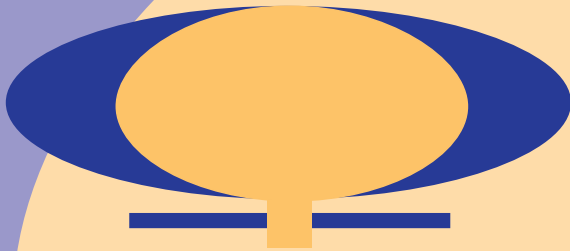


• FOURTH •
• INTERNATIONAL • CONFERENCE •

COPPER 99



COBRE 99



TECHNICAL PROGRAM

- Plenary Lectures
- Movement of Copper & Economic Industrial Outlook
- Applications and Fabrication
- Mineral Processing
- Hydrometallurgy
- Electrowinning
- Electrorefining
- Pyrometallurgy—Smelting Operations
- Pyrometallurgy—Fundamentals, Process Modeling, and Technology Development
- Environment & Safety

RANDOL INTERNATIONAL TRADE EXHIBITION

- Copper Processing
- Smelting
- Copper Extraction
- Hydrometallurgy
- Environmental Management

POST CONFERENCE TECHNICAL TOURS

- Kennecott Utah Copper
- Mineral Processing
- Smelting Operations
- Refineries
- Hydrometallurgical Practices
- Fabrication

SHORT COURSES

- Advances in Concentrate Smelting and Converting
- Cost Effective Tailings Disposal
- Copper Heap Leaching
- Hydrometallurgical Treatment of Concentrates
- Copper Hydromet Roundtables

Registration and Housing Forms Enclosed

OCTOBER 10-13, 1999

Pointe Hilton Resort on South Mountain
Phoenix, Arizona, USA

BOOKS • BOOKS • BOOKS • BOOKS • BOOKS • BOOKS • BOOKS • BOOKS • BOOKS • BOOKS

Specially Discounted Prices on Six Hardbound Volumes of



Each volume may be purchased individually at the conference price listed below, or purchase the entire, six-volume set at the additionally discounted price.

Order the 6-volume set
only \$495

Use Order No. 4410 for the six-volume set.

Presentations have been divided into six, hardbound volumes.

VOLUME I: Plenary Lectures/Industry Outlook & Economics/Applications & Fabrication
Approx. 600 pages • Order No. 4356
Conference Price \$95

VOLUME II: Mineral Processing/Environment & Safety
Approx. 614 pages • Order No. 4364
Conference Price \$95

VOLUME III: Electrowinning & Electrowinning
Approx. 740 pages • Order No. 4372
Conference Price \$95

VOLUME IV: Hydrometallurgy
Approx. 740 pages • Order No. 4380
Conference Price \$95

VOLUME V: Pyrometallurgy—Smelting Operations
Approx. 810 pages • Order No. 4399
Conference Price \$95

VOLUME VI: Pyrometallurgy—Fundamentals, Process Modeling & Technology Development
Approx. 810 pages • Order No. 4402
Conference Price \$95

Note: These special prices are only available for advance orders and during the meeting (ending October 13, 1999).

You may pre-order your selections on the conference registration form found in this brochure and you may have them sent directly to you by selecting the shipping option and paying an additional charge. All volumes will be available for pick-up at the meeting.

BOOKS • BOOKS • BOOKS • BOOKS • BOOKS • BOOKS • BOOKS • BOOKS • BOOKS • BOOKS

COPPER 99-COBRE 99 SITE & TECHNICAL INFORMATION

• DATE • AND • VENUE •

Copper 99 - Cobre 99 is the fourth in a series of international conferences devoted to mineral processing and the extractive metallurgy of copper. Conference participants will gain insight into important worldwide technological advancements, potential new commercial developments and opportunities, as well as understanding the challenges confronting the industry as it heralds the 21st century.

Held every four years, the Copper-Cobre conferences are organized by The Chilean Institute of Mining Engineers (IIMCH), The Metallurgical Society of the Canadian Institute of Mining, Metallurgy and Petroleum (CIM), and The Minerals, Metals and Materials Society (TMS). For Copper 99 - Cobre 99, The Society of Mining, Metallurgy and Exploration (SME) is serving as a sponsoring society.

Copper 99 - Cobre 99 will take place from October 10 to 13, 1999, at The Pointe Hilton Resort on South Mountain in Phoenix, Arizona, USA. The Pointe Hilton Resort on South Mountain is a Four Star, Four-Diamond Resort with exceptional meeting facilities.

• TECHNICAL • PROGRAM •

The Copper 99 - Cobre 99 technical program will commence at 8:30 AM on Monday, October 11, 1999 and conclude at 5:00 PM on Wednesday, October 13, 1999. Some 260 oral presentations are expected. Additional details regarding the technical program appear on page 17.

The Technical Program for this conference will provide the most extensive assembly of papers for a copper industry event this century. The conference will encompass all modern processing aspects of the copper industry, from the mineral processing stage through to finished metal and fabricated products via the smelting/electrorefining route, or via leaching/SX-EW operations. As well, there are sessions covering economics, finance, environment and safety issues. Overall, the conference will outline the state of the art for the entire industry, which is poised for great things in the next millennium. All the details can be found starting on page 17. This is one event that you cannot afford to miss.

• LETTERS • OF • INVITATIONS •

The Copper 99 - Cobre 99 Organizing Committee will issue letters of invitation to individuals requiring such a document. Such letters though, do not commit the Copper 99 - Cobre 99 Organizing Committee to providing financial support. Fax, E-mail or mail your request for letter of invitation to:

Michael Packard, Manager, Meeting Services
TMS, Meeting Services Department
184 Thorn Hill Road, Warrendale, PA 15086, USA
Fax: 724-776-3770; E-mail: packard@tms.org

• PROCEEDINGS • VOLUMES •

Proceedings volumes will be available for sale at the conference. Delegates may reserve copies at pre-conference prices by completing the appropriate section in the Advance Registration Form. There will be six (6) volumes offered at Copper 99 - Cobre 99.

Volume 1: *Plenary Lectures/Industry Outlook & Economics/Applications*

Volume 2: *Mineral Processing/Environment & Safety*

Volume 3: *Electrorefining & Electrowinning*

Volume 4: *Hydrometallurgy*

Volume 5: *Pyrometallurgy—Smelting Operations*

Volume 6: *Pyrometallurgy—Fundamentals, Process Modeling and Technology Development*

• EXHIBITION •

An added feature of Copper 99 - Cobre 99 is a trade exhibition. The Copper 99 - Cobre 99 Organizing Committee, in conjunction with Randol International, is organizing an exhibition of products and services for improved copper & byproduct extraction, recovery and environmental management. The exhibition will be held in the Exhibit Pavilion, adjacent to The Pointe Hilton Convention Center, from Sunday, October 10 - Wednesday, October 13, 1999. For additional information and to reserve your exhibit space, complete the Booth Reservation Form on page 15 and return it to:

Dennis Sigl, VP Exhibitions
Randol International, Ltd.
13701 W. Jewell Avenue, #14
Lakewood, CO 80228
Phone: 303-986-5579; Fax: 303-986-5577
E-Mail: randolinternational@worldnet.att.net

• COPPER • HYDROMET • • ROUNDTABLE • 99 •

Organized by Randol International Ltd., and to be held all day Sunday, October 10, 1999. The Copper Hydromet Roundtable 99 is an interactive and valuable international networking opportunity designed for operating and project managers at all levels. Copper Hydromet Roundtable 99 offers an excellent opportunity for metallurgists and engineers involved in the development of new hydrometallurgical technologies, processes and applications to network with a broad spectrum of international experts and operating managers. This year's Copper Hydromet Roundtable 99 will comprise four major panel discussions: 1) Heap & Dump Leaching, SW-EW; 2) Bio-Oxidation; 3) Concentrate Leaching and 4) Cost Reduction Options: A Systems Approach. Analogous processes and applications for other base metals derived from copper hydrometallurgy will also be presented and discussed.

Nominations and applications for panel participation on hot items in the four panel topics are open. For more information, check the conference page at www.randol.com and for registration or participation queries, contact Hans von Michaelis
Randol International Ltd
Golden, CO 80401
Phone: 303-526-1626; Fax: 303-526-1650
E-mail: hansvon@hotmail.com

To register for the Copper Hydromet Roundtables, complete the Roundtable Registration Form on page 13 and return it to Randol International, at the address listed above, by **September 20, 1999**. A separate registration of US \$200.00 will be charged for participation in the Copper Hydromet Roundtable.

COPPER 99-COBRE 99 SITE & TECHNICAL INFORMATION

• LATE • NEWS • POSTER • • SESSION •

Additional submissions will be considered as Late News Posters. This will function as a regular Poster Session to be run on Tuesday, 13 October and Wednesday, 14 October, 1999 from 10:30 AM - 4:00 PM, in parallel with the other sessions.

In a departure from previous Copper - Cobre Conferences, this poster session was considered important for Copper 99 - Cobre 99 in view of the high interest shown in the conference and the fact that a number of abstracts were

received after the deadline. Poster session abstracts, which should be no longer than 150 words, will be reviewed as they are received, and acceptance will be communicated to the authors within about 10 days of receipt.

Anyone wishing to participate in the conference, but has missed the oral presentation deadline, may submit their abstract for review through the TMS web site via the Conference Management System (<http://www.tms.org/cms>) or by contacting the TMS Programming Department at 724-776-9000, ext. 227 or by fax at 724-776-3770. Please identify submission as a poster session. The final deadline for submitting abstract is Friday, September 10, 1999.

• POLICY • ON • AUDIO/VIDEO • RECORDING • OF • • TECHNICAL • PAPER • PRESENTATIONS/SESSIONS •

The Minerals, Metals & Materials Society (TMS) reserves the right to any audio and video reproduction of all presentations at every TMS sponsored meeting. Recording of sessions (audio, video, still photography, etc.) intended for personal use, distribution or copyright without the express written consent of TMS and the individual authors is strictly prohibited. Contact Ms. Peggy Weiss, the TMS Technical Program Manager at 724-776-9000 ext. 227 in advance to obtain a copy of the waiver release form.

COPPER 99-COBRE 99 REGISTRATION & HOUSING INFORMATION

• REGISTRATION •

Copper 99 - Cobre 99 attendees, including authors, session chairs and exhibitors are required to register. To register, complete the Advance Registration Form on page 9 and return it by **September 20, 1999** to:

TMS
Customer Service Department
184 Thorn Hill Road
Warrendale, PA 15086, USA
Phone: 724-776-9000 x270
Fax: 724-776-3770
csc@tms.org

You may now register any time day or night via the Copper 99 - Cobre 99 Home Page on the World Wide Web at <http://www.tms.org/Meetings/Specialty/Copper99/Copper99.html>. TMS OnLine also provides detailed information on this and all TMS-sponsored conferences.

Full payment in US dollars must accompany the completed Advance Registration Form. Register by September 20, 1999 to receive a \$100.00 discount off of the on-site fee.

Onsite Conference registration hours:

Sunday, October 10, 1999 1:00 PM-7:00 PM
Monday, October 11, 1999 7:00 AM-5:00 PM
Tuesday, October 12, 1999 7:00 AM-5:00 PM
Wednesday, October 13, 1999 7:00 AM-12:00 PM

Badges must be worn to gain access to the technical sessions, short courses, exhibition and social functions.

The registration fee includes the welcoming reception, coffee breaks, conference banquet and access to the technical sessions and exhibition. The six conference publications and the lunch package are not included in the Registration fee.

• SOCIAL • PROGRAMS •

Sunday, October 10, 1999
Welcoming Reception 5:30 PM-7:00 PM
Monday, October 11, 1999
Exhibit Reception 5:30 PM-7:00 PM
Tuesday, October 12, 1999
Conference Banquet 6:00 PM-9:00 PM

• ACCOMMODATIONS •

The Headquarter's Hotel and site for Copper 99 - Cobre 99 are at The Pointe Hilton Resort on South Mountain, Phoenix, Arizona, USA. Located on the boundary of Phoenix and Tempe, the 700-acre resort sits beside the world's largest municipal park, Phoenix's South Mountain Preserve. The resort offers luxurious two-room suites to all its guests with minibars, coffee-makers, remote control/cable TV and two telephones.

An important component of the Copper - Cobre conferences is the opportunity to meet with representatives of the industry from all over the globe. In this respect, the Copper 99 - Cobre 99 venue at The Pointe Hilton Resort on South Mountain in Phoenix, Arizona will provide excellent opportunities for net-working, discussions with colleagues and associates to search for that unique way to make your company, or your project more comprehensive. Space is available for impromptu meetings and discussions, who knows, your next new idea to save money for your company may start here.

At the end of a busy and fulfilling day at the conference, the 42,000 square-foot Sports Club offers extraordinary range of recreational activities including fitness training, racquetball and a full-service hair and nail salon. Guests

COPPER 99-COBRE 99 REGISTRATION & HOUSING INFORMATION

also enjoy mountain biking and horseback riding. Locally, there are two championship 18-hole golf courses: Phantom Horse Golf Course on South Mountain and the Raven at South Mountain.

There are a variety of foods for all tastes at The Pointe Hilton Resort on South Mountain. Enjoy fabulous American Cuisine, at *Another Pointe in Tyme*. Spicy authentic Mexican delights are served at *Aunt Chilada's*, or for a taste of Arizona on South Mountain, enjoy *Phantom Horse Grill*, offering the flavors of the Southwest. Adjacent to the grill, *The Sports Bar* features satellite TV's, appetizers, drinks and dancing, or to get a taste of the Old West at *Rustler's Rooste* in its remarkable views of the city; lighter poolside favorites at *La Cabana or Juegos Cantina*.

Participants should mail or fax their Copper 99 - Cobre 99 Housing Form as early as possible to The Pointe Hilton Resort on South Mountain. The housing cut-off date is **September**

8, 1999. After September 8, 1999, the conference rate and availability of the suites at The Pointe Hilton on South Mountain may not be available.

The Pointe Hilton Resort on South Mountain, 7600 N. 16th Street, Suite 130, Phoenix, AZ 85020; Phone: (800) 876-4683; Fax: (602) 870-2783.

• AMERICANS • WITH • • DISABILITIES • ACT •

TMS strongly supports the Federal Americans with Disabilities Act (ADA) which prohibits discrimination against, and promotes public accessibility for those with disabilities. In support of this act, we ask that those attendees requiring specific equipment or services contact the TMS Meeting Services Department to advise specific needs in advance.

COPPER 99-COBRE 99 INDUSTRIAL TOUR

Tours will depart and return to The Pointe Hilton Resort on South Mountain. Space is limited on each individual tour. Reservations will be accepted on a first-come basis. The Organizer reserves the right to cancel any tour for which registration is undersubscribed; in the event of cancellation or over-subscription, a full refund will be made. All tours include baggage gratuities for up to two bags per person.

To register for the Industrial Tours, complete the Advance Registration Form on page 9 and return it by **September 20, 1999** to TMS.

Technical Tour 1: Kennecott Utah Copper

Thursday, October 14 - Friday, October 15, 1999

\$755 per person

Limit 15 persons

Kennecott Utah Copper operates the Bingham Canyon open pit mine, copperton concentrator, and a modern copper smelter and refinery. The Garfield Smelter includes Kennecott-Outokumpu flash smelting of concentrate and Kennecott-Outokumpu flash converting of matte. The refinery, which produces 300,000 tons of cathode copper per year, features The Kidd Process with automatically guided vehicles to transport process materials.

Day 1: Depart from The Pointe Hilton Resort on South Mountain at 3:30 PM. Deplane in Salt Lake City at 7:36 PM. A bus transfer will take you to the Comfort Inn in Sandy, Utah. Dinner at the Wagonmaster Restaurant. Return to hotel. **The cost of the hotel and dinner are included in the price of the tour.**

Day 2: Continental Breakfast is included. Checkout from the hotel (baggage can be stored under the bus) and depart at 8:00AM by bus for Kennecott Utah Copper. Tour Kennecott Utah Copper. In the middle of the tour, a boxed lunch will be served between the Bingham Canyon and Garfield facilities. Depart Kennecott Utah Copper for dinner at the Green Street Social Club. After dinner, depart restaurant for Salt Lake City International Airport. Arrive in Phoenix at 9:19 PM, and return by bus to The Pointe Hilton Resort on South Mountain. **Hotel accommodations for the evening of October 15 are not included; please make your own reservations with The Pointe Hilton on South Mountain.**

Technical Tour 2: Milling of Copper Ores

Thursday, October 14 - Friday, October 15, 1999

\$350 per person

Limit 20 persons

The Arizona copper belt offers a variety of ore types, for which various milling practices have evolved. This two-day tour of four copper milling operations provides opportunity to compare mill practices at two operations for each of two major copper producers.

Day 1: Depart by bus from The Pointe Hilton Resort on South Mountain at 7:00 AM for Asarco Ray Operations. Tour the modern, 30,000 tpd Asarco Ray Complex concentrator. A box lunch will be provided on the bus, en route to Phelps Dodge Morenci. After touring the Morenci milling operations, the group will depart by bus at 5:00 PM for the historic mining town of Silver City, New Mexico. Rooms have been reserved at the Comfort Inn. Dinner at the Red Barn Steakhouse in Silver City. **The cost of the hotel and dinner are included in the price of the tour.**

Day 2: Continental breakfast at the Comfort Inn. Depart the hotel at 7:30 AM for a tour of the milling operations of the Chino Mining Co., Hurley, New Mexico. After the tour, depart by bus for Asarco Mission Complex, Sahuarita, Arizona. A box lunch will be served on the bus. Tour the Asarco Mission Complex, including a recently installed secondary crushing facility. Return to The Pointe Hilton Resort on South Mountain at approximately 7:30 PM. **Hotel accommodations and dinner for the evening of October 15 are not included; please make your own reservations with The Pointe Hilton on South Mountain.**

Technical Tour 3: Smelting Operations

Thursday, October 14 - Friday, October 15, 1999
\$350 per person
Limit 25 persons

This two-day tour will visit Arizona's three operating copper smelters, which include three different smelting technologies.

Day 1: Depart by bus from The Pointe Hilton Resort on South Mountain at 7:30 AM for Cyprus Miami. After a tour of the (Isasmelt) smelting and related facilities, the group will have lunch at El Rey in Globe. Depart by bus for Asarco Hayden. After the tour of Asarco Hayden (Inco flash) smelter, the group will drive to Tucson, Arizona. Rooms have been reserved at the Ramada University Resort. Once settled in your room, the bus will depart for the Stardance cookout area for a western barbecue (menu to be determined) and a cash bar, accompanied by strolling guitarists and astronomers. After dinner, return to the Ramada University Resort. **The cost of the hotel and dinner are included in the price of the tour.**

Day 2: Full complimentary breakfast at the Ramada University Resort. Depart the hotel at 7:30 AM for a visit to BHP's San Manuel operations. The tour will include the recently relined smelter, and the converting, anode casting and anode handling facilities. After a group lunch in San Manuel, return to The Pointe Hilton Resort on South Mountain at approximately 2:30 PM. **Hotel accommodations and dinner for the evening of October 15 are not included; please make your own reservations with The Pointe Hilton on South Mountain.**

Technical Tour 4: Refineries

Thursday, October 14, 1999
\$95 per person
Limit 20 persons

This one-day trip will include comprehensive tours of Arizona's two major copper refineries.

Day 1: Depart by bus from The Pointe Hilton Resort on South Mountain at 7:30 AM for BHP San Manuel. Tour the refinery and related facilities. A box lunch will be provided, en route to Cyprus Miami. After touring the Cyprus Miami refinery and ancillary operations, the group will return to The Pointe Hilton Resort on South Mountain at approximately 5:30 PM. **Hotel accommodations and dinner for the evening of October 14 are not included; please make your own reservations with The Pointe Hilton on South Mountain.**

Technical Tour 5: Hydrometallurgical Practices

Thursday, October 14 - Friday, October 15, 1999
\$350 per person
Limit 20 persons

Four leaching operations will be visited over a two-day period

Day 1: Depart by bus from The Pointe Hilton Resort on South Mountain at 7:30 AM for a visit to BHP's Florence, Arizona pilot in situ leach operation. Depart by bus to Asarco's new Silver Bell leach/SX/EW operations. A box lunch will be served en route. After the tour of Asarco Silver Bell, the group will depart by bus at approximately 3:00 PM

to Safford, Arizona. Rooms have been reserved at the Ramada Spa Resort. After checking in, the bus will depart for the Golden Corral Steakhouse for a buffet dinner (no cash bar - family restaurant). Return to the Ramada Spa Resort. **The cost of the hotel and dinner are included in the price of the tour.**

Day 2: Complimentary continental breakfast at the Ramada Spa Resort. Depart the Resort early for a tour of Phelps Dodge Morenci 133,000 tpd heap leach and associated SX/EW operations. After the tour a box lunch will be provided on the bus traveling to Cyprus Miami. Tour the leaching and SX/EW operations there, and return to The Pointe Hilton Resort on South Mountain at approximately 7:00 PM. **Hotel accommodations and dinner for the evening of October 15 are not included; please make your own reservations with The Pointe Hilton on South Mountain.**

Technical Tour 6: Copper Fabrication

Thursday, October 14 - Friday, October 15, 1999
\$275 per person
Limit 20 persons

Copper 99 - Cobre 99 will supplement the applications programming with a tour of four plants forming copper products by casting, forging, drawing and electroforming, using both primary and secondary copper materials.

Day 1: Depart by bus from The Pointe Hilton Resort on South Mountain at 7:30 AM for Tucson Foundry. Tour this large casting shop before having a group lunch at Pinnacle Peak Steakhouse in Tucson, Arizona. Depart by bus to San Manuel. After the tour of BHP's rod plant there, the group will return by bus to the Phoenix area for dinner which will take place at Alcatraz Brewing Company (choice of entrée - limited menu and a sample of five mini beers). Return to The Pointe Hilton Resort on South Mountain at approximately 8:30 PM. **Hotel accommodations for the evening of October 14 are not included; please make your own reservations with The Pointe Hilton on South Mountain. Dinner is included in the price of the tour.**

Day 2: Breakfast on own at the hotel. Depart The Pointe Hilton Resort on South Mountain at 8:30 AM for a tour of Gould Electronics, Chandler, Arizona, which produces foils by electroforming. After the tour, the group will have lunch at Jackson's on Third in Phoenix, and then depart by bus for Cable Systems International, Phoenix. Tour CSI. Return to The Pointe Hilton Resort on South Mountain at approximately 4:30 PM. **Hotel accommodations and dinner for the evening of October 15 are not included; please make your own reservations with The Pointe Hilton on South Mountain.**



COPPER 99-COBRE 99 SHORT COURSES

Four short courses will be offered immediately prior to the conference. The courses will take place at The Pointe Hilton Resort on South Mountain. All courses include a buffet luncheon. Please review the following course descriptions and determine which course(s) might best benefit you and your colleagues.

You are encouraged to register early for short courses by using the enclosed Copper 99 – Cobre 99 Registration Form; short course registrations received after the September 20, 1999 pre-registration deadline will be assessed a \$50 late fee.

Cancellation Policy: TMS reserves the right to cancel any course due to low pre-registration. All pre-registered attendees will be notified of the cancellation and offered either a transfer or a full refund.

Refund Policy: Written requests must be sent to TMS Headquarters, 184 Thorn Hill Road, Warrendale, PA 15086 postmarked no later than September 20, 1999. A \$50 processing fee will be charged for all cancellations; this processing fee is separate from and in addition to the fee charged for cancellation of meeting registrations. Absolutely no refunds will be issued after the September 20, 1999 deadline.

Contact the TMS Education Department with questions at Telephone: 724-776-9000 ext. 245, Facsimile: 724-776-3770, E-mail: bradel@tms.org.

“Advances in Concentrate Smelting and Converting”

Saturday, October 9

8:30 AM–5:00 PM

\$350 per person

Who Should Attend:

This course is intended for project and plant engineers who wish to update their knowledge on the technologies, which are available to expand or modernize existing smelters, and to improve on their ability to analyze smelter operations and the options to decrease operating costs and emissions.

Course Content will include:

This course will focus on the technologies that are available to improve existing smelters or to expand them, discussing the critical subjects which determine the selection of smelting and converting processes, such as:

- Plant Capacity and Existing Facilities
- Applicable Environmental Regulations
- Energy and Type of Fuel Availability and Costs
- Type of Feed and Impurities
- Degree of Automation Desired
- Intensity of Use of Oxygen
- Gas Handling and Acid Manufacture
- Operating Costs
- Investment Costs

A presentation will also be made of some of the principles and tools available to analyze the smelting and converting processes, such as the materials and energy balances, and plant modeling by the use of modern software.

About the Presenter:

Antonio A. Luraschi currently a Partner and Head, Process Engineering, CADE IDEPE Eng. Dr. Luraschi's engineering and research experience is mainly in the field of Copper Smelting and Refining, Project Technical and Economic Evaluation, Plant Emissions Analysis and Control, Molybdenum and Vanadium Extractive Metallurgy, and the Pyrometallurgical Processing of Precious Metals.

“Cost Effective Tailings Disposal”

Sunday, October 10

8:30 AM–5:00 PM

\$350 per person

Who Should Attend:

This one day learning intensive course will be of interest to mine managers, concentrator superintendents, tailings operations superintendents and staff, mine engineering and environmental staff, design engineers and environmental scientists involved with tailings disposal.

Course Content will include:

- Tailings Disposal Methods
- Recent developments in Tailings Disposal
- Tailings Impoundment Failures
- Design of On-Land Tailings Impoundments
- Tailings Impoundment Configurations
- Evaluation of On-Land Tailings Deposition Methods
- Marine Disposal Methods

About the Presenters:

Han Ilhan is currently a Senior Project Engineer working on assignment in Salt Lake City, Utah. Mr. Ilhan has over 15 years of geotechnical engineering experience focusing on tailings dam and heap leach pad work for the mining industry.

Pedro Repetto is currently Vice-President and Manager of the Geotechnical Engineering Group, Denver, Colorado. Mr. Repetto has over 30 years of experience which include experience with basic studies and investigations, design, permitting, preparation of bidding documents, and construction phase services for mine tailing projects.

Jim Obermeyer, P.E., has over 25 years of diversified heavy civil engineering experience providing services for the mining industry. His experience includes providing design criteria, preparing plans and specifications, cost estimating, construction engineering and project management for tailing dam, earth and earth-rock dam and waste storage projects.

Chris Hatton, P.E. has over 10 years of diversified heavy civil engineering and environmental engineering experience providing services for the mining industry. He has been responsible for the investigation, evaluation, design, construction, and rehabilitation of civil engineering structures and environmental projects throughout the western United States.

“Copper Heap Leaching”

Co-sponsored by SME

Saturday & Sunday

8:00–6:00 PM

October 9 thru 10

\$500 per person

Who Should Attend:

Copper heap and dump leaching contributes significantly to the production of copper from oxide and sulfide ores. This course offers an overview of the regulatory, theoretical and practical aspects of copper heap leaching. Much attention is given to the importance of ore testing and ore geochemical characteristics. Ore preparation and the practical aspects of project design, construction and operation are presented. This course is of particular interest to developers of copper heap leach projects, project managers, design professionals, and mining and metallurgical engineers. State and Federal officials will also find this course applicable to their regulatory responsibilities.

Course Content will include:

- Overview of Copper
- Ore Testing
- Geotechnical Aspects of Copper Heap Leaching
- Rock Fabric/Ore Preparation
- Heap/Dump Leaching and Solution Application
- Design of SX-EW Plants
- Regulatory Framework and Permitting
- Bioleaching
- Economics of Copper Heap Leach Design

About the Presenters:

A.J. Liguori is a 1972 graduate of the University of Arizona, with over 17 years experience in copper processing. He served as Chief Metallurgist for Magma Copper for seven years prior to becoming the Director of Divisional Metallurgical Services.

Corale Brierley has over 20 years of research, development and applications experience in bioleaching and other metal-related technologies. Dr. Brierley is now a Denver based consultant to the mining, chemical and water treatment industries in the areas of bioleaching, environmental management and marketing/business development.

John E. Dreier holds a Ph.D. in geology and geochemistry for the University of Arizona. He has explored and developed gold, silver and copper deposits, and has worked as an environmental geochemist.

Dale A Deming has nineteen years of experience in the mining industry as a mining engineer and environmental engineer/manager. His expertise covers four western states for copper, gold, uranium, and lead/zinc industries,

with specialization's in hazardous waste management/remediation, mine permitting, reclamation planning and implementation, archaeological oversight, environmental audits, compliance oversight, and has working knowledge of federal environmental laws.

Joseph M. Keane began his association with the mining industry as an underground miner at age 16. He is currently President of Metcon Research, Inc. and KD Engineering Co., Inc. in Tucson, Arizona. He is a Registered Professional Metallurgical Engineer in nine states.

Gary Kordosky holds an MS degree in Organic Chemistry and Ph.D. in Inorganic Chemistry, both from Ohio State University where his research interests were in organometallic chemistry and coordination chemistry. He is currently the International Business Director for the Minerals Industry Division of Henkel Corporation.

Dirk Van Zyl is a Principal with Golder Associated Inc., Denver. He has more than 15 years experience in consulting and research associated with geotechnical aspects of waste disposal for the mining industry in South Africa and North America.

“Hydrometallurgical Treatment of Copper Concentrates”

Saturday & Sunday

8:00 AM–6:00 PM

October 9 thru 10

\$500 per person

Who Should Attend:

The course is ideally suited to all those involved in copper hydrometallurgy research and development. Graduate students, professors, government scientists, industrial researchers and operators will benefit from their participation.

Course Content will include:

The purpose of this course is to provide an overview of the current state of development of hydrometallurgical alternatives to conventional smelting and refining of copper concentrates. The emerging alternatives include (in alphabetical order): Activox Copper Process, Biological Leaching, CESL Copper Process, Dynatec Copper Process, INTEC Copper Process, MIM Nenatech Copper Process and the Total Pressure Oxidation Process. Representatives from each development company have been invited to present an in depth lecture on their technology and its application. In addition, experts on the leaching of copper concentrates and the application of solvent extraction and electrowinning to copper recovery from concentrate leaching will present detailed lectures on these topics. A panel discussion by the presenters is planned at the conclusion of the short course.

About the Presenters:

Ian Corrans,
Oretest, Perth, Australia.

The Activox Copper Process.

Paul Miller, (on Request)
Bactech, Perth, Australia.

The Bactech Copper Bioleach Process.

David Jones,
CESL, Vancouver, Canada.

The CESL Copper Process.

John Moyes,
INTEC, Sydney, Australia.
The INTEC Copper Process.

John Willis, (on Request)
MIM Hydrometallurgy Research Lab,
Brisbane, Australia.
The MIM Nenatech Copper Process.

Jim King,
Placer Dome, Vancouver, Canada.
**The Total Pressure Oxidation Process
for Copper Concentrates.**

Gary Kordosky,
Henkel, Tucson, AZ, U.S.A.
**The Recovery of Copper from Concentrate Leachate
by SX-EW using Henkel Reagents.**

Owen Tinkler,
Zeneca Specialities, Manchester, U.K..
**The Recovery of Copper from Concentrate Leachate
by SX-EW using Acorga Reagents.**

Herman Pieterse,
Pieterse Consulting Inc., Tucson, AZ, U.S.A.
**Autoclave Design Considerations
for Copper Concentrate Leaching.**

COPPER 99-COBRE 99 ACCOMPANYING PERSONS TOURS

Accompanying persons tours have been customized to enhance the Copper 99 - Cobre 99 conference experience. To register, please complete the Advance Registration Form in this mailer on page 9 and return it to TMS. Tour tickets will be included in your Advance Registration Packet in the Copper 99-Cobre 99 registration area at the meeting. Please note that reservations will be handled on a first-come, first-serve basis.

Pre-registration for the tour program will be accepted up to **September 20, 1999**. Tours will not be scheduled unless sufficient pre-registration is received. Therefore, please make your reservations early.

Tour desk registration hours:

Sunday, October 10, 1999	1:00 PM-7:00 PM
Monday, October 11, 1999	7:00 AM-1:00 PM
Tuesday, October 12, 1999	7:00 AM-1:00 PM
Wednesday, October 13, 1999	7:00 AM-Noon

All tours will originate and end at The Pointe Hilton Resort on South Mountain. Prices indicated include transportation and lunches.

Accompanying Persons Tour 1: "Red Rock Fantasy"

8:00 AM-5:00 PM
(\$75.00 per person) Monday, October 11, 1999

Much photographed Oak Creek Canyon and the picture-postcard town of two of Arizona's most scenic spots, second only to the Grand Canyon. Drive the most dramatic approach to the canyon, through sagebrush country brightened with sycamore-lined washes, where the earth itself begins to change color, from white to orange to red. The preserved cliff dwellings of Montezuma Castle are your first stop, and a chance to stretch your legs. Here, the dramatic limestone cliffs tell the story of the Sinagua civilization that vanished 800 years ago. Enjoy a buffet luncheon at the Sedona Swiss Restaurant and Café, and the breathtaking views of the red rocks of Sedona. Explore the shops and studios of Sedona's artists and craftsmen. Shop at Tlaquepaque, or venture into the newest shopping realm of Hozho. Surrounded by the unique architecture of the Arizona territory.



Accompanying Persons Tour 2: "Timeless Treasures"

(\$50.00 per person) Tuesday, October 12, 1999
9:00 AM-1:00 PM

Travel through the citrus groves to the Heard Museum to see a collection of arts and crafts of ancient cultures as well as contemporary works. Discover pottery, rugs, baskets, turquoise jewelry and a room devoted to Barry Goldwater's Kachina (spirit) doll collection, more than 400 varieties. The "southwest studies" exhibit features three actual Indian dwellings: a Navajo hogan, an Apache wickieup and a Hopi corn grinding room - as they look on today's reservations. Visitors to these interactive displays come away with a new appreciation for the strength and beauty of Native American ways of life. Luncheon will be at a restaurant converted from a historic old home that's been restored to its original beauty.



Accompanying Persons Tour 3: "The Savory Southwest" Cooking Demo & Luncheon

9:00 AM-1:00 PM
(\$75.00 per person) Wednesday, October 13, 1999

Enjoy southwestern cuisine with a French flair in the relaxed atmosphere of a historical Phoenix residence. Owner-chef Vincent Guerithault will prepare your gourmet luncheon right before your eyes! Quality, French cooking at its best — the presentation is pure artistry, looking almost too good to eat.

The restaurant was awarded Phoenix Magazine's coveted "Golden Spoon Award" in a reader's favorites poll, and Chef Vincent was named "Chef of the Southwest" at the 1993 James Beard competition in New York.

Next, head to the Biltmore Fashion Park, which offers more than fifty fine shops in a park-like setting with fountains, flowers and lovely shaded areas.

Home to Saks Fifth Avenue, Macy's, Banana Republic, Polo/Ralph Lauren, Origins, MAC Cosmetics, Gucci, Ann Taylor, and other exclusive specialty stores. The Biltmore also houses many fine restaurants including Wolfgang Puck's ObaChine, and is the Phoenix location of hotspots Planet Hollywood and the Hard Rock Cafe.





Copper 99 - Cobre 99

10 - 13 October 1999, Phoenix, AZ, USA

ADVANCE REGISTRATION FORM

ADVANCE REGISTRATION DEADLINE: 20 September 1999. Payment must accompany form. Forms received at the on-site fee structure.

Instructions: Check your selections, and fill in the necessary information.

Registration information box with fields for W, E, B, F, A, X, M, A, I, L and contact details for TMS.

Please print or type

Dr. Prof. Mr. Mrs. Ms.

This address is:

Business Home New Address

Address Correction

Personal information fields: Surname, Job Title, Address, State/Province, Telephone, E-Mail Address, Country, Area/City, Local Number.

REGISTRATION FEES table with columns: Fee, Advance Fees to 20 Sept. 99, On-Site Fees after 20 Sept. 99.

SHORT COURSE FEES table with columns: Fee, Price, Number, Total.

INDUSTRIAL TOUR FEES table with columns: Fee, Number, Total.

INDUSTRIAL TOUR FEES table with columns: Fee, Number, Total.

ACCOMPANYING PERSONS TOUR FEES table with columns: Fee, Number, Total.

SOCIAL FUNCTION TICKETS table with columns: Fee, Number, Total.

PAYMENT OPTIONS section with checkboxes for Visa, MasterCard, Diners Club, American Express, Bank Transfer.

PAYMENT POLICY section with registration fee information and refund policy.

Pointe Hilton
South Mountain Resort



**RESERVATION FORM
COPPER 99 – COBRE 99 CONFERENCE
OCTOBER 10 – 13, 1999**

PLEASE COMPLETE THE FORM BELOW AND RETURN TO:

The Pointe Hilton Resort on South Mountain
Attn: Reservations Manager
7600 N 16th Street, Suite 130
Phoenix, AZ 85020
Phone: (800) 876 - 4683
Fax: (602) 870 - 2783

I Plan to arrive: _____
Date

I Plan to Depart: _____
Date

Please Check:

- Single/Double - \$175
 Concierge Level - \$195

- Executive Boardroom Suite - \$300
 Presidential Suite - \$400

Room Tax - 10.55%

ALL RESERVATION REQUESTS MUST BE GUARANTEED BY THE FIRST NIGHT'S ROOM AND TAX BY PERSONAL CHECK OR CREDIT CARD. CANCELLATIONS MUST BE MADE SEVENTY-TWO (72) HOURS PRIOR TO ARRIVAL TO AVOID FIRST NIGHT'S BILLING.

All reservations must be received by: **WEDNESDAY, SEPTEMBER 8, 1999**
Requests prior to and after convention dates will be accepted on a space available basis only.
Convention rate applies three days prior and three days following official meeting date. (One card per room)

NAME: _____

Payment Enclosed: CHECK CREDIT CARD

FIRM: _____

CARD NO: _____

ADDRESS: _____

EXPIRATION DATE: _____

CITY, STATE, ZIP: _____

VISA MASTERCARD AMERICAN EXPRESS

TELEPHONE: _____

OTHER _____

FAX: _____

SIGNATURE: _____

Specific Requests: _____
(Requests Subject to Availability)

HHONORS NUMBER: _____

PLEASE NOTE: CHECK-IN TIME IS 4:00PM • CHECK-OUT TIME IS 12 NOON



COPPER HYDROMET ROUNDTABLE 99 REGISTRATION FORM ONLY

- The Pointe Hilton Resort on South Mountain, Phoenix, Arizona, USA
Essential Opportunity for Copper Metallurgy Managers
Sunday, October 10, 1999

Name: _____

Title: _____

Company: _____

Address: _____

Phone: _____

Fax: _____

ENCLOSED IS MY REGISTRATION FOR THE FOLLOWING:

- Delegate: Copper Hydromet Roundtable (includes admittance to the exhibition but not the Copper 99 - Cobre 99 Technical Sessions) US \$200
- Proceedings of Randol at Vancouver 98/Copper Hydromet Roundtable 98 US \$95
- Proceedings of Randol at Vancouver 97/Copper Hydromet Roundtable 97 US \$95
- Proceedings of Randol at Vancouver 96/Copper Hydromet Roundtable 96 US \$95

Total US \$ _____

REGISTRATION INCLUDES:

- AM and PM Breaks
- Lunch
- Reception in the Copper 99–Cobre 99 Exhibition

METHOD OF PAYMENT Check Enclosed Visa MasterCard American Express

Card #: _____

Expiration Date: _____

Name: _____

Signature: _____

Please E-mail or fax Roundtable registration to:
Hans von Michaelis
Randol International Ltd
21578 Mountsfield Drive, Golden, CO 80401
Fax: 303-526-1650
E-mail: hansvon@hotmail.com

**To register for the
Copper 99–Cobre 99 Conference
please fill out the
Registration Form on page 9.**



COPPER 99 - COBRE 99 EXHIBITION BOOTH RESERVATION FORM

The Pointe Hilton Resort on South Mountain,
Phoenix, Arizona, USA
October 10–13, 1999

Name: _____
Title: _____
Company: _____
Address: _____
City: _____
State: _____
Zip: _____
Phone: _____
Fax: _____
E-mail: _____

Hours of Operation:

Move-in:

Saturday, October 9, 1999

Show Times:

Sunday, October 10, 1999 4:30 AM–7:30 PM

Monday, October 11, 1999 10:00 AM–7:30 PM

Tuesday, October 12, 1999 10:00 AM–7:30 PM

Wednesday, October 13, 1999 10:00 AM–3:00 PM

Booth Cost—\$1,500 US Includes:

- 8' x 10' Exhibit area
- One 6' Skirted Table
- One Armchair
- One Spotlight for Lighting
- One Delegate Registration for Copper Hydromet Roundtable 99 Panel Discussion on Sunday, October 10, 1999.

BOOTH SELECTION

- 1st Choice
- 2nd Choice
- 3rd Choice

METHOD OF PAYMENT

- Check Enclosed Visa
- MasterCard American Express

Card #: _____
Expiration Date: _____
Name: _____
Signature: _____

Please E-mail or fax Booth Reservation Form to:
Dennis Sigl
Randol International Ltd.
13701 W. Jewell Avenue, #14
Lakewood, CO 80228
Fax: 303-986-5577
E-mail: randolinternational@worldnet.att.net



COPPER 99 - COBRE 99

Technical Program

Preliminary Program

PLENARY LECTURES

Coordinators: G. A. Eltringham, BHP Copper Inc., 550 California St., San Francisco, CA 94104-1020; P. J. Mackey, Noranda Technology Center, 240 Hymus Blvd., Pointe Claire, Quebec H9R 1G5 Canada

Markets for Copper-present and Into the Millennium: *Paul Dewison*¹; ¹Metalica Ltd., Forge Cottage, Ousden, Suffolk, CB8 8TR, England

The Financial Performance of the Copper Industry - Some Comparisons: *P. Kettle*¹; ¹CRU International Ltd., 31 Mount Pleasant, London WC1X 0AD England

World Technology Developments in Copper Through the 20th and 21st Centuries: *Dr. W. G. Davenport*¹; ¹University of Arizona, #12 Dept. of Mats. Sci. and Eng., Tucson, AZ 85721 USA

World Scenario Planning with Emphasis on Issues Affecting the Copper Industry: *Peter Schwartz*¹; ¹Global Business Network, P.O. Box 8395, Emeryville, CA 94662 USA

Copper Competitiveness in Relation to Other Metals: *TBA*¹; ¹Codelco-Chile, Huérfanos 1270, Santiago, Chile

Advances in the Copper Industry - Future Development and Environmental Constraints: *Dr. W. Marnette*¹; ¹Norddeutsche Affinerie, Hovestraße 50, Hamburg, Germany D-20539

MOVEMENT OF COPPER AND INDUSTRIAL OUTLOOK

Coordinators: Norbert L. Piret, Piret & Stolberg Partners, Consulting Engineers, Im Licht 12, Duisburg, Germany D-47279; Aldo Piccozzi, Chile

Markets and Trends

Trends and Insights into Worldwide Copper Acquisition Activity: *Douglas B. Silver*¹; ¹Balfour Holdings, Inc., 10 Inverness Dr. East, Suite 104, Englewood, CO 80112 USA

The Role of Brazil in the Copper Market: A 21st Century Supply and Demand Prospects: *Eduardo Vale*¹; ¹Bamburra, Planejamento e Economia Mineral Ltda., Rio de Janeiro Caixa Postal 37005, Brazil

Global Copper Consumption into the New Millennium: *Gary A. Campbell*¹; ¹Michigan Tech University, SBE, 1400 Townsend Dr., Houghton, MI 49931 USA

Writing Procedures for Start-up and Process Operations: *Horacio Aros*¹; ¹University Católica Valparaíso, Chem. & Met. Eng. School, Av. Brasil 2147, Valparaíso Chile

The 21st Century: A Century for the Chuquicamata Mine: *Juan H. Rojas*¹; ¹Codelco Chile, Division Chuquicamata, Chuquicamata, Chile

Copper, Market Growth Potential and Threats in the Asia Pacific Region: *Thomas Astorga*¹; Raul F. Campusano¹; ¹GEMEED-APEC, Dept. of Mining Chile

Risk Management in the New Millennium: *John M. Rogers*¹; ¹SGS Mineral Services, 1, Place des Alpes, P.O. Box 2152, Geneva 1 CH-1211

Meeting the Environmental Challenge by the Copper Industry in Chile: Lessons from the 90's: *Jaime Solari*¹; ¹SGA Ibersis, Encomenderos 260, Piso 9, Las Condes, Santiago Chile

The Chilean Copper Smelter Management Way: *Sergio Demetrio*¹; C. Queirolo²; R. Campos³; L. Conteras⁴; J. Sanhueza⁵; E. Morales⁶; M. A. Duran⁷; R. Alvarado⁸; ¹Smeltec S.A., Dept. of Metall. Eng.; ²Chuquicamata Smelter; ³Altonorte Smelter; ⁴Potretillos Smelter; ⁵Paipote Smelter; ⁶Ventanas Smelter and Refinery; ⁷Chagres Smelter; ⁸Caletones Smelter

The Group of Experts on Minerals and Energy Development and its Role Regarding Copper Mining Sustainability in the Asia-Pacific Region: *Thomas Astorga*¹; Raul F. Campusano¹; ¹GEMEED, Dept. of Mining, Chile

Economics - Finances

Project Phasing and the Bottom Line: *C. Twigge-Molecey*¹; D. Dawson¹; ¹Hatch, 2800 Speakman Dr., Mississauga, Ontario L5K2R7 Canada

Indirect Benefits of Private Mining Investment in Chile: *G. E. Lagos*¹; G. Donoso¹; M. Andia¹; ¹Catholic University of Chile, Vicuna Mackenna 4860, Santiago Chile

The Price-Stock Relationship in the Copper Market: A Surprising Approach: *Pablo Pinchera Brown*¹; ¹Division of Policy Plannings, Cochilco, Agustinas 1160, 4º Piso, Santiago, Chile

Comparative Post-Evaluation of Mining Projects: *P. F. Knights*¹; J. Hyslop¹; ¹Catholic University of Chile, Vicuna Mackenna 4860, Santiago Chile

Making Outsourcing Decisions with Incremental Analysis: *Bruce Cavender*¹; ¹BHP Copper, Inc., 8866 N. Duskfire Dr., Tucson, AZ 85737 USA

COPPER APPLICATIONS AND FABRICATION

Coordinators: Mahi Sahoo, Natural Resource Canada, 568 Booth St., Ottawa, ONT K1A 0G1, Canada; Konrad Kundig, Delta Met Int., 2 School House Rd., Randolph, NJ 07869

Applications

Influence of Environment on the Copper Patinas: *M. A. Llavona*¹; ¹University of Oviedo, Dept. of Mats. Sci., U.S. of Mining and Topographic Eng., Reinerio Garc'a, Mieres 33600 Spain

The Copper Motor Rotor and Plastic Injection Molds - New Developments Relying on Copper's Conductivity: *Dale T. Peters*¹; John G. Cowie¹; ¹Copper Development Association, Inc., 260 Madison Ave., 16th Floor, New York, NY 10016 USA

A Review of Bismuth and Selenium Modified Copper Alloys for Plumbing Applications: *M. Sahoo*¹; L. V. Whiting¹; M. Sadayappan¹; D. T. Peters²; ¹CANMET, Mats. Tech. Lab., 568 Booth St., Ottawa, Ontario K1A 0G1 00233 Canada; ²Copper Development Association, NY USA

Copper for Long Term Isolation of High Level Nuclear Waste: *Lars O. Werme*¹; ¹Swedish Nuclear Fuel and Waste Management Co. (SKB), Stockholm Sweden

Progress Report On Development Of A Cu-8 Cr-4 Nb Alloy Database For The Reusable Launch Vehicle (RLV): *David Ellis*¹; Hee Man Yun²; ¹Case Western Reserve University, White Blvd., 10900 Euclid Ave., Cleveland, OH 44106-7204 USA; ²Cleveland State University, 1983 East 24th St., Cleveland, OH 44115 USA

Study of Sulphide Ion in Corrosion Copper Resistance for Using in Containers for High Level Waste: *Ivan Escobar*¹; ¹Commission Chilena de Energia Nuclear, Casilla 188-D, Santiago Chile

Bilingual Copper Information Database: *Helga Larravide*¹; Konrad Kundig²; ¹Procobre-Chile; ²Delta Met Int., 2 School House Rd., Randolph, NJ 07869

Deterioration of Copper Electrodes in the Resistance Spot Welding of Aluminum: *J. R. Groza*¹; D. Bojin²; S. Steffensen¹; ¹University of California at Davis, Dept. of Chem. Eng. and Mats. Sci., Davis, CA 95616 USA; ²Polytechnic Institute, Bucharest Romania

Copper and Chlorinated Polyvinyl Chloride as Materials for Portable Water Usage: *William H. Dresher*¹; ¹WHD Consulting, 1201 E. Placita Ardilla, Tuscon, AZ 85718 USA

Fabrication

Effect of Oxygen Content on Annealing Kinetics of Copper: *Les Strezov*¹; ¹BHP Research & Technology Development, Centre for Metallurgy and Resource Processing, Newcastle Laboratories, P.O. Box 188, Wallsend, NSW 2287 Australia

Rheology and Metal Forming of Fire Refined Copper (FR): *Carlos Camurri*¹; ¹Concepcion University, Dept. of Metall., Casilla 53-C, Concepcion Chile

Mechanical Properties of a Family of Yellow Brasses Cast in Permanent Molds: *F. A. Fasoyinu*¹; R. Bouchard¹; J. Thomson¹; M. Sahoo¹; ¹Materials Technology Laboratory (CANMET), 568 Booth St., Ottawa, Ontario K1A 0G1 Canada

The Effect of Nickel on the Mechanical Properties of High Strength Yellow Brass: *D. G. Schmidt*¹; ¹R. Lavin and Sons, Inc., 3426 S. Kedzie

Ave., Chicago, IL 60623 USA

Microstructural Refinement and Strength Enhancement of Cu-4 Cr-2 Nb Alloy by Mechanical Milling: *K. R. Anderson*¹; J. R. Groza¹; ¹University of California, 5209 Dredger Way, Dept. of Chem. Eng. and Mats. Sci., Davis, CA 95616 USA

Grain Refinement of Copper Base Alloys: *M. Sadayappan*¹; F. A. Fasoyinu¹; M. Sahoo¹; ¹Materials Technology Laboratory (CANMET), 568 Booth St., Ottawa ON K1A 0G1 Canada

Application of Mechanical Alloying Processing to the Formation of Copper-Carbides Alloys: *Victor Vergara*¹; M. Lopez²; R. Benavente¹; C. Camurri¹; B. Cartes¹; H. Olivella¹; ¹Univ De Concepcion, Casilla 53-C, Concepcion 00187 Chile

Improved Rod Plant Metal Control with UNAC: *A. A. Shook*¹; C. Shelton¹; ¹BHP Copper, Suite 200, 7400 North Oracle Rd., Tucson, AZ 85737 USA

MINERAL PROCESSING

Coordinators: Bill A. Hancock, Great Western Chemical Co., 109 W. Penman, Bountiful, UT 84010; Scott Bird; Tim Fisch

Concentration - Operations

Improvements of Flotation Efficiency at the El Salvador Moly Plant by Flowsheet Modifications and Type Flotation Machines: *Sergio Castro*¹; ¹Universidad de Concepcion, Departamento de Ingenieria Metalurgica, Casilla 53-C, Concepcion Chile

Phosphate Nokes Process at El Teniente By-Product Molybdenite Plant: *S. H. Castro*¹; C. Henriquez²; E. Beas²; ¹Universidad de Concepcion, Dept. of Metall. Eng., Casilla, Concepcion 53-C Chile; ²Codelco-Chile El Teniente Division, Rancagua Chile

Copper Ore Preconcentration by Heavy Media Separation for Reduced Capital and Operating Costs: *Walter E. McCulloch*¹; John D. Hightower²; Roshan B. Bhappu²; ¹Bateman Engineering, Inc., 1860 E. River Rd., Suite 300, Tuscon, AZ 85718 USA; ²Mountain States R & D International

Technological Development for Igarape Bahia/Alemao Copper-Gold Project: *Vania Lucia Lima*¹; Nilce Alves dos Santos¹; Rinaldo Pedro Nardi¹; ¹Companhia Vale do Rio Doce - CRVD

Gold Occurrence in the Sar-Cheshmeh Prophyry Copper Ore and Its Behaviour during Beneficiation: *Mohammad Mehdi Salari Rad*¹; Masami Tsunekawa¹; Tsuyoshi Hirajima¹; Tetsuro Yoneda¹; ¹Hokkaido University, Graduate School of Engineering, Mineral Processing Lab., Kiat 13, Nishi 8, Sapporo, Hokkaido 060-8628 Japan

Equipment

A New Revolutionary Method of Classification: The Pansep Screen: *Rein Buisman*¹; ¹Particle Separation Systems (PTY), Ltd., P.O. Box 6575, Greenhills, Gauteng 1767 South Africa

Evaluation of a Ultrasonics Grinding Process: *Luis G. Gaete*¹; ¹Universidad de Santiago de Chile, Departamento de Fisica, Laboratorio de Ultrasonidos, Casilla 307, Santiago -2 Chile

Magnetic Collection of Grinding Ball Fragments from Sag and Ball Mill Circuits: *Daniel A. Norrgran*¹; Michale J. Mankosa¹; ¹Eriez Manufacturing Company, P.O. Box 10608, Erie, PA 16514-0608 USA

FUD vs Conventional and Column Flotation: *Daniel Urizar Funes*¹; ¹UPM LTDA

Advances in Application Driven Design of Flotation Cells: *Jouko Kallionen*¹; Daniel Monchak¹; ¹Dorr-Oliver, 333 South Allison Parkway, Suite 304, Denver, CO 80226 USA

Next Generation Sedimentation Equipment for Ultimate Thickening: *Alex Probst*¹; Jim Bowersox¹; ¹Dorr-Oliver, Inc., 333 South Allison Parkway, Suite 304, Denver, CO 80226-4656 USA

Development of Heat Treated Grinding Rod Altasteel: *Geoff Clinton*¹; ¹Altasteel Marketing

Operation Optimization

Ball Level Setting and Control in Semiautogenous Grinding: *Luis Magne*¹; Waldo Valderrama²; Fernando Bassaure³; Gilda Titichoca¹; ¹University of Santiago de Chile, Metallurg. Eng. Dept., Avda. L.B. O'Higgins 3363, Santiago Chile; ²Federico Santa Maria University of Technology, Mats. Sci. Dept.; ³Candelaria Mining Company

Feeding Granulometric Profile; The Most Incident Variable in Semi-Autogenous Grinding Output: *Fernando E. Cartes*¹; Domingo F. Baeza¹; ¹Codelco-Chile, Division El Teniente, Millan 1040, Rancagua Chile

The Recovery - Enrichment Ratio Model (AREV Equation): *Marco A. Vera*¹; J.-P. Franzidis¹; Emmy V. Manlapig¹; ¹JKMRC - The University of Queensland, Dept. of Mining, Mins., and Mats. Eng., University Mine, Isles Rd., Indooroopilly, Brisbane, Queensland 4068 Australia

Predictive Erosion Modeling for Hydrocyclone Liners: *Jim F. Benjamin*¹; Mark E. Hoyack¹; Brian LaCourse²; ¹Krebs Engineering, Product Development, 5505 W. Gillette Rd., Tucson, AZ 85743 USA; ²Saint-Gobain Industrial Ceramics, Northboro R&D Center, Goddard Rd., Northboro, MA 01532 USA

Metal Seated Ball Valves for the Flow Control of Abrasive Fluids: *Malcolm J. Harrison*¹; ¹Valtechnologies, Inc., Mining Div., 3227 Clayton Rd., Suite 10, Concord, CA 94519 USA

Operator Training in Collahuasi: *Marty Messner*¹; ¹Performance Associates International, Inc., 760 E. Pusch View Lane, Suite 100, Tucson, AZ 85737 USA

Milling for the Millennium: *Stuart M. Jones*¹; R. Fred Pena¹; ¹Metallic Minerals Svedala, Sales and Market., York, PA USA

Optimization and Control

Distribution of Pb Ions in Cu Rougher Flotation: Comparison of the Three Cu/Zn Concentrators: *J. C. Cremmel*¹; C. Sui¹; J. A. Finch¹; ¹McGill University, Dept. of Mining and Metall. Eng., Montreal, Quebec H3A 2B2 Canada

Effect of Clay Slimes on Copper, Molybdenum Flotation from Porphyry Ores: *S. Bulatovic*¹; ¹Lakefield Research, Ltd., 185 Concession St., Postal Bag 4300, Lakefield, Ontario K0L 2H0 Canada

Mineral Fragmentation and Porphyry Copper Process Design: *P. D. Munro*¹; T. H. Lafreniere²; P. J. Brown³; ¹MIM Holdings Brisbane; ²G&T Metallurgical Services Canada; ³MET Engineers, Ltd., 2957 Bowers Place, Kamloops, BC V1S 1W5 Canada

A Dynamic Simulator for Crushing - Screening Plants: *George Grandy*¹; Cristian Araya²; ¹Kvaerner E&C, Dept. of Tech., 12657 Alcosta Blvd., San Ramon, CA 94583 USA; ²Kvaerner E & C, Dept. of Tech., Nva Tajamar 481, Santiago Chile

Plant Models for Designing Soft-Sensor and Control Models: *Guillermo D. Gonzalez*¹; Ricardo Barrera¹; Aldo Casali²; Gianna Vallebuona²; Rafael Odgers¹; ¹University of Chile, Dept. of Elect. Eng., Tupper 2007, Santiago Chile; ²University of Chile, Dept. of Mining Eng., Tupper 2069, Santiago Chile

Development Of an "On-line" Eh-ph Electrochemical Sensor for the Flotation Process Control: *Christian C. Hecker*¹; Ernesto B. Beas²; Fernando M. Cartes²; ¹Universidad de Concepcion, Dept. de Ingenieria Metalurgica Chile; ²UGA - MINCO, Division El Teniente, Codelco-Chile, Chile

Plant-Wide Control for the Collahuasi Project: *Matthias Bolliger*¹; ¹ABB Industrie AG, IBAX, Segelhofstrasse, Baden-Dättwil 5405 Switzerland

Improvement in Crushing Plant Control in Copper Mining: *Christian Ottergren*¹; ¹Svedala, Malmo Sweden

HYDROMETALLURGY

Coordinators: Sharon Young, BHP Copper, 7400 N. Oracle Rd., Suite 200, Tucson, AZ 85704; David Dreisinger, University of British Columbia, 309-6350 Stores Rd., Vancouver, B.C. V6T 1Z4, Canada; Guillermo Ugarte, Ingeniero Investigador Senior, MOLYMET, Huerfanos 812, Piso 6, Santiago, Chile

Leaching

Recent Changes to Operating Practices at Minera Quebrada Bianca: *Henry Solomon-De-Friedberg*¹; ¹Compaioa Minera Quebrada Bianca S.A.

Enhanced Leaching of Copper Sulfide Leach Dumps: Application at Cananea: *Jose Hector Figueroa*¹; ¹Mexicana de Cananea, Cananea, Sonora Mexico

Heap Leaching Practices at San Manuel Oxide Operations: *Joel K. Witt*¹; Phil E. Cantrell¹; Manuel P. Neira¹; ¹San Manuel Operations, 28255 W. Redington Rd., P.O. Box M, San Manuel, AZ 85631 USA

Leach/Solvent Extraction/Electrowinning of Copper - World Operating Data: *William G. Davenport*¹; Jackson Jenkins²; Brian D. Kennedy³; Tim Robinson⁴; ¹University of Arizona, Dept. of Mats. Sci. and Eng., Tucson, AZ 85721 USA; ²Cyprus Sierrita Corporation, 6200 W. Duval Mine Rd., P.O. Box 527, Green Valley, AZ 85622-0527 USA; ³Simons Engineering, Inc., 2700 N. 3rd St., Suite 4000, Phoenix, AZ 85004 USA; ⁴CTI ANCOR, 2121 San Jacinto St., Dallas, TX 75201 USA

On-Line Chemical Analysis of Copper, Chloride and Acid in Copper Oxide Leachate: *Enrique Acuma*¹; Miguel Salinas²; Sergio Prado³; Alfred Fussa⁴; ¹Codelco, Salvador Division, Santiago Chile; ²Taylor Controls, Ltd., Providencia, Santiago Chile; ³In Motion, Providencia, Santiago Chile; ⁴Ionics, Inc., Watertown, MA USA

Copper Recovery from Concentrator Tailings: *Erol Kaya*¹; Peter B. Crimes¹; Charles H. Maxwell¹; ¹Phelps Dodge Mining Company, Process Technology Center, Safford, AZ USA

Designing the Leach System for Cerro Negro Ore: *W. L. Schlitt*¹; Joe Campbell²; Manuel Chavez¹; A. F. Kaczmarek³; Joseph M. Keane⁴; ¹Kvaerner Metals, 12657 Alcosta Blvd., Suite 200, San Ramon, CA 94583 USA; ²Sociedad Minera Cerro Verde S.A., Asiento Minera Cerro Verde-Uchumayo,

Casilla, Arequipa 299 Peru; ³Cyprus Amax Engineering & Project Development Company, P.O. Box 22015, Tempe, AZ 85285-2015 USA; ⁴KD Engineering Co., Inc., 7701 N. Business Park Dr., Tucson, AZ 85743 USA

Large Scale Hydrometallurgical Test Facilities of Phelps Dodge Mining Company: *Keven L. Purdy*¹; ¹Phelps Dodge Mining Company, Process Technology Center, 9780 E. Sanchez Rd., Safford, AZ 85546 USA

A Framework for Improving the Ability to Understand and Predict the Performance of Heap Leach Piles: *M. O'Kane*¹; S. L. Barbour²; M. D. Hang³; ¹O'Kane Consultants, Inc., 232-111 Research Dr., Saskatoon, SK S7N 3R2 Canada; ²University of Saskatchewan, Dept. of Civil Eng., Saskatoon, SK Canada; ³M.D. Hang and Associates, Ltd., Saskatoon, SK Canada

Leach Practice Improvements at El Abra Mine: *R. Canello*¹; ¹GCIA General SCM EA

The Use of a Mineralogical Data Base for Production Forecasting and Troubleshooting in Copper Leach Operations: *Wolfgang Baum*¹; ¹PMET, Inc., 700 Fifth Ave., New Brighton, PA 15066-1837 USA

The Treatment of Copper Concentrates with Nitrogen Species Catalyzed Pressure Leaching: *Corby G. Anderson*¹; ¹Montana Tech, The Center for Adv. Min. & Metall. Process., Rm. 221 ELC Bldg., Butte, MT 59701 USA

The Development of the Gunpowder Process: Low Temperature Autoclave Leaching for Copper Recovery from Chalcocite-Pyrite Ores: *David Dreisinger*¹; Geoff Richmond²; ¹The University of British Columbia, Dept. of Metals and Mats. Eng., 309-6350 Stores Rd., Vancouver, BC V6T 1Z4 Canada; ²Western Metals Resources, Ltd., P.O. Box 952, Burnie, Tasmania 7320 Australia

The Total Pressure Oxidation of El Indio Ore and Concentrate: *David Dreisinger*¹; Ben Saito¹; Ken Thomas²; Stephen Cryssoulis³; ¹The University of British Columbia, Dept. of Metals and Mats. Eng., 309-6350 Stores Rd., Vancouver, BC B6T 1Z4 Canada; ²Barrick Gold Corporation, Royal Bank Plaza, South Tower, Suite 2700, Toronto, Ontario M5J 2J3 Canada; ³Advanced Mineral Technology Laboratory, 100 Collip Circle, UWO Research Park, London, Ontario N6G 4X6 Canada

Pressure Leaching of Chalcopyrite Concentrates by Dynatec: Leslie A. Barta¹; *Kelvin R. Buban*¹; Michael J. Collins¹; John Stiksmal¹; ¹Dynatec Corporation, Metall. Tech. Div., 8301-113 St., Ft. Saskatchewan, Alberta T8L 4K7 Canada

Process Development Studies by Dynatec for the Recovery of Copper from Chalcocite Ore: *Michael J. Collins*¹; Tao Xue¹; Felix de Kock¹; Manher Makwana¹; ¹Dynatec Corporation, Metall. Tech. Div., 8301-113 St., Ft. Saskatchewan, Alberta T8L 4K7 Canada

Leaching of Copper Concentrate by a Chemical Catalytic Oxidation Method: *Burkhard Seeger*¹; ¹Universidad de Concepcion, P.O. Box 160-C, Concepcion Chile

New Atmospheric Leach Process for Copper Sulphide Ores and Concentrates: *C. J. Ferron*¹; ¹Lakefield Research, Ltd., 185 Concession St., Postal Bag 4300, Lakefield, Ontario KOL 2110 Canada

Hydrometallurgical Processing for Beneficiation of Copper Residues: *Luis Magne*¹; Francisco J. Alguacil²; ¹Universidad de Santiago de Chile, Departamento de Ingenieria Metalurgica, Avda. L. B. O'Higgins 3363, Santiago, Chile; ²Centro Nacional de Investigaciones Metalurgicas (CSIC), Avda. Gregorio del Amo 8, Ciudad Universitaria, Madrid 28040 Espana

An Electrochemical Study of the Leaching of Copper Sulfides in Acidified Ferrous Sulfate Solutions Sparged with an O₂-SO₂ Mixture: *Michael James Perpich*¹; ¹ECI Technology, 1 Madison St., East Rutherford, NJ 07073 USA

Ammonia Leaching of Copper Concentrates: Problems and Solutions: *Nathaniel Arbiter*¹; ¹Nathaniel Arbiter Associates, Inc., 6300 S.

Upper Valley Rd., Vail, AZ 85641 USA

Nico, A Dynamic Simulator for LIX-SX-EW Plants: *Cristian Araya*¹; ¹Kvaerner F&C, Dept. of Tech., Nva Tajamar 481.p19, Santiago Chile

Simulation of Oxide Copper Ores Heap Leaching Process: *Luiz R. P. De Andrade Lima*¹; ¹Polytechnic School, Federal University of Bahia, Rua Aristides Novis, 2, Federação, Salvador, Bahia 40210-630 Brazil

Interpretation of the Recovery/Time Curve and Scale-Up from Column Leach Tests on a Mixed Oxide/Sulfide Copper Ore: *Ronald J. Roman*¹; Jose Hector P. Figueroa²; Jorge Helleon³; Jorge Enrique H. Ruiz²; ¹Leach, Inc., 4741 N. Placita del Sol, Tucson, AZ 85749 USA; ²Mexicana de Cananea S.A. de C.V., Av. Juarez C.P. 84620, Cananea, Sonora Mexico; ³Mexicana de Cobre, Plante SXED, Nacoziari, Sonora Mexico

Enhanced Heap Leaching - Insights, Modeling, and Applications: *Shlomo Orr*¹; ¹Hydro Geo Chem, Inc., 51 West Wetmore Rd., Suite 101, Tucson, AZ 85705-1678 USA

Computation of Aqueous Species and Activities and Solution Equilibria in Heap Leaching of A Low-Grade Sulphuric Copper Ores: *Tero Kolhinen*¹; Heikki Jalkanen¹; ¹Helsinki University of Technology, Lab. of Metall., Vuorimiehentie 2, P.O. Box 6200, Espoo FIN- 02015 Finland

Design Modification at Zaldivar to Reach Plant Capacity Production: *H. Arias*¹; J. Binvignat¹; C. Garcia¹; J. Whittaker¹; ¹Compania Minera Zaldivar, Balmaceda #2536, 4th Floor, Don Guillermo Bldg., Antofagasta Chile

Hydrometallurgical Process in the Radomiro Tomic Division Codelco Chile: *Luis L. Farias*¹; ¹Codecol Chile Division Radomiro Tomic, Avenida Nueva Orrente 2696, Calama, II Region Chile

The Application of Bacterial Sulfate Reduction Treatment to Severely Contaminated Mine Waters: Results of Three Years of Pilot Plant Testing: *R. W. Hammack*¹; ¹U.S. Dept. of Energy, Federal Energy Technology Center, Pittsburgh, PA 15230 USA

An Alternative Process of Treating Copper-Gold Ore: *Xian Jian Guo*¹; Jame L. Hendrix²; ¹Noranda Technology Center, Copper, 240 Blvd. Hymus, Pointe-Claire, Quebec H9R 1G5 Canada; ²University of Nebraska at Lincoln, W181 Nebraska Hall, Lincoln, NE 68588-0501 USA

Advances in Computer-Based, Multimedia Training Provide Significant Opportunities to Improve Results: *Steve Brown*¹; ¹Performance Associates International, Inc., 760 E. Pusch View Lane, Suite 100, Tucson, AZ 85737 USA

Solvent Extraction

Advanced Cast Stainless Steels for Copper Industry Pumps: *Arto K. Riihimaki*¹; ¹Ahlstrom Pumps Corporation, Karhula Finland

VSF SX Developments and Operational Experiences: *Bror Nyman*¹; Esa Lindell¹; Petri Taipale²; Juhani Lyrra³; Timo Saarenpää⁴; Raimo Kuusisto²; ¹Outokumpu Research Oy, Kuparitie 5, P.O. Box 60, Pori 28101 Finland; ²Outokumpu Engineering Contractors Oy, Riihitontuntie 7E, P.O. Box 862, Espoo 02201 Finland; ³Outokumpu Engineering Services Oy, Riihitontuntie 7E, P.O. Box 863, Espoo 02201 Finland; ⁴Indepro Ingenieria Ltda, Gandellarias #265, P.O. Box 13255, Santiago de Chile, Chile

Ahlstrom Pumps - Advanced Pumping Solutions for The Copper Industry: *Jouni J. Lehtinen*¹; ¹Ahlstrom Pumps Corporation, Basic Metal and Fertilizer Industries, Karhula FIN-48601 Finland

Pilot Test Results of LIGHTNIN's Integrated SX Mixer Settler Unit: *Michael Anthony Giralico*¹; Tom Post¹; ¹LIGHTNIN, 135 Mt. Read Blvd., Rochester, NY 14611 USA

Pulsed Column Application in Copper Solvent Extraction: *Mark F. Vancas*¹; M. Curtis Nielson¹; ¹Bateman Engineering, Inc., 1860 E. River Rd., Suite 300, Tuscon, AZ 85718 USA

A Study of Copper/Iron Separation in Modern Solvent Extraction Plants: *D. C. Cupertino*¹; C. J. Maes¹; R. M. Swart¹; ¹ACORGA Metal Extraction Products, Zeneca Specialties

Investigation of Evaporative Losses in Solvent Extraction Circuits: *M. D. Bishop*; T. L. Young; K. E. Evans; L. A. Gray; M. G. Greene; J. May

Crud Formation: Field Studies and Fundamental Studies: *Michale J. Virnig*¹; Stephen M. Olafson²; Gary A. Kordosky³; ¹Henkel Corporation, 2430 N. Huachuca Dr., Tuscon, AZ 85745 USA

Recent Advances in the Application of Molecular Recognition Technology (MRT) in the Copper Industry: *S. R. Izatt*¹; R. L. Bruening¹; J. B. Dale¹; ¹IBC Advanced Technologies, Inc., P.O. Box 98, 856 East Utah Valley Dr., American Fork, UT 84003 USA

The Use of Mixed Extractants in a Unique Membrane SX System for the Recovery of Copper From Acid Cupric Chloride Solutions: *W. Daniel Ernst*¹; ¹ARS, 7360 Varna Ave., North Hollywood, CA 91605 USA

Operational Parameters Influencing Solvent Extraction Oxime Selectivity: *Kym Dudley*¹; ¹SX-EW Process Engineer, Girilambone Copper Company

Bioleaching

Bioleaching of Chalcopyrite in the Presence of Silver: Solids Characterization: *Alberto Alvarez*¹; E. Salinas²; M. Luisa Blazquez¹; *Antonio Ballester*¹; Monserrat Cruells³; Antonio Roca³; Felisa Gonzalez¹; ¹Universidad Complutense, Dept. Ciencia de Materiales, Facultad de CC Químicas, Madrid 28040 Spain; ²Universidad Autónoma de Hidalgo, Instituto de Ciencias de la Tierra, Hidalgo Mexico; ³Universidad de Barcelona, Dept. de Ing. Química y Metalurgia, Facultad de CC Químicas, Barcelona, Cataluña 08028 Spain

Microbiological Copper Dissolution from Mineral Sulphides: *Rosa E. Rivera*²; Maria Luisa Blazquez¹; *Antonio Ballester*¹; Felisa Gonzalez¹; ¹Universidad Complutense, Dept. Ciencia de Mats., Facultad de CC. Químicas, Madrid 28040 Spain; ²Universidad Nac. Aut. Méjico, Dept. de Ingeniería Metalúrgica, Facultad de Química, Ciudad Universitaria, D. F. 04510 Mexico

Copper Bioleaching: State-of-the-Art: *Corale L. Brierley*¹; James A. Brierley²; ¹Brierley Consultancy LLC, P.O. Box 260012, Highlands Ranch, CO 80163 USA; ²Newmont Metallurgical Services, 1010 East Dry Creek Rd., Englewood, CO 80112 USA

Ferrous Promoted Chalcopyrite Leaching: *Naoki Hiroyoshi*¹; Tsuyoshi Hirajima¹; Masami Tsunekawa¹; ¹Hokkaido University, Graduate School of Engineering, Kita 13, Nishi 8, Kita-ku, Sapporo, Hokkaido 060-8628 Japan

Bioleaching of Primary and Secondary Copper Sulfides: *J. R. Budden*¹; H. E. Urtubia¹; B. J. Sabacky¹; P. C. Duyvesteyn¹; ¹BHP Center for Minerals Technology, 204 Edison Way, Reno, NV 89502 USA

Technical Feasibility of Using Mill Tailings Recovered Pyrite as a Stockpile Leach-Aid: *John L. Uhrig*¹; Peter B. Crimes¹; ¹Process Technology Center, 9780 E. Sanchez Rd., Safford, AZ 85546 USA

Copper Production from Heap Leaching Solutions with an Innovative Process Competitive to the Traditional SX-EW: *M. Olper*¹; C. J. N. Buisman¹; C. E. Schultz²; ¹Paques Bio Systems V.B., Balk The Netherlands; ¹Engitec s.r.l., via Borsellino e Falcone 31, Novate Milanese, Milano 20026 Italy

Copper Sulfide Precipitation Using Biogenic Hydrogen Sulphide, Three years Experience at Kennecott Utah Copper: *Roy Van Lier*¹; ¹Paques Bio Systems B.V., T. de Boerstraat 13, 8560 AB Balk, The Netherlands

Bacterial Heap Leaching of Covellite: *Sergio Bustros*¹; Randolph E. Scheffel¹; Romilio Espejo¹; Cocilia Gonzalez¹; ¹Los Ebanistas 8585, Santiago Chile

Electrowinning

A Statistical Approach Study of Copper Electrowinning Parameters: *Damir Valic*¹; ¹Laurentian University, School of Eng., 935 Ramsey Lake Rd., Sudbury, Ontario P3E 2C6 Canada

Coulombimetric Reduction, An Alternative Corrosion Evaluation of Lead Base Anodes: *Antonio Pagliero*¹; Froilan Vergara¹; René Winand²; Jean Luc Delplancke²; ¹Universidad de Concepción, Dept. of Metall. Eng., Casilla 53 C, Concepción Chile; ²Université Libre de Bruxelles, Dept. Metall.-Electroch., CP 165 - 50 Avenue Roosevelt, Brussels B 1050 Belgium

On the Corrosion of Lead Anodes in Copper Electrowinning: *G. Cifuentes*¹; L. Cifuentes²; G. Crisotomo²; ¹Universidad de Santiago, Depto. Ingeniería Metalúrgica, Av.B. O'Higgins 3363, Santiago Chile; ²Universidad de Chile, Depto Ingeniería de Minas, Tupper 2069, Santiago Chile

New Anode Compositions for Copper Electrowinning and Copper Electrodeposition at High Current Density: *Jean-Luc Delplancke*¹; René Winand¹; Antonio Pagliero²; Jean-Paul Gueneau De Mussy²; ¹Université Libre de Bruxelles, Dept. of Metall. & Electrochem., CP165, 50 Ave. Roosevelt, Brussels B-1050 Belgium; ²Concepcion University, Dept. of Metall., Casilla 53-C -Correo 3, Concepcion Chile

Implementing Technology: Conversion of Phelps Dodge Morenci, Inc. Central EW Tankhouse from Copper Starter Sheet to Stainless Steel Technology: *Joanna M. Robertson*¹; B. J. Savage¹; J. C. Stauffer¹; ¹Phelps Dodge Morenci, Inc., 4521 U.S. Highway 191, Morenci, AZ 85540 USA

Electrocatalytic Titanium Mesh Surfaces Combined with Standard Lead Substrates for Process Improvements and Power Savings in Copper Electrowinning: *Kenneth L. Hardee*¹; Carl W. Brown¹; ¹ELTECH Systems Corporation, Research Dept., 625 East St., Fairport Harbor, OH 44077 USA

Improved Copper Electrowinning Operations Using Wright Pb-Ca-Su Anodes: *R. David Prengaman*¹; Andres Siegmund¹; ¹RSR Technologies, Inc., 2777 Stemmons Freeway, Suite 1800, Dallas, TX 75207 USA

A Study of the Spouted-Bed Electrowinning of Copper: *V. Jirieny*¹; A. Roy¹; *J. W. Evans*¹; ¹University of California at Berkeley, Dept. of Mats. Sci. and Min. Eng., Berkeley, CA 94720 USA

Iron Removal from Copper Leachate by Limestone Precipitation and Direct Electrowinning of Copper: *Baoguo Zhang*¹; Maurice C. Fuerstenau¹; ¹University of Nevada, Dept. of Chem. and Metall. Eng., Mackey School of Mines, Reno, NV 89557 USA

Engineered Membrane Systems for Acid Hydrometallurgical Solution Concentration, Separation, and Treatment: *Jeffrey J. Mueller*¹; Dennis H. Green¹; Ron Bernard¹; ¹HW Process Technologies, Inc., 1208 Quail St., Lakewood, CO 80215 USA

Guar Measuring with the CollaMat System: *Peter Stantke*¹; ¹Norddeutsche Affinerie Aktiengesellschaft, Hovestrasse 50, Hamburg 20539 Germany

Iron, Chloride and Permanganate Control in Copper Electrowinning Tankhouses: *Richard Shaw*¹; Juan D. Illescas¹; Cara Tomasek¹; *David Dreisinger*²; Be Wassink²; Simon Jupp²; Dave Readett³; *Tom*

Lancaster⁴; ¹Eichrom Industries, Inc., Hydrometallurgy, 8205 S. Cass Ave. Ste. 107, Darien, IL 60561 USA; ²University of British Columbia, Vancouver, British Columbia Canada; ³Straits Resources, NSW Australia; ⁴Nifty Copper, WA Australia

The Use of Electrodialysis for Separating and Concentrating Chemical Species in Acidic Cu-Fe-As-Sb Electrolytes: *L. Cifuentes*¹; J. Casas²; G. Cifuentes³; G. Crisotomo¹; F. Alvarez²; ¹Universidad de Chile, Dept. Ingenieria de Minas, Tuper 2069, Santiago Chile; ²Universidad de Chile, Depto Ingenieria Quimica, Beauchef 861, Santiago Chile; ³Universidad de Santiago, Depto. Ingenieria Metalurgica, Av.B O'Higgins 3363, Santiago Chile

Modelling and Simulation of Copper Electrowinning: *Hossein Aminian*¹; Claude Bazin¹; Daniel Hodouin¹; ¹Laval University, Dept. of Mining and Metall., Ste-Foy, Quebec G1K-7P4 Canada

Application of a Two Phase Hydrodynamic Modeling to an Electrowinning Cell: *Andreas Filzwieser*¹; Klaus Hein¹; Peter Paschen¹; Herwig Grogger²; ¹University of Leoben, Dept. of Nonferrous Metall., Franz-Josef-Strasse 18, Leoben, Styria A-8700 Austria; ²AVL List GmbH, Hans-List-Platz 1, Graz, Styria A-8700 Austria

Modeling of the Aqueous Speciation in Acidic Cupric Sulfate Solutions: *J. M. Casas*¹; G. Crisostomo²; F. Alvarez¹; G. Cifuentes³; L. Cifuentes²; ¹Universidad de Chile, Depto. Ingenieria Quimica, Beauchef 861, Santiago Chile; ²Univesidad de Chile, Depto Ingenieria de Minas, Tupper 2069, Santiago Chile; ³Universidad de Santiago, Depto Intenieria Metalurgica, Av.B. O'Higgins 3363, Santiago Chile

Mine Site Production of Value Added SX/EW Copper Products - The Alternative to Cathode: *Stephen J. Kohut*¹; Mark D. Precup¹; John J. Pio¹; ¹Electro Copper Products, Ltd., 1255 W. Baseline Rd., Mesa, AZ 85202 USA

Direct Cementation and Dissolution of Copper in Di-(2-Ethylhexyl) Phosphoric Acid: *C. Flores*¹; T. J. O'Keefe²; ¹BHP Copper, P.O. Box M, San Manuel, AZ 65401 USA; ²University of Missouri-Rolla, Rolla, MO 65401 USA

A Look at Leach SX-EW with 2020 Vision: *Sharon K. Young*¹; ¹Versitech, Inc., 1438 W. San Lucas Dr., Tucson, AZ 85704 USA

Hydrometallurgical Processing of Mechanically Activated Secondary Copper Ores: A. M. Amer¹; A. M. El-Tawil²; S. M. Megahed¹; ¹Alexandria University, Geology Dept., Faculty of Science, Moharren Bey, Alex Egypt; ²Wadi El Moulook St., N 51, ElSiuff Shama, Alexandria Egypt

Merrlin Composite Anode for Copper Electrowinning: *Marion Dattilo*¹; ¹Merrlin, L.L.C., 107500 CR 2000, P.O. Box 184, Rolla, MO 65402-0184 USA

ELECTROREFINING

Coordinators: V. Ramachandran, ASARCO, Inc., Technical Service Center, 3422 S. 700 West, Salt Lake City, UT 84119-4191; John E. Dutrizac, CANMET, 555 Booth St., Ottawa, Ontario K1A 0G1, Canada; Rodrigo F. Abel, Fundicion y Refineria Ventanas - ENAMI, Carretera F-30 E N 58270, Ventanas, Comuna Puchuncavi, V Region, Chile

Refinery Modernizations, Expansions and Improvements

Electrolytic Copper Refining - World Tankhouse Operating Data: *William G. Davenport*¹; Jackson Jenkins²; Brian D. Kennedy³; Tim Robinson⁴; ¹University of Arizona, Mines Bldg. #12, Dept. of Mats. Sci. and Eng., Tuscon, AZ 85721 USA; ²Cyprus Sierrita Corporation, 6200 W. Duval Mine Rd., P.O. Box 527, Green Valley, AZ 85622-0527 USA; ³Simon Engineering, Inc., 2700 N. 3rd St., Suite 4000, Phoenix, AZ 85004 USA; ⁴CTI Ancor, 2121 San Jacinto St., Dallas, TX 75201 USA

The Most Recent Copper Refinery in the World: *R. Manuel Ramos*¹; ¹Mexicana de Cobre, P.O. Box 20, Nacoziari, Sonora CP-84340 Mexico

Design and Operating Characteristics of the New Olen Tank House: *Johan Rambarter*; Charles Geenen

Design, Start-Up and Operation of the Cyprus-Miami Copper Refinery: *Jim Garvey*¹; Bernard J. (Bert) Ledebor²; James M. Lommen³; ¹Cyprus Miami Mining Corporation, P.O. Box 4444, Claypool, AZ 85532 USA; ²Electrometallurgical Consultant; ³Fluor Daniel Mining and Minerals

The Red Metal of Amarillo: *Retta M. Cunningham*¹; Weldon D. Read¹; George A. Herring¹; Abbas Mirza²; Harry E. Tallert¹; ¹Amarillo Copper Refinery, P.O. Box 30200, Amarillo, TX 79120 USA; ²Technical Services Center, Salt Lake City, UT USA

Recent Experiences and Tendencies at the Ventanas Electrolytic Refinery: *Rodrigo F. Abel*¹; Nelson R. Cornejo¹; Enrique C. Correa¹; ¹Fundicion y Refineria Ventanas - ENAMI, Carretera F-30 E N 58270, Ventanas, Comuna Puchuncavi, V Region Chile

Permanent Cathode Modernization at the Noranda - CCR Refinery: *O. Pogacnik*¹; M. Guilbert¹; H. Persson¹; F. Fisel¹; C. Belanger¹; ¹Noranda, Inc., CCR Refinery, 220 Ave. Durocher, Montreal-Est, Quebec H1B 5H6 Canada

Copper Refinery Modernization: Project Organization Coping with a Multi-Constraints Context: *Patrick Guillaume*¹; ¹UM Engineering S.A., Rue Du Bosquet, 4, Louvain-La-Neuve B-1348 Belgium

Improvements in the Tankhouse of the Tamano Smelter: *Ryuji Onizuka*¹; ¹Kyodou Smelting Co., Ltd., Tamano Smelter, Hibi, Tamano City, Okayama Pref., Japan

Tankhouse Expansion and Modernization of Copper Refineries, Ltd., Townsville, Australia: *Bob Edmonds*¹; John Hartland¹; Trevor Bothe¹; Laurie Adcock¹; Brendan O'Rourke¹; ¹Copper Refineries Pty, Ltd., Hunter St., P.O. Box 5484 MC, Townsville, QLD 4810 Australia

The Electrolytic Copper Production Increase at Caraiba Metals S.A.: *Vicemar D. J. Cruz*¹; Jose A. O. Souza¹; Erlander M. Aleantara¹; ¹Cariba Metals S.A., Via do Cobre n 3700, AIO - COPEC, Dias D'Avila, Bahia Brasil

Maintaining High Efficiencies While Increasing Current Density: Anthony Storey¹; ¹Southern Peru, Ltd., Refinery Div., Casilla 35, Ilo, Moquegua Peru

Productivity Improvements at the Toyo Copper Refinery: *Hiroshi Sato*¹; Kazuto Kugiyama¹; Osamu Nakai¹; Kozo Baba¹; ¹Sumitomo Metal Mining Co., Ltd., Toyo Smelter and Refinery, Besshi-Niihama District Division, Otu 145-1, Funaya, Saijyo, Ehime 793-0005 Japan

Improvements in Operating Practices at the Atlantic Copper Refinery: *Patricio Barrios*¹; Adelino Alonso¹; Carlos Ortiz¹; ¹Atlantic Copper, Avda Francisco Montenegro s/n, Huelva 21001 Spain

History of the Kidd Process Permanent Cathode Technology and Nickel Recovery System at Falconbridge's Kidd Creek Refinery: *Phil Donaldson*¹; Don Shane¹; ¹Falconbridge, Ltd., Kidd Metall. Div., P.O. Bag 2002, Timmins, Ontario P4N 7K1 Canada

Outokumpu Moves Towards Full Control and Automation of All Aspects of Copper Refining: *Henri Virtanen*¹; Tom Martila²; Ron Pariani³; ¹Outokumpu Pori, Kuparielektrolyysi; ²Outokumpu Espoo; ³Outokumpu Atlanta

Support Systems for Organised Employee Teams: *J. W. Holzenthaler*¹; M. E. Yarish¹; ¹Phelps Dodge Refining Corporation, P.O. Box 20001, El Pasco, TX 79998 USA

Current Efficiencies at High Current Density for Various Cathode Cycles: *Ivan Marcelo Santos Moraes*¹; ¹Caraiba Merais S.A., Technology, Via do Cobre n 3700 A.I.O. - Copec, Dias D'Avila, Bahia 42-850-000 Brazil

Anode Production

Improvements in Copper Anode Production at Southwire Company - Highlights of a 28 Day Makeover: *R. D. Hutcheson*¹; R. L. Every¹; S. M. Mobley¹; ¹Southwire Copper Division, P.O. Box 1000, Carrollton, GA 30117 USA

Update on The Contilnod Process - Continuously Cast and Sheared Anodes: *Peter C. Regan*¹; ¹Hazelett Strip-Casting Corporation, P.O. Box 600, Colchester, VT 05446 USA

Aluminum Diffusion Protection for Copper Anode Molds: *Joe Riccardi*¹; ¹PGE Industrial, Inc., 3589 Old U.S. 23, Grigton, MI 48114 USA

Electrochemical Processing of Speiss: *V. A. Lukanov*¹; E. N. Sajin¹; T. V. Chnyrenkova¹; ¹Kazak National Technical University, 22 Satpaev Str., Almaty ROK

Cathode Quality

Antimony Removal by Ion Exchange in Chilean Tankhouses at a Pilot Plant Scale: *J. E. Guzman*¹; Juan C. Salas¹; Enrique Roman Espinoza²; S. Muto³; ¹Codelco-Chile; ²Instituto de Innovacion en Minería y Metalurgia, S. A. Filial Codelco-Chile, Avda. del Parque 4980 1er piso Ciudad Empresarial del Huechuraba, Santiago Chile; ³Mesco, Inc., Japan

Reduction of Silver Losses during the Electrorefining of Copper: *Patricio Barrios*¹; Adelino Alonso¹; *Ulf Meyer*¹; ¹Atlantic Copper, S.A., Avda. Fco. Montenegro, s/n, Huelva E-21001 Spain

A Mineralogical Study of Nodulated Copper Cathodes: *J. E. Dutrizac*¹; T. T. Chen¹; ¹CANMET, 555 Booth St., Ottawa K1A 0G1 Canada

Studies on Copper Electrorefining by Factorial Design Methods - Pilot Plant Experience: *Erlander M. Aleantara*¹; ¹Caraiba Metais S.A., Via do Cobre n 3700, AIO- Copec, Dias D'Avila, Bahia Brasil

Reactions at the Anodes and Cathodes

Anodic Slimes Characteristics and Behaviour in Electrolytic Copper Refining: *Gerardo Cifuentes*¹; S. Hernandez¹; P. Navarro¹; J. Simpson¹; C. Reyes¹; A. Naranjo L. Tapia¹; Rodrigo F. Abel²; Nelson R. Cornejo²; Enrique C. Correa²; ¹Universidad de Santiago de Chile, Depto. de Ingeniería Metalúrgica, Av. Lib. B.O'Higgins 3363, Santiago Chile; ²Fundicion y Refineria Ventanas - ENAMI, Carretera F-30 E N 58270 Ventanas, Comuna Puchuncavi, V Region Chile

A Mineralogical Study of the Department of Impurities During the Electrorefining of Secondary Copper Anodes: *T. T. Chen*¹; J. E. Dutrizac¹; ¹CANMET, 555 Booth St., Ottawa K1A 0G1 Canada

Post-Passivation Reactions Occurring at the Anode during Copper Electrorefining: *Michael Scott Moats*¹; J. Brent Hiskey¹; ¹University of Arizona, Dept. of Mats. Sci. and Eng., 4717 E. Fort Lowell, Tucson, AZ 85719 USA

Effect of Forced Convection of Electrolyte on Copper Electrorefining in the Presence of Impurities: *Tomio Takasu*¹; Takashi Nakamura²; Fumio Noguchi¹; Hideyuki Itou¹; ¹Kyushu Institute of Technology, Dept. of Mats. Sci. and Eng., 1-1 Sensui, Tobata, Kitakyushu, Fukuoka 804-8550 Japan; ²Tohoku University, Institute of Advanced Mats. Proc., 2-1-1 Katahira, Aoba, Sendai, Miyagi 980-8577 Japan

Additive Monitoring and Interactions during Copper Electroprocessing: *D. W. Collins*¹; J. B. Hiskey¹; ¹University of Arizona, 4715 E. Ft. Lowell, Tucson, AZ 85712 USA

The Influence of Chloride and Glue on Copper Electrocrystallization on Titanium for Thin Film Applications: *A. J. B. Dutra*¹; T. J. O'Keefe¹; ¹COPPE/UFRRJ-PEMM, Cidade Universitaria-Centro de Tecnologia, sala F 210, 21945-970, Rio de Janeiro, RJ, Brazil

Nucleation and Initial Stages of Growth of Copper Electrodeposited on Anodized 304 Stainless Steel: *Melania Urda-kiel*¹; *Jean-Luc Delplancke*²; Liviu Oniciu¹; *René Winand*²; ¹University Babes-Bolyai, Dept. of Phys. Chem., Cluj-Napoca 3400 Romania; ²Universite Libre de Bruxelles, Dept. of Metall. & Electrochem., CP165, 50 Ave. Roosevelt, Brussels B-1050 Belgium

PYROMETALLURGY

Operations

Coordinators: David B. George, Kennecott Utah Copper Corporation, 8315 West 3595 South, P.O. Box 6001, Magna, UT 84044-6001; P. J. Mackey, Noranda Technology Center, 240 Hymus Blvd., Pointe Claire, Quebec H9R 1G5, Canada; Pete Chen, Phelps Dodge Mining Company, 2600 N. Central Ave., Phoenix, AZ 85004-3014; A. Luraschi, CADE-IDEPE, Santiago, Chile

Developments in Direct-to-Blister-Smelting at Olympic Dam: *Arthur G. Hunt*¹; Steven K. Day¹; Simon M. Cmrlac¹; Robert C. West¹; ¹WMC Resources, Ltd., Olympic Dam Operations, P.O. Box 150, Roxby Downs Australia

Modernization of the Luanshya Smelter, Zambia: *A. P. Mukharjee*¹; M. J. Morgan¹; C. L. Boetach²; A. A. Luraechi²; ¹Roan Antacope Mining Corporation of Zambia PLO, P.O. Box 90456, Luanshya Zambia; ²INDEC International Engineering Consulting Services, Avda, Profidencia 2653, OL, Santiago 512 Chile

Improving Smelter Performance Through Development of People: *Alistair Ross*¹; Ron Hill¹; ¹Phelps Dodge Hidalgo, 2600 North Central Ave., Phoenix, AZ 85004-3014 USA

Use of Porous Plugs in Molten Copper Refining: *A. J. Rigby*¹; Peter Gissing²; Michael D. Lanyi³; ¹Narco Canada, Inc., Non-Ferrous Marketing, P.O. Box 910, 4355 Fairview St., Burlington, Ontario L7R 3Y7 Canada; ²Veitsch-Radex, Mommsengasse 35, P.O. Box 143, Vienna, A-1011 Austria; ³Air Products and Chemicals, Inc., Non-Ferrous Metals, 7201 Hamilton Blvd., Allentown, PA 18195-1501 USA

Refractory Practice in the Peirce-Smith Converters at BHP Copper, San Manuel, Arizona: *A. J. Rigby*¹; O. D. Pasca²; ¹Narco Canada, Inc., Non-Ferrous Marketing, P.O. Box 910, Burlington, Ontario L7R 3Y7 Canada; ²BHP Copper, Dept. of Metals, 200 South Redington Rd., San Manuel, AZ 85631 USA

Online SO₂ Analysis of Copper Converter Off-Gas: *A. A. Shook*¹; O. Pasca¹; G. A. Eltringham¹; ¹BHP Copper Metals, San Manuel, AZ USA

Smelter Off-Gas Handling Optimization: *B. Curson*¹; A. A. Shook¹; ¹BHP Copper, Suite 200, 7400 North Oracle Rd., Tucson, AZ 85737 USA

Bath Smelting in the Noranda Process and El Teniente Converter Compared: *C. Harris*¹; ¹Kvaerner, Inc., San Francisco, CA USA

Copper Metallurgy at the KGHM Polska Mied S.A. - Present State and Perspectives: *Czernecki Jozef*¹; Mieszek Zbigniew¹; Miczkowski Zdzisaw¹; Dobrzaski Jerzy²; Warmuz Marian²; ¹Institute of Non-Ferrous Metals, ul.Sowiskiego 5, 44-100 Gliwice Poland; ²KGHM Polska Mied S.A., ul. M.C. Skodowskiej 48k, 59-301 Lubin Poland

Upgrading of the Teniente Technology: *Pedro C. Morales*¹; Roberto S. Mac-Kay¹; ¹Caletones Smelter, El Teniente Div., Codelco-Chile, Chile

Environmental Control in the Kennecott Utah Copper Smelter: *C. J. Newman*¹; A. J. Weddick¹; ¹Kennecott Utah Copper, Magna, UT USA

The Chuquicamata Smelter Development Plan for the Next Four Years: *Claudio Queirolo*¹; Carlos Caballero¹; Hernan Mendoza¹; Alejandro Dagnino¹; ¹Codelco-Chile, Div. Chuquicamata, Chuquicamata Chile

Indirect Drying of Concentrates at Copper and Nickel Smelters by Means of Innovative and Cost Effective Environmental Technologies: *Christian Monjau Sagedahl*¹; Hans Joergen Broenlund¹; ¹Kvaerner Eureka, Proc. Div., Joseph Kellers vei 20, P.O. Box 38, Tranby, Lier N-3401 Norway

Recent Progress in Copper Production and Smelting Technology in China: *Ding Chaogmo*¹; Qui Dingfan¹; ¹Beijing General Research Institute of Mining and Metallurgy, Beijing 10044 China

Recent Operation of the Kennecott Utah Copper Smelter: *D. N. Collins*¹; D. P. George-Kennedy¹; T. I. Probert¹; ¹Kennecott Utah Copper, Magna, UT USA

Redesigning the Flash Furnace Feed System at BHP Copper: *D. J. Goodwill*¹; D. Jones²; T. A. Royal³; ¹H. G. Engineering, Ltd., 400 Carlingview Dr., Etobicoke, Ontario M9W 5X9 Canada; ²BHP Copper, Inc., Box M, San Manuel, AZ 85631 USA; ³Jenike & Johanson, Inc., 400 Carlingview Dr., Etobicoke, Ontario M9W 5X9 Canada

1999 Rebuild of the BHP San Manuel Outokumpu Flash Furnace: *David M. Jones*¹; Ray Cardoza¹; Anthony Baus¹; ¹BHP Copper, Smelter Div., P.O. Box M, San Manuel, AZ 85631 USA

Concentrate Injection in Peirce Smith Converters at Noranda's Altonorte Smelter: *Ernest D. Mast*¹; ¹Noranda Chile, Fundición Altonorte, Gerencia Técnica, Panamericana Norte Km 1348, Antofagasta, II Región Chile

The Design of the Ausmelt Technology Smelter at Zhong Tiao Shan's Houma Smelter, PRC: John M. Floyd¹; Harry Li¹; *Edward N. Mounsey*¹; ¹Ausmelt, Ltd., P.O. Box 1003, 12 Kitchen Rd., Dandenong, Victoria 3175 Australia

Copper Recovery from Slag at BHP Copper-San Manuel: *G. L. Brown*¹; R. C. Cardoza¹; C. Flores¹; ¹BHP Copper, Inc., 200 S. Reddington Rd., P.O. Box M, San Manuel, AZ 85631 USA

Breaking New Ground - Recent Developments in the Smelting Practice at ZCCM: *G. M. Beene*¹; E. Mponda¹; M. M. Syamujulu¹; ¹Nkama Smelter, Dept. of Metall., Kitwo, Zambia

Copper Smelter Waste Heat Boiler Technology for the Next Millennium: *H. Holopainen*¹; J. Nokelainen¹; R. Peippo¹; ¹Foster Wheeler Energia Oy, P.O. Box 201 Finland

Use of Microporous Insulation in a Copper Holding Furnace: *Iain B. Mackenzie*¹; Ovidiu Pasca²; Joe Rigby³; ¹Microtherm, Inc.; ²BHP Copper; ³NARCO, Inc.

A Review of Design Modifications to Increase Rotary Dryer Capacity and Efficiency at the BHP San Manuel Smelter: *John W. Bryant*¹; David M. Jones¹; Danny Large¹; Mario Ramirez¹; ¹BHP Copper, P.O. Box M, San Manuel, AZ 85631 USA

Philippines Associated Smelting Electrostatic Precipitator Upgrade: *Jun Conde*¹; Bob Taylor²; Suresh Sarma³; Jose Suarez²; ¹PASAR; ²BHA Group Inc; ³BHA India

Control of Tapping and Launder Emissions: *John Davis*¹; ¹Environmental Systems, Ltd., 1211 Gorham St., Unit 1, Newmarket, Ontario L3Y 7V1 Canada

Development of More Environment-Friendly and Cost-Effective Drying Facility for Copper Concentrates: From Innovation to Full Scale Experience: *Jarkko Kalevi Partinen*¹; Shao Long Chen¹; Olli Tiit¹; ¹Kumera Corporation, Technology Center, Kumerankatu 2, Riihimäki, Finland FIN-11100 Europe

Electric Settling Furnace Operations at the Cyprus Miami Mining Corporation Copper Smelter: *Jason Eric Sallee*¹; ¹Cyprus Miami Mining Corporation, Dept. of Pyrometall., P.O. Box 4444, Claypool, AZ 85532 USA

Hernan Videla Lira Copper Smelter Modernization: *Jose Sanhueza*¹; Orlando Rojas¹; ¹Empresa Nacional De Minería, Paipote Chile

Improvements to BHP Hartley Platinum's Smelting Furnace: *J. Sarvinis*¹; S. de Vries¹; K. Joiner¹; C. van Mierlo¹; N. Voermann¹; F. Stober²; C. Rule²; P. Majoko²; ¹Hatch Associates, Ltd., 2800 Speakman Dr., Mississauga, Ontario L5K 2R7 Canada; ²BHP Hartley Platinum, P.O. Box CY 2288, Causeway, Harare Zimbabwe

Lime Fluxing during High Matte Converting: *J. Zuniga*¹; C. Guibout¹; P. Ruz²; C. Acuna¹; ¹Chuquicamata Smelter/Codelco-Chile, Division Chuquicamata, Subgerencia, Vitacura, Santiago Chile; ²Institute for Mining and Metallurgy Innovation/(IM2), Avenida del Parque 4980, Ciudad Empresarial, Hueschuraba, Santiago Chile

Copper Smelting and Refining in Indonesia: Shunichi Ajima²; *Kiyoshi Kanamori*¹; Koichi Konda¹; ¹PT Smelting Company, Gresik Smelter & Refinery/Operations & Maintenance, Desa Roomo, Kecamatan Manyar, P.O. Box 555, Gresik, Jawa Timur 61151 Indonesia; ²PT Smelting Company, Plaza 89, 6th Floor, S602, Jl. HR. Rasuna Said Kav. X-7 No. 6, Jakarta 12940 Indonesia

Tons and Profit from Understanding Gas Cooling and Heat Recovery: *Kurt A. M. Westerlund*¹; *Olaf Piehl*²; *Wolfgang Abeck*²; ¹Kamwest-Oschatz, Dept. of Non-Ferrous Gas Handling and Heat Recovery, World Trade Center, P.O. Box 800, Helsinki FIN-00101 Finland; ²Oschatz, Dept.

of Non-Ferrous Gas Handling and Heat Recovery, Westendhof 10-12, Postfach 102843, Essen D-45028 Germany

Gas Handling and Cleaning at the Potrerillos Smelter: *Leonel Contreras*¹; Pedro Reyes¹; Benjamin Martinich¹; Rene Bustamante²; ¹Codelco-Chile; ²Universidad de Santiago de Chile, Casilla 10233, Santiago Chile

Analysis of Sulfuric Acid Plant Gas Cooling and Cleaning Systems: *Leonard Joel Friedman*¹; ¹Acid Engineering & Consulting, Inc., 17770 Deauville Lane, Boca Raton, FL 33496 USA

Revising Copper Converter History: A Metallurgical “Whodunit”: *Larry M. Southwick*¹; ¹L. M. Southwick & Associates, 992 Marion Ave., Suite 306, Cincinnati, OH USA

Fugitive Emissions Control Methodology at Phelps Dodge, Chino Mines: *Mike Cricillo*¹; Paykan Safe²; Brian Wiggins²; ¹Phelps Dodge Chino Smelter, Hurley, TX USA; ²GCTx Process Technologies, Dallas, TX USA

Process Gas Handling in Copper Pyrometallurgy: *Maurice Coquerel*¹; Carlos Cuadra¹; ¹Kvaerner R&C, Dept. of Tech., 12657 Alcosta Blvd., San Ramon, CA 94583 USA

Agglomeration of ESP Dust for Recycling to Flash Smelting Furnace: *N. Smith*¹; P. Ryan¹; K. Hudson¹; ¹Produ-Kake, Inc., 1515 West 2200 South, Suite C, Salt Lake City, UT 84119 USA

Furnace Cooling Design for Modern, High-Intensity Pyrometallurgical Processes: *N. Voermann*¹; ¹Hatch Associates, 2800 Speakman Dr., Mississauga, Ontario L5K 2R7 Canada

The Utilization of Excess Reaction Heat in the Mitsubishi Converting Furnace: Osamu “Sam” Iida¹; Hiroshi Kumada¹; Tetsuro Sakai¹; ¹Mitsubishi Materials Corporation, Naoshima Smelter & Refinery, 4049-1 Naoshima-cho, Kagawa-gun, Kagawa 761-3110 Japan

Peirce Smith Converter Process and Off-Gas System Improvements at BHP Copper: *Ovidiu Pasca*¹; John Bryant¹; Paykan Safe²; Brian Wiggins²; ¹BHP Copper, Inc., P.O. Box M, San Manuel, AZ 85631 USA; ²GCTx Process Technologies, 4950 North O’Connor Rd., Suite 250, Irving, TX 75062 USA

Competitiveness of the Outokumpu Flash Smelting Technology - Now and in the Third Millennium: *Pekka Hanniala*¹; Ilkka V. Kojo¹; Aimo Kurki¹; ¹Outokumpu Engineering Contractors Oy, P.O. Box 862, Espoo FIN 02201 Finland

Development of New Bath Smelting Technology at Mines Gaspé: *B. Langlois*¹; ¹Mines Gaspé, Murdochville, Quebec G0E 1W0 Canada

New Strategic Scope of the Caletones Smelter Development: *Ruben Alvarado*¹; Jorge Codoy¹; ¹Caletones Smelter, Div. El Teniente, Codelco-Chile, Chile

Modification of the Mount ISA Copper Smelter to Feed a New Sulphuric Acid Plant: *Richard Hollis*¹; Adrian Werny¹; Greg Yeowart²; ¹Fluor Danikel Pty., Ltd., Brisbane, Qld Australia; ²Mount Isa Mines, Ltd., Brisbane, Qld Australia

First Year of Industrial Operation of the Noranda Continuous Converter: *R. Lapointe*¹; M. Zamalloa²; ¹Noranda Inc., Horne Smelter, C.P. 4000, Rouyn-Noranda, Quebec J9X5B6 Canada; ²Noranda Technology Center, 240 Hymus Blvd., Pointe Claire, Quebec Canada

Teniente Converter Slag Cleaning Using and Electric Furnace at Las Ventanas Smelter: *Ricardo Ponce*¹; Gerardo Sanchez¹; ¹Empres de Minería, Las Ventanas Smelter, Casilla 126-B, Quintero Chile

The Copper Smelters of the Year 2010, A Vision of the Future: *Sergio Demetrio*¹; Nelson Santander²; Marco Solar³; ¹Smeltec S.A., Dept. of Metall. Eng.; ²U. de Chile and U. Mayor, Dept. of Metall. Eng.; ³Gerete General - Masbing S. A., Dept. of Chem. Eng.

Expansion of Onsan Smelter: *Seong-won Kang*¹; Han-young Jo¹; Jeong-ha Lee¹; Jeong-ju Lee¹; ¹LG Metals Corporation, 70 Daejung-ri, Onsan, Ulju, Ulsan 689-890 Korea

Converter Operation at BHP San Manuel Smelter: *T. W. Gonzales*¹; D. Snashall¹; O. D. Pasca¹; R. David¹; ¹BHP Copper, Box M, San Manuel, AZ 85631 USA

Use of Optical On-line Production Control in Copper Smelters: *Wilhelm Wendt*¹; *Willy Persson*¹; ¹Semtech Metallurgy AB, Ideon, Lund S-223 70 Sweden

Recent Operation of the Flash Smelting Furnace at Saganoseki Smelter: *Yushiro Hirai*¹; Yutaka Yasuda¹; Yoshiaki Suzuki¹; Mitsumasa Hoshi¹; ¹Saganoseki Smelter & Refinery, Nippon Mining & Metals Co., Ltd., Saganoseki, Oita 879-2201 Japan

Technical Improvement and Modification of Guixi Smelter in Recent Ten Years: *Yuan Zeping*¹; ¹Guixi Smelter of Jiangxi Copper Company, P.O. Box Ye Jing Rd., Jiang Xi Province 335424 China

Secondary Copper

Optimisation of Blast Furnaces and Converter Processes in a Secondary Copper Smelter: *Andreas Nolte*¹; Ralf Kreyman¹; ¹Huttenwerke Kayser AG, Kupferstrasse 23, Lunen, Postfach D-44532 Germany

The Application of Copper Metallurgy in the Recycle of Precious Metals: *Corby G. Anderson*¹; Todd Fayram¹; ¹CAMP, Dept. of Eng., Butte, MT 59101 USA

Chile and the Application of the Basel Convention: *G. E. Lagos*¹; ¹Catholic University of Chile, Santiago Chile

Copper Recycling and the Environment: *G. E. Lagos*¹; M. E. Andia¹; ¹Catholic University of Chile, Santiago Chile

Problems in Secondary Copper Metallurgy and Solution Proposals: *Peter Paschen*¹; Jorg Wallner²; ¹University of Leoben, Montanuniversitat Leoben, Franz-Josef, Strabe 18 Austria; ²Metallwerke Brixlegg Austria

Copper Scrap Movements and the International Copper Scrap Industry: *Robert A. Stein*¹; ¹Louis Padnos Iron & Metal Company, P.O. Box 1979, Holland, MI 49422-1979 USA

PYROMETALLURGY

Fundamentals, Process Modeling, Technology and Development

Coordinators: Carlos Diaz, Roy Gordon Research Laboratory, Sheridan Park, Mississauga, Ontario L5K 1Z9, Canada; Carlos Landolt, INCO Limited, Copper Cliff, ONT P0M 1N0, Canada; T. A. Utigard, University of Toronto, Dept. of Metall. Mats. Sci., 184 College St., Toronto, Ontario M5S 3E4, Canada

High Oxygen Shrouded Injection at Falconbridge Converters: A. Bustos¹; B. Macnamara²; J. Kapusta¹; M. Coffin²; ¹Air Liquide Canada, Inc., 1250, Boul. Rene Levesque Ouest, Bureau 1700, Montreal, Quebec H3B 5E6 Canada; ²Falconbridge, Ltd., Falconbridge, Ontario Canada

Thermochemical Modeling of Smelting Operations: Alastair L. Davies¹; John F. Castle¹; John A. Gisby²; Marielle A. S. Sira¹; Philip J. Gabb¹; A. J. Weddick³; ¹Rio Tinto Technical Services, P.O. Box 50, Lower Castle St., Castlemead, Bristol BS99 7YR UK; ²National Physical Laboratory, Centre for Mats. Measure. and Tech., Queens Rd., Teddington, Middlesex TW11 0LW UK; ³Kennecott Utah Copper, Smelter, 12000 West 2100 South, Magna, UT 84044 USA

Application of Composite Furnace Module Cooling Systems in a Flash Furnace Reaction Shaft: Andrew K. Kyllö¹; Diamond Papazoglou²; Neil B. Gray¹; ¹The University of Melbourne, Dept. of Chem. Eng., Parkville, Vic 3052 Australia; ²Western Mining Resources, Ltd., Kalgoorlie Nickel Smelter, P.O. Box 448, Kalgoorlie, WA 6430 Australia

Databases and Software for Thermodynamic Simulations of Copper Smelting and Converting: Sergei Degerov¹; Arthur D. Pelton¹; Florian Kongoli¹; Manuel Zamalloa²; ¹Ecole Polytechnique, Dept. of Metall. Eng., P.O. Box 6079, Station "Downtown", Montreal, Quebec H3C 3A7 Canada; ²Noranda Technology Center, 240 Hymus Blvd., Pointe Claire, Quebec H9R 1G5 Canada

Alkaline Leaching of Arsenic from Smelter Flue Dust and Leaching Solution Regeneration: Antelmo V. Robles¹; Ana E. I. Serna¹; Manuel A. Sandez¹; ¹Mexicana de Cobre, S.A. de C.V., R&D Dept., Nacoziari, Sonora 84340 Mexico

Converter and Bath Smelter Vessel Design - Blast Delivery and Tuyeres Performance: A Re-assessment of Design Characteristics: A. E. Wraithphillih¹; P. J. Mackey²; ¹University of Newcastle, Dept. of Mech., Mats. and Manuf. Eng., Newcastle upon Tyne NE1 7RU UK; ²Noranda Technology Centre, 240 Hymus Blvd., Pointe Claire, Quebec Canada

Factors Determining the Efficiency of Copper Removal from a Highly Oxidized Slag in an Electric Furnace: A. Warczok¹; G. Riveros¹; C. Diaz¹; P. Echeverria²; H. Schwartze³; G. Sanchez⁴; ¹Universidad de Chile, Depto. de Ingenieria de Minas, Santiago Chile; ²El Teniente Division, Codelco-Chile, Caletones Chile; ³ENAMI, Santiago Chile; ⁴Fundacion Ventanas, ENAMI Chile

Mathematical Modeling of the El Teniente Slag Cleaning Process: A. Warczok¹; G. Riveros¹; C. Diaz¹; D. Cordero²; ¹Universidad de Chile, Depto. de Ingenieria de Minas, Santiago Chile; ²Codelco-Chile, El Teniente Division, Caletone Smelter Chile

Ferrous Calcium Silicate Slag to Be Used for Copper Smelting and Converting: Akira Yazawa¹; Yoichi Takeda²; Shigeatsu Nakazawa¹; ¹Tohoku University, 2-1-1 Kattahira, Sendai 980 Japan; ²Iwate University, Morioka Japan

Activity Measurement of Minor Elements in Cu-S-Me (Me=Ag, Se, Te) and Cu-Fe-S-Me Matte Systems at 1473 K by Mass Spectrometric Method: Alireza Zakeri¹; Mitsuhsa Hino¹; Kimio Itagaki¹; ¹Tohoku University, Institute for Advanced Mats. Proc. (IAMP), 2-1-1 Kattahira, Aoba-ku, Sendai, Miyagi-ken 980-8577 Japan

Application of a Reacting CFD Model to Drop Tube Kinetics and Smelter Simulations: B. R. Adams¹; K. A. Davis¹; M. P. Heap¹; A. F. Sarofim¹; G. A. Eltringham²; A. A. Shook²; ¹Reaction Engineering International, 77 West, 200 South, Suite 210, Salt Lake City, UT 84101 USA; ²BHP Copper, P.O. Box M, San Manuel, AZ 85631 USA

Computerized Fluid Dynamic (CFD) Modeling, an Important New Engineering Tool for Design Smelting Furnaces: Brigett M. Rosendall¹; D. Michael Lane¹; Jonathan M. Berkoe¹; ¹Bechtel Corporation, Mining & Metals Technology, P.O. Box 193965, San Francisco, CA 94119-3965 USA

Effect of ZnO, Cu₂S and CaO on Viscosity: C. M. Acuna¹; J. Jara¹; C. Hu¹; F. Parada²; ¹Chuquicamata Division, Codelco-Chile, Chile; ²Universidad de Concepcion, Depto. Ingenieria Metalurgica, Concepcion Chile

Sampling the Shaft of the Olympic Dam Copper Flash Furnace: D. N. Collins¹; F. R. A. Jorgensen¹; W. J. Rankin¹; ¹CSIRO Minerals, P.O. Box 312, Clayton South, Vic 3169 Australia

Slag Chemistry of the New Noranda Continuous Converter: E. Carissimi¹; M. Zamalloa²; ¹Noranda Inc., Horne Smelter, C.P. 4000, Rouyn-Noranda, QC J9X 5B6

Laboratory Reduction of Copper Slag by Graphite Electrodes Using Direct and Alternating Current: Eric John Grimsey¹; Ismail Dal¹; Nan Li¹; ¹WA School of Mines - Curtin University, PMB 22, Kalgoorlie, WA 6430 Australia

Behaviour of Copper Matte Particles in Suspension Oxidation: Esa J. Peuraniemi¹; Ari Jokilaakso²; Juha Jarvi³; ¹Helsinki University of Technology, Lab. of Mats. Proc. and Powder Metall., P.O. Box 6200, Espoo FIN-02015 Finland; ²Outokumpu Engineering Contractors Oy, P.O. Box 862, Espoo 02201 Finland; ³Outokumpu Research Oy, P.O. Box 60, Pori FIN-28101 Finland

Automatic Quantitative Mineralogy Applied to Copper Slags: E. A. Siegel¹; P. D. Siegel¹; ¹University of Chile, Dept. of Mining Eng., Chile

Numerical and Experimental Modeling of the Concentrate Burner in a Flash Smelt Furnace: F. Guevara¹; A. Valencia²; R. Fuentes¹; ¹Codelco-Chile, Institute for Innovation in Mining and Metallurgy (IM2), Avenida del Parque 4980, Ciudad Empresarial, Hucchuraba Santiago, Chile

The Effect of Minor Components and Flux Additions on the Liquidus Temperatures of the Multi-Component Iron Silicate Slags: Florian Kongoli¹; ¹Flogen Technologies, P.O. Box 49529, C.P. Du Muse, Montreal, Quebec H3T2A5 Canada

A Waterless Caster for Matte/Slag Granulation: Frank Mucciardi¹; Enzo Palumbo²; Ning Jin¹; ¹McGill University, Dept. of Metall. Eng., 3610 University, Montreal, Quebec H3A 2B2 Canada; ²Noranda Technology Centre, 240 Hymus, Pointe Claire, Quebec H9R 1G5 Canada

Extending Lance Life in Top Blowing: Frank Mucciardi¹; Ning Jin¹; ¹McGill University, Dept. of Metall. Eng., 3610 University, Montreal, Quebec H3A 2B2 Canada

Technology for Decreasing Refractory Wear on Mitsubishi Process: Fundamental Researches and Their Applications: Fumito Tanaka¹; Hideya Sato¹; Nozomu Hasegawa¹; ¹Mitsubishi Materials Corporation, Central Research Institute, 1-297 Kitabukuro-cho, Omiya, Saitama 330-8508 Japan

Improvements to the El Teniente Slag Cleaning Process: *Gerardo Achurra*¹; P. Echeverria¹; T. Utigard³; A. Warczok²; G. Riveros²; C. Diaz²; ¹Codelco Chile, Div. el Teniente, Millan 1020, Caletones Smelter, Rancagua Chile; ²Universidad de Chile, Dept. Ingenieria de Minas, Santiago Chile; ³University of Toronto, Dept. of Metall. and Mats. Sci., Toronto, Ontario Canada

Dissolution of Copper and Nickel in FeO_x-SiO₂ Base Slag Equilibrated with Copper-Nickel-Iron Matte under High Partial Pressures of SO₂: *Jonkion Marcos Font*¹; Ghasem Roghani²; Mitsuhisa Hino¹; Kimio Itagaki¹; ¹Tohoku University, Institute for Advanced Mats. Proc., Katahira 2-1-1, Sendai, Miyagi, Aoba Ku 980-8577 Japan; ²The University of Queensland, Dept. of Mining, Min. & Mats. Eng., QLS 4072, Brisbane Australia

Quantification of the Dynamics of the Flash Smelter: *J. H. Groeneveld*¹; I. H. Bonekamp¹; M. A. Reuter¹; G. Gopos²; P. Kuhn²; A. Lossin²; P. Willbrandt²; ¹TU Delft, Dept. of Raw Mats. Proc., The Netherlands; ²Norddeutsche Affinerie Aktiengesellschaft, Hovestrasse 50, Hamburg D-20639 Germany

Modelling of Slag-Skimming in a Peirce-Smith Converter: *Jong Leng Liow*¹; George E. Assaad¹; Petar Liovic¹; Murray Rudman²; Neil Boon Gray¹; ¹The University of Melbourne, Dept. of Chem. Eng., Parkville, Victoria 3052 Australia; ²CSIRO, Div. of Bldg., Constr. and Eng., P.O. Box 56, Graham Rd., Highett, Victoria 3190 Australia

Dynamic Modeling of Copper Losses in Slag: *J. W. Matousek*¹; ¹JW Technologies, LLC, 8547 East Araphahoe Rd., Greenwood Village, CO 80112-1430 USA

Studies on the Reactivity of Copper and Nickel Mattes under Suspension Smelting Conditions: *Johanna Tiina Sjöblom*¹; Jukka Yli-Penttilä¹; Ari Jokilaakso²; ¹Helsinki University of Technology, Dept. of Mats. Sci. and Rock Eng., P.O. Box 6200, Espoo FIN-02015 HUT Finland; ²Outokumpu Engineering Contractors Oy, P.O. Box 862, Espoo FIN-02201 Finland

Some Aspects on Matte Settling in Copper Smelting: *Kim Olof Fagerlund*¹; Heikki Jalkanen¹; ¹Helsinki University of Technology, Lab. of Metall., Vuorimiehentie 2, PL 6200, Espoo FIN-02015 TKK Finland

Ferritic-Calcium Slags for Copper Autogenous Smelting and Their Corrosion Effect on Refractories: *Karel Tomasek*¹; Jan Simko²; ¹Technical University of Kosice, Faculty of Metall., Letna 9, Kosice Slovakia; ²Copper Smelter, Ltd., Krompachy Slovakia

One Step Forward, Two Steps Back: Crackpots, Charlatans and Metallurgical Absurdities in the Development of Smelting Technology: *Larry M. Southwick*¹; ¹L. M. Southwick & Associates, 992 Marion Ave., Suite 306, Cincinnati, OH 45229 USA

Interaction Between a Gaseous Vertical Descending Jet and a Liquid Surface - A Theoretical and Experimental Study: *L. Salinas*¹; R. Fuentes¹; ¹Codelco-Chile, Institute for Innovation in Mining and Metallurgy (IM2), Avenida del Parque 4980, Ciudad Empresarial, Hucchuraba Santiago Chile

SKS Copper Smelting Process in China: *Li Cheng*¹; Wang Jianming¹; Wang Zhongshi¹; Jiang Jimu¹; Huang Qixing¹; ¹Beijing Central Design and Research Institute for Non-ferrous Metallurgical Industries, St. 12 Fuxing Ave., Beijing 100038 China

Direct Reduction of Copper-Iron Oxide Melts: Michel Paul Allibert¹; Roberto Andrés Parra²; Igor Wilkomirsky²; ¹CNRS, ENSEEG, P.O. Box 75, St Martin d'Heres 38402 France; ²Universidad de Concepción, Dept. Ing. Metalúrgica, Edmundo Larenas 270, Concepción Chile

A Fluid Dynamic Simulation of a Teniente Converter: *M. Rosales*¹; R. Fuentes¹; P. Ruz¹; J. Godoy¹; ¹Codelco-Chile, Institute for Innovation in Mining and Metallurgy (IM2), Avenida del Parque 4980, Ciudad Empresarial, Hucchuraba Santiago Chile

Flowsheet Development of the Single Stage Copper Making Process: *M. Somerville*¹; T. Norgate¹; W. Bruckard¹; E. Frazer¹; S. Jahanshahi¹; ¹GK Williams CRC for Extractive Metallurgy, CSIRO Minerals, P.O. Box 312, Clayton South, Victoria 3169 Australia

Corrosion Testing of Chrome-Free Refractories for Copper Production Furnaces: *Mark E. Schlesinger*¹; Michael D. Crites¹; ¹University of Missouri-Rolla, Dept. of Metall. Eng., 1870 Miner Circle, Rolla, MO 65409-0340 USA

Process Modeling for On-Line Furnace Control: *Marielle A. S. Siraá*¹; Alastair L. Davies¹; Philip J. Gabb¹; A. J. Weddick²; ¹Rio Tinto Technical Services, P.O. Box 50, Castlemead, Lower Castle St., Bristol BS99 7YR UK; ²Kennecott Utah Copper, Smelter, 12000 West 2100 South, Magna, UT 84044 USA

Single Furnace Coppermaking: A Challenge for the 21st Century: *Nickolas J. Themelis*¹; ¹Columbia University, Earth Engineering Center, 500 West 120th St., New York, NY 10027 USA

Methods to Increase Productivity in Copper Metallurgical Complexes: *Oswaldo A. Bascari*¹; J. P. Kennedy¹; ¹OSI Software, Inc., Houston, TX and San Leander, CA USA

Numerical Modeling of Heat Transfer in a Smelter Ladle, With and Without a Refractories Lining: *P. Ruz*¹; M. Rosales¹; R. Fuentes¹; J. Averous²; ¹Codelco-Chile, Institute for Innovation in Mining and Metallurgy (IM2), Avenida del Parque 4980, Ciudad Empresarial, Hucchuraba Santiago Chile; ²Ecole des Mines de Paris, Corps Techniques de l'Etat, 60 Blvd. St. Michel 75272, Paris, Cedex 06 France

Comparative Productivity and Quality Evaluation of Different Gas Cooling Methods in a Concentrate Copper Smelter: *Rene Bustamante*¹; Jaime Fernandez¹; ¹Universidad de Santiago de Chile, Depto. Ingenieria Metalurgica, P.O. Box 10233, Casilla, Santiago Chile

Gases Capture, Cooling and Cleaning in Copper Concentrate Smelters: *Rene Bustamante*¹; Claudio Dodds²; Sergio Carrasco²; ¹Universidad de Santiago de Chile, Depto. de Ingenier'a Metallurgica, P.O. Box 10233, Casilla, Santiago Chile; ²Coprim Ingenieria S. A., Av. hlanda 1158, Santiago Chile

Desulphurization Kinetics of Semi-Blister Copper: *Ralph Harris*¹; John Roumeliotis¹; ¹McGill University, Dept. of Mining and Metall. Eng., Rm. 2220 Wong Bldg., 3610 University St., Montreal, Quebec H3A 2B2 Canada

Dynamic Simulation of the Flash Smelting Furnace in the Chagres Smelter: *Roberto Parada*¹; Rene Bustamante²; ¹Chagres Smelter; ²Universidad de Santiago del Chile, Departamento de Ingenieria Metalurgia, Casilla 10233, Santiago Chile

Oxidation of Copper Matte by Gas Injection: *Ron Hiram Schone-wille*¹; James M. Toguri²; ¹Falconbridge, Ltd., Metall. Tech. Group, Falconbridge, Ontario P0M 1S0 Canada; ²University of Toronto, Dept. of Metall. and Mats. Sci., 184 College St. W., Toronto, Ontario M5S 1A4 Canada

Software for the Analysis of Flash Smelting Process Data: *Serban Motoiu*¹; ¹Institute for Nonferrous and Rare Metals, Heavy Metals Lab., B-dul Biruintei 102, Bucharest 73957 Romania

A Non-Linear Mathematical Model of a Copper Flash Smelting Furnace: *V. M. Sanchez*¹; Pedro Flores²; Jose Adolfo Valera³; ¹Universidad de Sonora, Depto.de Ingeniería Química y Metalurgia, Calle 3 y Ave. 4 #86, Fracc. Bugambilias, Hermosillo, Sonora CP 83140 Mexico; ²Universidad de Sonora, Depto. de Matemáticas, Rosales y Luis Encinas, Colonia Centro, Hermosillo, Sonora 83000 Mexico; ³Universidad de Sonora, Depto. de Ingeniería Química, Rosales y Luis Encinas, Colonia Centro, Hermosillo, Sonora 83000 Mexico

Copper Solubility in SiO₂-CaO-FeO_x Slag Equilibrated with Matte: *Yoichi Takeda*¹; ¹Iwate University, Dept. of Mats. Sci. and Eng., 4-5-3 Ueda, Morioka 020-8551 Japan

ENVIRONMENT & SAFETY

Coordinators: Melinda R. L. Pon, BHP Copper Inc., 550 California St., San Francisco, CA 94104-1020; Hans Gopfert, Chile

The Role of Ecosystem Management in Resolving Environmental Issues for Multinational Mining Companies: *Douglas P. Reagan*¹; ¹URS Greiner Woodard-Clyde, 4582 South Ulster St., Suite 1000, Denver, CO 80237 USA

The Use of Gracilaria Chilensis Biomass for Heavy Metals Adsorption in a Mining Waste Water: *F. Rios*¹; M. Sanchez¹; F. Vergara¹; ¹Universidad de Concepcion, Edmundo Larenas 270, Dept. of Metall. Eng., Concepcion Chile

Tailings Impoundments Management of The Zambian Experience: *G. M. Beene*¹; P. Chisanga¹; A. Mpishi¹; ¹Nikana Smelta, Dept. of Metall., Kitwo, Zambia

The Development of Environmental Regulations in Poland and its Influence on the Copper Industry: *Helena Byrdziak*¹; Jerzy Dobrzariski¹; Jan Garbaczewski¹; ¹KGHM Polska Miedz S.A., 59-300 Lubin, ul. M. Skjodowskiej 48 Poland

Selecting an Economical and Safe Tailings Disposal System: *Han Ilhan*¹; Peter Stauffer¹; Ely Robinsky²; Pedro Repetto¹; ¹URS Griener/Woodard-Clyde, 4582 South Ulster St., Suite 1000, Denver, CO USA; ²E.I. Robinsky Associates, Ltd., Toronto Canada

Uptake of Copper from Extremely Dilute Aqueous Solutions by Alginate Sorbent Material: An Alternative for Environmental Control: *Ibanez Juan Patricio*¹; Umetsu Yoshiaki¹; ¹Tohoku University, Institute for Adv. Mats. Proc., Katahira 2-1-1, Aoba-ku, Sendai, Miyagi-ken 981-8577 Japan

Human Health Assessment: An Ever-Moving Target: *Jenifer S. Heath*¹; ¹URS Greiner Woodward-Clyde, 4582 South Ulster, Suite 1000, Denver, CO 80237 USA

Hernan Videla Lira Copper Smelter Fulfillments of Environmental Regulations: *Jose Sanhueza*¹; Orlando Rojas¹; Ariel Balocchi¹; ¹Empresa Nacional De Minería, Paipote Chile

Development and Implementation of a Common International System for Safety and Health Management at Corporate Mining Operations: *Kyle B. Dotson*¹; ¹BHP Copper, Dept. of Safety, Health and Environ., 550 California St., 5th Floor, San Francisco, CA 94104 USA

Potential Use of Electron Beam Irradiation for SO₂ Abatement from Diluted Metallurgical Off-Gases: *Loreto Villanueva*¹; Luis Ahumada²; ¹Commission Chilena de Energía Nuclear, Santiago Chile

The Challenges Posed by Mine Closure in Chile: *M. E. Andia*¹; G. E. Lagos¹; ¹Catholic University of Chile, Vicuna, Mackenna 4860, Santiago Chile

International Health and Environmental Regulations for Metals: New Challenges for Copper: *Ricardo Badilla-Ohlbaum*¹; Gustavo F. Lagos²; ¹Chilean Mining & Metallurgy Research Centre (CIMM), Avda Parque A Rabat 6500, Vitacura, Santiago Chile; ²Catholic University of Chile, Centre for Mining, Vicuna Mackenna 4860, Santiago Chile

The New Paradigm: ISO 14000 and Its Place in Regulatory Reform: *Robert A. Reiley*¹; ¹RD 2, Box 2225, Orwigsburg, PA 17961 USA

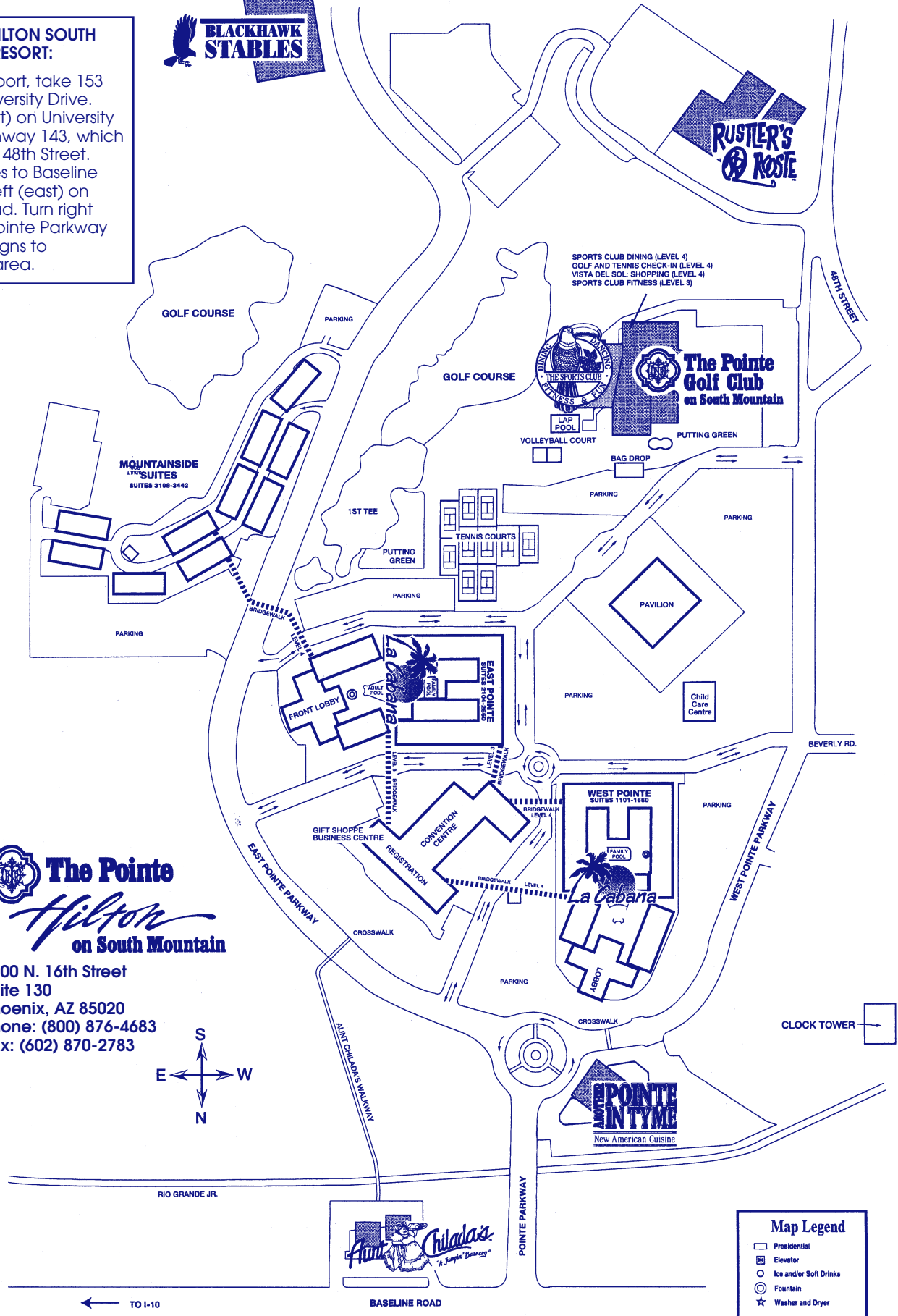
Environmental Problems and Effluent Treatment in the Chilean Copper Industry: *S. H. Castro*¹; M. A. Sanchez¹; F. Vergara¹; ¹The University of Concepcion, Dept. of Metall. Eng., Edmundo Larenas 270, Concepcion Chile

Closure of Mining Operations: *Ximena Massone Quiroz*¹; ¹Chilean Copper Commission, Chile

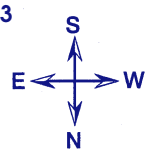
Arsenic Management in Copper Smelting: *Norbert L. Piret*¹; ¹Piret & Stolberg Partners, Consulting Engineers, Im Licht 12, Duisburg D-47279 Germany

TO POINTE HILTON SOUTH MOUNTAIN RESORT:

From the airport, take 153 South to University Drive. Turn left (east) on University Drive to Highway 143, which will become 48th Street. Follow 4 miles to Baseline Road. Turn left (east) on Baseline Road. Turn right (south) on Pointe Parkway and follow signs to registration area.



7600 N. 16th Street
Suite 130
Phoenix, AZ 85020
Phone: (800) 876-4683
Fax: (602) 870-2783



Map Legend	
	Presidential
	Elevator
	Ice and/or Soft Drinks
	Fountain
	Washer and Dryer

TMS

Minerals • Metals • Materials

184 Thorn Hill Road • Warrendale, Pennsylvania 15086 USA

NON-PROFIT
ORGANIZATION
U.S. POSTAGE
PAID
WARRENDALE, PA
PERMIT NO. 16