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Submission To
MALIBU METALS LTD. (N.P.L.)

JESMOND LIME PRODUCTS
CLINTON MINING DIVISION
LILLOOET LAND DISTRICT
BRITISH COLUMBIA

BY

TERENCE A. ROURKE, P.Eng. (P.Q.)
LIME PRODUCTS CONSULTING ENGINEER

14 APRIL 1971

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- ANNEX: B Report "Jesmond Limestone Corporation Quarry" by J. W. McCammon dated 9 September 1970

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- Figure: 1 Map showing General Location Details of Leases and Reserve Areas of Jesmond Deposit

TERENCE A. ROURKE, P.Eng. (P.Q.)
LIME PRODUCTS CONSULTING ENGINEER
UPPER LONG BEACH ROAD
R.R.#3, NELSON, British Columbia

14 April 1971

Malibu Metals Ltd. (N.P.L.),
Suite 428 - 510 West Hastings Street,
VANCOUVER, British Columbia.

Dear Sirs,

RE: JESMOND LIME PRODUCTS, CLINTON MINING DIVISION
LILLOET LAND DISTRICT, BRITISH COLUMBIA

The conclusions and recommendations of this presentation are based on my personal examination of large specimen samples of limestone from the Jesmond deposit, a study of aerial photographs, governmental maps and reports and a detail review of report entitled "Jesmond Lime Products, Operational Plan" by Warren H. Westphal, former Chairman of Earth Sciences Division, Stanford Research Institute, describing details about the deposit and recommendations for potential quarrying and lime production purposes (see Annex: A), and report by J. W. McCammon, Geologist of the B.C. Department of Mines, describing geological and chemical sample-results characteristics (see Annex: B) of the deposit, in addition results of other chemical analyses by various laboratories. These reports and background data provide a sound basis for my conclusions that the Jesmond Limestone Deposit affords a good possibility for the establishment of quarry and lime production facilities to service the potential demand for limestone and lime products of the various industrial requirements of British Columbia, especially the pulp mills, mining operations and building construction needs of the interior of the province.

Reference is to Figure: 1 for location details of the Leases and reserve areas of the Jesmond Deposit.

The grab sample analyses of the British Columbia Department of Mines confirms the typical appearance of the good grade limestone of the samples of Westphal from the potential quarrying area. Because of the high calcium carbonate content of these samples and the large area exposed as mapped in the report, the deposit warrants detailed investigation as well as supporting economic marketing studies to assess feasibility of limestone production potentialities of the deposit.

It is recommended that:

1. As the area is covered with little overburden, a diamond drilling programme should be carried out with minimum 200' long large-diameter core holes spaced at 200' x 200'; to prove up the continuity of the quality of the stone of the deposit and the quantity of stone available for marketing based upon a market survey.

2. A bulk sample programme, involving quarry pre-development work should be carried out with test runs of large tonnages of limestone to be supplied to present consumers of high calcium limestone to prove its suitability for use in their processes, viz. pulp mills and mine concentrator usage.

3. A sample of typical stone of correct size should be tested by one or two of the lime kiln manufacturing companies to prove the suitability for processing into lime and the type of process equipment and processes.

4. A market survey should be conducted to assess the present and future consumers of limestone and of lime, especially those markets that could be converted over to the use of quick lime instead of limestone (pulp mills) or to the use of British Columbia provincially produced lime, rather than present import sources.

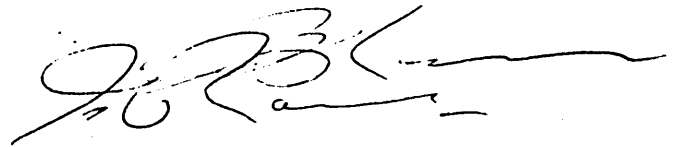
5. An engineering study of a suitable plant installation.

The estimated cost of the above programme is set as follows:

1. Access Preparation to Working Area.....	\$10,000.00
2. Diamond Drilling 2,000 feet.....	\$20,000.00
3. Feasibility Economic Market Study.....	\$10,000.00
4. Bulk Sampling.....	\$10,000.00
5. Administration and Miscellaneous.....	\$10,000.00

On completion of this study programme, or during the progress thereof, additional specific studies may be required which may require some revision to the programme expenditure.

Respectfully submitted,



TERENCE A. ROURKE, P.Eng. (P.Q.)
LIME PRODUCTS CONSULTING ENGINEER

TAR/WJW/et

CERTIFICATE OF QUALIFICATIONS

I, Terence A. Rourke, P.Eng. (P.Q.), Lime Products Consulting Engineer, of Upper Long Beach Road, R.R.#3, Nelson, British Columbia hereby certify that:

1. I am a graduate of Mining Engineering of Queen's University, Kingston, Ontario, B.Sc., 1948 and have been practising my profession for 23 years.
2. I am Vice-President of Dominion Lime Ltd., a company incorporated in the Province of Quebec and have been responsible since 1950 for the design and operations of the quarrying and lime calcining production facilities and the marketing therefrom of the products in Eastern Canada and North Eastern United States.
3. I am a member of the Corporation of Engineers of Quebec.
4. I am a member of the Canadian Institute of Mining and Metallurgy.
5. I am a member of the Engineering Institute of Canada.
6. I am a member of the American Society of Testing Materials.
7. I have been a Director of the National Lime Association and of the Canadian Lime Association.
8. I have no direct or indirect interest whatsoever in Jesmond Lime Products Properties or Associations, or in Malibu Metals Ltd. (N.P.L.); nor do I expect to receive any interest, direct or indirect in the properties of Jesmond Lime Products or Associations or Malibu Metals Ltd. (N.P.L.) or any affiliate or any security of the companies or affiliates.
9. The findings of the accompanying report are based on my personal examination of samples and review of all available information of the Jesmond Lime Products.

Dated at Vancouver, British Columbia, this 14th day of April 1971.



TERENCE A. ROURKE, P.Eng. (P.Q.)
LIME PRODUCTS CONSULTING ENGINEER

APPENDICES

WARREN H. WESTPHALVICE PRESIDENT - MINERAL RESOURCES

ROLE AT IOC: Chief Mineral Exploration
and Technical Officer

BUSINESS HISTORY

1959 - 1969

STANFORD RESEARCH INSTITUTE, California

Manager - Mineral Resources Programs, Senior Geophysicist, supervised world-wide natural resources exploration and geophysical research programs, responsible for applied earth science research programs with emphasis on exploration and evaluation technology; responsible for application of computer technology to natural resources exploration; carried out extensive field investigations in North America, South America and Far East.

1956 - 1959

UTAH CONSTRUCTION & MINING COMPANY

Chief Geophysicist in iron, uranium and coal exploration; recognized the Shirley Basin of Utah as having a significant uranium potential and led Utah Construction in filing the first claims in the area; later found uranium ore that is now valued at several billion dollars.

1955 - 1956

TIDEWATER ASSOCIATED OIL COMPANY

Senior Geologist in Uranium Department

1947 - 1954

NEW JERSEY ZINC COMPANY

Geologist and Geophysicist in laboratory and geophysical field operations in U.S. and Canada.

EDUCATION

1947

A.B. in Geology - Columbia University

JESMOND LIME PRODUCTS

OPERATIONAL PLAN

The purpose of this venture is to produce limestone and quick lime near Clinton, B.C. for the expanding British Columbia industrial, minerals, and pulp and paper enterprises. The business plan involves two stages:

- | | | |
|----------|---|--------------------------------|
| Stage I | - | Limestone Production and Sales |
| Stage II | - | Lime Production and Sales |

GENERAL DESCRIPTION

Location and Access

The proposed operation is in the Marble Range near Clinton, B.C. (Figure 1) at approximately $51^{\circ}06'N$, $121^{\circ}52'W$. The principal limestone deposits in the area are located north of Kelly Creek and east of Porcupine Creek about 12 miles northwest of Clinton at elevations of 4,000 to 7,000 feet. (Figure 2). The Pacific Great Eastern Railroad runs through the valley of Kelly Creek about 12 miles from the proposed quarry site on Porcupine Creek. Rail mileages from Kelly Lake to Tidewater at Squamish are 150 miles and to North Vancouver 194 miles.

Road access is via an all-weather gravel road from Clinton. Mileage from Clinton to the quarry site is 20 miles.

Property

E.J. Taylor-Smith made applications in November 1969 for 12 square miles (7,680 acres) of limestone leases covering the majority of the accessible outcrops of limestone in the area. According to the B.C. land Act of 1970 only two leases or 1,280 acres can be granted to one individual or corporation. The two leases selected are 0294888 and 0294889 on the northern tier of the application block (Figure 3). Discussions with the Director of Lands for B.C., Mr. W. Redel, on October 15th, 1970 indicated that the applications are in order and that there will be no reason not to grant at least one and perhaps both leases upon proof of bona-fide production plans and compliance with the survey and rental provisions of the Land Act. Mr. Redel also indicated that it is the policy of the Minister of Lands to establish map reserves to protect the viability of industrial enterprises. Thus it is likely that the remaining 10 or 11 square miles of lease applications will be put into a map reserve once quarry production is achieved.

Climate and Vegetation

The Marble Range lies in the B.C. Interior Dry Belt. The higher coastal ranges on the west are orographic barriers to the prevalent eastward moving Pacific storms. At Lillooet, the nearest weather station 30 miles south of Jesmond, the average annual precipitation over a 41 year period was 12.35 inches. Other smaller open pit operations in the area close down for only one or two days each winter because of heavy snowfalls. Summers are warm and winters cool. The minimum winter temperature is about -10 in January with a maximum of 106 degrees in July.

Vegetation is generally sparse but the western slopes are covered in places with dense pines, fir, and spruce forests. Timber line is 6,500 feet. The proposed Jesmond quarry is immediately below timber line. The proposed plant site is covered with a moderately dense fir and spruce forest.

General Geology

The Jesmond Limestone deposit lies in the Coastal Ranges of the Western Cordillera. The rocks of the Marble Range, which contains the deposit, lie within the Permian Cache Creek Group composed of massive limestone (Marble Canyon Limestone) volcanic material, cherty quartzites and serpentines. (Trettin, 1961) * The total thickness of the group is 9,500 of which the massive limestones of the Marble Canyon limestone make up 3,000 feet. The proposed Jesmond Limestone quarry lies in Member 111 of this Marble Canyon formation.

Member 111 is composed mainly of limestone with local small amounts of interbedded chert and argillite. It forms a high ridge about 13 miles long. Member 111 has a stratigraphic thickness of 1,000 feet. In the vicinity of the proposed quarry folding gives an apparent thickness of close to 3,000 feet. The limestone is pure and massive and shows no bedding. In some localities, alternating light grey and dark grey layers are visible. These layers differ in grain size and in the proportion of minute inclusions in the carbonate.

The Marble Range is an up-lifted thrust block with major faults separating the limestone from the Pavilion Group cherts, argillites, and tuffs to the west. (Campbell and Tipper, 1966)

* References at end

Limestone Grade

Analysis of a series of samples along a 450 foot bench opened by Jesmond Limestone Corporation and samples over the entire face by Jesmond and the B.C. Department of Mines are shown on Table 1 and Appendix "A". The average of these samples are:

CaO	55.17 %
CaCO ₃	98.40 %
Al ₂ O ₃	0.23 %
Fe ₂ O ₃	0.08 %
MgO	0.27 %
SiO ₂	0.35 %
L.O.I.	43.57 %
S	0.002 %
MnO	0.003 %
H ₂ O	0.06 %

Quarry Location

The proposed site of the quarry is at an elevation of about 6,000 feet, about 500 feet above the proposed plant site. The site was selected because of the absence of overburden and the presence of a good quarry face. One bench, 35 feet wide, 25 feet high, and 450 feet long has been opened to provide data on drilling characteristics and samples. Except for a 20 foot section adjoining the west boundary of the limestone against a fault no impurities such as silica, chert, or calcite were noted. In the 20 foot basal section the major impurity was petroleum stain and an increase in silica to 2.75 % (Appendix "A").

99.735 %
 .265 %

Reserves

The proposed initial quarry will be 400 feet long, 600 feet deep, and the final face 400 feet high. The reserve of high calcium limestone in this quarry is estimated to be 4,000,000 tons. At least three other quarries of similar size can be developed on the initial 640 acre lease giving a potential reserve of about 16,000,000 tons. At an ultimate production rate of 500,000 tons per year the productive life of the least would be 32 years. At least equal tonnages are available on the 12 other lease applications in the area.

STAGE I - LIMESTONE OPERATIONS

Operation Descriptions

The objective of Stage I is to place a modest limestone quarry into operations by early spring 1971. Production during 1971 will be a minimum of 50,000 tons and a maximum of 100,000 tons at a minimum rate of 300 tons per day on a one shift basis. Quarry operations will require a track mounted percussion drill with attached 600 CFM compressor, a 3 cubic yard front end loader, and a D-6 tractor for quarry floor clean-up. Crushing and screening will be by a 100/tons/hour plant. Pulp stone and other plus 10 mesh stone will be shipped via Pacific Great Eastern Railroad from Kelly Lake. This material will be trucked via truck from the quarry to the Kelly Lake siding. Glass stone and some pulp stone will be trucked to Kamloops and V ernon area by common carrier trucks.

100 tons/h
min
?

All operational plans are drawn on the assumption that the ultimate objective is to place into production by 1975 a 100,000 tons per year lime kiln operation plus a 100 to 200,000 ton per year limestone production schedule. Shipment from the kiln and quarry may be via a rail spur to the plant site from Kelly Lake in Stage 2 hence investment in over-the-road haulage trucks will be minimal in Stage 1.

ESTIMATED MARKET - STAGE 1

Assumed Markets

A market for Jesmond Lime Products limestone in 1971 is estimated as follows:

<u>PRODUCT</u>	<u>AVERAGE PRICE</u>	<u>ANNUAL MINIMUM</u>	<u>TONNAGE MAXIMUM</u>
Pulp Stone	\$3.50 FOB	25,000	63,000
Glass Stone	11.00 Del. Average	15,000	22,000
Bagged	20.00 Del. Average	10,000	15,000

In addition to these sales it may be possible to develop a 30,000 ton market for agricultural limestone per year in the Fraser Valley; an additional 20,000 tons of pulp stone at \$3.50 per ton; and miscellaneous other sales up to 10,000 tons. Operational plans do not however, include these other possible sales although no additional quarry equipment or capital investments would be necessary to meet these additional markets and economy of scale would sharply increase profits.

Net Profit Before Taxes - Summary - 1972

Total Annual Production rate	175,000
Net - Pulp Stone	\$108,000
Net - Glass Stone Vernon	66,200
Glass Stone Vancouver	28,700
Glass Stone Seattle	8,200
Net - Bagged	<u>83,000</u>
	\$294,100

STAGE II - LIME PRODUCTIONOperation Description

The objectives of Stage II are to a) continue the production and sales of limestone and 2) install and place into production a 200 to 300 tons per day lime kiln. The primary development phase in this stage will involve the establishment of a lime market position in British Columbia, engineering and erection of a kiln, and start-up operations. The limestone production facilities used in Stage I will provide sufficient rock for both a continued sale of limestone and production of lime.

Schedule

The present operational plans for Stage II are not well developed and can only be summarized here. It is expected however, that sufficient firm marketing, engineering, and other information will be available by mid 1971 to allow a decision to be made concerning the size, type, and production schedule for a lime plant. In any case plant design and installation will require 12 to 16 months placing the earliest production date into late 1972.

Preliminary Market Data

The consumption of lime in B.C. grew about 25% between 1963 and 1967. The expansion of paper mills and ore concentration milles in B.C. will double the consumption in the next 10 years from the present 100,000 tons to 200,000 tons. The use of lime in air and water pollution control is expected to grow substantially in the next decade. In general the lime market growth appears favorable. In 1969 the consumption exceeded the 1968 consumption by 8%.

A conservative estimate of the market based on the above for Jesmond lime starting in mid 1972 is 75,000 tons in British Columbia. Currently chemical lime sells for \$26.00 delivered in Vancouver and substantially higher in the interior because of increased freight rates. Very preliminary estimates indicate lime from the Jesmond operation can be competitive in the Vancouver area and substantially cheaper in the interior.

Proposed LIME Plant - General Description

Jesmond Limestone proposes to install a 200 to 300 tons per day lime plant at a site immediately below the quarry. This plant would utilize standard short rotary kilns with a pre-heater. Rock would be transported to the plant by a conveyor from the crushing plant.

The kiln would be fired by both gas and oil. A four inch gasline serves Clinton about 20 miles to the east. An estimated consumption of 4.2 million cubic ft. per day for a 350 tpd plant would probably require a new line to Clinton to supplement the present four inch line. Standby fuel oil facilities would be needed for winter operations when gas service is interrupted.

Power is available within 0.2 miles of the proposed plant. Two 500 KV lines and one 250 KV line of B.C. Hydro pass through the Porcupine Creek Valley.

Preliminary Operating Costs - Initial Lime Production

Limestone Costs - 250,000 tons/year

100,000 tons limestone and 150,000 tons for lime plant (75,000 tons of lime).

Quarry Labor	\$72,000	
Supervision	78,000	
Supplies & Repairs	50,000	
Overhead	35,000	
Land Rental	13,000	
Capital Depreciation	41,000	
Royalty 20 cents/ton	<u>50,000</u>	
	TOTAL	\$339,000
	PER TON	\$1.35

Lime Plant 200 tons/day

Labor & Supervision	165,000	
Fuel	360,000	
Power	27,000	
Supplies & Repairs	15,000	
Overhead	124,000	
Capital Depreciation	<u>150,000</u>	
	TOTAL	\$841,000
	PER TON	\$11.20

Summary - Preliminary Costs and Revenues - Lime

Limestone	\$1.35	\$339,000
Lime kiln	11.20	841,000
Sales Cost 10%	1.75	141,250
Freight - Vancouver	<u>6.40</u>	<u>48,000</u>
TOTAL COSTS	\$20.70	\$1,369,250
Revenue	<u>26.00</u>	<u>1,950,000</u>
NET REVENUE	\$ 5.30	\$ 581,000