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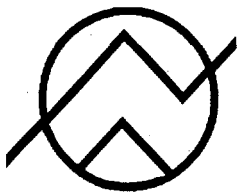



# NORTHERN ORION EXPLORATIONS LTD.

## ANNUAL INFORMATION FORM

## FOR THE YEAR ENDED DECEMBER 31, 2002

**DATED: May 16, 2003**

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***Throughout this Annual Information Form ("AIF"), Northern Orion Explorations Ltd. may be referred to as the "Company" or "NNO". The term Company includes the subsidiaries of the Company for the purposes of the information and discussion under "General Development of the Business", "Narrative Description of Business", Selected Consolidated Financial Information" and "Management's Discussion and Analysis". All dollar amounts in this AIF are in Canadian dollars unless otherwise stated. All information contained herein is as at December 31, 2002, unless otherwise stated.***

## CAUTIONARY STATEMENT REGARDING FORWARD-LOOKING STATEMENTS

This annual information form and the documents incorporated by reference herein contained "forward-looking statements". Forward-looking statements include, but are not limited to, statements with respect to the estimation of mineral reserves and resources, the realization of mineral reserve estimates, the timing and amount of estimated future production, costs of production, capital expenditures, success of exploration activities, currency fluctuations, requirements for additional capital, government regulation of mining operations, environmental risks, unanticipated reclamation expenses, title disputes or claims and limitations on insurance coverage. In certain cases, forward-looking statements can be identified by the use of words such as "plans", "expects" or "does not expect", "is expected", "budget", "scheduled", "estimates", "forecasts", "intends", "anticipates", or "does not anticipate", or "believes", or variations of such words and phrases or state that certain actions, events or results "may", "could", "would", "might" or "will be taken", "occur", or "be achieved". Forward-looking statements involve known and unknown risks, uncertainties and other factors which may cause the actual results, performance or achievements of the Company to be materially different from any future results, performance or achievements expressed or implied by the forward-looking statements. Such factors include, among others, risks related to international operations; risks related to joint venture operations; actual results of current exploration activities; changes in project parameters as plans continue to be refined; future prices of gold and copper; possible variations in ore reserves, grade or recovery rates; accidents, labour disputes and other risks of the mining industry; delays in obtaining governmental approvals or financing or in the completion of development or construction activities, as well as those factors discussed in the section entitled "General Development of the Business - Additional Risks and Uncertainties" in this annual information form. Although the Company has attempted to identify important factors that could cause actual actions, events or results to differ materially from those described in forward-looking statements, there may be other factors that cause actions, events or results not to be as anticipated, estimated or intended. There can be no assurance that forward-looking statements will prove to be accurate, as actual results and future events could differ materially from those anticipated in such statements. Accordingly, readers should not place undue reliance on forward-looking statements.

## CORPORATE STRUCTURE

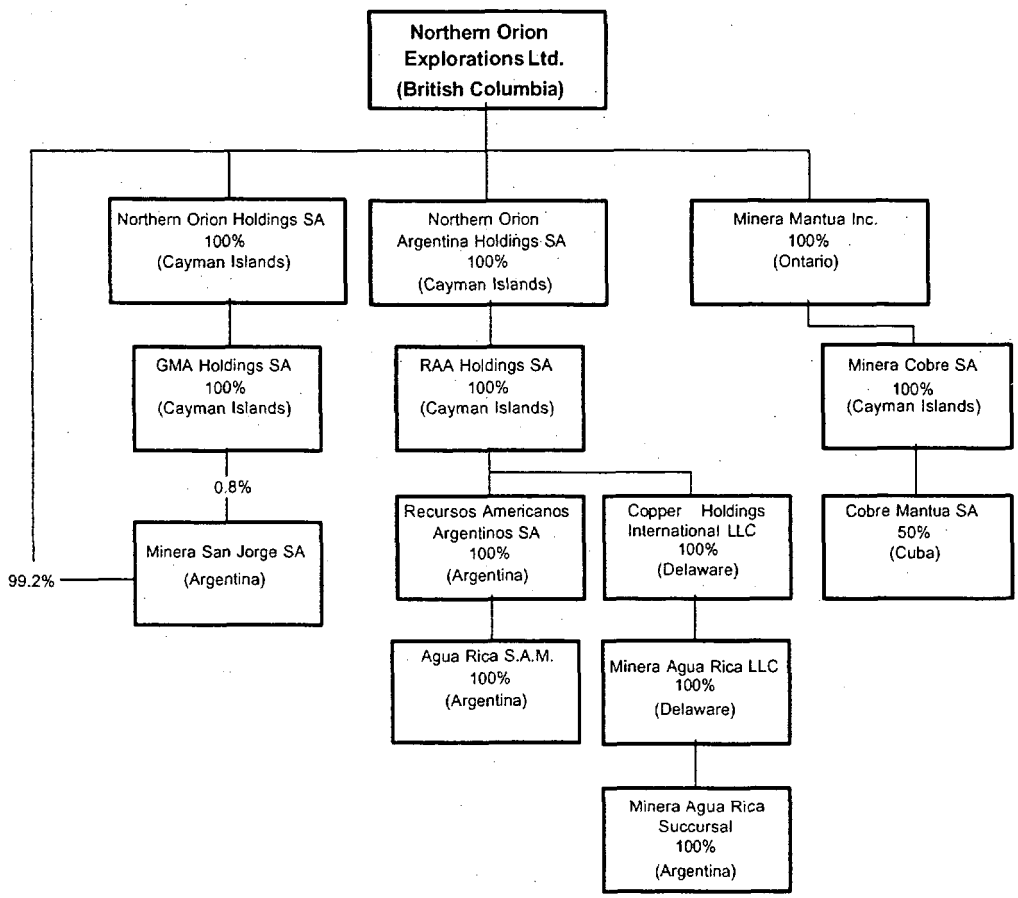
### Name and Incorporation

Northern Orion Explorations Ltd. was incorporated with the name Northern Orion Resources Ltd. under the *Company Act* (British Columbia) by memorandum and articles dated April 30, 1986. On October 31, 1986, the memorandum of the Company was amended to change the name of the Company to Northern Orion Explorations Ltd. On November 28, 1994, the memorandum of the Company was amended to increase the authorized capital from 25,000,000 to 100,000,000 common shares without par value ("Common Shares"), and on October 15, 1997, the memorandum and articles of the Company were amended to increase the authorized capital from 100,000,000 to 700,000,000 shares divided into 500,000,000 Common Shares, 100,000,000 First Preference Shares without par value and 100,000,000 Second Preference Shares without par value.

The registered and records offices of the Company are located at 10th Floor, 595 Howe Street, Vancouver, British Columbia V6C 2T5 and its principal executive office is located at Suite 250, 1075 West Georgia Street, Vancouver, British Columbia V6E 3C9.

## Intercorporate Relationships

The following chart sets forth the name of each material subsidiary of the Company, the jurisdiction of its incorporation or organization and the direct or indirect percentage ownership of the Company in such subsidiary as at May 16, 2003.



GENERAL DEVELOPMENT OF THE BUSINESS

The Company, through its subsidiaries, is engaged in the exploration for, and the development of, precious and base metals. The Company's principal project is the Agua Rica copper project (the "Agua Rica Project") in the Catamarca Province, Argentina. The Company also has an indirect 85% interest in the San Jorge copper/gold property (the "San Jorge Project") near Mendoza, Argentina, and an undivided 50% interest in the advanced Mantua gold/copper project (the "Mantua Project") in Cuba, which has been optioned to a third party. See "Narrative Description of Business – Mineral Property Interests".

In March,2003 the Company agreed to participate with Wheaton River Minerals Ltd. ("Wheaton") in the acquisition of a 25% interest in the Bajo de la Alumbrera gold/copper mine ("Alumbrera Mine") in Argentina. The Company and Wheaton will each acquire a net 12.5% interest on closing. As at the date of this Annual Information form, the acquisition is still subject to a number of conditions, including due diligence, financing, definitive agreements and all necessary third party and regulatory approvals and consents. See "Trends".

**Three Year History**

During the past three years financial constraints necessitated a significant reduction in all of the Company's activities. The Company's principal focus was on reducing costs and maintaining its principal properties. The Company has historically financed its operations through equity financings and financial support from its former controlling shareholder, Miramar Mining Corporation ("Miramar"). Due to market conditions and depressed copper prices from 1998 forward, the Company was unable to access external financing and became increasingly dependent upon Miramar for financial support.

In fiscal 2000, the Company embarked on a restructuring aimed at reducing its dependency on Miramar and enhancing its ability to access external financing. Approximately $18 million of debt owed to Miramar was converted to a royalty and proceeds interest (the "Royalty and Proceeds Interest") under which Miramar is entitled to a 2.5% net smelter returns royalty on production from the Company's interests in the Agua Rica Project, the San Jorge Project and the Mantua Project and an interest in the net proceeds received by the Company from a disposition of any of such interests, capped at approximately $18 million.

In May 2001, Miramar converted approximately $21.2 million of convertible debt into common shares of the Company at $1.47 of debt per share, for a total of 14,439,621 shares of the Company, the Company's remaining indebtedness to Miramar (approximately $6.9 million) was consolidated into promissory notes convertible into common shares of the Company at $0.15 of principal amount per share, the maximum amount payable by the Company to Miramar under a previously granted Royalty and Proceeds Interest was reduced from approximately $18 million to $15 million and Miramar relinquished any entitlement to proceeds of sale of any interest in the San Jorge Property. The 2001 debt restructuring was conditional upon completion of the following transactions concurrently with the debt restructuring, (i) the grant by Miramar of an option (the "Option") on all but 10 million of the approximately 70 million common shares of the Company it then held and on the new convertible promissory notes, to 1341180 Ontario Ltd. ("Ontario Ltd."), a company controlled by Robert Cross, and (ii) a private placement of 10 million units of the Company (consisting of one share and one whole share purchase warrant at $0.15 per unit for proceeds of $1,500,000. Mr. Cross became a director of the Company subsequent to negotiation of the Option. The private placement was completed by Valerie Gold Resources Ltd. (now ValGold Resources Ltd. ("ValGold"), and Frank Lang, a director of ValGold, was subsequently appointed to the Board of the Company.

The restructuring was completed in fiscal 2002, when, pursuant to transactions facilitated by Ontario Ltd. under its Option, 48 million shares held by Miramar were redistributed and the convertible promissory notes were converted into 46,097,367 shares of the Company. Miramar ceased to be a controlling shareholder of the Company as a result of the transactions. Further details regarding the restructuring are provided in the Company's 2002 Annual Report, filed on SEDAR under the Company's profile.

During fiscal 2000 through 2002, while restructuring efforts were ongoing, efforts were made to reduce the Company's financial commitments while preserving, to the extent possible, its interests in its principal properties. In March 2000, the Company released its interest in the Delita gold project on the Isle of Youth, Cuba and returned the project to Geominera S.A. The project had been placed on hold in 1998 due to low gold prices, and a write down of $8.4 million was recorded representing the costs of exploration of the project to 1998.

In July 2001 the Company granted an option on the Mantua Project, pursuant to which the optionee assumed the carrying costs of the project and committed to raise the financing and complete a bankable feasibility study within 18 months. In April 2002 the optionee announced that it was unable to secure the necessary financing on suitable terms and terminated the option. A portion of the carrying costs assumed by the optionee and unpaid were satisfied through the issuance of shares to the Company. In September, 2003 the Company granted a further option on its interest in the Mantua Project to Newport Explorations Ltd. ("Newport") pursuant to which Newport assumed the carrying costs of the project. See "Narrative Description of the Business - Mantua Project.

In the second quarter of fiscal 2001, the Company elected to not pay cash calls made by the operator of the Agua Rica Project and to instead accept a dilution of its interest in the project. In accordance with the operating agreement governing the Agua Rica Project, the Company's interest was diluted to approximately 29.12% at December 31, 2001, from the original interest of 30%. During 2002, the Company did not contribute any funds (2001 - $0.5 million) to the Agua Rica project, with the result that the Company's interest was further diluted from approximately 29.12% at December 31, 2001 to approximately 28.0% at December 31, 2002.

In March 2002 the Company completed a $0.5 million private placement financing and a $2.0 million private placement financing in August 2002, to raise funds for working capital and to finance a search for potential acquisitions which would enhance the Company's existing projects and provide positive cash flow. Further information regarding the financings is contained in the Company's 2002 Annual Report, filed on SEDAR under the Company's profile.

*Recent Developments*

In February, 2003, the Company announced that it had reached an agreement with BHP Minerals International Exploration Inc. ("BHP") to acquire from BHP the remaining 72% of the Agua Rica Project for a purchase price of US$12.6 million, US$9 million of which BHP agreed to defer, without interest, until June 30, 2005. The deferred payment is secured by, among other things, a pledge of the interest acquired. To fund the initial US$3.6 million payment and further working capital requirements, the Company negotiated a non-brokered private placement of 40 million units at $0.10 per unit, to raise gross proceeds of approximately $4 million and a further US$3 million secured convertible credit facility (the "Credit Facility"). The 40 million unit financing was completed in the first quarter of 2003. Each unit consists of one common share and one non-transferable share purchase warrant.

The acquisition of BHP's 72% interest in Agua Rica was completed on May 8, 2003. The Credit Facility, provided by Endeavour Mining Capital Corp., ("Endeavour") an arm's length company, was drawn to fund a portion of the initial payment. The Credit Facility bears interest at the rate of 10% per annum

payable monthly, is for an initial term of six months and can be extended for a further term of six months by payment of an extension fee of US$150,000 in cash, a combination of cash and shares, or all shares, provided that if the extension fee is satisfied with shares subject to a hold period, the fee will be US$225,000. The principal outstanding under the Credit Facility is convertible into common shares of the Company at the rate of $0.20 of principal amount per share. If the term of the loan is extended, the conversion rate is $0.175 per share. Endeavour received commitment and draw down fees totalling US$150,000 in cash and 3,000,000 share purchase warrants each exercisable to acquire one additional share of the Company at $0.15 per share for a period of two years. In February, 2003, the Company entered into a contract with Endeavour Financial Services Ltd., a company related to Endeavour pursuant to which Endeavour Financial Services Ltd. provides financial advisory services to the Company and receives compensation of US$10,000 per month and is entitled to success fees ranging from 1% to 2.5% on equity financings, acquisitions, divestitures and mergers and debt financings undertaken during the term of the agreement. The contract is for an initial term of twelve (12) months.

In April 2003, the Company announced that it had entered into agreements with Wheaton River Minerals Ltd. ("Wheaton") and Rio Algom Limited ("Rio Algom") pursuant to which the Company and Wheaton agreed to acquire a 25% interest in the Bajo de la Alumbrera ("Alumbrera") gold-copper mine in Argentina for US$180 million (the "Alumbrera Acquisition"). Rio Algom has agreed to defer payment of up to US$50 million of the purchase price until May 30, 2005. The purchase will be effected through a Company owned equally by Wheaton and the Company ("AcquisitionCo"). The deferred amount will be secured by a charge on the shares of AcquisitionCo.

The Alumbrera Acquisition is scheduled to close on June 23, 2003. The Company's participation in the Alumbrera Acquisition is conditional upon it receiving sufficient commitments for its required equity contribution by May 23, 2003, failing which Wheaton will be entitled to acquire the Company's interest for $1.00. The Alumbrera Acquisition is subject to a number of conditions including due diligence, financing, all necessary regulatory and third party approvals and consents (including consents of the lenders to Alumbrera) and entering into a definitive purchase and sale agreement with Rio Algom. As at the date of this Annual Information Form, none of the conditions have been satisfied. See "Trends".

**Significant Acquisitions and Significant Dispositions**

The Company did not complete any significant acquisitions or dispositions, as that term is defined under applicable securities rules, in 2002. Throughout 2002, the Company reviewed a number of potential acquisitions with a focus on projects with the potential for providing positive cash flow. Subsequent to its 2002 fiscal year-end, the Company completed the acquisition of the 72% interest held by BHP in the Agua Rica Project and entered into an agreement relating to the Alumbrera Acquisition. See "General Development of the Business - Three Year History" and "Trends".

**Trends**

The Alumbrera Acquisition is subject to a number of conditions including due diligence, financing, all necessary regulatory and third party approvals and consents and entering into a definitive purchase and sale agreement with Rio Algom. To fund its share of the purchase price and its working capital requirements the Company has entered into an engagement letter with a syndicate of agents to conduct a private placement of special warrants on a best efforts basis to raise US$65 million, with an over-allottment option for a further US$15 million. The issue price of the special warrants is $0.13 and each special warrant will be exercisable without additional consideration to acquire one common share and one-half of one share purchase warrant. These securities have not been and will not be registered under the US Securities Act of 1933, as amended, or the securities laws of any U.S. state, and may not be

offered or sold in the United States or to U.S. persons without registration unless an exemption from registration is available.

Up to US$65 million of the proceeds will fund the Company's portion of the purchase price in respect of the Alumbrera Acquisition and the balance, if any, will be used for working capital requirements. The Company will be required to file and obtain receipts for a prospectus to qualify the issuance of common shares and any share purchase warrants underlying the special warrants and a 10% penalty, payable in securities, will apply if the Company fails to obtain a receipt for a final prospectus within 90 days of the closing date of the private placement. The financing will result in substantial dilution to the Company's existing shareholders.

The financing is subject to shareholder and regulatory approval and will require shareholder approval of an increase in the authorized capital of the Company, which will be sought at the Company's annual and extraordinary general meeting scheduled for June 16, 2003. At the meeting shareholders will also be asked to approve a consolidation of the Company's common share capital of the basis of one (1) new share for ten (10) old common shares held and a change of name of the Company to "Northern Orion Resources Inc.

As a result of the Agua Rica acquisition the Company has significant financial commitments (US$9 million deferred payment to BHP due June 2005 and US$3million loan due November 8, 2003). The Company's ability to meet such commitments is dependent upon it acquiring a source of cash flow sufficient to meet these obligations or undertaking further equity financings to raise the required funds. While it is expected that revenues generated from its acquisition of a 12.5% interest in Alumbrera will be sufficient to allow the Company to meet all of its obligations, the Alumbrera Acquisition is subject to a number of conditions which, at the date hereof, have not yet been satisfied, and accordingly there is no assurance that the Company will be successful in accessing the funds required to meet its commitments. Failure to do so could result in the Company losing its entire interest in the Agua Rica Project unless it is otherwise able to extend or otherwise renegotiate its commitments.

Except as otherwise disclosed herein and in the discussion in the Company's 2002 Annual Report under "Management's Discussion and Analysis of Financial Condition and Results of Operations for the year ended December 31, 2002, - Liquidity and Capital Resources", filed on SEDAR under the Company's profile, management does not presently know of any trend, commitment, event or uncertainty that may reasonably be expected to have a material effect on the Company's business, financial condition or result of operations. See "Three Year History" and "Narrative Description of the Business – Additional Risks and Uncertainties".

## NARRATIVE DESCRIPTION OF THE BUSINESS

### General

The Company's principal areas of activity in fiscal 2002 were Argentina and Cuba, the economic and political environments of which are less stable than those of Canada and the United States. Instability in the Argentinean currency has subjected the Company to an increased foreign currency risk. However, most of the Company's expenditures in Argentina and Cuba are in United States (US) dollars. The Company minimizes the exchange rate risks associated with its operations by maintaining most of its cash in Canadian and US dollars outside of Argentina and Cuba.

The mining industry is intensely competitive in all its phases. The Company competes with many companies possessing greater financial resources and technical facilities, for the acquisition of mineral

concessions, claims, leases and other mineral interests as well as for the recruitment and retention of qualified employees. See "Additional Risks and Uncertainties".

The Company does not directly employ any personnel. The Company conducts its exploration activities in Argentina and Cuba through consultants, the services of the Company's Chief Executive Officer and Chairman are provided under contract and the Company contracts for certain administrative services with LMC Management Services Ltd., whose employees and consultants supervise and carry out the day-to-day business of the Company under the direction of the Chief Executive Officer.

The Company completed a material debt restructuring involving its former controlling shareholder in 2001 and 2002. The nature and results of the restructuring are described in "General Development of the Business – Three Year History" and in the Company's 2002 Annual Report under "Management's Discussion and Analysis of Financial Condition and Results of Operations for the year ended December 31, 2002. Following the completion of this debt restructuring, one of the Company's principal focus in fiscal 2002 was the search for an accretive acquisition.

## Additional Risks and Uncertainties

The Company's operations are subject to the following additional risks and uncertainties.

### Financial/Going Concern Risks

The Company has no earnings record and there is no assurance that the Company will receive adequate or any revenues from its operations for the foreseeable future. The Company's continuing ability to meet its obligations as they come due and to hold and develop its properties is dependent upon obtaining the financing necessary to meet its liabilities and obligations as they become due. See "Trends".

### Financing Risks

The Company currently has no revenue other than interest income. A mining project typically requires a number of years from discovery, definition and development to construction and, as a result, no production revenue is expected from any of the Company's existing projects in the near term. The Alumbrera Acquisition, if completed, will provide the Company with a source of revenue, however, the acquisition remains subject to a number of conditions and there is no assurance that it will complete. In the meantime all of the Company's short to medium-term operating and exploration expenses must be paid from existing cash, external financing or assumption of such costs by joint venture partners or optionees. Actual funding obligations may vary from that budgeted due to a number of factors, the most significant of which would be the progress of exploration and development. In the event that the Company is unable to obtain external financing when required, the Company would be forced to review its property holdings and consider the disposition or dilution of some or all of its interests.

### Dilution

As at May 16, 2003, there were approximately 110 million common shares issuable upon exercise of warrants and options and other convertible securities and rights to purchase common shares at prices ranging from $0.075 to $0.20 per share. During the life of the warrants, options and other rights, the holders are given an opportunity to profit from a rise in the market price of the common shares of the Company with a resulting dilution in the interest of the other shareholders. The Company's ability to obtain additional financing during the period such warrants, options and other rights are outstanding may be adversely affected and the existence of the warrants, options and other rights may have an adverse effect on the price of the Company's common shares. The holders of the warrants, options and other

rights may exercise such securities at a time when the Company would, in all likelihood, be able to obtain any needed capital by a new offering of securities on terms more favourable than those provided by the outstanding warrants, options and other rights.

Shareholders will experience substantial further dilution in connection with the proposed financing required for the Alumbrera Acquisition. Assuming the financing raises proceeds of US$80 million, an issue price of $0.13 per special warrant and each special warrant exercisable to acquire one common share and one-half of one warrant, a further 1.385 billion shares of the Company will be issued and subject to issue on exercise of the share purchase warrants, without taking into account any penalty securities which may become issuable if the Company does not obtain a receipt for its prospectus within 90 days of the closing of the financing. Shareholders may also experience further dilution if the Company is successful in negotiating additional third party financings. See "Trends".

Any increase in the number of common shares in the market and the possibility of such increase may have a depressive effect on the market price of the Company's common shares. In addition, on issue of any additional common shares, the voting power of the Company's existing shareholders will be substantially diluted.

**Exploration and Mining Risks**

The business of the exploration for and development of mineral deposits involves a high degree of risk. Few properties that are explored are ultimately developed into producing mines. At present, none of the Company's properties is in production. Substantial expenditures are required to establish ore reserves through drilling, to develop metallurgical processes to extract the metal from the ore and to develop the mining and processing facilities and infrastructure at any site chosen for mining. Although substantial benefits may be derived from the discovery of a major mineralized deposit, no assurance can be given that minerals will be discovered in sufficient quantities to justify commercial operations or that funds required for development can be obtained on a timely basis.

**Uninsured Risks**

In the course of exploration, development and production of mineral properties, certain risks, and in particular, unexpected or unusual geological and operating conditions including rock bursts, unusual or unexpected formations, formation pressures, cave-ins, land-slides fires, explosions, flooding and earthquakes, power outages, labour disruptions, and the inability to obtain suitable or adequate machinery, equipment or labour may occur. It is not always possible to fully insure against such risks and the Company may decide not to take out insurance against such risks as a result of high premiums or other reasons. Should such liabilities arise, they could reduce or eliminate any future profitability and result in increasing costs and a decline in the value of the securities of the Company.

**Metal Prices, Political and Economic Uncertainty, Environmental and other Regulatory Requirements**

The economics of developing gold, copper and other mineral properties is affected by many factors, including the cost of operations, variations in the grade of ore mined, fluctuations in metals markets, costs of processing equipment and factors such as government regulations, including regulations relating to royalties, allowable production, importing and exporting of minerals and environmental protection. The Company has a history of losses and it has no producing mines.

The operations of the Company will require licenses and permits from various governmental authorities. There can be no assurance that the Company will be able to obtain all necessary licenses and permits that

may be required to carry out exploration, development and mining operations at any of its mineral properties.

Factors beyond the control of the Company may affect the marketability of any gold, copper or other minerals discovered. Metal prices have fluctuated widely, particularly in recent years, and are affected by numerous factors beyond the Company's control, including international economic and political trends, acts of terrorism, expectations of inflation, currency exchange fluctuations, interest rates, global or regional consumption patterns, speculative activities and worldwide production levels. The effect variances in any of the foregoing may have on the Company's results of operations cannot accurately be predicted.

The Company's operations may be subject to environmental regulations promulgated by government agencies from time to time. Environmental legislation provides for restrictions and prohibitions on spills, releases or emissions of various substances produced in association with certain mining industry operations, such as seepage from tailings disposal areas, which would result in environmental pollution. A breach of such legislation may result in imposition of fines and penalties. In addition, certain types of operations require the submission and approval of environmental impact assessments. Environmental assessments of proposed projects carry a heightened degree of responsibility for companies and directors, officers and employees. The cost of compliance with changes in governmental regulations has a potential to reduce or eliminate the profitability of operations.

**Economic and Political Instability in Foreign Countries**

The Company's investments in foreign countries such as Argentina and Cuba carry certain risks associated with different political and economic environments.

In particular, the Company's interests in Argentina are currently subject to risks relating to an uncertain or unpredictable political and economic environment in Argentina. In the short term, significant macroeconomic instability in the region is expected to negatively impact on the business environment and may lead to longer term negative changes in the national approach taken to foreign private ownership of natural resources. In addition, the government has renegotiated or defaulted on contracts respecting borrowings from a consortia of international commercial banks.

Argentina is experiencing severe economic difficulties, including a significant currency devaluation. In response to the economic instability in Argentina, the government announced the abandonment of the one to one peg of the Argentina peso to the US dollar in January 2002. During the economic crisis, Argentina defaulted on foreign debt repayments and, from November 2002 to January 2003, Argentina defaulted on the repayment on a number of loans to multinational organizations. In January 2003, the International Monetary Fund agreed to reschedule certain debt owed by Argentina and approved a short term credit line to repay debts to multinational organizations that could not be postponed.

There is a risk of political violence and increased social tension in Argentina as a result of the economic crisis, and Argentina has experienced increased civil unrest, crime and labour unrest. Roadblocks by members of the local communities, unemployed persons and unions can occur on most national and provincial routes without notice. Although there has not been any recurrence of disruptions in the past several months, there is no assurance that disruptions will not occur in the future which will affect the supply of goods. Civil disruptions may become more frequent if the economic situation in Argentina continues to deteriorate and may significantly disrupt the continuous supply of goods.

**Foreign Subsidiaries**

The Company is a holding company that conducts operations through foreign (Argentina, Cuba, the Cayman Islands and Delaware) direct and indirect subsidiaries and divisions, and substantially all of its assets are held in such entities. Accordingly, any limitations on the transfer of cash or other assets between the parent company and such entities, or among such entities, could restrict the Company's ability to fund its operations efficiently. Any such limitations, or the perception that such limitations may exist now or in the future, could have a material adverse impact on the Company's results of operations and stock price.

**Title Matters**

Although the title to properties held by the Company has been reviewed by or on behalf of the Company, there is no guarantee that title to such properties will not be challenged or impugned. The Company's mineral property interests may be subject to prior unregistered agreements or transfers or native land claims and title may be affected by undetected defects. The Company has not conducted surveys of the claims in which it holds direct or indirect interests and, therefore, the precise area and location of such claims may be in doubt. Accordingly, the Company's mineral property interests may be subject to prior unregistered liens, agreements, transfers or claims and title may be affected by, among other things, undetected defects.

**Key Executives**

The Company is dependent on the services of its key executives, its Chairman and Chief Executive Officer. Due to the concentration of management responsibilities, the loss of these persons or the Company's inability to attract and retain additional highly skilled employees could adversely affect its business and future operations.

**Competition**

The mining industry is competitive in all of its phases. The Company faces strong competition from other mining companies in connection with the acquisition of properties producing, or capable of producing, precious and base metals. Many of these companies have greater financial resources, operational experience and technical capabilities than the Company. As a result of this competition, the Company may be unable to maintain or acquire attractive mining properties on terms it considers acceptable or at all. Consequently, the Company's possible future revenues, operations and financial condition and its ability to raise additional capital may be materially adversely affected.

**Conflicts of Interest**

Certain of the directors and officers of the Company and its subsidiaries also serve as directors and/or officers of other companies involved in natural resource exploration and development or related businesses. Consequently, there exists the possibility for such directors and officers to be in a position of conflict. Two directors of the Company's subsidiaries are directors or employees of Endeavour and, as such it is possible that a conflict may arise between their duties to that subsidiary and their duties to Endeavour. Under the corporate law of the Cayman Islands and the articles of the relevant subsidiaries, directors in a position of conflict are required to disclose their interest but are not required to abstain from voting on any matter in which they are interested. Each of the Directors of the Company is required to declare and refrain from voting on any matter in which such Director may have a conflict of interest, in accordance with the procedures set forth in the *Company Act* (British Columbia) and other applicable laws. Any decision made by any of such directors and officers involving the Company will be made in

accordance with their duties and obligations to act in good faith with a view to the best interests of the Company and its shareholders.

## Mineral Property Interests

***Agua Rica Project***

Effective May 8, 2003, the Company acquired the 72% interest of BHP in the Agua Rica Project, with the result that the Company now holds 100% of the Agua Rica Project.

BHP's initial 70% interest was earned by spending US$1 million on exploration and agreeing to reimburse the Company's indirect subsidiary the US$7.9 million spent by it to acquire the Agua Rica project. As at December 31, 2000, BHP had fully reimbursed the US$7.9 million. In the second quarter of fiscal 2001, the Company elected not to make the cash calls of the operator from December 31, 2000 and to instead reduce its interest in the Agua Rica project to approximately 29.12% from the original interest of 30%. Due to financial constraints the Company continued to dilute its interest in the Agua Rica project and as at December 31, 2002, the Company held an approximate 28% interest in the Agua Rica project.. See "General Development of the Business – Three Year History ".

Under a joint operating agreement between the Company's indirect subsidiary and BHP, BHP managed and operated the project and exploration expenditures were shared by BHP and the Company in proportion to their respective interests in the project. BHP completed the 2001/2002 work program in June 2002. The Company's share of the work program (including management fees to the operator) in fiscal year 2002 was approximately US$303,000 (2001 - US$545,000), but was not paid and contributed to the dilution of the Company's interest in the Agua Rica project. Due to the continued weak world copper price in 2002, activities at Agua Rica continued on a reduced scale from previous years. The budget for the 2002/2003 year presented by the project operator of US$1.4 million was a continuation of this reduced work program. Work programs in the past two years have built on the work performed in completing the initial feasibility study, which was issued in November 1997. The 2002/2003 work program is currently underway and relates specifically to the simplification of the ownership interests in the project.

Information contained in this AIF that is of a scientific or technical nature relating specifically to the Agua Rica Project has been prepared by or under the supervision of Paul Hosford, P.Eng. and Callum Grant, P.Eng., of HATCH Associates Ltd., each of whom is a "qualified person" as the term is defined in National Instrument 43-101. The following information is extracted from a report (the "Technical Report") prepared by the foregoing titled "Northern Orion Explorations Ltd. Agua Rica Project, Argentina" dated May 16, 2003 and filed on SEDAR under the Company's profile. References to Figures in the following text are references to the corresponding Figures in the Technical Report.

**Property Description, Location and Access**

Agua Rica is located in the northwestern Argentine province of Catamarca approximately 200 kms from the provincial capital, and 25 kms to the north of the nearest settlement of Andalgalá.

The property covers an area of approximately 12.5 square kms with its centre point at approximately latitude of 27° 26' South, longitude 66° 16' West.

Figure 4-2 of the HATCH Report provides details of the location of the mining claims making up the core *"minas"* concessions, and the surrounding mineral rights that on average extend for

some 30kms north-south and 20kms east-west. In addition, several land easements covering access routes and potential water sources were acquired by the Joint Venture in the 1990s.

Future production from a mining operation at Agua Rica would be subject to a 3% "mine-mouth" royalty payable to the provincial Catamarca government.

To Hatch's knowledge, no environmental liabilities apply to the property

**Accessibility, Climate, Local Resources, Infrastructure, and Physiography**

The property lies in a rugged range of mountains known as the Sierra de Aconquija that runs northeast-southwest through this eastern flank of the Andes. Towards the south and north of the Sierra de Aconquija, the mountain range gives way to gentler terrain as the basinal areas known as Campo Arenal in the north and Salar de Pipanaco in the south and west are approached. Locally around the property itself, the terrain reaches to over 3,500m and is dissected by steeply eroded V-shaped valleys covered by partially consolidated scree, poorly developed soils (< 1m thick), and scrubby, sparse vegetation. The terrain in the area is rugged with more than 80 percent having slopes greater than 25 degrees, and over 40 percent with slopes over 35 degrees. Sediment control and water erosion during the summer rainy season are issues that will require mitigation in any development activities at the site.

The climate in this part of Argentina is generally mild and typical of this arid north-western region of Argentina. The mountain ranges of Catamarca act to interrupt the passage of humid air from the north east that causes the heavy summer rainfall. The flanks of the mountain range to the north of Agua Rica tend be drier than the immediate area around the project site and also towards the south where olives are intensively cultivated around Andalgalá. Annual precipitation is in the order of 300 mm, with the highest rainfall occurring in January (114 mm measured in Quebrada Minas in 1996). The warmest months are December and January (~30° C) while in the winter months of June, July, and August the temperatures can fall to below zero Centigrade at higher elevations.

Access to the site is via the principal road developed by the Joint Venture to service its exploration programs. This routing follows the Potrero valley northwards to the site from Andalgalá over a distance of some 20 kms. An alternative routing via the town of Capillitas to the north of the project site is more circuitous and is longer in both distance and time.

Andalgalá is a town of some 11,000 inhabitants and serves as the local centre for agriculture in the area, principally the cultivation of olives and walnuts. The town provides adequate facilities for small commercial businesses, automobile shops, some fabrication, small hotels, schools, and a hospital.

**History**

Since the early 1900s, the mining of copper and the semi-precious stone rhodochrosite has been recorded from the region around Agua Rica from several small-scale, artesanal mines, principally at Capillitas immediately to the west of the project site. Activities at Agua Rica itself date back to the period 1959-1965 when a restricted area known as Mi Vida was explored around Quebrada Minas and three small adits were driven.

The first systematic exploration work at Agua Rica dates back to the early 1970s when Compañia Cities Services Argentina S.A. examined the property (known at that time as Mi Vida) and completed several drillholes from pads located at the lower elevations of the geological sequence, i.e. close and adjacent to Quebrada Minas. While Cities Services recognised the significant potential for a porphyry type of copper occurrence, other aspects such as the epithermal "overprint" carrying precious metals and the potential for supergene enrichment at higher elevations was not fully appreciated, and so little follow-up work was carried out. By the late 1970s, the property had reverted back to its original Argentine owner, Recursos Americanos Argentinos S.A. (RAA).

In the early 1990s, RAA optioned the property to BHP Minerals Inc. (BHP) on the basis of 30% RAA, and 70% BHP. Also at that time, Northern Orion Explorations Ltd. (NNO) of Vancouver, Canada concluded an agreement with RAA to acquire a majority share of its exploration holdings throughout Argentina, including Agua Rica, and in this way NNO became the JV partner with BHP in the subsequent extensive exploration of the property from 1994 until late 1998. During this period, the Joint Venture carried out a series of field programs including basic mapping, geochemical (rock chip) sampling, and geophysics from which the larger potential of the property was recognised, particularly related to zones of secondary enrichment and evidence pointing to a post-porphyry epithermal stage of precious metals mineralization.

By 1995, a major program of diamond drilling was underway together with more detailed mapping and surface sampling, aerial photography for generation of accurate topography, metallurgical testwork principally at BHP's Reno laboratory, geophysical investigations to identify locations for the supply of water for a future mining and milling operation, plus various work programs to examine technical issues to support an Initial Feasibility Study of the project (1997).

In 1997, the JV completed an Initial Feasibility Study (IFS) on the basis of Inverse Distance Squared "103-hole resource model" in which two open pit options, one at 60,000 tpd and the other at 120,000 tpd, were investigated. This IFS was subsequently updated in 1998 (the kriged "150-hole model") and again in 1999 (the "176-hole model"). This latest 176-hole model (using Indicator Kriging) comprises all of the drilling information available on the property. A summary of these principal resource estimates is provided as follows (all at a 0.40% Cu cutoff grade):

| *Model* | *Date* | *Measured & Indicated Resource* | | | | | *Inferred* | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | *Mt* | *Cu %* | *Mo %* | *Au g/t* | *Ag g/t* | *Mt* | *Cu %* | *Mo %* | *Au g/t* | *Ag g/t* |
| 103-Model | 02/1997 | 722 | 0.61 | 0.034 | 0.24 | 3.2 | 80 | 0.61 | 0.034 | 0.24 | 3.2 |
| 150-Model | 01/1998 | 678 | 0.64 | 0.037 | 0.24 | 2.7 | 72 | 0.43 | 0.044 | 0.15 | 2.4 |
| 176-Model | 03/1999 | 592 | 0.60 | 0.033 | 0.23 | 3.3 | 148 | 0.60 | 0.033 | 0.23 | 3.3 |

*Source: BHP-NNO Report, March 1999*

In 1999, the Joint Venture halted all further field exploration activities at Agua Rica and no additional work of any significance has taken place since that time.

**Geological Setting**

Agua Rica lies to the east of, and is spatially related to, the prominent Farallón Negro Volcanic Complex covering 700 km2 and hosting the producing Alumbrera open pit mine. At a regional and tectonic scale, this complex sits between the high mountainous plateau of the Puna to the northwest and the basin and range province of Sierras Pampeanas, of which the Sierra de Aconquija is one example. Within the Farallón Complex and its immediate vicinity, several metalliferous occurrences have now been exposed including Alumbrera and Agua Rica, other porphyry types such as Cerro Atajo and Bajo del Durazano, as well as smaller polymetallic and gold/silver vein deposits.

The main unit of the Farallón complex is a series of volcanic breccias with related basalts, basaltic andesites, and dacites, all representing elements of a strato-volcanic complex that has been deeply eroded. Agua Rica lies on the flank of this ancient strato-volcano (8.5 to 5.5 million years before present) and compared to the Alumbrera complex has no major extrusive units present.

Figure 7-1 in the Technical Report illustrates the geological setting of Agua Rica and the principal mineralogy/rock types:

- meta-sedimentary rocks of the Sierra Aconquija Complex (country rocks);
- locally minor outcrops of granites or granitoid stocks of Ordovician age;
- a series of Tertiary intrusives notably early, weakly-mineralized Melcho intrusives;
- two irregular bodies of feldspar porphyry that form the main host for porphyry copper mineralization;
- various distal porphyries interpreted as late-stage events of no economic significance;
- several types and generations of hydrothermal breccia related to epithermal precious metal mineralization that overprinted the earlier copper-molybdenum stage.

Significant structural deformation and movement has been recorded at Agua Rica, principally related to the prominent fault zone now occupied by the Quebrada Minas creek that is believed to have formed the locus and zone of weakness for intrusion of the porphyry stocks. Low-angle reverse faulting is believed to have contributed to thickening of leached zones particularly on the west of the deposit, while to the east (Trampeadero), north-south faulting has promoted deep leaching at a local scale.

Rapid uplifting, "unroofing", intrusion of breccias, and subsequent erosion is believed to have been the principal factors in the genesis of the varied primary and secondary enriched mineralization at Agua Rica.

**Deposit Types**

During exploration of the deposit, BHP and NNO geologists identified several different ore types at Agua Rica that were formalised into a classification system for block modelling and resource estimation. In general terms, these ore types fall within three main categories that in turn can be related to the evolutionary history of mineralization on the property, the interpreted geological model, and the style of the mineralization:

*Stage 1:* early porphyry mineralization associated with the Seca and Trampeadero porphyries: quartz stockwork and disseminations of pyrite, molybdenite, chalcopyrite, and rare bornite and pyrrhotite

*Stage 2:* an overprinting epithermal event carrying precious metals and copper sulphosalts and best exemplified in the central Quebrada Minas breccia body that separates the Seca and Trampeadero porphyries, and in the Trampeadero porphyry itself;

*Stage 3:* supergene enrichment of hypogene copper mineralization forming an extensive blanket of higher copper values, now partially eroded into remnants on both sides of Quebrada Minas.

These three stages and deposit types form the basis for Agua Rica's resource and are found within three principal zones, namely Seca Norte on the east and Trampeadero on the west with Quebrada Minas breccia in the centre, all combining to form an elongated zone measuring ~2.75 kms long (east-west) by ~2.5 km wide (north-south). The principal characteristics of these three bodies are shown in Figure 8-1 of the Technical Report, and summarised as follows:

*Seca Norte:* an enriched porphyry sequence of Cu-Mo-Au, with a core rich in Cu-Mo flanked by a haloe of Mo to the south and west. In area, measures ~400m by 400m over a vertical interval of ~500m (level 3,400m to below 2,950m);

*Quebrada Minas:* dominated by epithermal sulphides within a funnel-shaped hydrothermal breccia unit that formed the conduit for deep-seated hydrothermal fluids. Outcrops in Quebrada Minas, measures ~300m by 300m between approximately level 3,000m to ~2,500m;

*Trampeadero:* forming the eastern third of the deposit, displays both epithermal and porphyry styles of mineralization. Occurs over a vertical interval of 300m as an elongated unit 500m east-west by 400m north-south.

**Mineralization**

Ore types at Agua Rica have been formalized by BHP and NNO into a classification system that reflects both mineralogy and metallurgy. Classifications in the latest, 176-hole geological model are based principally on:

- contaminant elements, principally on the basis of the As-bearing mineral, enargite;
- mineralogy: for example primary and secondary copper minerals
- mineralogical texture: for example, coarse versus finer-grained covellite;
- alteration: based on variations in clay facies alteration products.

A total of 13 ore type zones were classified using this scheme, and can be summarised as follows:

*Major "Dirty" Ore Types:* occur principally in the Trampeadero and Quebrada Minas zones with dominant mineralogy consisting of covellite, chalcocite, digenite, and enargite with minor sphalerite and galena, and abundant molybdenite locally (for example on the eastern fringe of the zone);

*Major "Clean" Ore Types:* generally confined to the Seca porphyry unit: covellite, chalcocite, chalcopyrite, and digenite. Locally abundant molybdenite.

These two ore types comprise over 80% of the mineralization at Agua Rica with the balance made up of Minor "Clean" and "Dirty" Ore Types within the three mineralized zones.

**Exploration**

Agua Rica has been explored through the sequential and systematic application of exploration programs involving basic mapping and sampling at the earlier stages, through more detailed investigations using ground geophysics and geochemistry, to a drilling campaign of 176 diamond drill holes and underground bulk sampling to confirm grade and provide material for metallurgical testwork.

The principal programs and the relevant results can be summarised as follows:

- Cities Services (1970-1972): geological mapping, alteration studies, rock geochemistry, and diamond drilling with helicopter access aimed at a copper-porphyry target at the lower elevations in the Quebrada Minas and southern flank of the property;

- the BHP-NNO Joint Venture: originally involving Recursos Americans Argentinos prior to its acquisition in 1995, this comprehensive exploration involved a 5-year period of geological mapping and rock geochemistry, a regional BLEG survey, an aerial photographic survey, a regional airborne magnetic/radiometric survey, and a total of 176 diamond drill holes completed over the period 1994 through 1998. At an early stage of the Joint Venture, the work programs were based on recognition that Agua Rica offered greater exploration potential than indicated by the early work had indicated, principally the occurrence of blankets of secondary enrichment at the higher elevations of the property on the Seca and Trampeadero sides of Quebrada Minas, and the importance of a later epithermal over-printing event with associated precious metal mineralization. During this period, an extensive network of drill roads was developed to the highest levels of the mineral system.

The 1993-1998 exploration at Agua Rica was completed by BHP Minerals as the operator of the Joint Venture, and involved both BHP staff and contractors for specific field programs such as geophysics, drilling, and underground bulk sampling. Hatch believes that these work programs have been carried out to industry standards, and that the information generated provides a reliable database for resource estimation and evaluation of the production potential of the property.

**Drilling**

Drilling was carried out at Agua Rica between 1992 and 1998 in four campaigns:

1) Cities Services (1972-73): 7,927m in 38 holes of less than 200m in length successfully intercepted porphyry-style mineralization, however owing to poor recovery and the small

size of the core (BX and AX), the assay results were not used in the subsequent resource estimates of BHP-NNO;

2) BHP-NNO, Phase 1 (1994/95): 14,802m in 39 holes to depths of ~450m were completed by the contractor Boytec (Chile) using HXWL and NXWL diamond core;

3) BHP-NNO, Phase 2 (1996): 26,995m of HXWL and NXWL diamond core completed in 64 vertical and inclined drillholes of up to 700m by a combination of contractors including Connors, Perfoeste, and Boytec;

4) BHP-NNO Phase 3 (1997-98): the final phase of diamond drilling on the property totalled ~23,000m for an accumulated total of ~65,000m for the BHP-NNO Joint Venture.

In all of the BHP-NNO programs, core recovery was typically in the 80-90% range, and all holes were surveyed by down-the-hole instruments. The later phases of the drilling included holes specifically for geotechnical evaluation of the ground conditions for a future open pit operation.

The Phase 2 and 3 programs were designed to drill off the property on 100m north-south sections across the east-west trend of the mineralization.

**Sampling Method and Approach**

The BHP-NNO sampling programs have followed the following general methodologies:

- standard 2m core samples sawn in half at site, with one half being returned to the core box and the other bagged for sample preparation (in later stages, core shipped to Andalgalá for preparation);
- logging by qualified geologists recorded an extensive data set of observations and measurements including lithology, alteration mineralogy, sulphide/oxide mineralogy, sulphide percentages, structural features, veining, and iron oxide characteristics;
- geotechnical data collected by qualified technicians included RQD and fracture frequency by 2m core intervals for use in subsequent geotechnical studies into open pit and underground mining;
- all core was routinely photographed before geological and geotechnical logging took place;
- all data collected through the logging procedures has been computerized.

All sample preparation and assaying was completed by industry standard laboratories such as Bondar Clegg (early programs) and by SGS for the later programs.

As an example of the extensive data collected through the drilling programs, the following tabulation provides a partial listing of the information collected and used for coding into the geological model of the deposit (176-hole model of 1998/1999):

| Lithologies | Mineralogy | Alteration | Other |
|---|---|---|---|
| Metasediment | Leached | Unaltered | Topography |
| Melcho Intrusive | Partial Leached | Potassic | Faults |
| Porphyry | Chalcocite | Phyllic | RQD, FF |
| Seca Porphyry | (enriched) | Advanced Argillic | SAG Index |
| Trampeadero Porphyry | Covellite | | |
| Hydrothermal Breccia | Pyrite | | |
| Igneous Breccia | Chalcopyrite | | |
| Biotite Porphyry | Coarse Covellite | | |
| Diatreme Breccia | | | |
| Clay- facies Breccia | | | |

The drilling and sampling programs covered the entire extent of known mineralization on the property both laterally and vertically, and provides a reliable basis for understanding the distribution of mineralization and variations with rock type, alteration, etc. In the central core of the deposit (Quebrada Minas), some deep holes to +700m below surface elevation were stopped before reaching the limits of the mineralization.

**Sample Preparation, Analysis and Security**

Two different sample preparation protocols have been used at Agua Rica:

- Holes AR-1 to AR-39: at a sample prep facility supervised by Bondar Clegg in Coquimbo, Chile, samples were crushed entire 2m half-core to ~60% passing –8 mesh, with a further step of pulverizing of a 1/8 or 1/16 split to 150 mesh (30g). Assaying completed by Bondar Clegg in La Serena, Chile, using fire assaying for Au an multi-acid digestion for AA assaying of Ag, Cu, Pb, Zn, Mo, and As;

- Holes AR-40 thru' the end of the drill programs (i.e., the bulk of the drilling programs): core samples crushed under the supervision of the company SGS to produce a sub-sample at 150 mesh (30g). Sample preparation in Mendoza, Argentina, with assaying by SGS, Santiago, Chile, using fire assaying for Au (50g) aqua regia digestion for AA analysis of Ag, Cu, Mo, Pb, Zn, As, Sb, and Fe.

In addition to assaying for contained metal values, density determinations are available for over 2,000 core samples collected from the drill programs. This data was collected from dried whole-core using the caliper method, and classified by lithology and mineralogy. In general, density increases with increasing Fe, Cu, Zn, and Pb content reflecting the sulphide content. For block modeling and resource estimation, a density value was calculated for each rock type from this base data.

Approximately 5% of the drill samples were randomly selected for check assaying at independent laboratories, as follows:

- Early Drilling (AR-1 thru' AR-39):
- primary laboratory: Bondar-Clegg, La Serena, Chile;
- check laboratories: Chemex (Toronto) and Acme (Vancouver)

- Later Drilling (after AR-40):
- primary lab: SGS, Santiago, Chile;
- check labs: Bondar-Clegg (Chile), Chemex (Toronto), and Acme (Vancouver).

BHP's standards program consisted of selecting pulps with less than a 10% relative difference from the four check laboratories, and inserting these pulps in the sample stream as their standards.

The results from these QA/QC procedures are discussed below.

**Data Verification**

*Results of QA/QC Programs*

In early 1998, Mineral Resources Development, Inc. (MRDI) was contracted by BHP to audit the sample and assaying QA/QC procedures employed by the Joint venture during its drilling programs at Agua Rica. This audit arose from statistical evaluation of the check assay results in 1997 indicating a relative low bias of 6% in copper assays from the primary SGS, Santiago laboratory compared to the check assay results at Chemex and Acme (using median values):

***Average of Copper Results for 1,245 samples (ppm)***

| | *Bondar-Clegg* | *SGS* | *Chemex* | *Acme* | *Average of Median* |
|---|---|---|---|---|---|
| Mean | 3,485 | 3,350 | 3,676 | 3,628 | 3,564 |
| (Mean-Median)/Median | -2.2% | -6.0% | 3.1% | 1.8% | |

*(Source:; MRDI, January 1998)*

Good agreement between assays for both Au and Mo were noted by MRDI during its audit. With respect to the copper bias, MRDI concluded in its report of January 1998:

*"...MRDI found BHP's practices meet or exceed those found in the mining industry, excepting that the recently instituted check assaying program indicated a low bias exists in copper assays performed by SGS, Santiago; the relative difference compared to check assay results is estimated to be 6 relative percent. While the bias is conservative, inasmuch as copper is under-estimated, differences greater than 5 relative percent may effect mine planning, reserve estimation, and net present value; at a minimum, selective re-assaying is warranted."*

However the statistical analysis of the check assay results by Cu grade also showed that the greatest inter-laboratory differences occurred at low copper grades of <0.05% Cu, and hence would not have a significant impact on resource calculations. Nevertheless, an additional check assaying program was undertaken by BHP in 1998, selecting those samples that had returned significant (+/-20%) differences between the primary and the three original check laboratories for shipment and assaying at Chemex Laboratories in Vancouver. This involved some 1,700 samples and replacement of the re-assayed Chemex assays in the Agua Rica assay database used for the 176-hole resource model (the latest and most up-to-date resource for the property). Comparisons of these Chemex results versus three independent check labs were as follows:

*Average of Copper Results from re-assay program (ppm)*

| | Bondar-Clegg | SGS | Chemex | Acme | Average of Means |
|---|---|---|---|---|---|
| Mean | 4,693 | 4,571 | 4,812 | 4,804 | 4,720 |

*(Source: BHP memorandum, June 1998)*

An additional, more detailed audit of the check assaying procedures at Agua Rica was completed in mid-1999 by Pincock, Allen & Holt (PAH). In their report, PAH concluded that the check error rates were within industry standards, that the amount of cross-lab checking was "good" to "excellent", and that the assay database was suitable for a feasibility-level study.

Hatch concludes that any bias in copper assaying has been adequately addressed through the 1998 re-assay program, and that therefore the database used for the latest 176-hole geological and resource model is sufficiently reliable within industry standards of resource reporting.

*Bulk Sampling Program, 1998:*

In late 1998, two underground adits with a combined length of 350m were driven for the purposes of collecting metallurgical samples of different ore types and for grade confirmation. The two adits, one at Trampeadero side (250m) and the other at Seca (100m), were driven by the contractor Redpath Más Errazuriz over a period of 58 days during which four bulk samples were collected and shipped to the Mintek metallurgical plant in Johannesburg, South Africa.

Since the adits were driven horizontally along two pilot drillholes, a detailed comparison of the original assay results could be made against wall and face channel samples and muck samples, all of which were taken on a round-by-round basis. Average comparisons of the drillhole values ("DDH") versus the bulk sampling face channels taken round by round ("Faces") provide additional support for the reliability of the drill data used for resource estimation:

| | | Cu % | Mo % | Au g/t | Ag g/t | Length (m) |
|---|---|---|---|---|---|---|
| *SECA* | *DDH* | 0.53 | 0.022 | 0.41 | 0.88 | 100 |
| | *Face* | 0.53 | 0.024 | 0.37 | 1.30 | |
| *TRAMPEADERO* | *DDH* | 0.95 | 0.094 | 0.15 | 6.01 | 250 |
| | *Face* | 1.10 | 0.090 | 0.203 | 9.24 | |

**Adjacent Properties**

Approximately 20kms to the west of Agua Rica, the Joint Venture holds title to a central portion of the Cerro Atajo copper property which forms a prominent gossan zone on the southwest facing slopes of the Aconquija range of mountains. During the 1990s, the Joint Venture explored and sampled an area of 15km$^2$ around Cerro Atajo identifying a 1100m by 600m zone of vuggy silica, alunite, quartz and clay alteration centred over a swarm of dacite porphyry dykes with a peripheral zone of less intense alteration. Although no fresh sulphides can be seen at surface, mineralization reported from drilling by Placer Ltd in the 1970s records occurrences of pyrite, chalcopyrite, tetrahedrite, and chalcocite. Copper oxides are common at surface within the propyllitically altered volcanics at their contact with quartz-sericite altered vein zones. A

total of 456 rock chip samples were collected by BHP-NNO and returned elevated values in the central quartz-alunite zone in Au (20-76 ppb), Pb (150-1000 ppm), and Mo (10-21 ppm). BHP-NNO concluded from their field work that the alteration and geochmeical zoning at Cerro Atajo suggests the presence of a large porphyry stock at depth, and possibly porphyry-style mineralization.

Further to the west of Agua Rica by approximately 34 kms, the Bajo de la Alumbrera mine ("Alumbrera") is operated by Minera Alumbrera Ltda. (MAA), a joint venture between MIM of Australia (50%), BHPBilliton (25%), and Wheaton River Gold Mines (25%), with MIM acting as operator of the mine (Wheaton recently announced the purchase of BHPBilliton's share in the project).

Alumbrera was originally discovered, explored, and studied by various parties in the 1960s and 1970s, but it was not until the 1990s that the property reached the production stage after MIMM acquired the Canadian company Musto International who had completed a final program of drilling at the site. Following a construction period of ~3 years and expenditures of US$1.3 billion (a 32% over-run), the mine went into production at a rate of 80,000 tpd in early 1998. For the year to June 2002, the operation mined and processed 29.5 million tonnes of ore grading 0.74% Cu and 1.04g/t Au.

Alumbrera lies in the same general geological setting as Agua Rica but closer to the center of the regional Farallón Negro volcanic complex. It is a typical copper porphyry deposit with 2002 Proved and Probable open pit reserves stated by MIMM at 372 million tonnes at 0.53% Cu and 0.61g/t Au.

**Mineral Processing & Metallurgical Testing**

*Introduction*

The mineral processing program for the Agua Rica ore body was conducted in three phases to identify the mineralogy and metallurgy of the ore to provide data for engineering studies.

The initial scoping type testwork was conducted as Phase 1 in 1997 at BHP's Center for Minerals Technology and led to a flowsheet design and a feasibility study. The testwork investigated the mineralogy of the ore and its mineral processing characteristics, particularly with regards to its amenability to grinding, flotation, liquid-solid separation and dewatering.

This work was followed by more detailed Phases 2 and 3 test programs in 1999 whereby the operating parameters were confirmed and optimized. The programs further investigated the ore mineralogy and concentrate recovery through batch, locked-cycle and pilot plant grinding and flotation. The test campaigns identified the processing parameters required in each unit operation for a technically viable operation to produce marketable concentrates. These programs were completed by the major facilities, Mintek and Lakefield Research, who are recognized specialists in the mineral processing industry.

*Mineralogy*

The Aqua Rica ore occurs in the Quebrada Minas, Quebrada Seca Norte and Trampeadero regions. During Phase 1, the major copper minerals were identified to be chalcocite, covellite, digenite, chalcopyrite and bornite. The occurrences of mineral combinations depends on the

region of deposit. For example, fine chalcocite-covellite-digenite occurs in Quebrada Seca Norte and Trampeadero regions, while coarse covellite occurs in Quebrada Minas region.

In Phase 2, the geology of the ore body was redefined. As a result, the ore was classified into six types or composites for metallurgical testing. These represent 80% of the deposit according to the major copper mineralogy and contained minor elements, such as lead, zinc, arsenic and sulphur, that affect concentrate grades. Metallurgical testing was conducted on drill core rejects to determine the set of processing conditions that will produce acceptable concentrate grades from the range of ores.

*Grinding*

In the initial 1997 Phase 1 study, Bond Ball and Rod Mill Work Indices and Minnovex SAG Power Indices were examined to estimate the milling characteristics and power requirements. This was investigated further and confirmed in Phases 2 and 3 on more representative composites of the ore.

Generally, the ore is softer than typical porphory copper ores and covers a range of hardness which may be due to the clay content. The average Ball Mill Work Index of 12 kWh/t was used in the engineering study.

*Flotation*

The Phase 1 scoping work in 1997 evaluated grind and reagent scheme against rougher flotation performance in terms of kinetics, residence time, and copper recovery. It was established that the optimum grind was 80% passing 150 microns. The conditions identified produced a copper rougher recovery of 89.5%. Preliminary tests on molybdenum and gold recoveries were below expectations.

Phase 2 built on Phase 1 work by conducting locked cycle testwork which gave improved recoveries for copper by 5% and molybdenum by 10% using revised reagent schemes and a regrinding circuit.

For Phase 3, pilot plant campaigns, based on the conditions determined in Phase 2 locked cycle tests, were run on two samples representing the feed ore for the first 5 years of operation to explore several possible flowsheet modifications and confirm the reagent schemes developed in Phase 2. The results were an improvement over Phase 2 and showed that approximately 90% of the copper could be recovered in a concentrate at 45% Cu grade. These are higher than the design criteria of 86% recovery and 30% Cu grade used in the 1997 initial feasibility study.

Pilot plant tests showed that a separate marketable molybdenum concentrate could potentially be produced. The pilot plant yielded an overall molybdenum recovery of 52% to a concentrate grading 55% Mo. Compared with the 1997 design criteria, the grade was improved by 5% at the expense of recovery which decreased from 65%. A marketable concentrate requires a minimum grade of 50% Mo.

Gold recovery to final copper concentrate was low at 55% to 59% and was attributed to its occurrence with pyrite which was rejected to tailings.

A significant change in Phase 3 was the elimination of cyanide addition for pyrite depression. Proper and consistent pH control rather than cyanide was found to be effective for pyrite separation from copper.

The pilot plant work also raised a concern on potential high bismuth and fluorine contamination of the concentrate. This was not observed in the earlier work phases.

*Thickening and Filtration*

Thickening and filtration tests were conducted by vendors on concentrate and tailings generated in Phase 3 pilot plant operation. The concentrate slurry had a stable froth which presented difficulties to settling. Tailings could be settled with moderate amounts of flocculant. Pressure filtration was more effective than ceramic disc filtration on the concentrate.

*Recommendations*

The pilot plant campaigns demonstrated a possible flowsheet for the recovery of copper and molybdenum concentrates. Further optimization work was recommended particularly to improve molybdenite recovery and gold recovery by separation from pyrite.

**Mineral Resource & Reserve Cost Estimates**

*Resource Estimates*

The principal resource estimates generated by BHP-NNO over the period 1994 through 1998 and 1999 have been:

- February 1997: a "103-hole block model" used for the "Initial Feasibility Study" (Inverse Distance Squared method, or ID2);
- January 1998: a "150-hole model" (an updated version of the 103-hole model, also estimated by ID2 and Ordinary Kriging);
- March 1999: based on all 176 holes drilled on the property and a revised classification of ore types described earlier in this report, a kriged block model was generated and used as the basis for an updated Initial Feasibility Study completed in July 1999 (the "176-hole model"). This kriged model was a joint effort between BHP and NNO staff and a geostatistical specialist, Isaaks & Company.

All of the resource estimation procedures applied in the generation of the block models since 1997 followed consistent, industry-standard methodologies and incorporated substantial geological inputs for zone interpretation, and modelling of the various ore types identified on the property.

For the purposes of this Independent Technical Report, a description of the latest 176-hole model is provided to illustrate the resource estimation procedures:

*Raw Database:*

- The raw data files used for resource modelling included files for topography at 5m intervals; collar locations; orientation and depth of 150 drillholes; downhole surveys;

lithology logs; mineralogy classifications; alteration data; fault intervals; 2m assay data linked to laboratory name and batch number for each analysis; over 3,000 density measurements of dried drillcore using the calliper method and cross-checked using the wax method at an outside laboratory (densities varied from a low of 2.36 for leached material to a high of 2.70 for mineralized hydrothermal breccia).

*Derived Files:*

- During the modelling procedures in MedSystem, several output files were generated such as: 15m bench composites coded by lithology and mineralogy; 15m composites with geological codes loaded from the block model; various "vbm" files produced in Meds; summary files with raw data checks; block totals of each value generated.

*Modelled Parameters:*

- lithology; Cu-Fe mineralogy (leached, chalcocite, covellite, primary, and mixed zones); alteration (8 zones); native sulphur zone; clean/dirty boundary (from As and Cu levels); geotechnical parameters (RQD and core recovery), and assay values for Cu, Mo, Au, Ag, Pb, Zn, As, and Fe;

- modelled parameters based on geological interpretation on 50m N-S and E-W sections at a 1:2000 scale.

*Block Size:*

- 25m by 25m by 15m high, fully diluted

*Kriging Methodology:*

- Ordinary Kriging for east and west sectors of the deposit based on variography for low and high grade copper and molybdenum zones (exponential models with ranges varying from 25m vertically to over 190m horizontally); high-grade samples restricted to 75m search;

*Resource Classification:*

- based on kriging variances for east and west sectors, for example for the east sector: Measured <0.40; Indicated between 0.41 and 0.47; and Inferred > 0.47.

The following table summarises the 150-hole resource model for Agua Rica:

***Agua Rica Resource Estimates, March 1999 (150-Hole Model)***
*(Source: BHP-NNO Joint Venture)*

***MEASURED RESOURCE***

| Cut-off %Cu | Mt | %Cu | %Mo | Au g/t | Ag g/t |
|---|---|---|---|---|---|
| 0.20 | 898 | 0.51 | 0.032 | 0.21 | 1.7 |
| 0.40 | 522 | 0.67 | 0.036 | 0.25 | 2.4 |
| 0.70 | 154 | 1.00 | 0.036 | 0.32 | 3.1 |

***INDICATED RESOURCE***

| Cut-off %Cu | Mt | %Cu | %Mo | Au g/t | Ag g/t |
|---|---|---|---|---|---|
| 0.20 | 431 | 0.37 | 0.031 | 0.16 | 3.1 |
| 0.40 | 156 | 0.52 | 0.038 | 0.21 | 3.5 |
| 0.7 | 11 | 0.83 | 0.039 | 0.32 | 4.1 |

***INFERRED RESOURCE***

| Cut-off %Cu | Mt | %Cu | %Mo | Au g/t | Ag g/t |
|---|---|---|---|---|---|
| 0.20 | 385 | 0.32 | 0.031 | 0.11 | 2.5 |
| 0.40 | 72 | 0.49 | 0.044 | 0.15 | 2.4 |
| 0.70 | 2 | 0.80 | 0.032 | 0.35 | 3.0 |

***MEASURED+INDICATED***

| Cut-off %Cu | Mt | %Cu | %Mo | Au g/t | Ag g/t |
|---|---|---|---|---|---|
| 0.20 | 1,329 | 0.46 | 0.032 | 0.14 | 2.2 |
| 0.40 | 678 | 0.64 | 0.037 | 0.24 | 2.7 |
| 0.70 | 165 | 0.99 | 0.036 | 0.32 | 3.2 |

## Mineral Reserves

On the basis of the 150-hole resource model, pit optimization studies were completed using the Meds System Lerchs-Grossman method (the "Dipper" and "Stripper" modules of Meds). The principal input parameters to the pit optimization studies were as follows:

| *Input Item, 1998* | | Unit | *Value* |
|---|---|---|---|
| Prices | | | |
| | Copper | $/lb | $0.95 |
| | Gold | $/oz | $350 |
| | Silver | $/oz | $4.50 |
| | Molydenum | $/lb | $3.50 |
| Mill Production Rate | | tpd | 68,000 |
| Metallurgical Recoveries | Copper | all % | 85 |
| | Gold | | 46 |
| | Silver | | 60 |
| | Molybdenum | | 70 |
| Internal Cut Off Grade (years 1-12) | | Cu | 0.40% |

| *Input Item, 1998* | Unit | *Value* |
|---|---|---|
| Operating Costs: | | |
| Mining, fixed | $/t moved | $0.65 |
| Incremental mining cost by bench | $/t moved | $0.01 |
| Process | $/t milled | $3.00 |
| G&A | $/t milled | $0.90 |
| Concentrate Transportation | $/t con | $47 |
| TCRCs | $/lb metal | $0.24/lb Cu<br>$6/oz Au<br>$0.45/oz Ag |
| Royalties | % | 3% |
| Pit Slopes, 3 sectors: | | |
| Variable by sector | degree | 36-55 |
| Pit Parameters: | | |
| Bench Height | m | 15 |
| Face Angle | degree | 60 |
| Catch Berms, every 180m | m | 30m |
| Haul Road | m | 36 |
| Benching | double | 30m |
| Minimum pushback width | m | 75m |
| Dilution & Loss: | Included in 15m bench composites | |

In generating the optimum pit shells, only the Measured and Indicated resource blocks were allowed to generate revenue, the Inferred blocks being assigned as waste with zero values. Furthermore, no block <0.40% Cu was allowed to generate revenue in the net value calculations of the optimization routines (i.e., the external cutoff grade). In order to speed up the optimization procedure, the 25m by 25m by 15m resource model blocks were re-blocked to 50m by 50m by 15m.

Optimization of the pit was based on Net Value calculations to take into account the multiple elements present in the deposit and a block-by-block calculation of total payable value from all the elements, less operating costs, including treatment and smelting costs, provided that the block had at least 0.40% Cu. The Lerchs-Grossman routine calculates the maximum profit pit incorporating the Net Values for all blocks in the model. Waste blocks generate negative dollar value equivalent to the mining costs multiplied by block tonnage. Through an iterative process, a maximum, undiscounted net dollar value is obtained.

Within the ultimate pit design, improved economic results were evaluated by applying varying copper prices from $0.70 per lb to $0.90 per lb to produce a series of pit phases. After mine planning to allow for haul roads by phase and by bench, the following combined Proven and Probable Mineral Reserves were obtained:

*Agua Rica Proven & Probable Reserves, 68k Case*
*(0.40% Cu Cutoff Grade)*

*1998*

| | Proven & Probable | | | | | Waste | |
|---|---|---|---|---|---|---|---|
| | Mt | Cu % | Mo % | Au g/t | Ag g/t | Mt | W/O |
| TOTALS | 516.6 | 0.64 | 0.033 | 0.27 | 4.1 | 1,109 | 2.15 |

Source: *BHP-NNO Joint Venture 68k Production Report, 1998*

In the mine planning and scheduling of these reserves, lower grade material below the 0.40% Cu internal cutoff was stockpiled and retrieved during the latter years of the 22-year mine life.

## Additional Information for Development Properties

*Open Pit Mining*

The basis of the Joint Venture's open pit mining plan was a large-scale truck-and-shovel operation operating at 68,000 tpd over 350 days per year on two shifts. An initial access and development fleet of 218t trucks and hydraulic shovels was scheduled for the initial two years of pre-production to remove ~30 million tonnes to expose the Seca and Trampeadero deposits. Once in production, high material movements averaging over 350,000 tpd (ore and waste) in the first 10 years of the operation would be met through a combination of large rope shovels, hydraulic shovels, and a 20-24 unit fleet of 218t trucks An auxiliary fleet of tracked and wheel dozers and other support equipment was also included in the BHP-NNO mine plan. Haul truck cycles were derived for all pit benches by mining phase and input to the Meds System scheduling module.

*Underground Mining Alternatives*

In the early 1990s, the Joint Venture carried out a study into an underground Block Caving approach to the Agua Rica deposit. The method is capable of high rates of production and relies principally on natural gravity for both fragmentation of the caving ore, and for materials handling of the broken ore as it passes vertically down through a series of raises to a central haulage system. The method has been extensively applied for many years in the Chilean porphyry copper deposit, either as a traditional "grizzly" method or the more modern "zanja y calle" methods using LHD equipment.

Unlike many block cave situations that are accessed via vertical shaft systems for both ore handling and services, the higher grade zones at Seca and Trampeadero can easily be targeted and accessed from the sides of the Quebrada Minas valley thus avoiding a costly and lengthy development period prior to start-up. Other advantages of a block caving approach would be:

- the method does not require handling of ARD waste disposal on surface;
- rapid access and reduced start-up time compared to open pit approach;
- significant savings in capital costs compared to open pit mining;

- since the ore zones can be accessed from adits, no vertical hoisting of material would be required, and an efficient ventilation system would be possible.

Through a geotechnical consulting firm in Santiago, Chile (Ingeroc Ltda.), the caving parameters were established from an analysis of the RQD and Rock Mass Ratings of the Agua Rica ground from which it was concluded that block caving is geotechnically feasible, and that a drawpoint spacing of between 9m by 9m for Seca and 10m by 12m for Trampeadero would produce optimum caving conditions.

Using the Block Caving modules of Meds System, a Single Lift and Double Lift option were evaluated using the following input parameters:

| *Input Item* | | Unit | *Value* |
|---|---|---|---|
| Prices | | | |
| | Copper | $/lb | $0.90 |
| | Gold | $/oz | $350 |
| | Silver | $/oz | $5.00 |
| | Molydenum | $/lb | $4.00 |
| Mill Production Rate | | Tpd | 50,000 |
| Cutoff Grade | | % | 0.40% |
| Metallurgical Recoveries | Copper | | 85 |
| | Gold | all % | 45 |
| | Silver | | 68 |
| | Molybdenum | | 48 |
| Operating Costs: | | | |
| | Mining | $/t | $3.00 |
| | Process, G&A | $/t | $4.00 |
| | Development | $/t | $0.50 |
| | TCRCs | | $0.71 |
| | Cu | $/lb | $0.24 |
| | Royalty | % | 3% |

Based on a Two Lift option with a First Lift established at the 3105m elevation and a Second Lift at the 2940m elevation, a Proven & Probable Reserve was derived as follows:

***50k Block Cave, Proven & Probable Reserve***

| *Mine Life Years* | *Mt* | *Cu %* | *Mo %* | *Au g/t* | *Ag g/t* |
|---|---|---|---|---|---|
| 23 | 410.7 | 0.63 | 0.038 | 0.26 | 3.52 |

Below the 2940m elevation, an additional Inferred Resource of 210 million tonnes at 0.54% Cu, 0.037% Mo, 0.27g/t Au, and 3.3g/t Ag offers the possibility of extending the block cave to a Third Lift (~10 years of additional production).

## Processing

*Introduction*

A process flowsheet has been developed from the three phases of testwork, particularly the pilot plant campaigns, based on a conventional sulphide concentrator. The plant will include a

grinding circuit utilizing SAG and ball milling, flotation and dewatering circuits. Separate copper and molybdenum concentrates will be produced.

*Process Description*

Based on the 1997 feasibility study, the process plant for the Agua Rica project will be similar to a typical porphyry copper plant, except for the addition of a molybdenum recovery circuit. The required reagents are standard commercial products which are readily available.

Agua Rica ore will be crushed in a single-stage primary crusher then conveyed to the mill site. The ore will be ground through a SAG mill-Ball mill circuit before feeding the copper flotation circuit.

Ground ore will be fed to copper rougher flotation. The rougher concentrate will be reground then upgraded in three stages of cleaning. Both the rougher and first stage cleaner will operate in open circuit with the combined tailings going to the tailings thickener. The concentrate from the first cleaner will be upgraded in the second and third stage cleaners operating in closed circuit to produce a bulk copper concentrate which will contain molybdenum.

The bulk copper concentrate will be processed in the molybdenum flotation circuit consisting of rougher flotation, a regrind, followed by five stages of cleaning to produce a final copper concentrate and a molybdenum concentrate.

Both the final copper and molybdenum concentrates will be thickened then filtered. The copper and molybdenum concentrates will be filtered in-plant. Copper concentrate will be truck hauled to the Belgrano railhead at Chumbicha and railed to the port. Molybdenum concentrate will be truck hauled to a regional smelter facility.

*Process Equipment*

Standard industry proven equipment has been proposed for the plant. Some new technologies, outlined below, have been developed since the 1997 feasibility study and should be evaluated for possible enhancement of the metallurgical performance.

There have been improvements to flotation cell design, such as the Jameson cell and column cell, for increased recovery through flotation of fine mineral particles. These might be applicable to Agua Rica to minimize losses of fine copper minerals to tailings as observed in the testwork.

Deaerators, such as the Outokumpu FrothBusters, are available to disengage air from the concentrate slurry prior to settling. These might overcome the settling difficulties observed in the pilot plant work to improve settling and overflow clarity. This has the potential of reducing the thickener capacity. In addition, various thickener designs such as the high capacity and E-CAT designs should be investigated for possible reduction in capacity requirements and improved overall operation and costs.

**Infrastructure**

The infrastructure requirements for a standalone concentrator for the Agua Rica project as described in the 1997 IFS document include the following facilities:

- Minesite and plantsite access roads from Andalgala, approximately 28km long. The area terrain is very rugged and there are opportunities to optimize the routing, particularly using the Potrero valley.
- A 20 km long overland conveyor system to transport ore from the minesite to the plantsite, including a 4km long tunnel and a conveyor routing tracking the access road. The conveyor is regenerative.
- Tailings dam located at La Isla on the valley floor and approximately 28km south of the plantsite, with reclaim water system.
- Power supply provided by a local utility company, tapped off from an existing 132kV transmission line feeding Andalgala.
- Fresh water supply provided by a series of well fields located on the valley floor, south of the plantsite. These have still to be confirmed.
- On site maintenance/warehouse, truckshop, administration and laboratory buildings, fuel storage and distribution, water distribution and fire protection and sewage treatment facilities.
- Concentrate filter plant including storage tanks, pressure filters, clarifiers and truck weigh scale.
- Upgrade to existing port facilities , including railcar unloading station, concentrate storage and reclaim facilities to tie into existing ship loading equipment.

No camp accommodation is provided, as personnel will be bussed to the plant and mine site from Andagala.

**Financial Analysis**

In completing this report, Hatch examined several studies completed by the BHP-NNO joint venture. The 1997 IFS completed by BHP-NNO was based on open pit options of 60ktpd and 120ktpd feeding concentrators at two alternative locations. In 1999, this study was reviewed by Minproc who suggested a number of improvements to reduce capital costs. Around the same time, a scoping level study into an alternative underground mining scheme (the block cave) was completed in 1998. Also in 1999, BHP evaluated a 68ktpd open pit option with an alternative plant site. Betchel then completed a scoping level study of an overland conveyor system for the revised Agua Rica plant site location. In December 2001, the Argentine peso underwent rapid devaluation from a rate of 1:1 to 3.5:1 to the US dollar, which has had a significant effect in reducing local costs (ie, in pesos).

For the financials in this report, Hatch has examined a standalone case of an open pit and concentrator combination processing 68,000 tpd of ore (the 68k Case). Cost inputs for this financial evaluation have been taken from information developed in the earlier BHP-NNO studies, adjusted and updated for current cost and exchange conditions in Argentina.

## Capital and Operating Cost Estimates

Capital and operating cost estimates for the updated Hatch 68k Case have been developed as follows:

- Initial Feasibility Study ("IFS") estimates form the basis of the cost inputs, with unit rates updated for current Argentine construction and operating labour, concrete and steel erection;
- Overland conveyor capital costs have been taken from the 1999 Bechtel study. The overland conveyor routing from the mine site to the plant site was determined from 10m contour maps of the site, with estimates, not supported by geotechnical investigations, for the relative amounts of rock deemed rippable and that requiring blasting. Tunneling costs were based on typical rates for the region;
- Costs for the on site buildings have been updated using recent actual constructed costs for similar size facilities for a project in Peru that Hatch is involved with currently;
- Costs for consumables have been updated using consumption rates reported for the pilot plant testwork and recent budgetary costs;
- Costs for seafreight have been based on current published data for the Alumbrera operation (approximately $32/dmt concentrate). Unit rates for power, road and rail transportation have not changed.
- Mining costs for the 68k open pit operation have been based on the current published unit rates for Alumbrera, of 71c/t moved.
- An operating cost factor of 0.89 was applied to the total operating cost estimates to account for lower cost components resulting from the Argentine currency devaluation. This was based on recent published data for Alumbrera where actual costs for 2002 were 89% lower than planned, due largely to devaluation, an experience considered appropriate for this 68k case at Agua Rica.

The capital and operating cost estimates for the 1997 IFS 60ktpd and 120 ktpd concentrator, the 1999 BHP updated 68 ktpd concentrator, and the updated Hatch case are summarized on the following page (some original BHP estimates for the 120k case not available and shown for reference only):

*Capital Cost Estimates for Production Alternatives (Millions US$)*

| CAPITAL COST ESTIMATE | Units | Standalone concentrator IFS 60 k BHP | Standalone concentrator IFS 120k BHP | Standalone concentrator 68k BHP | Standalone concentrator 68 k Hatch |
|---|---|---|---|---|---|
| Plantsite,roads | $M | 18.4 | | 40.4 | 45.9 |
| Mine access road | $M | Incl | | 23.3 | 9.6 |
| Crushing | $M | 12.9 | | Incl | 7.8 |
| Overland conveyors,tunnels | $M | 131.5 | | 57.4 | 41.5 |
| Concentrator | $M | 123.6 | | 103.9 | 114.0 |
| Power supply,distribn | $M | 18.7 | | 22.9 | 17.1 |
| Ancillary buildings | $M | 14.2 | | Incl | 14.1 |
| Tailings impoundment | $M | 30.4 | | 5.3 | 5.5 |
| Water supply,distribn | $M | 47.3 | | 60.6 | 12.0 |
| Mobile equipment, water treatment plant | $M | 2.3 | | Incl | 5.6 |
| Port site | $M | 10.0 | | 10.0 | 8.8 |
| Mine equipment | $M | 112.6 | | 116.7 | 100.3 |
| Mine preproduction | $M | 20.8 | | ~13.0 | 43.8 |
| Total direct costs | $M | 542.6 | | 449.8 | 441.5 |
| Indirect costs | $M | 219.0 | | 160.9 | 103.9 |
| Contingency | $M | 119.2 | | 95.9 | 76.5 |
| Owners costs | $M | 33.7 | | 32.9 | 20.2 |
| Total expansion cost | $M | - | 378.5 | - | - |
| Total capital costs | $M | 914.5 | 1293.0 | 743.2 | 625.6 |

*Operating Cost Estimates*

| | | | | | |
|---|---|---|---|---|---|
| Mining | $/t moved | 0.58 | 0.48 | 0.57 | 0.71 |
| Strip ratio | | 2.35 | 1.80 | 2.27 | 2.48 |
| Mining | $/t ore | 1.95 | 1.35 | 1.86 | 2.34 |
| Process | $/t ore | 3.41 | 3.08 | 2.99 | 2.93 |
| General and administration | $/t ore | 0.64 | 0.37 | 0.59 | 0.56 |
| Total mine site | $/t ore | 6.00 | 4.80 | 5.44 | 5.83 |
| Transport,marketing | $/t ore | 0.63 | 0.55 | Incl | 0.30 |
| Ocean freight | $/t ore | 0.45 | 0.38 | 1.16 | 0.45 |
| Total operating cost | $/t ore | 7.08 | 5.74 | 6.60 | 6.58 |
| Adjusted Operating Cost/ t Ore | | | | | 5.86 |

## Taxes and Fiscal Regime

The fiscal regime and conditions presented in the IFS are still valid. After the devaluation of the Argentine peso in January 2001, the Senate introduced a resolution supporting the continuance of the "Fiscal Stability Regime".

The key taxation criteria incorporated into the preliminary cash flow model are as follows:

- Income tax rate of 33%
- No import taxes or duties on capital goods, equipment or spares
- 100% Depreciation of capital assets allowed over a three year period. Straight-line depreciation was utilized in the model.

## Financial Projections

The financial model developed by Hatch for the updated 68k case assumes 100% equity financing, does not include working capital, does not incorporate price escalation or inflation projections, nor does it incorporate any possible tax pools that may be available.

Current metal price forecasts of 80c/lb copper, $325/oz gold, $4.5/oz silver and $4.0/lb molybdenum have been used. By comparison, the 1997 IFS and 1999 BHP studies were based on $1.0/lb copper, $380/oz gold, $5.25/oz silver and $4.0/lb molybdenum, and marginally different metal recoveries (from testwork completed to that date). The mining schedule used by Hatch for cash flow projections has been taken directly from the 1999 BHP 68k Case (ie, the 150-hole resource model).

Recovery of metal to concentrate is discussed in Section 16 of this report. The smelter terms and refining charges are based on typical current terms, and published data for Alumbrera. Concentrate smelting is estimated at $66/dmt concentrate, and refining charges at 7c/lb of payable copper and $5/oz of payable gold in concentrate. Payable copper and gold in concentrate is estimated at 96.4% and 97% respectively.

The key cash flow results for the updated Hatch 68k Case are summarized below with the earlier studies:

| | | *Standalone concentrator IFS 60k* | *Standalone concentrator IFS 120k* | *Standalone concentrator BHP 68k* | *Standalone concentrator Hatch 68k* |
|---|---|---|---|---|---|
| *Capital cost* | $M | 886.8 | 1265.2 | 743.2 | 625.6 |
| *LOM Cash cost to concentrate* | $/t ore | 7.08 | 5.74 | 6.60 | 5.86 |
| *LOM Project cash cost to cathode* | $/t ore | na | na | 9.51 | 7.72 |
| *Operating cash costs (C1) after credits(Au,Mo,Ag* | c/lb Cu | na | na | 54 | 35 |
| *IRR Project* | % | 15.5 | 17.6 | 15.7 | 19.2 |
| *NPV (0%)* | $M | na | na | na | 1326 |
| *NPV (10%)* | $M | 250 | 422 | 192 | 260 |

*(Note: LOM = Life of Mine)*

The cash flow projection for the updated 68k Case shows that the revenue contribution by metal is approximately 74% copper, 11% gold, 12% molybdenum and 2% silver, indicating the significant contribution of by-product metals. The metallurgical testwork furthermore indicates that higher molybdenum and gold recoveries could be attainable, and this therefore merits further investigation.

At 35 cents per pound of copper (net of by-products), the estimated C1 cash cost for Hatch's updated 68k case falls within the lowest quartile of current copper industry costs.

Sensitivity analyses have been performed to test the likely impact on project economics of changes in the prices of metals produced. The results are summarized below –

***Sensitivity Analysis***

| *Input Parameters* | *68 k Standalone Case* | |
|---|---|---|
| | *Total NPV,$M* | *Total NPV,$M* |
| ***Discount rate*** | 0% | 10% |
| ***At Base Case prices*** | $1,326 | $260 |
| ***At Base case prices +10%*** | $1,770 | $418 |
| ***At Base case prices -10%*** | $882 | $100 |

These results indicate that further investigation is warranted to improve the level of confidence in the capital and operating cost estimates and financial viability of the project for the production alternative examined in this report.

***San Jorge Project***

The Company holds an indirect 85% interest in the San Jorge copper/gold property. Argentina Mineral Development ("AMD") holds a 15% interest, redeemable in exchange for a net smelter returns royalty subject to certain conditions.

The San Jorge property is located approximately 90 kilometres northwest of Mendoza, Argentina and 250 kilometres northeast of Santiago, Chile. The project consists of seven mining concessions (covering about 5.5 square kilometres) and 35 mineral claims (covering about 102 square kilometres). The purchase price for the seven concessions was US$4.015 million. During 2000, the Company expended $414,000 in exploration and development expenses on the San Jorge project (compared to $1.7 million in 1999). In fiscal 2000, the Company wrote down the San Jorge project by $22.027 million due to continuing low metal prices. The property remains in good standing.

The information of a scientific and technical nature on the San Jorge Project was prepared under the supervision of Dean W. MacDonald, PhD. P.Geo., a "qualified person" under National Instrument 43-101.

**Location and Access**

The San Jorge property is located approximately 90 kilometres northwest of the city of Mendoza in Mendoza Province, Argentina and 250 kilometres northeast of Santiago, Chile. The property is accessed from the paved Mendoza-Santiago highway to the town of Uspallata and then 40 kilometres north on a

good gravel highway along the Uspallata valley. The property is at an elevation of 2,500 metres and the deposit occurs as a small hill surrounded by flat alluvium plains.

**History**

Several test pits were dug at San Jorge in the 1960s to investigate outcropping copper-oxide mineralization and, in 1964, Compania Minera Aguilar ("Aguilar") optioned the property. Over the next four years, Aguilar completed approximately 950 metres of trenching, 111 kilometres of induced polarization geophysical surveys ("IP") and 32 drill holes for 4,894.5 metres of core. Exploraciones Falconbridge Argentinos ("Falconbridge") optioned the property in 1973 and drilled six holes for 1,126 metres. Falconbridge also sent samples for metallurgical testing.

The property was optioned to Recursos Americanos Argentinos S.A. in 1992 and, between 1993 and 1995, 45 reverse circulation holes for a total of 5,518 metres and two core holes totalling 165 metres were drilled. In 1994, metallurgical testing of oxide mineralization from various cutting samples and of an enriched zone was conducted. From 1994 to 1996, 43 reverse circulation holes were drilled for 3,942 metres and eight lines totalling 17.6 kilometres of IP were surveyed over and beyond the mineralized outcrop. The property was purchased in 1995 by GMA Holdings S.A. ("**GMA**"), an indirect subsidiary of the Company. Between September 1995 and February 1996, a 5,746-metre drill program was conducted on the property. From this drilling, samples were taken for metallurgical testing.

In March 1999, GMA and Argentina Mineral Development ("**AMD**"), an associate of Climax Mining of Australia, entered into an agreement pursuant to which both companies agreed to contribute their property holdings and mining rights in San Jorge and the surrounding area to a newly formed holding company of which GMA owns 85% and AMD owns 15%. AMD's 15% interest is redeemable in exchange for a 2% net smelter return royalty on the mine developed if the newly formed holding company produced a feasibility study within three years, obtained financing within another year and committed to construction of a mine within another six months. If AMD's interest were redeemed, GMA would own 100% of MSJ.

**Geology and Mineralization**

San Jorge mineralization consists of a porphyry copper-gold deposit. Mineralization at San Jorge trends northeast and occurs in four approximately horizontal but irregular layers, from top to bottom as follows:

Leached: A leached cap with copper grades averaging 0.15% copper or less, primarily as green and black copper oxides that should be amenable to dump leaching.

Oxide: Best developed along the western contact of the granite porphyry with the clastics containing malachite, chrysocolla, tenorite and pitch limonite with grades averaging approximately 0.5% copper and 0.25 grams of gold per tonne at a 0.1% copper cut-off.

Enriched: Associated with areas of intense faulting and repetitive water recharge, and occurs as sooty and steely chalcocite, covellite, digenite and subordinate chalcopyrite averaging approximately 0.7% copper and 0.20 grams of gold per tonne at a 0.1% copper cut-off.

Primary: Three high-grade areas have been defined in clastics sedimentary units. Good copper grades in both sedimentary and intrusive rocks have been detected to a depth of 495 metres below surface. Copper occurs dominantly as chalcopyrite with very minor bornite. At a 0.4% copper cut-off, the primary mineralization has an average grade of 0.5% copper and 0.2 grams of gold per tonne.

Gold occurs in native form and uniformly grades 0.2 grams of gold per tonne throughout the copper deposit. Silver distribution is approximately proportional to copper grade and averages 3.5 grams of silver per tonne overall.

**Resources**

In May 1999, the Company re-stated the total inferred resource at San Jorge for oxide, enriched, and primary mineralization, using a 0.25% copper cut-off, estimated by the Company to be 381.4 million tonnes grading 0.39% copper and 0.15 g/t Au for a contained 1.49 million tonnes of copper and 1.8 million ounces of gold. At a 0.4% copper cut-off, the total inferred resource is reduced to 113.1 million tonnes grading 0.60% copper and 0.18 g/t gold for a contained 670,000 tonnes of copper and 636,000 ounces of gold.

The Company, based on open pit mining and heap leaching of the oxide, has estimated an indicated resource and secondary enriched mineralization for solvent extraction and electrowinning (SX/EW) for copper recovery. Assuming a US$0.85 per pound copper price, a 0.25% copper cut-off, and a 2% net smelter return royalty with incremental dump leach of low-grade material, an in-pit resource has been estimated at 57.3 million tonnes grading 0.61% copper, for 348,900 tonnes of contained copper. Primary copper-gold mineralization could then potentially be evaluated for a primary milling style of operation, producing concentrates. At current metal prices, this is not economic, but it provides an idea of the potential of the property if metal prices were to improve.

**Metallurgy**

In 1997, a metallurgical test program was undertaken to determine the response of the ore to bacterial oxidation. Preliminary results indicated recoveries up to 75% in 250 days. Flotation tests on primary mineralization have given copper recoveries of up to 92% producing concentrates grading 25% copper. Gold is mostly free milling and recoveries of 60% have been achieved.

**Exploration**

Drilling by GMA and AMD has encountered indications of additional copper mineralization to the northeast, east and southeast of the main San Jorge deposit in a similar geologic setting to the main San Jorge deposit.

Areas to the east and southeast of San Jorge, within the expanded property area, contain large IP chargeability anomalies that coincide with anomalous copper-bearing, intercepts in the core of a reconnaissance drill hole, indicating potential for satellite copper systems similar to the San Jorge deposit. The Company is currently evaluating the potential for exploring for and developing additional resources in the satellite areas. However, limited work is planned for 2003 in light of the continued poor metal prices.

The Company has evaluated, on a pre-feasibility basis, the potential for developing a solvent extractive, electrowinning operation at San Jorge. Although the results were encouraging, management believes that the project economics could be more attractive with the definition of additional resources through further exploration drilling supplemented by a recovery in the copper price. The Company is seeking a third party with which to form a joint venture to undertake the necessary work program and to complete a final feasibility study.

*Mantua Project*

The Company holds an indirect undivided 50% interest in the Mantua project. Geominera S.A. ("Geominera"), a Cuban company formed by the Cuban Ministry of Basic Industry for the purpose of holding mineral rights and entering into agreements with foreigners for the development of such mineral rights, holds the remaining 50% interest in the project.

The Company acquired all of the outstanding shares of Minera Mantua Inc. ("MMI") from a group of vendors, including Miramar, in 1995. When it acquired MMI, through Minera Cobre S.A. the Company had a 50% working interest in the Mantua Project.

The 50% working interest in the Mantua Project was acquired pursuant to an agreement with Geominera dated August 13, 1993, the "Cobre Association Agreement". The Cobre Association Agreement and the related articles of incorporation are the constating documents of Cobre Mantua S.A. ("**Comantua**"), a Cuban joint enterprise corporation, the shares of which are allocated on a 50/50 basis between Geominera and the Company's indirect subsidiary, Minera Cobre S.A.

Geominera's contribution to the joint enterprise was the exclusive right to explore, develop, mine and exploit the Mantua Project, and all previous studies and investigations relating to the Mantua Project. The Company's contribution included a feasibility study on the Mantua Project prepared in 1993 and an initial cash contribution of US$20,000. Profits of the joint enterprise are to be distributed 50% to Cobre Mantua S.A., the Company's subsidiary, and 50% to Geominera. Pursuant to the Cobre Association Agreement, the Company was required to negotiate and obtain all financing necessary for the commercial development of the Mantua project by June 30, 1995. Geominera subsequently agreed to waive the June 30, 1995 date provided that Cobre Mantua S.A. obtained financing to develop the Mantua Project.

Under the Cobre Association Agreement, Cobre Mantua S.A. is entitled to the total net income (after satisfaction of all current obligations in respect of third party financing) of the Mantua Project during the first two years of operations of any mine, in repayment of advances made by it to the joint enterprise. If any advances remain outstanding at the end of that two-year period, Cobre Mantua S.A. will continue to be entitled to no less than 75% of the net income of the Mantua Project until all such advances are repaid. All major decisions of Comantua require the approval of the representatives of each of Geominera and the Company; however, all ordinary operating decisions are made by the operations manager who is appointed by the Company for a specified period of time.

Efforts continued in 2002 to arrange financing for a bankable feasibility study for the copper mining phase of the Mantua Project. The Company's ability to develop the copper phase at Mantua is dependent upon obtaining third party financing. In August 2001, the Company optioned its interest in the project to an arm's length third party. To maintain the option, the optionee assumed all carrying costs in respect of the Mantua Project. To exercise the option, in addition to paying carrying costs, the optionee was required, among other things, to complete a bankable feasibility study within 18 months. In April 2002, the optionee elected to terminate the option due to its inability to raise financing on suitable terms. The Company subsequently granted another further option to Newport Explorations Ltd., an arm's length company listed on the TSX Venture Exchange. In consideration for the option Newport issued 400,000 common shares to the Company at a deemed price of $0.26 per. Miramar is entitled to 200,000 of these shares under the Royalty and Proceeds Agreement. To maintain the option:

(a) Newport is required to assume and pay the carrying costs relating to the Mantua project up to a maximum of US$20,000 per month. The carrying costs have been invoiced at monthly intervals, but payment has not yet been received by the Company; and

(b) Newport is required to complete a program of sampling for metallurgical test work within twelve months from regulatory approval of the acquisition, in order to complete a bankable feasibility study, to a maximum cost of US$750,000.

If the Company secures a credit facility satisfactory to Newport in order to commence commercial production, Newport will issue 1,400,000 common shares to the Company. The Mantua project is subject to approximately US$28 million in subordinated debt owed to the Company and the 2.5% net smelter returns and proceeds royalty in favour of Miramar. See "General Description of the Business – Three Year History". Newport will assume US$20 million of the US$28 million in subordinated debt owing to the Company by Geominera. Should Newport identify and secure financing, Newport will assume US$14 million of the subordinated debt, leaving the Company with the remaining US$14 million of the subordinated debt. Upon full exercise of the option of the shares in the Mantua Project, Newport agrees to assume the Company's obligations under the Royalty and Proceeds Agreement in respect of the Mantua project.

The information of a scientific and technical nature on the Mantua Project was prepared under the supervision of Dean MacDonald, PhD. P.Geo., Exploration Manager of Miramar Mining Corporation and a "qualified person" under National Instrument 43-101.

**Property Description, Location and Access**

The Mantua property contains a secondarily enriched copper deposit. It is located in Pinar del Rio Province, western Cuba, 240 kilometres from Havana. The property consists of an 8 square kilometre production concession and an adjoining 11.2 square kilometre area of interest. The site is reached via a four-lane highway from Havana to Pinar Del Rio, which is 65 kilometres east of Mantua. A paved secondary road then links with the site.

**History and Exploration**

In the early 1960s, workers from the Instituto de Recursos Minerales, a Cuban government agency, explored the Mantua copper deposit. In 1964, copper mineralization was discovered beneath an iron rich gossanous cap by an exploration program, including drilling, supervised by Soviet geologists. In 1992, Marc Rich & Co., a United Kingdom-based investment firm, completed an additional 12 drill holes, geotechnical investigations and metallurgical test work.

In late 1993, the Company, through Minera Cobre S.A., commenced detailed investigations, including an additional 13 drill holes, bulk sampling and metallurgical testing. An 11 tonne metallurgical sample was collected from one of the test shafts for metallurgical testing. A preliminary metallurgical scoping study was completed in the latter part of 1993 on material collected from one drill hole and a metallurgical test program was commenced in February 1994 on material from the 11 tonne bulk sample.

In the summer of 1994, Minera Cobre S.A. drove a 145-metre exploration tunnel to access the ore body, and, in September and October 1994, extracted 600 tonnes of material for pilot scale metallurgical testing. A pilot plant was operated using material extracted from the tunnel. Pilot plant operations were conducted in two phases, in November and December 1994 and from January to March 1995. Results of these operations confirmed the viability of the preferred processing method.

In 1995, Minera Cobre S.A. identified significant gold values in the gossan cap overlying the main copper deposit, as well as payable gold credits in the copper ore itself, and a zone of anomalous gold values parallel to the copper deposit. A program of work to evaluate the potential for an economic gold operation to recover gold values from the gossan cap was commenced in February 1995. A total of 65

drill holes were completed, delineating a zone of potentially commercial gold values over the centre of the copper deposit. Metallurgical testing has demonstrated the amenability of this material to conventional heap leach recovery methods.

In 1996, a regional exploration program was initiated to identify additional gold occurrences in gossans, saprolites and regional shear structures. In excess of six hundred surface samples were taken throughout the region and some minor gold occurrences were identified.

Drilling in 1997 involved two main phases that included nine diamond drill holes for 655 metres and eight diamond drill holes for 684.7 metres, respectively. Both programs were primarily designed to define the distribution of near surface, gold gossan; however, the second program included two deep holes. Late in the year, a single hole was drilled to collect a metallurgical sample.

**Geology and Mineralization**

The Mantua copper deposit is a secondary enrichment of copper mineralization produced by the weathering of primary sulphide mineralization of volcanogenic-exhalative origin. Copper has been leached from trace amounts of sulphide copper mineralization (chalcopyrite) and re-deposited beneath a gold-rich gossanous cap.

Primary sulphide mineralization, both massive and disseminated, occurs within a 50 to 100 metre thick sequence of inter-layered basic volcanic rocks, shale, siltstones and sandstones. Folding and thrust faulting in the Late Mesozoic was focused between the more competent limestone units causing extensive shearing and brecciation of the volcanic and sedimentary sequence.

The folding of the Mantua and surrounding area rocks is interpreted as a broad syncline and anticline defining an open "S" shape. The eastern limb of the syncline contains the majority of the mineralization defined by drilling. The Mantua copper deposit forms an elongate lens with a northeast to southwest strike, concordant with the enclosing formations. The deposit dips 50 to 70 degrees to the west and has a strike length of 1,300 metres.

Unoxidized mineralization is dominated by pyrite, with some chalcopyrite and sphalerite. The leached cap oxide zone is composed of lateritic iron oxides with essentially no copper content. The supergene zone below this leached cap consists mainly of chalcocite, with cuprite, covellite and some native copper. The secondary-enriched copper zone can be divided into three distinct ore types that may be segregated during mining operations.

**Geological Resources**

Within the proposed open pit and assuming a copper price of US$0.85 per pound, proven and probable reserves are estimated to be 7,525,000 tonnes grading 2.74% copper containing 206,212 tonnes or 454.6 million pounds of copper and additional measured and indicated resources are estimated to be 4,454,000 tonnes grading 0.76% copper containing 33,850 tonnes or 74.6 million pounds of copper (as stated in the Company's 1998 Annual Report).

Mine Plan and Capital Cost

After a thorough review of previous test work and a rigorous program of laboratory and pilot tests conducted in Cuba, Chile and Canada from 1993 through 1998, a processing scheme was selected which utilizes modern, proven processing technologies to extract the maximum amount of copper economically

possible. These processing steps include grinding, agitation leaching, solvent extraction and, finally, electrowinning for the production of copper cathodes.

The copper ore will be fed as mined directly to a SAG (semi-autogenous grinding) mill, followed by leaching in agitated tanks. A series of counter current decantation thickeners will then wash out all of the copper-containing acid solution. Copper-containing acid solutions will be processed through a solvent extraction circuit to form a strong electrolyte solution from which copper cathodes will be produced by conventional electrowinning. Tailings will be pumped to a nearby impoundment for disposal based on an environmentally sound design.

The preliminary design is for processing facilities capable of treating 750,000 tonnes of high-grade copper ore per annum.

*Phase 1 Gold Leaching*

Construction of the Phase 1 gold leaching at the Mantua Project commenced in March 1997 and concluded in February 1998. Phase 1 consisted of a heap leach gold operation that was planned to recover approximately 70,000 ounces of gold from the gossan cap over a two-year period at a capital cost of approximately US$11.6 million. Removal of this material was intended to allow access to the high-grade copper reserve under the gossan cap.

Mining of gold ore commenced in February 1998 and was concluded in September 1999. Prior to achieving commercial production, all costs of start up operations and related interest and overhead were capitalized. During the operation, recovered gold was below expectations and totalled 31,389 ounces, of which the Company's share was 15,694 ounces. Due to higher than expected ore clay and fines content, field leach times had to be extended to 70 days from the designed 28 days and ultimate gold recoveries were 50% of what was forecast.

*Phase 2 Copper Mining*

The Phase 2 copper operation is planned to commence after gold leaching is completed. Evaluation of the copper phase is proceeding, with production targeted to average about 40 million pounds of copper cathode per year at a cash cost of US$0.45 per pound.

Capital costs are anticipated to be US$50 million with a moderate pressure and temperature ferric leach process. This process utilizes proven technologies that are in use at other mining operations.

A 1998 preliminary financial evaluation by the Company, independently reviewed by Bateman Project Holdings Limited, indicates that an average annual production rate of 39 million pounds of copper cathode can be achieved with direct operating costs of US$0.445 per pound over a 11 year mine life. This would place the operation in the lower quartile of world copper production costs. Capital costs, also reviewed by Bateman Project Holdings Limited, including contingency are estimated at US$48.5 million.

The Company's ability to develop the copper phase at Mantua is dependent upon obtaining third party financing. The Mantua Project is subject to approximately US$28 million in subordinated debt owed to the Company and the Royalty and Proceeds Agreement in favour of Miramar.

SELECTED CONSOLIDATED FINANCIAL INFORMATION

## Five Year Comparative Data

The following table is a summary of selected financial information concerning the Company for each of the last five years and should be read in conjunction with the consolidated financial statements of the Company and notes thereto for the relevant periods filed on www.SEDAR.com under the Company's profile. All figures are expressed in thousands of dollars, except per share amounts.

| | 2002 (1) | 2001 (1) | 2000 (1) |
|---|---|---|---|
| Total Revenue | 21 | 362 | 66 |
| Loss | 1,992 | 1,285 | 23,804 |
| Loss per Share | 0.01 | 0.01 | 0.28 |
| Total Assets | 84,217 | 84,021 | 83,071 |
| Long-Term Debt | -- | -- | 27,254 |

(1) As at and for the year ended December 31.

## Quarterly Financial Information

The following table is a summary of selected quarterly financial information (unaudited) concerning the Company for each of the four quarters ending December 31, 2002. All figures are expressed in thousands of dollars, except per share amounts.

| | Dec. 31, 2002 | Sep. 30, 2002 | June 30, 2002 | Mar. 31, 2002 |
|---|---|---|---|---|
| Revenue | 20 | -- | (2) | 3 |
| Expenses | 431 | 693 | 418 | 471 |
| Loss | 411 | 693 | 418 | 468 |
| Loss/Common Share | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Assets | 84,217 | 84,606 | 83,654 | 84,278 |
| Current Liabilities | 428 | 407 | 713 | 7,858 |
| Reclamation and Future Income Taxes | 24,525 | 24,525 | 24,525 | 24,525 |
| Total Liabilities | 24,953 | 24,932 | 25,238 | 32,383 |
| Share Capital | 158,635 | 158,639 | 149,774 | 149,774 |
| Contributed Surplus | 115 | 105 | 107 | -- |
| Deficit | 99,486 | 99,073 | 98,380 | 97,879 |

The following table is a summary of selected quarterly financial information (unaudited) concerning the Company for the last four quarters to December 31, 2001. All figures are expressed in thousands of dollars, except per share amounts.

| | Dec. 31, 2001 | Sep. 30, 2001 | June 30, 2001 | Mar. 31, 2001 |
|---|---|---|---|---|
| Revenue | 12 | 328 | 2 | 20 |
| Expenses | 607 | 283 | 415 | 342 |
| Loss (Income) | 595 | (41) | 413 | 322 |
| Loss/Common Share | 0.00 | 0.00 | 0.00 | 0.00 |
| Total Assets | 84,018 | 84,078 | 84,230 | 83,701 |
| Current Liabilities | 7,630 | 347 | 540 | 1,021 |
| Reclamation and Future Income Taxes | 25,525 | 24,356 | 24,356 | 24,356 |
| Total Liabilities | 32,155 | 31,618 | 31,811 | 53,575 |
| Share Capital | 149,274 | 149,280 | 149,280 | 126,574 |
| Deficit | 97,411 | 96,820 | 96,861 | 96,448 |

### Dividends

There are no restrictions that could prevent the Company from paying dividends. However, the Company has not paid any dividends on its common shares since incorporation and has no present intention of paying dividends, as it anticipates that all available funds will be invested to finance the growth of the Company.

## MANAGEMENT'S DISCUSSION AND ANALYSIS

### Form 44-101F2 Disclosure

The Company's Management's Discussion and Analysis of Financial Condition and Results of Operations for the year ended December 31, 2002 contained in the 2002 Annual Report filed via SEDAR is incorporated herein by reference.

## MARKET FOR SECURITIES

### Market for Securities

The Company's common shares are listed and posted for trading on The Toronto Stock Exchange under the symbol NNO.

DIRECTORS AND OFFICERS

## Name, Address, Occupation and Security Holding

The following table sets forth the names and municipalities of residence of the Directors and officers of the Company, their positions held with the Company and their principal occupations.

| Name, Office Held and Municipality of Residence | Director Since | Principal Occupation for the Previous Five Years |
|---|---|---|
| John K. Burns[(1)(2)(3)]<br>Director<br>Philadelphia, Pa. | 1995 | Managing Director of FRM Management, Chicago, Illinois, President and Chief Executive Officer, Frontier Resources Management, Inc., both of Chicago, Illinois |
| David Cohen<br>President, Chief Executive Officer and Director<br>West Vancouver, BC | 2002 | President and Chief Executive Officer, Northern Orion Explorations Ltd.; 2000-2002, Vice-President and Chief Operating Officer, Northern Orion Explorations Ltd.; 1997-2001, Sr. Vice President, Miramar Mining Corporation |
| Robert Cross<br>Chairman of the Board and Director<br>West Vancouver, BC | 2001 | Private investor |
| P. Terrance O'Kane[(1)(2)(3)]<br>Director<br>Surrey, BC | 1999 | Self-employed Metallurgical Engineer |
| Stephen Wilkinson[(1)(2)(3)]<br>Director<br>North Vancouver, BC | 1999 | President, ValGold Resources Ltd.; 1999-2002, President and Chief Executive Officer, Northern Orion Explorations Ltd.; 1997-1999, Mining Analyst, Global Mining and Metals Group, RBC Dominion Securities Inc. |
| Shannon Ross<br>Chief Financial Officer<br>Burnaby, BC | N/A | Chief Financial Officer, Lang Mining group of companies; 1999, Controller and Corporate Secretary, Dia Met Minerals Ltd.; 1996-1999, Controller, Hunter Dickinson Group of companies |
| Sargent H. Berner<br>Corporate Secretary<br>Vancouver, BC | N/A | Partner, DuMoulin Black, Barristers and Solicitors |
| Mary P. Collyer<br>Assistant Secretary<br>West Vancouver, BC | N/A | Partner, DuMoulin Black, Barristers and Solicitors |

(1) Member of audit committee.

(2) Member of executive compensation and corporate governance committee.

(3) Member of environmental committee.

The executive committee of the Company was dissolved by the Board of Directors in July 2002. The primary responsibility of the executive committee prior to its dissolution was to review and approve any transactions of the Company involving its former controlling shareholder, Miramar. Miramar ceased to be the controlling shareholder of the Company in 2002.

The Directors of the Company are elected and hold office until the next annual general meeting of the shareholders, unless any Director resigns, is removed, or becomes disqualified earlier.

As at April 30, 2003, the Directors and officers of the Company as a group, beneficially owned, directly or indirectly, or exercised control or direction over, 10,404,000 common shares or 4.56% of the voting common shares of the Company. This information is based on information provided by the individual directors.

### Corporate Cease Trade Orders or Bankruptcies

Except as disclosed herein, to the knowledge of Management, no Director or officer of the Company, or any shareholder holding a sufficient number of securities of the Company to affect materially the control of the Company, is, or within the 10 years before the date of this AIF, has been, a Director or officer of any other issuer which, while that person was acting in that capacity:

(a) was the subject of a cease trade order or similar order, or an order that denied the other issuer access to any exemptions under Canadian securities legislation, for a period of more than 30 consecutive days; or

(b) became bankrupt, made a proposal under any legislation relating to bankruptcy or insolvency or was subject to or instituted any proceedings, arrangement or compromise with creditors or had a receiver, receiver manager or trustee appointed to hold its assets.

Robert Cross, a Director of the Company, joined the board of Livent Inc. ("Livent") as part of the M. Ovitz Group in June 1998. Accounting irregularities were subsequently uncovered and Livent declared bankruptcy in late 1998. Thereafter, a class action suit was filed against Livent and its directors. Mr. Cross is currently not involved in any actions or proceedings respecting Livent.

### Penalties or Sanctions

To the knowledge of Management, no Director or officer of the Company, or any shareholder holding a sufficient number of securities of the Company to affect materially the control of the Company, has:

(a) been subject to any penalties or sanctions imposed by any court relating to Canadian securities legislation or by a Canadian securities regulatory authority or has entered into a settlement agreement with a Canadian securities regulatory authority; or

(b) been subject to any other penalties or sanctions imposed by a court or regulatory body that would likely be considered important to a reasonable investor in making an investment decision.

### Personal Bankruptcies

To the knowledge of Management, no Director or officer of the Company, or any shareholder holding a sufficient number of securities of the Company to affect materially the control of the Company, or a personal holding company of any such person has, within the last 10 years before the date of this AIF, become bankrupt, made a proposal under any legislation relating to bankruptcy or insolvency, or was subject to or instituted any proceedings, arrangement or compromise with creditors, or had a receiver, receiver manager or trustee appointed to hold the assets of the Director or officer.

### Conflicts of Interest

Except as disclosed herein, to the knowledge of Management, there are no existing or potential material conflicts of interest between the Company or a subsidiary of the Company and a Director or officer of the

Company or a subsidiary of the Company. See "Narrative Description of the Business - Conflicts of Interest".

The Company's Directors and officers may serve as Directors or officers of other companies or have significant shareholdings in other resource companies and, to the extent that such other companies may participate in ventures in which the Company may participate, the Directors of the Company may have a conflict of interest in negotiating and conducting terms respecting the terms of such participation. In the event that such conflict of interest arises at a meeting of the Company's Directors, a Director who has such a conflict is required to disclose such conflict and abstain from voting for or against the approval of such participation or such terms.

## ADDITIONAL INFORMATION

The information contained in this AIF is as at December 31, 2002, unless otherwise stated. The Company's information circular dated May 16, 2003 for its annual and extraordinary general meeting of shareholders scheduled to be held on June 16, 2003 contains further information, including information relating to Directors' and officers' remuneration, principal holders of voting securities, options to purchase securities and interests of insiders in material transactions. Additional financial information is provided in the Company's comparative financial statements for its most recently completed financial year and its 2002 Annual Report filed via SEDAR under the profile of the Company. The applicable sections of those documents are incorporated herein by reference.

The Company will provide to any person, upon written request to the Secretary of the Company, c/o Northern Orion Explorations Ltd., Suite 250, 1075 West Georgia Street, Vancouver, British Columbia, Canada, V6E 3C9,

(a) when the securities of the Company are in the course of a distribution under a preliminary short form prospectus or a short form prospectus:

  (i) one copy of the AIF of the Company, together with one copy of any document, or the pertinent pages of any document, incorporated by reference in the AIF;

  (ii) one copy of the comparative financial statements of the Company for its most recently completed financial year for which financial statements have been filed together with the accompanying report of the auditor and one copy of the most recent interim financial statements of the Company that have been filed, if any, for any period after the end of its most recently completed financial year;

  (iii) one copy of the information circular of the Company in respect of its most recent annual meeting of shareholders that involved the election of Directors or one copy of any annual filing prepared instead of that information circular, as appropriate; and

  (iv) one copy of any other documents that are incorporated by reference into the preliminary short form prospectus or the short form prospectus and are not required to be provided under clauses (i), (ii) or (iii) above; or

(b) at any other time, one copy of any other documents referred to in clauses (a)(i), (ii) and (iii) above, provided that the Company may require the payment of a reasonable charge if the request is made by a person or company who is not a security holder of the Company.

Additional information, including Directors' and officers' remuneration and indebtedness, principal holders of the Company's securities, options to purchase securities and interests of insiders in material transactions, where applicable, is contained in the Company's information circular for the most recent annual meeting of shareholders that involved the election of Directors. Additional financial information is provided in the Company's comparative financial statements for its most recently completed financial year.

# PACIFIC CORPORATE TRUST COMPANY

**625 Howe Street – 10th Floor**
**Vancouver, B.C. V6C 3B8**

**Telephone: (604) 689-9853**
**Fax: (604) 689-8144**




May 20, 2003

B.C. Securities Commission
Executive Director
701 W Georgia Street, 9th Floor
Vancouver, BC V7Y 1L2

Dear Sirs\Mesdames:

**RE: NORTHERN ORION EXPLORATIONS LTD**
**MAILING ON MAY 20, 2003**

We confirm that on the above date, the material following material issued by the subject Company was forwarded by prepaid first class mail to all of the registered members of the Company and that it was distributed to intermediaries in accordance with National Instrument 54-101:

- Notice of Meeting
- Information Circular
- Proxy
- Supplemental Return Card
- Annual Financial Statements for the Year Ending December 31, 2002
- Annual Report

The filing fee(s) for the financial statements have been remitted via SEDAR.

Yours truly,
**PACIFIC CORPORATE TRUST COMPANY**

"Norm Hamade"

Norm Hamade
NH/jo

cc: Alberta Securities Commission
cc: Director of Corporations - PEI
cc: Manitoba Securities Commission
cc: Nova Scotia Securities Commission
cc: Office of the Administrator of Securities - NB
cc: Ontario Securities Commission
cc: Quebec Securities Commission
cc: Registrar of Securities - NT
cc: Registrar of Securities - YT
cc: Saskatchewan Securities Commission
cc: Securities Division - Department of Justice - NF
cc: Toronto Stock Exchange
cc: Nunavut Securities Commission

cc: Northern Orion Explorations Ltd
cc: Dumoulin Black
cc: KPMG Peat Marwick Thorne.

**CONSENT**

**OF**

**DEAN W. McDONALD**
**PhD. P. Geo**

**TO:** British Columbia Securities Commission
Alberta Securities Commission
Manitoba Securities Commission
Nova Scotia Securities Commission
New Brunswick Securities Commission
Newfoundland Securities Commission
Ontario Securities Commission
P.E.I. Securities Commission
Quebec Securities Commission
Saskatchewan Securities Commission
Registrar of Securities - Northwest Territories
Registrar of Securities - Yukon Territory
Nunavut

I, **Dean W. McDonald, PhD. P.Geo.**, do hereby consent to the use of my name in the Annual Information Form of **Northern Orion Explorations Ltd.** dated May 16, 2003.

I also certify that I have read the written disclosure being filed and I do not have any reason to believe that there are any misrepresentations in the information derived from information on the San Jorge Project and the Mantua Project prepared by me or under my supervision and contained in a disclosure document filed prior to February 1, 2001 or that the written disclosure in the Annual Information Form of **Northern Orion Explorations Ltd.** contains any misrepresentation of such information.

**DATED** this **20th** day of **May, 2003.**

"Dean W. McDonald"
Signature of Qualified Person

[Seal or Stamp of Qualified Person]

Dean W. McDonald
Print name of Qualified Person

# NORTHERN ORION
## EXPLORATIONS LTD

*Suite 1400, 570 Granville Street, Vancouver, B.C. V6C 3P1*
*Tel: (604) 687-4622 Fax: (604) 687-4212*


May 20, 2003

**FILED VIA SEDAR**

BRITISH COLUMBIA SECURITIES COMMISSION
ALBERTA SECURITIES COMMISSION
SASKATCHEWAN SECURITIES COMMISSION
MANITOBA SECURITIES COMMISSION
ONTARIO SECURITIES COMMISSION
COMMISSION DES VALEURS MOBILIERES DU QUEBEC
NOVA SCOTIA SECURITIES COMMISSION
REGISTRAR OF SECURITIES, PRINCE EDWARD ISLAND
OFFICE OF THE ADMINISTRATOR OF SECURITIES, NEW BRUNSWICK
SECURITIES DIVISION, DEPARTMENT OF JUSTICE, NEWFOUNDLAND
YUKON SECURITIES COMMISSION
NORTHWEST TERRITORIES SECURITIES COMMISSION
NUNAVUT SECURITIES COMMISSION

To whom it may concern:

**Re: Northern Orion Explorations Ltd. (the "Company") - Change of Auditor**

This letter confirms that the Company's audit committee has reviewed the Notice of Change of Auditor from the Company dated May 16, 2003, the letter from the Company's former auditor dated May 20, 2003 and the letter from the Company's successor auditor dated May 20, 2003.

Yours truly,

**NORTHERN ORION EXPLORATIONS LTD.**

Stephen J. Wilkinson
Member of the Audit Committee

KPMG LLP
Chartered Accountants
PO Box 10426 777 Dunsmuir Street
Vancouver BC V7Y 1K3
Canada

Telephone (604) 691-3000
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03 JUN 12 AM 7:21

British Columbia Securities Commission
Alberta Securities Commission
Saskatchewan Securities Commission
The Manitoba Securities Commission
Ontario Securities Commission
Commission des valeurs mobilières du Québec
Nova Scotia Securities Commission
Registrar of Securities, Prince Edward Island
Office of the Administrator, New Brunswick
Securities Commission of Newfoundland
Registrar of Securities, Government of the Yukon Territories
Northwest Territories Securities Commission
Registrar of Securities, Nunavut

May 20, 2003

Dear Sirs:

**Re: Northern Orion Exploration Ltd. (the "Company")**

We have read the attached Notice of the Company dated May 16, 2003 and are in agreement with the statements contained in such Notice.

Yours very truly,

KPMG LLP

Chartered Accountants

Vancouver, Canada

cc: Glenn Ives , Deloitte & Touche LLP

Deloitte & Touche LLP
P.O. Box 49279
Four Bentall Centre
2800 - 1055 Dunsmuir Street
Vancouver, British Columbia
V7X 1P4

Tel: 604-669-4466
Fax: 604-685-0395
www.deloitte.ca



Deloitte & Touche

May 16, 2003

BRITISH COLUMBIA SECURITIES COMMISSION
ALBERTA SECURITIES COMMISSION
SASKATCHEWAN SECURITIES COMMISSION
MANITOBA SECURITIES COMMISSION
ONTARIO SECURITIES COMMISSION
COMMISSION DES VALEURS MOBILIERES DU QUEBEC
NOVA SCOTIA SECURITIES COMMISSION
REGISTRAR OF SECURITIES, PRINCE EDWARD ISLAND
OFFICE OF THE ADMINISTRATOR OF SECURITIES, NEW BRUNSWICK
SECURITIES DIVISION, DEPARTMENT OF JUSTICE, NEWFOUNDLAND
YUKON SECURITIES COMMISSION
NORTHWEST TERRITORIES SECURITIES COMMISSION
NUNAVUT SECURITIES COMMISSION

Dear Sirs/Mesdames:

**Re: Northern Orion Explorations Ltd. (the "Company")**

As required by National Policy No. 31, we have reviewed the information contained in the Company's Notice of Change of Auditor dated May 16, 2003 and we do not disagree with the information contained in such notice as at the date thereof.

Yours truly,

Deloitte & Touche LLP

CHARTERED ACCOUNTANTS

Per: Thomas Kay, Partner

cc: Northern Orion Explorations Ltd., Attn: Shannon Ross

# NORTHERN ORION
## EXPLORATIONS LTD

*Suite 1400, 570 Granville Street, Vancouver, B.C. V6C 3P1*
*Tel: (604) 687-4622 Fax: (604) 687-4212*


May 16, 2003

**KPMG LLP**
777 Dunsmuir Street
Vancouver, British Columbia
V7Y 1K3

Attention: Jim Bennett

**DELOITTE & TOUCHE LLP**
2800 – 1055 Dunsmuir Street
Four Bentall Centre
Vancouver, British Columbia
V7X 1P4

Attention: Glenn Ives

Dear Sirs/Mesdames:

**Re: Change of Auditor**

This notice is being provided pursuant to National Policy Statement No. 31 – "Change of Auditor of a Reporting Issuer" and the relevant securities and corporate legislation under which Northern Orion Explorations Ltd. ("Northern Orion") is a reporting issuer. We confirm that KPMG LLP ("KPMG") has resigned as auditor of Northern Orion. KPMG informed Northern Orion of its resignation by way of a letter dated May 16, 2003. The resignation was considered by, and the recommendation to appoint Deloitte & Touche LLP on May 16, 2003 was approved by, the Audit Committee of Northern Orion. We further confirm that there were no reservations in the auditor's reports for the years ended December 31, 2002 and December 31, 2001 or for any period subsequent to December 31, 2002 and preceding the date of the resignation. We also confirm that there were no reportable events, as such term is described in National Policy Statement No. 31, in connection with the audits of Northern Orion for the year ended December 31, 2002 and preceding the date of the resignation.

Yours truly,

**NORTHERN ORION EXPLORATIONS LTD.**

Shannon Ross

Shannon Ross
Chief Financial Officer

## CERTIFICATE OF OFFICER

**RE: Annual and Extraordinary General Meeting of Members of Northern Orion Explorations Ltd. (the "Company") scheduled to be held on June 16, 2003 (the "Meeting")**

The undersigned, acting in his capacity as the President and Chief Executive Officer of the Company and not in his personal capacity, hereby confirms that the Company has made the arrangements described in paragraphs (a) and (b) of Section 2.20 of National Instrument 54-101 in connection with the Meeting and relies on Section 2.20 of National Instrument 54-101.

DATED at Vancouver, British Columbia this 20th day of May, 2003.

**NORTHERN ORION EXPLORATIONS LTD.**

Per: *"David Cohen"*
David Cohen
President and Chief Executive Officer

**FEE RULE**

**FORM 13-502F1**
**ANNUAL PARTICIPATION FEE FOR REPORTING ISSUERS**

03 JUL 12 AM 7:21

**Reporting Issuer Name:** Northern Orion Explorations Ltd.

**Participation Fee for the Financial Year Ending:** December 31, 2002

**Complete Only One of 1, 2 or 3:**

**1. Class 1 Reporting Issuers (Canadian Issuers – Listed in Canada and/or the U.S.)**

Market value of equity securities:

| | | | |
|---|---|---|---|
| Total number of equity securities of a class or series outstanding at the end of the issuer's most recent financial year | | 188,600,922 | |
| Simple average of the closing price of that class or series as of the last trading day of each of the months of the financial year (under paragraph 2.5(a)(ii)(A) or (B) of the Rule) | X | $0.08125 | |
| Market value of class or series | = | 15,323,825 | |
| | | | 15,323,825(A) |

(Repeat the above calculation for each class or series of equity securities of the reporting issuer that are listed and posted for trading, or quoted on a marketplace in Canada or the United States of America at the end of the financial year) _____ (A)

Market value of corporate debt or preferred shares of Reporting Issuer or Subsidiary Entity referred to in Paragraph 2.5(b)(ii): _____ (B)
**[Provide details of how determination was made.]**

(Repeat for each class or series of corporate debt or preferred shares) _____ (B)

**Total Capitalization (add market value of all classes and series of equity securities and market value of debt and preferred shares) (A) + (B) =** $15,323,825

**Total fee payable in accordance with Appendix A of the Rule** $1,000

Reduced fee for new Reporting Issuers (see section 2.8 of the Rule) _____

Total Fee Payable x $\frac{\text{Number of months remaining in financial year or elapsed since most recent financial year}}{12}$ $1,000

Late Fee, if applicable _____
(please include the calculation pursuant to section 2.9 of the Rule)

**2. Class 2 Reporting Issuers (Other Canadian Issuers)**

Financial Statement Values (use stated values from the audited financial statements of the reporting issuer as at its most recent audited year end):

Retained earnings or deficit _____

Contributed surplus _____

Share capital or owners' equity, options, warrants and preferred shares (whether such shares are classified as debt or equity for financial reporting purposes) _____
Long term debt (including the current portion) _____

Capital leases (including the current portion) _____

Minority or non-controlling interest _____

Items classified on the balance sheet between current liabilities and shareholders' equity (and not otherwise listed above) _____

Any other item forming part of shareholders' equity and not set out specifically above _____

**Total Capitalization** _____

***Total Fee payable pursuant to Appendix A of the Rule*** _____

Reduced fee for new Reporting Issuers (see section 2.8 of the Rule)

Total Fee Payable x $\frac{\text{Number of months remaining in financial year year or elapsed since most recent financial year}}{12}$ _____

Late Fee, if applicable (please include the calculation pursuant to section 2.9 of the Rule) _____

**3. Class 3 Reporting Issuers (Foreign Issuers)**

Market value of securities:
*If the issuer has debt or equity securities listed or traded on a marketplace located anywhere in the world (see paragraph 2.7(a) of the Rule):*
Total number of the equity or debt securities outstanding at the end of the reporting issuer's most recent financial year _____

Simple average of the published closing market price of that class or series of equity or debt securities as of the last trading day of each of the months of the financial year on the marketplace on which the highest volume of the class or series of securities were traded in that financial year. X _____

Percentage of the class registered in the name of, or held beneficially by, an Ontario person X _____

(Repeat the above calculation for each class or series of equity or debt securities of the reporting issuer) = _____

**Capitalization (add market value of all classes and series of securities)** _____

*Or, if the issuer has no debt or equity securities listed or traded on a marketplace located anywhere in the world (see paragraph 2.7(b) of the Rule):*

Financial Statement Values (use stated values from the audited financial statements of the reporting issuer as at its most recent audited year end):

Retained earnings or deficit _____

Contributed surplus _____

Share capital or owners' equity, options, warrants and preferred shares (whether such shares are classified as debt or equity for financial reporting purposes) _____

Long term debt (including the current portion) _____

Capital leases (including the current portion) _____

Minority or non-controlling interest _____

Items classified on the balance sheet between current liabilities and shareholders' equity (and not otherwise listed above) _____
Any other item forming part of shareholders' equity and not set out specifically above _____

Percentage of the outstanding equity securities registered in the name of, or held beneficially by, an Ontario person X _____

**Capitalization** _____

**Total Fee payable pursuant to Appendix A of the Rule** _____

Reduced fee for new Reporting Issuers (see section 2.8 of the Rule)

Total Fee Payable x $\frac{\text{Number of months remaining in financial year year or elapsed since most recent financial year}}{12}$ _____

Late Fee, if applicable
(please include the calculation pursuant to section 2.9 of the Rule) _____

**Notes and Instructions**

1. This participation fee is payable by reporting issuers other than investment funds that do not have an unregistered investment fund manager.

2. The capitalization of income trusts or investment funds that have no investment fund manager, which are listed or posting for trading, or quoted on, a marketplace in either or both of Canada or the U.S. should be determined with reference to the formula for Class 1 Reporting Issuers. The capitalization of any other investment fund that has no investment fund manager should be determined with reference to the formula for Class 2 Reporting Issuers.

3. All monetary figures should be expressed in Canadian dollars and rounded to the nearest thousand. Closing market prices for securities of Class 1 and Class 3 Reporting Issuers should be converted to Canadian dollars at the [daily noon] in effect at the end of the issuer's last financial year, if applicable.

4. A reporting issuer shall pay the appropriate participation fee no later than the date on which it is required to file its annual financial statements.

5. The number of listed securities and published market closing prices of such listed securities of a reporting issuer may be based upon the information made available by a marketplace upon which securities of the reporting issuer trade, unless the issuer has knowledge that such information is inaccurate and the issuer has knowledge of the correct information.

6. Where the securities of a class or series of a Class 1 Reporting Issuer have traded on more than one marketplace in Canada, the published closing market prices shall be those on the marketplace upon which the highest volume of the class or series of securities were traded in that financial year. If none of the class or series of securities were traded on a marketplace in Canada, reference should be made to the marketplace in the United States on which the highest volume of that class or series were traded.

7. Where the securities of a class or series of securities of a Class 3 Reporting Issuer are listed on more than one exchange, the published closing market prices shall be those on the marketplace on which the highest volume of the class or series of securities were traded in the relevant financial year.

# NORTHERN ORION
## EXPLORATIONS LTD
*Suite 1400, 570 Granville Street, Vancouver, B.C. V6C 3P1*
*Tel: (604) 687-4622 Fax: (604) 687-4212*


May 20, 2003

**VIA SEDAR**

Commission des valeurs mobilieres du Quebec

Dear Sirs/Mesdames:

**Northern Orion Explorations Ltd. – (the "Company")**
**Report on the securities distributed in Quebec under the exemptions prescribed by section 52**

This letter is in accordance with section 114 of the Regulations

We hereby advise that the Company made no distribution of securities in Quebec under the exceptions prescribed by section 52 for the financial years ended December 31, 2002.

Yours truly,

(signed)
Rodrigo A. Romo
Legal Assistant
for **Northern Orion Explorations Ltd.**

# Northern Orion Explorations Ltd.
# Agua Rica Project, Argentina

## Independent Technical Report



Prepared by:

Paul Hosford, P.Eng. — May 16, 2003

Callum Grant, P.Eng. — May 16, 2003

### Approvals

### Hatch

Approved by:

Adam Majorkiewicz, P.Eng. — May 16, 2003

### Distribution List

Northern Orion
Hatch
file

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## List of Figures

# 1. Summary

Agua Rica is a large porphyry-style copper-gold-molybdenum-silver deposit located in the north-western Argentine province of Catamarca.

Originally discovered in the early 1970s, it was the subject of a lengthy advanced exploration program and feasibility-level studies completed in the 1990s by a Joint Venture formed between BHP Minerals Inc. and Northern Orion Explorations Ltd. (the "Joint Venture"). Over a period of some 5 years, the Joint Venture defined the full extent of mineralization on the property through field programs of geology, geophysics and geochemistry, 176 cored drillholes, underground bulk sampling from two adits, several metallurgical programs (including pilot test work), and various basic engineering studies to establish the operating and capital cost profile for a large-scale mining and processing operation. Since mid-1999, no significant field or study activity has taken place at Agua Rica.

The deposit occupies the base and slopes of a steeply incised, V-shaped valley known as Quebrada Minas with the Trampeadero zone lying to the east and the Seca zone to the west. Mineralization consists of a primary, chalcopyrite-dominant porphyry phase (~ 0.2%-0.6% Cu) over-printed by a breccia-related epithermal phase (Quebrada Minas) carrying precious metals (and molybdenum). Stronger copper values to greater than 1% are associated with secondary enrichment blankets of chalcocite/covellite developed at the upper levels of the Trampeadero and Seca zones. On plan, the deposit covers an area of ~2.75 km by 2.5 km and has been defined by drilling to depths of over 600m below collar elevation.

The BHP-NNO Joint Venture completed several resource estimates for Agua Rica during the 1990s. The majority of the mining studies have been based on a "150-hole model" using all the drill results available to December 1997. This 3D geological and resource model incorporated geological, alteration, and metallurgical characteristics of the various ore types found in the deposit and, for example, distinguishes between "clean" and "dirty" ore types in terms of arsenic and sulphur contents. Using Ordinary Kriging routines, the 150-hole resource model at a 0.40% Cu cutoff grade produced the following estimates:

| *Measured & Indicated Resource (150-Hole) January 1998* | | | | |
|---|---|---|---|---|
| *Mt* | *Cu (%)* | *Mo(%)* | *Au (g/t)* | *Ag (g/t)* |
| *678* | *0.64* | *0.037* | *0.24* | *2.65* |
| *Inferred Resource (150-Hole)* | | | | |
| *72* | *0.49* | *0.044* | *0.15* | *2.37* |

*Source: BHP-NNO Report, January 1998*

On completion of the entire 176 holes on the property in late 1998, an updated resource model was generated from a revised geological and mineralogical classification scheme and interpretation, however this model has not been used to any significant extent for evaluating the mineability of the deposit or economic analysis. Based on Indicator Kriging at a 0.40% Cu cutoff, this 176-hole model generated Measured and Indicated Resources of 592 million tonnes at 0.60% Cu, 0.033% Mo, 0.32g/t Au, and 3.3g/t Ag (plus an additional Inferred Resource of 148 million tonnes at the same grades as above).

Hatch has relied on the 150-hole model for the purposes of evaluating the mineability and economics of the deposit, and did not redesign the pits at current prices and operating costs in Argentina.

The extent and grade of mineralization at Agua Rica indicate that either a large surface, and/or a large underground operation could be supported by the property's resource for a period in excess of 20 years. The Joint Venture has examined the feasibility of various open pit and underground alternatives at high milling rates of between 50k tpd to 120k tpd. For example, their 68k tpd case (1998) was based on a representative set of open pit cost and technical input parameters, and prices of $0.95/lb Cu, $3.50/lb Mo, $350/oz Au, and $4.50/oz Ag. Using the pit optimization routines of Mintec's Medsystem and detailed planning of ore and waste movement, the following Proven and Probable Mineral Reserve estimate was generated for the 68k option:

| *Proven & Probable Reserve, 68K Pit* | | | | | *Waste* | *W/O* |
|---|---|---|---|---|---|---|
| *Mt* | *Cu (%)* | *Mo(%)* | *Au (g/t)* | *Ag (g/t)* | *Mt* | |
| *516.6* | *0.64* | *0.033* | *0.27* | *4.1* | *1,109* | *2.15* |

*Source: BHP-NNO Joint Venture Report, March 1999*

These reserves reflect a base internal cutoff grade of 0.40% Cu, with marginal grade material (<0.40% Cu) mined and stockpiled for feeding to the plant in the final three years of a 22 year operation. The Joint Venture estimated that this open pit alternative would require a 1-year pre-production period to remove ~30 million tonnes of waste, followed by disposal of ~60 million tonnes per year of waste, some potentially acid-generating (ARD). Annual metal production over the initial 10 year phase of the operation would be in the order of 167,000t of copper, 107,000ozs gold, and 1.4 million ozs of silver (annual averages).

Given the challenges posed by a large surface operation at Agua Rica, a high capacity underground approach using block and/or panel caving was proposed as an alternative to surface mining, and this concept was subsequently examined in more detail at a scoping level in early 1999 (using the 150-hole resource model). Advantages of an underground approach compared to open pit mining include rapid access to higher grade zones in the deposit (readily accessible by horizontal adit), ability to support high tonnage rates over an extended mine life, competitive operating costs compared to surface mining particularly during the initial years of high waste movements, and low materials handling and ventilation requirements. With a block caving approach, disposal of and treatment of large tonnages of potential ARD waste material could also be avoided.

In 1999, the Joint Venture modeled a 50,000 tpd block caving operation using Mintec's MedSystem software at metal prices of $0.90/lb Cu, $4.00/b Mo, $350/oz Au, and $5.00/oz Ag. For a mine life of 23 years, the following Mineral Reserve was generated for a Two Lift operation:

| *Proven & Probable Reserve, 50k tpd Block Cave* | | | | |
|---|---|---|---|---|
| *Mt* | *Cu (%)* | *M o(%)* | *Au (g/t)* | *Ag (g/t)* |
| *411* | *0.63* | *0.038* | *0.26* | *3.52* |

*Source: Report commissioned by BHP-NNO, 1999*

Inferred Resources at grades of 0.54-0.62% Cu (plus by-products) below the Second Lift offer the possibility for Third Lift production and extension of the mine life by an additional 5-10 years (beyond an initial 23-year period for Lifts One and Two, depending on the cutoff grade applied.

Hatch has examined the preliminary financials of a stand-alone 68,000 tpd open pit and concentrator option (the "68k" Case) using capital and operating costs derived from BHP-NNO project information, and from current published data for the nearby Alumbrera operation.

A preliminary, simplified after-tax cashflow model was used to investigate the viability of the 68k project under current operating cost conditions in Argentina (exchange rate of 3 pesos to the US dollar), and metal prices of US$0.80/lb copper, US$325/oz gold, US$4.50/oz silver and US$4.0/lb molybdenum.

The key results are summarized as follows :

| *Parameter* | *Units* | *68ktpd Open Pit* |
|---|---|---|
| *Total NPV (0%)* | $M | $1,326 |
| *Total NPV (10%)* | $M | $260 |
| *Capital Cost* | $M | $626 |
| *Operating Cost* | $/t ore | $5.85 |
| *C1 Cash Cost* | $/lb copper | $0.35 |

*(Note: C1 Cash Costs are net of by-product credits, & include all concentrate transportation costs, and TCRCs)*

The estimated C1 cash cost at 35 cents per lb copper (net of by-product credits) therefore fall within the lowest quartile of copper industry costs (32-49c/lb copper). It should be noted that operating cost and cash flow estimates may be impacted by on-going inflation and exchange rate fluctuations in Argentina, and that NPV estimates will be impacted by pit designs at current metal prices.

# 2. Introduction

Agua Rica is a large Cu-Mo-Au porphyry deposit located in north west Argentina approximately 34 kms due east of the operating Bajo de la Alumbrera mine.

In the 1990s, Agua Rica was extensively explored by a Joint Venture between BHP Minerals ("BHP") and Northern Orion Explorations Ltd. ("NNO"). Over a period of 4-5 years, the Joint Venture proportionally funded extensive and systematic exploration of the deposit including geological and structural mapping, ground geophysics, diamond and Reverse Circulation drilling, a bulk sampling program in two tunnels, and several work programs to support an Initial Feasibility Study (IFS) issued in August 1997, and updated in mid-1999.

Since 1999, the property has remained dormant apart from basic care and maintenance at the site and on-going environmental monitoring baseline programs.

In March 2003, Hatch was commissioned by NNO under Terms of Reference to complete an Independent Technical Report to the standards of National Instrument 43-101 describing all the relevant technical aspects of the property.

Hatch's work has been completed entirely on the basis of data provided by NNO.

# 3. Disclaimer

In preparing this report, Hatch has relied on various reports and documents, plans, maps, and sections provided by BHP and NNO that we believe describe the principal and relevant technical aspects of the property sufficient to support this Independent Technical Report. Hatch has not generated any of its own mine plans.

This information was generated by the BHP-NNO Joint Venture during the exploration and evaluation of Agua Rica over the period 1994 thru' 1999 when the Argentine currency (the peso) was fixed at a ratio of one-to-one against the US dollar; the current rate is ~3.0 pesos against the US dollar. Hatch has adjusted the operating and capital cost projections set out in the BHP-NNO feasibility-level studies to reflect this exchange rate adjustment. The open pits have not been redesigned with these costs or at current metal prices. NPV estimates in this report will be impacted by pit designs at current metal prices and costs.

No legal due diligence of the land status has been undertaken as part of Hatch's assignment, nor have we investigated to any extent the Argentine legal or royalty regulations currently in force at either a Provincial or Federal level. Where environmental issues are discussed in the report, reference has been made to studies completed by other consultants contracted by BHP-NNO during the various pre-feasibility and initial feasibility studies completed in the 1990s.

# 4. Property Description and Location

As shown in Figure 4-1, Agua Rica is located in the northwestern Argentine province of Catamarca approximately 200 kms from the provincial capital, and 25 kms to the north of the nearest settlement of Andalgalá.

The property covers an area of approximately 12.5 square kms with its centre point at approximately latitude of 27° 26' South, longitude 66° 16' West.

In February 2003, Northern Orion announced that it had entered a binding agreement with BHP Minerals International Exploration Inc. to consolidate ownership of 100% of Agua Rica through the purchase of BHP's 72% interest in the property for US$3.6 million payable on April 30, 2003 and a final payment of US$9.0 million due on or before 30 June, 2005.

Figure 4-2 provides details of the location of the mining claims making up the core *"minas"* concessions, and the surrounding mineral rights that on average extend for some 30kms north-south and 20kms east-west. In addition, several land easements covering access routes and potential water sources were acquired by the Joint Venture in the 1990s.

Future production from a mining operation at Agua Rica would be subject to a 3% "mine-mouth" royalty payable to the provincial Catamarca government.

To Hatch's knowledge, no environmental liabilities apply to the property.

**Figure 4-1: General Location Map**

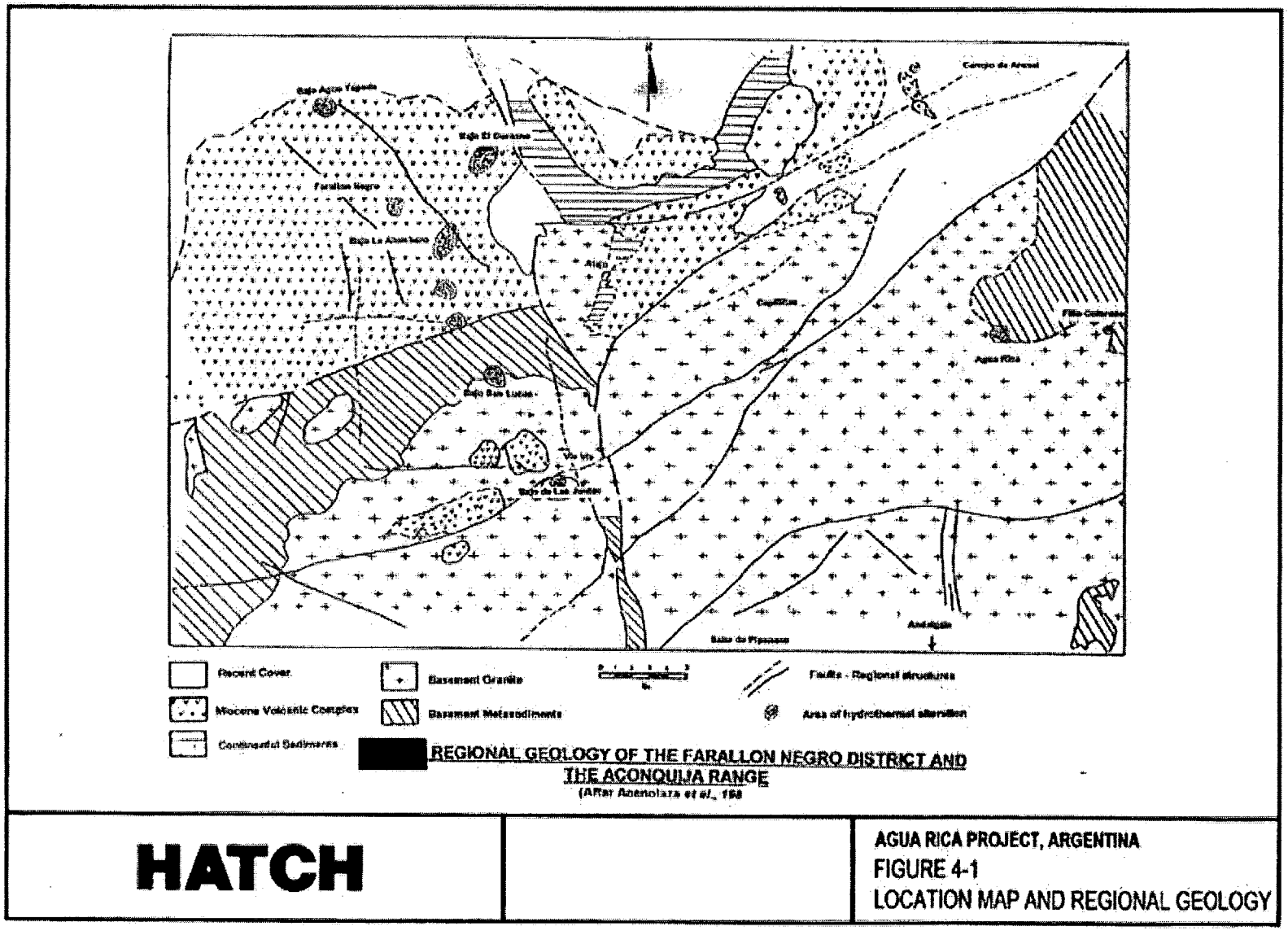
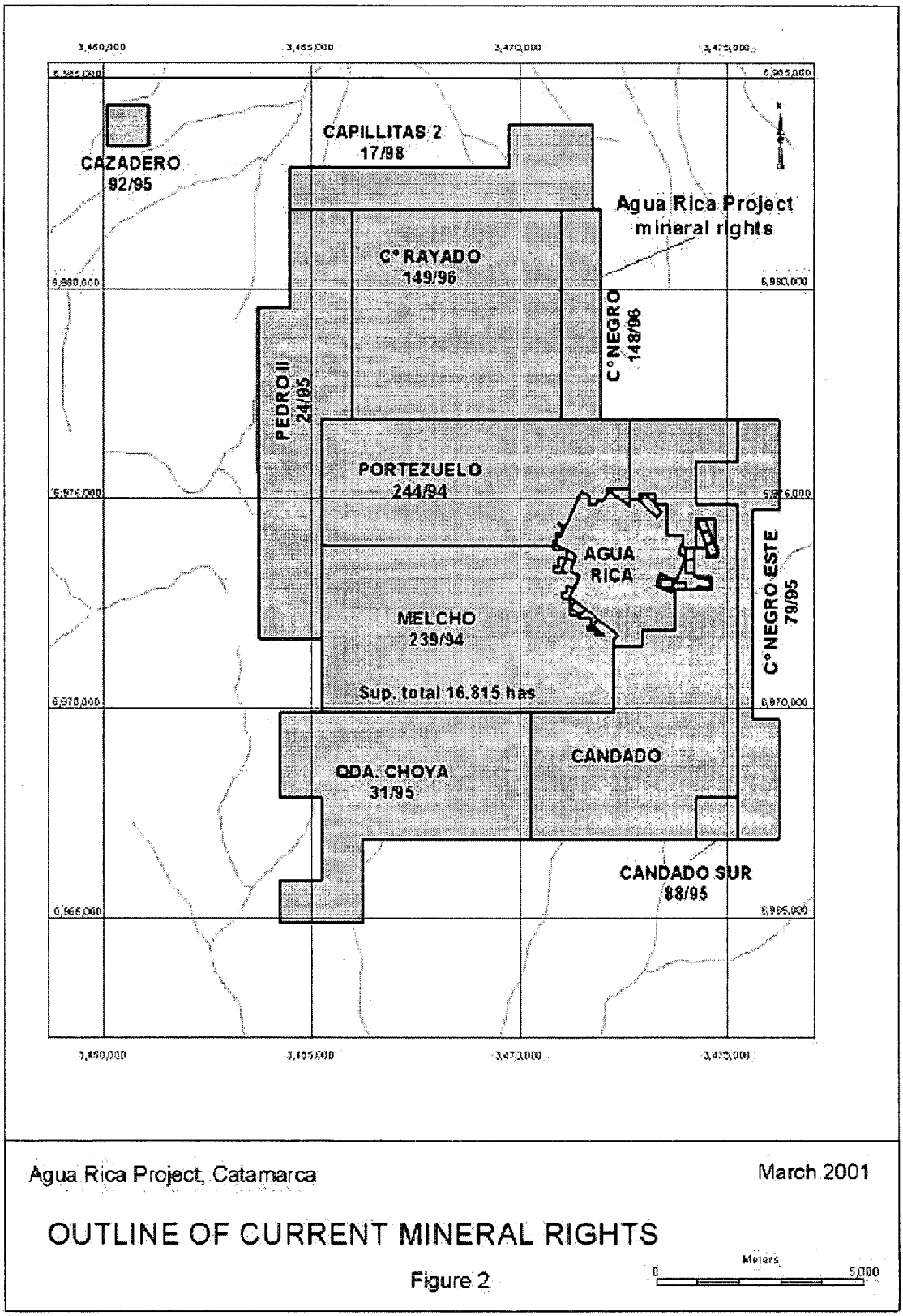


**Figure 4-2: Property Claim Map**



# 5. Accessibility, Climate, Local Resources, Infrastructure, and Physiography

The property lies in a rugged range of mountains known as the Sierra de Aconquija that runs northeast-southwest through this eastern flank of the Andes. Towards the south and north of the Sierra de Aconquija, the mountain range gives way to gentler terrain as the basinal areas known as Campo Arenal in the north and Salar de Pipanaco in the south and west are approached. Locally around the property itself, the terrain reaches to over 3,500m and is dissected by steeply eroded V-shaped valleys covered by partially consolidated scree, poorly developed soils (< 1m thick), and scrubby, sparse vegetation. The terrain in the area is rugged with more than 80 percent having slopes greater than 25 degrees, and over 40 percent with slopes over 35 degrees. Sediment control and water erosion during the summer rainy season are issues that will require mitigation in any development activities at the site.

The climate in this part of Argentina is generally mild and typical of this arid north-western region of Argentina. The mountain ranges of Catamarca act to interrupt the passage of humid air from the north east that causes the heavy summer rainfall. The flanks of the mountain range to the north of Agua Rica tend be drier than the immediate area around the project site and also towards the south where olives are intensively cultivated around Andalgalá. Annual precipitation is in the order of 300 mm, with the highest rainfall occurring in January (114 mm measured in Quebrada Minas in 1996). The warmest months are December and January (~30° C) while in the winter months of June, July, and August the temperatures can fall to below zero Centigrade at higher elevations.

Access to the site is via the principal road developed by the Joint Venture to service its exploration programs. This routing follows the Potrero valley northwards to the site from Andalgalá over a distance of some 20 kms. An alternative routing via the town of Capillitas to the north of the project site is more circuitous and is longer in both distance and time.

Andalgalá is a town of some 11,000 inhabitants and serves as the local centre for agriculture in the area, principally the cultivation of olives and walnuts. The town provides adequate facilities for small commercial businesses, automobile shops, some fabrication, small hotels, schools, and a hospital.

# 6. History

Since the early 1900s, the mining of copper and the semi-precious stone rhodochrosite has been recorded from the region around Agua Rica from several small-scale, artesanal mines, principally at Capillitas immediately to the west of the project site. Activities at Agua Rica itself date back to the period 1959-1965 when a restricted area known as Mi Vida was explored around Quebrada Minas and three small adits were driven.

The first systematic exploration work at Agua Rica dates back to the early 1970s when Compañia Cities Services Argentina S.A. examined the property (known at that time as Mi Vida) and completed several drillholes from pads located at the lower elevations of the geological sequence, i.e. close and adjacent to Quebrada Minas. While Cities Services recognised the significant potential for a porphyry type of copper occurrence, other aspects such as the epithermal "overprint" carrying precious metals and the potential for supergene enrichment at higher elevations was not fully appreciated, and so little follow-up work was carried out. By the late 1970s, the property had reverted back to its original Argentine owner, Recursos Americanos Argentinos S.A. (RAA).

In the early 1990s, RAA optioned the property to BHP Minerals Inc. (BHP) on the basis of 30% RAA, and 70% BHP. Also at that time, Northern Orion Explorations Ltd. (NNO) of Vancouver, Canada concluded an agreement with RAA to acquire a majority share of its exploration holdings throughout Argentina, including Agua Rica, and in this way NNO became the JV partner with BHP in the subsequent extensive exploration of the property from 1994 until late 1998. During this period, the Joint Venture carried out a series of field programs including basic mapping, geochemical (rock chip) sampling, and geophysics from which the larger potential of the property was recognised, particularly related to zones of secondary enrichment and evidence pointing to a post-porphyry epithermal stage of precious metals mineralization.

By 1995, a major program of diamond drilling was underway together with more detailed mapping and surface sampling, aerial photography for generation of accurate topography, metallurgical testwork principally at BHP's Reno laboratory, geophysical investigations to identify locations for the supply of water for a future mining and milling operation, plus various work programs to examine technical issues to support an Initial Feasibility Study of the project (1997).

In 1997, the JV completed an Initial Feasibility Study (IFS) on the basis of Inverse Distance Squared "103-hole resource model" in which two open pit options, one at 60,000 tpd and the other at 120,000 tpd, were investigated. This IFS was subsequently updated in 1998 (the kriged "150-hole model") and again in 1999 (the "176-hole model"). This latest 176-hole model (using Indicator Kriging) comprises all of the drilling information available on the property. A summary of these principal resource estimates is provided as follows (all at a 0.40% Cu cutoff grade):

| *Model* | *Date* | *Measured & Indicated Resource* | | | | | *Inferred* | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | *Mt* | *Cu %* | *Mo %* | *Au g/t* | *Ag g/t* | *Mt* | *Cu %* | *Mo %* | *Au g/t* | *Ag g/t* |
| 103-Model | 02/1997 | 722 | 0.61 | 0.034 | 0.24 | 3.2 | 80 | 0.61 | 0.034 | 0.24 | 3.2 |
| 150-Model | 01/1998 | 678 | 0.64 | 0.037 | 0.24 | 2.7 | 72 | 0.43 | 0.044 | 0.15 | 2.4 |
| 176-Model | 03/1999 | 592 | 0.60 | 0.033 | 0.23 | 3.3 | 148 | 0.60 | 0.033 | 0.23 | 3.3 |

*Source: BHP-NNO Report, March 1999*

In 1999, the Joint Venture halted all further field exploration activities at Agua Rica and no additional work of any significance has taken place since that time.

# 7. Geological Setting

Agua Rica lies to the east of, and is spatially related to, the prominent Farallón Negro Volcanic Complex covering 700 km2 and hosting the producing Alumbrera open pit mine. At a regional and tectonic scale, this complex sits between the high mountainous plateau of the Puna to the northwest and the basin and range province of Sierras Pampeanas, of which the Sierra de Aconquija is one example. Within the Farallón Complex and its immediate vicinity, several metalliferous occurrences have now been exposed including Alumbrera and Agua Rica, other porphyry types such as Cerro Atajo and Bajo del Durazano, as well as smaller polymetallic and gold/silver vein deposits.

The main unit of the Farallón complex is a series of volcanic breccias with related basalts, basaltic andesites, and dacites, all representing elements of a strato-volcanic complex that has been deeply eroded.

Agua Rica lies on the flank of this ancient strato-volcano (8.5 to 5.5 million years before present) and compared to the Alumbrera complex has no major extrusive units present.

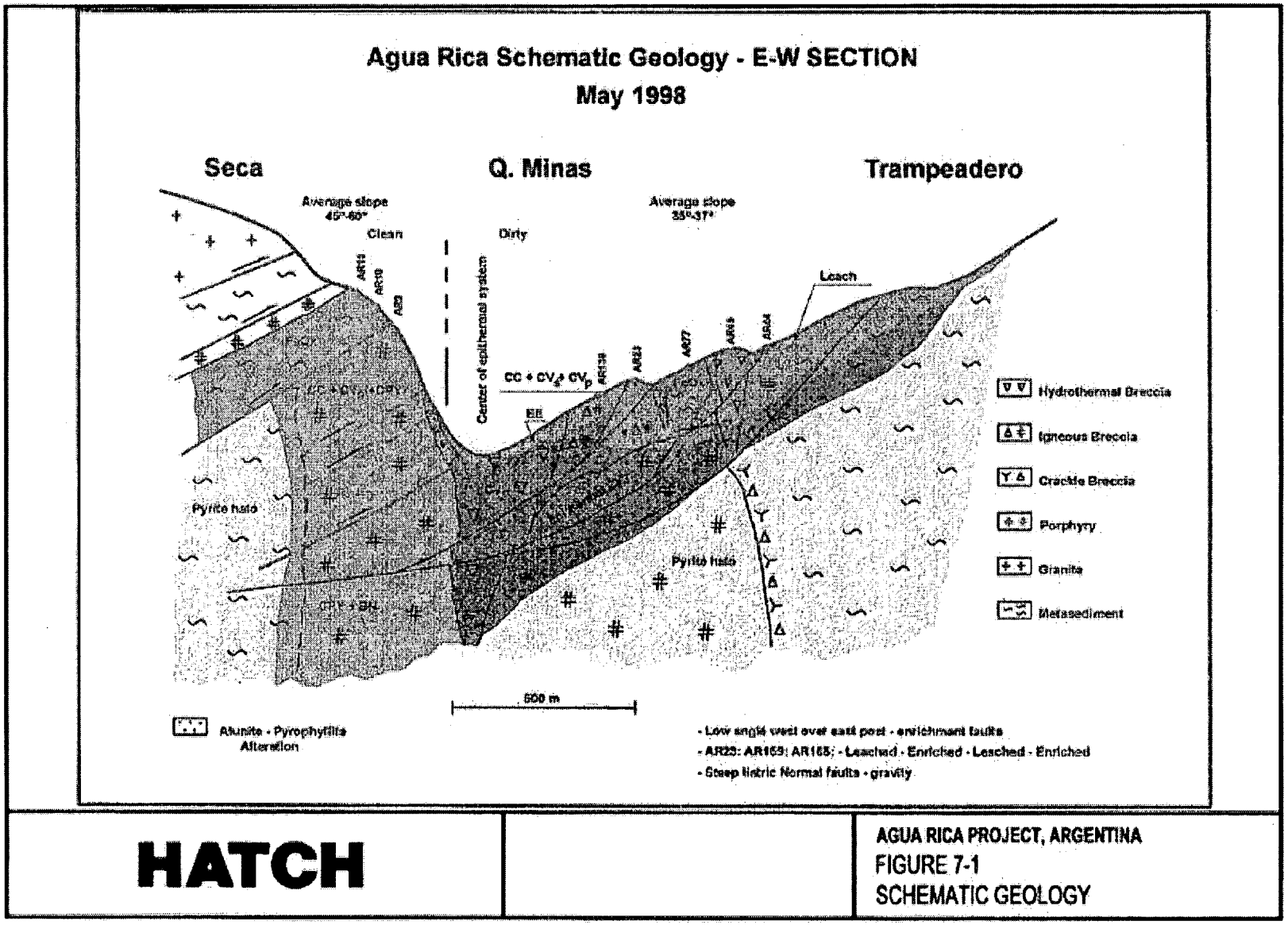
Figure 7-1 illustrates the geological setting of Agua Rica and the principal mineralogy/rock types:

- meta-sedimentary rocks of the Sierra Aconquija Complex (country rocks);
- locally minor outcrops of granites or granitoid stocks of Ordovician age;
- a series of Tertiary intrusives notably early, weakly-mineralized Melcho intrusives;
- two irregular bodies of feldspar porphyry that form the main host for porphyry copper mineralization;
- various distal porphyries interpreted as late-stage events of no economic significance;
- several types and generations of hydrothermal breccia related to epithermal precious metal mineralization that overprinted the earlier copper-molybdenum stage.

Significant structural deformation and movement has been recorded at Agua Rica, principally related to the prominent fault zone now occupied by the Quebrada Minas creek that is believed to have formed the locus and zone of weakness for intrusion of the porphyry stocks. Low-angle reverse faulting is believed to have contributed to thickening of leached zones particularly on the west of the deposit, while to the east (Trampeadero), north-south faulting has promoted deep leaching at a local scale.

Rapid uplifting, "unroofing", intrusion of breccias, and subsequent erosion is believed to have been the principal factors in the genesis of the varied primary and secondary enriched mineralization at Agua Rica.

**Figure 7-1: Property Geology**



# 8. Deposit Types

During exploration of the deposit, BHP and NNO geologists identified several different ore types at Agua Rica that were formalised into a classification system for block modelling and resource estimation. In general terms, these ore types fall within three main categories that in turn can be related to the evolutionary history of mineralization on the property, the interpreted geological model, and the style of the mineralization:

***Stage 1:*** early porphyry mineralization associated with the Seca and Trampeadero porphyries: quartz stockwork and disseminations of pyrite, molybdenite, chalcopyrite, and rare bornite and pyrrhotite

***Stage 2:*** an overprinting epithermal event carrying precious metals and copper sulphosalts and best exemplified in the central Quebrada Minas breccia body that separates the Seca and Trampeadero porphyries, and in the Trampeadero porphyry itself;

***Stage 3:*** supergene enrichment of hypogene copper mineralization forming an extensive blanket of higher copper values, now partially eroded into remnants on both sides of Quebrada Minas.

These three stages and deposit types form the basis for Agua Rica's resource and are found within three principal zones, namely Seca Norte on the east and Trampeadero on the west with Quebrada Minas breccia in the centre, all combining to form an elongated zone measuring ~2.75 kms long (east-west) by ~2.5 km wide (north-south). The principal characteristics of these three bodies are shown in Figure 8-1, and summarised as follows:

***Seca Norte:*** an enriched porphyry sequence of Cu-Mo-Au, with a core rich in Cu-Mo flanked by a haloe of Mo to the south and west. In area, measures ~400m by 400m over a vertical interval of ~500m (level 3,400m to below 2,950m);

***Quebrada Minas:*** dominated by epithermal sulphides within a funnel-shaped hydrothermal breccia unit that formed the conduit for deep-seated hydrothermal fluids. Outcrops in Quebrada Minas, measures ~300m by 300m between approximately level 3,000m to ~2,500m;

***Trampeadero:*** forming the eastern third of the deposit, displays both epithermal and porphyry styles of mineralization. Occurs over a vertical interval of 300m as an elongated unit 500m east-west by 400m north-south.

# 9. Mineralization

Ore types at Agua Rica have been formalized by BHP and NNO into a classification system that reflects both mineralogy and metallurgy. Classifications in the latest, 176-hole geological model are based principally on:

- contaminant elements, principally on the basis of the As-bearing mineral, enargite;
- mineralogy: for example primary and secondary copper minerals
- mineralogical texture: for example, coarse versus finer-grained covellite;
- alteration: based on variations in clay facies alteration products.

A total of 13 ore type zones were classified using this scheme, and can be summarised as follows:

*Major "Dirty" Ore Types:* occur principally in the Trampeadero and Quebrada Minas zones with dominant mineralogy consisting of covellite, chalcocite, digenite, and enargite with minor sphalerite and galena, and abundant molybdenite locally (for example on the eastern fringe of the zone);

*Major "Clean" Ore Types:* generally confined to the Seca porphyry unit: covellite, chalcocite, chalcopyrite, and digenite. Locally abundant molybdenite.

These two ore types comprise over 80% of the mineralization at Agua Rica with the balance made up of Minor "Clean" and "Dirty" Ore Types within the three mineralized zones.

# 10. Exploration

Agua Rica has been explored through the sequential and systematic application of exploration programs involving basic mapping and sampling at the earlier stages, through more detailed investigations using ground geophysics and geochemistry, to a drilling campaign of 176 diamond drill holes and underground bulk sampling to confirm grade and provide material for metallurgical testwork.

The principal programs and the relevant results can be summarised as follows:

- Cities Services (1970-1972): geological mapping, alteration studies, rock geochemistry, and diamond drilling with helicopter access aimed at a copper-porphyry target at the lower elevations in the Quebrada Minas and southern flank of the property;

- the BHP-NNO Joint Venture: originally involving Recursos Americans Argentinos prior to its acquisition in 1995, this comprehensive exploration involved a 5-year period of geological mapping and rock geochemistry, a regional BLEG survey, an aerial photographic survey, a regional airborne magnetic/radiometric survey, and a total of 176 diamond drill holes completed over the period 1994 through 1998. At an early stage of the Joint Venture, the work programs were based on recognition that Agua Rica offered greater exploration potential than indicated by the early work had indicated, principally the occurrence of blankets of secondary enrichment at the higher elevations of the property on the Seca and Trampeadero sides of Quebrada Minas, and the importance of a later epithermal over-printing event with associated precious metal mineralization. During this period, an extensive network of drill roads was developed to the highest levels of the mineral system.

The 1993-1998 exploration at Agua Rica was completed by BHP Minerals as the operator of the Joint Venture, and involved both BHP staff and contractors for specific field programs such as geophysics, drilling, and underground bulk sampling. Hatch believes that these work programs have been carried out to industry standards, and that the information generated provides a reliable database for resource estimation and evaluation of the production potential of the property.

# 11. Drilling

Drilling was carried out at Agua Rica between 1992 and 1998 in four campaigns:

1) Cities Services (1972-73): 7,927m in 38 holes of less than 200m in length successfully intercepted porphyry-style mineralization, however owing to poor recovery and the small size of the core (BX and AX), the assay results were not used in the subsequent resource estimates of BHP-NNO;

2) BHP-NNO, Phase 1 (1994/95): 14,802m in 39 holes to depths of ~450m were completed by the contractor Boytec (Chile) using HXWL and NXWL diamond core;

3) BHP-NNO, Phase 2 (1996): 26,995m of HXWL and NXWL diamond core completed in 64 vertical and inclined drillholes of up to 700m by a combination of contractors including Connors, Perfoeste, and Boytec;

4) BHP-NNO Phase 3 (1997-98): the final phase of diamond drilling on the property totalled ~23,000m for an accumulated total of ~65,000m for the BHP-NNO Joint Venture.

In all of the BHP-NNO programs, core recovery was typically in the 80-90% range, and all holes were surveyed by down-the-hole instruments. The later phases of the drilling included holes specifically for geotechnical evaluation of the ground conditions for a future open pit operation.

The Phase 2 and 3 programs were designed to drill off the property on 100m north-south sections across the east-west trend of the mineralization.

# 12. Sampling Method and Approach

The BHP-NNO sampling programs have followed the following general methodologies:

- standard 2m core samples sawn in half at site, with one half being returned to the core box and the other bagged for sample preparation (in later stages, core shipped to Andalgalá for preparation);
- logging by qualified geologists recorded an extensive data set of observations and measurements including lithology, alteration mineralogy, sulphide/oxide mineralogy, sulphide percentages, structural features, veining, and iron oxide characteristics;
- geotechnical data collected by qualified technicians included RQD and fracture frequency by 2m core intervals for use in subsequent geotechnical studies into open pit and underground mining;
- all core was routinely photographed before geological and geotechnical logging took place;
- all data collected through the logging procedures has been computerized.

All sample preparation and assaying was completed by industry standard laboratories such as Bondar Clegg (early programs) and by SGS for the later programs.

As an example of the extensive data collected through the drilling programs, the following tabulation provides a partial listing of the information collected and used for coding into the geological model of the deposit (176-hole model of 1998/1999):

| Lithologies | Mineralogy | Alteration | Other |
|---|---|---|---|
| Metasediment | Leached | Unaltered | Topography |
| Melcho Intrusive | Partial Leached | Potassic | Faults |
| Porphyry | Chalcocite (enriched) | Phyllic | RQD, FF |
| Seca Porphyry | Covellite | Advanced Argillic | SAG Index |
| Trampeadero Porphyry | Pyrite | | |
| Hydrothermal Breccia | Chalcopyrite | | |
| Igneous Breccia | Coarse Covellite | | |
| Biotite Porphyry | | | |
| Diatreme Breccia | | | |
| Clay-facies Breccia | | | |

The drilling and sampling programs covered the entire extent of known mineralization on the property both laterally and vertically, and provides a reliable basis for understanding the distribution of mineralization and variations with rock type, alteration, etc. In the central core of the deposit (Quebrada Minas), some deep holes to +700m below surface elevation were stopped before reaching the limits of the mineralization.

## 13. Sample Preparation, Analyses and Security

Two different sample preparation protocols have been used at Agua Rica:

- Holes AR-1 to AR-39: at a sample prep facility supervised by Bondar Clegg in Coquimbo, Chile, samples were crushed entire 2m half-core to ~60% passing –8 mesh, with a further step of pulverizing of a 1/8 or 1/16 split to 150 mesh (30g). Assaying completed by Bondar Clegg in La Serena, Chile, using fire assaying for Au an multi-acid digestion for AA assaying of Ag, Cu, Pb, Zn, Mo, and As;

- Holes AR-40 thru' the end of the drill programs (i.e., the bulk of the drilling programs): core samples crushed under the supervision of the company SGS to produce a sub-sample at 150 mesh (30g). Sample preparation in Mendoza, Argentina, with assaying by SGS, Santiago, Chile, using fire assaying for Au (50g) aqua regia digestion for AA analysis of Ag, Cu, Mo, Pb, Zn, As, Sb, and Fe.

In addition to assaying for contained metal values, density determinations are available for over 2,000 core samples collected from the drill programs. This data was collected from dried whole-core using the caliper method, and classified by lithology and mineralogy. In general, density increases with increasing Fe, Cu, Zn, and Pb content reflecting the sulphide content. For block modeling and resource estimation, a density value was calculated for each rock type from this base data.

Approximately 5% of the drill samples were randomly selected for check assaying at independent laboratories, as follows:

*Early Drilling (AR-1 thru' AR-39):*

- primary laboratory: Bondar-Clegg, La Serena, Chile;
- check laboratories: Chemex (Toronto) and Acme (Vancouver)

*Later Drilling (after AR-40):*

- primary lab: SGS, Santiago, Chile;
- check labs: Bondar-Clegg (Chile), Chemex (Toronto), and Acme (Vancouver).

BHP's standards program consisted of selecting pulps with less than a 10% relative difference from the four check laboratories, and inserting these pulps in the sample stream as their standards.

The results from these QA/QC procedures are discussed below.

# 14. Data Verification

***Results of QA/QC Programs***

In early 1998, Mineral Resources Development, Inc. (MRDI) was contracted by BHP to audit the sample and assaying QA/QC procedures employed by the Joint venture during its drilling programs at Agua Rica. This audit arose from statistical evaluation of the check assay results in 1997 indicating a relative low bias of 6% in copper assays from the primary SGS, Santiago laboratory compared to the check assay results at Chemex and Acme (using median values):

***Average of Copper Results for 1,245 samples (ppm)***

| | *Bondar-Clegg* | *SGS* | *Chemex* | *Acme* | *Average of Median* |
|---|---|---|---|---|---|
| Mean | 3,485 | 3,350 | 3,676 | 3,628 | 3,564 |
| (Mean-Median)/Median | -2.2% | -6.0% | 3.1% | 1.8% | |

*(Source:; MRDI, January 1998)*

Good agreement between assays for both Au and Mo were noted by MRDI during its audit. With respect to the copper bias, MRDI concluded in its report of January 1998:

*"...MRDI found BHP's practices meet or exceed those found in the mining industry, excepting that the recently instituted check assaying program indicated a low bias exists in copper assays performed by SGS, Santiago; the relative difference compared to check assay results is estimated to be 6 relative percent. While the bias is conservative, inasmuch as copper is under-estimated, differences greater than 5 relative percent may effect mine planning, reserve estimation, and net present value; at a minimum, selective re-assaying is warranted."*

However the statistical analysis of the check assay results by Cu grade also showed that the greatest inter-laboratory differences occurred at low copper grades of <0.05% Cu, and hence would not have a significant impact on resource calculations. Nevertheless, an additional check assaying program was

undertaken by BHP in 1998, selecting those samples that had returned significant (+/-20%) differences between the primary and the three original check laboratories for shipment and assaying at Chemex Laboratories in Vancouver. This involved some 1,700 samples and replacement of the re-assayed Chemex assays in the Agua Rica assay database used for the 176-hole resource model (the latest and most up-to-date resource for the property). Comparisons of these Chemex results versus three independent check labs were as follows:

***Average of Copper Results from re-assay program (ppm)***

| | *Bondar-Clegg* | *SGS* | *Chemex* | *Acme* | *Average of Means* |
|---|---|---|---|---|---|
| Mean | 4,693 | 4,571 | 4,812 | 4,804 | 4,720 |

*(Source: BHP memorandum, June 1998)*

An additional, more detailed audit of the check assaying procedures at Agua Rica was completed in mid-1999 by Pincock, Allen & Holt (PAH). In their report, PAH concluded that the check error rates were within industry standards, that the amount of cross-lab checking was "good" to "excellent", and that the assay database was suitable for a feasibility-level study.

Hatch concludes that any bias in copper assaying has been adequately addressed through the 1998 re-assay program, and that therefore the database used for the latest 176-hole geological and resource model is sufficiently reliable within industry standards of resource reporting.

***Bulk Sampling Program, 1998:***

In late 1998, two underground adits with a combined length of 350m were driven for the purposes of collecting metallurgical samples of different ore types and for grade confirmation. The two adits, one at Trampeadero side (250m) and the other at Seca (100m), were driven by the contractor Redpath Más Errazuriz over a period of 58 days during which four bulk samples were collected and shipped to the Mintek metallurgical plant in Johannesburg, South Africa.

Since the adits were driven horizontally along two pilot drillholes, a detailed comparison of the original assay results could be made against wall and face channel samples and muck samples, all of which were taken on a round-by-round basis. Average comparisons of the drillhole values ("DDH") versus the bulk sampling face channels taken round by round ("Faces") provide additional support for the reliability of the drill data used for resource estimation:

| | | *Cu* % | *Mo* % | *Au* g/t | *Ag* g/t | *Length* (m) |
|---|---|---|---|---|---|---|
| *SECA* | *DDH* | 0.53 | 0.022 | 0.41 | 0.88 | 100 |
| | *Face* | 0.53 | 0.024 | 0.37 | 1.30 | |
| *TRAMPEADERO* | *DDH* | 0.95 | 0.094 | 0.15 | 6.01 | 250 |
| | *Face* | 1.10 | 0.090 | 0.203 | 9.24 | |

# 15. Adjacent Properties

Approximately 20kms to the west of Agua Rica, the Joint Venture holds title to a central portion of the Cerro Atajo copper property which forms a prominent gossan zone on the southwest facing slopes of the Aconquija range of mountains. During the 1990s, the Joint Venture explored and sampled an area of 15km$^2$ around Cerro Atajo identifying a 1100m by 600m zone of vuggy silica, alunite, quartz and clay alteration centred over a swarm of dacite porphyry dykes with a peripheral zone of less intense alteration. Although no fresh sulphides can be seen at surface, mineralization reported from drilling by Placer Ltd in the 1970s records occurrences of pyrite, chalcopyrite, tetrahedrite, and chalcocite. Copper oxides are common at surface within the propyllitically altered volcanics at their contact with quartz-sericite altered vein zones. A total of 456 rock chip samples were collected by BHP-NNO and returned elevated values in the central quartz-alunite zone in Au (20-76 ppb), Pb (150-1000 ppm), and Mo (10-21 ppm). BHP-NNO concluded from their field work that the alteration and geochmeical zoning at Cerro Atajo suggests the presence of a large porphyry stock at depth, and possibly porphyry-style mineralization.

Further to the west of Agua Rica by approximately 34 kms, the Bajo de la Alumbrera mine ("Alumbrera") is operated by Minera Alumbrera Ltda. (MAA), a joint venture between MIM of Australia (50%), BHPBilliton (25%), and Wheaton River Gold Mines (25%), with MIM acting as operator of the mine (Wheaton recently announced the purchase of BHPBilliton's share in the project).

Alumbrera was originally discovered, explored, and studied by various parties in the 1960s and 1970s, but it was not until the 1990s that the property reached the production stage after MIMM acquired the Canadian company Musto International who had completed a final program of drilling at the site. Following a construction period of ~3 years and expenditures of US$1.3 billion (a 32% over-run), the mine went into production at a rate of 80,000 tpd in early 1998. For the year to June 2002, the operation mined and processed 29.5 million tonnes of ore grading 0.74% Cu and 1.04g/t Au.

Alumbrera lies in the same general geological setting as Agua Rica but closer to the center of the regional Farallón Negro volcanic complex. It is a typical copper porphyry deposit with 2002 Proved and Probable open pit reserves stated by MIMM at 372 million tonnes at 0.53% Cu and 0.61g/t Au.

# 16. Mineral Processing & Metallurgical Testing

## 16.1 Introduction

The mineral processing program for the Agua Rica ore body was conducted in three phases to identify the mineralogy and metallurgy of the ore to provide data for engineering studies.

The initial scoping type testwork was conducted as Phase 1 in 1997 at BHP's Center for Minerals Technology and led to a flowsheet design and a feasibility study. The testwork investigated the mineralogy of the ore and its mineral processing characteristics, particularly with regards to its amenability to grinding, flotation, liquid-solid separation and dewatering.

This work was followed by more detailed Phases 2 and 3 test programs in 1999 whereby the operating parameters were confirmed and optimized. The programs further investigated the ore mineralogy and concentrate recovery through batch, locked-cycle and pilot plant grinding and flotation. The test campaigns identified the processing parameters required in each unit operation for a technically viable operation to produce marketable concentrates. These programs were completed by the major facilities, Mintek and Lakefield Research, who are recognized specialists in the mineral processing industry.

## 16.2 Mineralogy

The Aqua Rica ore occurs in the Quebrada Minas, Quebrada Seca Norte and Trampeadero regions. During Phase 1, the major copper minerals were identified to be chalcocite, covellite, digenite, chalcopyrite and bornite. The occurrences of mineral combinations depends on the region of deposit. For example, fine chalcocite-covellite-digenite occurs in Quebrada Seca Norte and Trampeadero regions, while coarse covellite occurs in Quebrada Minas region.

In Phase 2, the geology of the ore body was redefined. As a result, the ore was classified into six types or composites for metallurgical testing. These represent 80% of the deposit according to the major copper mineralogy and contained minor elements, such as lead, zinc, arsenic and sulphur, that affect concentrate grades. Metallurgical testing was conducted on drill core rejects to determine the set of processing conditions that will produce acceptable concentrate grades from the range of ores.

## 16.3 Grinding

In the initial 1997 Phase 1 study, Bond Ball and Rod Mill Work Indices and Minnovex SAG Power Indices were examined to estimate the milling characteristics and power requirements. This was investigated further and confirmed in Phases 2 and 3 on more representative composites of the ore.

Generally, the ore is softer than typical porphory copper ores and covers a range of hardness which may be due to the clay content. The average Ball Mill Work Index of 12 kWh/t was used in the engineering study.

## 16.4 Flotation

The Phase 1 scoping work in 1997 evaluated grind and reagent scheme against rougher flotation performance in terms of kinetics, residence time, and copper recovery. It was established that the optimum grind was 80% passing 150 microns. The conditions identified produced a copper rougher recovery of 89.5%. Preliminary tests on molybdenum and gold recoveries were below expectations.

Phase 2 built on Phase 1 work by conducting locked cycle testwork which gave improved recoveries for copper by 5% and molybdenum by 10% using revised reagent schemes and a regrinding circuit.

For Phase 3, pilot plant campaigns, based on the conditions determined in Phase 2 locked cycle tests, were run on two samples representing the feed ore for the first 5 years of operation to explore several possible flowsheet modifications and confirm the reagent schemes developed in Phase 2. The results were an improvement over Phase 2 and showed that approximately 90% of the copper could be recovered in a concentrate at 45% Cu grade. These are higher than the design criteria of 86% recovery and 30% Cu grade used in the 1997 initial feasibility study.

Pilot plant tests showed that a separate marketable molybdenum concentrate could potentially be produced. The pilot plant yielded an overall molybdenum recovery of 52% to a concentrate grading 55% Mo. Compared with the 1997 design criteria, the grade was improved by 5% at the expense of recovery which decreased from 65%. A marketable concentrate requires a minimum grade of 50% Mo.

Gold recovery to final copper concentrate was low at 55% to 59% and was attributed to its occurrence with pyrite which was rejected to tailings.

A significant change in Phase 3 was the elimination of cyanide addition for pyrite depression. Proper and consistent pH control rather than cyanide was found to be effective for pyrite separation from copper.

The pilot plant work also raised a concern on potential high bismuth and fluorine contamination of the concentrate. This was not observed in the earlier work phases.

### 16.5 Thickening and Filtration

Thickening and filtration tests were conducted by vendors on concentrate and tailings generated in Phase 3 pilot plant operation.

The concentrate slurry had a stable froth which presented difficulties to settling. Tailings could be settled with moderate amounts of flocculant.

Pressure filtration was more effective than ceramic disc filtration on the concentrate.

### 16.6 Recommendations

The pilot plant campaigns demonstrated a possible flowsheet for the recovery of copper and molybdenum concentrates. Further optimization work was recommended particularly to improve molybdenite recovery and gold recovery by separation from pyrite.

## 17. Mineral Resource & Reserve Estimates

### 17.1 Resource Estimates

The principal resource estimates generated by BHP-NNO over the period 1994 through 1998 and 1999 have been:

- February 1997: a "103-hole block model" used for the "Initial Feasibility Study" (Inverse Distance Squared method, or ID2);
- January 1998: a "150-hole model" (an updated version of the 103-hole model, also estimated by ID2 and Ordinary Kriging);
- March 1999: based on all 176 holes drilled on the property and a revised classification of ore types described earlier in this report, a kriged block model was generated and used as the basis for an updated Initial Feasibility Study completed in July 1999 (the "176-hole model"). This kriged model was a joint effort between BHP and NNO staff and a geostatistical specialist, Isaaks & Company.

All of the resource estimation procedures applied in the generation of the block models since 1997 followed consistent, industry-standard methodologies and incorporated substantial geological inputs for zone interpretation, and modelling of the various ore types identified on the property.

For the purposes of this Independent Technical Report, a description of the latest 176-hole model is provided to illustrate the resource estimation procedures:

*Raw Database:*

- The raw data files used for resource modelling included files for topography at 5m intervals; collar locations; orientation and depth of 150 drillholes; downhole surveys; lithology logs; mineralogy classifications; alteration data; fault intervals; 2m assay data linked to laboratory name and batch number for each analysis; over 3,000 density measurements of dried drillcore

using the calliper method and cross-checked using the wax method at an outside laboratory (densities varied from a low of 2.36 for leached material to a high of 2.70 for mineralized hydrothermal breccia).

*Derived Files:*

- During the modelling procedures in MedSystem, several output files were generated such as: 15m bench composites coded by lithology and mineralogy; 15m composites with geological codes loaded from the block model; various "vbm" files produced in Meds; summary files with raw data checks; block totals of each value generated.

*Modelled Parameters:*

- lithology; Cu-Fe mineralogy (leached, chalcocite, covellite, primary, and mixed zones); alteration (8 zones); native sulphur zone; clean/dirty boundary (from As and Cu levels); geotechnical parameters (RQD and core recovery), and assay values for Cu, Mo, Au, Ag, Pb, Zn, As, and Fe;

- modelled parameters based on geological interpretation on 50m N-S and E-W sections at a 1:2000 scale.

*Block Size:*

- 25m by 25m by 15m high, fully diluted

*Kriging Methodology:*

- Ordinary Kriging for east and west sectors of the deposit based on variography for low and high grade copper and molybdenum zones (exponential models with ranges varying from 25m vertically to over 190m horizontally); high-grade samples restricted to 75m search;

*Resource Classification:*

- based on kriging variances for east and west sectors, for example for the east sector: Measured <0.40; Indicated between 0.41 and 0.47; and Inferred > 0.47.

The following table summarises the 150-hole resource model for Agua Rica:

**Agua Rica Resource Estimates, March 1999 (150-Hole Model)**

*(Source: BHP-NNO Joint Venture)*

**MEASURED RESOURCE**

| Cut-off %Cu | Mt | %Cu | %Mo | Au g/t | Ag g/t |
|---|---|---|---|---|---|
| 0.20 | 898 | 0.51 | 0.032 | 0.21 | 1.7 |
| 0.40 | 522 | 0.67 | 0.036 | 0.25 | 2.4 |
| 0.70 | 154 | 1.00 | 0.036 | 0.32 | 3.1 |

**INDICATED RESOURCE**

| Cut-off %Cu | Mt | %Cu | %Mo | Au g/t | Ag g/t |
|---|---|---|---|---|---|
| 0.20 | 431 | 0.37 | 0.031 | 0.16 | 3.1 |
| 0.40 | 156 | 0.52 | 0.038 | 0.21 | 3.5 |
| 0.7 | 11 | 0.83 | 0.039 | 0.32 | 4.1 |

**INFERRED RESOURCE**

| Cut-off %Cu | Mt | %Cu | %Mo | Au g/t | Ag g/t |
|---|---|---|---|---|---|
| 0.20 | 385 | 0.32 | 0.031 | 0.11 | 2.5 |
| 0.40 | 72 | 0.49 | 0.044 | 0.15 | 2.4 |
| 0.70 | 2 | 0.80 | 0.032 | 0.35 | 3.0 |

**MEASURED+INDICATED**

| Cut-off %Cu | Mt | %Cu | %Mo | Au g/t | Ag g/t |
|---|---|---|---|---|---|
| 0.20 | 1,329 | 0.46 | 0.032 | 0.14 | 2.2 |
| 0.40 | 678 | 0.64 | 0.037 | 0.24 | 2.7 |
| 0.70 | 165 | 0.99 | 0.036 | 0.32 | 3.2 |

## 17.2 Mineral Reserves

On the basis of the 150-hole resource model, pit optimization studies were completed using the Meds System Lerchs-Grossman method (the "Dipper" and "Stripper" modules of Meds). The principal input parameters to the pit optimization studies were as follows:

| *Input Item, 1998* | | *Unit* | *Value* |
|---|---|---|---|
| Prices | | | |
| | Copper | $/lb | $0.95 |
| | Gold | $/oz | $350 |
| | Silver | $/oz | $4.50 |
| | Molydenum | $/lb | $3.50 |
| Mill Production Rate | | tpd | 68,000 |
| Metallurgical Recoveries | Copper | all % | 85 |
| | Gold | | 46 |
| | Silver | | 60 |
| | Molybdenum | | 70 |
| Internal Cut Off Grade (years 1-12) | | Cu | 0.40% |

| *Input Item, 1998* | *Unit* | *Value* |
|---|---|---|
| Operating Costs: | | |
| Mining, fixed | $/t moved | $0.65 |
| Incremental mining cost by bench | $/t moved | $0.01 |
| Process | $/t milled | $3.00 |
| G&A | $/t milled | $0.90 |
| Concentrate Transportation | $/t con | $47 |
| TCRCs | $/lb metal | $0.24/lb Cu<br>$6/oz Au<br>$0.45/oz Ag |
| Royalties | % | 3% |
| Pit Slopes, 3 sectors: | | |
| Variable by sector | degree | 36-55 |
| Pit Parameters: | | |
| Bench Height | m | 15 |
| Face Angle | degree | 60 |
| Catch Berms, every 180m | m | 30m |
| Haul Road | m | 36 |
| Benching | double | 30m |
| Minimum pushback width | m | 75m |
| Dilution & Loss: | Included in 15m bench composites | |

In generating the optimum pit shells, only the Measured and Indicated resource blocks were allowed to generate revenue, the Inferred blocks being assigned as waste with zero values. Furthermore, no block <0.40% Cu was allowed to generate revenue in the net value calculations of the optimization routines (i.e., the external cutoff grade). In order to speed up the optimization procedure, the 25m by 25m by 15m resource model blocks were re-blocked to 50m by 50m by 15m.

Optimization of the pit was based on Net Value calculations to take into account the multiple elements present in the deposit and a block-by-block calculation of total payable value from all the elements, less operating costs, including treatment and smelting costs, provided that the block had at least 0.40% Cu. The Lerchs-Grossman routine calculates the maximum profit pit incorporating the Net Values for all blocks in the model. Waste blocks generate negative dollar value equivalent to the mining costs multiplied by block tonnage. Through an iterative process, a maximum, undiscounted net dollar value is obtained.

Within the ultimate pit design, improved economic results were evaluated by applying varying copper prices from $0.70 per lb to $0.90 per lb to produce a series of pit phases. After mine planning to allow for haul roads by phase and by bench, the following combined Proven and Probable Mineral Reserves were obtained:

***Agua Rica Proven & Probable Reserves, 68k Case***
***(0.40% Cu Cutoff Grade)***

***1998***

| | Proven & Probable | | | | | Waste | W/O |
|---|---|---|---|---|---|---|---|
| | Mt | Cu % | Mo % | Au g/t | Ag g/t | Mt | |
| TOTALS | 516.6 | 0.64 | 0.033 | 0.27 | 4.1 | 1,109 | 2.15 |

*Source: BHP-NNO Joint Venture 68k Production Report, 1998*

In the mine planning and scheduling of these reserves, lower grade material below the 0.40% Cu internal cutoff was stockpiled and retrieved during the latter years of the 22-year mine life.

# 18. Additional Information for Development Properties

## 18.1 Open Pit Mining

The basis of the Joint Venture's open pit mining plan was a large-scale truck-and-shovel operation operating at 68,000 tpd over 350 days per year on two shifts. An initial access and development fleet of 218t trucks and hydraulic shovels was scheduled for the initial two years of pre-production to remove ~30 million tonnes to expose the Seca and Trampeadero deposits. Once in production, high material movements averaging over 350,000 tpd (ore and waste) in the first 10 years of the operation would be met through a combination of large rope shovels, hydraulic shovels, and a 20-24 unit fleet of 218t trucks An auxiliary fleet of tracked and wheel dozers and other support equipment was also included in the BHP-NNO mine plan. Haul truck cycles were derived for all pit benches by mining phase and input to the Meds System scheduling module.

## 18.2 Underground Mining Alternatives

In the early 1990s, the Joint venture carried out a study into an underground Block Caving approach to the Agua Rica deposit. The method is capable of high rates of production and relies principally on natural gravity for both fragmentation of the caving ore, and for materials handling of the broken ore as it passes vertically down through a series of raises to a central haulage system. The method has been extensively applied for many years in the Chilean porphyry copper deposit, either as a traditional "grizzly" method or the more modern "zanja y calle" methods using LHD equipment.

Unlike many block cave situations that are accessed via vertical shaft systems for both ore handling and services, the higher grade zones at Seca and Trampeadero can easily be targeted and accessed from the sides of the Quebrada Minas valley thus avoiding a costly and lengthy development period prior to start-up. Other advantages of a block caving approach would be:

- the method does not require handling of ARD waste disposal on surface;

- rapid access and reduced start-up time compared to open pit approach;
- significant savings in capital costs compared to open pit mining;
- since the ore zones can be accessed from adits, no vertical hoisting of material would be required, and an efficient ventilation system would be possible.

Through a geotechnical consulting firm in Santiago, Chile (Ingeroc Ltda.), the caving parameters were established from an analysis of the RQD and Rock Mass Ratings of the Agua Rica ground from which it was concluded that block caving is geotechnically feasible, and that a drawpoint spacing of between 9m by 9m for Seca and 10m by 12m for Trampeadero would produce optimum caving conditions.

Using the Block Caving modules of Meds System, a Single Lift and Double Lift option were evaluated using the following input parameters:

| *Input Item* | | *Unit* | *Value* |
|---|---|---|---|
| Prices | | | |
| | Copper | $/lb | $0.90 |
| | Gold | $/oz | $350 |
| | Silver | $/oz | $5.00 |
| | Molydenum | $/lb | $4.00 |
| Mill Production Rate | | Tpd | 50,000 |
| Cutoff Grade | | % | 0.40% |
| Metallurgical Recoveries | Copper | | 85 |
| | Gold | all % | 45 |
| | Silver | | 68 |
| | Molybdenum | | 48 |
| Operating Costs: | | | |
| | Mining | $/t | $3.00 |
| | Process, G&A | $/t | $4.00 |
| | Development | $/t | $0.50 |
| | TCRCs | | $0.71 |
| | Cu | $/lb | $0.24 |
| | Royalty | % | 3% |

Based on a Two Lift option with a First Lift established at the 3105m elevation and a Second Lift at the 2940m elevation, a Proven & Probable Reserve was derived as follows:

***50k Block Cave, Proven & Probable Reserve***

| *Mine Life Years* | *Mt* | *Cu %* | *Mo %* | *Au g/t* | *Ag g/t* |
|---|---|---|---|---|---|
| 23 | 410.7 | 0.63 | 0.038 | 0.26 | 3.52 |

Below the 2940m elevation, an additional Inferred Resource of 210 million tonnes at 0.54% Cu, 0.037% Mo, 0.27g/t Au, and 3.3g/t Ag offers the possibility of extending the block cave to a Third Lift (~10 years of additional production).

## 18.3 Processing

### *18.3.1 Introduction*

A process flowsheet has been developed from the three phases of testwork, particularly the pilot plant campaigns, based on a conventional sulphide concentrator. The plant will include a grinding circuit utilizing SAG and ball milling, flotation and dewatering circuits. Separate copper and molybdenum concentrates will be produced.

### *18.3.2 Process Description*

Based on the 1997 feasibility study, the process plant for the Agua Rica project will be similar to a typical porphory copper plant, except for the addition of a molybdenum recovery circuit. The required reagents are standard commercial products which are readily available.

Agua Rica ore will be crushed in a single-stage primary crusher then conveyed to the mill site. The ore will be ground through a SAG mill-Ball mill circuit before feeding the copper flotation circuit.

Ground ore will be fed to copper rougher flotation. The rougher concentrate will be reground then upgraded in three stages of cleaning. Both the rougher and first stage cleaner will operate in open circuit with the combined tailings going to the tailings thickener. The concentrate from the first cleaner will be upgraded in the second and third stage cleaners operating in closed circuit to produce a bulk copper concentrate which will contain molybdenum.

The bulk copper concentrate will be processed in the molybdenum flotation circuit consisting of rougher flotation, a regrind, followed by five stages of cleaning to produce a final copper concentrate and a molybdenum concentrate.

Both the final copper and molybdenum concentrates will be thickened then filtered. The copper and molybdenum concentrates will be filtered in-plant. Copper concentrate will be truck hauled to the Belgrano railhead at Chumbicha and railed to the port. Molybdenum concentrate will be truck hauled to a regional smelter facility.

### *18.3.3 Process Equipment*

Standard industry proven equipment has been proposed for the plant. Some new technologies, outlined below, have been developed since the 1997 feasibility study and should be evaluated for possible enhancement of the metallurgical performance.

There have been improvements to flotation cell design, such as the Jameson cell and column cell, for increased recovery through flotation of fine mineral particles. These might be applicable to Agua Rica to minimize losses of fine copper minerals to tailings as observed in the testwork.

Deaerators, such as the Outokumpu FrothBusters, are available to disengage air from the concentrate slurry prior to settling. These might overcome the settling difficulties observed in the pilot plant work to improve settling and overflow clarity. This has the potential of reducing the thickener capacity. In addition, various thickener designs such as the high capacity and E-CAT designs should be investigated for possible reduction in capacity requirements and improved overall operation and costs.

### 18.4 Infrastructure

The infrastructure requirements for a standalone concentrator for the Agua Rica project as described in the 1997 IFS document include the following facilities:

- Minesite and plantsite access roads from Andalgala, approximately 28km long. The area terrain is very rugged and there are opportunities to optimize the routing, particularly using the Potrero valley.
- A 20 km long overland conveyor system to transport ore from the minesite to the plantsite, including a 4km long tunnel and a conveyor routing tracking the access road. The conveyor is regenerative.
- Tailings dam located at La Isla on the valley floor and approximately 28km south of the plantsite, with reclaim water system.
- Power supply provided by a local utility company, tapped off from an existing 132kV transmission line feeding Andalgala.
- Fresh water supply provided by a series of well fields located on the valley floor, south of the plantsite. These have still to be confirmed.
- On site maintenance/warehouse, truckshop, administration and laboratory buildings, fuel storage and distribution, water distribution and fire protection and sewage treatment facilities.
- Concentrate filter plant including storage tanks, pressure filters, clarifiers and truck weigh scale.
- Upgrade to existing port facilities , including railcar unloading station, concentrate storage and reclaim facilities to tie into existing ship loading equipment.

No camp accommodation is provided, as personnel will be bussed to the plant and mine site from Andagala.

## 19. Financial Analysis

In completing this report, Hatch has examined several studies completed by the BHP-NNO joint venture. The 1997 IFS completed by BHP-NNO was based on open pit options of 60ktpd and 120ktpd feeding concentrators at two alternative locations. In 1999, this study was reviewed by Minproc who suggested a number of improvements to reduce capital costs. Around the same time, a scoping level study into an alternative underground mining scheme (the block cave) was completed in 1998. Also in 1999, BHP evaluated a 68ktpd open pit option with an alternative plant site. Betchel then completed a scoping level study of an overland conveyor system for the revised Agua Rica plant site location. In December 2001, the Argentine peso underwent rapid devaluation from a rate of 1:1 to 3.5:1 to the US dollar, which has had a significant effect in reducing local costs (ie, in pesos).

For the financials in this report, Hatch has examined a standalone case of an open pit and concentrator combination processing 68,000 tpd of ore (the 68k Case). Cost inputs for this financial evaluation have been taken from information developed in the earlier BHP-NNO studies, adjusted and updated for current cost and exchange conditions in Argentina.

## 19.1 Capital and Operating cost estimates

Capital and operating cost estimates for the updated Hatch 68k Case have been developed as follows:

- Initial Feasibility Study ("IFS") estimates form the basis of the cost inputs, with unit rates updated for current Argentine construction and operating labour, concrete and steel erection;
- Overland conveyor capital costs have been taken from the 1999 Bechtel study. The overland conveyor routing from the mine site to the plant site was determined from 10m contour maps of the site, with estimates, not supported by geotechnical investigations, for the relative amounts of rock deemed rippable and that requiring blasting. Tunneling costs were based on typical rates for the region;
- Costs for the on site buildings have been updated using recent actual constructed costs for similar size facilities for a project in Peru that Hatch is involved with currently;
- Costs for consumables have been updated using consumption rates reported for the pilot plant testwork and recent budgetary costs;
- Costs for seafreight have been based on current published data for the Alumbrera operation (approximately $32/dmt concentrate). Unit rates for power, road and rail transportation have not changed.
- Mining costs for the 68k open pit operation have been based on the current published unit rates for Alumbrera, of 71c/t moved.
- An operating cost factor of 0.89 was applied to the total operating cost estimates to account for lower cost components resulting from the Argentine currency devaluation. This was based on recent published data for Alumbrera where actual costs for 2002 were 89% lower than planned, due largely to devaluation, an experience considered appropriate for this 68k case at Agua Rica.

The capital and operating cost estimates for the 1997 IFS 60ktpd and 120 ktpd concentrator, the 1999 BHP updated 68 ktpd concentrator, and the updated Hatch case are summarized on the following page (some original BHP estimates for the 120k case not available and shown for reference only):

*Capital Cost Estimates for Production Alternatives (Millions US$)*

| *CAPITAL COST ESTIMATE* | *Units* | *Standalone concentrator* | *Standalone concentrator* | *Standalone concentrator* | *Standalone concentrator* |
|---|---|---|---|---|---|
| | | *IFS 60 k BHP* | *IFS 120k BHP* | *68k BHP* | *68 k Hatch* |
| *Plantsite,roads* | $M | 18.4 | | 40.4 | 45.9 |
| *Mine access road* | $M | Incl | | 23.3 | 9.6 |
| *Crushing* | $M | 12.9 | | Incl | 7.8 |
| *Overland conveyors,tunnels* | $M | 131.5 | | 57.4 | 41.5 |
| *Concentrator* | $M | 123.6 | | 103.9 | 114.0 |
| *Power supply,distribn* | $M | 18.7 | | 22.9 | 17.1 |
| *Ancillary buildings* | $M | 14.2 | | Incl | 14.1 |
| *Tailings impoundment* | $M | 30.4 | | 5.3 | 5.5 |
| *Water supply,distribn* | $M | 47.3 | | 60.6 | 12.0 |
| *Mobile equipment, water treatment plant* | $M | 2.3 | | Incl | 5.6 |
| *Port site* | $M | 10.0 | | 10.0 | 8.8 |
| *Mine equipment* | $M | 112.6 | | 116.7 | 100.3 |
| *Mine preproduction* | $M | 20.8 | | ~13.0 | 43.8 |
| *Total direct costs* | $M | 542.6 | | 449.8 | 441.5 |
| *Indirect costs* | $M | 219.0 | | 160.9 | 103.9 |
| *Contingency* | $M | 119.2 | | 95.9 | 76.5 |
| *Owners costs* | $M | 33.7 | | 32.9 | 20.2 |
| *Total expansion cost* | $M | - | 378.5 | - | - |
| *Total capital costs* | $M | 914.5 | 1293.0 | 743.2 | 625.6 |

*Operating Cost Estimates*

| | | | | | |
|---|---|---|---|---|---|
| *Mining* | $/t moved | 0.58 | 0.48 | 0.57 | 0.71 |
| *Strip ratio* | | 2.35 | 1.80 | 2.27 | 2.48 |
| *Mining* | $/t ore | 1.95 | 1.35 | 1.86 | 2.34 |
| *Process* | $/t ore | 3.41 | 3.08 | 2.99 | 2.93 |
| *General and administration* | $/t ore | 0.64 | 0.37 | 0.59 | 0.56 |
| *Total mine site* | $/t ore | 6.00 | 4.80 | 5.44 | 5.83 |
| *Transport,marketing* | $/t ore | 0.63 | 0.55 | Incl | 0.30 |
| *Ocean freight* | $/t ore | 0.45 | 0.38 | 1.16 | 0.45 |
| *Total operating cost* | $/t ore | 7.08 | 5.74 | 6.60 | 6.58 |
| *Adjusted Operating Cost/ t Ore* | | | | | 5.86 |

## 19.2 Taxes and fiscal regime

The fiscal regime and conditions presented in the IFS are still valid. After the devaluation of the Argentine peso in January 2001, the Senate introduced a resolution supporting the continuance of the "Fiscal Stability Regime" .

The key taxation criteria incorporated into the preliminary cash flow model are as follows:

- Income tax rate of 33%
- No import taxes or duties on capital goods, equipment or spares
- 100% Depreciation of capital assets allowed over three year period. Straight line depreciation was utilized in the model.

## 19.3 Financial projections

The financial model developed by Hatch for the updated 68k case assumes 100% equity financing, does not include working capital, does not incorporate price escalation or inflation projections, nor does it incorporate any possible tax pools that may be available.

Current metal price forecasts of 80c/lb copper, $325/oz gold, $4.5/oz silver and $4.0/lb molybdenum have been used. By comparison, the 1997 IFS and 1999 BHP studies were based on $1.0/lb copper, $380/oz gold, $5.25/oz silver and $4.0/lb molybdenum, and marginally different metal recoveries (from testwork completed to that date). The mining schedule used by Hatch for cash flow projections has been taken directly from the 1999 BHP 68k Case (ie, the 150-hole resource model).

Recovery of metal to concentrate is discussed in Section 16 of this report. The smelter terms and refining charges are based on typical current terms, and published data for Alumbrera. Concentrate smelting is estimated at $66/dmt concentrate, and refining charges at 7c/lb of payable copper and $5/oz of payable gold in concentrate. Payable copper and gold in concentrate is estimated at 96.4% and 97% respectively.

The key cash flow results for the updated Hatch 68k Case are summarized below with the earlier studies:

| | | *Standalone concentrator IFS 60k* | *Standalone concentrator IFS 120k* | *Standalone concentrator BHP 68k* | *Standalone concentrator Hatch 68k* |
|---|---|---|---|---|---|
| *Capital cost* | $M | 886.8 | 1265.2 | 743.2 | 625.6 |
| *LOM Cash cost to concentrate* | $/t ore | 7.08 | 5.74 | 6.60 | 5.86 |
| *LOM Project cash cost to cathode* | $/t ore | na | na | 9.51 | 7.72 |
| *Operating cash costs (C1) after credits(Au,Mo,Ag* | c/lb Cu | na | na | 54 | 35 |
| *IRR Project* | % | 15.5 | 17.6 | 15.7 | 19.2 |
| *NPV (0%)* | $M | na | na | na | 1326 |
| *NPV (10%)* | $M | 250 | 422 | 192 | 260 |

*(Note: LOM = Life of Mine)*

The cash flow projection for the updated 68k Case shows that the revenue contribution by metal is approximately 74% copper, 11% gold, 12% molybdenum and 2% silver, indicating the significant contribution of by-product metals. The metallurgical testwork furthermore indicates that higher molybdenum and gold recoveries could be attainable, and this therefore merits further investigation.

At 35 cents per pound of copper (net of by-products), the estimated C1 cash cost for Hatch's updated 68k case falls within the lowest quartile of current copper industry costs.

Sensitivity analyses have been performed to test the likely impact on project economics of changes in the prices of metals produced. The results are summarized below –

***Sensitivity Analysis***

| *Input Parameters* | *68 k Standalone Case* | |
|---|---|---|
| | *Total NPV,$M* | *Total NPV,$M* |
| *Discount rate* | 0% | 10% |
| *At Base Case prices* | $1,326 | $260 |
| *At Base case prices +10%* | $1,770 | $418 |
| *At Base case prices -10%* | $882 | $100 |

These results indicate that further investigation is warranted to improve the level of confidence in the capital and operating cost estimates and financial viability of the project for the production alternative examined in this report.

## 20. References

The following documents were reviewed during the preparation of this report:

1. Initial Feasibility Study (IFS) Agua Rica, BHP/Fluor Daniel Wright, august 1997
2. "Pilot plant recovery of copper from Agua Rica ore", MINTEK, 31 May 1999
3. "Agua Rica conveying options- revised 30/11/00", Walter Kung, 30 November 2000
4. "The block caving approach", C.Grant, May 1999
5. "Concept and costing review of the IFS", Minproc, July 1999
6. "Alternative tailings site study – Prefeasibility study input", Fluor Daniel Wright, October 1998
7. "Independent Technical Report of the Bajo de la Alumbrera Mine", SEDAR, Micon International Ltd., March 2003

# STATEMENT OF QUALIFICATIONS

## STATEMENT OF QUALIFICATIONS

I, Callum Leith Brown Grant, P.Eng., do hereby certify that:

I. I am currently employed as Manager of Geology & Mining by:

HATCH Associates Ltd.,
Suite 200, 1550 Alberni Street,
Vancouver, British Columbia,
CANADA V6G 1A5

II. I graduated with the degree of B.Sc. Geology (Honours) from the University of Aberdeen, Scotland in 1971. In addition I obtained the degree of M.Eng. (Mining) from McGill University in 1977.

III. I am a member of the Association of Professional Engineers and Geoscientists of the Province of British Columbia, and of the Association of Professional Engineers of the Province of Ontario.

IV. I have worked as a geologist and mining engineer for 27 years since my graduation from my first university.

V. I have read the definition of "qualified person" set out in National Instrument 43-101 ("NI 43-101") and certify that by reason of my education, affiliation with a professional association (as defined in NI 43-101) and past relevant work experience, I fulfill the requirements to be a "qualified person" for the purposes of NI 43-101.

VI. I am responsible for the geology and mining section of this report (the "Technical Report"). I visited the property several times in 1998.

VII. As an employee of Northern Orion in 1998, I supervised the underground development of the bulk sampling program. Subsequently in 1999, as an Independent Consulting Engineer I completed a conceptual block caving study on behalf of BHP Minerals Inc.

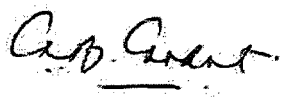
VIII. I am not aware of any material fact or material change with respect to the subject matter of the Technical Report that is not reflected in the Technical Report, the omission to disclose which makes the Technical Report misleading.

IX. I am independent of the issuer applying all the tests in section 1.5 of National Instrument 43-101.

X. I have read National Instrument 43-101 and Form 43-101F1, and the Technical Report has been prepared in compliance with that instrument and form.

XI. I consent to the filing of the Technical Report with any stock exchange and other regulatory authority and any publication by them, including electronic publication in the public company files on their website accessible by the public, of the Technical Report.

Dated this 16th day of May 2003



CLB Grant, P.Eng.
Manager Geology & Mining
Hatch Vancouver

## STATEMENT OF QUALIFICATIONS

I, Paul A.J. Hosford, P.Eng., do hereby certify that:

I. I am currently employed as Manager of Metallurgy by:

HATCH Associates Ltd.,
Suite 200, 1550 Alberni Street,
Vancouver, British Columbia,
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II. I graduated with the degree of Chemical Engineer from the University of Edinburgh, Scotland in 1982.

III. I am a member of the Association of Professional Engineers and Geoscientists of the Province of British Columbia and a registered Chartered Engineer (C.Eng.) in United Kingdom.

IV. I have worked as a metallurgical engineer for over 18 years since my graduation from university.

V. I have read the definition of "qualified person" set out in National Instrument 43-101 ("NI 43-101") and certify that by reason of my education, affiliation with a professional association (as defined in NI 43-101) and past relevant work experience I fulfill the requirements to be a "qualified person" for the purposes of NI 43-101.

VI. I am responsible for the preparation of the metallurgical sections of this report "Independent Technical Report, Mantua Copper Project" dated November 18th, 2002 (the "Technical Report") relating to the Mantua Property in Cuba.

VII. I was involved with the design of a gold heap leaching operation at Mantua.

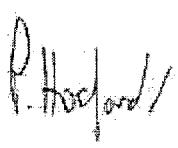
VIII. I am not aware of any material fact or material change with respect to the subject matter of the Technical Report that is not reflected in the Technical Report, the omission to disclose which makes the Technical Report misleading.

IX. I am independent of the issuer applying all the tests in section 1.5 of National Instrument 43-101.

X. I have read National Instrument 43-101 and Form 43-101F1, and the Technical Report has been prepared in compliance with that instrument and form.

XI. I consent to the filing of the Technical Report with any stock exchange and other regulatory authority and any publication by them, including electronic publication in the public company files on their website accessible by the public, of the Technical Report.

Dated this 16th day of May 2003



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## CONSENT OF AUTHOR

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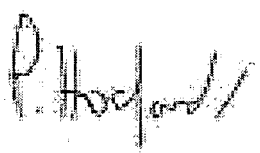
Quebec Securities Commission
Saskatchewan Securities Commission
Registrar of Securities - Northwest Territories
Registrar of Securities - Yukon Territory
Nunavut

I, Paul A.J. Hosford, do hereby consent to the filing, with the regulatory authorities referred to above, of the technical report titled "Independent Technical Report – Northern Orion Exploration Ltd. – Agua Rica Project, Argentina" and dated May 16th, 2003 (the "Technical Report") and to the written disclosure of the Technical Report and of extracts from or a summary of the Technical Report in the written disclosure in the submission of Northern Orion Exploration Ltd. being filed.

I also certify that I have read the written disclosure being filed and I do not have any reason to believe that there are misrepresentations in the information derived from the Technical Report or that the written disclosure in the prospectus of Northern Orion Exploration Ltd. contains any misrepresentation of the information contained in the Technical Report.

Dated this 20th day of May 2002.

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## CONSENT OF AUTHOR

**TO:** Toronto Stock Exchange
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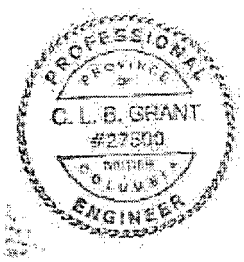
Nova Scotia Securities Commission
New Brunswick Securities Commission
Newfoundland Securities Commission
Ontario Securities Commission
P.E.I. Securities Commission
Quebec Securities Commission
Saskatchewan Securities Commission
Registrar of Securities - Northwest Territories
Registrar of Securities - Yukon Territory
Nunavut

I, Callum LB Grant, do hereby consent to the filing, with the regulatory authorities referred to above, of the technical report titled "Independent Technical Report – Northern Orion Exploration Ltd. – Agua Rica Project, Argentina" and dated May 16th, 2003 (the "Technical Report") and to the written disclosure of the Technical Report and of extracts from or a summary of the Technical Report in the written disclosure in the submission of Northern Orion Exploration Ltd. being filed.

I also certify that I have read the written disclosure being filed and I do not have any reason to believe that there are misrepresentations in the information derived from the Technical Report or that the written disclosure in the prospectus of Northern Orion Exploration Ltd. contains any misrepresentation of the information contained in the Technical Report.

Dated this 20th day of May 2002.




CLB Grant, P.Eng.
Manager Geology & Mining
Hatch Vancouver

## STATEMENT OF QUALIFICATIONS

I, Paul A.J. Hosford, P.Eng., do hereby certify that:

I. I am currently employed as Manager of Metallurgy by:

HATCH Associates Ltd.,
Suite 200, 1550 Alberni Street,
Vancouver, British Columbia,
CANADA V6G 1A5

II. I graduated with the degree of Chemical Engineer from the University of Edinburgh, Scotland in 1982.

III. I am a member of the Association of Professional Engineers and Geoscientists of the Province of British Columbia and a registered Chartered Engineer (C.Eng.) in United Kingdom.

IV. I have worked as a metallurgical engineer for over 18 years since my graduation from university.

V. I have read the definition of "qualified person" set out in National Instrument 43-101 ("NI 43-101") and certify that by reason of my education, affiliation with a professional association (as defined in NI 43-101) and past relevant work experience I fulfill the requirements to be a "qualified person" for the purposes of NI 43-101.

VI. I am responsible for the preparation of the metallurgical sections of this report "Independent Technical Report, Mantua Copper Project" dated November 18th, 2002 (the "Technical Report") relating to the Mantua Property in Cuba.

VII. I was involved with the design of a gold heap leaching operation at Mantua.

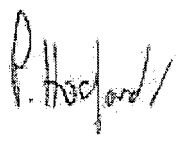
VIII. I am not aware of any material fact or material change with respect to the subject matter of the Technical Report that is not reflected in the Technical Report, the omission to disclose which makes the Technical Report misleading.

IX. I am independent of the issuer applying all the tests in section 1.5 of National Instrument 43-101.

X. I have read National Instrument 43-101 and Form 43-101F1, and the Technical Report has been prepared in compliance with that instrument and form.

XI. I consent to the filing of the Technical Report with any stock exchange and other regulatory authority and any publication by them, including electronic publication in the public company files on their website accessible by the public, of the Technical Report.

Dated this 16th day of May 2003



Paul A.J. Hosford, P.Eng.
Manager of Metallurgy
Hatch Vancouver

## STATEMENT OF QUALIFICATIONS

I, Callum Leith Brown Grant, P.Eng., do hereby certify that:

I. I am currently employed as Manager of Geology & Mining by:

HATCH Associates Ltd.,
Suite 200, 1550 Alberni Street,
Vancouver, British Columbia,
CANADA V6G 1A5

II. I graduated with the degree of B.Sc. Geology (Honours) from the University of Aberdeen, Scotland in 1971. In addition I obtained the degree of M.Eng. (Mining) from McGill University in 1977.

III. I am a member of the Association of Professional Engineers and Geoscientists of the Province of British Columbia, and of the Association of Professional Engineers of the Province of Ontario.

IV. I have worked as a geologist and mining engineer for 27 years since my graduation from my first university.

V. I have read the definition of "qualified person" set out in National Instrument 43-101 ("NI 43-101") and certify that by reason of my education, affiliation with a professional association (as defined in NI 43-101) and past relevant work experience, I fulfill the requirements to be a "qualified person" for the purposes of NI 43-101.

VI. I am responsible for the geology and mining section of this report (the "Technical Report"). I visited the property several times in 1998.

VII. As an employee of Northern Orion in 1998, I supervised the underground development of the bulk sampling program. Subsequently in 1999, as an Independent Consulting Engineer I completed a conceptual block caving study on behalf of BHP Minerals Inc.

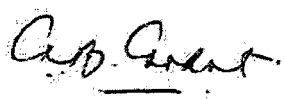
VIII. I am not aware of any material fact or material change with respect to the subject matter of the Technical Report that is not reflected in the Technical Report, the omission to disclose which makes the Technical Report misleading.

IX. I am independent of the issuer applying all the tests in section 1.5 of National Instrument 43-101.

X. I have read National Instrument 43-101 and Form 43-101F1, and the Technical Report has been prepared in compliance with that instrument and form.

XI. I consent to the filing of the Technical Report with any stock exchange and other regulatory authority and any publication by them, including electronic publication in the public company files on their website accessible by the public, of the Technical Report.

Dated this 16th day of May 2003



CLB Grant, P.Eng.
Manager Geology & Mining
Hatch Vancouver

**BC FORM 53-901F**
**Form 25 (*Securities Act*, 1988 (Saskatchewan))**
**Form 26 (*Securities Act* (Newfoundland))**
**Form 27 (*Securities Act* (Nova Scotia))**

**Material Change Report**
**Under:**
**Section 85(1) of the *Securities Act* (British Columbia)**
**Section 118(1) of the *Securities Act* (Alberta)**
**Section 75(2) of the *Securities Act* (Ontario)**
**Section 81(2) of the *Securities Act* (Nova Scotia)**
**Section 76(2) of the *Securities Act* (Newfoundland)**
**Section 84 (1) of *Securities Act* (Saskatchewan)**

**Item 1** **Reporting Issuer**

Northern Orion Explorations Ltd.
Suite 250 - 1075 West Georgia Street
Vancouver, BC V6E 3C9

(the "Company")

Telephone: (604) 689-9663

**Item 2.** **Date of Material Change**

May 8, 2003

**Item 3.** **Press Release**

May 9, 2003

**Item 4.** **Summary of Material Change**

See press release dated May 9, 2003

**Item 5.** **Full Description of Material Change**

See attached press release dated May 9, 2003

**Item 6.** **Reliance on Section 85(2) of the Act**

N/A

**Item 7.** **Omitted Information**

N/A

**Item 8.** **Senior Officers**

The following senior officer of the Issuer is knowledgeable about the material change and may be contacted by the Commission at the address and telephone number:

David W. Cohen
President and CEO
Suite 250 – 1075 West Georgia Street
Vancouver, BC V6E 3C9

Telephone: (604) 689-9663

**Item 9.** **Statement of Senior Officer**

The foregoing accurately discloses the material change referred to herein.

May 9, 2003
Date

"Shannon Ross"
Signature

**Shannon Ross**
Name

**CFO**
Position

**Vancouver, British Columbia**
Place of Declaration

*IT IS AN OFFENCE FOR A PERSON TO MAKE A STATEMENT IN A DOCUMENT REQUIRED TO BE FILED OR FURNISHED UNDER THE APPLICABLE SECURITIES LEGISLATION THAT, AT THE TIME AND IN THE LIGHT OF THE CIRCUMSTANCES UNDER WHICH IT IS MADE, IS A MISREPRESENTATION.*

NORTHERN ORION
EXPLORATIONS LTD.
Suite 250, 1075 West Georgia Street, Vancouver, B.C. V6E 3C9

**Friday, May 9, 2003** **NEWS RELEASE** NNO – TSE

## Northern Orion Closes Agua Rica Acquisition

Vancouver, B.C., May 9, 2003 -- Northern Orion Explorations Ltd (TSX: NNO) ("Northern Orion") is pleased to announce the closing of its acquisition from BHP Minerals International Exploration Inc ("BHP Billiton") of their 72% interest in the Agua Rica copper-gold-molybdenum project in Argentina. Northern Orion now owns 100% of the Agua Rica project.

The BHP Billiton interest was purchased for US$3.6 million paid on the closing date, with a further payment of US$9.0 million to be paid on or before 30 June 2005. Northern Orion has drawn on its previously announced US$3 million convertible term loan from Endeavour Mining Capital Corp (TSXV: EDV) to fund a portion of the initial payment to BHP Billiton.

Northern Orion is currently focused on completing its previously announced acquisition of a 12.5% interest of the Bajo de la Alumbrera copper-gold mine in Argentina. This transaction is expected to close by June 23, 2003. The Alumbrera operations are located approximately 34km west of the Agua Rica project.

With the Agua Rica and Alumbrera transactions, Northern Orion intends to position itself as a leading mid-tier copper production and development company. Northern Orion is focused on maximizing the economic potential of its assets and is actively assessing a number of other potential opportunities that could provide the basis for continued growth.

David Cohen, President and CEO
Northern Orion Explorations Ltd.

For further information:

Investor Relations: Vanguard Shareholder Solutions Inc.
Tel: 1-866-608-9970
Email: ir@vanguardsolutions.ca