The Canguc

G.A.C. - Mineral Deposits Division

Issue 58 April 1998

JIM FRANKLIN SYMPOSIUM: The Directions of VMS Research into the 21st Century

Howard Poulsen and Ian Jonasson

Jim Franklin retired from the Geological Survey of Canada on January 17, 1998, after an illustrious career spanning more than three decades. Jim's association with VMS deposits started before becoming a research scientist at the GSC when he worked closely with the mining companies that found and developed the deposits in the Sturgeon Lake camp. His understanding of what the mineral industry requires from mineral deposit research directed much of his research into VMS deposits at the GSC. His extensive knowledge of ancient massive sulphide environments was balanced during the 1980's by his pioneering work on modern seafloor deposits off of Canada's west coast. Jim's dedication to geoscience is perhaps best shown by his acceptance of the Chief Scientists position at the GSC during what, in retrospect, was perhaps its time of greatest duress. Luckily, Jim managed to maintain enough of his sanity to return to working with his favourite deposit type.

The ideas on how this ore deposit type forms have changed dramatically over the course of Jim's career, and it was with this in mind that an informal symposium was convened on future directions of research on VMS deposits. Accordingly, a group of approximately 75 geologists from industry, academia and government assembled at Camsell Hall in Ottawa on Sunday, February 8 to hear four outstanding presentations on this topic. Three of the speakers represented perspectives from the study of ancient and modern VMS systems, and industry's ideas on the usefulness of VMS exploration and associated research. The fourth speaker was Jim Franklin, who outlined his view of our present state of knowledge on this economically significant deposit type.

The first speaker was **Dick Hutchinson (Professor Emeritus, Colorado School of Mines)**, Jim's long time mentor, friend and colleague. Dick's affair with VMS deposits started at the Normetal Mine back in 1948, when massive sulphide ("the V was missing then") deposits were viewed to be epigenetic. This was in keeping with Lindgren's classification of hydrothermal ore deposits which was derived mainly from experience in the western United States, where there were few deposits of this type. Fluids and metals were believed to have differentiated during magmatic recrystallization from the nearest pluton, which then deposited sulphides through mole/mole and volume/volume replacement of favourable rocks. Despite the inadequate understanding of the geology of these deposits, many were discovered after WWII using geophysical and geochemical techniques. Continued geological inquiry using basic field observations coupled with whole rock geochemistry resulted in slow, but steady, paradigm shift in thinking between the mid 50's and mid 60's. Dick was in the thick of it between 1954 and 1959, when he spent time in Flin Flon, Geco, Buchans and Brunswick in Canada, and in the Troodos ophiolite of Cyprus. Although he speculated for a while that these deposits formed from Joshia Spurr's "ore magmas", he quickly embraced the "heretical" ideas of Stanton, Christoffer Oftedahl and Haddon King that these deposits were actually syngenetic seafloor accumulations formed from debouched, hydrothermal fluids. This was the result of recognizing the stratigraphic concordance of the ore, the asymmetric development of alteration, and the common association with laminated ferruginous sediments. The gradual acceptance of the syngenetic model led to two broad avenues of study. The first concerned inquiry into the many technical questions that persist to the present day concerning the sources of metals, the magmatic versus seawater contributions to ore fluids and the nature and distribution of hydrothermal alteration associated with the deposits. The second was an appraisal of VMS deposits in the context of new concepts in global tectonics, which included seafloor spreading. The concept of seafloor spreading

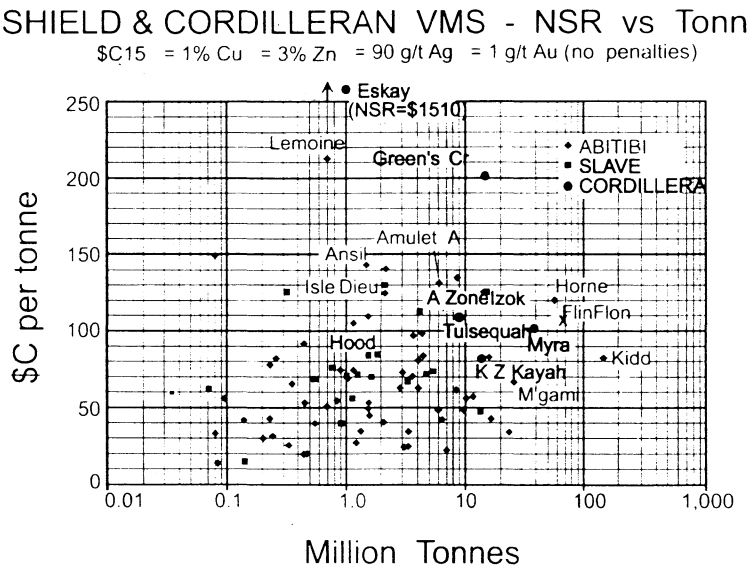

Figure 1. Net smelter return versus tonnes for VMS deposits in Canada (Gerald Riverin, Inmet Mining inc.)

proved key, although proposed models for ore genesis remained controversial until hydrothermal metalliferous sediments were discovered in the Red Sea (1965-66) and active hydrothermal vents fields observed on the Galapagos (1977-79). These first, rudimentary connections between ore genesis and oceanic spreading centres has since broadened out to encompass other extensional regimes in both oceanic and continental arc environments.

Dick emphasized throughout his presentation that the key lesson learned from these studies of massive sulphide deposits is that they illustrate a fundamental principle concerning ore deposits in general. Those deposits that formed synvolcanically have been surely overprinted by subsequent deformation, metamorphism and hydrothermal alteration which conspire to obscure the truth about their ultimate genesis. He wondered aloud whether this may not also hold true for certain types of gold deposits and for some iron and base metal skarn and manto deposits.

In his concluding remarks, Dick Hutchinson offered his perspective of future directions of massive sulphide research. First, he urged that there be more effective communication between on land and seafloor studies. Second, he noted that those directly involved in exploration for VMS deposits have a lot of practical knowledge to contribute and urged them to communicate this as much as possible. He also felt that seafloor studies have yet to adequately address the question as to where the similar sediment-hosted exhalative deposits fit in. Furthermore, he urged workers to seek links between VMS deposits and other ore types which they broadly resemble (e.g. carbonate hosted Pb-Zn, porphyry systems), or deposits with which they are commonly spatially related or at least "guilty by association" (e.g. iron formation, komatiitic nickel sulphides, lode gold). Finally, Dick pointed out that there are some well known differences among Archean, Proterozoic, Phanerozoic and modern deposits of this type. He suggested that it would be fruitful to study the secular variations in massive sulphide deposits in that these differences may be indicators of global changes in the atmosphere and oceans as well as in tectonic regimes. As a conclusion to his thoughtful and entertaining presentation Dick Hutchinson reminded workers that it would be worthwhile to address all of these questions, not only to provide unifying concepts for future ore deposits education, but also for the health of future mineral exploration.

During the latter part of his career, Jim Franklin focused a great deal of his effort on collaborative research on active seafloor hydrothermal systems. It was therefore appropriate for **Steve Scott of the University of Toronto**, himself an eminent researcher in this field, to give an overview of modern seafloor research and its role in understanding ancient VMS environments. Steve began his presentation by noting that there are 140 active hydrothermal sites currently known to exist on the modern sea floor, with less than 1% of prospective seafloor environments yet to be examined. In most cases they correspond to bathymetric minima (topographically elevated areas) probably because they are underlain by buoyant magmas. Scott went on to describe two of these sites in greater detail, the Southern Explorer Ridge and the East Manus Basin.

The Cu-Zn seafloor deposits on the Southern Explorer Ridge occur in an elevated area characterized by abundant sheet flows that vary in composition from N-MORB through E-MORB to T-MORB. The presence of these last two K-Rb-Ba-enriched suggests anomalous magmatic compositions spatially associated with the Southern Explorer vent fields. This structural ridge in turn contains hydrothermal mineralization that is also much richer in barium than other mid-ocean ridge deposits, suggesting a link between ore and magma chemistry. Jim Franklin noted later in his talk that the host lavas at East Galapagos Ridge range from ferro-MORB to andesite and rhyodacite. This supports the idea that magmas are more evolved/fractionated around hydrothermal vent sites.

A closer analogue to ancient deposits such as those at Noranda, however, are the sites in the East Manus Basin in an area which is representative of the back-arc rift basin tectonic environment, in which an immature pull-apart basin (Miocene?) has formed within an older volcanic terrane. Three vent sites (Pacmanus, SuSu and Desmos) are enclosed in an area the size of a typical VMS camp. Here the bathymetric minima correspond to fault controlled volcanic ridges perpendicular to transform faults. The ridges contain not only basalt but also abundant felsic rocks in coalesced lava domes. At the 1400m deep Pacmanus site some boiling vents are discharging both low-metal and high-metal fluids simultaneously and surrounding seafloor hyaloclastite is being thoroughly altered by broadly distributed discharge of low temperature fluids. Fluid discharge is thought to be controlled by cross-fault arrays similar to those controlling the distribution of orebodies in the Noranda Millenbach deposit. Some chimneys contain material grading from 20 to 30 ppm gold and alunite alteration has been identified at the Desmos vents. Furthermore, some samples dredged from the Manus basin consist of a banded sediment composed of 80% altered hyaloclastic and 20% sulphides; this rock is thought to be an accumulation of "fallout" from nearby dense hydrothermal plumes and strongly resembles ancient "tuffaceous exhalites" like those that are so well known at Noranda and Mattagami Lake.

As a conclusion to his well-illustrated presentation, Steve Scott suggested that further research should be devoted to the possible magmatic source of metals. Citing new data from gas and melt inclusions near modern vents, he showed that magmatic fluids have undoubtedly deposited Cu, Zn, Ni, S and Cl compounds which line gas cavities. Steve surmises that supercritical CO_2 can carry these elements, and therefore the degassing of

Message from the (temporary?) Editor

In the last issue of the Gangue Brian Grant advised our readers that he would no longer be able to take a leading role in editing and producing *The Gangue*, as he was going to be busy pursuing new career directions in places where computer facilities can be few and far between. Brian has been the mainstay of this newsletter for so long that it was a hard blow to all of us when he left. Naturally, I realized that it would be difficult to follow Brian's eye for interesting tidbits about the industry, and his instinctive ability to chase down topical articles, but I figured that any number of souls would rise to the challenge. I knew I was in trouble when everytime I walked into a group of geologists they would scatter like leaves before the wind. I inadvertently sometimes offend individuals, but this wholesale avoidance of my person was a mystery I couldn't fathom. After trying out several varieties of deordorant, with little result, I realized that only when I stopped my hunt for a new Gangue editor would I be accepted back into the company of my peers. The hunt hasn't ended, but I have become more Machiviallian. The plan is now to subject the readership to my (lack of) editorial skills until some civic-minded soul decides to save the rest of you by volunteering to take over.

In the meantime, I would appreciate all the help I can get from the readership in the form of articles, ideas for articles, and some of those wonderful "tidbits" that has made this newsletter so unique. The only alternative is that I fill the space with my own subjective views and other trivia too horrible to contemplate!

Let the reader beware!

Alan Galley, Caretaker - The Gangue

shallowly emplaced magma bodies may play a key role in the development of VMS deposit. Whereas some subvolcanic intrusions which serve passively as heat sources for convective hydrothermal systems may indeed create volcanic associated massive sulphide deposits, there are those which are "active" and serve not only as a heat source but also as a major source of metal are necessary to generate giant VMS deposits. Steve concluded his talk by reminding the audience that, although studies of the modern hydrothermal systems were only of a scientific nature in aid of better understanding of economically viable on-land deposits, there is increasing interest overseas in the seafloor mining of the recently formed massive sulphides.

One of the hallmarks of Jim Franklin's career has been his enthusiastic interaction with the mineral industry. Speaking from the perspective of that industry, **Gerald Riverin of Inmet Mining** addressed the question whether VMS deposits will be viable targets for future exploration. Beginning with a "one slide lesson in mineral economics", Gerald clearly explained that, to be economically viable a good VMS target should contain more than 10.9 million tonnes (almost 10 times the median size of VMS deposits globally) and should be composed of material that will yield a net-smelter return of $100 US per tonne (i.e approximately 7%Cu or 17.7% Zn or 7 g/t Au or 715 g/t Ag or some equivalent combination of these elements) (Figure 1). He stressed therefore that qualitative descriptions of VMS deposits as being 'large" or "rich" can be misleading owing to different rates of net smelter return for the different contained commodities. He also showed how the presence of anomalous concentrations of certain elements (e.g. As, Sb, Hg, Se) in concentrates can result in severe penalties from smelters but how gold tends to be a key positive component that can often decide the viability of a deposit. With these sobering points of caution in mind, Riverin pointed out that there are nonetheless some good reasons why exploration for VMS will continue, including their potential for containing "high margin" ore, their polymetallic nature, their high specific gravity (more tonnes per unit volume than a quartz vein for example) and the existence of a proven, effective exploration model. The exploration model includes elements of both science and technology and it is important to translate scientific results into vectors that can be applied in the field. Noting that exploration is about "WHERE?", Riverin begged for release from the common geochemical spider diagrams and bivariate plots and stressed that " *if it can't be put on a map, it likely won't be used in exploration*".

In concluding his lucid and well-received presentation, Gerald Riverin pointed to the exploration challenges that future research might help to overcome. Specifically, he questioned whether there might not be ways to confidently predict that: i) a belt will host VMS before a deposit is actually found; ii) exploration is unwarranted in a belt; iii) a zinc camp could host copper deposits; iv) all VMS in a camp have or don't have the same geochemical signatures; v) a given belt contains gold-rich VMS; vi) it is time to stop drilling a barren VMS. He also offered specific suggestions for future research topics. First, are there links between tectonics and the geochemistry of related igneous rocks and similarly links between tectonic setting and the geochemistry of the ore deposits? Second, why are the massive sulphide deposits in a particular camp so restricted in age and finally, what has generated VMS in camps with no obvious subvolcanic intrusions?

Fittingly, the last speaker of the symposium was its guest of honour, **Jim Franklin.**

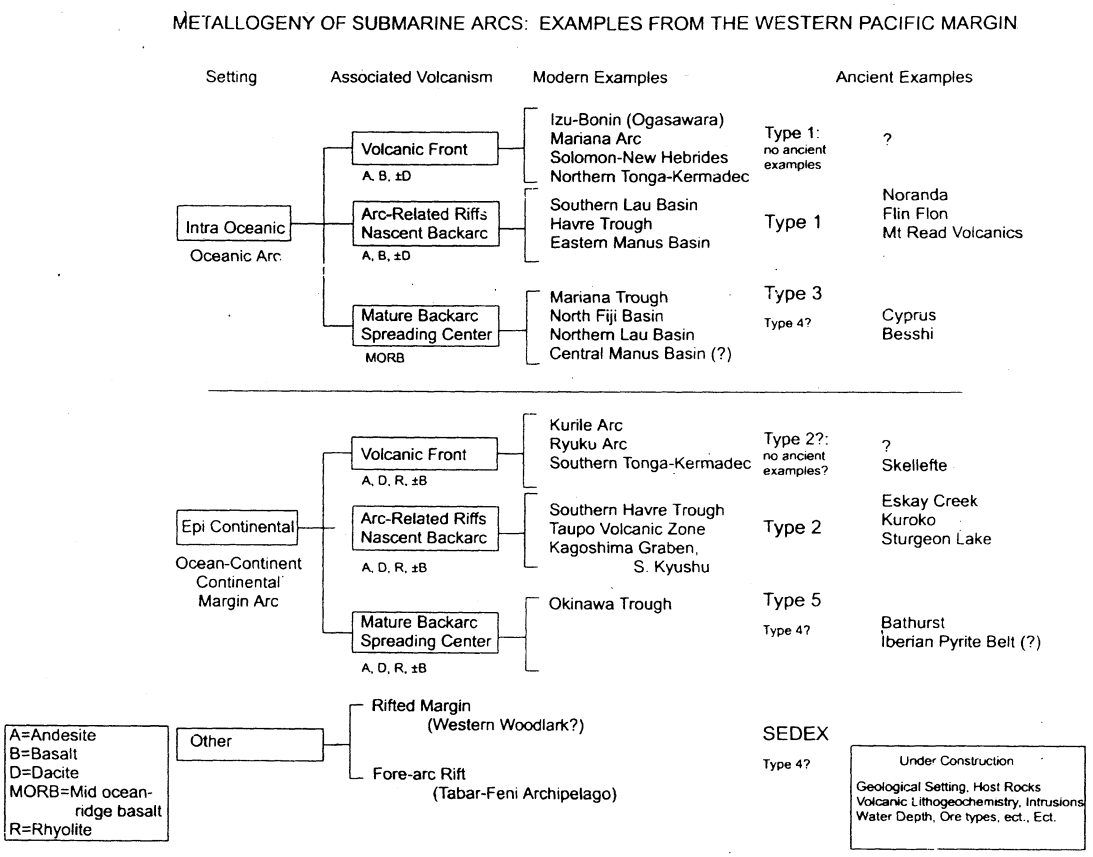

Figure 2. Proposed tectonic classification for volcanogenic massive sulfide deposits (Jim Franklin).

With a range of slides that, in both number and content, covered a lifetime of work, Jim summarized his views on VMS deposits. He pointed out that rifting is the key unifying tectonic element in massive sulphide genesis and that most deposits form in rifts in both intra-oceanic and epicontinental settings. Although he noted that there are problems associated with classification in that there may be a continuum of types and that tectonic environments aren't always easy to distinguish from one another, he suggested that there are at least 5 significant types of VMS based on their specific settings (Figure 2):

i) Bi-modal mafic dominated settings related to early arc-rifting in ocean-ocean arcs. Typified by volcanic sequences containing 75% pillow basalt and % sodic felsic flows, these include deposits at Noranda, Mattagami, Snow Lake and the Norwegian Caledonides.

ii) Bi-modal felsic dominated settings

containing 65% sodic and locally potassic felsic rocks, basalt and andesite forming the remainder. Likely reflecting nascent rifting of ocean-continent arcs, these deposits include those in the Hokuroko, Skellefte, Sturgeon Lake, Buchans, Buttle Lake and Mount Read districts.

iii) Ophiolite settings dominated by mid-ocean ridge and ocean island basalt. Deposits, including those in Cyprus and Oman and at Lokken are thought to have formed in either immature oceanic forearcs, mature backarcs and in oceanic spreading centres.

iv) Mixed pelagic sediment and mafic volcanic settings. Thought to represent sedimented mature oceanic backarcs, these settings likely apply to deposits like Besshi and Windy Craggy.

v) Felsic siliciclastic settings. These likely represent continental back-arc rifts and include many giant deposits like those at Bathurst, in the Iberian pyrite belt, in the Urals and in Kazakhstan.

Jim went on to analyze the main elements of the hydrothermal systems that are thought to generate massive sulphides and pointed out some remaining questions associated with each. Subvolcanic intrusions are thought to be the heat sources that drive the systems. Are there active and passive ones as Steve Scott suggested? Are they the sources of metals and do we really have evidence of the timing of their emplacement relative to that of hydrothermal alteration? VMS deposits are also associated with volcanic rocks of highly variable magma chemistry. Why is this so and what role does magma chemistry really play, if any, in massive sulphide genesis? The existence of high temperature interaction zones (i.e lower semi-conformable alteration) is well established in some camps. Are they, owing to originally high permeability, also sources of VMS metal? Are they only present in mafic-dominated settings and can we find within them better vectors to ore? The alteration pipes beneath massive sulphide deposits are thought to be the conduits along which ascending fluids traveled. Subsequent metamorphic effects aside, they vary quite a bit in their mineralogy and chemistry as reflected by differences among Noranda deposits, Mattabi and Kuroko deposits. What is the influence of water depth and phase separation on the nature of the alteration? Is alteration due to advection or to convection of ore fluids? To what extent do the compositions of alteration fluids reflect those of adjacent rocks? Processes at the depositional site tend to determine the nature of the VMS ore. To what degree does the sulphide mound structure influence this and what are the controls of temperature and post-depositional history on the composition of ores? Jim finished his presentation by pointing out that some even bigger issues also remain to be resolved concerning VMS deposits. Two of the most important are the questions as to why the Paleozoic and Proterozoic examples tend to be so such bigger than the rest and why big deposits seem to have been generated in mature backarcs.

What started out as an informal review of developments in VMS research over the course of Jim Franklin's career turned out to be an impressive demonstration of the substantial experience of each of the speakers. They also did an admirable job of translating that experience into the identification of many important problems for future VMS research, a task that evidently is far from over.

BRITISH COLUMBIA

Cliff Pearson
Chief Geologist
Boliden-Westmin,
Myra Falls Operations
P.O. Box 8000
Campbell River, B.C.
V9W5E2

File: Myra Falls

May 20, 1998

Dear Cliff:

Re: MYRA FALLS EXPLORATION FORUM

Thank your very much for your letter dated May 11, 1998 informing me of Boliden-Westmin's Myra Falls Operations plans for an exploration forum scheduled for July 23-26, 1998, and in particular the kind invitation to participate. As you know, I have had a keen interest in the project for almost 30 years now, as well as the geology and mineral deposits on Vancouver Island. This obviously stems from the 'initiation' both you and I received in the late '60s around the Buttle lake area.

Obviously, much good information has been learned since then; however, there's still much more work ahead. I'm glad to see that your group is continuing to be proactive in defining future exploration directions. This is certainly not a surprise, given your strong exploration and mine staff over the years!

I have blocked out the time period proposed. Robert Pinsent is currently on holidays; however, I believe he would like to attend also. Sean has also been in touch with Dave Lefebure in our Victoria office and it's possible that the Geological Survey Branch might like to send two staff from that office.

On a separate matter, at the KEG '98 meeting in Kamloops last month, I had the opportunity to compliment Sean on both his presentation and the quality of the slides used. I asked him if it would be possible to get copies for my files of about half a dozen slides and he suggested I ask you. You may remember that several years ago you very

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BRITISH COLUMBIA

kindly provided me with copies of slides as requested. As before, I'm particularily interested in the 'overview' type slides (e.g. aerial photos, plan and sections, model). I quess my question is "When would be a convenient time to examine and choose the slides I'd like?" Would the planning meeting be appropriate? I wouldn't need any of the new slides before late November.

Looking forward to further details on the planning meeting.

Yours sincerely,

Tom

Tom G. Schroeter, P.Eng.
Senior Regional Geologist
Vancouver Mineral Development Office

cc. R. Pinsent
R. Smyth
S. McKinley

Ministry of Employment and Investment

Geological Survey Branch

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MYRA FALLS OPERATIONS
WESTMIN RESOURCES LIMITED
P.O. Box 8000, Campbell River, B.C., Canada V9W 5E2
Telephone: (250) 287-9271

Fax: Administration: (250) 287-7123
Employee Relations: (250) 287-2093
Purchasing: (250) 287-8310
Mill: (250) 286-6171

May 11, 1998

Tom Schroeter
Senior Regional Geologist
302-865 Hornby St.
Vancouver, B.C.
V6Z 2G3

Dear Tom,

The exploration group at Boliden-Westmin's Myra Falls Operations is planning an exploration forum to which you are cordially invited. This event is tentatively scheduled for July 23-26, 1998. Our vision is to assemble a group consisting of Myra Falls Exploration alumni, Boliden Ltd. explorationists, interested B.C. Geological Survey staff and researchers from CODES, GSC and MDRU for the purpose of defining future exploration directions for Myra Falls. The first component of the forum will consist of minesite tours and presentations to update the group on Myra Falls geology and past and present exploration programs. Following this, the participants will break up into discussion groups for brainstorming sessions aimed at defining the best minesite exploration strategy for Myra Falls.

I realize that the July time frame is difficult for explorationists so please let me know quickly if you are available, and suggest an alternate time if you are not. I will be at the CIM in Montreal next week and on vacation then until May 19th, so if you have questions or want more information please call Sean McKinley or Dean Crick at the site (phone 250-287-9271, local 290; e-mail: smckinley@westmin-resources.com).

Best Regards,

Cliff Pearson, Chief Geologist
Boliden-Westmin, Myra Falls Operations

I N T E R O F F I C E M E M O R A N D U M

Created: 19-May-1998 11:14am PDT
Sent: 19-May-1998 11:14am PDT
From: Lefebure, Dave EI:EX
Dave.Lefebure@gems8.gov.bc.ca@GEMS@VENUS

Title.
Dept:
Tel No:

TO: Smyth, Ron EI:EX (Ron.Smyth@gems4.gov.bc.ca@GEMS@VENUSTO:

CC: RPINSENT (RPINSENT@A1)
CC: TSCHROETER (TSCHROETER@A1)
CC: Bobrowsky, Peter EI:EX (Peter.Bobrowsky@gems7.gov.bc.ca@GEMS@VENUS)
CC: McMillan, Bill EI:EX (Bill.McMillan@gems7.gov.bc.ca@GEMS@VENUS)

Subject: Myra Falls Exploration Forum

Ron:

Robert, Tom and I have received invitations to participate in an Exploration Forum to define the future exploration directions for Myra Falls. The Forum is tentatively scheduled for July 23-26, 1998, although they are willing to consider rescheduling to another date (August?) if more people can attend. I will forward the letter to you with the details.

I called Sean McKinley to discuss their request. They are aiming for 15 to 20 people and are anticipating some modifications to the list of invitees. I mentioned that the GSB might wish to send a project geologist with experience in VMS deposits and he agreed that this was a good idea.

Sean mentioned that Westmin/Boliden would be "putting up the participants" in a hotel in Campbell River. Therefore, we can assume at least some of the costs will be paid for by them.

This Forum should be discussed at the next Managers meeting. I said that we would get back to them by early next week.

Cheers,
Dave

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TGS → Myra Falls

May 28th, 1998

Cliff Pearson,
Chief Geologist,
Boliden-Westmin, Myra Falls Operation,
Westmin Resources Limited.
P.O. Box 8000, Campbell River, B.C.,
Canada, V9W 5E2

Dear Cliff,

Thank you very much for the invitation to attend Boliden-Westmin's planning and exploration forum at Myra Falls on July 23-26th. I would be delighted to attend both in my new capacity as a research geologist with Ministry of Energy and Mines and in my past and currently acting capacity as *de facto* Regional Geologist for Southwestern Region. I doubt if the position will be filled much before the end of the year, so I will likely be involved in the writing up of the Region's annual exploration review.

Given the amount of detailed work that has been carried out at the mine over the past few years, your idea of a planning and exploration forum seems both sensible and timely. I would be pleased to attend and contribute what I can.

Yours truly,

Robert Pinsent,
Research Geologist,
Vancouver Mineral Development Office

CC: Tom Schroeter. ✓

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I N T E R O F F I C E M E M O R A N D U M

Created: 01-Apr-1998 02:29pm PST
Sent: 01-Apr-1998 02:29pm PST
From: Jones, Larry EI:EX
Larry.Jones@gems5.gov.bc.ca@GEMS@
VENUS

Title.
Dept:
Tel No:

TO: TSCHROETER (TSCHROETER@A1)

CC: Lefebure, Dave EI:EX (Dave.Lefebure@gems8.gov.bc.ca@GEM
S@VENUS)

Subject: Re: Table 1 Comments

Tom

MINFILE attaches production to the Lynx (092F 71) from 1967 to 1985 and to the H-W (092F 330) from 1986 to 1996.

Production totals 23.9 oz (16.2 for Lynx + 7.7 for H-W) silver. Lynx has already been added.

I will fax the production reports. Let me know of errors.

Larry

> ----------
> From: Schroeter, Tom EI:A1
> Sent: Tuesday, March 31, 1998 3:17 PM
> To: Jones, Larry EI:EX
> Cc: Lefebure, Dave EI:EX; Schroeter, Tom EI:A1
> Subject: Re: Table 1 Comments
>
> Dave/Larry, I agree with Dave's comments in email dated Mar. 30th. To
> the end of
> 1996, I have "Myra Falls" producing approx. 26 million ounces of
> silver. Should
> I be adding approx. 17 million oz from Lynx for a grand total of 43
> million oz
> of silver produced? Tom
>

I N T E R O F F I C E M E M O R A N D U M

Created: 31-Mar-1998 03:16pm PST
Sent: 31-Mar-1998 03:24pm PST
From: Robert Pinsent of EI
RPINSENT
Title. District Geologist
Dept: Ministry of Energy & Mines
Tel No: 660-0223

TO: Tom Schroeter of EI (TSCHROETER)

Subject: Myra FAlls Production

In 1997, Myra Falls produced 1,257,045 tonnes grading 1.51% Cu, 5.35% Zn, 0.18% Pb, 1.56 g/t Au and 21.3 g/t Ag.

This generated 63,693 tonnes of copper concentrate, 113,912 tonnes of zinc concentrate and 8.266 tonnes of knelson concentrate. Boliden didn't have the final metal production figures but they should have them by now.

In December, 1997, there was a proven and probable mining reserve of 8,057,756 tonnes grading 1.6% Cu, 7.5% Zn, 0.4% Pb, 1.4 g/t Au and 33.5 g/t Ag.

I hope this helps.

Robert

I N T E R O F F I C E M E M O R A N D U M

Created: 31-Mar-1998 03:17pm PST
Sent: 31-Mar-1998 03:22pm PST
From: Tom Schroeter of EI
TSCHROETER@A1@GALAXY
Title.
Dept: Ministry of Energy & Mines
Tel No: 660-2812

TO: Jones, Larry EI:EX (Larry.Jones@gems5.gov.bc.ca@GEMS@VENUS:)

CC: Lefebure, Dave EI:EX (Dave.Lefebure@gems8.gov.bc.ca@GEMS@VENUS)
CC: TSCHROETER (TSCHROETER@A1)

Subject: Re: Table 1 Comments

Dave/Larry, I agree with Dave's comments in email dated Mar. 30th. To the end of 1996, I have "Myra Falls" producing approx. 26 million ounces of silver. Should I be adding approx. 17 million oz from Lynx for a grand total of 43 million oz of silver produced? Tom

I N T E R O F F I C E M E M O R A N D U M

Created: 31-Mar-1998 11:35am PST
Sent: 31-Mar-1998 11:35am PST
From: Jones, Larry EI:EX
Larry.Jones@gems5.gov.bc.ca@GEMS@
VENUS

Title.
Dept:
Tel No:

TO: Lefebure, Dave EI:EX (Dave.Lefebure@gems8.gov.bc.ca@GEM
S@VENUS)

CC: TSCHROETER (TSCHROETER@A1)

Subject: Re: Table 1 Comments

Dave

I will make the changes. HW is included with Myra Falls.

Larry

> ----------
> From: Lefebure, Dave EI:EX
> Sent: Monday, March 30, 1998 2:15 PM
> To: Jones, Larry EI:EX
> Cc: Schroeter, Tom EI:A1
> Subject: Table 1 Comments
>
> Larry:
>
> I have reviewed Table 1 again and have the following questions and
> comments.
>
> 1) Have you included HW in the Myra Falls numbers?
> 2) Add the ranks of the mines to the table.
> 3) change the following deposit types
>
> Big Missouri - Polymetllic vein
> Silver Butte - Polymetallic vein and Epithermal vein: low sulphidation
> Torbrit, Doly Varden and North Star - polymetallic vein
> Annex, HB - Irish-type Carbonate-hosted Pb-Zn
> Mineral King - sedimentary exhalative Zn-Pb-Ag?
>
> 4) remove deposit type opposite Brandywine Camp
> 5) change Granisle/Bell to Babine Camp
>
> Tom please speak up if you disagree or have any questions.
>
> Dave
>