ARIS SUMMARY SHEET

District Geologist, Victoria

Off Confidential: 89.05.30

ASSESSMENT REPORT 17433 MINING DIVISION: New Westminster

PROPERTY: Coquihalla North
LOCATION: LAT 49 29 00 LONG 121 16 00
UTM 10 5482412 625550
NTS 092H06W
CLAIM(S): Tax 51-56,N 27
OPERATOR(S): Border Res.
AUTHOR(S): Hall, P.;Hackl, R.P.
REPORT YEAR: 1988, 7 Pages
COMMODITIES
SEARCHED FOR: Nickel
GEOLOGICAL
SUMMARY:

The Coquihalla serpentine belt trends south to north along a line some 20 kilometres east of Hope, B.C. The serpentine belt is up to several kilometres wide. It comes closest to the surface on the company's two blocks of claims where it outcrops along ravines and in cliff faces. A shallow dunite cap usually overlies the serpentine proper. Nickel mineralization is widely dispersed as microscopic needles throughout the serpentine.

WORK
DONE: Geochemical
META 1 sample(s) ;NI
MAP ILE: 092HSW135

17433

Province of British Columbia

Ministry of Energy, Mines and Petroleum Resources

ASSESSMENT REPORT TITLE PAGE AND SUMMARY

TYPE OF REPORT/SURVEY(S)	TOTAL COST
Metallurgical	$1500.

AUTHOR(S) Peter Hall, BA ..... SIGNATURE(S) .....

Ralph P. Hackl .....

DATE STATEMENT OF EXPLORATION AND DEVELOPMENT FILED 30 May 1988 YEAR OF WORK 1988

PROPERTY NAME(S) Coquihalla North Group

COMMODITIES PRESENT Ni

B.C. MINERAL INVENTORY NUMBER(S), IF KNOWN

MINING DIVISION New Westminster NTS 92H6

LATITUDE 49°29'N LONGITUDE 121°16'W

NAMES and NUMBERS of all mineral tenures in good standing (when work was done) that form the property [Examples: TAX 1-4, FIRE 2 (12 units); PHOENIX (Lot 1706); Mineral Lease M 123; Mining or Certified Mining Lease ML 12 (claims involved)]:

TAX. 51-56; N22-27, 28FR, 29FR; GWH. 2; G. 1-2

Record Nos.: 21629-34(5); 26333-40(7); 26025(7); 29430-31(7)

OWNER(S)

(1) BORDER RESOURCES LTD. (2) .....

FILMED

MAILING ADDRESS

5132 Alderfeild Place,
West Vancouver, B.C. V7W 2W7

OPERATOR(S) (that is, Company paying for the work)

(1) (as above) (2) .....

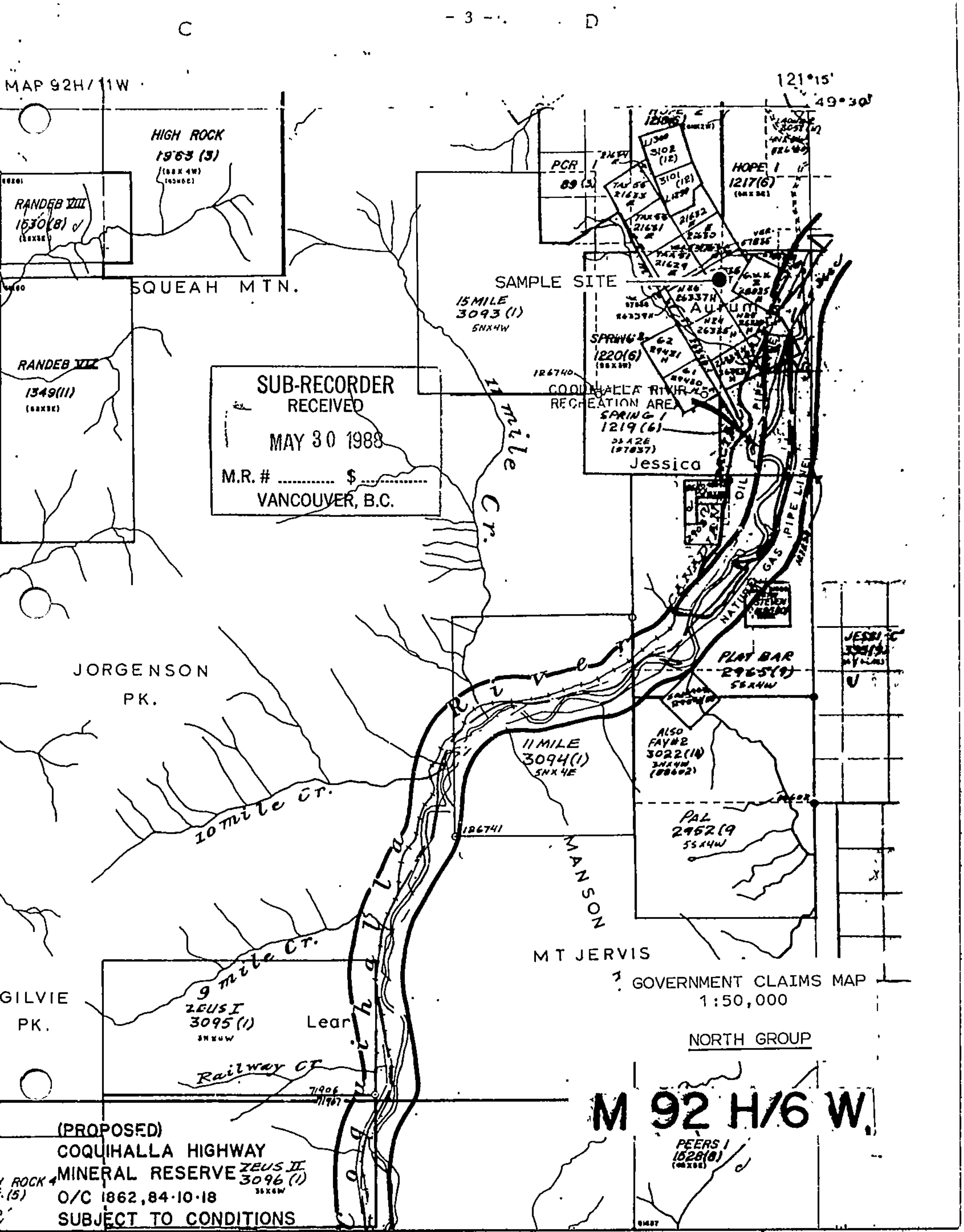
MAILING ADDRESS

SUMMARY GEOLOGY (lithology, age, structure, alteration, mineralization, size, and attitude):

The Coquihalla serpentine belt trends south to north along a line some 20 km East of Hope, B.C., to well into the Interior of the Province. Its width extends to several km in places. It comes closest to the surface on the Company's two blocks of claims where it outcrops along ravines and in cliff faces. A shallow dunite cap usually overlies the serpentine proper. The projected value of the serpentine lies in the presence of nickel mineralization widely dispersed throughout it in a microscopic needle format.

REFERENCES TO PREVIOUS WORK

(over)


C
D
MAP 92H/11W
121°15'
49°30'
HIGH ROCK
1963 (3)
RANDEB VIII
1630(8)
SQUEAH MTN.
RANDEB VII
1349(11)
PCR
89 (3)
HOPE I
1217(6)
SAMPLE SITE
15 MILE
3093 (1)
5NX4W
SPRING 2
1220(6)
COQUIHALLA RIVER
RECREATION AREA
SPRING I
1219 (6)
Jessica
SUB-RECORDER
RECEIVED
MAY 30 1988
M.R. # .... $ ....
VANCOUVER, B.C.
11 mile Cr.
NATURAL GAS PIPE LINE
OIL
JORGENSON
PK.
River
PLAT BAR
2965(9)
5SX4W
11 MILE
3094(1)
5NX4E
ALSO
FAY #2
3022(11)
10 mile Cr.
126741
MANSON
PAL
2962(9
5SX4W
9 mile Cr.
MT JERVIS
GILVIE
PK.
ZEUS I
3095 (1)
Lear
Railway Cr.
GOVERNMENT CLAIMS MAP
1:50,000
NORTH GROUP
M 92 H/6 W.
PEERS I
1628(8)
(PROPOSED)
COQUIHALLA HIGHWAY
MINERAL RESERVE
ZEUS II
3096 (1)
O/C 1862,84·10·18
SUBJECT TO CONDITIONS

GIANT BAY

Suite 107F Discovery Park
3700 Gilmore Way
Burnaby, B C Canada V5G 4M1

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GEOLOGICAL BRANCH
ASSESSMENT REPORT

April 25, 1988

BIOLEACHING OF BORDER RESOURCES ORE FOR NICKEL RECOVERY

17,433

INTRODUCTION

Border Resources owns a large low grade serpentine nickel deposit located in British Columbia. Previous work performed by CANMET to produce an upgraded product by flotation or magnetic separation met with limited success. CANMET concluded that the ore was too low grade and recommended continued exploration to search for zones of better mineralization.

Giant Bay Biotech Inc. was contracted by Border Resources to explore the possibility of bioleaching for nickel recovery. It was felt that a biological heap leach method for treating the low grade ore directly might prove to be economically feasible.

This report summarizes the results of a preliminary bioleach amenability assessment which was performed on the Border Resources ore.

SAMPLE

The sample of serpentine was obtained at a location 2/3 NW on B cation of N-27 and about 5 metres east, at elevation 707 metres.

Giant Bay received a 2 kg rock fragment sample on February 26, 1988. The sample was crushed and pulverized to 70% minus 200 mesh prior to assaying and bioleaching. The sample assayed as follows:

4.71% Fe	0.13% S_T
0.16% Ni	0.12% S^{2-}
0.008% Co	

The nickel assay was done two different ways: one method involved digesting the sample with aqua regia and the other involved a high temperature peroxide fusion of the sample. The latter method breaks down the entire sample including any silicates which may encapsulate nickel. The results were as follows:

aqua regia:	0.15% Ni
peroxide fusion:	0.16% Ni

The peroxide fusion assay was considered to be more accurate and was used for all subsequent bioleach extraction calculations.

BIOLEACH TESTS

Procedures

Bioleach tests were performed in 250 mL capacity shake flasks at 35 ^{o}C. To start the test, the desired weight of pulverized ore was mixed with water and bacterial nutrient salts, and the pH of the test was stabilized at 2 by adding 12N H_2SO_4. The test was then inoculated with a culture of the sulphide oxidizing bacterium Thiobacillus ferrooxidans, and the test was continuously agitated by placing the flask on a gyratory shaker.

The flasks were sampled daily for pH, redox potential (Eh) and dissolved iron and nickel. If necessary, acid was added to maintain the pH in the range 1.8-2.2. A visual microscopic examination of the leach solutions was periodically made to check for the presence of active bacteria.

Three shake flask tests were performed; bioleach tests at 10% and 20% pulp density, and a sterile control test at 10% pulp density in which 5 mL of a dilute bactericide (thymol) was added to ensure no biological activity occurred. The control test was in

effect a chemical acid leach test in which the acid soluble nickel and iron content of the ore was determined.

Results

The tests required the addition of 22.1 kg H_2SO_4 per tonne of ore to bring the pH down to 2. Throughout leaching, further acid additions were required to maintain the pH at 2. After 21 days leaching, approximately 69.8 kg/t acid had been added in total.

Metal extractions achieved after 21 days leaching are summarized below.

Test	% Extracted Fe	Ni
Sterile Control, 10% P.D.	8.6	35.7
Bioleach, 10% P.D.	13.3	45.1
Bioleach, 20% P.D.	7.5	44.0

Iron and nickel extractions were low, with bioleach nickel extractions slightly higher than the acid (control) nickel extraction. Microscopic examination of the bioleach tests revealed the presence of a small population of bacteria. Biological activity was confirmed by the high redox potentials (greater than 600 mV vs. Ag/AgCl reference) which indicated that all solubilized iron had been oxidized to the ferric state. In contrast, the control test redox potential was about 200 mV lower.

CONCLUSIONS

Approximately 35% of the nickel in the Border Resources ore proved to be acid soluble. Bioleaching extracted slightly more nickel, about 44-45%, but recoveries were disappointingly low. The presence of acid soluble iron provided some substrate for the limited growth of T. ferrooxidans; this was confirmed by

microscopic inspection and the evidence of high redox potentials.

However, the ore contained insufficient sulphides to sustain a vigorous bioleach. Acid consumption to maintain the test pH's at 2 was moderately high as virtually no acid was produced biologically. In commercial practice it would be impossible to sustain bioleaching unless acid was continuously added to maintain an acidic environment, an expensive proposition.

The Border Resources ore is therefore considered to be unsuitable for bioleaching.

Ralph P. Hackl

Ralph P. Hackl
Manager, R. and D. Lab

GIANT BAY BIOTECH INC.
a subsidiary of Giant Bay Resources Ltd
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Burnaby, B.C., Canada V5G 4M1

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I N V O I C E

No. 88-014

April 25, 1988

TO: Border Resources Ltd.
4547 West 5th Avenue
Vancouver, B. C.
V6R 1S6

Attn: Mr. Geoff Hornby

FOR: Bioleach amenability assessment of a nickel ore $ 1,500.00

AR 16245

STATEMENT OF QUALIFICATIONS

I am a graduate of the University of British Columbia in Resource Geography.

I have worked in all phases of mineral exploration and as a Mineral Lands Manager with B.C. mining companies since 1969.

I participated in the performance of the fieldwork about which this report is based and can attest that the costs listed herein are both reasonable and correct.

Vancouver, B.C.
20 August 1987

Peter Hall, BA