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REPORT ON TITANIUM

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REPORT ON TITANIUM

by

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GENERAL

MINERALOGY

The ore minerals are mainly ilmenite ($FeTiO_3$) and rutile (TiO_2); some titanite ($CaTiSiO_5$).

GEOLOGY AND METALLURGY

Titanium is the 4th most abundant element in the earth's crust.

Titanium minerals are common in igneous rocks but are rarely conc. into workable deposits; also found in metamorphic rocks, as magmatic deps. associated with magnetite, and in large massive magmatic deps. associated with minor hematite; sometimes conc. into mineable deposits in anorthosite (e.g., Pr. of Quebec).

Titanium minerals are heavy and resistant, and often accumulate in placer deposits (e.g., India, and Florida in the U.S.).

Rutile and ilmenite are found often as disseminated replacement deposits.

Titanium is very difficult to separate from its bound elements.

Classic method: - ore first concentrated, then heated in electric furnaces, leached with sulphuric acid to

make TiO_2, and then further purified.

Problems in melting, rolling and forging the metal, and in the reclamation of scrap metal.

USES

At least 95% is used in the titanium pigment industry; makes the whitest of all paints; used in the form of titanium dioxide, called "titanium white".

Pigment also used in toilet articles, linoleum, artificial silks, white inks, colored glass, pottery glazes, etc.

Metallurgically, it is alloyed with steel to make high-speed steels.

90% of the production of titanium metal has been going into jet and missile components, (because of high strength-to-weight ratio between 400°F and 800°F., and resisting to corrosion and fatigue).

But defense requirements for titanium have been cut back considerably (partly because of replacement by nickel alloys); therefore a new market for titanium metal must be found; possible civilian markets are in anodizing and plating equipment, paper mill screens and piping, chemical process equipment, and marine fittings; also the civilian aircraft and suto industries.

Some new alloys developed recently:-

New high-temp. columbium base alloy called "Cb-65"; contains 7.5% titanium and 0.75% zirconium; could be

used in nuclear, missile and gas turbine areas.

Zinc-titanium-copper alloy, called "T-metal"; withstands high temp. and stress, all is easily workable.

A titanium sheet alloy developed by Republic Steel Corp.

PRODUCERS

Chief producers of ilmenite concentrates are the U.S., India, Norway Canada, Finland and Malaya; also deposits in U.S.S.R., Mexico, Africa, Ceylon and Sweden. Production of ilmenite conc. in U.S. reached a near record peak of 750,000 T. in 1960; 18% higher than in 1959.

Australia producers bulk of the rutile concentrates; some from U.S., and lately, some from Mexico; most important deposits of rutile are in beach sands; Brazil and Africa also have deposits.

World's largest known magnetite-ilmenite deposit is near Sokndal, Norway, where National Lead Co. reports 300,000,000 T. of ore indicated by drilling; another large body near Tahawus, N.Y., contains an indicated 100,000,000 T. of ore; (also National Lead Co.); this type of ore-body contains ±17% TiO_2.

Quebec Iron and Titanium Co., at Allard Lake, P.Q. has large dep. of ilmenite-hematite.

The only free world producers of titanium metal are U.S., Japan and U.K. U.S. production and use of titanium sponge metal in 1960 was about 15% higher than in 1959.

PRICES

(March, 1960) - U.S., sponge metal, + 99.3% pure - $1.50-$1.60/lb.

Titanium ore - U.S. ilmenite, 59.5% TiO_2, f.o.b. Atlantic ports - $24-$25/gross T.

DEPOSITS AND PRODUCERS

Canada

1957 - produced 186,422 T. of titanium dioxide, valued at $9,740,570; all from P.Q. (Quebec Iron & Titanium).

Value of titanium shipped in 1959 (ore, heavy aggregate and titanium-bearing slag) was $8,489,000, an increase of $1,900,000 over 1958. Canada 3rd. in production of titanium concentrates, with almost all of this country's output coming from Quebec Iron and Titanium Corporation in the form of titanium slag. After the U.S. and India, Canada produced 247,858 T. in 1959.

No commercial prod. of titanium metal, though pilot plant quantities have been produced by such companies as Dominion Magnesium Ltd., at Haley, Ontario. Commercial production and fabrication of titanium mill products and forgings is carried out by several Canadian firms; e.g., Atlas Titanium

at Welland, and Canadair, Ltd. at Montreal.

Ilmenite ore also mined for use in heavy aggregate; e.g. Continental Iron and Titanium at St. Urbain

In fall of 1957, Canada's first titanium pigment plant was opened at Varennes, P.Q.

Ilmenite and titaniferous magnetite are fairly common in the south part of the Canadian Shield, especially in P.Q.; some titaniferous mag. in Ontario, e.g., at Bad Vermilian Lake; minor ilmenite in iron deposits N. of Burmis, Alta., and near St. Georges, Newf.

Research work is being done by the Mines Branch, Ottawa, into the processing of ores through to the production and fabrication of the metal and its alloys.

TITANIUM AND TITANIFEROUS IRON

MONTREAL DISTRICT

Plants

Quebec Iron and Titanium Corp.

Company is owned 2/3 by Kennecott Copper, and 1/3 by New Jersey Zinc, both U.S. companies.

Ore from Allard Lake is electrically melted at Sorel, P.Q., to yield pure iron, and a slag containing 70-75% TiO_2 which is used to produce "Titanium white". Most of this slag is exported to the U.S. for use in the titanium pigment industry. But increasing sales to such countries as

Germany, Belgium, England, Japan and Mexico.

Produces a very high quality type of pig iron, called "Sorel-metal", which contains only very small amts. of P and SiO_2 and virtually no Mn. Useful in the man. of ductile iron. Several new grades of "Sorel-metal" developed, with increased C content.

Recently developed a special line of pig irons for the local market in Quebec. These contain silicon and manganese in addition to high C.

After being closed down for nearly six months, the Sorel plant re-opened at the beginning of March, 1959, at about 60% capcity. Three new furnaces (in addition to the original 5) had been completed in 1958, and an old one completely re-built. Expect to be operating at full 8-furnace capacity in spring of 1961, at rate of about 400,000 T. of TiO_2 slag and 300,000 T. of high grade iron/year.

1959 - 217,589 T. of slag - 145,990 T. of iron. No figures available, but record was probably bettered in 1960.

The company also produces "Sorelflux", a complex calcium-magnesium-aluminum silicate, for use as a slag - fluxing material in basic electric steel-making.

Canadian Titanium Pigments Ltd.

Opened Canada's first titanium pigment plant in the fall of 1957, at Varennes, P.Q. Uses TiO_2 slag from

the Q.I.T. smelters at Sorel. Many different grades of pigment produced, and supplies the domestic paint, paper, rubber, plastics, ceramic and construction industries.

Rated capacity is 18,000 T. of TiO_2 pigments/year, but not at full capacity due to competition from the U.K.

Price (March, '59) - $24.60-$26.50/100-lb. unit.

This co. is a wholly-owned subsidiary of National Lead Co., in the U.S.

British Titan Products (Canada) Ltd.

This company announced, in the fall of 1959, that they had started construction of a $16 million TiO_2 pigment plant, expected to be in operation by 1962. Located at Tracy, P.Q., near Sorel, and to be supplied with some 15,000 T. of raw material/year by Q.I.T.

This is a subsidiary of British Titan Products Co., which commenced selling TiO_2 pigments in Canada in 1950, when it won 19% of the market; upped its share to 45% by 1957 (This is C.T.P.s competition).

Deposits

The Ivry Deposit

Located on lots 37 and 38, range V, of Beresford township. The main pit on E½ of lot 38 is owned by E. Latremoille, who also owns the surface rights. (Titanium

Development Corporation holds claim on part of lot 37). The open-pit is 150' x 75' and 20-30' deep.

The deposit is made up of small irregularly shaped bodies of massive ilmenite-hematite in anorthosite.

Between 1912-1918, 16,000 T. of ore were taken out. In 1958, Mr. Latremoille optioned the mining rights on the E½ of lot 38 to Heavy-Rock Mines. That summer, this company produced and shipped 26,000 T. of ilmenite-hematite ore for use as heavy aggregate (mainly for pipelines). An additional 10,000 T. was blasted and made ready for the crusher. All production was sold to Houston Aggregate Co. of Canada. Ore was loaded at near-by Mantel Station, where the selling price was $5.75/Ton. Heavy-Rock Mines has now dropped their option on the property, and removed their equipment from the loading point at Mantel.

During 1958, 58 holes were drilled on the E½ of lot 38, for a total of 3,613'. An estimated 160,780 T. of ore in Zone to end of lot 38, and to depth of 65'. Possible additional ore at depth and to N.E. of pit along ore zone, and possibly in "northern ore zone" indicated by an early magnetometer survey. Grade of "heavier ore sections" is 47% Fe and 19% TiO_2 with a Sp. G. of 4.5.

(1)* Titanium Development Corp.

Located in Beresford twp., range V, lot 36 and E½ of 37 (adjoining old Ivry Mine property). Ilmenite-

* Numbers correspond to those on the titanium map

hematite ore occurs as massive concentrations and as zones of dissemination in a gabbroic phase of the anorthosite.

A magnetometer survey and 4,029' of diamond drilling have indicated the presence of 2,900,000 T. of ore, grading 30.84% TiO_2 and 38.5% Fe to a depth of 300'. Also about 1,000,000 T. of lower-grade disseminated ore.

Pilot plant tests at Cleveland continued in 1958 and 1959.

Quebec Smelting and Refining Ltd.

Still holds 1 claim in Beresford twp., near the Ivry Mine property.

(2) Lumau Mining Corp.

Optioned, in the fall of 1959, the S½ lots 36-41, range VI, Beresford twp., from Pershing Amalgamated Mines. This includes the Degrosbois deposit, which is situated on S½ lots 38-41, the open-cut being in the middle of lot 39. Lumau Mining also staked the N. halves of these lots, as well as lots to the east and south.

Previous work, including 3,910' of diamond drilling, has indicated that the "A zone" contains:-

5,527,443 T. avg. 40.87% Fe and 10.99% TiO_2, with av. th. of 95.2'
& 1,051,400 T. avg. 25.67% Fe and 6.64% TiO_2, with av. th. of 18.8'

In the "B zone" to the W., 1 drill hole intersected 40' grading 44.73% Fe and 11.56% TiO_2. The ore is titaniferous magnetite

in a gabbroic phase of the anorthosite. The open-cut has dimensions of 160' x 120', its highest face measuring 20'. Considerable broken ore and waste lies on the pit floor.

Pershing Amalgamated carried out lab work and concentrating tests between 1953 and 1957. Some pilot plant investigation work was carried out by the Federal Department of Mines. Results were satisfactory, except as regards complete separation of TiO_2 from the iron.

In the summer of 1960, Lumau Mining collected and assayed 20 samples from the open-cut and vicinity. Further work is planned.

③ Laurentian Titanium Mines Ltd.

Hold claims in Wexford and Chertsey twps. Chertsey:- last work done here in 1955; estimate 626,400 T. grading 19.4% TiO_2 and 27.3% Fe. Wexford:- St. Hippolyte orebody (massive ilmenite-hematite in anorthosite) est. to contain 15,131,400 T., grading 19.9% TiO_2 and 27.6% Fe. This tonnage proved by extensive development work, including 14,000 feet of diamond drilling, up to the end of 1955. Test samples have been sent to firms in Canada, the U.S. and Germany.

In 1958, mapping, sampling, dip needle surveys and 4 drill holes outlined 2 low-grade titaniferous iron deposits on the Wexford twp. property, adjacent to the St. Hippolyte orebody. This is magnetite-ilmenite mineralization

associated with a more gabbroic phase of the anorthosite.

(1) North deposit:- 43,200,000 T. grading 20.11% Fe and 6.95% TiO_2 to 150'

(2) South deposit:- 25,920,000 T. grading 23.52% Fe and 7.59% TiO_2 to 150'

In late 1960, the company commenced negotiations with large iron-producing companies for development of its low-grade iron deposits. Concentrating tests done during the year had indicated that pellets could be produced, grading 66% Fe and -1% silica and titania.

④ Tamara Mining Ltd. and Drummond Copper Corp.

Tamara Mining has 7 claims, and Drummond Copper 9 claims (adjoining to the south) in Wexford twp. Drummond has leased their group to Tamara for development purposes.

Based mainly on magnetometer work and limited surface sampling, and on three 500-foot drill holes put down by the previous owners of the property (Terrebonne Titanium Corp.), company officials estimate that there are 360,000,000 T. of ore (allowing for 20% dilution factor), grading about 22% Fe and 7% TiO_2 on the combined Tamara-Drummond holdings. This ore is the magnetite-ilmenite type, associated with a gabbroic belt in the anorthosite, and is an extension of similar ore found to the south (Laurentian Titanium). (In fact, this is part of a mineralized gabbroic anorthosite belt which extends in a north-south direction for over 4 miles, and has widths of up to 1,000 feet).

Recent work has included some shallow diamond

drilling carried out in late 1960 on Tamara's zone. This was done mainly to obtain structural information. In addition, recent bulk sampling and testing have indicated a recoverable concentrate of 67.6-68.8% Fe pellets, with 0.5-0.6% TiO_2 and 1.62-2.32% silica, after grinding to -200-mesh.

(6) Chess Mining Corp.

Own a magnetite-ilmenite-apatite prospect in the Mt. St. Hilaire region, 23 miles E. of Montreal; doing milling tests, mainly with view to conc. of apatite.

(7) Yates Iron Sand Claims

Located in Normand twp. Drilling of 28 holes, averaging 17.5' deep, indicated the presence of 12,000,000 T. of crude sand/vertical foot, averaging 4.66% Fe and 1.08% TiO_2. In late 1959, 15 confirmatory holes, for a total of 315', were drilled.

Concentration tests indicate that separate concentrates of iron and titanium may be easily made; zirconium may also be recovered as a by-product.

(8) Grondin Mine

Shawinigan twp., range VII, lot 22 (not worked at present). The pit on lot 22 is in magnetite ore. Near-by, on a small hill, are bands of titaniferous magnetite for a distance of 300' along strike. Dip needle survey indicates

a magnetic anomaly with area of "several thousand square feet" around the pit area. The enclosing rock is a gabbro. Sample from exposure on lot 23 assayed 41.55% Fe and 5.44% TiO_2.

Chilton twp.

⑤ In range VIII, lot 12, and range IX, lot 2. Formerly held by Continental Iron and Titanium Corp. (as late as 1958). Large deposit of evenly disseminated titaniferous magnetite, grading 13.9-23.75% Fe and 9.32-19.9% TiO_2, in a medium-grained anorthosite. Too low-grade to be economical at present.

Other Occurrences

㉗ Wolfe twp., on road about 1 mile S. of St. Faustin. Bands of gabbroic anorthosite, carrying unevenly diss. ilmenite-hematite, traced for a length of 1,200' and width of 200'. Farther S., near L. Larin, are outcrops of gabbroic anorthosite with considerable fine-grained titaniferous magnetite and ilmenite.

⑨ Wexford twp., range VI, lot 2. Bands of ilmenite-hematite in anorthosite. Formerly held by Laurentian Titanium Mines, who dug 3 trenches, bored 3 shallow drill holes, and ran a dip needle survey in the vicinity.

⑨ Wexford twp., range VI, lots 12-15. Occurrences of titaniferous magnetite reported from here, with one assay sample running 23.30% Fe and 7.62% TiO_2. These claims

abandoned by Laurentian Titanium, as well as claims in range IV, lots 29-33, range V, lots 29-34, and range VII, around a small showing on lot 45.

(11) Brandon twp., range VII, lot 14; Arthur Dugas claims; local concentrations of mag. and ilmenite.

(10) Lussier twp., range III, lots 17-26 and range IV, lots 50 & 51. Evenly diss. mag. and ilmenite. Used to be held by Continental Iron and Titanium, but too low-grade, and dropped.

(12) Rawdon twp., range II, lot 3. Band, containing mag. and ilmenite, up to 40' wide. Too widely diss., and not economic.

(13) Wakefield twp., small occurrence near town of Wakefield.

(14) Provost twp., range "A" lot 15; magnetite-ilmenite values in an anorthositic rock.

(15) Bristol twp., range I, lot 22; small occurrence.

(16) Clarendon twp., range VII, lot 27; small occurrence.

(17) Litchfield twp., range V, lot 12, small occurrence
range VIII, N.½ lot 10, small occ.
range X, lots 4 & 5, small occ.

(18) Arundel twp., range I, lots 23-25; small local concentration in gabbroic rocks; grab sample - 15.78% Fe and 2.68% TiO_2.

(19) Dudley twp., range IX, lots 24-26 (minor); mag. and ilmenite-bearing sands.

(2) Beresford twp., range V, lot 36; magnetite-ilmenite mineralization traced by dip needle survey. Chip sample from lone outcrop assayed 20.56% Fe and 5.89% TiO_2.

(20) Hull twp., range XI, lot 1 and Templeton twp., range VII, lots 27 & 28 (The old Haylock Mine). Small lenses and pockets of ore. Assays from 47.23-68.49% Fe and from 0.9-16.8% TiO_2. No quantity left apparently.

(12) Rawdon twp., range II, lot 2 (the Ste. Julienne deposit). Dyke-like masses of magnetite and ilmenite exposed for 700' N-S and 100' E-W. Associated with dykes of gabbro in anorthosite.

Chertsey twp., a few small concentrations of ilmenite found (see Q.D.M., G.R. 93, by P.E. Côté).

(21) Morin twp., range III, lots 41-44. Main showing is an area of 130' x 115' near the center of the claims. Selected samples ranged from 27.63-37.77% Fe and from 18.63-28.62% TiO_2.

(22) Chilton twp., range III, lot 12; some ilmenite

values in anorthosite, as well as titaniferous mag. in a more gabbroic anorth.

(23) Wentworth twp., range II, lot 27; small occurrence of slightly titaniferous iron.

(28) Templeton twp., range IX, lot 22; minor ilmenite associated with small pockets of hematite.

(20) Hull twp., range X, lot 3; -10" hematite-ilmenite vein exposed for a length of 60'.

(20) Hull twp., range XI, lot 1; small stringers and lenses of titaniferous mag.

(24) Harrington twp., range II, lot 15b; slightly titaniferous mag. as small disconnected bodies in anorthosite.

(25) Cathcart twp., range V, lot 7; concentrations of ilmenite observed in the anorth. due W. of Crépeau lake, on the Gareau Lakes road.

(26) McGill twp., range VI, lot 12; small pockets and irregular bands of ilmenite.

PROVINCE OF QUEBEC, OUTSIDE MONTREAL DISTRICT

Producing Mines

Quebec Iron & Titanium

Deposit is at Allard Lake, 22 mi. N. of Havre St. Pierre, P.Q., the shipping point on the N. shore of the

Gulf of St. Lawrence. Ilmenite ore shipped from there to the smelter site at Sorel, P.Q.

First report on this deposit by Retty in 1941; rail-road from Havre St. Pierre constructed in 1948; first shipment in 1950. One of the largest such deposits in the world, with reserves estimated at about 112,000,000 T., averaging 36% Fe and 32% TiO_2. Mining conducted only during the summer season.

The ore is ilmenite intergrown with hematite; in dykes, irregular lenses or sill-like bodies lying within an anorthosite mass; possibly a late magmatic injection.

Continental Titanium Corp.

Name changed from Continental Iron and Titanium Ltd. in 1960.

Has deposits in the St. Urbain area, Charlevoix Co., some of which were formerly operated by Baie St. Paul Titanic Iron Co. Porperty encompasses the Bignell deposit, and the previously operated Furnace, General Electric, Coulombe East and Coulombe West deposits and open-pit mines.

A crushing, screening and concentrating plant with capacity of 700 T./day, was constructed at Baie St. Paul in 1957. In 1958, 123,370 short tons were shipped for use in the "heavy aggregate" industry. In 1959, 40,600 T. of ore were mined and milled, and 36,150 short tons sold. Of this,

9,450 T. was sold as heavy aggregate, 1,900 T. sent out for metallurgical and other purposes, and 24,800 T. shipped as raw material for the pigment industry in Italy.

From January until the end of July, 1960, 14,650 T. were shipped. 13,000 T. of this came from the Bignell deposit, and was sent in the form of heavy aggregate to the U.S. for use in atomic reactor shields. 1,650 T., with a high TiO_2 content, but not concentrated, was taken from the G.E. Mine and sent to Niagara Falls, N.Y., to enter into the making of ferrotitanium. No ore sent to Italy, as that country now obtaining raw material from newly discovered deposits in Egypt.

Probable construction of a 10 T./day capacity pilot plant next fall at Baie St. Paul for the man. of titanium dioxide. Involves use of sulphuric acid for leaching out of TiO_2 from ilmenite.

In all, the company's 5 deposits are estimated to contain about 20,000,000 T. of ore, grading 30-40% Fe and 32-50% TiO_2.

In the summer of 1960, several "pack-sack" drill holes were bored on a deposit of titaniferous iron ½ mi. E. of L. Ontario on the Quebec Seminary Land. Could be used for heavy aggregate, but does not seem to be enough tonnage.

Important Deposits and Prospects

A- Saguenay Co.

Awater-Lapointe deposit

Located near Marybelle Lake in twp. 1770 of Saguenay Co., about 75 mi. N. of Mingan. Recently optioned ½ by Stratmat Ltd., and ½ by Halmon Mining and Processing. Halmon has now allowed their half of the option to lapse, but Stratmat apparently still retains an interest.

Hollinger Exploration Co. (holding option from 1953 to 1955) proved up tonnage. 4 deposits on the property est. to contain 1,553,000,000 T. of ore avg. 45% Fe and 12% TiO_2, in the form of titaniferous magnetite.

Testing at Niagara Falls, N.Y., by Stratmat (Strategic-Udy process) has revealed the feasibility of direct reduction of the ore to pig iron or semi-steel, with titanium at less than 0.1%.

Bersimis Mining Co.

Closely associated with Anglo-Canadian Pulp & Paper Co., who hold surface rights over large area N. of Forestville, in Saguenay Co. Iron-titanium values shown in surface work and limited diamond drilling.

La Blache Lake area - twp. 745; (46 claims). Four large masses of titaniferous mag. over a dist. of some 10 mi. Surface samples avg. 49% Fe and 21% TiO_2. Estimated 25,000,000 T. to depth of 100'. Exposed ore and "assured

extensions" to 300' would give 135,000,000 T. Metallurgical tests have indicated a difficulty in the separation of Fe from TiO_2.

Lac Brulé Prospect - twp. 344. A series of flat-lying lenses of coarse massive ilmenite-hematite exposed for dist. of 3,000'. 4,638' of diamond drilling done. An estimated 1,000,000 T., avg. 44% Fe and 37% TiO_2.

Canus Iron Co. Ltd.

Hold a 3,000-acre property in twp. 1770, Saguenay Co. Magnetometer survey in 1957 revealed 6 anomalies. Grab samples showed Fe-TiO_2 values. Last work on prop. done in 1958.

Twp. 343

Adjacent to the L. Brulé prop. of Bersimis Mining: a dyke or lense of massive ilmenite cutting the anorthosite. 2-5' wide and at least 35' long.

Parker twp.

Claims, 24 mi. N. of Havre St. Pierre, formerly held by Dubuisson Mines Ltd. and Lake Opawica Mines Ltd. (Everett Ilmenite Property). Large bodies of ilmenitic anorthosite, reported to contain 25% coarse-grained ilmenite, within relatively barren anorthosite. Main body is 7.200 ' x 1,200'; another, of lower grade is 3,000' x 1,000'. Estimated 80,000,000 T. to a depth of 100'

35 claims in this twp. formerly held by Aconic Mining Corp. Did some surface work in 1955.

Additional

At places along the N. shore of the Gulf of St. Lawrence, and near Seven Islands bay in particular, mag. and ilmenite occur heavily disseminated, or as segregations, in a gabbroic anorthosite.

Rutile is present in the hematite-rutile quartzite of the Beetz Lake area, about 35 miles N.E. of Havre St. Pierre. In one case it comprises 13% of the rock, but in general it is seldom in excess of 5%.

In addition, there are small amounts of possibly recoverable TiO_2 in the iron-bearing sands which occur extensively along the N. shore of the Gulf of St. Lawrence, from Natashquan to the Moisie area. They are especially abundant near Natashquan. Some are also found in Laval twp., near Forestville.

B- Roberval Co.

Roberval Mining Corp.

Hold claims in Lyonne twp., and adjacent undivided parts of Roberval Co. Magnetometer survey and diamond drilling done in 1958. Five separate zones of titaniferous mag. Indicated 110,000,000 T. of open-pit ore to depth of 500', with average grade of about 24% Fe and 6.5% TiO_2 (Possible 450,000,000 tons).

Can be treated to produce a 100-mesh concentrate, grading 69.72% Fe and 0.51% TiO_2.

Property optioned briefly to Oglebay-Norton Co., of Cleveland, but in the fall of 1960, this co. decided not to renew their option.

In March, 1959, Roberval Mining took over Lyndvue Mines and Baraca Mines. These latter companies held claims adjacent to Roberval Mining, on which some magnetometer work, surface work and limited diamond drilling were carried out.

Included in the Lyndvue-Baraca holdings taken over at that time by Roberval Mining were 29 claims in Beaudet twp., Roberval Co. This is a titanium-columbium prospect. Grab samples show 35.44% Fe, 49.77% TiO_2 and 11% Cb_2O_5 (probably quite selective?). A limited amount of stripping has been done, with magnetometer and electromagnetic survey work. Some drilling done in the summers of 57 and '58. There is no recent report on this property.

Hubert & Panneton twps.

Continental Titanium Corp. formerly held a 1,000-acre property here. 2 diamond drill holes, 8 pack-sack drill holes and surface samples ind. the presence of material grading 10.27-31.70% Fe and 2.70-7.50% TiO_2.

C- Chibougamau Area

Chibougamau Mining and Smelting Co.

Drilling in 1957 on claim-group "C" had outlined a substantial titaniferous magnetite deposit underlying the waters of Doré lake, in the Chibougamau district. Estimated to contain about 300,000,000 T., grading 25% Fe and 5% TiO_2, with varying widths up to 400'. Some concentration tests have been run. No recent report.

Trepan Mining Corp.

Own 30 claims in Lemoine twp., Chibougamau area. Magnetite-ilmenite as massive bands and as disseminations in a gabbroic anorthosite. Mineralized zone has a length of 3 miles and an average estimated width of 300'. Some geophysical work and diamond drilling were done in the summer of 1959. (366' of ore in 1st drill hole; 1st 82' ran 30.7% Fe and 8.2% TiO_2). Magnetite and ilmenite are intimately mixed.

Jones and Laughlin Steel Co.

Optioned from J.P. Kellogg, in January 1958, a group of 29 claims covering titaniferous mag. deposits adjacent to the boundary between Lemoine and Rinfret twps. In the summer of 1958, carried out a program of diamond drilling, bulk sampling, geological mapping and dip needle traverses. No work done in 1959.

D- Chicoutimi District

Saguenay Exploration and Mining Inc.

Hold 54 claims in Jonquière and Kenogami twps., Chicoutimi area. Most work to date centred around lot 29-31, ranges III & IV, Kenogami twp. At least 7 or 8 separate deposits of titaniferous mag. in anorthosite. Good assay samples, but insufficient work done; incl. stripping, blasting and some magnetometer work.

Grand Saguenay Mines and Minerals, Ltd.

Holds property in Bourget twp., Chicoutimi area, including the old St. Charles deposit. Titaniferous mag. as irregular bodies in anorthosite; sometimes with appreciable quantities of apatite. Magnetic survey carried out in 1959 on lots 44-47, range II, and N½ of lots 44-47, range I. Two main groups of deposits, containing titaniferous mag. (36-50% Fe): N. group - med.-grnd., with 5-30% apatite; S. group - coarser grnd., with -5% apatite.

Canadian Javelin Ltd.

Indicated large tonnage, averaging 42% Fe and 16% TiO_2, in survey work and diamond drilling done on 300-acre property in Bourget twp. (including N. part of old St. Charles dep.). Metallurgical tests have shown that a 51% TiO_2 conc. and a 61% Fe conc. could be obtained.

No longer doing any work on the property (see Grand Saguenay Mines and Minerals Ltd., above).

Inter-Ocean Exploration of Canada

Holds a titaniferous mag. property in Taché twp., Chicoutimi district.

Kenogami twp.

An old open-pit is located on east-central part of lot 33, range IV, in mineralized fine to med-grnd. anorth. and gabbro. Formerly held by Canada Iron Furnace Co. Ltd. Ten carloads were shipped in 1901. A chip sample over the width (35') of the open-pit assayed 33.99% Fe and 18.38% TiO_2. Other mineralized exposures were noted in the vicinity.

Additional

Other minor occurrences in the Chicoutimi district include those in Taché and Alma Island townships.

E- Charlevoix Co.

Les Minéraux Laurentiens, Ltée

Hold 3,500' acres in St. Urbain parish, Gouffre Seign., Charlevoix Co. Surface work, including geophysical, done in 1957. Diamond drilling in fall of 1958; 15 holes, for 1,121'; "good ilmenite values obtained". More drilling done later in 1958, and then further geophysical work (dip needle and magnetometer) in the summer of 1959. Blasting and sampling of showings has returned assays grading 39% Fe and 40% TiO_2.

In 1960, this co. completed a working option deal with Holennah Mines for further exploration and development

of its ilmenite property.

Rosaire Beaudoin Claims

The claims adjoin those of Les Minéraux Laurentiens Limited. Diamond drilling done in 1958.

Brossard Prospect

Located in Lacoste twp., 30 miles N. of Baie St. Paul. Once held by Montreal Titanium Corp. Number of ilmenite deposits in anorthosite exposed by surface stripping and trenching. Four short d.d. holes bored. Tonnage and grade unknown. Five rep. samples gave 43-45% Fe and 36-39% TiO_2.

Quebec Seminary Land, Charlevoix Co.

A number of small deposits occur on Quebec Seminary Land, in Côte de Beaupré seign. One, near L. Ontario, has been described under Continental Titanium Corp. A second is the Dupont deposit, which is found on lot 619, St. Jerome range, St. Urbain parish. Another deposit outcrops ½ mi. W. of lac des Sources, in Gouffre seign. A representative sample assayed 40% Fe and 37% TiO_2.

Occurrences

Eastern Townships Area

St. Hyacinthe seign.

Some titaniferous mag. reported from Yamaska mountain.

Rigaud-Vaudreuil seign.

Range A, lot : Small irregular pockets of titaniferous mag. occurring in a serpentine rock.

St. Charles range, lots 301 & 302; Titaniferous mag. as small pockets a few feet in diam., and as lenses up to 12' wide in pyroxenite and peridotite.

South Ham twp., R. I, lot 21a; some trenching and pitting done.

Sutton twp., R. IX, lot 8; range XI, lots 7 & 9.

Brome twp., R. III, lot 1

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Montreal, January 1961