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**BHP Minerals Limited**  
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Hawthorn Victoria 3122  
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Victoria 3122 Australia  
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Facsimile 03 810 7722

10 January 1994



Dr K M Dawson  
Cordilleran Division  
Geological Survey of Canada  
100 West Pender Street  
Vancouver BC V6B 1R8  
CANADA

Dear Dr Dawson

I received your facsimile of 21 December 1993, concerning your proposal for research on the Island Copper Mine. I am certainly interested in what you propose.

I agree that it would be a great waste if the Island Copper Mine were to close without more research being done on it. It is my view, and one shared by John Fleming, that it is probably too late for any work now to alter the fate of the mine. It is not too late for work there to learn more about porphyry copper deposits and their associates, to assist in recognising favourable settings for them, and to improve our search techniques.

Because there is little likelihood of any work affecting the mine, it is unlikely that the mine will be interested in funding any work. Within my research funds I can consider funding some worthwhile work.

Your facsimile suggested several possible research avenues, without specifically indicating what you would prefer to do - presumably you do not propose to do them all?

Provided that the mine was prepared to assist by providing access, I would be interested in considering possible projects. On the ones you have suggested, I would make the following comments:

1. Mapping the lower levels of the pit and collecting a representative suite of rocks is worthwhile to document the deposit. This is the sort of project that could probably best be done as an MSc thesis. The studies involved would differ little in scope or significance from what has been and can be done on many other porphyry copper deposits, and I am not enthusiastic about supporting it, particularly if documentation is the main purpose of the work.

2. Locating displaced blocks of ore may have been of interest five years ago, but now it is probably too late to influence the fate of the mine, so again it not something I am very enthusiastic about.
3. A regional lithogeochemistry and geochronology study would help to define relationships between igneous rocks and mineralisation. I think a study of this type has merit, and might give improved insights into the igneous evolution of the region, and its relation to mineralisation.
4. Study of fluid inclusions in well controlled situations is worthwhile (so few fluid inclusion studies are well controlled!). If indeed it could characterise the fluid evolution in time and space, then it might well prove a very interesting study. However I fear that the extent of exposure both vertically and laterally is probably inadequate to see much change in fluid characteristics. Change over time seems more realistic.
5. Investigation of the zoning of rhenium may be interesting. I do not know what work has already been done on this: I will make inquiries.
6. The occurrence of pyrophyllite and dumortierite is of considerable interest, and could be worthy of study. In particular it could shed light on the behaviour and evolution of fluids, and may point to how porphyry copper-related fluids may evolve into high sulfidation epithermal fluids (if indeed they do).

On this point, I have already had discussions with Dr Stuart Simmons of the Geothermal Institute, University of Auckland, New Zealand, on the need for studies of advanced argillic alteration associated with porphyry copper deposits. My interest lies in recognising the origin of this alteration, and how (if at all) it relates to the advanced argillic alteration associated with high sulfidation epithermal gold deposits. Can we recognise what sort of system we are in, the stage of its evolution, and its economic mineralisation potential? This probably has to tie in with proposal 4 above.

Stuart has recently put a research proposal to me, involving study (by a Canadian MSc student) of the advanced argillic alteration at Island Copper. I have not yet agreed to his proposal (copy attached). I have told him of your proposal, and he said that he sees no problem collaborating with you, if that could be worked out to the satisfaction of all. As he points out, these systems are large and complex, and can support many different studies.

I have contacted John Fleming about these proposals, because we would be wasting our time even talking about it if there is not some mine support. John has largely confirmed my guess, that the mine would probably permit work if it does not involve them in any cost. That leaves it with me! I cannot afford to put huge sums into such a project; how much I put in depends on how strongly I feel about the value of the work. It is possible I might be able to get additional funds from operations groups if they were

convinced of the merit of the work, but I would need to be persuasive.

I now find myself in a position where I have a specific proposal from Stuart Simmons, and a general proposal from you. Rather than get involved in a three-way negotiation, I propose that you and Stuart Simmons discuss what should be done (bearing in mind my comments above). If you can reach agreement, then I would like to see a costed proposal, and then we can start two-way negotiations to settle what funds I can make available. If you cannot reach agreement, I will make an arbitrary decision.

I would be pleased to see work proceed at Island Copper. I want to see the best and most beneficial work done, taking a long-term view of BHP Minerals' world-wide interests. I look forward to hearing from you again.

Yours sincerely

A handwritten signature in cursive script that reads "Noel White".

**DR N C WHITE**  
Chief Geologist

cc J Fleming, Island Copper Mine  
Dr S Simmons, Geothermal Institute, Auckland University

SENT BY FAX TO GEOLOGICAL SURVEY OF CANADA, VANCOUVER  
FAX NO 1- 604- 666 1124

**Draft proposal to BHP Minerals to investigate pyrophyllite alteration at the Island Copper porphyry system in the context of high sulfidation ore-formation.**

**Submitted by Stuart F Simmons, Geology Department, University of Auckland**

Background

High sulfidation Au-Cu mineralization occurs in subvolcanic environments in association with advanced argillic alteration (alunite-kaolinite-dickite-pyrophyllite-quartz), indicating the passage of acid oxidising hydrothermal fluids of magmatic origin (e.g. Stoffregen, 1987; Rye et al., 1992; Hedenquist et al., 1994). White (1991) distinguishes high sulfidation deposits based on alteration mineralogy and deposit form/geometry, both of which relate to temperature and inferred pressure-depth of their formation. Nansatsu-type deposits form at relatively shallow depths of <1km and are characterised by a mineralised core of intense siliceous alteration (vuggy silica) enveloped by concentric zones of kaolinite-alunite, mixed layered clays and propylitic assemblages. Temora-type deposits form at greater depths (>1.5 km?) and are characterised by disseminated mineralisation associated with pyrophyllite-sericite-quartz alteration. An intermediate type is represented by El Indio where mineralisation is associated with quartz veins and clay-sericite alteration. Some high sulfidation deposits (e.g. Lepanto) are spatially associated with subjacent porphyry deposits implying a genetic link in the development of these two environments (e.g. Sillitoe, 1983; White, 1991).

Definition of the Problem

$\$ NZ = .7865 \$ CDN$

Despite recent major advances through studies at Summitville (Stoffregen, 1987), Nansatsu (Hedenquist et al., 1994) and Lepanto (Hedenquist pers. comm.), the genetic relationship between alteration and mineralisation in the high sulfidation environment remains poorly understood. This is particularly true for the deeper formed Temora-type deposits. Intriguing (and frustrating) is the variable development of metal concentrations in these environments, irrespective of formation depth and development of comparable alteration. To explain these observations White (1991), following on from the magmatic vapour plume model of Henley and McNabb (1978), suggests that the alteration assemblage develops in the presence of acid fluids generated by absorption of magmatic gases into cool groundwater, with ore-formation being dependent on the subsequent injection of coeval, metal-bearing brines. Scant fluid inclusion data (e.g. observation of inclusions containing halite daughter crystals) from Nansatsu and Lepanto exists to support this model. To further explore White's model and to better understand the formation conditions of advanced argillic alteration, we propose a mineralogic-fluid inclusion-(isotope?) study of the pyrophyllite alteration zone at the Island Copper porphyry Cu-Mo deposit in Vancouver Island.

## Island Copper Porphyry Cu-Mo Deposit

The geology and alteration-mineralisation of the Island Copper porphyry deposit is described by Cargill et al.(1976). Mineralisation (Jurassic) is hosted in andesitic volcanics intruded by a quartz-feldspar porphyry dike and related breccias (Figures 1 and 2). Hydrothermal alteration is zoned about the intrusion, with an inner sericite and an outer sericite-chlorite assemblage in the core, surrounded outward by biotite-rich and chlorite-rich zones, successively. The Yellow Dog alteration zone contains sericite and chlorite but is distinguished by the open-space fillings of ferroan dolomite. The main assemblage of research interest is the pyrophyllite zone, which consists of pyrophyllite, dumortierite ( $\text{Al}_8\text{BSi}_3\text{O}_{19}(\text{OH})$ ), muscovite, kaolinite, pyrite and leucoxene, and which is largely confined to a broad zone of brecciation that caps the quartz-feldspar intrusion. Late carbonate-zeolite veins represent the waning stage of hydrothermal activity. Cu-Mo mineralisation occurs throughout the system, attaining ore grades in breccias and volcanic hosted stockwork veins in association with sericitic alteration.

### Objectives

1. Establish spatial and temporal relations of the pyrophyllite alteration zone within the overall context of porphyry Cu mineralization/alteration through geologic mapping of field relations.
2. Determine the nature and extent of precious and base-metal mineralisation present within the pyrophyllite zone.
3. Using paragenetically constrained rock samples (from 1), assess the role, timing and possible interplay between acid volatiles and hydrothermal fluids (including brines) through:
  - a) petrographic study of the the alteration mineralogy (microscopy, XRD)
  - b) petrographic and heating/freezing studies of fluid inclusions.
  - c) stable isotope ( $^{18}\text{O}/^{16}\text{O}$ , D/H) studies of hydrothermal minerals depending on results from a) and b) (this aspect is not critical to the study at this stage)
4. Develop a genetic model for the formation of advanced argillic alteration at Island Copper and compare it with what is known about high sulfidation environments.

### Programme and Funding

Given uncertainties with respect to logistics at Island Copper, this study should be initially undertaken as part of an MSc study at the University of Auckland, with the possibility of expanding the project into a PhD study depending on results. MSc students take papers their first year (start 1 March) and are not prepared to begin field work until the end of exams in mid-November; the second year is devoted to research and writing with a thesis deadline of 28

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February (about 15 months after the completion of exams). Field work is a fundamental component of this project and is likely to require up to 3 months by the student, including 1 to 2 weeks in the company of the supervisor. Laboratory work will be undertaken at the University of Auckland (the Geology Department is equipped with thin sectioning equipment, petrographic microscopes and a fluid inclusion heating/freezing stage); this should take on the order of six to nine months to complete with the remaining time devoted to thesis write up.

Funds will be required to support travel and field costs for a student and the supervisor, including return trans-Pacific air tickets from Auckland to Vancouver Island (~\$NZ 6000.00) and food and accommodation in the field. No funds are requested for laboratory work unless isotopic studies are deemed worthwhile and in that case a separate application for funding will be made. A 10% surcharge on the budget is requested to diffray overheads. The total budget is dependent on the living costs during field work, and a maximum of \$NZ 10,000 is estimated. *£ 7865<sup>3</sup> CDW*

All results including the MSc thesis will be presented to BHP Minerals at the end of the project. Publication of any outcomes of this study will be under permission from BHP Minerals, only.

#### References

- Cargill et al., 1976, CIMM Spec vol 15 (Porphyry Deposits of the Canadian Cordillera), p. 206-218
- Hedenquist et al., 1994, Econ. Geol., v. 89, in press.
- Henley, RW and McNabb, A, 1978, Econ. Geol., v. 73, p. 1-20.
- Rye et al., 1992, Econ. Geol., v. 87, p. 225-262.
- Sillitoe, RH, 1983, Econ. Geol., v. 78, p. 348-352.
- Stoffregen, R., 1987, Econ. Geol., v. 82, p. 1575-1591.
- White, NC, 1991, Geol. Surv. Japan Rept. No. 277, p. 9-20.



To: Dr. C.W. Jefferson  
Mineral Resources Division,  
Geological Survey of Canada

From: Dr. K.M. Dawson  
De:

Subject: **Submission of Draft IPP Proposals for Island Copper and Toodoggone Projects.**  
Objet:

Security Classification – Classification de sécurité	
Our File – Notre référence	
Your File – Votre référence	
Date	4 Feb., 1994

I enclose draft proposals under the GSC Industrial Partners Program entitled: "Toodoggone epithermal-porphyry connection" and "Island Copper deep study". Further to our discussion during my program review, I have discussed prioritization of the proposals with my co-project leader Rod Kirkham, and conclude that equal weight must be assigned.

All collaborating parties identified have been contacted. Notable additions are Tom Schroeter of the BCGS Branch for Toodoggone and Andy Rencz who has agreed to handle GIS aspects of Island Copper. Neil leNoble of BHP Minerals Canada has also been added to the Island Copper team.

Your comments on merits, demerits, budgets, etc. would be greatly appreciated. Please convey comments to Rod, since I will be in France until Feb.16.

Kenneth M Dawson

## **GSC Industrial Partners Program (Draft, Feb. 2, 1994)**

### **General Information**

Project Title: Island Copper deep study  
Project No./ Financial Subunit/ RC code: 740098  
Project Leaders: K.M. Dawson, R.V. Kirkham  
Branch/Division/Subdivision/Section: MCGB/ MRD/ MDS/ CMS  
Program/ Subprogram/ Component: Minerals/ Metallogeny of Northern Cordillera/ Study the interrelationships between alteration, ore mineralization, intrusion and brecciation at deep levels in a porphyry Cu-Mo-Au system.

EARP Status:

Start/ End dates: April 1, 1994 to March 31, 1996 (2 years)

### **Project Description (Corporate Level)**

Geographic/ NTS Area: Northern Vancouver Island, B.C./ NTS 92L/12

Objectives and Description: To document characteristics of porphyry Cu-Mo-Au mineralization at deep mine levels and establish its relationship with high level advanced argillic alteration assemblages.

Justification and Benefits: At closure of Island Copper mine at the end of 1994, deep levels of the open pit not yet mapped will be flooded and unavailable for study. These studies could lead to discovery of new orebodies needed to maintain production. Opportunity exists to cooperate with regional alteration and geochronology studies by A. Panteleyev of BCGS, and a proposed MSc thesis study of advanced argillic alteration assemblages to be supervised by Dr. S. Simmons, University of Auckland.

Milestones: 1995 Preliminary map of open pit  
1996 4 papers, mineral and alteration zonation, lithochemistry, fluid inclusions, U/Pb geochronology  
Final report, journal paper on alteration zonation

Business Opportunities: None

Planned Accomplishments: To document relationships between early, deep seated Fe, Na-rich alteration with intermediate potassic alteration and copper mineralization and high level advanced argillic alteration; to contribute to discovery of ore reserves, thereby prolonging the life of the mine.

Outputs/ Deliverables: Year 1 (1995): GSC Open File map of the orebody  
Year 2 (1996): 4 GSC Current Research Papers  
1 Journal paper, as given above

Link to Government Initiatives: Aid in the discovery of mineral resources.



**Projected Resource Requirements:**

<b>O &amp; M</b>	<b>1994-95</b>	<b>1995-96</b>	<b>Total</b>
a) GSC (IPP)	8,000	10,000	18,000
b) Industry (BHP Minerals Ltd.)	8,000	10,000	18,000
<b>Salary</b>			
a) GSC (IPP) C.H.B. Leitch and assistant	9,000	20,000	29,000
b) Industry (BHP Minerals Ltd.)	9,000	20,000	29,000
<b>Total</b>	<b>34,000</b>	<b>60,000</b>	<b>94,000</b>

Collaborators: GSC: K.M. Dawson, R.V. Kirkham, C.H.B. Leitch K.V. Ross, S. Paradis, A.N. Rencz  
BHP Minerals Ltd.: Noel White, D. Neil le Nobel  
Island Copper Mines: John Fleming  
Auckland University: Stuart Simmons, MSc student  
BCGS<sup>1</sup>: A. Panteleyev

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<sup>1</sup>. BCGS personnel will collaborate with project scientists, using their own resources.

To: Craig Leitch@MRD@GSC VANCOUVER  
Cc: ISMTP@601C@GSC OTTAWA [DLEFEBURE@galaxy.gov.bc.ca]  
Ken Dawson@MRD@GSC VANCOUVER, Rod Kirkham@MRD@GSC VANCOUVER  
Murray Duke@MRD@GSC OTTAWA, Arvind Anand@MRD@GSC OTTAWA  
Bcc:  
From: Charlie Jefferson@MRD@GSC OTTAWA  
Subject: re: Island Copper  
Date: Monday, May 2, 1994 13:27:47 EDT  
Attach:  
Certify: N  
Forwarded by:

-----  
Hi Craig, I have allocated a minimum \$5K to Island Copper (less than 1/5 of the "minimum" budget Ken gave me, but want to talk to Dave Lefebure tomorrow (he is out of town today) to see what if anything BCGS could contribute to a joint venture. If there is no other \$ can you do anything useful with those funds or would it be better to bolster Sullivan? Dave was not keen on talking up or formalizing any industry contributions, even in kind, so these things would best be minimized and left informal. I understand from Ken that you would like to spend 1 month and Kika 2 months in mapping and sampling. Once I have cleared things up conceptually with Dave and BCGS, it would help if you, Kika, Rod, Ken, whoever is involved from BC, Dave Lefebure and I would have a teleconference about the Island Copper project: what it is we need to accomplish at a minimum, what would be nice to accomplish, expected timing of what is to be done, proposed budgets, and expected products. Then we can submit a project proposal to the BCGS-GSC Cooperation Committee for their consideration.

Basically, Arvind and I have thrown MDS capital into the O&M equation and we are converting a lot of capital into salary (with 10-20% penalty) and O&M (1:1) on a one-time-only basis in order to fulfil commitments like Sullivan for this fiscal year. Then we are going to pare down to carefully chosen, more cost-shared priority topics in the future. I am supporting Island Copper this year as a new project because of its high rating at the planning conference, but it is not going to be easy.

Cheers, Charlie.

To: Charlie Jefferson@MRD@GSC OTTAWA  
Cc: Ken Dawson@MRD@GSC VANCOUVER  
Bcc:  
From: Craig Leitch@MRD@GSC VANCOUVER  
Subject: re: Island Copper  
Date: Monday, May 2, 1994 12:43:05 EDT  
Attach:  
Certify: N  
Forwarded by:

-----  
Hi Charlie,

After conversations recently with Jose Perello in Santiago and John Fleming of Island Copper, Ken suggested that I bring you up to date regarding developments. Perello is enthusiastic about a fluid inclusion and stable isotope study, and gave us the O.K. to see a copy of the CIM manuscript; John Fleming will now send us one. Alan Clark had earlier promised a copy of the Arancibia and Clark manuscript but has not delivered - I am trying to contact him again. Fleming is receptive to the idea of in-kind support (even although it would be Noel White who would be providing the support). Specific targets for such support would be the rental accomodation in Coal Harbour near the mine, thin section prep contract, zircon crushing and picking contracts, use of a pick-up while working in the pit, etc. As I understand it, Ken has tentatively booked a house, but we are waiting for a final confirmation from you as to the existence and level of a budget. Could you let us know just as soon as the budget for Island Copper is decided on? I would also like to order some equipment from TFSS as soon as possible.

Cheers, Craig

To: Ken Dawson@MRD@GSC VANCOUVER  
Cc: jmd,Gina LeCheminant@MRD@GSC OTTAWA  
Craig Leitch@MRD@GSC VANCOUVER,Kika Ross@MRD@GSC VANCOUVER  
Rod Kirkham@MRD@GSC VANCOUVER  
Bruce TAYlor@MRD@GSC OTTAWA  
Bcc:  
From: Charlie Jefferson@MRD@GSC OTTAWA  
Subject: Possible Island Copper Deposit Study  
Date: Tuesday, May 3, 1994 11:46:52 EDT  
Attach:  
Certify: N  
Forwarded by: Charlie Jefferson@MRD@GSC OTTAWA

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Forwarded to: Ken Dawson@MRD@GSC VANCOUVER  
cc:  
Forwarded date: Tuesday, May 3, 1994 14:45:25 EDT  
Comments by: Charlie Jefferson@MRD@GSC OTTAWA

----- [Original Message] -----

Thanks for your revised budget proposal for Island Copper (April 26). I called Dave Lefebure to discuss, but he has been out of his office until today. Please review this quickly and see if it is OK to forward to Dave.

I understand that Stewart Simmons (Aukland) could do a study of the pyrophyllite alteration assemblage funded entirely by BHP (under their supervision).

From what you have provided, I see that the total O&M cost for a minimum study of the pit could be:

2 months mapping rock units, other alteration and petrology (K. Ross):	3K
1 month mapping veins, and sampling for fluid inclusions (C. Leitch):	6K
Stable isotopes: O on quartz, H on chl/biot/ser (CL):	5K
Camp and mine lithogeochem, 100 samples, database constr. (KR?):	2K
Geochemical analyses by Gina's shop	--
Zircon U/Pb on 2 Bonanza Volcanics, 2 intrusions (Mortensen?):	4K
Report preparation:	2K
TOTAL	22K

Supposing we can only spend 5K this fiscal year, can we do the field work and publish a preliminary report with minimum petrology before the pit is flooded? Then budget 20K next year for follow-up lab studies and further field work if the pit is still open? All salaries are covered for this fiscal year.

MDS O&M is really squeezed this year with commitments to completing Sullivan, starting the Bathurst Extech, carrying VMS etc. etc. We are going to have to convert Capital to salary to cover off some of the PDF's and other term supports in MDS. But next year, when MITEC kicks in and Sullivan is done, we should have some room to breathe.

To: "jefferson@gsc.emr.ca" jefferson@gsc.emr.ca  
Cc: "Craig=Leitch%MRD%GSC=VANCOUVER@gsc." Craig=Leitch%MRD%GSC=VANCOUVER@gsc.emr.ca  
DLEFEBURE DLEFEBURE@galaxy.gov.bc.ca  
"kdawson@gsc.emr.ca" kdawson@gsc.emr.ca  
"rkirkham@gsc.emr.ca" rkirkham@gsc.emr.ca  
"Murray=Duke%MRD%GSC=OTTAWA@gsc.emr." Murray=Duke%MRD%GSC=OTTAWA@gsc.emr.ca  
"mds@gsc.emr.ca" mds@gsc.emr.ca  
Bcc:  
From: David Lefebure 952-0404 <DLEFEBURE@galaxy.gov.bc.ca>  
Subject: Re: Island Copper  
Date: Thursday, May 5, 1994 at 4:13:00 pm  
Attach: Headers.822  
Certify: N  
Forwarded by:

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Charlie:

We are keen on cooperating with the GSC to get the Island Copper project up and running. it would be a pleasure to help develop a program which can be submitted to the BCGS-GSC Cooperation Committee for approval.

I recommend that we make Andre Panteleyev an adjunct member of the Island Copper project team and that we profile the project as a GSC-BCGSB partnership. This project would obviously complement our North Vancouver Island Integrated Project. This represents a BCGS committment of an already busy staff member. Unfortunately the BCGS cannot contribute any funds.

There is one element that we would like to be considered for inclusion in the Island Copper project. This would be to collect representative cross-sections, plans and other information to be archived before the mine closes.

Andre and I look forward to discussing the project in more detail. Your suggestion of a conference call is excellent. We look forward to talking to you soon.

Cheers,  
Dave

To: Charlie Jefferson@MRD@GSC OTTAWA  
Cc: Craig Leitch@MRD@GSC VANCOUVER  
Bcc: .  
From: Ken Dawson@MRD@GSC VANCOUVER  
Subject: email address for BHP  
Date: Monday, May 9, 1994 12:21:37 EDT  
Attach:  
Certify: N  
Forwarded by:

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Dear Charlie:

In response to your request of Friday ,May 6 for BHP email addresses, I can provide only the following FAX and phone numbers:

Dr. Noel C. White,  
BHP Minerals, Exploration Dept.,  
801 Glenferrie Rd.,  
Hawthorn, Victoria 3122 Australia  
Tel: 61-3-810-7700  
FAX: 61-3-810-7722

Mr. John A. Fleming, Chief Geologist,  
BHP Minerals Canada,  
Island Copper Mine,  
P.O. Box 370,  
Port Hardy, B.C. Canada V0N 2P0  
Tel; 604-949-6326  
Fax: 604-949-6060

Dr. Sturt F. Simmons,  
Geothermal Institute, Auckland University,  
Private Bag 92019,  
Auckland, New Zealand  
Tel: 64-9-373-7999  
Fax: 64-9-373-7436  
email: thermal@aukuni.ac.nz

Noel White may have an email address, and definitely should be included in the network.

To avoid further embarrassing changes of position vis-a-vis funding the project, I suggest that our position be confirmed before a regular email interchange is established, if it is possible.

Best regards, Ken

To: ISMTP@601C@GSC OTTAWA [DLEFEBURE@galaxy.gov.bc.ca]  
Cc: aa, Ken Dawson@MRD@GSC VANCOUVER  
Craig Leitch@MRD@GSC VANCOUVER  
Kika Ross@MRD@GSC VANCOUVER  
Bcc:  
From: Charlie Jefferson@MRD@GSC OTTAWA  
Subject: re: Re: Island Copper  
Date: Friday, May 6, 1994 9:23:30 EDT  
Attach:  
Certify: N  
Forwarded by:

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Hi Dave,

Thanks for your several E-mails of yesterday. We eagerly await a more definite reply early next week and will treat your draft letter in the same confidence that you showed for the planning memo we ended up drafting together.

Don't worry about the \$ - we'll emphasize field work this year to extract as much archival data as possible, and profile sufficient funds next year to complete analyses and interpretation. I expect that any support we obtain from BHP will be in-kind and very informal; heavy on the scientific input and guidance.

Does Andre have an E-mail address so we can plug him in once things get rolling?

Have a good weekend!

Cheers, Charlie.

PS to Craig and Ken - can we get an E-mail address for BHP so they can become part of this loop?

To: ISMTP@601C@GSC OTTAWA [APANTALEYEV@galaxy.gov.bc.ca]  
ISMTP@601C@GSC OTTAWA [DLEFEBURE@galaxy.gov.bc.ca]  
Ken Dawson@MRD@GSC VANCOUVER, Rod Kirkham@MRD@GSC VANCOUVER  
Craig Leitch@MRD@GSC VANCOUVER, Kika Ross@MRD@GSC VANCOUVER  
Cc: JMD, WDS, AA  
Bcc:  
From: Charlie Jefferson@MRD@GSC OTTAWA  
Subject: Island Copper Deep Study Proposal  
Date: Wednesday, May 11, 1994 15:39:52 EDT  
Attach:  
Certify: N  
Forwarded by:

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Dear Dave:

In response to your telephone call last night, here is a draft of the Island Copper research proposal and budget for two-years. I would appreciate comments from you and all cc'd so we can finalize this for submission to Cooperation Committee.

Title: ISLAND COPPER DEEP STUDY  
Project No. 7400098ic  
Project Leader: K.M. Dawson  
Principle Investigators: C.H.B. Leitch, K. Ross  
Associated Participants: A. Pantaleyev, R.V. Kirkham, S.F. Simmons,  
J.A. Fleming, N.C. White  
RC Manager: 087 C.W. Jefferson, Mineral Deposits Subdivision  
Sector/Branch/Division/Subdivision/Section: GSC/MCGB/MRD/MDS/CMS  
Start/End Dates: June 1, 1994 / March 31, 1996

Geographic/NTS Area: Northern Vancouver Island, B.C./NTS 92L/12

Objectives and Description: To document characteristics of porphyry Cu-Mo-Au mineralization at deep mine levels and establish its relationship with high level advanced argillic alteration assemblages.

Justification and Benefits: At closure of Island Copper mine at the end of 1994, deep levels of the open pit not yet mapped will be flooded and unavailable for study. These studies could lead to discovery of new orebodies needed to maintain production. Opportunity exists to cooperate with regional alteration and geochronology studies by A. Pantaleyev of BCGS, and a proposed MSc thesis study of advanced argillic alteration assemblages to be supervised by Dr. S. Simmons, University of Auckland.

Milestones: 1995 Preliminary map of open pit  
1996 4 papers, mineral and alteration zonation,  
litho geochemistry, fluid inclusions, U/Pb geochronology  
Final report, journal paper on alteration zonation.

Business Opportunities: None

Planned Accomplishments: To document relationships between early, deep seated Fe, Na-rich alteration with intermediate potassic alteration and copper mineralization and high level advanced argillic alteration: to contribute to discovery of ore reserves, thereby prolonging the life of the mine.

Outputs/Deliverables: Year 1 (1995): GSC Open File map of the orebody



Year 2 (1996): 4 GSC Current Research Papers  
1 Journal paper, as given

above

Link to Government Initiatives: Aid in the discovery of mineral resources.

PROPOSED BUDGET

SUBPROJECT	PERSONNEL	94/95 O&M		95/96 O&M	
Pit mapping, petrog., altn, struct.	KVR	2mo	2K	2mo	2K
Vein, altn assemb, petr, min, fl. incl	CHBL	1mo	2K	2mo	4K
Stbl isot: O qtz, H ser/chl/biot	CHBL, BET			1mo	5K
Lithogeochem mine, camp, database	KVR, CHBL, GML			1mo	2K
Geochron zirc U/Pb, 2 Bonanz, 2 int.	GHBL, UBC contr.			1mo	4K
Supervision, report preparation	GHBL, KVR, KMD, RVK		1K		1K
Accom, transport, grocery, supplies			5K		5K
TOTAL			10K		23K

\*\*\*AVAILABLE GSC O&M IS ONLY 5K; WE ARE STILL MODIFYING THE PROPOSAL AND PROFILING SOME ELEMENTS FOR 1995-96. WE WONDER IF INFORMAL CONTRIBUTION IN-KIND FROM BHP MIGHT COVER OFF SOME ACCOMMODATION AND ON-SITE SUPPLIES. CONVERSION OF SOME CAPITAL IS ALSO BEING CONSIDERED.\*\*\*

Expected Products:

1994-95: Roundup poster: CHBL, KVR  
Preliminary pit geology, map: GSC Paper 95-1A; KVR  
Alteration study +/- petrog, mineral: GSC Paper 95-1A; CHBL

1995-96: Roundup, Colloq posters: CHBL, KVR  
Mine geology map, GSC Prelim map; KVR  
Mine geology, alteration: GSC Paper 96-1A; KVR  
Alteration study: GSC Paper 96-1A; CHBL

1996-97: Alteration/fluid inclusions/stable isotopes: journal paper  
CHBL, KVR, BET  
Mine geology, lithogeochem, structure: journal paper:  
KVR, CHBL, KMD, RVK, GML

The financial and personnel structure of this proposal would be changed significantly with the welcome addition of BCGS ideas, resources and/or staff.

END OF DRAFT

Cheers,

Charlie

To: "kdawson@gsc.emr.ca" kdawson@gsc.emr.ca  
Cc: DLEFEBURE DLEFEBURE@galaxy.gov.bc.ca  
"jefferson@gsc.emr.ca" jefferson@gsc.emr.ca  
APANTELEYEV APANTELEYEV@galaxy.gov.bc.ca  
Tom Schroeter TSCHROETER@galaxy.gov.bc.ca  
Gib McArthur GMCARTHUR@galaxy.gov.bc.ca  
Linda Hitchen LHITCHEN@galaxy.gov.bc.ca  
Bcc:  
From: David Lefebure 952-0404 <DLEFEBURE@galaxy.gov.bc.ca>  
Subject: RE: Archival Island Copper data  
Date: Monday, May 16, 1994 at 5:36:00 pm  
Attach: Headers.822  
Certify: N  
Forwarded by:

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Ken:

I was glad to see your positive response to the request for help in archiving data from the Island Copper mine. We are just starting to address this problem, although several of us have been concerned about this issue for some time. Tom Schroeter has been particularly active at pushing to get information from mines that will be closing.

This is a B.C. mandate so I will contact John Fleming and Island Copper. The information will be archived by our Geoscience Information section which is headed up by Gib McArthur. On the GSB side, Tom and I will work with one of Gib's staff to coordinate this information.

There is no set process for collecting the data at this point. Our emphasis is on collecting representative geological data, particularly sections, plans, drill logs and key reports. We are discussing the methods for archiving the information. Our preferred method would be to microfilm the information, although we need to cost out this method. In any case the GSB would be responsible for any copying costs related to the archival material.

At this point we are not talking about capturing drill core because we have no storage facilities. While I am sympathetic to the concept of a core library, previous attempts to start this type of facility in B.C. have not gotten off the ground.

Cheers,  
Dave

To: ISMTP@601C@GSC OTTAWA [DLEFEBURE@galaxy.gov.bc.ca]  
Charlie Jefferson@MRD@GSC OTTAWA  
Cc: ISMTP@601C@GSC OTTAWA [APANTELEYEV@galaxy.gov.bc.ca]  
Bcc:  
From: Ken Dawson@MRD@GSC VANCOUVER  
Subject: Archival Island Copper data  
Date: Monday, May 16, 1994 18:41:04 EDT  
Attach:  
Certify: N  
Forwarded by:

---

Dear Dave:

On behalf of Craig and Kika, I can say we will be glad to collect mine data for archival purposes, but, since this is a new function for me, I would like to have more specific instructions on "representative" sections, plans and drill logs. Do you wish to archive original copies? If so, a letter of intent from you to John Fleming would seem appropriate. If not, a budget for reproduction costs should be established.

Kika and Craig will be systematically logging and sampling drill core in the course of their studies - do you think that these sections and logs would suffice? I cannot give you an estimate of section density until I examine the data at the mine. Guidelines would help.

Another type of archival data that should be considered in this context are representative drill core sections. Is there a facility in Victoria where core could be stored? Do you have any suggestions re shipping and storage? Perhaps this core could form the nucleus of a long-awaited core library!

Best regards

Ken



Province of  
British Columbia

Ministry of  
Energy, Mines and  
Petroleum Resources  
GEOLOGICAL SURVEY BRANCH

Suite 301, 865 Hornby Street  
Vancouver  
British Columbia  
V6Z 2G3  
Telephone: (604) 660-2708  
Fax: (604) 775-0313

COPY

March 8, 1995

FILE: Mine Closures- Island Copper

D. Neil, leNobel, P.Eng.  
Exploration Manager, Western Canada  
BHP Minerals Canada Ltd.  
Ste 1600-1050 W. Pender Street  
Vancouver, B.C.  
V6E 3S7

Dear Neil:

RE: ISLAND COPPER DATABASE

Thank you for your letter dated February 28, 1995 regarding the "database" subject we touched on at Roundup. As you know, I have been dealing with the subject of collection of geological materials from mines destined for imminent closure over the past four years. To date, most discussions between Ministry of Energy Mines & Petroleum Resources (EMPR), and the respective mine owners have been on an informal (cf. regulated) basis; I suggest we continue in this manner. The key to success will depend on the commitment by all individuals involved. The EMPR would certainly like the opportunity to examine and collect very selected (e.g. one to two core boxes), core specimens, and importantly parts of the paper database which may assist the mining industry in the future, the appropriate materials to be preserved would be a joint decision by mine owners and the government representatives.

Robert Pinsent, Regional Geologist with the B.C. Land Management and Policy Branch in Vancouver, will be attending a reclamation meeting on March 30, 1995 at the mine. I understand he will contact Chief Engineer Brent Findlay regarding the 'Island Copper database.' During the visit Robert will examine the type and scope of materials which might be available for preservation.

I have also discussed this 'preservation' matter with the Geological Survey of Canada (GSC), (Ken Dawson). He would like to see the GSC involved. Thus, I suggest that we consider a 'team' of individuals make arrangements with the mine (e.g. John Fleming and/or Brent Findlay) to visit the mine in June to collect appropriate materials. Where will the paper database and/or selected core samples be stored and/or made available for study eventually? Unfortunately, I cannot answer this question with certainty at this time. I can assure you, however, that EMPR will be a worthy custodian of the materials. I will contact you later in April to pursue this matter. In the meantime, please do not hesitate to contact any of my colleagues if you have any questions.

Yours sincerely,

*Maryanne Hunter*

for Tom Schroeter, P. Eng  
Senior Regional Geologist

TGS:mch

CC: R. Pinsent  
D. Lefebure  
G. McArthur  
K. Dawson ✓



Province of  
British Columbia

Ministry of  
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Telephone: (604) 660-2708  
Fax: (604) 775-0313

June 14, 1995

FILE: Mine Closures-  
Island Copper

John Fleming, Chief Geologist  
Island Copper Mine  
BHP Minerals Canada Limited  
P.O. Box 370  
Port Hardy, B.C.  
V0N 2P0

Dear John:

**RE: MINE CLOSURE - ISLAND.COPPER**

Just a short note to confirm that I will meet with you at the minesite on **Tuesday morning (9:00 a.m. or earlier?)** on June 27, 1995 to discuss the subject of preserving geological 'materials' from the mine after closure. I plan on driving to Port Hardy on Saturday, June 24 and staying with Andre Panteleyev at the Pioneer Inn.

We will be in the field on June 25 and 26; please do not hesitate to contact us upon your return from Vancouver. I believe you are familiar with the concept of preserving geological 'materials', such as maps, technical reports, specimens, selected core - basically anything which you and your employer feel could be useful to future explorers. As professionals, we all know the importance of good databases; this initiative is meant to strengthen 'our' already good system. In order for the Government of British Columbia to be a good custodian of any donated geological 'materials' (eg. provide adequate storage space and maintain accessibility to the industry), I would like to know in advance what volume and type of material might be made available, when it could be accessed, etc.

If you feel any other BHP staff should be involved in our discussion, please invite them. I have also invited Robert Pinsent.

Yours sincerely,

Tom G. Schroeter, P. Eng  
Senior Regional Geologist

TGS:mch

cc: Neil leNobel, BHP  
Gib McArthur, GSB  
Dave Lefebure, GSB  
Ken Dawson, GSC  
Robert Pinsent, LMPB

To: Charlie Jefferson@MRD@GSC OTTAWA  
Cc: ISMTP@601C@GSC OTTAWA[dlefebure@galaxy.gov.bc.ca]  
Bcc:  
From: Ken Dawson@MRD@GSC VANCOUVER  
Subject: Archival of Island Copper materials  
Date: Thursday, June 22, 1995 11:22:39 PDT  
Attach:  
Certify: N  
Forwarded by:

---

Dear Charlie:

I discussed this subject with John Fleming during the recent mine visit by Rod, Kika, the Chinese visitors and myself, and with Tom Schroeter who is going to the mine this weekend for that purpose.

At present, BHP plans to ship all paper data to their US office for storage upon mine closure. Steel core racks will be sold, and drill core will be dumped. Core stored on site is deemed to be an environmental liability. Date of closure will be in the next few months, probably August or September.

Tom Schroeter has initiated a program entitled "Preservation of Geological Materials from Closing or Recently Closed Mines in B.C." An internal BCGSB draft document is in preparation, that will be reviewed in September. The program seeks funding for preservation of selected mine data on either microfilm or digital formats, and archiving it so as to be readily accessible to industry, government, academic and general public alike. It is viewed as a joint government-industry program. The benefit to the industry of archiving data for their future use will be stressed. Full participation by BC mining and exploration companies is expected. The enthusiastic support for the Whitehorse core library by industry is a model to pursue.

Tom has asked us for a letter of support in principle for the initiative. Considering past GSC support for a related initiative to establish core libraries in BC under the first MDA, I see no reason why we should not comply. The question of financial support for the program from NRCan must be addressed. Given the demise of the MDA program, another suitable federal funding source needs to be identified. The IPP would not be suitable. A cost analysis of the program should be undertaken by the BCGSB. It would be quite modest if only capture of microfilmable data were considered. In my opinion, the establishment of core libraries is an essential part of the program, and a cost analysis of this important component should be prepared, including capital and operating costs.

Charlie, will you look into the issues I have outlined, discuss it with Murray and others in senior management, and send a letter stating our position to Tom with a copy to me?

Best regards,

Ken



June 29, 1995

FILE: Mine Closures - Island Copper

John Fleming; Chief Geologist  
Island Copper Mine  
BHP Minerals Canada Limited  
PO Box 370  
Port Hardy, BC  
V0N 2P0

Dear John:

**RE: MINE CLOSURE - ISLAND COPPER**

Once again, thank you very much for taking the time out of your busy schedule to discuss the matter of 'Preservation of Geological Materials from Closing/Closed Mines' with me during my visit of June 26, 1995. After outlining the history and goals of this initiative and our ensuing discussion, I am confident that you, on behalf of BHP Minerals, understand the purpose and significance of this project. A brief list of potential geological materials to be considered for preservation includes (in no particular order):

- 1) Historical maps (discovery through mining completion).
- 2) >20 years of geological mapping @ 1"=100'.
- 3) Diamond drill hole logs.
- 4) Digital database (GEMCON) of all diamond drill holes.
- 5) GEOLOG format database (up to 1987) of all drill holes.
- 6) Reports: Technical (in house) reports (not previously filed as Assessment Reports). (Eg: Smee geochemistry study (including biogeochemical). (Eg: mineralogical or metallurgical studies).
- 7) Assay/blast hole data for last 10 years - especially gold distribution (predicted vs. actual).
- 8) Routine magnetic susceptibility measurements on all core = contours in the pit. (cf.: pit values vs. airborne values).
- 9) Geotechnical database: a) Strikes/dips in the pit; b) Distribution in space of different metal-bearing fractures/structures.
- 10) Interpretive data: Probably very limited value? Confidential?

- 11) Colour slides/photos: a) Slides: up until 1991, a complete slide library of drill core (8-10 years); also, a 'canned/standard' "Island Copper Mine" slide show (approx. 30 slides); b) Aerial photos of the mine over the years.
- 12) Selected/representative hand specimens, including cut/sliced pieces of core, with descriptive notes [Note: North Island (Port Hardy) Museum has requested 'representative' samples for display. Mine would/will accommodate with written notice that if the samples were no longer needed/usable, they would be donated to the Province (EMPR).]
- 13) Core: The most 'immediate' issue, apparently because of the mines' reclamation/closure plan requiring the removal/disposal of the core rocks ± logging facilities (buildings) ± the core itself (potential acid rock drainage?). Fleming and Schroeter agreed that a couple of key telescoped drill holes illustrating the significant alteration and mineralization characteristics of the Island Copper Cluster deposits should be preserved. [Note: Could consist of 2 to 10 boxes of core?] If necessary, a 'Swat Team' (comprised of GSB ± GSC geologists) could be involved on short notice (in conjunction with appropriate mine staff).
- 14) Regional materials: Eg: Core from Hushamu deposit and other BHP properties. Example: Transition between the Parson Bay Formation and the Bonanza Group. [Note: Regional mappers.]
- 15) Thin Sections: Approximately 200, including Craig Leitch's (GSC) digital data file.
- 16) Pulps (from drill core): Stored in 'bankers' boxes (approx. 200 bags/box). Might be useful/wise to preserve the intervals of the representative core sections selected for preservation.

As discussed, I will be working on a Draft report on this scenario, to be delivered in September. If you or any of your colleagues have any questions or further comments, please do not hesitate to contact me at (604)660-2812 (Tel) or (604)775-0313 (Fax).

I am pleased to hear that BHP Minerals plans to send mine data for storage to its head office in San Francisco. I hope Ken Witherly's visit later this summer will be constructive regarding this scenario.

In summary, the **key goals** of this initiative are:

- 1) Provide additional, non-confidential data to the provincial database for the use and betterment of a) Future explorers (to cut down on costs, duplication of effort and provide incentive for new ideas/models); b) Researchers/academia (to avoid duplication and provide sound data backup); and c) the historical record.
- 2) To make the 'materials' accessible (to the above groups).

I personally want to thank you for your commitment, on behalf of BHP Minerals to "get something into the collection". I fully understand the company's situation with respect to closure; we hope that this can be a "joint venture" which will be mutually agreeable to everyone in the end. I would ask that you review this 'checklist' and as time passes, perhaps you could set aside specific pieces of geological materials so that when it comes time to 'dealing' with them, the process can proceed without delay.

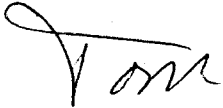


John Fleming  
June 28, 1995  
Pdge #3

Also, as mentioned, the Geological Survey of Canada is very much interested in seeing geological materials preserved, and have made a commitment of support to us. We will be exploring the possibility of a financial commitment from it at a later date.

Congratulations to you and your co-authors on a 'landmark' paper on the "Island Copper Cluster Deposits", to be published early this fall as one of 69 papers in Canadian Institute of Mining, Metallurgy and Petroleum, Special Volume 46.

Yours sincerely,



Tom G. Schroeter, P.Eng.  
Senior Regional Geologist

TS/msk

cc: Bill Hogan, Mine Manager  
Brent Findlay, Chief Engineer  
Gib McArthur, GSB  
Dave Lefebure, GSB  
Ken Dawson, GSC  
Robert Pinsent, GSB

List for Tom Schroeder - Minimum Drillholes that would compliment our study.

Sheet1

July 6, 1995

List of Drillholes that would be good to archive. They lie on our sections and we have thinsection and geochem data.					
Drillhole	Section	Length	Location	Priority	
D-71	139W	851'	upper core shack, rack 36	1	QFP/volcanics
D-75	139W	1061'	upper core shack?	2	variably altered volcanics
D-77	139W	894'	upper core shack?	1	QFP/volcanics
D-125A	139W	769'	upper core shack?	2	variably altered volcanics
D-159	139W	454'	upper core shack?	1	QFP/volcanics
D-163	139W	320'	upper core shack?	1	QFP/volcanics
D-192	139W	850'	upper core shack, outside	2	variably altered volcanics
D-193	139W	926'	upper core shack, outside	1	variably altered volcanics, pebble dyke
D-26	155W	751'	inside upper core racks 13,14,25,26	1	QFP/brxx
D-35	155W	753'	upper core shack, rack 17	2	volcanics /sheeted qz-mt veins
D-51	155W	890'	upper core shack, rack 1	1	QFP/volcanic/brxx contact
D-72	155W	502'	upper core shack, rack 36	1	QFP/volcanic/brxx contact
D-79	155W	187'	upper core shack, rack 37	2	peripheral alteration
D-101	155W	963'	upper core shack, rack 40	1	peripheral alteration
D-187	155W	500'	upper core shack, outside racks	1**	QFP/volcanic contact/geochem sample
D-30	171W	608'	lower core shack?	2	variably altered volcanics, minor QFP
D-33	171W	851'	lower core shack?	1	QFP different ages
D-59	171W	300'	??	2	variably altered volcanics
D-83	171W	867'	??	1	yellow dog, QFP/volcanic contact
D-109	171W	397'	??	2	variably altered volcanics
D-147	171W	650'	??	1**	excellent porphyry hole, must save
D-111	187W	397'	lower core shack	1	young/old QFP/brxx contacts
D-115	187W	724'	lower core shack	2	variably altered volcanics
D-164	187W	1176'	lower core shack?	1	QFP/volcanic contact
D-56	195W	550'	upper shack, inside rack 32	2	variably altered volcanics
D-85	195W	717'	upper shack, inside rack 39	1**	advanced argillic alteration
D-86	195W	620'	upper shack, inside rack 39	1	advanced argillic alteration
D-104	195W	815'	upper shack, outside rack 42	2	variably altered volcanics
D-119	195W	601'	lower core shack, rack 28	1	variably altered volcanics
D-32	LONG SS	787'	lower core shack	1	volcanic/QFP/pebble dyke
D-41	LONG SS	857'	lower core shack	2	QFP/brxx
D-45	LONG SS	778'	??	2	volcanic/QFP
D-97B	LONG SS	1048'	??	1	mostly volcanic, minor late QFP
D-139	LONG SS	667'	??	2	variably altered volcanics
D-153	LONG SS	407'	??	2	variably altered volcanics, brxx
D-157	LONG SS	640'	??	2	two phases of QFP
D-160	LONG SS	1011'	??	1	QFP, good mineralization, ends in volcanics
E-157	P ZONE	600'	upper core shack, outside rack	1	QFP outside pit
E-162	P ZONE	826'	upper core shack, outside rack	2	alteration outside pit
C-312	RUPERT	?	upper core shack, inside rack	1	sample of Rupert stock
E-92	BAY LAKE	+1000'	upper core shack, outside rack	1**	excellent contacts between intrusions
E65	Skarn zone	?	upper core shack, inside rack 35	2	intrusive/skarn/sediments
E64	Skarn zone	?	upper core shack, inside rack	1**	intrusive/skarn/sediments
E66	Skarn zone	?	upper core shack, inside rack	2	intrusive/skarn/sediments
W6	Skarn zone	?	upper core shack, inside rack	1	intrusive/skarn/sediments
EC-102	102W	405'	upper core shack, outside rack	2	QFP/volcanic
EC-103	120W	1099'	upper core shack, outside rack	1	QFP/volcanic good comparative hole
EC-105	116W	641'	upper core shack, outside rack	1	QFP/volcanic good comparative hole
EC-109	136W	588'	upper core shack, outside rack	1	QFP/volcanic good comparative hole
Approximately 35,000 feet of core in total, 21,000 feet of which are high priority.					