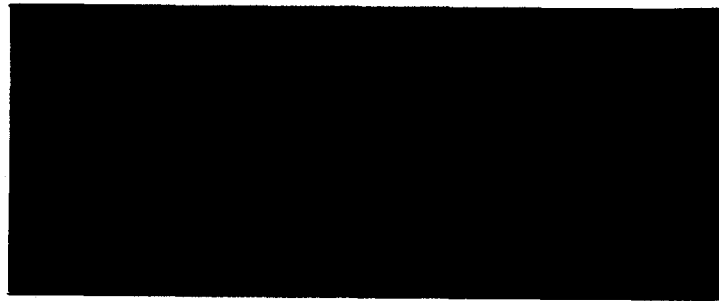




rpc

RESEARCH AND PRODUCTIVITY COUNCIL

LE CONSEIL DE RECHERCHE ET DE PRODUCTIVITE



RESEARCH AND PRODUCTIVITY COUNCIL

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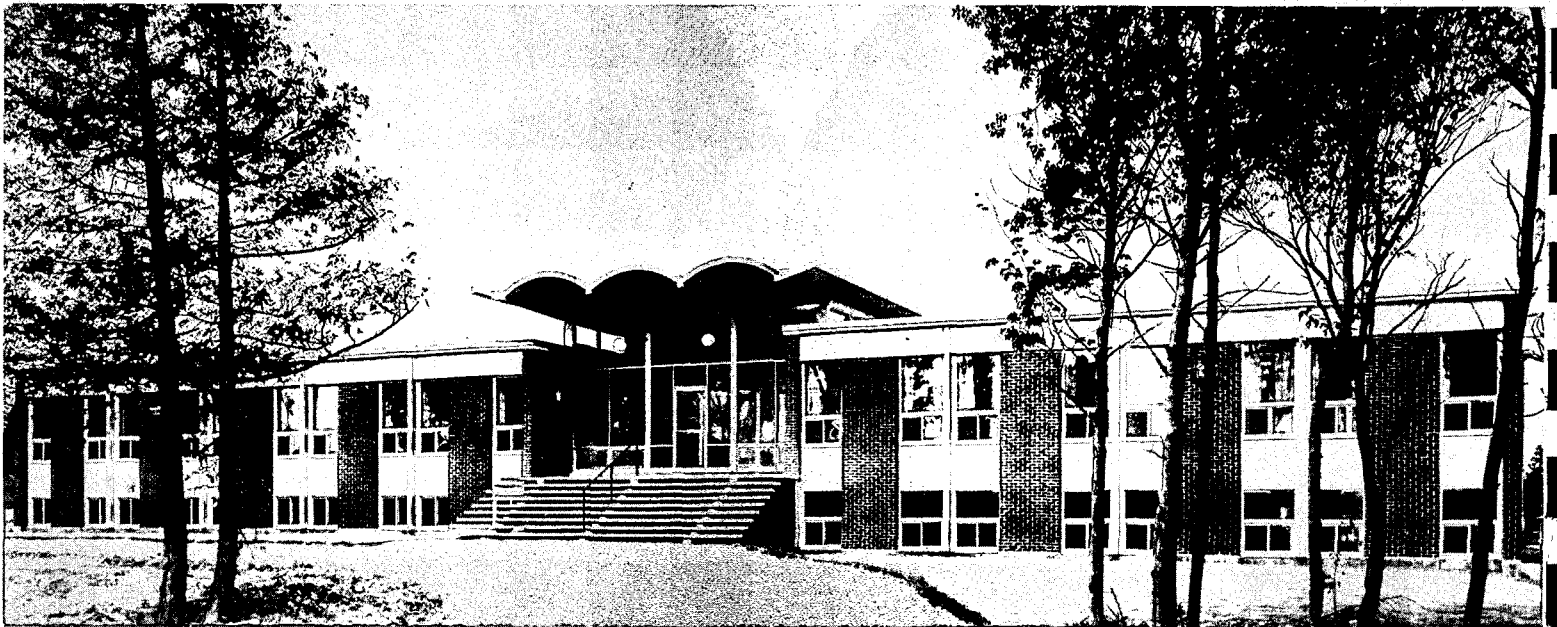


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M.E. Chalkley
R. Gilders
K. Jibiki
J. Synnott

1.0 INTRODUCTION

Giant Yellowknife Mines Limited (Giant) contacted the New Brunswick Research and Productivity Council (RPC) in August 1987 to enquire about fluidized-bed pilot plant testing of a process for the production of a high grade marketable arsenic trioxide product. The feedstock to the process would be crude arsenic trioxide baghouse dust, containing quantities of gold which would also be recovered in the process.

Giant provided RPC with details of bench-scale testwork carried out in 1980, the results of which were used to develop a pilot plant flowsheet. Following a review of this work, Dr. M.E. Chalkley, Head, Minerals Development and Processing Department, RPC visited Yellowknife on October 1st and 2nd, 1987 to discuss the testwork requirements with Giant personnel.

Giant has received approval from their board to proceed with a pilot test program to generate the data required for the design of a commercial plant for the treatment of up to 14,000 short tons/y of crude arsenic trioxide to produce 10,000 short tons/y of high grade marketable product. Giant has asked RPC to provide a proposal detailing the work program, timing and costs associated with continuous pilot plant testwork.

2.0 COMPANY INFORMATION

2.1 Giant Yellowknife Mines Limited

The Giant Mine is located about four miles north of Yellowknife, N.W.T., on the north shore of Great Slave Lake, 600 miles north of Edmonton. The mine started production in 1948 with an annual throughput of 85,000 tons of ore at a grade of 0.82 oz/t Au. Starting as an underground operation, production increased to 400,000 t/y in 1964. As reserves dwindled, small open pits were brought into production and in 1982, the operation was placed on a five day per week milling schedule. Current annual production is 400,000 t/y at 0.25 oz/t Au.

The occurrence of visible gold in the ore is extremely rare. Most of the gold is believed to occur as submicroscopic inclusions in arsenopyrite, or even in solid solution with arsenopyrite. The ore is refractory to direct cyanidation treatment and the most practical method of treatment is a bulk sulphide flotation followed by roasting of the concentrates and cyanidation of the calcine for the recovery of gold.

Roasting is carried out in two fluosolids roasters in series. In the first stage, flotation concentrate, fed in the form of a slurry, is roasted under reducing conditions to effect removal of the arsenic content. Reducing conditions ensure the removal of arsenic in the gaseous trivalent form. Excess oxygen would promote the oxidation of trivalent arsenic to the pentavalent form which would remain in the calcine and inhibit the subsequent extraction of gold from the calcine. Calcine from the first stage overflows to the second stage reactor.

The second, or oxidizing, stage results in the further elimination of sulphur. Complete oxidation of sulphur is not desirable since magnetite would be formed and the resulting non-porous calcine would yield low gold recoveries.

Off-gas from the first stage passes into the top of the second stage unit and the combined stream, containing arsenic trioxide vapour, sulphur dioxide, residual oxygen, nitrogen and water vapour passes through two cyclones to recover entrained calcine dust. The gas, at 450°C, is tempered, by the introduction of air, to 370°C before entering two electrostatic precipitators where fine calcine dust is removed. Tail gas from the precipitators is cooled to 105°C by the addition of tempering air. The arsenic trioxide vapour condenses into a fine-grained dust in an expansion chamber. The condensed arsenic trioxide is recovered from the cooled roaster off-gas in a baghouse. Arsenic trioxide is pneumatically conveyed into specially prepared underground stopes located in permafrost zones.

2.2 Research and Productivity Council

The Research and Productivity Council was founded in 1962. Operating funds were provided initially by a provincial government annual grant. The policy of RPC is to recover operating costs by charging fees for service. This has allowed the organization to expand in personnel and equipment to meet the ever changing needs of industry without placing a financial burden on the Province.

RPC is one of eight Provincial Research Organizations in Canada. It conducts research and development under contract for clients in industry and government. The

Mineral Development and Processing Department has developed an expertise in fluidized bed technology over a period of fifteen years.

New Brunswick has large resources of complex base metal sulphide ores. Due to the extremely fine grain size of the minerals, both grade and recovery of the metals contained in concentrates are usually poor. Following extensive mineralogical testwork and an assessment of suitable technologies for improving recoveries from the exploitation of these orebodies, the Sulphation Roast Leach Process was selected by RPC.

The process was initially tested at the bench scale. This work was followed by testing in 6" and 14" diameter pilot fluidized bed roasters, culminating in construction of a 10 t/d pilot plant employing a 1.5m diameter fluidized bed roaster. During the period covered by this testwork, a wide variety of feedstocks were examined.

In addition to roasting of complex base metal sulphides, RPC has also examined a number of other fluidized bed processes including the removal of arsenic from copper concentrate and the roasting of antimony sulphide concentrate to produce an upgraded antimony oxide product. During the past five years, RPC has developed an expertise in the fluidized bed combustion of energy minerals. In particular, a large amount of continuous piloting has been carried out in a 5" diameter circulating fluidized bed reactor. Much of the testwork has involved the combustion of high sulphur coals with limestone or oil shale.

3.0 BACKGROUND

The treatment of Giant Yellowknife baghouse dust has two potential benefits, the production of a high purity saleable arsenic trioxide product and the concentration of gold in the process residue. Baghouse dust consists of two types, that currently produced in the the operation at Giant, and that which has been stored underground. Current production grades 60-72% As and 0.2 oz/t Au, while the stored material averages 40% As and >1 oz/t Au. Considering gold alone, co-treatment of existing production and reclaimed dust, with an average feed grade of 0.6 oz/t Au, would yield about 8400 ounces of gold in an upgraded residue with a potential annual value of in the range US \$3-4 x 10⁶.

In 1980, Falconbridge Mines Limited, formerly major shareholders in Giant Yellowknife Mines Limited, conducted small scale testwork to investigate the technical feasibility of a fuming approach for the production of high grade arsenic trioxide from crude baghouse dust. The primary conclusion of this testwork was that the fuming of arsenic trioxide from Giant Yellowknife baghouse dust in a fluid bed reactor is technically feasible. The purity of the arsenic trioxide crystals was >99.7% As₂O₃ and in the temperature range 400 to 500°C, there was no bed degradation or agglomeration.

As a result of the test program, a pilot plant flowsheet was developed. The feed rate for the pilot plant was 40 kg/h. A schematic flowsheet is presented in Figure 1, together with the recommended operating conditions. It is this flowsheet which will provide the basic design parameters for the test program which is the subject of this proposal.

4.0 OBJECTIVES

The objectives of the study are:

to construct a pilot plant circuit incorporating the unit operations shown in Figure 1,

to commission the circuit to prove its mechanical reliability,

to assess the proposed operating parameters and carry out optimization studies where necessary, using current production baghouse dust,

to treat sufficient current production baghouse dust to assess recoveries and product quality,

to treat dust from arsenic chamber 32-08 to assess recoveries and product quality,

to treat dust from two or three other locations to determine the range of operating parameters that will be required,

to determine the recovery of gold from the calcine product, and

to generate material balance and process criteria sufficient to produce process flowsheets, capital and operating cost data.

5.0 WORK PLAN

It is anticipated that the work plan will incorporate five phases. In order to develop this proposal, RPC has studied the test program and equipment requirements extensively. A schematic flowsheet of the pilot plant is presented in Figure 2.

5.1 Phase I - Equipment Procurement and Set-Up

In carrying out the testwork, a major emphasis must be placed on environmental aspects. Material handling has therefore received much consideration. The concept of using a hot baghouse to remove particulate contaminants from the gas stream requires new technology. Bags capable of operating at high temperatures have been identified and a major supplier of baghouse equipment is prepared to provide a unit that will operate at elevated temperatures. The duration of this phase will be dependent on equipment delivery and is anticipated to be twelve to fourteen weeks.

The equipment will be set up in an enclosed area to ensure minimum contamination of the general work area.

5.2 Phase II - Commissioning and Testing of Current Baghouse Production

Initial commissioning of the feed system could be carried out in Phase I. Once the complete circuit has been set up, the system will be tested with a sand bed and hot fluidizing air alone. This test will determine whether a cyclone will be required. Of equal importance will be to demonstrate the ability of the circuit to maintain the required temperatures at all points, particularly upstream

of the condenser. Commissioning of the circuit will continue with current production baghouse dust being fed to the circuit. Once stable operation with baghouse dust feed has been obtained, the phase will be completed by a continuous run of 100h duration, under constant operating conditions. Data obtained will provide information on recoveries and product quality. This phase will be a maximum of four weeks in duration.

5.3 Phase III - Testing of Dust from Arsenic Chambers 32-08

Operating parameters identified in Phase II will be used at the start of this Phase. Some parameter optimization may be required due to differences in dust composition. Data will be obtained in a 100h continuous run and the phase is expected to be of three weeks duration, including preparation.

5.4 Phase IV - Testing of Dust from Other Locations

The range of operating parameters required for a commercial plant will be determined by testing dust from other locations in the mine. Depending on the experience gained in Phases II and III, each test would be of 48 to 96h duration. Including preparation, the maximum duration of this phase is anticipated to be four weeks.

5.5 Phase V - Flowsheet Development and Final Report

This phase will run concurrently with Phases II - IV and will be completed three weeks after the completion of Phase IV. A preliminary flowsheet design could be available at an earlier date.

5.6 Analytical Requirements

Samples which will be taken for analysis are feed, hot baghouse product and cold baghouse product. Samples will be taken at four-hour intervals during the test programs. Analytical requirements will be determined in consultation with the client.

5.7 Cyanidation Testwork

A daily composite sample of hot baghouse product will be submitted to cyanidation to assess the recovery of gold. Conditions for the cyanidation will be those currently used by Giant Yellowknife for the treatment of thier roaster calcine. If a bed overflow product is obtained from the fluidized bed reactor, this will be combined with the hot baghouse product.

6.0 PERSONNEL, COSTS AND SCHEDULE

6.1 Personnel

The project will be conducted by the Mineral Development and Processing Department of RPC under the direction of Dr. M.E. Chalkley, Department Head, who will be Project Leader. The pilot plant will be operated on a three shift basis with one professional and one technician per shift. The professionals will be Mr. R. Gilders, Dr. J. Synnott and Dr. K. Jibiki, each of whom has wide experience in pilot plant operations.

RPC has used Dr. I. Wilkomirsky, University of Concepcion, Chile, as a consultant on many roasting programs. He has experience in the design and operation of condensing units for recovering volatile species from off-gases. It is recommended that his services are used at an early stage of Phase I, to assist with condenser design and review the proposed flowsheet and operating parameters.

6.2 Costs

The estimated cost and its breakdown are summerized in Table 1. The analytical costs have been assumed to be 15% of the Labour costs. The total estimated cost of the project is \$293,542.15, including a 10% contingency.

TABLE 1

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ESTIMATED PROJECT COSTS1. Labour Charges

Phase I - Equipment Procurement and Set-Up

Category		Rate \$/h	Hours h	Sub Total	Total
Professional	5	91	40	3,640.00	
Professional	4	85	120	10,200.00	
Professional	3	72	40	2,880.00	
Technician	2	40	20	800.00	
Technician	1	29	145	4,205.00	
				<u>21,725.00</u>	21,725.00

Phase II - Commissioning and Testing of Current
Baghouse Production

Professional	5	91	80	7,280.00	
Professional	4	85	160	13,600.00	
Professional	3	72	320	23,040.00	
Technician	1	29	480	13,920.00	
				<u>57,840.00</u>	57,840.00

Phase III - Testing of Dust from Arsenic Chambers 32-08

Professional	5	91	60	5,460.00	
Professional	4	85	100	8,500.00	
Professional	3	72	180	12,960.00	
Technician	1	29	312.5	9,062.50	
				<u>35,982.50</u>	35,982.50

Phase IV - Testing of Dust from Other Locations

Professional	5	91	80	7,280.00	
Professional	4	85	140	11,900.00	
Professional	3	72	260	18,720.00	
Technician	1	29	432.5	12,542.50	
				<u>50,442.50</u>	50,442.50

Phase V - Flowsheet Development and Final Reports

Professional	5	91	120	10,920.00	
Professional	4	85	20	1,700.00	
Professional	3	72	72.5	5,220.00	
				<u>17,840.00</u>	17,840.00

Cyanidation

Professional	3	72	90		6,480.00
Total Labour Charge					\$190,310.00

.12

2. Analytical Costs15% of Labour Charge \$ 28,546.503. Materials and SuppliesSafety Supplies & Consumables \$ 10,000.004. Equipment Rental

Phase II - 480h at \$45/h	21,600.00	
Phase III - 240h at \$25/h	6,000.00	
Phase IV - 360h at \$15/h	<u>5,400.00</u>	<u>\$ 33,000.00</u>

5. TravelVisits to Yellowknife \$ 5,000.00

Project Total \$266,856.50

10% Contingency \$ 26,685.65

Maximum Project Total Cost \$293,542.15

6.3 Schedule

A tentative schedule is presented in Figure 3. The critical element in this schedule is equipment delivery. It is assumed that approval for the proposal will be obtained to allow orders to be placed in the week commencing November 16th. Any delay in that decision will require appropriate adjustment to the schedule. The final report will be delivered 28 weeks after approval of the project.

7.0 REPORTING AND BILLING

Billing will be on a monthly basis and will be accompanied by a monthly progress report. Invoices are normally despatched by the 15th day of the following month.

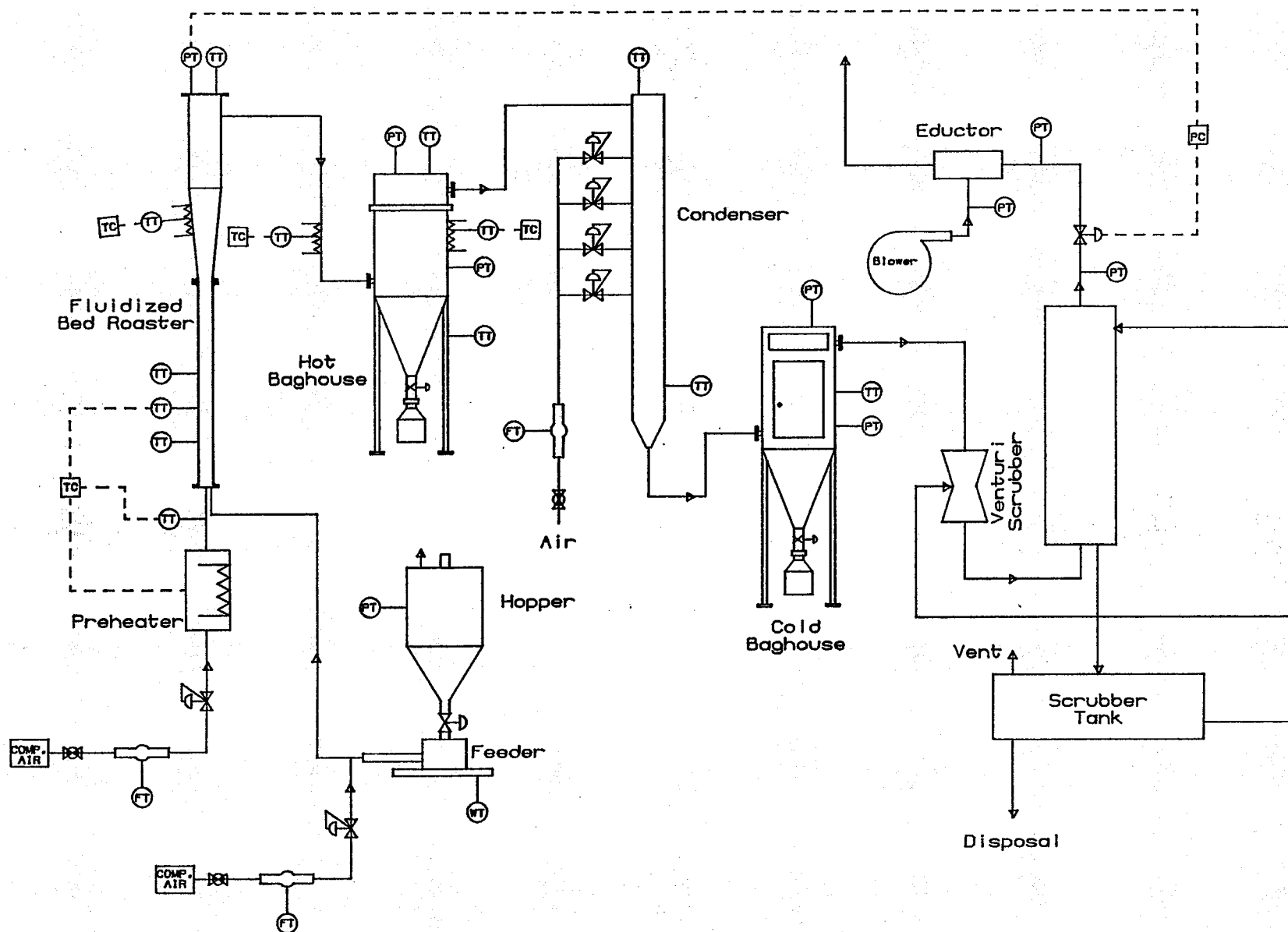
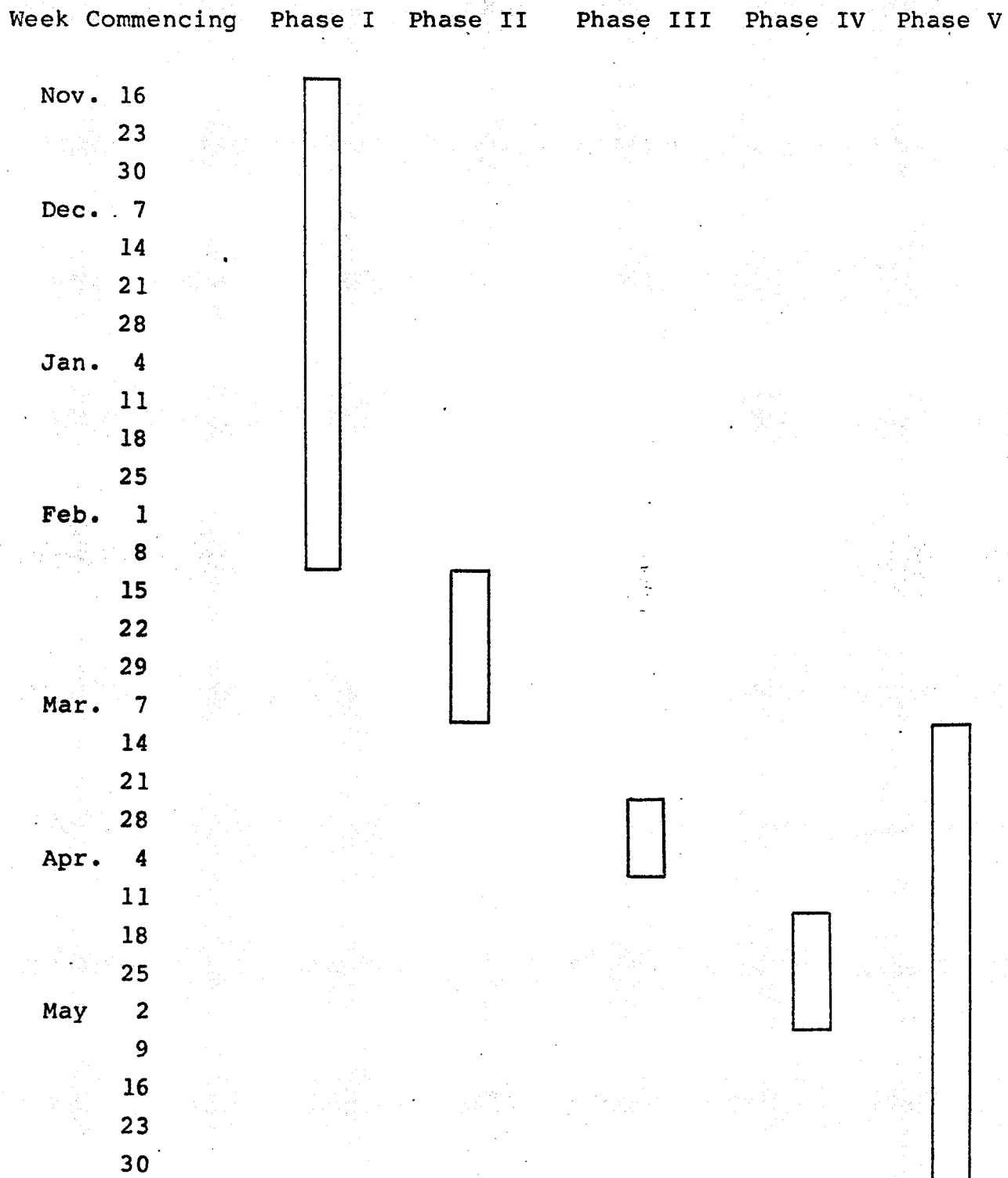


FIGURE 2 : SCHEMATIC FLOWSHEET OF PILOT PLANT

FIGURE 3

SCHEDULE



RPC - MINERAL DEVELOPMENT AND PROCESSING

MICHAEL EDWARD CHALKLEY, B.Sc., Ph.D., P.Eng.
Head, Department of Mineral
Development and Processing

EDUCATION

- 1965 - 1968 University of Newcastle upon Tyne, B.Sc. (Appl. Sci.) Metallurgy, Honours.
- 1969 - 1972 University of Newcastle upon Tyne studying for a Ph.D.
- 1974 Awarded Ph.D., Title of Thesis: Gas Injection Phenomena in Water and Mercury.

EXPERIENCE

- January 1986 - Present Head, Mineral Development and Processing Department, Research and Productivity Council, Fredericton, New Brunswick, Canada. Department consists of Processing, Industrial Chemistry and Analytical Services, Mineralogy, Fuel Technology and Wood Energy Sections.
- March 1986 - Present General Manager, Enhanced Recovery Systems Ltd., Chatham, New Brunswick, Canada. Subsidiary of RPC, 10 t/d Pilot Plant for testing the RPC Sulphation-Roast-Leach Process.
- October 1983 - December 1985 Senior Hydrometallurgist, BP Research Centre, Sunbury on Thames, Middlesex, England. Responsible for all zinc research carried out by the group. Advisory role for all hydrometallurgical testwork.
- April 1980 - September 1983 Senior Research Metallurgist, Sherritt Gordon Mines Limited, Fort Saskatchewan, Alberta, Canada. Responsible for the laboratory testwork for the development of a pressure leach process for the treatment of New Brunswick complex sulphide concentrate. Responsible for the design, construction and commissioning of continuous pressure leaching and liquid-solid separation equipment on a laboratory scale. Assisted in several continuous pilot studies on zinc, cobalt, nickel and gold concentrates.
- February 1978 - March 1980 Research Associate, University of Newcastle upon Tyne. Employed on a Science Research Council contract, studying Tuyere Mouth Erosion by physical modelling.

November 1974 -
November 1977

Matthey Rustenburg Refiners (Rustenburg) (Pty) Ltd., South Africa. Transferred as Research Metallurgist, Research and Development Department, with responsibility for improving the performance of a new precious metals recovery plant. Promoted to Assistant Research and Development Manager, April 1975 and Manager, Research and Development Department in May 1976. Responsible for Research and Development projects for an essentially hydro-metallurgical operation.

January 1973 -
November 1974

Rustenburg Platinum Mines Limited, South Africa (Johannesburg Consolidated Investment Company). Employed as Senior Technical Assistant. Five months shift training on copper-nickel smelter followed by four months training at a concentrator. Took up permanent position at the smelter, commissioning new process in October 1973. Promoted to Acting Plant Metallurgist, April 1974.

September 1968 -

Dorman Long Limited, Teesside (British Steel Corporation). Twelve months' post to gain industrial experience prior to commencing Ph.D. studies. Employed in Research and Development Department, five months in Ironmaking section, seven months in Refractories section.

PUBLICATIONS

Wraith, A.E. & Chalkley, M.E.
'Tuyere Injection for Metal Refining' In 'Advances in Extractive Metallurgy 1977' ed. M.J. Jones (London: IMM, 1977), 27-33.

Chalkley, M.E. & Wraith, A.E.
'Gas Dispersion From a Tuyere in Mercury: Application of Pressure Pulse Analysis'. Trans. Inst. Min. Met., Sec. C, 87, 1978, C266-C271.

Chalkley, M.E. & Wraith, A.E.
'Gas Dispersion at an Annular Tuyere', presented at 'Gas Injection into Liquid Metals' meeting, April 1979, Newcastle upon Tyne.

Chalkley M.E., Doyle B.N., Masters I.M., & Weir D.R.
'Pressure Leaching of New Brunswick Complex Sulphide Concentrate' presented at Canada/EC Seminar, Ottawa, October, 1982.

Chalkley M.E., Masters I.M. & Weir D.R.
'Miniplant Leaching of Zinc Concentrate', presented at Zinc'83, Annual Meeting of Hydromet. Soc., CIM, Edmonton, August 1983.

PUBLICATIONS (Cont'd.)

Chalkley, M.E., Gilders, R.D., Synnott, J., Wilkomirsky, I. and Boorman, R.S.: 'The RPC Sulphation Roast Process - Operating Results for the Demonstration Pilot Roaster', presented at 25th Conference of Metallurgists, CIM, Toronto, August 1986.

Belland, G., Chalkley, M.E., Synnott, J. and Gilders, R.: 'The Enhanced Recovery System Ltd. Pilot Plant', presented at 17th Annual Technical Session, CIM New Brunswick Branch, Bathurst, September 1986.

Synnott, J., Salter, R.S., Gilders, R. and Chalkley, M.: 'Iron Control in the RPC Sulphation-Roast-Leach Process', presented at International Symposium on Iron Control in Hydrometallurgy, Toronto, October 1986.

Wilkomirsky, I., Boorman, R.S. and Chalkley, M.E.: 'Process and Reactor Design for the RPC Sulphation Roast Process', presented at Reinhardt Scrubmann International Symposium on Innovative Technology, and Reactor Design in Extraction Metallurgy, Colorado Springs, November 1986.

RPC - MINERAL DEVELOPMENT AND PROCESSING

ROSS D. GILDERS, B.Sc. (Hon)
Mineralogist

EDUCATION B.Sc. (Hon) University of Ottawa (1975) Geology

SPECIALTIES Applied Mineralogy, Automated Image Analysis,
Process Metallurgy.

EXPERIENCE

1976 - Present Chatham Sulphation Roast-Leach Pilot Plant; Process
Design; Process/Mechanical Detail Design; Procure-
ment Coordination. Planning and Scheduling; Equip-
ment Design and Operating Specifications; Equipment
Cost Projection. Plant Superintendent-
Pyrometallurgy.

Research and Productivity Council Mineral Develop-
ment and Processing Laboratory and Semi Pilot
Process Research and Development in Fluid Bed
Technology, Directed Towards Sulphation Roasting of
Complex Base Metal Ores.

Influence of the Mineralogy of Coal and In
Particular of Sulphur Compounds on the Possibility
of Sulphur and Ash Reduction.

Microscopic Investigation, Microsizing and Image
Analyses of Coal Slurry Product.

Numerous Confidential Reports on Mineralogy of Coal
and Base Metal Ores and Concentrator Mill Products.

Silver Carriers in the Brunswick Mining and Smelt-
ing Ore.

Distribution of Silver Carriers in Copper and Lead
Circuit Tails.

Mineralogy Study of Aznalcollar Mill Samples

Silver Carriers in Brunswick Concentrates and
Possible Enhanced Recovery.

A preliminary Examination of Coke Fines at
Brunswick Mining and Smelting.

The Mineralogy, Magnetic & Solution Behaviour of
Select Mount Pleasant Tungsten Concentrates.

Silver Carriers in Concentrates and Tailings from Brunswick Mining and Smelting Corporation Ltd.

Recovery of Gold and Silver via Segregation Roasting.

Improved Silver Recovery at Brunswick Mining and Smelting.

Fluidized Bed Combustion of High Sulphur Coal and Oil Shale.

Selective Ferric Sulphate Oxidation/Brine Leach Process for the Recovery of Lead, Silver, and Zinc from Lead Cleaner Concentrate.

Development of Chloride Leach Process for Recovery of Lead and Associated Silver in Lead Concentrates.

Consultant to Minuvar Ltd. in Mineral Exploration and Development.

Senior Fluid Bed Roaster Operator and Maintenance Engineer, Member of Pyrometallurgical System Design Group.

High Temperature/Pressure Pyrolysis Design Engineer.

Volume Reduction of Radioactive Waste by Steam Pyrolysis.

Immobilization of Complexed Metals Prior to Storage of Spent Ion Exchange Resins.

Arsenic Removal from Copper Concentrates by Fluid Bed Roasting.

Calcination and Slaking Tests of a Limestone Sample.

Thermal Dissociation of Limestone to Lime.

Anaconda Copper Company, RPC Sulphation Roast Process Trials and Application, Caribou Ore and Bulk Concentrate.

Resource Utilization Linkage Program Zinc/Electrolytic Manganese Dioxide.

Examination of Off Gas Cleaning and Cooling System for the RPC Sulphation Roast-Leach Electrowinning Process.

RPC Sulphation Roast Process, Development and Application to New Brunswick Complex Base Metal Ores.

Bench Scale Sulphation Roasting Demonstration Trials on Brunswick - Type Mill Products.

Geology and Geophysics of Woodstock Manganese Claim Group.

Demonstration: Retorting of New Brunswick Oil Shales in a Pilot Scale Retort.

Resource Utilization Linkage Program Zinc/Electrolytic Manganese Dioxide - CIDA/Indonesia Project.

The Technical Evaluation of the Application of the RPC Metals Recovery Process to Indonesian Zinc, Bulk Zinc-Lead, and Low Grade Manganese Concentrates.

PUBLICATIONS

Sedman, K.G.; Thornley, J.C.; Gilders, R.D.;
1984 The Validity of Fuel Recycling During Erosivity Testing Using Coal Water Liquid Fuels, ASTMA Symposium, Denver, Colorado, June 26-27, 1984.

Stirling, A.R.; Gilders, R.D.;
1983 The Petrography of Pyrite in Some Maritime Coals. Atlantic Geoscience Symposium, Amherst, N.S., Survey 20-21, 1983.

Chrysoulis, S.; Gilders, R.; Surges, L.J.;
Salter, R.S.; Boorman, R.S.
1984 Silver Mineralogy at Brunswick Mining and Smelting and its Implications for Enhanced Recovery. Presented to the 23rd Annual Conference of Metallurgists, August 19-22, 1984.

Salter, R.S.; Synnott, J.; Gilders, R.; Doucet, G. and Boorman, R.S.
1985 Design, Construction and Commissioning of the Demonstration Plant for the R.P.C. Sulphation Roast Process, International Symposium on Complex Sulphides. November 10-13, 1985.

Salter, R.; Boorman, R.S.; Gilders, R.
Chloride Leach Process for the Recovery of Lead and Silver Minerals and Process Residues. Canadian and U. S. Patents.

Boorman, R.S.; Salib, P.; Gilders, R.
1982 Fluidized Bed Co-Combustion of Coal and Oil
Shales, A Route to SO₂ Emission Control. Presented
to the CIM 3rd District No. 1 Meeting, Sept. 21-25,
1982.

Boorman, R.S.; Petruck, W.; Gilders, R.
1982 Silver Carriers in Concentrates and Tailings
from Brunswick Mining and Smelting Corporation Ltd.
Presented to the CIM 3rd District No. 1 Meeting,
Sept. 21-25, 1982.

Gilders, R.; Smith, P.; Koster, E.H.
1976 Hydrologic & Hydrogeologic Effects of Urban-
ization. West Branch of Bilbery Creek and East
Branch of Green's Creek, Orleans Ontario.

RPC - MINERAL DEVELOPMENT AND PROCESSING

JOHN A. SYNNOTT, B.Sc., Ph.D
Senior Process Chemist
Department of Mineral Development
and Processing

EDUCATION

University of New Brunswick
Fredericton, New Brunswick

B.Sc. (Chemistry) 1970 - 1974

Ph.D. (Physical Chemistry) 1979
Thesis Title: Photochemistry of the
Di-deuterated Benzenes.

SPECIALTIES

Process Chemistry, Process Control, Plant
Balances, Economic Estimates, High
Temperature/Pressure Systems, Emission and Gas
Analysis

EXPERIENCE

October 1986 -
Present

Senior Process Chemist
Mineral Development and Processing Department
of RPC.
Duties involve:

Data reduction and results for Hydrometallurgical
Section of ERS Technical Report.

Plant balance for Hydrometallurgical Section of
ERS Technical Report.

Operating cost estimates for full scale SRLE
Plant.

October 1985 -
October 1986

Technical Superintendent
Enhanced Recovery Systems Ltd., Chatham, N. B.

Responsible for technical and operation of
Roaster, Leach, Purification, Electrowinning and
Brine Leach at 10 ton per day Pilot Plant.

March 1985 -
October 1985

Superintendent of Hydrometallurgical Section
Enhanced Recovery Systems Ltd., Chatham, N. B.
Responsibilities include:

Responsible for technical and operation of Leach,
Purification and Electrowinning Plants.

Plant instrumental section and configuration of
process control system.

EXPERIENCE

1984 - 1985

Group Leader (Process Engineering) Mineral Development and Processing Department of RPC.
Duties involve:

R & D Projects Leader.

Specific projects include:

The Design, Construction, and Testing of a Demonstration Pyrohydrolysis System.

Hydrogen Retorting of Oil Shales from Eastern Canada.

A Study of Settling Rates, Thickener Capacity and Neutralization Efficiency for Brunswick Mining and Smelting Mine Water Treatment Operation.

Group Leader (Process Control and Instrumentation)
Chatham Sulphation Roast-Leach Pilot Plant.

Duties involve:

Configuration of Plant Process Control System.

Preliminary Piping and Instrumentation Diagram Design.

Process Control System and Instrumentation Specifications.

Preliminary Equipment Sizing, Design and Costing on Leach, Purification and Lead/Silver Recovery and Brine Leach.

Material Selection for Leach, Purification, Lead/Silver Recovery.

Process Flowsheet Design and Consulting.

1981 - 1984

Project Leader

Mineral Development and Processing Department of RPC

Duties involve:

Project Leader - Volume Reduction of Radioactive Waste by High Temperature/Pressure Steam Pyrolysis.

Project Leader - Design, Construction and Testing of Hydroretort Facility for Evaluation of Oil Shales.

Supervisor - Leaching and Purification Development of RPC Sulphation Roast Process on Brunswick Tailings for Chatham Pilot Plant.

Supervisor - Leaching and Purification Section of RPC Sulphation Roast Process Trials and Application to Caribou Ore and Bulk Concentrates.

Technical Supervisor - CDTF - Consultant for Combustion Demonstration Test Facility on Emission and Efficiency Testing.

1979 - 1981

Supervisor, Atlantic Analytical Services Limited, Saint John, New Brunswick.

General analyses and consulting to New Brunswick industries.

Specialties included - X-Ray Fluorescence Methods Development, Industrial Source Emission Testing, Gas Analysis, Analytical Instrumentation Applications.

1975 - 1979

Laboratory Instructor, 4th year Physical Chemistry and Instrumentation, Chemistry Department, U.N.B., Fredericton, N. B.

PUBLICATIONS

'Reactions of Sodium Nitrite with Ethylurea in the Presence and Absence of Ascorbic Acid', Naturwissen Schafthch 62, (3), p. 132 (1975).

'The Photochemistry of the Di-deuterated Benzenes'; Ph.D. thesis title, 1979.

'Photochemistry of the Di-deuterated Benzenes', Ber. Bunsenges. Phys. Chem. 87, p. 382 (1983).

'Hydrogen Retorting of Oil Shales from Eastern Canada', Fuel Processing Technology, 8, p 293 (1984).

'Design, Construction and Commissioning of the Demonstration Plant for the RPC Sulphation Roast Process', Complex Sulfides, Processing of Ores, Concentrates and By-Products, p.609 (1985).

'Iron Control in the RPC Sulphation Roast Leach Process', Iron Control in Hydrometallurgy, 2, p.56 (1986).

RPC - RESEARCH AND PRODUCTIVITY COUNCIL

Kyo Jibiki, Ph.D.
Process Engineer
Mineral Development and Processing Department

EDUCATION: University of Hokkaido, Sapporo, Japan
B. Engineering/Metallurgical Engineering, 1968

University of British Columbia
M.A.Sc. (Metallurgical Engineering), 1971

University of British Columbia
Ph.D. (Metallurgical Engineering), 1974

SPECIALTIES: Hydrometallurgy, Extractive Metallurgy, Electro-metallurgy, Corrosion.

EXPERIENCE:

1985-Present Senior Process Metallurgist - RPC, Mineral Development and Processing Department.

-Process Metallurgist, Enhanced Recovery Systems Ltd. Operation Technical Assistance to plant engineers and operators in the leach + purification + electrolytic plant and effluent treatment plant. Supervisor in Residue Treatment Plant.

1974-1985 Research Metallurgist - Cominco; Technical Research and Development Centre, Trail, B. C.

- Construction of 25 kg/d copper electrowinning cells for the Valley Copper Ltd. dump leach-SX-EW pilot plant project.
- Zinc dust purification in laboratory tests and in the pilot plant.
- Zinc electrolyte quality monitoring using electro-chemical methods.
- Development of new zinc electrolyte purification methods.
- Production of high purity electrolytic antimony in laboratory cells.
- Additive control and anode slime control in electrorefining of lead.
- Technical feasibility study in Lithium metal recovery processes.
- Development of a corrosion preventive method for the Alloy-20 acid solution preheater.
- Mild steel corrosion in the Cominco dehalogenation leach system.
- Bench scale tests and design of a flowsheet for the indium, gallium and germanium recovery process.

- Bench scale and pilot plant tests for a germanium recovery process.
- Bench scale and mini plant tests for Cominco ferrite residue treatment process.
- Zinc oxide fume leaching mini plant test.
- Sulphur recovery from sulphide leach residues.
- Bench scale tests and technical assistance in the zinc pressure leach plant.
- Zinc pressure leach bench scale tests with various zinc concentrates.
- Hydrometallurgical upgrading of low grade zinc and lead concentrates.
- Arsenic removal from Cominco's lead feed materials.
- Flotation of scheelite, a tungsten mineral, from low grade ores.
- Ferric chloride leaching of a New Brunswick low grade lead concentrate and Cominco lead concentrates.
- Iron removal from copper concentrates in partial roasting.
- Mini plant tests on zinc calcine leaching.
- Hematite precipitation from zinc leach solutions.

PUBLICATIONS AND PRESENTATIONS:

- W.A. Jankola, H. Salomon-De-Friedberg, K. Jibiki; Corrosion Prevention in Alloy-20 Zinc Plant Acid Preheater. Presented at the 24th Annual Conference of Metallurgists, CIMM, Vancouver, August 18-21, 1985.
- R. Singh, T.J. O'Keefe, R.C. Kerby, K. Jibiki; The Effect of Impurity-Oxidation State on Zinc Polarization Behaviour and Current Efficiency of Zinc Electrowinning Solution. Page 235-250, Zinc '85 Conference Proceedings, Tokyo, Japan, Oct. 1985.
- T.J. O'Keefe, O. Mirkovic, K. Jibiki; Influence of Morphology on Cadmium Cementation. AIME. "Energy Reduction Techniques in Metal Electrochemical Processes", p217-227 (1985).
- E. Peters, K. Jibiki; Acid Leaching of Nickel and Cobalt Containing Pyrrhotite Concentrate. Presented at the 13th Annual Conference of Metallurgists, CIMM, Toronto, August (1974).
- T. Tanaka, H. Shimamura, K. Jibiki; Hydrogen Reduction of Cupric Sulphide. Inorg. Und Al. Chemie, (1968).

ASSOCIATIONS:

- Member of Canadian Institute of Mining and Metallurgy.
- Member of the American Institute of Mining and Metallurgical Engineers.

