, and, in bulk, offers little difficulty to the metallurgist in the recovery of platinum.

At present there is no property known in British Columbia which has any important ore-body of this type blocked out; there are many deposits, however, which give traces of platinum in general samples, and some which give high values in picked samples; it has been shown in at least two cases that the platinum is practically confined to the sulphides of copper. The divergence in values obtained from different samples from the same property, is thus probably to be correlated with an accompanying variation of chalcopyrite content.

Of the third type, those in shear zones in granite, only one example is known. Kemp¹ showed that platinum was present in the granite about Siwash creek in the Tulameen district; his samples were taken from shear zones and there is no data to show whether there is any platinum in the undisturbed granite; the values obtained were not such as to make the deposit of economic interest, except to show that the conditions under which platinum may be found are much more varied than generally supposed.

Properties from Which Samples Containing Platinum Were Obtained.

Mining division	Property	Ores	Remarks
Similkameen....	Olivine mountain.....	Chromite.....	
	Lodestone mountain.....		
	Siwash creek.....		In granite.
	St. George.....	Copper-gold.....	Replacement in limestone.
	Newton creek.....	Copper.....	Thin veins.
	Copper mountain.....	".....	As sperrylite.
Ainsworth.....	Cable claim.....		Quartz in granodiorite.
	Nome claim.....		Reported rich in Pt; Samples were barren.
Greenwood.....	Sappho property.....	Copper.....	Indications of Pt noted at smelter.
Trail creek.....	B.C. Consolidated....	Copper-gold.....	Palladium noted at smelter.
Grand Forks....	Maple Leaf.....	Copper.....	Contact metamorphism.
	Union.....	Lead-gold-silver. Little copper.-	Quartz veins. Traces.

¹ U. S. Geol. Surv., Bull. 103.

*Properties from Which Samples Containing Platinum Were Obtained—
Concluded.*

Mining division	Property	Ores	Remarks
	Buffalo.....	Copper.....	Segregations.
	Lucky Jack.....	".....	"
	Mountain Lion.....	".....	"
	Averill group.....	".....	"
	Ottawa.....	".....	"
	Columbia.....	".....	"
	Cerargyrite.....	Chromite.....	In serpentine.
	Midnight.....	".....	"
	Blacktail.....	".....	"
	Blacktail Fr.....	".....	"
	Mastodon.....	".....	"
	Fife mines.....	Copper-gold.....	
	Mother Lode.....	Copper.....	Reported in 1902. Recent samples are barren.
Kamloops.....	Fortuna claim.....	Gold in FeS ₂ Some copper.....	Owners claim good values in Pt; smelter says none in the ore.
Lillooet.....	Bridge River district.	Nickel.....	Pt reported from sample.
Nelson.....	Molly Gibson.....	Gold.....	Reported from engineer's sample.

Platinum in Gravels, etc. (Placers). Platinum is known to occur in placers from one end of the province to the other; as early as 1876 it was reported from "several localities" by Geo. M. Dawson, and in 1878 he mentions it occurring with the gold in the placers of the Tranquille and Similkameen rivers. Since no value was attached to this metal by the miners, there was no effort to save it until about 1887. In the report of the Bureau of Mines, B.C., for 1887, page 278, the situation was summed up as follows:

"I may mention that the production of platinum for the past season is estimated at 2,000 ounces. It now commands from \$2.60 to \$3 per ounce, according to quality. It is a remarkable fact that many thousands of ounces of this rare metal have been thrown away by the miners as worthless, in consequence of the prevailing ignorance as to its value . . ."

Up to 1900, the only place where platinum was saved was in the Similkameen district and as the placer mining for gold became less and less active, the production of platinum likewise dropped, so that only a few ounces per year have been reported since 1900.

Platinum has been reported from placers in the following localities:

Creek or river	Mining division	Remarks
Similkameen, South Fork	Similkameen.....	Some recovered in washing for gold.
Tulameen river.....	".....	In the present bed and bench below Siwash creek.
Slate creek.....	".....	Tributaries to the Tulameen from the south. In
Cedar creek.....	".....	places platinum = one-half amount of gold.
Granite creek.....	".....	
Whipsaw creek.....	".....	Tributary to South Similkameen.

Creek or river	Mining division	Remarks
Rock creek.....	Greenwood.....	At Camp McKinney. Rock creek is a tributary to Kettle river.
Tranquille river.....	Kamloops.....	In fine scales with gold.
North Thompson river..	".....	Near Clearwater river. Five samples gave traces.
Fraser river.....	Yale.....	At Boston Bar. Dredging. At North Bend. Near Yale. Opposite Saddle Rock station. Ten miles below Lillooet. Four to 5 miles below Lillooet, on east side of river. One-half mile above Goldfield (reported).
Lardeau river.....	Trout lake.....	Reported mixed with coarse gold.
Toby creek.....	Windermere.....	Below Quesnel lake; in benches, old channels, and present river-bed.
Quesnel river.....	Quesnel.....	Tributary to Hixon creek and the Fraser from east. Pannings.
Government creek.....	Cariboo.....	Reported but not proved.
Willow river.....	".....	Flows into Quesnel lake. Noted with gold recovered.
Horsefly creek.....	".....	
Manson creek.....	Omineca.....	Tributary to Finlay.
Ingenika creek.....	".....	Tributary to Finlay.
Omineca river.....	".....	Tributary to Finlay river.
Finlay river.....	".....	North branch of Peace river.
Peace river.....	Peace river.....	Near Hudson Hope.
Thibert creek.....	Liard.....	Flows into Dease lake. Found in gold placers.
Dease creek.....	".....	Flows into Dease lake.
Macdonald creek.....	".....	Vicinity of Dease lake. By report only.
McLean creek.....	".....	Vicinity of Dease lake. By report only.
Graham island near Rose point.	Queen Charlotte islands.	Reported with gold in beach placers.

The widespread occurrence of platinum is demonstrated by the above table; in nearly all of the occurrences listed, gold has been the metal which was considered of prime importance and in three divisions only have serious efforts been made to recover the platinum commercially, i.e., in Similkameen, Quesnel, and Liard mining divisions. This work was done at a time when the value of platinum was a mere fraction of its present value.

The total production of platinum from the Similkameen is estimated at more than 10,000 ounces, but the general enthusiasm for placer mining in this district waned with the working-out of the more easily accessible gravels, and large quantities of possible placer material remain, untested.

In the Quesnel district platinum was obtained in unrecorded amount by Chinese in their placer workings along the Quesnel river, and operators on a small scale have frequently noted its occurrence, some assays being quite high in platinum; no systematic testing has, however, been undertaken although the results of panning in this district apparently warrant a much closer examination of the possible placers than has been given to them. There are two large hydraulic plants in this district, each representing an outlay of more than a million dollars; they are the Consolidated Cariboo Hydraulic mine, now known as the Bullion mine, and the Quesnel Hydraulic Gold Mining Company's mine.

Concerning the Consolidated Cariboo Hydraulic mine near Quesnel Forks, Cariboo district, the manager, Mr. J. B. Hobson, reported:¹

"For several years past, qualitative tests have been made from time to time for the presence of gold, platinum, and osmiridium, in the heavy concentrates that remain in the sluices after cleaning up; and while making one of these tests in May 1903, the presence of palladium was indicated in addition to platinum and osmiridium. An analysis of a sample of concentrates, made by J. O'Sullivan, F.C.S., chemist, of Vancouver, in May 1903, gave large percentages of gold, platinum, palladium, and osmiridium, which brought the value of the concentrates up to \$3,872.76 per ton. A second sample taken from a pan of concentrates taken from the sluices after the clean-up in September, 1904, was sent to Mr. J. O'Sullivan, chemist, of Vancouver, and gave the following results:

	Ozs. per ton.	Gross value per ton of 2,000 lbs.
		\$ cts.
Gold.....	95	1,900 00
Silver.....	180	90 00
Platinum.....	64	832 00
Palladium.....	64.4	1,769 00
Osmiridium.....	42	1,386 00
Copper.....	10.5%	16 56
Total value.....		5,993 56

"The gold and silver values are, no doubt, included in particles of pyrite and argentiferous galena, and partly in small particles of gold covered by manganese and other metallic oxides, and cannot be recovered by the process of amalgamation. The platinum, palladium, and osmiridium are found in minute metallic grains, and enclosed in small fragments and nuggets of magnetite and chromite, which appear to make up quite a large percentage of the sluice concentrates found after cleaning-up.

"What quantity of these high grade concentrates are included in the deposits, or can be recovered therefrom, cannot be determined until after the completion of the system of undercurrents which is to be placed at the end of the sluice outside the tunnel, where everything of value will be separated from the tailings, before going over into the dump, and concentrated on the undercurrent tables. These undercurrents will probably be completed before the close of the ensuing season."

Unfortunately, before the new apparatus was installed the mine was sold, temporarily shut-down, and finally closed because of litigation; this proves a great handicap to the district, for the continued success of this large property would be a great inducement to carry out the much needed testing of placers in the whole district.

In 1909, a large hydraulic plant was installed by the Quesnel Hydraulic Gold Mining Company, in connexion with their property on Twentymile creek, which enters Quesnel river about 12 miles below Quesnel Forks, Cariboo district. This property is also said to carry minerals of the

¹ Rept. E.C. Bureau of Mines, 1904, p. G41.

platinum group and at the present time tests are being carried on to recover them. The plant is installed on a large scale, but the returns in gold up to date have been disappointing; the management believes that if the platinum values in the gravels can be recovered, as well as the gold, the property will be a good paying proposition.

In the Liard mining division, platinum and osmiridium were both known to occur with the gold in the placers of Thibert creek, but no effort was made to save them until 1905 when experiments were conducted by Mr. Hamfield of the Berry Creek Mining Company, Limited, located on Thibert creek, Mr. Hamfield reported as follows:

"Experiments were made to concentrate the black sands containing minerals of the platinum group. For this purpose an undercurrent, and a series of tables covered with cocoa-matting, canvas, and burlap, were installed at the end of No. 2 sluice.

"Although it was this year largely experimental, the mechanical concentration was quite satisfactory. During the twenty-one days that the concentrating plant was in operation, it yielded 250 pounds of concentrates, and this amount could have been greatly increased by a man in attendance with some experience in concentration.

"Assays of these concentrates, made at the British Columbia Government Assay office, gave 60 ounces of platinum to the ton of concentrates and assays obtained in San Francisco gave up to 15 ounces of platinum and 7 ounces in gold per ton. These results were obtained almost entirely from top gravel, and as the bottom gravels will naturally contain more of the heavier minerals, the concentrates from the latter should be very much better than this year's output."¹

Enough has been said to show that platinum minerals do occur in important amounts in placers in British Columbia, over a large range of country. The gold in the gravels has generally been sufficient to pay for the operation, so that the platinum was regarded with only casual interest until the price advanced so enormously during the last few years. The only systematic attempts to recover the platinum on a large scale gave considerable promise, but were discontinued when the properties suffered setbacks which resulted in their being closed temporarily.

Yukon.

The following notes on the occurrence of platinum in the Yukon were furnished by W. E. Cockfield.

"At the close of the field season of 1918 the writer had occasion to examine some reported discoveries of platinum on Burwash creek, in the Kluane mining district, and the results of that examination, and a general review of all information with regard to platinum deposits in Yukon, are to be published in a report dealing with the occurrences of platinum minerals in Canada. In order, however, that certain parts may be published as early as possible, the following brief summary has been prepared.

"Platinum has been reported² to occur in samples of gold dust from near Dawson and from Yukon generally to an amount which has a commercial significance. In one case, 390 milligrams of osmiridium per ounce of gold was obtained. This platinum appears to be directly combined

¹ Rept. B.C. Bureau of Mines, 1905, pp. 77-78.

² Rept. B.C. Bureau of Mines, 1903, p. 23H; 1905, p. 30J.

with the gold and for that reason has doubtless been overlooked in the ordinary process of melting and refining. Taking these figures as the basis of calculation, the total output of gold dust from the Yukon would contain at least 2,500 ounces of platinum metals per annum.

"The platinum occurring in the auriferous gravels on Burwash creek is small in amount. Here it is visible as a separate metal in the gold dust, amounting to about 150 milligrams per ounce of gold. This can be separated from the gold dust with care, but the production from this locality cannot exceed 4 or 5 ounces per season, under present conditions of mining.

"Platinum has been reported also from a number of other sources, such as Ferguson creek, a tributary to O'Connor (Kaskawulsh) river, Teslin (Hootalinkwa) river, Scroggie creek, and Stewart river, but no figures as to the content of the gravels can be given.

"In conclusion, it appears that the platinum minerals are widely distributed in Yukon, but as yet there are no deposits known which could prove profitable to exploit for these metals alone. Where gold is present in sufficient quantities to pay for mining, platinum and the allied metals may prove to be valuable by-products at some localities, and it is worth while testing occasional samples of gold dust from the territory in order to see that none of these constituents is being overlooked."

FACILITIES FOR THE TREATMENT OF PLATINUM ORES.

At present there is no smelter in western Canada which gives any return to the shipper for any platinum contained in the ore shipped; the reason for this is that any such shipments have been very small in proportion to the capacity of the smelters, the ores are mixed in the general smelting operations, and the platinum which may have been important in a small part of the furnace-charge, is relatively unimportant in relation to the whole. In the refining of the metals no allowance is made to the smelter for a recovery of platinum metals, and the cost of recovery of relatively small amounts is said to equal or exceed the value of the recovered metal. For instance, the gold recovered at Trail, B.C., is said to carry 1.8 ounces of palladium to every 1,000 ounces of gold, but the estimated cost of recovering the palladium practically equals its value, so that no effort is made to separate it; the largest item in the cost of recovery is said to be the interest charges on the large amount of gold held up during the time necessary to the process of recovery. Such metals could probably be profitably extracted when the gold is in storage at the treasury or mint.

The problem of securing returns for the platinum ore of small shippers resolves itself into securing a total assured tonnage sufficient to run a complete unit of a smelter either continuously, or intermittently; the smaller the unit used the greater will be the probable losses, and in intermittent runs the losses in the furnace-linings will be much greater than in continuous operations.

The smallest blast-furnace units available are at Ladysmith where 45 tons per day could be handled; there are no convertors at this plant and the final product of this smelter is a matte. The units at all the other smelters are considerably larger than those at Ladysmith, and it would require a large tonnage to warrant the smelters in treating separate shipments of ore. At Trail, however, the equipment is available to carry the treatment to a final gold-platinum product if shipments of say 100 tons

per day could be assured. If such a large tonnage could not be assured, the best plan would be to store the ore until a total of about 2,000 tons had accumulated, when a separate run could be made of it. This practice would entail a certain amount of government supervision and the mint might be required to make the final separation, but there is no doubt that the whole treatment can be carried out in Canada, if sufficient tonnage of ore is secured.

In Ontario the copper-nickel ores of the Sudbury district, which carry platinum metals, are smelted at Coniston and at Copper Cliff. The Coniston matte is shipped to Swansea, Wales, where the final recoveries are made, but no returns for platinum recovered are made to the Canadian government. The matte of the Canadian Copper Company at Copper Cliff, which is not used in making monel metal, has been sent to New Jersey, U.S.A., for final treatment and only a small percentage of the platinum content is said to be recovered. The company have built a large refinery at Port Colborne, Ontario, and are at present treating a large part of their product there; no figures are available to show what percentage recovery of the platinum metals is made at this place. A large refinery for the British American Nickel Company is being erected at Deschenes, Que., and it may be expected that a return for platinum will be made from this source.

No information is at hand as to what arrangements could be made with these companies to handle any platinum ore shipped to them from an outside source.

SUMMARY AND CONCLUSIONS.

Canada certainly has possibilities of becoming one of the world's largest producers of metals of the platinum group. At the present time the production is reported at less than 100 ounces per annum, but the figures presented seem to show that there are probably more than 50,000 ounces of the platinum metals contained in ores mined in Canada each year from which no recovery is reported. All the information to hand points out that a very large amount of this material is lost, from one cause or another. It is entirely reasonable that the government should inquire what becomes of this material which represents a value, at present prices, of over \$5,000,000 and which, up to the conclusion of the war, was so vital in its prosecution; every encouragement should be given to arrive at a successful solution of the difficulties incident to the recovery of a large part of these precious metals.

Efforts should also be made to encourage the testing of placers for platinum metals, since there are areas of placer ground in which the values in gold are not sufficient to warrant installing a plant to recover that metal alone, but which could be mined at a profit if appreciable returns from other metals could be obtained in addition to the gold. Particularly is this the case in British Columbia, and there seems to be no good reason why government assistance should not be given in testing likely placers on the same basis as is at present given to lode miners in testing their properties by diamond-drilling, i.e., upon the recommendation of its engineer, the government would order a systematic test of the placer to be carried out, and if successful the cost of testing would later be borne by the property tested.

The British Columbia government, under its progressive policy of stimulating prospecting in any way it can, has recognized the fact that government assistance should be given and has been feeling its way to arrive at the best method of carrying out such a policy; one government drill has been in operation for some time, and it is hoped that the practice will be extended.

The ideal method of proving the placers would be for the government to lay down some comprehensive scheme by which all placers in the province, that show promise, would receive a thorough testing, not necessarily in one year, but progressively until an accurate knowledge was obtained of the potential value of this resource. Placer ground could then be handled on a basis somewhat similar to timber limits which have been thoroughly cruised and estimated by government foresters.

To carry out such a scheme the government would have to control all the facilities for mining in any given district. It is very probable that there are large areas that could be worked only on a large scale, under the best of working conditions, and with the most modern methods of mining, to produce a profit, and the men in charge should not be handicapped by any outside control of essentials, such as water-supply, timber-supply, transportation facilities, etc. No new leases of placers should be granted; old leases which were not paid up should be cancelled, and those in the hands of bona fide workers could be brought into a general co-operative scheme for the development and working of the whole of the district which had been shown to be workable by the tests.

In the British Empire the production of platinum minerals is insignificant; New Zealand, Australia, and Canada are the only producers and the total is only a few hundred ounces. The richer and more easily accessible placers of Russia are becoming exhausted and the Republic of Colombia is the only other large producer, having doubled its production in 1917 to about 50,000 ounces.

Finally, there is the bearing on the problem of production of gold. Each nation is striving to conserve and to build up its gold reserves, and any increase in production is warmly welcomed.

There are in Canada, especially in British Columbia, great placers which contain both gold and platinum in small amounts. In testing for platinum, a test is also made for gold, with little extra expense, and the combined values may warrant operations on such a scale as to appreciably increase the production of gold as well as that of the platinum metals.

The great war has emphasized the fact that any nation that must depend on another nation for its supply of some vital commodity is in a position of corresponding disadvantage, so it is clearly the duty of Canada to see that any resources of this nature within its borders are made available to the Empire.

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