BRITISH COLUMBIA DEPARTMENT OF MINES

HON. W. A. McKENZIE, Minister

Non-Metallic Mineral Investigations

REPORT No. 5.

MAGNESITE AND HYDRO-MAGNESITE IN BRITISH COLUMBIA

By

A. M. RICHMOND

Submitted by

JOHN D. GALLOWAY, PROVINCIAL MINERALOGIST

Bureau of Mines

Victoria

BUREAU OF MINES

VICTORIA, B. C.
MARCH, 1933.

TO THE HONOURABLE W.A. MCKENZIE,

MINISTER OF MINES.

SIR:—

I BEG TO SUBMIT HEREWITH REPORT NO. 5 OF A SERIES ON NON-METALLIC INVESTIGATIONS BY A. M. RICHMOND.

IN ACCORDANCE WITH YOUR INSTRUCTIONS, MR. RICHMOND COMMENCED THIS INVESTIGATION IN JUNE, 1931, AND HAS BEEN CONTINUOUSLY ENGAGED SINCE THAT TIME. THE OBJECTIVE IS TO INVESTIGATE PRIMARILY MANY NON-METALLIC MINERAL DEPOSITS TO SEE IF THEY CAN BE UTILIZED IN BRITISH COLUMBIA MANUFACTURES AND INDUSTRIES. IT INVOLVES FIELD EXAMINATION, A STUDY OF IMPORTS OF NON-METALLICS, SPECIFICATIONS OF PURCHASE AND MANY INTRICATE FACTORS IN NON-METALLIC TRADE.

IT IS HOPED THAT THE FACTS OBTAINED AND INFERENCES DRAWN THEREFROM WILL STIMULATE THE USE OF PROVINCIAL DEPOSITS OF CERTAIN NON-METALLIC MINERALS.

FURTHER REPORTS IN THE SERIES WILL BE ISSUED FROM TIME TO TIME AS COMPLETED.

I AM, SIR,

YOURS FAITHFULLY,

JOHN D. GALLOWAY,

PROVINCIAL MINERALOGIST.

THE BRITISH COLUMBIA DEPARTMENT OF MINES.

HON. W.A. MCKENZIE, MINISTER.

NON-METALLIC INVESTIGATIONS, REPORT No. 5.

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INTRODUCTION

THIS REPORT, THE FIFTH OF THE SERIES ON THE NON-METALLIC MINERAL RESOURCES OF THE PROVINCE, IS ESSENTIALLY A BRIEF COMPILATION OF EXISTING INFORMATION ON MAGNESITE AND HYDROMAGNESITE, AND THEIR OCCURRENCE IN BRITISH COLUMBIA. THE COMPILATION HAS BEEN SUPPLEMENTED WHERE NECESSARY BY NOTES OBTAINED BY THE WRITER IN RECENT FIELD STUDIES.

THE FIRST SECTION OF THE REPORT PRESENTS INFORMATION ABOUT THE MINERAL MAGNESITE, SUCH AS ITS COMPOSITION, THE VARIETIES FOUND AND THEIR GEOLOGICAL RELATIONSHIPS, THE INDUSTRIAL USES AND APPLICATIONS OF THE MINERAL, THE MARKETS, PRICES AND TARIFFS. THE SECOND PART OF THE REPORT DESCRIBES THE KNOWN OCCURRENCES OF THE MINERAL IN B.C.

THE SELECTED BIBLIOGRAPHY HAS PROVIDED MOST OF THE GENERAL INFORMATION PRESENTED AND THE VARIOUS SOURCES OF DATA ARE HEREWITH GRATEFULLY ACKNOWLEDGED.

MAGNESITE

COMPOSITION.

THE MINERAL MAGNESITE, CHEMICALLY KNOWN AS MAGNESIUM CARBONATE ($MgCO_3$), WHEN PURE CONTAINS 47.6% MAGNESIUM OXIDE AND 52.4% CARBON DIOXIDE. IT IS NON-METALLIC MINERAL SLIGHTLY HEAVIER AND HARDER THAN CALCITE AND HAS A SPECIFIC GRAVITY OF 3 (THREE TIMES AS HEAVY AS WATER) AND A HARDNESS SUCH THAT IT CAN BE READILY SCRATCHED WITH A KNIFE.

THE COLOUR OF PURE MAGNESITE IS SNOW-WHITE TO CREAMY PORCELAIN WHITE BUT DUE TO IMPURITIES OF IRON, MANGANESE, ALUMINA, SILICA AND CALCITE, GENERALLY PRESENT IN SMALL PERCENTAGES, THE COLOUR IS NOT INFREQUENTLY A CREAMY YELLOW TO REDDISH BROWN, OCCASIONALLY GRADING INTO GREYS OR BLACK. THE POWDERED MINERAL IS WHITE AND THE LUSTRE IS DULL TO EARTHY IN MOST SAMPLES. IT OCCURS GENERALLY AS A COMPACT, FINE-GRAINED MASSIVE MINERAL WHICH SHOWS A SMOOTH CONCHOIDAL FRACTURE SOMEWHAT RESEMBLING UNGLAZED PORCELAIN. MAGNESITE UNLIKE CALCITE IS ALMOST INSOLUBLE IN COLD HYDROCHLORIC OR SULPHURIC ACIDS BUT DOES DISSOLVE READILY WITH EFFERVESCENCE IN WARM ACIDS.

PROPERTIES.

THE MOST VALUABLE PROPERTIES OF MAGNESITE ARE ONLY DEVELOPED ON CALCINATION, OR BURNING, AT HIGH TEMPERATURES. CRUDE MAGNESITE WHEN BURNED AT TEMPERATURES OF ABOUT 1100°C (2012°F) OR RED HEAT HAS PART OF ITS CARBON DIOXIDE GAS CONTENT DRIVEN OFF

LEAVING A PRODUCT KNOWN AS "CAUSTIC-CALCINED MAGNESITE." THIS MATERIAL, WHICH CONTAINS FROM 3 TO 5% CARBON DIOXIDE, SLAKES IN CONTACT WITH MOISTURE AND COMBINES WITH MAGNESIUM CHLORIDE TO FORM SOREL OR OXYCHLORIDE CEMENT. THE USES TO WHICH THIS HARD, DENSE, ELASTIC AND EXCEPTIONALLY STRONG CEMENT ARE PUT ARE DESCRIBED LATER IN THIS REPORT. APPROXIMATELY 15% OF THE TOTAL MAGNESITE PRODUCTION OF THE WORLD IS USED FOR PLASTIC WORK.

IF INSTEAD OF CALCINING AT A RED HEAT THE CALCINATION TAKES PLACE AT A WHITE HEAT (1450 TO 1700°C OR 2642 TO 3092°F, DEPENDING ON THE AMOUNT OF IRON IMPURITY PRESENT) ALL BUT ABOUT $\frac{1}{2}$% OF THE CARBON DIOXIDE IS DRIVEN OFF AND THE RESULTING PRODUCT IS KNOWN AS "DEAD-BURNED MAGNESITE." THIS FORM OF MAGNESITE IS AN ESSENTIAL BASIC REFRACTORY WHICH IS USED EXTENSIVELY FOR LINING BASIC OPEN-HEARTH STEEL FURNACES AS WELL AS FOR LINING COPPER, LEAD, CEMENT AND ELECTRIC FURNACES. THE MELTING POINT OF THE "DEAD-BURNED MAGNESITE" IS ABOUT 2800°C (5072°F) BUT SOFTENING UNDER LOAD TAKES PLACE AT CONSIDERABLY LOWER TEMPERATURES. THE REFRACTORY QUALITY OF BURNED MAGNESITE IS THE MINERAL'S MOST VALUABLE PROPERTY AND IT IS ESTIMATED BY VARIOUS AUTHORITIES THAT FROM 75 TO 85% OF ALL THE MAGNESITE MINED IS USED FOR THIS PURPOSE.

VARIETIES OF MAGNESITE.

THE TWO PRINCIPAL TYPES OF MAGNESITE FOUND ARE (1) THE AMORPHOUS OR FINE-GRAINED, COMPACT, EARTHY VARIETY, WHICH RESEMBLES UNGLAZED PORCELAIN AND (2) THE COARSELY CRYSTALLINE, OR SPATHIC VARIETY, WHICH LOOKS NOT UNLIKE COARSE-GRAINED DOLOMITE. HYDROMAGNESITE, THE HYDRATED BASIC MAGNESIUM CARBONATE, IS A WHITE TO GREY CHALK-LIKE VARIETY WHICH OCCURS IN EARTHY MASSES AND CONTAINS ABOUT 18% WATER OF COMPOSITION. THE IRON-BEARING VARIETY OF MAGNESITE IS KNOWN AS BRUENNERITE AND CONTAINS MORE THAN 5% FERROUS OXIDE. MESITITE AND PISTOMESITE ARE SUBSPECIES OF MINERALS INTERMEDIATE BETWEEN BRUENNERITE AND IRON CARBONATE (SIDERITE). THE AMORPHOUS AND CRYSTALLINE VARIETIES FIRST MENTIONED ARE THE MOST IMPORTANT COMMERCIALLY ALTHOUGH SOME PURE HYDROMAGNESITES HAVE BEEN USED.

OCCURRENCE.

MAGNESITE DEPOSITS ARE, BROADLY SPEAKING, OF TWO TYPES. THE MASSIVE OR COMPACT VARIETY WHICH IS THE MOST COMMON, IS FOUND AS VEINS, MASSES OR STOCKWORK DEPOSITS IN SERPENTINE AND THEY HAVE RESULTED FROM THE DECOMPOSITION AND ALTERATION OF MAGNESIA-RICH ROCKS OF THE PERIDOTITE FAMILY. THE DEPOSITS OF THE BRIDGE RIVER AND CLINTON AREAS ARE OF THIS TYPE.

CRYSTALLINE MAGNESITE IS CUSTOMARILY FOUND AS MASSIVE BEDDED DEPOSITS ASSOCIATED WITH LIMESTONE AND DOLOMITIC SEDIMENTS, THEIR ORIGIN COMMONLY BEING ASCRIBED TO THE REPLACEMENT OF THE LIME BY MAGNESIA-BEARING SOLUTIONS. THE RECENTLY DISCOVERED DEPOSIT OF CRYSTALLINE MAGNESITE FOUND NORTH-WEST OF CRANBROOK, BY C.E. CAIRNES OF THE GEOLOGICAL SURVEY OF CANADA IS OF THIS TYPE.

GENERALLY SPEAKING, THE MAGNESITE DEPOSITS RESULTING FROM THE ALTERATION OF SERPENTINE ARE ERRATIC IN SIZE AND EXTENT, THOUGH CHEMICALLY PURER AND BETTER SUITED FOR THE MAKING OF "CAUSTIC-CALCINED" OR PLASTIC MAGNESIA CEMENTS. THE CRYSTALLINE VARIETY HAS ALSO BEEN UTILIZED FOR MAKING PLASTIC PRODUCTS BUT AS THE SMALL PERCENTAGE OF IRON OXIDE CUSTOMARILY PRESENT IN THE CRYSTALLINE VARIETY AIDS IN CALCINING THE MAGNESITE AT HIGH TEMPERATURES, IT HAS GENERALLY BEEN USED FOR THE MANUFACTURE OF "DEAD-BURNED MAGNESITE" REFRACTORIES. THE CRYSTALLINE DEPOSITS ARE MORE UNIFORM IN SIZE AND EXTENT THAN THE COMPACT MAGNESITE DEPOSITS, AND HENCE BETTER SUITED FOR CHEAP PRODUCTION AND MINING METHODS.

THE HYDROMAGNESITES OF THE MEADOW LAKE AND CLINTON AREAS WERE, ACCORDING TO LEOPOLD REINECKE, CARRIED TO THEIR PRESENT SITES IN SOLUTION BY UNDERGROUND WATERS AND PRECIPITATION OCCURRED IN PONDS OR ON DRY LAND ACCORDING TO THE SURFACE CONDITION EXISTING AT THE PLACE OF EMERGENCE OF THE MAGNESIA-CARRYING WATERS.

USES OF MAGNESITE.

(1) REFRACTORIES.

THE HIGH FUSION POINT AND THE CHEMICAL INERTNESS OF CALCINED MAGNESITE MAKE IT A DESIRABLE REFRACTORY FOR METALLURGICAL OPERATIONS. DEAD-BURNED MAGNESITE IS A BASIC REFRACTORY AND THEREFORE FORMS THE PRINCIPAL REFRACTORY USED IN BASIC OPEN-HEARTH STEEL FURNACES AND BASIC CONVERTERS. IT IS ALSO USED IN THE BURNING ZONE OF CEMENT KILNS, IN ELECTRIC FURNACES, AND FOR COPPER AND LEAD SMELTING FURNACE LININGS. EITHER DEAD-BURNED "GRAIN", WHICH IS CALCINED MAGNESITE CRUSHED TO MINUS 5/8" TO [illegible]", OR MAGNESITE BRICK SHAPES ARE USED, DEPENDING ON THE PART OF THE FURNACE BEING LINED. GENERALLY, THE DEAD-BURNED GRAIN IS USED FOR MAKING THE HEARTH, FETTLING AND FOR PATCHING, WHILE THE ENDS, WALLS, PORTS AND CROWNS ARE LINED WITH BRICK SHAPES OF MAGNESITE.

PRE-WAR CONSUMPTION WAS 6 TO 14 POUNDS OF DEAD-BURNED MAGNESITE PER TON OF STEEL MADE, BUT SCARCITY OF FOREIGN SUPPLIES, THE DEVELOPMENT OF CHEAPER THOUGH NOT AS EFFICIENT SUBSTITUTES, AND METALLURGICAL ADVANCES MADE DURING AND AFTER THE WAR, HAVE REDUCED THESE FIGURES TO 5 POUNDS OF MAGNESITE REFRACTORIES PER TON OF STEEL MADE.

IT IS DESIRABLE FOR DEAD-BURNED REFRACTORIES THAT THE CRUDE MAGNESITE SHOULD CONTAIN FROM 8 TO 14% OF IMPURITIES SUCH AS IRON, SILICA AND LIME, SO THAT THE MAG-NESITE WILL BOND PROPERLY WHEN THOROUGHLY CALCINED. CONSIDERABLY LOWER CALCINING TEMPERATURES ARE OBTAINED, WITH A CORRESPONDING SAVING OF FUEL, WHEN THE CRUDE MAG-NESITE ORE CONTAINS FROM 3 TO 7% IRON OXIDES AND, GENERALLY THE PURER GRADES OF MAG-NESITE WHICH ARE CALCINED TO THE DEAD-BURNED STATE, HAVE TO HAVE IRON ORE ADDED TO THEM TO REMEDY THEIR IRON DEFICIENCY.

(2) SOREL CEMENT.

AS PREVIOUSLY STATED, A MIXTURE OF FINELY GROUND "CAUSTIC" OR "LIGHTLY" CALCINED MAGNESITE WITH THE PROPER PROPORTION OF MAGNESIUM CHLORIDE MAKES OXYCHLORIDE OR SOREL CEMENT, A HARD, DENSE, ELASTIC AND EXCEPTIONALLY STRONG CEMENT WHICH CAN BE DRILLED, SCRAPED AND BURNISHED LIKE WOOD. SOREL CEMENT, IN PRACTICE, IS MIXED WITH MANY FILLERS SUCH AS GROUND MARBLE, SILICA, SAND, SAWDUST, WOOD FIBRE, CORK, ASBESTOS AND TALC, TO MAKE ARTIFICIAL STONE, STUCCOS, STONEWOOD, AND WATERPROOF, SANITARY, NOISELESS FLOORS FOR RAILWAY CARS, STATIONS, SHIPDECKS, OFFICES, KITCHENS AND HOSPI-TALS, ETC. THE CEMENT IS ALSO USED AS A BINDER IN MAKING BUILT-UP EMERY-WHEELS, GRINDSTONES, AND POLISHING BLOCKS. THE CEMENT SETS QUICKLY AND CAN BE USED IN FREEZ-ING TEMPERATURES AND ON ACCOUNT OF ITS FIRE AND CHEMICAL-RESISTING QUALITIES, IT MIGHT BE USED FOR THE PRESERVATION OF MINE TIMBERS, AND RAILWAY TIES. THE CEMENT ADHERES WELL TO WOOD, METAL OR STONE. A CRUDE MAGNESITE LOW IN LIME AND IRON IMPURITIES IS DESIRABLE IN THE MANUFACTURE OF "CAUSTIC-CALCINED" MAGNESITE AND FOR THIS REASON THE AMORPHOUS, MASSIVE, COMPACT VARIETY OF PROPER ANALYSIS IS USED. THE CRYSTALLINE MAGNESITES OF CHEWELAH, WASHINGTON, HAVE BEEN SUCCESSFULLY USED FOR "CAUSTIC-CALCINED" DUE TO THEIR RELATIVELY LOW IRON CONTENT.

(3) MISCELLANEOUS USES.

CAUSTIC-CALCINED MAGNESITE WAS USED EXTENSIVELY BY THE SULPHATE-PAPER PULP PLANTS OF THE PACIFIC COAST FOR MAKING MAGNESIUM BISULPHITE USED IN THE DIGESTION OF WOOD PULP. THIS FORM OF MAGNESITE IS ALSO USED IN THE MANUFACTURE OF CARBON DIOXIDE

GAS, THOUGH THE WASTE GASES FROM LIME AND COKE NOW FORM THE PRINCIPAL SOURCES OF THIS GAS. ONE TON OF CRUDE MAGNESITE WILL YIELD ABOUT 500 POUNDS OF CARBON DIOXIDE GAS WHEN COMPRESSED TO LIQUID FORM.

CAUSTIC-CALCINED MAGNESITE IS USED IN THE RUBBER INDUSTRY FOR WEIGHTING; IN THE BUILDING INDUSTRY WHEN MIXED WITH WOOD SHAVINGS OR ASBESTOS FOR MAKING LUMBER, WALL BOARD, LATH OR HEAT AND STEAM-PIPE INSULATORS, 85% MAGNESIA PIPE INSULATION BEING A WELL-KNOWN COMMODITY. OTHER USES FOR THE GROUND CAUSTIC-CALCINED MAGNESITE ARE FOUND IN EXPLOSIVES MANUFACTURING WHERE IT IS USED AS A FILLER AND ABSORBENT; IN THE CHEMICAL INDUSTRY WHERE IT IS USED FOR MAKING A VARIETY OF CHEMICALS INCLUDING MAGNESIUM SULPHATE (EPSOM SALTS), MAGNESIUM CHLORIDE, AND MAGNESIUM ALBA. IT IS ALSO USED FOR TOOTH PASTES, FILTERING MEDIUMS FOR OILS, IN THE SUGAR REFINERIES, AND AS A SOURCE OF THE LIGHT METAL MAGNESIUM. UNTIL RECENTLY, HOWEVER, MOST OF THE METALLIC MAGNESIUM PRODUCED IN AMERICA HAS BEEN FROM THE MAGNESIUM CHLORIDE RESIDUES OBTAINED IN THE SALT AND BROMIDE BRINES OF THE SAGINAW VALLEY, MICHIGAN.

SPECIFICATIONS.

VERY LITTLE CRUDE ORE IS SOLD DIRECT TO THE CONSUMER, EXCEPT FOR THE MANUFACTURE OF EPSOM SALTS AND MAGNESIUM CHEMICALS. LUMPS OF PURE, WHITE TO CREAM-COLORED MAGNESITE FROM 4 TO 14 INCHES SIZE ARE REQUIRED FOR CHEMICAL PURPOSES, THE LARGE SIZE PIECES DISSOLVING BEST IN THE SOLUTION TANKS.

NO DEFINITE LIMITS GOVERN THE CHEMICAL COMPOSITION OF THE CAUSTIC-CALCINED MAGNESITE SOLD. GENERALLY, THE MAGNESIUM OXIDE CONTENT IS FROM 72 TO 90% WITH 2 TO 6% LIME, AND 3 TO 15% SILICA. THE COLOUR, SETTING QUALITIES, PLASTICITY AS WELL AS THE CHEMICAL COMPOSITION, MUST ALL BE CONSIDERED WHEN BUYING THIS GRADE OF MAGNESITE.

AS THE DEAD-BURNED VARIETY OF MAGNESITE IS PRIMARILY FOR REFRACTORY PURPOSES, ANY IMPURITIES WHICH TEND TO DECREASE THIS QUALITY ARE DETRIMENTAL. IN PRACTICE IT IS FOUND NECESSARY TO HAVE SOME SILICA AND IRON PRESENT SO THAT THE REFRACTORY MAGNESITE CAN BE PROPERLY FUSED IN PLACE IN THE FURNACE BEING LINED. FROM 8 TO 14% BY VOLUME OF SILICA, LIME AND IRON ARE FOUND NECESSARY IN METALLURGICAL MAGNESITE REFRACTORIES. THE DEAD-BURNED MATERIAL IS SOLD GENERALLY AS GRAIN OR IN SHAPES THOUGH SOME USE IS MADE OF THE LUMP SIZE PRODUCT.

MARKETS.

A STUDY OF THE MANY USES TO WHICH MAGNESITE IN ITS CRUDE AND CALCINED FORMS IS PUT — AS LISTED IN A PREVIOUS SECTION OF THE REPORT — SHOULD INDICATE TO THE READER WHERE THE LOCAL AND CANADIAN MARKETS ARE TO BE FOUND. COMPETITION BY CHROME BRICK AND HIGH-GRADE REFRACTORY CEMENTS HAS REDUCED THE QUANTITY OF MAGNESITE USED BY THE IRON FOUNDRIES, STEEL PLANTS, SMELTERS AND CEMENT PLANTS OF THE PROVINCE UNTIL THE PRESENT DEMAND, WHICH IS ALL IMPORTED, IS NOT MORE THAN 100 TO 150 TONS PER ANNUM. FROM CORRESPONDENCE RECEIVED, IT IS ESTIMATED THAT 100 TONS OF MAGNESITE IS SOLD ANNUALLY IN THE PROVINCE IN THE FORM OF 85% MAGNESIA PIPE INSULATION AND THAT AN EVEN SMALLER TONNAGE OF CAUSTIC-CALCINED MAGNESIA IS REQUIRED TO MEET THE STUCCO AND PLASTIC CEMENT TRADE DEMANDS.

THERE IS NO PRODUCTION OF MAGNESITE IN BRITISH COLUMBIA AT THE PRESENT TIME. THE RECORDS SHOW THAT 835 TONS OF HYDROMAGNESITE WERE SHIPPED FROM THE ATLIN DEPOSITS (200 TONS IN 1904 AND 635 TONS IN 1916) AND 1,000 TONS OF HYDROMAGNESITE WERE SHIPPED FROM THE 108-MILE HOUSE DEPOSITS IN 1921 TO THE PACIFIC ROOFING CO. LTD. OF VANCOUVER.

THE FOLLOWING FIGURES SHOW THE APPARENT CONSUMPTION OF MAGNESITE IN CANADA FOR THE YEARS 1929, 1930 AND 1931:

TABLE I. PRODUCTION OF MAGNESITE IN CANADA, WITH IMPORT AND EXPORT FIGURES FOR 1929, 1930 AND 1931*.

	1929		1930		1931	
	TONS	VALUE $	TONS	VALUE $	TONS	VALUE $
CRUDE MINED	43,229	—	27,638	—	—	—
CRUDE CALCINED	39,514	—	28,128	—	—	—
PRODUCTION: CALCINED AND DEAD-BURNED.	18,809	$491,170	13,366	$336,162	11,411	$295,579
IMPORTS.						
MAGNESIA PIPE COVERING	—	259,080	—	297,513	—	126,210
MAGNESITE CRUDE			260	5,187	—	—
MAGNESITE DEAD-BURNED, CALCINED, ETC.	125	4,423	1,182	22,069	1,787	40,628
MAGNESITE FIRE-BRICK	—	256,635	—	270,180	—	152,435
IMPORTS: TOTAL VALUE:		$520,138		$594,949		$319,273
PRODUCTION VALUE AND IMPORT VALUE		$1,011,308		$931,111		$614,852
EXPORTS:						
MAGNESITE, CALCINED AND DEAD-BURNED.	5,279	125,613	1,851	48,536	1,610	45,257
APPARENT CANADIAN CONSUMPTION:		$885,695		$882,575		$569,595

* FROM "MINERAL PRODUCTION OF CANADA."

FIGURES FOR WORLD PRODUCTION OF CRUDE MAGNESITE MINED IN 1929, 1930 AND, WHERE AVAILABLE, FOR 1931 ARE GIVEN IN TABLE 2. THEY ARE TAKEN FROM THE 1931 ISSUE OF "MINERAL INDUSTRY."

TABLE 2. WORLD PRODUCTION OF CRUDE MAGNESITE BY COUNTRIES.

COUNTRY.	1929	1930	1931
	SHORT TONS	SHORT TONS	SHORT TONS
AUSTRALIA	10,208	9,744	N.A.*
AUSTRIA	482,807	335,536	197,797
CANADA	43,229	27,638	APPROX 24,000
CZECHOSLOVAKIA	111,462	71,723	N.A.
GREECE	92,619	85,327	N.A.
INDIA (BRITISH)	26,316	18,529	N.A.
ITALY	18,929	4,544	N.A.
JUGOSLAVIA	7,292	27,361	N.A.
NORWAY	1,133	1,242	N.A.
RUSSIA	146,286	N.A.	N.A.
TURKEY	216	355	N.A.
SOUTH AFRICA (UNION)	1,299	2,100	1,496
UNITED STATES	187,657	129,419	73,602

* N.A. — NOT AVAILABLE.

THE FOLLOWING ABSTRACT FROM INFORMATION CIRCULAR 6437 OF THE U.S. BUREAU OF MINES, MAY 1931, BY PAUL M. TYLER, GIVES A BRIEF PICTURE OF THE WORLD SITUATION.

"UNTIL 1914, AUSTRIA-HUNGARY AND GREECE SUPPLIED THE BULK OF THE WORLD'S MAGNESITE BUT THE LIST OF PRODUCING COUNTRIES HAS BEEN GREATLY ENLARGED IN LATER YEARS. OF THE PRE-WAR OUTPUT OF AUSTRIA-HUNGARY, ABOUT 75% WAS PRODUCED IN AUSTRIA AND 25% IN WHAT IS NOW CZECHOSLOVAKIA. THESE SUCCESSION STATES AND GREECE STILL FURNISH A LARGE OUTPUT, BUT THEY DO NOT PRODUCE SO LARGE A TONNAGE AS IN 1913, SO THAT SINCE WORLD DEMANDS HAVE INCREASED (FROM 619,071 TONS IN 1913 TO 1,025,163 TONS IN 1929) THEY ARE RELATIVELY LESS IMPORTANT. OTHER COUNTRIES LIKE THE UNITED STATES (AND CANADA) HAVE INCREASED PRODUCTION AND SEVERAL NEW FIELDS HAVE BEEN OPENED. STILL OTHER FIELDS AWAIT A FURTHER INCREASE IN DEMAND BEFORE THEY CAN BE EXPLOITED COMMERCIALLY. MAGNESITE IS NOT AN UNCOMMON MINERAL AND DEPOSITS OF CONSIDERABLE SIZE EXIST IN MANY PARTS OF THE WORLD."

DURING THE WAR PERIOD, THE MAGNESITE INDUSTRY OF BRITISH INDIA, THE UNITED STATES IN CALIFORNIA AND WASHINGTON, CANADA, ITALY, AUSTRALIA AND RUSSIA INCREASED RAPIDLY. FOLLOWING THE ARMISTICE, TARIFF PROTECTION WAS GIVEN TO THE AMERICAN MARKET AND LARGE INCREASES IN RUSSIAN AND JUGOSLAVIAN PRODUCTION HAVE BROUGHT THE INDUSTRY TO THE POINT WHERE DOMESTIC DEMANDS CAN BE MET AT HIGHLY COMPETITIVE RATES. THE INTRODUCTION OF SUBSTITUTES FOR REFRACTORY MAGNESITES AND A MORE THAN DEPRESSION SLUMP IN THE USES FOR CAUSTIC-CALCINED PLASTIC MAGNESIA CEMENTS HAS REDUCED THE PEAK DEMANDS OF 1929 TO FIGURES WHICH APPROXIMATE PRE-WAR WORLD CONSUMPTION TONNAGES.

PRICES.

THE FOLLOWING PRICES TAKEN FROM THE FEBRUARY 16, 1933 ISSUE OF "MINERAL AND METAL MARKETS" WILL SERVE TO INDICATE THE VALUE OF DIFFERENT GRADES OF MAGNESITE AS PREPARED FOR MARKET.

MAGNESITE. PER TON F.O.B. CALIFORNIA, DEAD-BURNED, $25.
KILN RUN, 94 PER CENT MgO (ARTIFICIAL PERICLASE), $65;
88 PER CENT MgO, $35. CAUSTIC, 95 PER CENT MgO, $38;
90 PER CENT MgO, $35.

WASHINGTON, PER TON F.O.B. DEAD-BURNED GRAIN MAGNESITE, $22.

THE FIGURES FOR 1931 IN CANADA INDICATE THE CANADIAN CALCINED MAGNESITE PRODUCTION TO HAVE BEEN WORTH AN AVERAGE OF $25.15 PER TON.

LIST OF MAGNESITE DEALERS, IMPORTERS, AND MANUFACTURING COMPANIES IN CANADA AND UNITED STATES

CANADIAN:

CANADIAN JOHNS-MANVILLE CO. LTD., 19 FRONT ST. EAST, TORONTO.
EHRET MAGNESIA MFG. CO., 12 FRONT ST. EAST, TORONTO.
NORTH AMERICAN MAGNESITE PRODUCERS, LTD., 112 SACREMENT ST., MONTREAL.
INTERNATIONAL MAGNESITE COMPANY, MONTREAL, QUEBEC.
SCOTTISH CANADIAN MAGNESITE CO. LTD.,— MONTREAL, QUEBEC.
WILSON, PATTERSON AND GIFFORD CO. LTD., 42 SACREMENT ST., MONTREAL.

AMERICAN:

ASBESTOLITH MFG. CO., 1 MADISON AVENUE, NEW YORK.
H.J. BAKER AND BROS., 271 MADISON AVENUE, NEW YORK.
J.T. BAKER CHEMICAL CO., 15 NO. BROAD ST., PHILIPSBURG, N.J.
BRAUN-KNECHT-HEIMANN CO., 584 MISSION ST., SAN FRANCISCO, CALIF.
FOOTE MINERAL CO., 1608 SUMMER ST., PHILADELPHIA, PA.
GENERAL MAGNESITE AND MAGNESIA CO., VENANGO AND BALFOUR STS., PHILADELPHIA, PA.
GENERAL REFRACTORIES CO., 106 SO. 16TH ST., PHILADELPHIA.
HARBISON-WALKER REFRACTORIES CO., PITTSBURGH, PA.
HAWS REFRACTORIES CO., JOHNSTOWN, PA.
INNIS, SPEIDEN AND CO. INC., 117 LIBERTY ST., NEW YORK.
IRON AND ORE CORP. OF AMERICA, 11 BROADWAY, NEW YORK.
KIAMENSI CLAY CO., WILMINGTON, DEL.
E.J. LAVINO AND CO., BULLITT BLDG., PHILADELPHIA, PA.
C.S. MALTBY, 1006 HUMBOLDT BANK BLDG., SAN FRANCISCO, CALIF.
NORTHWEST MAGNESITE CO., CROCKER BLDG., SAN FRANCISCO.
SHIMER AND CO. INC., 133 SO. 4TH ST., PHILADELPHIA, PA.
SIERRA MAGNESITE CO., 233 SANSOME ST., SAN FRANCISCO.
STANDARD FIRE BRICK CO., PUEBLO, COLO.
JOHN C. WIARDA AND CO., 91 PROVOST ST., BROOKLYN, N.Y.

TARIFFS

CANADIAN

THE PRESENT CUSTOMS DUTIES ON MAGNESITE AND PRODUCTS ENTERING CANADA ARE AS FOLLOWS:—

MAGNESITE, CRUDE ROCK:	FREE
MAGNESITE, DEAD-BURNED, SINTERED, CAUSTIC-CALCINED OR PLASTIC MAGNESIA, MAGNESIUM CARBONATE, BASIC OR OTHERWISE, EXCEPTING CRUDE ROCK:	BRITISH PREFERENCE 20 P.C. LESS 10 P.C. INTERMEDIATE TARIFF 27½% GENERAL TARIFF 30%
MAGNESITE FIRE-BRICK	FREE

AMERICAN

THE FOLLOWING RATES OF DUTY ARE CHARGED ON CANADIAN EXPORTS OF MAGNESITE AND PRODUCTS TO THE UNITED STATES:

MAGNESITE, CRUDE ORE, 15/32¢ PER LB. — $9.375 PER SHORT TON

MAGNESITE — CAUSTIC-CALCINED: 15/16¢ PER LB. — $18.75 PER SHORT TON

MAGNESITE — DEAD-BURNED AND GRAIN MAGNESITE UNSUITABLE FOR MANUFACTURE INTO OXYCHLORIDE CEMENT; INCLUDES PURCHASE. 23/40¢ PER LB.: — $11.50 PER SHORT TON

MAGNESITE BRICKS — $\frac{3}{4}$¢ PER LB. AND 10% AD VALOREM.

BRITISH COLUMBIA DEPOSITS OF MAGNESITE

THE ROCK MAGNESITE DEPOSITS IN THE CRANBROOK, PERRY CREEK AND BRIDGE RIVER AREAS, AND THE HYDROMAGNESITE DEPOSITS AT ATLIN, IN THE NORTH, AND AT CLINTON, KELLY LAKE, MEADOW LAKE, RISKE CREEK, WATSON LAKE, 108 MILE HOUSE, 141 MILE HOUSE AND KAMLOOPS IN THE SOUTH CENTRAL PORTION OF THE PROVINCE, HAVE ALL BEEN DESCRIBED IN VARIOUS REPORTS PUBLISHED BY THE DOMINION AND PROVINCIAL DEPARTMENTS OF MINES. AS THERE HAS BEEN PRACTICALLY SPEAKING, NO EXPLOITATION OF THE VARIOUS DEPOSITS SINCE THE REPORTS WERE WRITTEN, THEY MAY BE CONSIDERED UP-TO-DATE IN DETAIL. HOWEVER, SEVERAL OF THE AFTERWARD MENTIONED REFERENCES ARE DIFFICULT TO OBTAIN, MANY OF THE REPORTS BEING OUT OF PRINT, AND AS ONE OR TWO NEW DISCOVERIES HAVE RECENTLY BEEN MADE, IT HAS BEEN CONSIDERED ADVISABLE TO SUMMARIZE THE EXISTING PUBLISHED DATA AND ASSEMBLE IT INTO ONE BRIEF BUT INCLUSIVE COMPILATION. SUCH FIELD STUDIES AS WERE NECESSARY WERE MADE BY THE WRITER AND IN ALL CASES AN EFFORT HAS BEEN MADE TO SECURE THE LATEST INFORMATION. FOR CONVENIENCE, THE DEPOSITS ARE REFERRED TO UNDER THE MINERAL SURVEY DISTRICT IN WHICH THEY OCCUR.

NO. 1 MINERAL SURVEY DISTRICT — NORTHWESTERN DISTRICT

ATLIN MINING DIVISION

ATLIN HYDROMAGNESITE DEPOSITS.

REFERENCES: 1. J.C. GWILLIM, IN G.S.C. ANNUAL REPORT, NEW SERIES, 1898, SECTION XI, PAGE 11R.

2. G.A. YOUNG, "HYDRO-MAGNESITE DEPOSITS OF ATLIN" G.S.C. SUMMARY REPORT 1915, PP. 50 — 61.

3. W.F. ROBERTSON, "ATLIN MAGNESITE". B.C. MINISTER OF MINES REPORT, 1904, PP. 82 — 83.

4. ANNUAL REPORTS OF B.C. MINISTER OF MINES.

THY HYDROMAGNESITE DEPOSITS NEAR ATLIN ARE FOUND IN TWO MAIN GROUPS, THE FIRST ADJOINING THE TOWNSITE ON THE SOUTH-EAST AND THE SECOND AND LARGEST BEING FOUND ABOUT HALF A MILE NORTH-EAST OF THE CITY WHARF AT ATLIN LAKE. ACCORDING TO A RECENT COMMUNICATION FOUR CLAIMS COVERING BOTH DEPOSITS ARE NOW HELD IN THE NAME OF THE ARMSTRONG-MORRISON INVESTMENT COMPANY OF 1005 ROYAL BANK BUILDING, VANCOUVER, B. C.

ACCESS TO THE DISTRICT IS BY WAY OF THE WHITE PASS AND YUKON RAILWAY RAIL AND BOAT SYSTEM FROM SKAGWAY, ALASKA, VIA CARCROSS TO ATLIN, AND ACCORDING TO 1931 SCHEDULES THE FREIGHT RATE ON SACKED HYDROMAGNESITE IN CARLOAD LOTS OF 20,000 POUNDS MINIMUM LOADING IS $12 PER TON FROM ATLIN TO EITHER VANCOUVER OR SEATTLE.

THE OCCURRENCES WERE FIRST NOTED BY J.C. GWILLIM IN 1898 AND LATER DESCRIBED IN SOME DETAIL BY W.F. ROBERTSON, LATE PROVINCIAL MINERALOGIST, WHO VISITED THE DISTRICT IN 1904. HOWEVER, THE MOST COMPREHENSIVE REPORT ON THE DEPOSITS IS BY G.A. YOUNG, OF THE G.S.C., WHO EXAMINED THE PROPERTIES IN AUGUST, 1915, AND THE FOLLOWING NOTES ARE BRIEFED FROM HIS ADMIRABLE REPORT:—

AS EARLY AS 1904 APPROXIMATELY 200 TONS OF THE ATLIN HYDROMAGNESITE WERE MINED AND SHIPPED TO SAN FRANCISCO AND THE OLD COUNTRY. AGAIN IN 1915 ANOTHER SHIPMENT WAS MADE; THIS TIME 635 TONS WERE SENT TO VANCOUVER BY THE FIRM OF ARMSTRONG-MORRISON AND COMPANY OF VANCOUVER. HOWEVER, THE REMOTE SITUATION AND CONSEQUENTLY SOMEWHAT HIGH FREIGHT RATES HAVE PREVENTED FURTHER SHIPMENTS BEING MADE.

A NUMBER OF HYPOTHESES HAVE BEEN ADVANCED TO ACCOUNT FOR THE ORIGIN OF THE HYDROMAGNESITES OF THIS AREA. GWILLIM SUGGESTED THAT THE MATERIAL HAD BEEN DEPOSITED FROM SPRINGS OF THE DISTRICT, EVIDENCE FOR WHICH THEORY WAS FOUND IN ANALYSES OF THE SPRING WATERS WHICH SHOWED THEIR CONSIDERABLE MAGNESIA CONTENT. ROBERTSON CONCLUDED THE DEPOSITS WERE THE RESULT OF THE WEATHERING OF THE MAGNESIA-RICH ROCKS UNDERLYING THE DEPOSITS BUT YOUNG, ON THE OTHER HAND, POINTED OUT THAT THE DEPOSITS DID NOT HAVE THE TUFFACEOUS STRUCTURES OF SPRING DEPOSITS AND DID NOT REST ON MAGNESIA-RICH ROCKS BUT ON SOIL. HE THEREFORE SUGGESTED THAT THE HYDROMAGNESITE REPRESENTS MATERIAL DEPOSITED ON THE BOTTOM OF PONDS WHICH HAVE DISAPPEARED SINCE THE DEPOSITION TOOK PLACE.

THE LARGEST GROUP OF DEPOSITS CONSISTS OF ONE LARGE AND FOUR SMALL AREAS OF HYDROMAGNESITE WHICH OCCUPY A FAINTLY MARKED DEPRESSION (HALF A MILE NORTH-EAST OF THE WHARF) WHICH OPENS TO THE NORTH-WEST INTO A SWAMPY AREA. THE SURFACE OF THE MAIN DEPOSIT, THOUGH NEARLY LEVEL FOR THE GREATER PART, IS MARKED BY SHALLOW DEPRESSIONS NOT UNLIKE DRAINAGE CHANNELS; WHILE IN THE NORTH-EASTERN PART OF IT THERE IS AN IRREGULAR MOUND-LIKE AREA WHOSE TOPS ARE 3 TO 5 FEET OR MORE ABOVE THE GENERAL GROUND LEVEL WHICH HERE IS 110 FEET ABOVE ATLIN LAKE.

SAVE FOR THE PRESENCE OF ROCK FRAGMENTS NEAR THE SOUTH BORDER OF THE MAIN BED, ALL THE BEDS APPEAR TO BE VERY UNIFORM IN STRUCTURE AND COMPOSITION AND TO BE COMPOSED OF A WHITE, FINE-GRAINED, POWDERY, GRITLESS HYDROMAGNESITE WHICH IS PLASTIC LIKE CLAY WHEN WET. THE MATERIAL SHOWS NO SIGNS OF BEDDING AND THE BASE OF THE DEPOSITS WHEREVER PENETRATED WITHIN THEIR BORDERS IS SHARPLY DEFINED.

IN THE LARGE MAIN DEPOSIT OF THIS GROUP, 31 PITS AND BOREHOLES WERE SUNK AND IN NEARLY EVERY CASE PASSED THROUGH THE BASE OF THE DEPOSIT, AND INDICATED THE THICKNESS TO VARY FROM 1 TO 6 FEET, WITH AN AVERAGE THICKNESS OF 2' 8". AS THE DEPOSIT IS APPROXIMATELY 18 ACRES IN AREA THE VOLUME OF HYDROMAGNESITE IS ABOUT 80,000 CUBIC YARDS, AND THIS AT 115 POUNDS PER CUBIC FOOT IN PLACE GIVES APPROXIMATELY 125,000 TONS OF HYDROMAGNESITE IN RESERVE, IN THIS, THE LARGEST OF THE ATLIN DEPOSITS. THE FOUR SMALL DEPOSITS NEARBY CONTAIN ABOUT 9,000 TONS ADDITIONAL HYDROMAGNESITE, THEIR AGGREGATE AREA BEING 2 ACRES, WITH A DEPTH VARYING FROM 1 TO 2½ FEET.

Two sets of samples were taken from the main body and on analysis by N.L. Turner of the Dominion Mines Branch, gave the following results:—

Samples of hydromagnesite from largest of Atlin deposits
(Analyses made on material dried at 105°C)

	1A	1B	1C	2A	2B	2C
Silica (SiO_2)	1.86	0.90	0.54	1.22	1.96	9.22
Alumina (Al_2O_3)	0.67	0.10	0.17	0.67	0.14	0.94
Ferric Oxide (Fe_2O_3)	0.15	0.09	0.11	0.18	0.45	0.73
Ferrous Oxide (FeO)	0.60	0.45	0.64	0.63	0.65	0.78
Calcium Oxide (CaO)	2.04	0.82	0.68	1.26	1.50	6.44
Magnesium Oxide (MgO)	41.13	42.35	42.19	40.56	41.93	35.23
Carbon Dioxide (CO_2)	35.98	36.10	36.17	35.96	36.04	37.70
Combined Water (H_2O)	18.02	18.95	19.05	19.04	17.66	8.20
	100.45	99.76	99.55	99.52	100.33	99.24

Samples 1A, 1B, 1C were taken from a pit in the southeastern part of the main body where the depth of hydromagnesite is 2 feet 2 inches, 1A being from a depth of 3 inches, 1B from a depth of 1 ft. 1 in. and 1C, from a depth of 1 ft. 11 in. Samples 2A, 2B and 2C, were taken from a pit in the northern end of the deposit where the hydromagnesite was 3' 6" deep; 2A being from a depth of 4 inches, 2B from a depth of 1' 4½" and 2C from a depth of 2' 4".

The second group of deposits is situated just east of Atlin and lies in marked depressions formed in unconsolidated materials. The group consists of three beds of hydromagnesite, the southeastern one of the three having an area of 4.5 acres and an average thickness (from 9 boreholes) of 3 feet or a volume equivalent to 33,000 tons of hydromagnesite in place. Two samples were taken by G.A. Young, No. 3 from a depth of 1' 9" in the centre of the bed (here 3 feet thick) and No. 4 from a point 100' south-east of sample No. 3 at a depth of 1' 4" in the 3-foot bed. The analyses are given in the following table.

The north-western deposit of this trio has an area of 0.75 acres, an average thickness (from 4 boreholes) of 5 feet and consequently there is approximately 8,600 tons of hydromagnesite in place. Samples No. 5 and No. 6 were taken from depths of 1' 6" and the surface at points near the north edge and centre of the deposit respectively. The analyses are given with those for samples No. 3 and No. 4.

The third, or westerly deposit, has an area of 1.0 acres and five boreholes gave an average thickness of 2 feet, the tonnage of hydromagnesite in reserve in place being therefore approximately 4,500. Sample No. 7 was taken from the southern portion of the bed from a depth of 4 inches at a place where the bed is 2' thick. The analysis is given with those for samples No. 3 to 6 inclusive.

SAMPLE ANALYSES FROM THREE DEPOSITS OF HYDROMAGNESITE

(ANALYSES MADE ON MATERIAL DRIED AT 105°C)

SAMPLE.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.
SILICA (SiO_2)	0.74	3.48	0.96	0.62	1.18
ALUMINA (Al_2O_3)	0.35	2.85	0.23	0.41	0.33
FERRIC OXIDE (Fe_2O_3)	0.15	0.56	0.12	0.09	0.10
FERROUS " (FeO)	0.66	0.81	0.53	0.36	0.71
CALCIUM " (CaO)	0.32	0.42	0.16	0.26	0.48
MAGNESIUM OXIDE (MgO)	42.85	38.94	43.04	43.45	42.12
CARBON DIOXIDE (CO_2)	36.35	34.31	36.21	36.23	35.89
COMBINED WATER H_2O	19.10	18.10	19.26	18.95	19.42
TOTALS:	100.52	99.47	100.51	100.37	100.23

THERE IS THEREFORE IN THE TWO GROUPS OF ATLIN DEPOSITS APPROXIMATELY 180,000 TONS OF HYDROMAGNESITE IN THE FORM OF BEDS SELDOM MORE THAN 5 FEET OR LESS THAN 1 FOOT THICK. THERE IS NO OVERBURDEN, THE DEPOSITS COULD BE CHEAPLY DRAINED OF ANY WATER WHICH MIGHT ACCUMULATE, AND COULD BE CHEAPLY AND EFFICIENTLY WORKED. WITH CAREFUL MANAGEMENT ROUGHLY 150,000 TONS OF MATERIAL AVERAGING BETWEEN 41 AND 42% MgO WITH ABOUT 3% COMBINED CaO — Fe_2O_3 — Al_2O_3 AND SILICA, COULD BE READILY SHIPPED.

AT THE PRESENT TIME, IT IS CONSIDERED THAT VERY MUCH HIGHER PRICES FOR MAGNESITE PRODUCTS WOULD HAVE TO PREVAIL BEFORE ANYTHING PROFITABLE COULD BE DONE WITH THESE EXCELLENT RESERVES OF HYDROMAGNESITE.

MISCELLANEOUS OCCURRENCES.

IN THE 1899 REPORT OF THE GEOLOGICAL SURVEY OF CANADA, NEW SERIES, SECTION XII, PAGE 21B, REFERENCE IS MADE BY J.C. GWILLIM TO BROWN WEATHERING OUTCROPS OF MAGNESIUM ROCK WHICH OCCUR ALONG THE SHORE OF ATLIN LAKE NEAR THE MOUTH OF PINE CREEK, AND ALSO ON TAKU INLET WEST OF TAKU MOUNTAINS. OCCURRENCES WERE ALSO NOTED IN SMALLER AREAS NEAR THE HEAD OF McKEE CREEK AND ON THE MOUNTAINS BETWEEN RUBY, BOULDER AND BIRCH CREEKS. AN ANALYSIS OF THE ROCK SHOWED THE FOLLOWING PERCENTAGE CONTENT: MAGNESIA, 21.70; FERRIC OXIDE, 5.10; CARBON DIOXIDE, 27.0; SILICA, 45.68; COMBINED WATER AND LOSS, 0.52. IT WAS ALSO NOTED THAT A PURER WHITE IVORY-LIKE FORM OF MAGNESITE OCCURRED AS NARROW BANDS OR VEINS CUTTING THE COUNTRY ROCKS OF THE AREA CONSISTING OF MIXED DUNITE AND SERPENTINES IN CONJUNCTION WITH THE MAGNESIUM ROCK ABOVE REFERRED TO.

NO. 2 MINERAL SURVEY DISTRICT — NORTH-EASTERN DISTRICT

OMINECA MINING DIVISION

THE ONLY REFERENCE TO THE OCCURRENCE OF MAGNESITE IN THE No. 2, OR NORTH-EASTERN MINERAL SURVEY DISTRICT, IS CONTAINED IN THE 1894 REPORT OF THE G.S.C., NEW SERIES, SECTION VII, PAGE 25C, WHERE IT IS NOTED BY R.G. McCONNELL THAT "IN PROCEEDING UP GERMANSEN CREEK FROM GERMANSEN LANDING THE PREDOMINANT TYPE OF ROCKS FOR SOME MILES IS A GREEN ASH ROCK, PRESSED AND ALTERED INTO A SCHIST AND INTERBEDDED WITH IT ARE LAYERS OF GRAYWACKE, FELSITE AND HALLAFLINTA, AND BANDS OF DOLOMITE SERPENTINE AND MAGNESITE."

NO. 3 MINERAL SURVEY DISTRICT — CENTRAL DISTRICT

BOTH ROCK MAGNESITE AND HYDROMAGNESITE ARE FOUND IN THIS MINERAL SURVEY DISTRICT, ROCK MAGNESITE OCCURRENCES BEING NOTED ALONG THE LINE OF THE PACIFIC GREAT EASTERN RAILWAY, NEAR LAC LA HACHE, AND ALSO ABOUT 6 MILES NORTH-EAST OF CLINTON, WHILE HYDROMAGNESITE DEPOSITS HAVE BEEN REPORTED FROM MEADOW LAKE, WATSON LAKE (OR 108-MILE HOUSE), RISKE CREEK, CLINTON, AND 141-MILE HOUSE IN THE CLINTON MINING DIVISION, AND FROM NEAR BUCE LAKE TO THE EAST OF KAMLOOPS, IN THE KAMLOOPS MINING DIVISION.

CLINTON MINING DIVISION

REFERENCES:

1. G.S.C. ANNUAL REPORT 1898, NEW SERIES, VOLUME XI, PAGE 10R.

2. G.S.C. 1920, MEMOIR 118, L. REINECKE. "MINERAL DEPOSITS BETWEEN LILLOOET AND PRINCE GEORGE." PAGES 20 — 49.

3. CHAS. CAMSELL, G.S.C. SUMMARY REPORT 1917, PART 3. PAGES 25 — 26B.

4. B.C. MINISTER OF MINES REPORTS: 1918, PAGES 228 — 243; 1919, PAGES 177 — 187; 1921, PAGE 194 AND 1922, PAGE 155.

ROCK MAGNESITE DEPOSITS

VICINITY OF LAC LA HACHE.

ACCORDING TO NOTES BY C. CAMSELL, ABOVE REFERRED TO:—

"A DISCOVERY OF MAGNESITE IN WHAT HAS NOT YET, HOWEVER, PROVED TO BE COMMERCIAL QUANTITY, WAS MADE IN 1917 BY MR. C.E. CARTWRIGHT, C.E., OF VANCOUVER; IN SEVERAL PLACES ALONG THE RAILWAY GRADE OF THE PACIFIC GREAT EASTERN RAILWAY ON THE SOUTH-WEST SIDE OF LAC LA HACHE. THE MAGNESITE IS A HARD, WHITE, FINE-GRAINED VARIETY AND WAS FIRST DISCOVERED IN THE FORM OF FLOAT IN SEVERAL OF THE CUTS IN THE RAIL-WAY GRADE. IT OCCURS IN A NUMBER OF SHORT, NARROW VEINS, THE LARGEST ONLY ABOUT 12 INCHES WIDE, IN THE BASALT AND ON THE CONTACT BETWEEN THE BASALT AND THE UNDER-LYING DECOMPOSED MATERIAL, AND THOUGH THE DEPOSITS SO FAR DISCOVERED ARE NOT OF COMMERCIAL IMPORTANCE, IT IS PROBABLE THAT LARGER BODIES, CAPABLE OF BEING PROFITABLY WORKED, EXIST SOMEWHERE IN THIS DISTRICT. THE PRESENCE OF A NUMBER OF DEPOSITS OF HYDROMAGNESITE BETWEEN 108-MILE HOUSE AND 127-MILE HOUSE SUPPORTS THIS IDEA. A CHEMICAL ANALYSIS BY M.F. CONNOR OF THE DOMINION MINES BRANCH ON A SMALL SAMPLE OBTAINED FROM MR. CARTWRIGHT GAVE THE FOLLOWING: MAGNESIUM CARBONATE, 70%; CALCIUM CARBONATE, 27%; AND IRON, 2%. THE LIME CONTENT IS RATHER TOO HIGH FOR A COMMERCIAL MAGNESITE."

SINCE THE ABOVE WAS WRITTEN IN 1918 BY DR. CAMSELL, THERE HAS BEEN NO FURTHER DEVELOPMENT IN THIS AREA, ALTHOUGH IN LATER YEARS THE LATE R.C. CAMPBELL-JOHNSON SPENT CONSIDERABLE TIME AND MONEY IN SEARCHING FOR MAGNESITE ON BOTH SIDES OF THE RAILWAY IN THE VICINITY OF THE 141-MILE HOUSE.

CLINTON ROCK MAGNESITE.

DURING THE SUMMER OF 1928 D.B. HUTCHISON OF 70-MILE HOUSE, B.C. DISCOVERED AN OUTCROP OF PURE ROCK MAGNESITE TO THE EAST SIDE OF BONAPARTE CREEK AND SOME SIX MILES NORTH-EAST OF CLINTON.

THE AREA WAS EXAMINED BY THE WRITER DURING THE SUMMER OF 1931 WHEN TWO CLAIMS,

THE WHITE ROCK AND WHITE ROCK NO. 2 WERE HELD BY MR. HUTCHISON. THE OUTCROPS ARE SITUATED AT 3,100 FEET ELEVATION AND ABOUT HALF A MILE FROM THE WAGON-ROAD WHICH LEADS TO CLINTON, A STATION ON THE PACIFIC GREAT EASTERN RAILWAY, 206 MILES NORTH OF VANCOUVER. CLINTON IS ALSO 34 MILES NORTH OF ASHCROFT BY ROAD, THE NEAREST POINT TO BOTH THE CANADIAN NATIONAL AND CANADIAN PACIFIC RAILWAYS.

THE MAGNESITE, A CREAMY WHITE, DENSE, PORCELAIN TYPE, OCCURS AS AN ALTERATION PRODUCT OF THE SERPENTINE ROCKS WHICH UNDERLIE THE AREA. WHEN EXAMINED THE ONLY WORK WHICH HAD BEEN DONE CONSISTED OF BLOWING OFF A FEW OF THE WEATHERED KNOBS OF SERPENTINE AND MAGNESITE OUTCROPPING ON THE SIDE OF A SMALL HILL. A FOUR-FOOT EXPOSURE OF MAGNESITE WAS SAMPLED AND ON ANALYSIS GAVE AS FOLLOWS: MAGNESIUM CARBONATE, 97.8%; (PLUS THE CO_2); CALCIUM CARBONATE, 1.8%; FERRIC OXIDE, 0.4%; AND A TRACE OF SILICE AND NO ALUMINA. THE PURITY OF THE MAGNESITE AS WELL AS THE LOCALITY WARRANT FURTHER DEVELOPMENT WORK TO PROVE OR DISPROVE THE ATTRACTIVENESS OF THE DEPOSIT.

HYDROMAGNESITE OCCURRENCES

THE HYDROMAGNESITE DEPOSITS OF THE CLINTON MINING DIVISION HAVE BEEN OFFICIALLY KNOWN SINCE 1898 WHEN A REFERENCE WAS MADE IN THAT YEAR'S ANNUAL REPORT BY THE GEOLOGICAL SURVEY OF CANADA, PAGE 10R, TO THE WATSON LAKE OR 108-MILE HOUSE DEPOSITS. THE MOST COMPREHENSIVE REPORT ON THE AREA IS THAT BY LEOPOLD REINECKE MADE DURING 1918 AND WHILE THE DEPOSITS WERE VISITED IN 1931 BY THE WRITER, MOST OF THE INFORMATION GIVEN HERE IS A COMPILATION FROM THE EXCELLENT REPORT BY REINECKE (MEMOIR NO. 118) ON THE "MINERAL DEPOSITS BETWEEN LILLOOET AND PRINCE GEORGE." THE DEPOSITS WILL BE DESCRIBED IN ORDER OF SIZE.

MEADOW LAKE HYDROMAGNESITE.

THIS DEPOSIT, 16 MILES BY ROAD WEST OF CHASM, A SMALL SIDING ON THE PACIFIC GREAT EASTERN RAILWAY NORTH OF CLINTON, WAS STAKED IN 1931 BY L. BURLEY OF NORTH VANCOUVER, B.C. THE DEPOSITS COVER AN AREA OF 48.3 ACRES AND CONTAIN ABOUT 114,000 TONS OF BETTER QUALITY WHITE HYDROMAGNESITE. THEY ARE SITUATED IN A VALLEY THAT FORMS PART OF THE DEPRESSION IN WHICH MEADOW LAKE LIES, THE DEPOSITS THEMSELVES FORMING FLAT, WHITE, SLIGHTLY RAISED MOUNDS IN THE LOWER PARTS OF THE DEPRESSION. THERE ARE FIVE MAIN AREAS OF PURE HYDROMAGNESITE AT THIS PROPERTY.

AREAS 1 AND 2 TOGETHER COVER ABOUT 16,500 SQUARE YARDS AND CONTAIN A GREY-WHITE HYDROMAGNESITE OF DOUBTFUL QUALITY BUT PROBABLY FAIRLY PURE GRADE. THE DEPTH OF WHITE HYDROMAGNESITE VARIES FROM 6 TO 18 INCHES, UNDER WHICH LIES A BROWNISH HYDROMAGNESITE. IT IS ESTIMATED THAT 5,640 TONS OF GREY-WHITE MATERIAL ARE AVAILABLE IN THESE TWO DEPOSITS.

AREA NO. 3 COVERS 154,000 SQUARE YARDS AND EIGHT OPENINGS BY REINECKE SHOWED AN AVERAGE DEPTH OF 18 INCHES OF WHITE HYDROMAGNESITE. THE GRADE IS INDICATED BY SAMPLES NOS. 1 AND 2 IN THE FOLLOWING TABLE. UNDERLYING THE PURER MATERIAL IS A $3\frac{1}{2}$-FOOT BED OF CREAM-COLOURED HYDROMAGNESITE AND BELOW THAT AN IMPURE EARTH. SAMPLE NO. 3 IN THE TABLE GIVES THE COMPOSITION OF THE CREAM-COLOURED MATERIAL. THE ESTIMATED TONNAGE OF WHITE HYDROMAGNESITE IN THIS DEPOSIT IS 78,900 TONS.

IN AREA NO. 4, WHICH COVERS 8,200 SQUARE YARDS, IT IS ESTIMATED THERE IS 3,500 TONS IN THE TOP 12 TO 16 INCHES OF WHITE HYDROMAGNESITE. AREA NO. 5 COVERS 56,000 SQUARE YARDS, HAS AN AVERAGE DEPTH OF 15 TO 16 INCHES AND CONTAINS 25,900 TONS OF WHITE HYDROMAGNESITE BENEATH WHICH THERE IS ABOUT 4 FEET OF THE CREAMY-COLOURED HYDROMAGNESITE.

ANALYSES OF MEADOW LAKE HYDROMAGNESITE BY DOMINION MINES BRANCH

SAMPLE:	No. 1	No. 2	No. 3
SILICA	4.00	1.22	11.33
ALUMINA	1.36	0.67	2.88
FERRIC OXIDE	0.14	0.18	0.24
FERROUS OXIDE	0.23	0.63	0.20
MAGNESIUM OXIDE	41.38	40.56	35.68
CALCIUM OXIDE	1.32	1.26	6.38
CARBON DIOXIDE	37.67	35.95	36.63
WATER ABOVE 105°C	12.12	18.00	4.15
WATER BELOW 105°C	1.48	1.45	2.29
TOTALS:	99.84	99.93	99.78

1. CENTRE OF MAIN DEPOSIT AT MEADOW LAKE 0 TO 15 INCHES BELOW SURFACE.

2. AVERAGE OF FIVE SAMPLES 0 TO 2 INCHES FROM SURFACE IN AREAS 3 AND 5.

3. UNDERLYING SAMPLE NO. 1 GRANULATED CREAM-COLOURED EARTH 15 TO 51 INCHES FROM SURFACE.

THE WRITER VISITED THE MEADOW LAKE DEPOSITS DURING THE SUMMER OF 1931 AND A COMBINED SAMPLE TAKEN FROM MANY POINTS ON THE SURFACE OF THE LARGEST DEPOSIT (AREA 3 ABOVE) WAS ANALYZED IN THE BUREAU OF MINES LABORATORY, VICTORIA, AND FOUND TO CONTAIN MAGNESIUM CARBONATE, 80.7%; CALCIUM CARBONATE, 2.1%; FERRIC OXIDE, 0.6; ALUMINA, 0.3%; INSOLUBLE, 5.9% (MOSTLY SILICA); WATER AT 105°C, 10.5%; AND A TRACE OF CALCIUM SULPHATE.

WATSON LAKE HYDROMAGNESITE DEPOSITS.

THIS GROUP OF FIVE SMALL HYDROMAGNESITE DEPOSITS IS SITUATED ONE MILE EAST OF TATTON SIDING ON THE PACIFIC GREAT EASTERN RAILWAY, WHICH IS 269 MILES NORTH FROM VANCOUVER. IT IS NOW CALLED THE WHITE EMPRESS CLAIM AND IS OWNED BY R.D. DINNING OF THE CANADIAN CREDIT MEN'S TRUST ASSOCIATION, LIMITED, VANCOUVER, B.C. IN THE PAST IT HAS BEEN CALLED THE 108-MILE HOUSE HYDROMAGNESITE AND IS PROBABLY BEST KNOWN AS THE WATSON LAKE DEPOSIT. IN 1921 ABOUT 1,000 TONS OF THE PURER GRADE HYDROMAGNESITE WAS SHIPPED TO THE PLANT OF THE PACIFIC ROOFING COMPANY, LTD. IN VANCOUVER AND AN ADDITIONAL 1,500 TO 1,700 TONS WAS MINED AND STORED ON AN OPEN PLATFORM AT THE RAILWAY SIDING AT TATTON. THE FOLLOWING NOTES ARE FROM L. REINECKE'S DESCRIPTION OF THE DEPOSIT MADE AS A RESULT OF HIS 1918 EXAMINATION:—

APPROXIMATELY ONE-FOURTH OF A MILE SOUTH OF WATSON LAKE AND EXTENDING ABOVE THE GENERAL SURFACE OF THE SURROUNDING LAKE FLATS A FOOT OR MORE, ARE THE FIVE SMALL DEPOSITS OF HYDROMAGNESITE WHICH, GROUPED TOGETHER, ARE COVERED BY THE CROWN-GRANTED WHITE EMPRESS MINERAL CLAIM. THE HYDROMAGNESITE, A CREAMY-WHITE IN COLOUR IS TRAVERSED ON THE SURFACE BY NUMEROUS CRACKS WHICH MAKE THE HYDROMAGNESITE SOMEWHAT RESEMBLE THE TOP OF A CAULIFLOWER. THE FIVE AREAS RANGE IN SIZE FROM $\frac{1}{4}$ ACRE TO SLIGHTLY OVER 2 ACRES IN AREA; THEY HAVE A THICKNESS OF BETTER QUALITY HYDROMAGNESITE RANGING FROM 16.5 INCHES TO OVER 60 INCHES AND CONTAIN IN ALL, APPROXIMATELY 23,000 TONS OF COMMERCIAL MATERIAL. THE LARGEST DEPOSIT CONTAINS 13,230 TONS, THE

SMALLEST BUT 535 TONS OF HYDROMAGNESITE, WITH THE REMAINING THREE DEPOSITS CONTAINING 4,570, 3,720 AND 680 TONS RESPECTIVELY. SEVEN TEST HOLES WERE PUT DOWN UNDER THE DIRECTION OF MR. REINECKE AND ANALYSES REPRESENTATIVE OF THE HYDROMAGNESITE ARE GIVEN IN THE FOLLOWING TABLE. THE ANALYSES WERE MADE IN THE DEPARTMENT OF MINES LABORATORIES AT OTTAWA, AND INDICATE A MAGNESITE COMPARATIVELY LOW IN LIME CONTENT BUT HAVING A VARYING SILICA CONTENT.

ANALYSES OF WATSON LAKE HYDROMAGNESITE

ANALYSES BY MINES BRANCH, OTTAWA

SAMPLE:	No. 1	No. 2	No. 3
SILICA	4.62	1.73	6.36
ALUMINA	0.16	0.12	0.20
FERRIC OXIDE	0.16	0.07	0.12
MAGNESIUM OXIDE	43.17	43.73	41.06
CALCIUM OXIDE	1.14	....	1.62
CARBON DIOXIDE	43.64	37.03	38.04
WATER ABOVE 105°C	5.26	17.79	11.25
WATER BELOW 105°C	1.42	....	1.32
TOTALS:	99.57	100.47	99.97

1. FROM EAST END OF THE 13,230 TON DEPOSIT, SAMPLE 0 TO 36 INCHES FROM SURFACE.
2. FROM GENERAL SAMPLE WATSON LAKE, EXACT POSITION OF SAMPLE UNKNOWN.
3. FROM THE WESTERLY OR 4,570-TON DEPOSIT, SAMPLE INCLUDES 26 INCHES OF WHITE EARTH AND PART OF LAYER OF CREAM EARTH, BASE DEPOSIT AT 85 INCHES DEPTH.

RISKE CREEK HYDROMAGNESITE.

THE RISKE CREEK DEPOSITS OF HYDROMAGNESITE, TWO IN NUMBER, ON LOTS 178 AND 1188, WHEN LAST REPORTED ON WERE OWNED RESPECTIVELY BY MESSRS. S.M. BECHER OF RISKE CREEK, AND A.E. CAREW-GIBSON OF VANCOUVER. THEY ARE SITUATED WEST OF THE FRASER RIVER AND 35 MILES BY A ROUGH, STEEP ROAD FROM THE PACIFIC GREAT EASTERN RAILWAY AT WILLIAMS LAKE. THE FOLLOWING NOTES ARE FROM L. REINECKE'S REPORT:

THE DEPOSIT ON LOT 178 COVERS 10,000 SQUARE YARDS AND ONE AUGER HOLE SHOWED WHITE TO CREAM-TINTED HYDROMAGNESITE TO A DEPTH OF 33 INCHES WITH AN ADDITIONAL DEPTH OF 17 INCHES OF BROWNISH MATERIAL. THE RESERVE OF THE WHITE MATERIAL IS ESTIMATED AT 6,900 TONS, AND THE ANALYSIS NO. 1 IN THE FOLLOWING TABLE INDICATES THE GRADE FROM THE UPPER TWO FEET OF THE AUGER HOLE.

THE DEPOSIT ON LOT 1188 COVERS 26,600 SQUARE YARDS OF WHICH 7,775 SQUARE YARDS IS COVERED BY WHITE HYDROMAGNESITE STANDING SOMEWHAT HIGHER THAN THE REMAINDER. TWO HOLES WERE PUT DOWN IN THE WHITE MATERIAL AND SHOWED DEPTHS OF 2 AND 3 FEET BEFORE PASSING INTO BROWNISH EARTH. IT IS ESTIMATED THERE ARE 6,600 TONS OF PURE HYDROMAGNESITE IN THIS DEPOSIT AND OF A GRADE SOMEWHAT SIMILAR TO THAT GIVEN BY SAMPLE NO. 2 IN THE FOLLOWING TABLE:

ANALYSIS OF RISKE CREEK HYDROMAGNESITE

MADE BY MINES BRANCH, OTTAWA

SAMPLE:	No. 1	No. 2
SILICA	1.85	1.22
ALUMINA	0.48	0.48
FERRIC OXIDE	0.20	0.25
FERROUS OXIDE	0.16	0.09
MAGNESIUM OXIDE	41.74	41.14
CALCIUM OXIDE	0.17	0.10
CARBON DIOXIDE	40.85	37.70
WATER ABOVE 105°C	12.98	17.78
WATER BELOW 105°C	1.67	1.28
TOTALS:	100.10	100.03

1. FROM CENTRE OF DEPOSIT, LOT 178. SAMPLE 0 TO 24 INCHES FROM SURFACE.

2. TOWARDS SOUTHERN END OF DEPOSIT LOT 1188. SAMPLE 0 TO 26 INCHES FROM SURFACE.

CLINTON HYDROMAGNESITE DEPOSITS.

ACCORDING TO REINECKE THERE ARE THREE AREAS OF COMMERCIAL HYDROMAGNESITE SITUATED ABOUT 1 MILE EAST OF THE PACIF GREAT EASTERN RAILWAY STATION AT CLINTON AND ABOUT 275 FEET BELOW IT IN ELEVATION. AREA NO. 1 COVERS 260 SQUARE YARDS, AVERAGES $3\frac{1}{2}$ TO $4\frac{1}{2}$ FEET THICK AND CONTAINS 355 TONS OF PURE WHITE HYDROMAGNESITE; AREA NO. 2 COVERS 1,200 SQUARE YARDS, AVERAGES 2 FEET THICK AND CONTAINS 820 TONS; WHILE AREA NO. 3 COVERS 1,850 SQUARE YARDS, AVERAGES 2.6 FEET THICK AND CONTAINS 1,474 TONS OF PURE MATERIAL. THE COMBINED TONNAGE OF THESE THREE ADJOINING SMALL DEPOSITS IS THEREFORE 2,650, OF WHICH AMOUNT 965 TONS IS OF DOUBTFUL PURITY. THE FOLLOWING ANALYSIS IS TYPICAL OF ALL THREE DEPOSITS, THE SAMPLE BEING TAKEN FROM THE TOP 2 FEET OF THE DEPOSITS AND ANALYZED IN THE MINES BRANCH LABORATORY AT OTTAWA: SILICA, 2.30%; ALUMINA, 0.63%; FERRIC OXIDE, 0.13%; MAGNESIUM OXIDE, 41.60%; CALCIUM OXIDE, 0.22%; CARBON DIOXIDE, 35.88%; SULPHUR TRIOXIDE, 0.36%; WATER ABOVE 105°C, 17.50%; AND WATER BELOW 105°C, 1.12%.

MISCELLANEOUS OCCURRENCES.

IN ADDITION TO THE FOUR MAIN GROUPS OF HYDROMAGNESITE DEPOSITS MENTIONED ABOVE AS OCCURRING IN THE CLINTON MINING DIVISION, MANY OTHER SMALLER DEPOSITS ARE KNOWN TO EXIST THROUGHOUT THIS INTERIOR PLATEAU REGION, PARTICULARLY IN THE VICINITY OF 141-MILE HOUSE. THEY ALL EXHIBIT THE SAME TENDENCY TO FORM IN FLAT-LYING DEPRESSIONS, AND ARE GENERALLY ROUGHLY CIRCULAR OR OVAL IN OUTLINE AND STAND UP A FOOT OR TWO ABOVE THE SURROUNDING GROUND LEVEL, THEIR SURFACE RESEMBLING TO A MARKED EXTENT, THE CAULIFLOWER-TOP STRUCTURE.

Kamloops Mining Division

Several occurrences of hydromagnesite, generally of impure grade are found in this Mining Division. At a point about half a mile east of Buce Lake (17 miles east of Kamloops on the Kamloops—Vernon road), G.C. Scatchard of Kamloops has staked a deposit of hydromagnesite, called the Dolomite claim. The deposit occupies the bottom of an L-shaped depression and is approximately 20 acres in extent. A 4-foot pit at the junction of the L (which has sides 2,000 feet long and averaging 250 feet wide) has been sunk by the owner. A sample taken from the four sides of the pit from the surface to a depth of 3 feet was taken by the writer in 1931 and, upon analysis in the Bureau of Mines laboratory in Victoria, showed:— Insoluble, 30.5%; ferric oxide, 2.3%; alumina, 5.2%; calcium oxide, 0.95%; magnesium oxide, 28.9%; carbon dioxide, 27.95%; and water at 105°C, 4.1%. This is a very low-grade hydromagnesite.

More recently samples of hydromagnesite from the Kamloops area, (exact location not known to the writer), were submitted by L.V. Bennett of Kamloops. The sample submitted was analyzed in the Bureau of Mines laboratory and showed as follows: Loss on ignition, 54.2%; insoluble, 2.4%; iron oxide, 0.25%; alumina, 1.15%; calcium oxide, nil; and magnesium oxide, 41.0%. This is quite a good grade hydromagnesite.

No. 4 Mineral Survey District — Southern District

Magnesite occurs in the limestone and serpentine rocks of the Summit mine in the Greenwood Mining Division of this Mineral Survey District, according to notes by R.W. Brock in the 1903 Report of the G.S.C., Volume XV, page 123A. The occurrence is of no commercial interest.

No. 5 Mineral Survey District — Eastern District

Fort Steele Mining Division

What is undoubtedly the most important discovery of rock magnesite in British Columbia and possibly in North America, was made during the field season of 1932 by C.E. Cairnes of the Geological Survey of Canada while working in the Cranbrook—Marysville area. The deposit which is adjacent to and immediately south of Marysville, and close to the Kimberley-Cranbrook branch of the Canadian Pacific Railway, was described in a paper recently issued by the Survey. This report is reproduced here in detail.

"A MAGNESITE DISCOVERY NEAR CRANBROOK, B. C."

BY C.E. CAIRNES

"IN THE COURSE OF GEOLOGICAL FIELD WORK IN CRANBROOK DISTRICT, BRITISH COLUMBIA, THIS YEAR (1932), A LARGE AND CONVENIENTLY SITUATED DEPOSIT OF CRYSTALLINE, ROCK MAGNESITE WAS DISCOVERED.

THE DEPOSIT FORMS AN IMPORTANT PART OF A NARROW BELT OF MAGNESITE-BEARING SEDIMENTS EXTENDING IN A N.N.E.-S.S.W. DIRECTION BETWEEN ST. MARY RIVER AND PERRY CREEK AND IS WITHIN A FEW HUNDRED YARDS OF THE ROAD FROM MARYSVILLE. THE MOST NORTHERLY EXPOSURES OBSERVED OCCUR ALMOST DIRECTLY SOUTH OF MARYSVILLE AND LESS THAN A MILE SOUTH OF AND ABOUT 400 FEET ABOVE ST. MARY RIVER. FROM THIS POINT THE BELT WAS TRACED TO WITHIN A MILE OF PERRY CREEK. AS EXPOSED IT HAS AN AVERAGE WIDTH OF 150 FEET OR MORE, AN AVERAGE AND FAIRLY REGULAR DIP OF 60 DEGREES W.N.W., A LENGTH OF OVER FOUR MILES, A VERTICAL RANGE OF ABOUT 2,000 FEET, AND A CONTAINED AVERAGE WIDTH OR WIDTHS OF CRYSTALLINE MAGNESITE CONSERVATIVELY ESTIMATED AT 30 FEET AND POSSIBLY AMOUNTING TO 50 FEET OR MORE.

THE PURER MAGNESITE OCCURS TOWARDS THE MIDDLE OF THE MAGNESITE BELT. IT VARIES FROM COARSE TO FINELY CRYSTALLINE, WEATHERS ROUGH, AND IS COMMONLY COATED RUSTY-BROWN. FRESH SURFACES ARE PEARLY GREY, WHITE AND CREAM. IN PLACES THE MAGNESITE MAY BE TRAVERSED BY IRREGULAR, SMALL VEINS AND VEINLETS OF QUARTZ BUT FOR THE MOST PART SEEMS RELATIVELY FREE OF VISIBLE IMPURITIES. ON EITHER SIDE THE PURER MAGNESITE BODY GRADES INTO MATERIAL CONSISTING CHIEFLY OF MAGNESITE INTERBANDED WITH NARROW BEDS OF QUARTZITE AND ARGILLITE. MOST OF THE BETTER GRADE MAGNESITE FORMS A SINGLE BAND WHICH, THOUGH NOT CONTINUOUSLY EXPOSED, IS PROBABLY NOWHERE LESS THAN 15 TO 20 FEET THICK AND IN PLACES WAS OBSERVED TO HAVE A THICKNESS OF AT LEAST 50 FEET. LOCALLY, TOO, THE MAGNESITE BELT INCLUDES ONE OR MORE OTHER BANDS OF GOOD-LOOKING MAGNESITE UP TO SEVERAL FEET THICK.

TWO CHIP-SAMPLES OF THE MAGNESITE DEPOSIT WERE OBTAINED AT POINTS 1½ AND 3 MILES SOUTH OF ST. MARY RIVER AND ABOUT 1,000 AND 2,000 FEET, RESPECTIVELY, ABOVE THE RIVER. THE SAMPLES (NOS. 388-R AND 330 REPRESENT WIDTHS OF 18 FEET AND 50 FEET OF THE PUREST-LOOKING MAGNESITE AT THESE RESPECTIVE LOCALITIES. IN ADDITION, AND PARTICULARLY AT THE MOST NORTHERLY POINT, THERE APPEARED TO BE MUCH MATERIAL WHICH COULD BE READILY SORTED TO PROVIDE MAGNESITE OF THE SAME GRADE AS THE SAMPLES. THE SAMPLES WERE SUBMITTED TO THE MINES BRANCH, DEPARTMENT OF MINES, OTTAWA, FOR ANALYSES AND WERE FOUND TO CONTAIN:-

	No. 388-R	No. 330
SiO_2	4.54%	4.40%
Fe_2O_3	2.40	1.44
Al_2O_3	.40	.66
CaO	.79	.73
MgO	43.70	44.80
LOSS ON IGNITION	48.00	48.00

THESE ANALYSES, SAVE IN THEIR RATHER HIGH SILICA CONTENT, COMPARE FAVOURABLY WITH THOSE OF THE MORE IMPORTANT COMMERCIAL DEPOSITS OF MAGNESITE THE WORLD OVER. THESE ARE ANALYSES OF CHIP SAMPLES TAKEN AT OR CLOSE TO THE SURFACE AND CONSEQUENTLY ARE SUBJECT TO WHATEVER CHANGES WEATHERING MAY PRODUCE AS WELL AS SUCH INACCURACIES AS THIS METHOD OF SAMPLING INVOLVES; ON THE OTHER HAND, IN ACTUAL OPERATION IT MIGHT BE POSSIBLE, BY EXPERIENCED SORTING, TO REMOVE MUCH OF SUCH IMPURITIES AS ARE PRESENT AND THEREBY SECURE A HIGHER GRADE PRODUCT THAN THAT INDICATED BY AN AVERAGE SAMPLE."

SINCE THIS REPORT WAS ISSUED IN JANUARY, 9 CLAIMS WERE STAKED BY THE CONSOLIDATED MINING AND SMELTING COMPANY ALONG WHAT IS SUPPOSEDLY THE OUTCROP OF THE MAGNESITE. THE CLAIMS COMMENCE NEAR THE TOWN OF MARYSVILLE AND EXTEND IN A SOUTHERLY DIRECTION FOR APPROXIMATELY 2 MILES.

ROCK MAGNESITE IS ALSO KNOWN TO OCCUR TO THE WEST OF THIS AREA, NEAR THE HEADWATERS OF PERRY CREEK, WHERE THE CONSOLIDATED COMPANY HELD SEVERAL CLAIMS. THE PERRY CREEK DEPOSITS ARE NOT NEARLY AS EASY OF ACCESS AS THE MARYSVILLE DISCOVERY, BEING ABOUT 23 MILES BY ROAD AND SEVERAL MILES BY TRAIL FROM THE CITY OF CRANBROOK.

REVELSTOKE MINING DIVISION

THE FOLLOWING NOTE BY E.D. INGALL APPEARS IN THE 1896 REPORT OF THE G.S.C., VOLUME IX, NEW SERIES, PAGE 96'S: "MAGNESITE ALSO OCCURS NEAR ILLECILLEWALT, B.C. BUT IT HAS NOT BEEN FOUND IN COMMERCIAL QUANTITIES."

NO. 6 MINERAL SURVEY DISTRICT — WESTERN DISTRICT

LILLOOET MINING DIVISION

REFERENCES: 1. C.W. DRYSDALE IN G.S.C. SUMMARY REPORT 1915, PAGES 81 — 84.

2. C.W. DRYSDALE IN G.S.C. SUMMARY REPORT, 1916, PAGES 48 — 52.

THE DEPOSITS OF ROCK MAGNESITE DISCOVERED BY C.W. DRYSDALE OF THE G.S.C. IN HIS FIELD WORK OF 1914 ARE SITUATED ON THE EAST AND WEST SIDES OF THE SOUTH END OF LIZA LAKE IN THE LILLOOET MINING DIVISION. THE OCCURRENCES ARE REACHED BY OVER 30 MILES OF ROAD AND SEVERAL MILES OF TRAIL FROM BRIDGE RIVER STATION ON THE PACIFIC GREAT EASTERN RAILWAY. BRIDGE RIVER IS 152 MILES BY RAIL AND BOAT FROM VANCOUVER AND, DUE TO TRANSPORTATION DIFFICULTIES FROM THE PROPERTY, AS COMPARED TO MORE ADVANTAGEOUSLY LOCATED MAGNESITE DEPOSITS OF THE PROVINCE, IT WOULD SEEM THAT MANY YEARS MUST ELAPSE UNTIL THE COMMERCIAL POSSIBILITIES OF THE DEPOSIT ARE REALIZED.

THE MAGNESITE OCCURS AS BOTH MASSIVE AND CRYSTALLINE ROCK VARIETIES AS MASSES AND VEINS IN SERPENTINED MAGNESIUM ROCKS OF THE AREA. MUCH FLOAT IS FOUND IN THE AREA AND THE MAIN OUTCROP, WHICH MEASURED 52 FEET WIDE BY 48 FEET LONG, OCCURS AT ABOUT 4,300 FEET ELEVATION.

THE DEPOSITS ARE IRREGULAR IN CHARACTER AND CLOSELY RESEMBLE THE CALIFORNIA DEPOSITS. THE MAGNESITE IS BUFF—YELLOW IN COLOUR AND THE FOLLOWING ANALYSES WERE MADE BY MR. TURNER AND D.M. STEWART OF THE MINES BRANCH STAFF AT OTTAWA, ON SAMPLES COLLECTED IN 1915 AND 1916 BY DR. DRYSDALE:

BRIDGE RIVER MAGNESITE ANALYSES

SAMPLE:	No. 1	No. 2	No. 3
MAGNESIUM OXIDE	43.42%	42.20%	28.14%
CALCIUM OXIDE	0.46	3.25	18.48
FERROUS OXIDE	0.56	....	....
FERRIC OXIDE	0.25	0.95	1.64
ALUMINA	0.23	0.59	0.92
CARBON DIOXIDE	47.28	48.55	45.18
SILICA	7.46	4.08	4.08
WATER ABOVE 105°C	0.58	....	....
WATER BELOW 105°C	0.10	....	....
TOTALS:	100.34	99.62	98.44

1. FROM NORTH-EAST SIDE OF VALLEY NEAR LIZA LAKE — ANALYST, MR. TURNER.
2. MASSIVE VARIETY FROM NORTH-WEST END OF LIZA LAKE — ANALYST, D.M. STEWART.
3. CRYSTALLINE DOLOMITIC VARIETY FROM SAME LOCALITY AS (2) ANALYST, D.M. STEWART.

CONCLUSIONS

IN REVIEWING BRIEFLY THE INFORMATION CONTAINED IN THIS REPORT, IT IS APPARENT THAT B.C. IS AMPLY SUPPLIED WITH RESERVES OF BOTH ROCK AND EARTHY VARIETIES OF MAGNESITE. ONLY SOME OF THE DEPOSITS ARE WELL LOCATED HOWEVER FOR ECONOMICAL OPERATION, SHOULD SUITABLE MARKETS FOR MAGNESITE AND ITS MANUFACTURED PRODUCTS BE DEVELOPED IN THE NEAR FUTURE.

THE NEWLY DISCOVERED DEPOSIT OF CRYSTALLINE ROCK MAGNESITE FOUND NEAR CRANBROOK IS THE MOST IMPORTANT OF THE PROVINCIAL RESERVES, BOTH IN POINT OF TONNAGE INDICATED AND ACCESSIBILITY, AND WHEN IT IS RECALLED THAT IT IS SITUATED IN THE SAME GENERAL AREA AS THE KITCHENER IRON DEPOSITS, IT MAY SOME DAY BE DEVELOPED TO PROVIDE REQUISITE REFRACTORY MATERIALS FOR THE MANUFACTURE OF IRON AND STEEL IN THAT SECTION OF THE PROVINCE. IT WILL POSSIBLY BE DEVELOPED IN A SMALL WAY IN THE IMMEDIATE FUTURE TO SUPPLY THE MAGNESITE REFRACTORIES NOW USED BY THE TRAIL SMELTER.

THE PRESENT MARKETS AS PREVIOUSLY INDICATED ARE LOCALLY SMALL AND THE PROHIBITIVE PROTECTIVE TARIFF ON EXPORTS TO THE UNITED STATES EFFECTIVELY CURTAILS EXPANSION OF MARKETS TO THE SOUTH. SOME ATTENTION AND INVESTIGATION OF THE ORIENTAL MARKET MIGHT BE WORTH WHILE AS THE JAPANESE PARTICULARLY ARE WITHOUT VISIBLE NATIONAL SUPPLIES OF MAGNESITE.

BIBLIOGRAPHY

In addition to the references to published reports contained throughout this report, the following general references are included for those desiring a more extended knowledge of the subject.

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3. "The Magnesite Deposits of Washington, Their Occurrences and Technology," by Geo. S. Whitell and E.N. Patty, Washington Geological Survey Bulletin No. 25, 1921, 194 pages.

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