

COPPER 2003 / COBRE 2003

Final Circular - Registration Information

TECHNICAL PROGRAM

Plenary Lectures

Economics

Applications

Health, Environment and Sustainable Development

Mineral Processing

Hermann Schwarze Symposium: Pyrometallurgy

Electrorefining and Electrowinning

Hydrometallurgy

5th
International
Conference

POST CONFERENCE TECHNICAL TOURS

Codelco's El Teniente Division

Codelco's Andina Division

ENAMI's Las Ventanas Smelter and Refinery

Los Pelambres Mine and Mill

Doña Inés de Collahuasi, Quebrada Blanca and Cerro Colorado

El Tesoro, Radomiro Tomic and San Pedro de Atacama

Codelco's Chuquicamata Division and Alto Norte Smelter

Escondida, Mantos Blancos, Mejillones Port, Chuquicamata and San Pedro de Atacama

SHORT COURSES

Combustion and Gas Injection Techniques

Hydrometallurgy of Copper

Process Management

Environmental Issues in the Mining and Metallurgical Industries

November 30 - December 3, 2003

Sheraton Santiago Hotel - Convention Center

Santiago, Chile

SITE & TECHNICAL INFORMATION

Date and Venue

Copper 2003–Cobre 2003 will be the fifth in a series of international conferences devoted to the economics, the mineral processing, the extractive metallurgy, the environment and the applications of copper. The 1987 and 1995 conferences were hosted by Chile, whereas the 1991 and 1999 conferences were held, respectively, in Ottawa, Canada and Phoenix, USA. The present conference, the first of the new millennium, will take place from November 30th to December 3rd, 2003 in the Sheraton Santiago Hotel and Convention Center (www.sheraton.cl), Santiago, Chile.

Following a tradition established in 1987, Copper 2003–Cobre 2003 will be organized by the Chilean Institute of Mining Engineers (IIMCH) and the Metallurgical Society of the Canadian Institute of Mining, Metallurgy and Petroleum (MetSoc of CIM). These conferences represent a unique opportunity for exchanging knowledge, ideas and experiences among the participants. The conference publications have become highly valuable reference material for the copper industry.

Technical Program

The Copper 2003–Cobre 2003 technical program will commence at 8:30 AM on Monday, December 1, 2003 and conclude at 5:00 PM on Wednesday December, 2003. Over 300 oral presentations are expected. Additional details regarding the technical program can be found on the conference web page. (www.cu2003.cl)

Letter of Invitation

The Copper 2003–Cobre 2003 Organizing Committee will issue letters of invitation to individuals requiring such a document for visa purposes. Such letters, though, do not commit the Copper 2003–Cobre 2003 Organizing Committee to provide financial support. Each participant is expected to pay the conference registration fee.

If you need a letter of invitation, fax, e-mail or mail your request to:

Dr. Gustavo Lagos
Chairman Organizing Committee
Centro de Minería, Pontificia Universidad Católica de Chile
Vicuña Mackenna 4860, Santiago, Chile
Fax: 56 2 686 5805
[e-mail: info@cu2003.cl](mailto:info@cu2003.cl)

Mr. Raúl Fuentes
Manager
Encomenderos 260 / Of. 31
Phone: 56 2 246 1615
Fax: 56 2 246 6387
[e-mail: rfuentes@cu2003.cl](mailto:rfuentes@cu2003.cl)

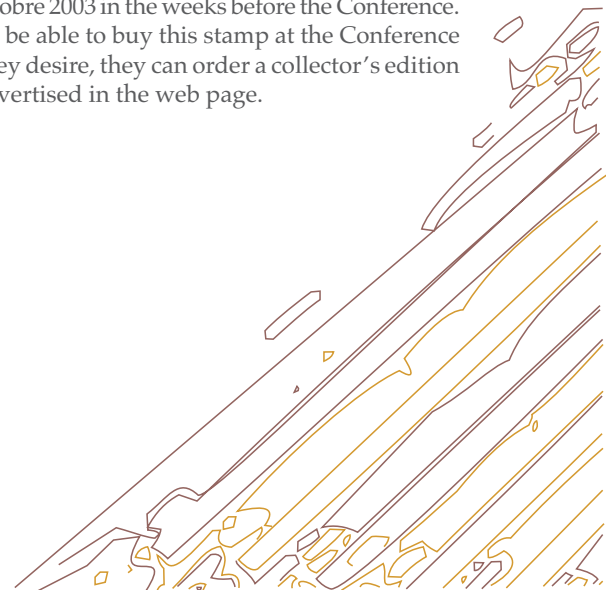
Publication

Six volumes, consisting of eight books, 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.

- Volume 1:** *Plenary Lectures, Economics, and Applications of Copper.*
- Volume 2:** *Health, Environment and Sustainable Development.*
- Volume 3:** *Mineral Processing.*
- Volume 4:** *Pyrometallurgy I and II;*
- Volume 5:** *Electrorefining and Electrowinning;*
- Volume 6:** *Hydrometallurgy I and II.*

Postage - Stamp

The Chilean Post Office will issue a postage-stamp with Copper 2003–Cobre 2003 in the weeks before the Conference. Attendees will be able to buy this stamp at the Conference and, should they desire, they can order a collector's edition that will be advertised in the web page.



REGISTRATION & HOUSING INFORMATION

Copper 2003-Cobre 2003 attendees, including authors, session chairs and exhibitors are required to register. To register, please complete the web Registration Form (<http://www.cu2003.cl>). Full payment of your total fees using a credit card must accompany your registration. If you choose not to register via the web, return the attached Advance Registration Form to:

Instituto de Ingenieros de Minas
Conference Copper 2003-Cobre 2003
Encomenderos 260, oficina 31
Las Condes
Santiago, Chile
Phone: 56 2 246 1615, Fax: 56 2 246 6387
e-mail: registration@cu2003.cl

*Contact: Raúl Fuentes
Manager Copper 2003
e-mail: rfuentes@cu2003.cl

Social Program

Sunday, November 30, 2003
Welcoming Reception 7:00 PM-9:00 PM

Tuesday, December 2 2003
Conference Banquet 8:00 PM-10:00 PM

Accommodation

The Headquarters' hotel and the site for Copper 2003-Cobre 2003 are the Sheraton Santiago Hotel and Convention Center, Santiago, Chile.

Additional details regarding other possibilities of hotel accommodation can be found in the Conference web page.

2

In the latter case, you are still required to pay your total fees using a credit card. If you have to use other means of payment, please contact us beforehand at registration@cu2003.cl

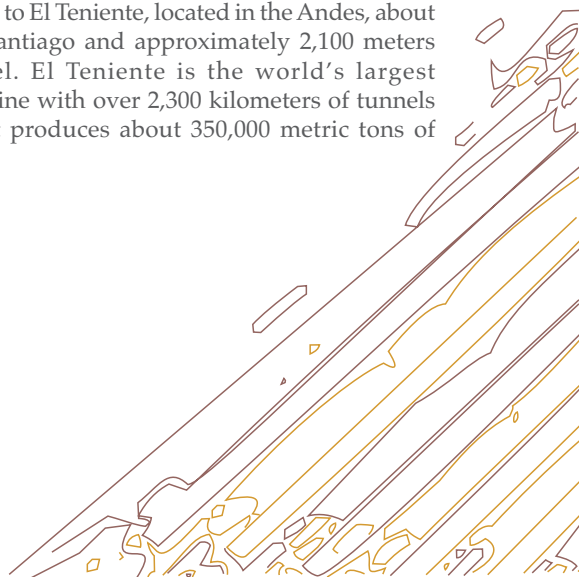
INDUSTRIAL TOURS

Tours will depart from and return to the Sheraton Santiago Hotel and Convention Center. Space is limited on each individual tour. Reservations will be accepted on a first-come basis. The Organizing Committee 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 tour prices are given in US dollars.

Tour 1 - Codelco's El Teniente Division: Colon Mill and Caletones Smelter

Thursday, December 4, 2003; one-day tour / US\$ 90 per person.

Morning: By bus to El Teniente, located in the Andes, about 120 km SE of Santiago and approximately 2,100 meters above sea level. El Teniente is the world's largest underground mine with over 2,300 kilometers of tunnels and galleries. It produces about 350,000 metric tons of copper per year.



The visit includes the mineral processing and smelting installations.

Afternoon: Visit surrounding areas, and return to Sheraton Santiago Hotel and Convention Center.

Tour 2 - Codelco's Andina Division: Open Pit and Mill

Friday, December 5, 2003; one-day tour / US\$ 90 per person

By bus to Los Andes, located 120 kilometers north of Santiago. On the way it is possible to visit the "Chacabuco" monument that commemorates a battle of Chile's war of independence from Spain. The trip continues up the Andes Mountains to the Andina Mill, an underground concentrator, and the open pit mine. The altitudes of the mill and the open pit are respectively 2,500 and 4,500 meters above sea level. The concentrator treats approximately 64,500 metric tons of ore per day.

Return to Santiago in the evening.

Tour 3 - ENAMI's Las Ventanas Smelter and Refinery

Thursday, December 4, 2003; one-day tour / US\$ 90 per person.

Morning: Las Ventanas Smelter and Refinery is located on Chile's Pacific coast about 200 km northeast of Santiago. The Smelter's nominal annual processing capacity is 400,000 metric tons of copper bearing materials. The Refinery's cathode annual production is 315,000 metric tons.

Afternoon: Visit Viña del Mar, Chile's main sea resort. It is also possible either to visit Nobel laureate Pablo Neruda's house in Valparaiso or to climb Valparaíso's hills to enjoy a magnificent view.

Tour 4 - Los Pelambres Mine and Mill, Salamanca

Thursday, December 4, 2003; one-day tour / US\$ 320 per person

Morning: Fifty-minute flight from Santiago to Minera Los Pelambres, located north of Santiago. Visit the mill, located at 3,600 meters above sea level. The mill processes between 114,000 and 120,000 metric tons of ore per day. The mine is at 3,600 meters above sea level.

Afternoon: Visit the Puerto Punta Chungo installations. Return to Santiago.

Tour 5 - Doña Inés de Collahuasi, Quebrada Blanca and Cerro Colorado

Thursday, December 4 - Sunday, December 7, 2003; four-day tour / US\$ 950 per person

Day 1: Afternoon: Transfer to Santiago Airport. Flight from Santiago to Iquique, a port located in Chile's First Region, at about 1,800 km north of Santiago.

Day 2: Morning: Travel by bus to the Collahuasi installations, 185 kilometers southeast of Iquique at an altitude of 4,400 meters above sea level.

Visit to the mill that has a daily processing capacity of 60,000 metric tons of ore, and to the oxide plant, that has an annual grade A cathode production capacity of 50,000 metric tons.

Afternoon: Transfer to Quebrada Blanca by bus. The trip takes 20 minutes. This is a leach-SX-EW operation that produces 75,000 metric tons of cathodes per year.

Return to Iquique in the evening.

Day 3: Morning: By bus to Compañía Minera Cerro Colorado, located 120 kilometers east of Iquique. This operation produces 97,000 metric tons of copper per year.

Day 4: Morning: Transfer to Iquique's airport and flight back to Santiago.

Tour 6 - El Tesoro, Radomiro Tomic and San Pedro de Atacama

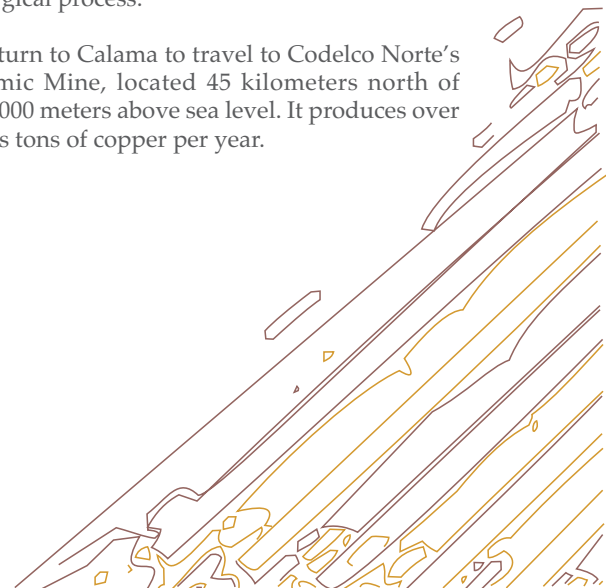
Thursday, December 4, 2003- Saturday, December 6, 2003; three-day tour / US\$ 800 per person

Day 1: Afternoon: Transfer to Santiago Airport and flight to Calama, approximately two-hour flight.

Day 2: Morning: One and a half hour trip to El Tesoro, passing through the driest desert in the world, the Atacama Desert.

This mine, located 2,100 meters above sea level, has been in operation for over two years and it produces around 75,000 metric tons of high quality cathodes via a hydrometallurgical process.

Afternoon: Return to Calama to travel to Codelco Norte's Radomiro Tomic Mine, located 45 kilometers north of Calama and 3,000 meters above sea level. It produces over 260,000 metric tons of copper per year.



Travel to San Pedro de Atacama, located 100 kilometers east of Calama.

Day 3: Morning: Very early visit to the Tatio Geysers. Tour of San Pedro de Atacama and its surroundings. This town, located in the Second Region's high plateau, is considered Chile's archaeological capital. With over 470 years of history, a walk through the town is recommended as well as a visits to the Church, built in the 15th century, and the Padre Gustavo Le Paige Museum. Here, you can learn about the history of the Atacamenean people, native of the zone and founders of the so-called "San Pedro Culture".

Afternoon: Trip to Calama and flight back to Santiago.

Tour 7 - Codelco's Chuquicamata Division and Alto Norte Smelter

Thursday, December 4, 2003- Friday, December 5, 2003; two-day visit / US\$ 700 per person.

Day 1: Morning: Transfer to Santiago airport and two hour flight to Calama. Check in at the hotel and transfer to Chuquicamata by bus. The mine is 2,800 meters above sea level and it produces over 640,000 metric tons of copper per year.

Afternoon: Complete visit of Chuquicamata's installations and the remains of the camp, which should disappear by the end of 2003 due to environmental reasons.

Dinner and lodging at the hotel in Calama.

Day 2: Morning: Bus trip to Antofagasta, two-hour travel through the Atacama Desert. Visit the Altonorte Smelter installations, property of Noranda Inc. The smelter treats around 820,000 metric tons of concentrate per year.

Afternoon: Transfer to Cerro Moreno airport in Antofagasta and flight back to Santiago.

Tour 8 - Escondida, Mantos Blancos, Mejillones Port, Chuquicamata and San Pedro de Atacama.

Thursday, December 4 – Monday, December 8, 2003; five-day tour / US\$ 1,300 per person

Day 1: Afternoon: Transfer to airport and flight to Antofagasta.

Day 2: Morning: Trip to Minera Escondida, located 160 kilometers southeast of Antofagasta and 3,050 meters above sea level. Escondida is the mine with the biggest copper production in the world today. Complete visit to Escondida's installations.

Afternoon: Return to the city of Antofagasta.

Day 3: Morning: Bus trip to Empresa Minera Mantos Blancos, 45 kilometers northeast of Antofagasta. Since 2001, it features a leaching process. Its total production is approximately 100,000 metric tons per year.

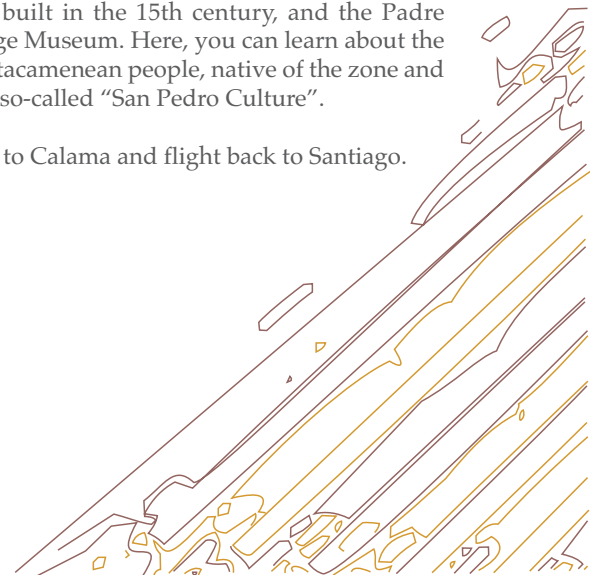
Afternoon: Visit to the Complejo Portuario of Mejillones, where you can see the first of five general loading and containers terminals. It will have a transference capacity of two million metric tons per year, designed for copper handling and general loading. Return to the city of Antofagasta and flight to Calama.

Day 4: Morning: Bus trip to Codelco Norte's Chuquicamata mine, located 15 kilometers north of Calama and 2,800 meters above sea level. It produces over 640,000 metric tons of copper per year.

Transfer to San Pedro de Atacama, located 100 kilometers east of Calama.

Day 5: Morning: Very early visit to the Tatio Geysers. Tour of San Pedro de Atacama and its surroundings. This town, located in the Second Region's high plateau, is considered Chile's archaeological capital. With over 470 years of history, a walk through the town is recommended as well as a visits to the Church, built in the 15th century, and the Padre Gustavo Le Paige Museum. Here, you can learn about the history of the Atacamenean people, native of the zone and founders of the so-called "San Pedro Culture".

Afternoon: Trip to Calama and flight back to Santiago.



SHORT COURSES

Four short courses will be offered immediately prior to the conference, starting on Saturday, November 29, 2003. All courses include simultaneous English-Spanish translation. The courses will take place at the Sheraton Santiago Hotel and Convention Center. All courses include a buffet luncheon. Please review the following course descriptions and determine which course(s) would best benefit you and your colleagues.

You are encouraged to register early for the short courses by using the enclosed Copper 2003- Cobre 2003 Registration Form on the conference web site. Short course registrations received before the October 31, 2003 will have a US\$ 50 discount.

Cancellation Policy: The Organizing Committee reserves the right to cancel any course having a low pre-registration. All pre-registered attendees will be notified of the cancellation and offered either a transfer to another short course or a full refund.

Refund Policy: Written requests must be sent to shortcourse@cu2003.cl. A US\$ 50 processing fee will be charged for all cancellations; this processing fee is separate from, and in addition to, the fee charged for the cancellation of conference registrations. No refunds will be issued after the October 31, 2003.

“Combustion and Gas Injection Techniques”

Saturday, November 29, 2003-Sunday, November 30, 2003 / US\$ 500 per person.

Course Content: The objective of this course is to provide a greater understanding of combustion and gas injection techniques in metallurgical processes. Combustion fundamentals will be reviewed and burner technologies presented with specific examples of air-fuel and oxy-fuel combustion. The dynamics of submerged gas injection and

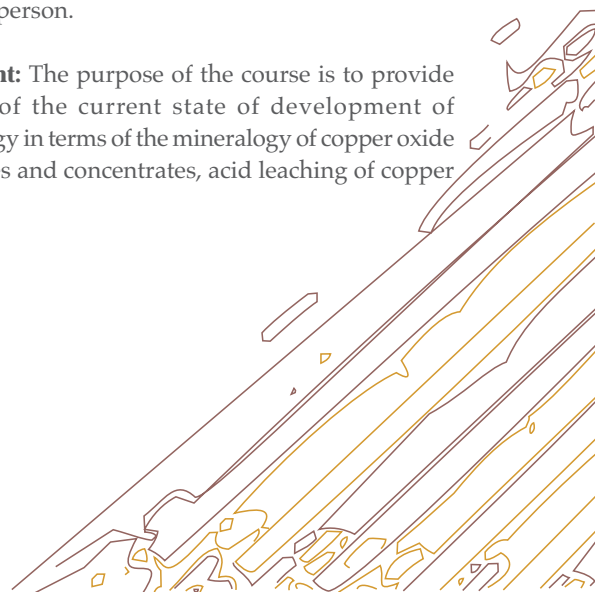
lancing techniques will be explored including such topics as bubbling and jetting regimes (low versus high pressure), single-pipe tuyere injection, concentric-pipe shrouded injection, high oxygen enrichment, accretion growth modelling, subsonic versus supersonic lancing, and tuyere and nozzle design. The theoretical concepts of both combustion and injection will be illustrated by various industrial demonstration and implementation examples. Emphasis is on applications for the non-ferrous industries, more particularly for converting and refining processes. The modes of production and supply of oxygen, nitrogen, argon and hydrogen will also be reviewed with reference to economical aspects. Notions of flammability of gas mixtures and safe handling of industrial gases will be presented. Ample opportunity for questions and discussion will be provided in addition to an Open Forum at the conclusion of the course.

About the Presenter: Joël Kapusta, holder of a Ph.D. in Process Metallurgy (University of British Columbia, Canada), joined Air Liquide Canada in 1995 and has since been involved with the development of innovative gas injection techniques, primarily for non-ferrous pyrometallurgy applications, and their implementation at North American smelters. Dr. Kapusta also holds a B.Sc. in Applied Geology and a M.Sc. in Mineral Processing. He worked for several years in Europe in the fields of mineral processing, process metallurgy and by-products reclamation.

“Hydrometallurgy of Copper”

Saturday, November 29, 2003-Sunday, November 30, 2003 / US\$ 500 per person.

Course Content: The purpose of the course is to provide an overview of the current state of development of hydrometallurgy in terms of the mineralogy of copper oxide and sulfide ores and concentrates, acid leaching of copper



ores, bioheap leaching of sulfides, solvent extraction recovery of copper, and new developments in the hydrometallurgical treatment of copper concentrates.

Experts on the different topics will present an in depth lecture on their specific area of expertise. In addition, representatives from selected industrial plants have been invited to provide an overview of their operations and to discuss specific problems and their solutions. A panel discussion by the presenters is planned at the conclusion of the short course.

About the Presenters:

Speakers to be confirmed

Copper Mineralogy: Oxide and Sulfide Ores and Concentrates

Jorge Menacho
Codelco Chile / De Re Metallica Ingeniería Ltda., Chile
Acid Leaching of Copper Ores; Solvent Extraction Recovery of Copper

Esteban Domic
Universidad de Chile, Chile
Bioheap Leaching of Sulfides

Christian Hecker
Universidad de Concepción, Chile
The Electrowinning of Copper

Dave Dreisinger
University of British Columbia, Canada
New Developments in the Hydrometallurgical Treatment of Copper Concentrates

Diego Verdejo
Minera El Tesoro, Chile
Case Study 1: Copper Oxide Leach SX-EW

Luis Veloso
Compañía Minera Cerro Colorado, Chile
Case Study 2: Copper Sulfide Heap Leach SX-EW

Tom Lancaster
Western Metals, Canada
Case Study 3: The Mt. Gordon Copper Process

“Process Management”

Saturday November 29, 2003-Sunday, November 30, 2003 / US\$ 500 per person.

Course Content: The operation of mining and metallurgical systems requires professionals with management competencies in addition to those in the hard technological disciplines. This enables them to view each production step as a link in the mining-refining-marketing chain. A holistic view of systems permits the identification of inefficiencies and the prioritization of the actions required to attain productivity improvements.

The course focuses on concepts of optimum operation and the practical application of techniques for identifying and quantifying the causes leading to the wasteful use of production resources. The focus is techno-economic and presents mining-metallurgical systems as a business.

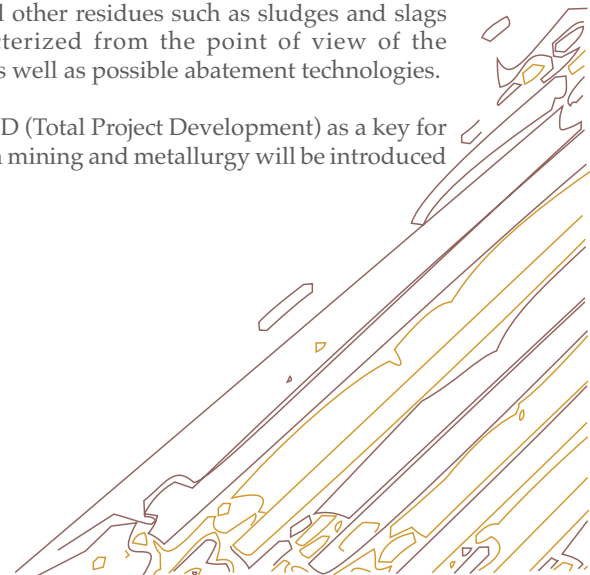
About the Presenter: The course will be presented by Carlos Landolt (Min. Eng. U. Chile; M.Sc., Ph.D. Pennsylvania State University). Dr. Landolt has more than 40 years of experience in the non-ferrous industry, including university lecturing, basic and applied research, process development and plant experience in Chile and in Canada. At present he is Adjunct Professor in the School of Engineering at Laurentian University in Canada, where he teaches Operations Management (MBA) and Process Management and Productivity (M.Eng.). He has been a visiting Professor at the Mining Department, University of Chile since 1995.

“Environmental Issues in the Mining and Metallurgical Industries”

Saturday, November 29, 2003-Sunday, November 30, 2003 / US\$ 500 per person

Course Content: The course will give an overview of world copper production by both pyrometallurgical and hydrometallurgical processes. Copper production from primary and secondary sources and the associated environmental effects will be analysed. Effluents containing SO₂, dust, metal compounds, organic compounds, wastewater and other residues such as sludges and slags will be characterized from the point of view of the contaminants as well as possible abatement technologies.

Concepts on TPD (Total Project Development) as a key for sustainability in mining and metallurgy will be introduced



and explained. Special attention will be given to arsenic and dioxines produced during primary and secondary extraction, as well as disposal and/or destruction techniques for these species.

Examples of Best Available Techniques (BAT) for copper production and the identification of hierarchies in the choice of new processes will be presented. Emissions to air will also be discussed. Summaries of the sources and treatment/abatement options, together with overviews of the chemical treatment methods for some gaseous components, will be given.

The use of BAT for gaseous effluents will be emphasized. Overviews of BAT for wastewater streams and general process residues will also be provided.

About the Presenters: Mario Sánchez is a Doctor of Engineering, Institut National Polytechnique, Grenoble, France, and is presently Professor at the Metallurgy Department of the University of Concepción, Chile. Edita Vircikova holds a Doctoral Degree from the Technical University, Kosice. She is presently Professor at the Technical University, Faculty of Metallurgy, Institute of Metallurgy and Materials, Kosice, Slovakia.

COMPANIONS PROGRAM

The Companions Program has been customized to enhance the Copper 2003-Cobre 2003 conference experience. To register, please complete the Advance Registration Form on the web site or in this mailer and return it to the Organizing Committee. Tour tickets will be included in your Advance Registration Packet available at the Copper 2003-Cobre 2003 registration desk at the meeting. Please note that reservations will be handled on a first-come, first-serve basis.

Pre-registration for the tour program will have the deadline of October 31, 2003. Tours will not be scheduled unless sufficient pre-registration is received. Therefore, please make your reservation early.

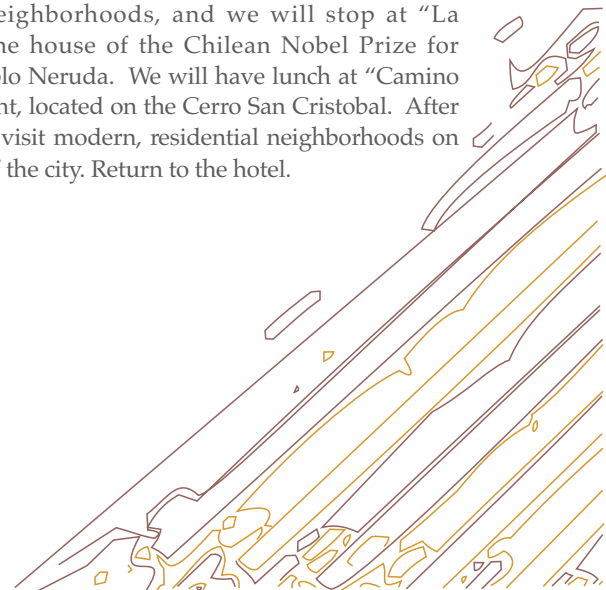
All tours will originate from the Sheraton Santiago Hotel and Convention Center. Prices indicated include transportation, lunch, and a bilingual guide.

Tour 1: "City Tour: Santiago Downtown and East Side"

Monday, December 1st, 2003, 9:00 A.M. - 7:00 P.M. /
US\$ 100 per person.

Santiago, Chile, a surprising city with modern steel and glass buildings, has a history of over four and a half centuries. Although Chile has always been looking toward the future, a few decades ago it focused on a search for its historical roots, and tourists may currently visit old palaces and churches of colonial times, as well as modern neighborhoods that show Chile's modern development. This is the framework in which you can discover the history of our country.

You can walk along the Plaza de Armas and its surroundings, you will then have a guided visit of the Precolombian Art Museum, the Barrio Cívico and the La Moneda Palace, the house of government. You will also have the chance to taste delicious natural fruit juices at the Hotel Carrera. We will continue our tour with a panoramic visit of the República and Brazil neighborhoods, and we will stop at "La Chascona", the house of the Chilean Nobel Prize for Literature, Pablo Neruda. We will have lunch at "Camino Real" restaurant, located on the Cerro San Cristobal. After lunch we will visit modern, residential neighborhoods on the east side of the city. Return to the hotel.



Tour 2: “Visit to Sewell and Santa Rita Winery”

Tuesday, December 2, 2003, 8:00 A.M. - 7:00 P.M. / US\$ 110 per person.

Sewell is located within the boundaries of the El Teniente Mine, the largest underground mine in the world, with over two thousand kilometres of tunnels. In Sewell you will witness two important aspects of Chilean geography and history: the Andes Mountains and copper mining. Because of the town’s original urban development, it has been presented to UNESCO for its consideration to be included in the list of the select group of cities that form part of the World Heritage. In 1992, on the occasion of the celebration of the Fifth Centennial of America’s discovery, Sewell was chosen an emblematic city together with Teotihuacan, Mexico; Sucre, Bolivia, and Brazilia, Brazil.

Sewell was founded in 1904 to start exploiting El Teniente’s natural wealth. With the years, its magnificent Central Stairway became a public “plaza” or the meeting place of 20,000 people. The town became the residence for American engineers as well as for peasants of the “Hacienda de la Compañía” who attracted by Sewell’s high salaries started working as miners.

We will stop for lunch at Viña Santa Rita, where you will have a chance to become acquainted with Chilean winemaking tradition.

Return to the hotel in the evening.

Tour 3: “The Chilean Pacific Coast: A Visit to Valparaíso”

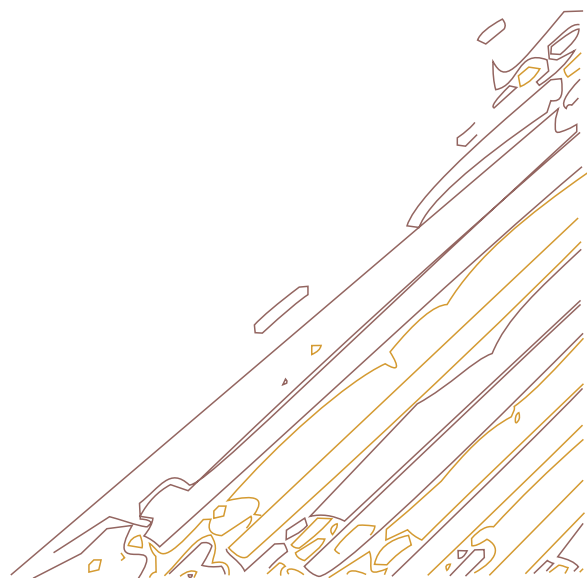
Wednesday, December 3, 2003, 8:30 A.M.- 8:00 P.M. / US\$ 70 per person.

Valparaíso, located 120 kilometers north-west of Santiago, is the capital of Chile’s Region V, and the country’s main port.

During the XIX century Valparaíso was Chile’s principal city. The English-inspired, wooden architecture dates back to those days, when the British Empire – through its protected companies – managed from Valparaíso the navigation of its fleet towards Australia and India. At present the city is the seat of the Chilean Parliament.

Bus trip to Valparaíso, where we will start with a visit of the Docks and Port. We will then continue with the city’s downtown, including the Plaza Sotomayor, Prat street and the “Bar Inglés”. We will also visit Lukas house, getting there by the famous Valparaíso old funicular cars, the city’s most popular means of transportation. We will stop for lunch and visit the “Open Air” Museum and “La Sebastiana”, one of the houses of the Chilean Literature Nobel Laureate, Pablo Neruda.

Return to Santiago by bus.



CONFERENCE REGISTRATION FORM

WEB

Take advantage of the convenience of on-line pre-registration via Conference Web Site
<http://www.cu2003.cl>
 To: Eng. Raúl Fuentes P. Attn.: Conference Registration
 e-mail: registration@cu2003.cl
Web registration requires credit card payment

FAX

Fax this form to IIM/Ch:
 Copper 2003 - Cobre 2003
 Fax : 56 2 246 6387
 Phone : 56 2 246 1615
 To: Eng. Raúl Fuentes P.
Fax registration requires credit card payment

MAIL

Return this form with payment to:
 Instituto de Ingenieros de Minas
 Encomenderos 260, oficina 31
 Las Condes, Santiago, Chile
 To: Eng. Raúl Fuentes P.

**ADVANCE REGISTRATION DEADLINE: October 31, 2003
 PAYMENT MUST ACCOMPANY FORM**

Forms received past this date will be processed at the on site fee structure Instructions: Check your selections, and fill in the necessary information.

Please Print or Type

Dr. Prof. Mr. Mrs. Ms.

This Address is: Home Business

New Address Address Correction

Surname _____ First Name _____ Middle Initial _____
 Job Title: _____ Employer: _____
 Address: _____ City: _____
 State / Province: _____ Zip / Postal Code: _____
 Telephone: _____ Country _____ Area / City _____ Local Number _____
 E-mail Address: _____ Fax: _____ Country _____ Area / City _____ Local Number _____
 Accompanying Person Name for Badge: _____

REGISTRATION FEES:

<input type="checkbox"/> Full Conference* Member: <input type="checkbox"/> IIMCH <input type="checkbox"/> CIM	Advance Fees to 31 Oct.03	Fees after 31 Oct. 03
<input type="checkbox"/> Full Conference* Non - members	\$575	\$695
<input type="checkbox"/> Retired - Full Conference**	\$625	\$695
<input type="checkbox"/> Student - Full Conference** (A copy of your School identification card must accompany this form)	\$250	\$300
	\$150	\$225

SHORT COURSES FEES:

<input type="checkbox"/> Combustion and Gas Injection Techniques	Advance Fees to 31 Oct.03	Fees after 31 Oct. 03
<input type="checkbox"/> Hydrometallurgy of Copper	\$500	\$550
<input type="checkbox"/> Process Management	\$500	\$550
<input type="checkbox"/> Environmental Issues in the Mining and Metallurgic Industries	\$500	\$550

INDUSTRIAL TOURS FEES:

Tour	Price	Number	Total
<input type="checkbox"/> Tour 1: Codelco's El Teniente Division: 4 Dec.2003	\$90		\$
<input type="checkbox"/> Tour 2: Codelco's Andina Division: 5 Dec.2003	\$90		\$
<input type="checkbox"/> Tour 3: ENAMI's Las Ventanas Smelter and Refinery: 4 Dec. 2003	\$90		\$
<input type="checkbox"/> Tour 4: Los Pelambres Mine and Mill: 4 Dec.2003	\$320		\$
<input type="checkbox"/> Tour 5: Doña Inés de Collahuasi, Quebrada Blanca and Cerro Colorado: 4-7 Dec. 2003	\$950		\$
<input type="checkbox"/> Tour 6: El Tesoro, Radomiro Tomic and El Abra: 4-6 Dec. 2003	\$800		\$
<input type="checkbox"/> Tour 7: Codelco's Chuquibambilla Division and Alto Norte Smelter: 4-5 Dec. 2003	\$700		\$
<input type="checkbox"/> Tour 8: Escondida, Mantos Blancos, Mejillones Port, Chuquibambilla and San Pedro de Atacama: 4-8 Dec. 2003	\$1300		\$

PUBLICATION VOLUMES: Will be available for pick-up at the meeting

<input type="checkbox"/> Volume 1: Plenary Lectures, Economics and Applications of Copper Development	\$120		\$
<input type="checkbox"/> Volume 2: Health, Environment and Sustainable Development	\$120		\$
<input type="checkbox"/> Volume 3: Mineral Processing	\$100		\$
<input type="checkbox"/> Volume 4: Pyrometallurgy I & II (2 books)	\$200		\$
<input type="checkbox"/> Volume 5: Electrometallurgy and Electrowinning	\$120		\$
<input type="checkbox"/> Volume 6: Hydrometallurgy I & II (2 books)	\$200		\$
<input type="checkbox"/> 6 Volume Set	\$745		\$

SOCIAL FUNCTION TICKETS: Additional tickets

<input type="checkbox"/> Welcoming Reception, 30 Nov. 2003	Fee	Number	Total
<input type="checkbox"/> Banquet, 2 Dec. 2003	\$60		\$60
<input type="checkbox"/> Luncheon Package, 1-3 Dec.	\$70		\$70

COMPANIONS PROGRAM - TOURS FEES

<input type="checkbox"/> Tour 1: City Tour: Santiago DOWNTOWN 1 Dec. 2003	Fee	Number	Total
<input type="checkbox"/> Tour 2: City Sewell and Santa Rita Winery, 2 Dec. 2003	\$100		\$100
<input type="checkbox"/> Tour 3: The Coast of The Pacific Ocean, 3 Dec. 2003	\$110		\$110
<input type="checkbox"/> Tour 3: The Coast of The Pacific Ocean, 3 Dec. 2003	\$70		\$70

TOTAL FEES:

REGISTRATION	\$
SHORT COURSES	\$
INDUSTRIAL TOURS PUBLICATIONS	\$
SOCIAL FUNCTION TICKETS	\$
COMPANIONS PROGRAM TOURS	\$
TOTAL PAYMENT	\$

PAYMENT OPTIONS: Credit Card

Visa Master Card Diners Club American Express

Card No.: _____ Exp.: _____

Cardholder Name (print): _____ Signature: _____

* Full Conference includes luncheons and Welcoming Reception
 ** The first 50 people registered will be granted full conference rights.

REFUND POLICY: Written request must arrive to IIMCh, no later than 31 Oct. 2003.
 A \$50 processing fee will be charged for all registration and/or short course cancellations.



COPPER 2003 / COBRE 2003 HOTEL RESERVATION FORM

November 30 - December 3, 2003

PLEASE COMPLETE THE FORM BELOW AND MAIL OR FAX TO:

Mrs. Claudia López, Copper 2003 / Cobre 2003
Attn: Hotel Reservation Cu2003
Encomenderos 260, Piso 3 / Las Condes, Santiago, Chile
Phone: 56 2 3353766 / Fax: 56 2 2337277
e-mail: reservation@cu2003.cl

*For further information on Copper 2003 / Cobre 2003 visit our website:
www.cu2003.cl*

Please Print or Type

Arrival Date: _____ Flight N°: _____ Departure Date: _____ Flight N°: _____

Sharing With: _____

Dr. Prof. Mr. Mrs. Ms.

Name: _____ *Payment Enclosed: CREDIT CARD*

Firm: _____ Card N°: _____

Address: _____ Expiration Date: _____

City / State / Zip: _____ Visa Master Card

Telephone: _____ American Express Diners

Country Area / City Local Number

Fax: _____ Signature: _____

Country Area / City Local Number

- All prices in US\$Dollars
- Room Tax (VAT) 18% / Foreign guests who pay their accounts in US\$Dollars, traveler's checks or international credit card emitted outside Chile, will be exempt of the 18% VAT surcharge.
- If your flight arrives to Santiago before 9:00 AM, we suggest you make your reservation from the night before.
- Participants must return this form as soon as possible, due to hotels in Santiago have great demand (high season).
- Allow two weeks for processing. You will receive a confirmation letter from the Copper 2003 secretariat.
- All rates include breakfast.

PLEASE NOTE: CHECK - IN TIME IS 3:00 PM AND CHECK - OUT TIME IS BEFORE 4:00 PM
All reservations must be guaranteed by two night's room with a credit card

Sheraton Santiago (Site Hotel) 5* *If Sheraton Santiago is one of your choices please FILL OUT SPECIAL FORM BELOW*

Sheraton Santiago
Site Hotel
SPECIAL FORM

	Before 30 Sept.	After 30 Sept.
<input type="checkbox"/> Standard Single/Double	\$135	\$145
<input type="checkbox"/> Executive Floor Single/Double	\$165	\$175
<input type="checkbox"/> Standard Suite Single/Double	\$360	\$360
<input type="checkbox"/> Grand Deluxe Single/Double	\$195	\$205
<input type="checkbox"/> Executive Suite Single/Double	\$460	\$460

Indicate your hotel preference in order: first, second and third choice. Return this form by September 30, 2003.

OTHER HOTELS OPTIONS

CHOICE			SINGLE	DOUBLE
<input type="checkbox"/>	Hotel Hyatt	5*	\$145	\$145
<input type="checkbox"/>	Hotel The Ritz - Carlton Santiago	5*	\$215	\$215
<input type="checkbox"/>	Santiago Marriott Hotel	5*	\$150	\$150
<input type="checkbox"/>	Hotel NH Ciudad de Santiago Suites	4*S	\$130	\$130
<input type="checkbox"/>	Hotel Neruda	4*S	\$120	\$120
<input type="checkbox"/>	Santiago Park Plaza Hotel	4*S	\$145	\$155
<input type="checkbox"/>	Radisson Royal Santiago Hotel	4*S	\$140	\$140
<input type="checkbox"/>	Director Suites Santiago	4*	\$100	\$110
<input type="checkbox"/>	Four Points by Sheraton Santiago	4*	\$105	\$105
<input type="checkbox"/>	Hotel Torremayor	4*	\$ 90	\$ 90
<input type="checkbox"/>	Atton Santiago Hotel	3*	\$ 87	\$ 87
<input type="checkbox"/>	Hotel Providencia	3*	\$ 90	\$ 90
<input type="checkbox"/>	Hotel Los Españoles	3*	\$ 85	\$ 85
<input type="checkbox"/>	Plaza El Bosque Apart Hotel	-	\$100	\$100

- All reservations must be guaranteed by the first night with a credit card.
- Check-in time is 1:00 PM and check-out time is 12:00 Noon.



PRELIMINARY TECHNICAL PROGRAM

Plenary Lectures

Copper Promotion and Industry Strategy: J. Villarzú, President of International Copper Association, Chile.

Copper in Human Health: R. Uauy, University of Chile and University of London.

The Chilean Copper Industry: Challenges and Opportunities: W. Hayes, President of Consejo Minero, Chile.

Novel Applications in Copper: N. Brodersen, CEO, KM Europa Metal AG, Germany.

The Forces that Shape the Copper Industry: S. Payton, Secretary General of the IWCC, United Kingdom.

Knowledge, Technology and Profit: C. Twigge-Molecey, Hatch Associates, Canada.

Economics

Business

Project Financing in Mining: *L.F. Saenz*¹; ¹Standard Bank London, Peru.

Taxation Incentives for Mining Investment: *J.L. Caty*¹; ¹Ministry of Natural Resources Quebec, Canada.

Measuring Innovation in Copper Mining and Metallurgy: *D. Louit*¹; *G. Lagos*¹; *A. Bertens*¹; Pontificia Universidad Católica de Chile, Chile.

Engineering Methodology to Approach Hydrometallurgical Small Plants Projects: *C. Avendaño*¹; ¹Sociedad Terral S.A., Chile.

Hydrometallurgy and the Techno-Economic Factors at Play: *J.R. Kuramoto*¹; Grupo de Análisis para el Desarrollo (GRADE), Peru.

Is There a Single Pattern of Reaction to Price Shocks in the Chilean Copper Industry?: *N. Altamirano*¹; ¹Tskububa University, Japan.

New Paradigms to Improve the Economic Value in the Copper Pyrometallurgy Industry: *R. Moraga*¹; *R. Parada*¹; *R. Parra*²; ¹Compañía Minera Disputada de Las Condes, Chile; ²Universidad de Concepción, Chile.

Markets

Long-Run Trends in the Copper Market: *J. Tilton*¹; ¹Pontificia Universidad Católica de Chile, Chile.

Market Strategies of the Main Producers: *J.E. Herrera*¹; ¹Codelco Chile, Chile.

Trends in the Copper Market: *E. Silva*¹; ¹Codelco Chile, Chile.

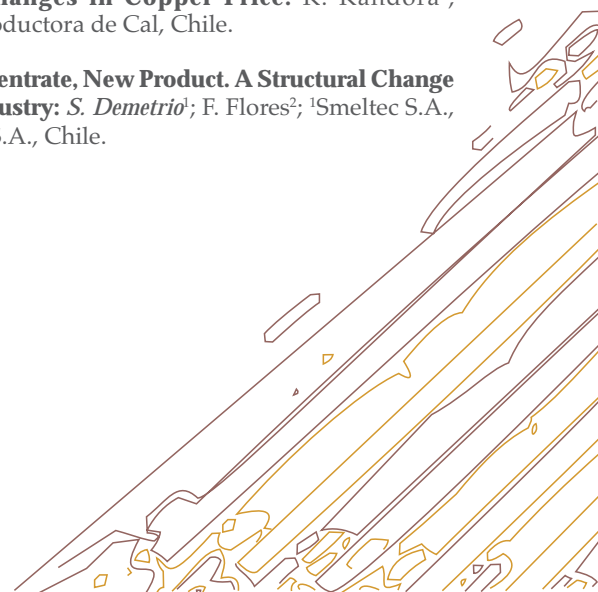
Copper Consumption and Production Trends in Asia: *G.A. Campbell*¹; *D. Galsandorj*²; ¹Michigan Technological University, USA; ²Mongolian Mineral Resources Development Center, Mongolia.

The Role of Brazil in the Copper Market: A 21st Century Supply and Demand Prospects: *E. Vale*¹; ¹Bamburra, Brazil.

Scenarios for Copper Supply and Demand in the XXI Century: *G.E. Lagos*¹; *H. Henríquez*¹; Pontificia Universidad Católica de Chile, Chile.

Structural Changes in Copper Price: *K. Kandora*¹; ¹Compañía Productora de Cal, Chile.

Plateado Concentrate, New Product. A Structural Change in Copper Industry: *S. Demetrio*¹; *F. Flores*²; ¹Smeltec S.A., Chile; ²Agesa S.A., Chile.



Integrated Models

Imitation-Optimizing Planning of Winning Operations at Open Casts: *D. Bukeikhanov*¹; U. Dzhalkaganov¹; B. Bekmurzayev¹; M.Z. Zhanasoz²; B.D. Lerman³; T.G. Gabdullin³; ¹National Center of the Republic of Kazakhstan, Kazakhstan; ²NOVA-Trading & Commerce AG, Kazakhstan; ³Altynalmas, Kazakhstan.

Optimizing Long Term Planning for Underground Copper Mines: *R. Epstein*¹; F. Caro¹; J. Catalán¹; P. Santibáñez¹; A. Weintraub¹; S. Gaete²; ¹Universidad de Chile, Chile; ²Codelco Chile, Chile.

Strategic Planning Models: *R. Jerez*¹; ¹Mineral Industry Consultants, USA.

Integrated Planning in the Mining Business: *J. Camus*¹; F. Azócar¹; ¹Codelco Chile, Chile.

Optimal Long Term Planning at El Teniente Mine: *O. Araneda*¹; S. Gaete¹; F. de la Huerta¹; L. Zenteno¹; ¹Codelco Chile, Chile.

Statistical Multivariate Analysis and Dynamics Monitoring for Plant Supervision Improvement: *M. Orchard*¹; L. Yachter¹; ¹CONTAC Ingenieros Ltda., Chile.

Improving Metallurgical Performance: Advances in Operations and Production Management: *O. Bascur*¹; A. Soudek¹; ¹OSI Software Inc., USA.

Advanced Nonlinear Models of Residual Resistivity Ratio of Cryogenic Grade Copper: *A. Bulsari*¹; H. Rajainmäki²; O. Naukkarinen²; ¹Nonlinear Solutions Oy, Finland; ²Outokumpu Poricopper Oy, Finland.

Process Improvements: Identification and Quantification: *C.A. Landolt*¹; ¹Laurentian University, Canada.

Applications

Emerging Technologies

The Die-Cast Copper Motor Rotor - A New Copper Market Opportunity: *D.T. Peters*¹; J.G. Cowie¹; E.F. Brush¹; ¹Copper Development Association Inc., USA; ²BBF Associates, USA.

Production of Copper Alloy Parts Via Semisolid Metal Forming: *D.T. Peters*¹; K.P. Young²; C.S. Rice²; J.G. Cowie¹;

E.F. Brush³; ¹Copper Development Association Inc., USA; ²Vforge Inc., USA; ³BBF Associates, USA.

Fabrication and Testing of Copper Canisters for Long Term Isolation of Spent Nuclear Fuel, Recent Developments: *L.O. Werme*¹; C.G. Andersson¹; ¹Svensk Kärnbränslehantering AB (SKB), Sweden.

High Purity Copper for Semiconductor Applications: *F. Ojebuoboh*¹; H.T. Michaels²; ¹Asarco, Inc., USA; ²Copper Development Association, USA.

Development of a New Lead-Free Copper-Base Alloy for Permanent Mold Casting: *J. Thomson*¹; M. Sadayappan¹; M. Sahoo¹; ¹CANMET, Canada.

Design and Process Parameters for Permanent Mold Cast Copper Base Alloys: *F.A. Fasoyinu*¹; M. Sadayappan¹; M. Sahoo¹; ¹CANMET, Canada.

How Copper Alloys Can Improve Plastics Injection Molded Parts Productivity and Quality: *H.T. Michels*¹; P.V. Engelmann²; K. Hayden²; D.T. Peters¹; R. Dealey³; ¹Copper Development Association Inc., USA; ²Western Michigan University, USA; ³Dealey's Mold Engineering, USA.

Environmental Issues

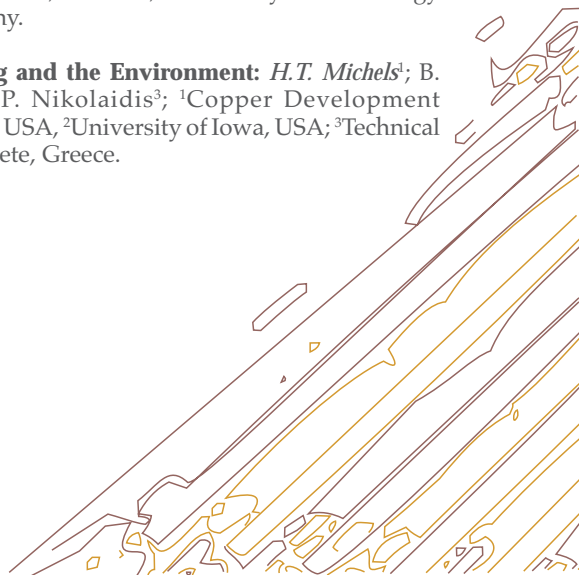
The Effect of Selected Anions on the Formation of Patina on Copper Artificially: *M. Llavona*¹; A.M. Fernández¹; J.L. Ibáñez¹; R. Zapico¹; ¹University of Oviedo, Spain.

Effect of the Exposed Copper Area/Volume of the Solution Ratio on the Corrosion of Copper: *M. Llavona*¹; A.M. Fernández¹; J.L. Ibáñez¹; R. Zapico¹; ¹University of Oviedo, Spain.

Copper Corrosion Resistance in Solutions that Simulate the Underground Water in a Swedish Nuclear Repository: *I. Escobar*¹; C. Silva¹; E. Silva¹; L.O. Werme²; ¹Comisión Chilena de Energía Nuclear, Chile; ²Svensk Kärnbränslehantering AB (SKB), Sweden.

Utility of Copper as Influencing Parameter for Recycling Processes: *T. Schäfer*¹; T. Pretz¹; ¹University of Technology Aachen, Germany.

Copper Roofing and the Environment: *H.T. Michels*¹; B. Boulanger²; N.P. Nikolaidis³; ¹Copper Development Association Inc., USA; ²University of Iowa, USA; ³Technical University of Crete, Greece.



The Anti-microbial Effects of Copper Alloy Surfaces on the Bacteria E.coli 0157:H7 and New Market Opportunities: *H.T. Michels*¹; S.A. Wilks²; C.W. Keevil²; ¹Copper Development Association Inc., USA; ²University of Southampton, United Kingdom.

Economy

Rational Use of Materials and Technologies in the Bronze Age: *A. Paulin*¹; ¹University of Ljubljana, Slovenia.

Taking the Challenge for Bright Future for Copper: *J. Asteljoki*¹; W. Bartel¹; ¹Outokumpu Oy, Finland.

Some Aspects of the Mechanical Reliability of Copper: *M. Ignat*¹; ¹M INPGrenoble, France.

Current and Future Highlights in the Markets for Copper: *A.C. Lea*¹; ¹International Copper Association, USA.

Copper in the New Economy: *W. Drescher*¹; ¹WHD Consulting, USA.

Technological Development and Copper Consumption a New Paradigm for the 21st Century: *K.J.A. Kundig*¹; ¹Metallurgical Consultant, USA.

Fundamental Aspects

Productivity Improvements at Continuous Casting, Rod Plant of Sterlite Copper at Silvassa: *B.P. Kamath*¹; R. Adiga¹; Sameer Grupta¹; ¹Sterlite Industries (India) Limited, India.

Differential Isothermal Calorimetry of Short-Range-Ordering in aCu-10 a% Al as Influenced by Bound Vacancies: *E. Donoso*¹; A. Varschavsky¹; ¹Universidad de Chile, Chile.

The Connection Between Copper Powder Grade and Its Structure Under Different Electrolysis Conditions: *I.B. Mourashova*¹; K.A. Plekhanov¹; V.V. Ashikhin¹; A.B. Lebed¹; O.V. Trybunsky¹; N.G. Bourhanova¹; ¹Ural Mining Metallurgical Company, UMMC, Russia.

Copper Powder Modified with Silver by Contact Deposition: *K.A. Plekhanov*¹; V.V. Ashikhin¹; A.B. Lebed¹; G.V. Ostarkova¹; I.B. Mourashova¹; ¹UGMK, Uralelectromed, Russia.

Development and Performance of New Dispersion-Precipitation Strengthened Copper-Ceramic Materials Made by Mechanical Alloying and Hot Consolidation: *M. López*¹; V. Vergara¹; C. Camurri¹; J.A. Jiménez²; O. Ruano²; ¹Universidad de Concepción, Chile; ²CSIC Spain, Centro Nacional de Investigaciones Metalúrgicas CENIM, Spain.

Study of Grain Refinement and Hard Spot Formation in Copper-Base Alloys using Thermal Analysis: *J. Thomson*¹; M. Sadayappan¹; M. Sahoo¹; ¹CANMET, Canada.

Impurity Limits in Aluminum Bronze C95800: *M. Sadayappan*¹; M. Sahoo¹; ¹CANMET, Canada.

Performance of Dispersion-Strengthened-Copper Resistance-Welding Electrodes: *R. Palma*¹; A. Sepúlveda¹; R. Montiglio¹; R. Espinoza¹; ¹Universidad de Chile, Chile.

Effect of the Temperature on Copper Powder Particle Size Distribution: *L.A. Almazán*¹; S. Aguayo Salinas¹; J. Lizarraga Delgado¹; ¹Universidad de Sonora, Mexico.

Health, Environment and Sustainable Development

Sustainable Development

Long-Run Perspectives of Global Copper Material Flow: Transition towards Sustainable Development?: *W.R. Poganietz*¹; P. Zapp¹; W. Kuckshinrichs¹; ¹Forschungszentrum Jülich GmbH, Germany.

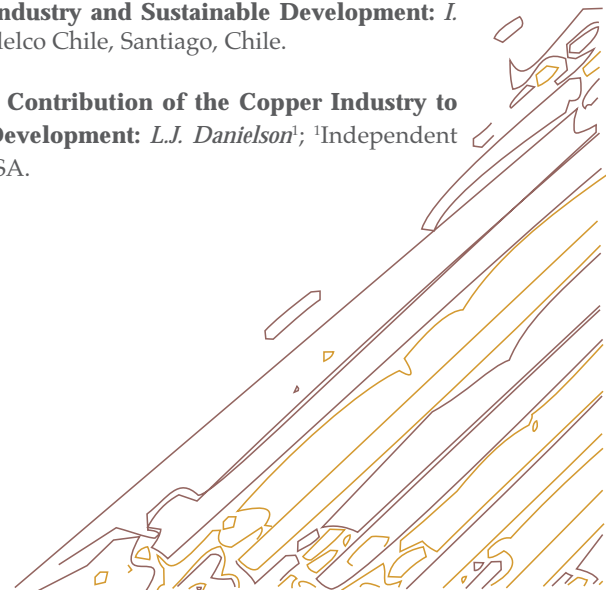
Scenario Analysis of Copper in a Green World: *A. Kapur*¹; T. Graedel¹; ¹Yale University, USA.

Influencing the Resource Requirement in Copper Primary Production by Technique Variation: *T. Müller*¹; B. Friedrich¹; P. Zapp¹; ¹Technical University Aachen, Germany; ²Forschungszentrum Jülich GmbH, Germany.

A Resource-Orientated View on Worldwide Copper Mining: *P.N. Martens*¹; M. Mistry¹; J. Pateiro¹; D. Jennert¹; ¹Aachen University of Technology, Germany.

The Copper Industry and Sustainable Development: *I. Marshall*¹; ¹Codelco Chile, Santiago, Chile.

The Potential Contribution of the Copper Industry to Sustainable Development: *L.J. Danielson*¹; ¹Independent Consultant, USA.



Statistical Entropy Analysis as a Decision-Making and Design Tool in Copper Management: *H. Rechberger*¹; ¹ETH, Swiss Federal Institute of Technology Zurich, Switzerland.

The Information system of the CRC 525: *S. Janser*¹; *R. Hünefeld*¹; *V. Popescu*¹; ¹University of Aachen, Germany.

Collecting Systems for Copper Products: *S. Janser*¹; *A. Seeliger*¹; *R. Hünefeld*¹; ¹University of Aachen, Germany.

Studies On Water Conservation At Caraiba Metais: *J.L. Rodrigues Bravo*¹; ¹Caraiba Metais S.A., Brazil.

Copper in Urban Mining: *D. Wittmer*¹; ¹EAWAG, Swiss Federal Institute for Environmental Science and Technology, Switzerland.

The Contemporary Latin American Copper Cycle: One Year Stocks and Flows: *S. Spatar*¹; *T. Graedel*¹; *M. Bertram*¹; ²D. Vexler; ¹Yale University, USA; ²Environmental Resources Management, USA.

Copper Recovery from Acid Mine Drainage and Metallurgical Streams using Biological Reduction Technology: *R. Lawrence*¹; *D. Kratochvil*¹; *P.B. Marchant*¹; ¹BioteQ Environmental Technologies Inc., Canada.

Application of Ion Exchange Polymers in Acid Mine Drainage: *M. Adams*¹; *W. Jay*²; ¹Lakefield Ore Pty Ltd.; ²Oretek Ltd., Australia.

The Impact of the MMSD Initiative on Sustainable Development in the Mining and Minerals Sector in SA: *M. Hoadley*¹; ¹University of the Witwatersrand, South Africa.

Mining and Sustainable Development: The Case of the Antofagasta Region (Chile): *F. Cortez*¹; ¹Gobierno Regional de Antofagasta, Chile.

Advances Toward an Environmental Sustainability in the Chilean Mining Sector: *A. Valenzuela*¹; ¹Comisión Chilena del Cobre, Chile.

The Scientific Paradigm Change And Its Impact on the Non-Renewal Natural Resources Business: *F. Flores*¹; *S. Demetrio*²; ¹Agesa S.A., Chile; ²Smeltec S.A., Chile.

Mountain Medicine for Sustainable High Altitude Mining: *D. Jimenez*¹; ¹Compañía Minera Doña Inés de Collahuasi, Chile.

Clean Production

Efficient Treatment of Complex Wastewaters at Unimicore Precious Metals Using Biotechnology: *M. Picavet*¹; *H. Dijkman*¹; *J. Boonstra*¹; *C. Buisman*¹; *W. Ghyoot*²; ¹Paques B.V., Netherlands; ²Unimicore, Belgium.

Metals Recovery and Decontamination of Teniente Furnace Dust: *Y. Watanabe*¹; *K. Kojima*²; *C. Peña*³; *B. Diaz*⁴; ¹Mitsui Mining & Smelting Co. Ltd., Japan; ²Metal Mining Agency of Japan, Japan; ³Centro de Investigación Minera y Metalúrgica, Chile; ⁴Empresa Nacional de Minería, Chile.

Ecologically Pure Processing of Copper-Bearing Industrial Sewage: *S. Dyssembayeva*¹; ¹The Chemical-Metallurgical Institute, Kazakhstan.

A Review of Available Flowsheet Options Incorporating Molecular Recognition Technology (MRT) Separation Systems Now Available to the Copper Industry, with Emphasis on Value Recovery from Process, By-product, Waste, and Environmental Streams: *S. Izatt*¹; *N. Izatt*¹; *R. Bruening*¹; *J. Dale*¹; ¹IBC Advanced Technologies Inc., USA.

Environmental Management at Caletones Smelter Codelco Chile, El Teniente Division: *A. Olavarría*¹; *F. Montané*¹; ¹Codelco Chile, Chile.

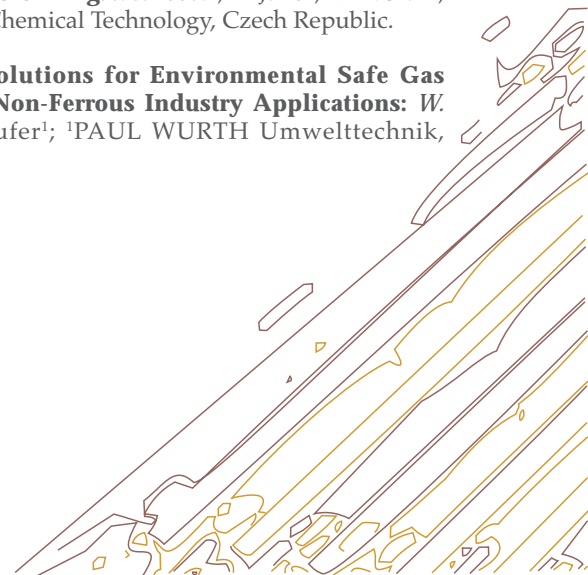
An Integral Arsenical Effluent Stabilization Concept: *E. Román*¹; *F.A. Lagno*¹; *A.C. Gómez*¹; *L.A. Flores*²; ¹Instituto de Innovación en Minería y Metalurgia S.A. (IM2), Chile; ²Codelco Chile, Chile.

Early Adverse Gastrointestinal Effects Associated with Acute Copper Exposure: *M. Araya*¹; *M. Olivares*¹; *F. Pizarro*¹; *R. Uauy*¹; ¹Universidad de Chile, Chile.

Silica Micro Encapsulation Treatment of Heavy Metal Contaminants and Its Potential Contribution to Sustainable Development in the Copper Mining Industry: *P. Mitchell*¹; ¹KEECO UK, United Kingdom.

Separation of Copper and Valuable Metals from Electrical Scrap by Electrorefining: *J. Jandová*¹; *R. Janu*¹; *P. Dvorak*¹; ¹P. Institute of Chemical Technology, Czech Republic.

Paul Wurth Solutions for Environmental Safe Gas Treatment of Non-Ferrous Industry Applications: *W. Bucken*¹; *F. Reufer*¹; ¹PAUL WURTH Umwelttechnik, Luxembourg.



Risk Assessment of Copper in Health and the Environment

Essential Trace Element (ETE) Risk Assessment: A Human Balancing Act: *C. Abernathy*¹; ¹U.S. Environmental Protection Agency, USA.

Copper and Health – Changing Perceptions: *R. Gaunt*¹; ¹Rio Tinto, United Kingdom.

Risk Assessment of Copper in Health: State of the Art and Challenges: *J.M. Donohue*¹; ¹U.S. Environmental Protection Agency, USA.

Copper Databases and the Need for Establishing a Coherent Understanding of Human Exposure to Copper: *P. Liroy*¹; *P. Georgopoulos*¹; *S.W. Wang*¹; *V. Vyas*¹; *I.G. Georgopoulos*¹; *M.J. Yonone-Liroy*¹; ¹EOHHSI, USA.

Copper Biomarkers for Human Health: *M. Araya*¹; *M. Olivares*¹; *M. González*¹; *F. Pizarro*¹; *R. Uauy*¹; ¹Universidad de Chile, Chile.

Copper as a Possible Modulator of Neuronal Excitability: *R. Delgado*¹; *J. Bacigalupo*¹; *O. Alvarez*¹; *D. Wolff*¹; *C. Vergara*¹; ¹Universidad de Chile, Chile.

Regulating Copper in Drinking Water: An Historical Case Study of Data and Processes Used: *G.C. Becking*¹; ¹Phoenix OHC Inc., Canada.

Copper and Copper Alloys In Contact With Drinking Water: The European Perspective: *N. Slaats*¹; ¹K. Water Research, The Netherlands.

Estimating Human Exposure to Copper in Drinking Water: *G.E. Lagos*¹; ¹Pontificia Universidad Católica de Chile, Chile.

Microbiologically Influenced Corrosion of Copper - Exposure, Remedial Treatment and Ways to Avoid It: *P. Arens*¹; *H.G. Tuschewitzki*²; ¹German Copper-Institute, Germany; ²Hygiene-Institute des Ruhrgebiets, Germany.

Does Copper from Copper Pipes Connected to a Public Drinking Water Supply Pose a Health Hazard for Babies?: *H.H. Dieter*¹; *H. Dunkelberg*¹; *B. Zietz*¹; ¹Federal Environmental Agency, Germany.

The Risk Assessment Model and Copper Exposure from Food and Water: *M. Olivares*¹; *M. Araya*¹; *F. Pizarro*¹; *S. de Pablo*¹; *R. Uauy*¹; ¹Universidad de Chile, Chile.

U.S. EPA Science and Policy Trends for Metals in Aquatic Environments: *M. Reiley*¹; ¹U.S. Environmental Protection Agency, USA.

Advances in Ecological Risk Assessment of Copper: *K. Delbeke*¹; *P. Van Sprang*²; ¹European Copper Institute, Belgium; ²Euras, Belgium.

Evaluating Copper Bioaccumulation in Aquatic Risk Assessments: *W. Adams*¹; *K.V. Brix*²; *D.K. De Forest*³; ¹Rio Tinto; ²EcoTox, USA; ³Parametrix, USA.

Application of the Biotic Ligand Model in Developing a Freshwater Acute Criterion for Copper: *C. Roberts*¹; ¹U.S. Environmental Protection Agency, USA.

Biotic Ligand Models for Predicting Chronic Metal Toxicity to Freshwater Organisms and Ecosystems: *C.R. Janssen*¹; *K. De Schampelaere*¹; *D. Heijerick*¹; *B. Bossyut*¹; ¹University of Ghent, Belgium.

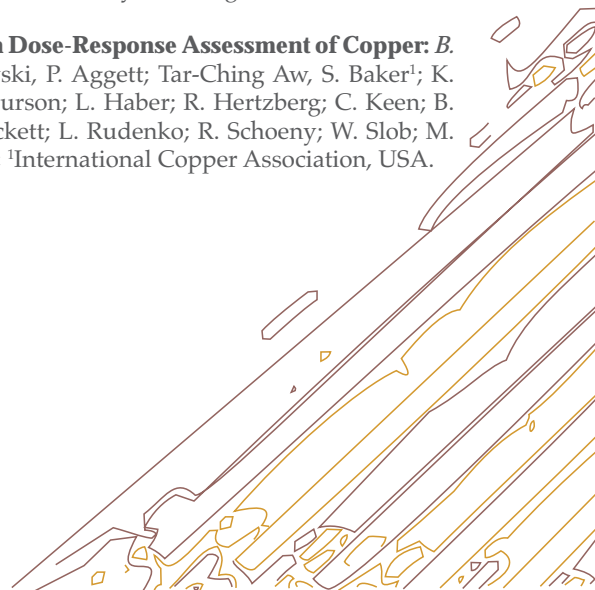
BLM in Fresh and Sea Water in Brazil: *A. Bianchini*¹; ¹Fundação Universidade Federal do Rio Grande, Brazil.

Influences of EDTA and Fulvic Acid on Distribution of Copper in Fresh Water Algae (*Scenedesmus Subspicatus* 86.81 SAG)? An Implication for the Biotic Ligand Model (BLM): *W. Zijian*¹; *M.A. Mei*¹; *Z.H.U. Wangzhao*²; ¹Chinese Academy of Sciences, China; ²TU-Delft, The Netherlands.

Predicting the Risk of Copper to Soil Organisms: *H.E. Allen*¹; *A.A. Ponizovsky*^{1,2}; ¹University of Delaware, USA; ²Russian Academy of Sciences, Russia.

Copper in Chilean Soils and Its Associated Phytotoxic Risks: *R. Ginocchio*¹; *P. Rodríguez*²; *J.C. Torres*³; ¹Pontificia Universidad Católica de Chile, Chile; ²Centro de Investigaciones Mineras y Metalúrgicas, Chile; ³Instituto de Innovación en Minería y Metalurgia (IM2), Chile.

Human Health Dose-Response Assessment of Copper: *B. Stern*; *D. Krewski*, *P. Aggett*; *Tar-Ching Aw*, *S. Baker*¹; *K. Crump*; *M. Dourson*; *L. Haber*; *R. Hertzberg*; *C. Keen*; *B. Meek*; *L. Plunckett*; *L. Rudenko*; *R. Schoeny*; *W. Slob*; *M. Solioz*; *T. Starr*; ¹International Copper Association, USA.



Mineral Processing

Size Reduction

The Mathematical Simulation of Ore Production and Shipment from Various Copper Mines to Preparation Plants: *S.I. Petrovitch*¹; M.A. Faizulin¹; R.G. Smailova¹; N.G. Stukalova¹; V.A. Urumov²; ¹National Center of The Republic of Kazakhstan, Kazakhstan; ²Kazakhmys Corporation, Kazakhstan.

A Hard Look on High Pressure Grinding Rolls for the Copper Industry: *R. Klymwowsky*¹; J. Knecht¹; ¹Polysius AG, Germany.

Nitrogen Inhibition of Grinding Media Corrosion in Copper Mineral Processing Plants: *G. Cifuentes*¹; P. Melani²; ¹Universidad de Santiago de Chile, Chile; ²Indura S.A., Chile.

Assessment and Management of Risk in the Design of the World's Largest Mills: *C. Meimaris*¹; R. Delucchi²; C. Rojas²; C. Lindsay³; V. Svalbonas⁴; F. Moser⁵; J.F. Betolaza⁶; ¹EanD, Australia; ²Compañía Minera Doña Inés de Collahuasi, Chile; ³Noranda, Chile; ⁴Metso Minerals, USA; ⁵ABB Industrie AG, Switzerland; ⁶Alstom Power, Spain.

New Trends in Size Reduction: *C.A. Barahona*¹; O. Alruiz¹; ¹Mineral Engineering Consultants, Gecamin Ltd, Chile.

Equipment Improvements

New Flotation Machines in Polish Copper Industry: *Z. Smieszek*¹; Z. Myczkowski¹; A. Wieniewski¹; B. Skorupska¹; ¹Institute of Non-Ferrous Metals, Poland.

New Concepts in Flotation Machine Design: *D. Lelinski*¹; B. Oblad¹; L. Hales¹; ¹EIMCO Process Equipment, USA.

Mini-Pilot Plant: Extracting Maximum Value From Drill Cores: *V.L. de Lima Andrade*¹; G. Dávila²; ¹Companhia Vale do Rio Doce, Brazil; ²Canadian Process Technologies Inc. CPT, Canada.

Pneumatic Flotation Technology. An Experience in the Chilean Mining Industry: *S.E. Sánchez*¹; R. Imhof²; S.A. Sánchez¹; F. Rojas¹; M. Fernández¹; ¹Ingeniería de Minerales Ltda., Chile; ²Maelgwyn Mineral Service Limited, United Kingdom.

Process Management and Optimization

Twelve Technology Tools to Design and Optimize the Production Chain from Resource to Product: *R. Morrison*¹; P. Cameron¹; ¹University of Queensland, Australia.

Production and Metallurgical Accounting at Minera Antamina, Peru: *L. Fradette*¹; F. Flament¹; ¹Igosys Inc., Canada.

Operation Management Systems: *L. Mundaca*¹; ¹Codelco Chile, Chile.

Flotation Process Characterization

Bubble Size Estimation and Rate Constant Modelling for Copper Rougher Flotation: *G. Vallebuona*¹; C. Suazo¹; A. Casali¹; ¹Universidad de Chile, Santiago, Chile.

Determination of Bubble Surface Load in the Pulp Zone of Industrial Flotation Machines: *D.R. Seaman*¹; J.R. Hernandez-Aguilar²; C.O. Gomez²; ¹University of Queensland, Australia; ²McGill University, Canada.

Measurement of Gas Velocity in Flotation Cells: *C.O. Gomez*¹; J.R. Hernandez-Aguilar¹; P. Voigt¹; J.A. Finch¹; ¹McGill University, Canada.

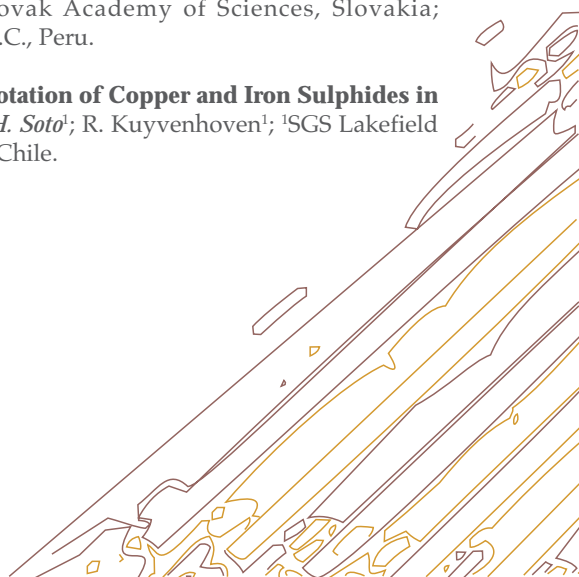
Experience with Bubble Size Measurement in Flotation: *C.O. Gomez*¹; J.R. Hernandez-Aguilar¹; P. Voigt¹; J.A. Finch¹; ¹McGill University, Canada.

Mixing and Effective Pulp Volume in Flotation Equipments: *J. Yianatos*¹; J. Rodríguez²; F. Díaz²; ¹Universidad Federico Santa María, Chile; ²Comisión Chilena de Energía Nuclear, Chile; ³Codelco Chile, Chile.

Flotation Chemistry, Sulphides

Mechanical Activation of Copper Minerals: New Challenges in Extractive Metallurgy: *P. Baláz*¹; C. Villachica²; ¹Slovak Academy of Sciences, Slovakia; ²Consulcont S.A.C., Peru.

Collectorless Flotation of Copper and Iron Sulphides in Acidic Media: *H. Soto*¹; R. Kuyvenhoven¹; ¹SGS Lakefield Research Chile, Chile.



Identification and Quantification of DPG on Chalcocite, Heazlewoodite and Inco Matte: *D. Lascelles¹; J.A. Finch¹;*
¹McGill University, Canada.

Amine-Type Agents in Flotation Sulfides: *J. Laskowski¹;*
¹University of British Columbia, Canada.

Flotation Chemistry, Oxides and Oxidized Surfaces

Electrochemical Processing of the Oxidized Copper Ores: *Z. Tokayeva¹;*
¹The Chemical-Metallurgical Institute, Kazakhstan.

Fundamental Thermodynamic Properties of Oxidized Copper Ores Minerals: *M. Bissengaliyeva¹;*
¹The Chemical-Metallurgical Institute, Kazakhstan

Flotation Character of Polymetallic Copper Ores: *A. Tarasov¹;*
M.I. Mantsevich¹; I.I. Khersonskaya¹; ¹State Research Institute of Non-Ferrous Metals "Gintsvetmet", Russia.

Floatability of Oxidized Copper, Oxidized Chalcocite and Copper Slag Using Octyl Hydroxamate as a Collector: *S. Salmon¹;*
R. Herrera¹; V. Sánchez¹; A. Robles²; ¹Universidad de Sonora, Mexico; ²Mexicana de Cobre S.A. de C.V., Mexico.

Processing of Mineral Sulfide-Oxide Ores: A New Method for their Beneficiation: *V. Conejeros¹;*
J.F. Hevia¹; A. Morales¹; ¹Universidad Católica del Norte, Chile.

Characterization of the Copper Wad in the Samples of Metallurgical Tests from the Deposit of "Extensión Norte Mina Sur" in Chuquicamata: *M. Pinchera¹;*
Ursula Kelm¹; Sonia Helle¹; Ramón Freire²; ¹Universidad de Concepción, Chile; ²Codelco Chile, Chile.

Modelling and Control

On-line Bulk Ore Grades Measurement for Copper Minerals: *N. Heres¹;*
I. Piñeyro¹; L.F. Mujica¹; M.L. Osses²; A. Reghezza²; J.L. Pinault³; ¹Instituto de Innovación en Minería y Metalurgia S.A. (IM2), Chile; ²Codelco Chile, Chile; ³Bureaux de Recherches Géologiques et Minières (BRGM), France.

Flotation Control Using XRF and Potentiometric Pulp Measurements: *V. Morozov¹;*
V. Avdokhin¹; V. Troitski¹; V.

Stolyarov²; N. Konovalov²; ¹Moscow State University of Mining, Russia; ²Private Jt. St. Co. "Elsco", Russia.

Control of Flotation Circuits: *P. Cameron¹;*
M. Vera¹; ¹University of Queensland, Australia.

Bias and Pulp Level Control in Flotation Columns: A Review: *R. Del Villar¹;*
A. Desbiens¹; J. Bouchard¹; ¹Université Laval, Canada.

An Experimental Set-Up for the Study of Supervisory Control of Flotation Columns: *J.F. Huard¹;*
R. Del Villar¹; A. Desbiens¹; ¹Université Laval, Canada.

The Use of the QemSCAN Automated Mineral Analyzer in the Candelaria Concentrator: *M. Kendrick¹;*
J. Marsden²; W. Baum³; G. Wilkie⁴; P. Gottlieb⁴; P. Thompson⁵; ¹Minera El Abra, Chile; ²Phelps Dodge Mining Company, USA; ³Phelps Dodge Process Technology Center, USA; ⁴CSIRO Minerals, USA; ⁵Dawson Metallurgical Labs, USA.

Technological Developments to the Mining Industry: Robotic, Sensors, and New Equipments: *R. Segovia¹;*
H. Salamanca¹; J.P. Tapia¹; L. Baeza¹; ¹HighService Ltd., Chile.

Hermann Schwarze Symposium: The Pyrometallurgy of Copper

Operations

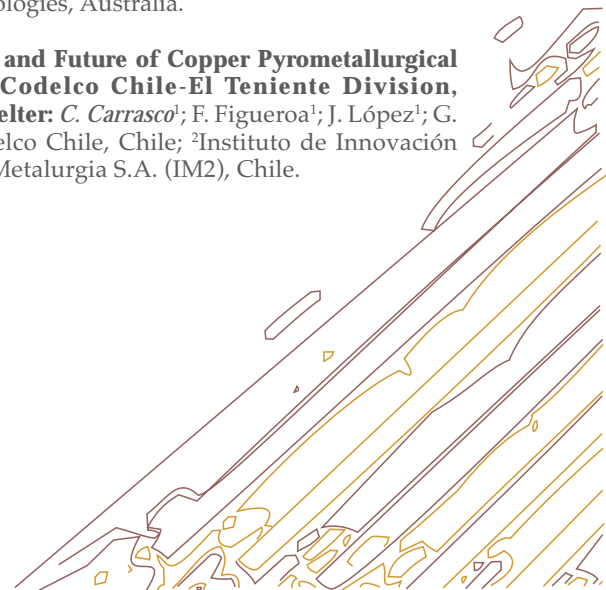
Modernization of the Copper Corporation Ilo Smelter: *M. Herrera¹;*
W. Torres¹; H. Walqui¹; ¹Southern Peru Copper Corporation Ilo, Peru.

Khatoon-Abad Copper Smelter: First Iranian Flash Smelter: *S. Kashani-Nejad¹;*
M. Reza Karami²; M. Hassan Sharif²; J. Khosravi³; McGill University, Canada; ²NICICO, Iran; ³NIPEC, Iran.

Selection and Operation of Indirect Steam Drying of Copper Concentrates at Copper Smelters: *C. Sagedahl¹;*
H. Broenlund¹; Kvaerner Eureka, Norway.

ISASMELT - Not Just a Flash in the Pan: *P. Arthur¹;*
¹MIM Process Technologies, Australia.

Optimization and Future of Copper Pyrometallurgical Refining at Codelco Chile-El Teniente Division, Caletones Smelter: *C. Carrasco¹;*
F. Figueroa¹; J. López¹; G. Alvear²; ¹Codelco Chile, Chile; ²Instituto de Innovación en Minería y Metalurgia S.A. (IM2), Chile.



The Future of Flash Smelting: *P. Hanniala*¹; M. Kytö¹; ¹Outokumpu Technology, Finland.

Natural Gas Firing of Copper Smelting and Melting Operations: *J. Hugens*¹; J. Kondziela¹; ¹North American Manufacturing Company Ltd., USA.

Ausmelt Technology, Copper Production Technology for the 21st Century: *J. Sofra*¹; R. Matuszewicz¹; ¹Ausmelt Ltd., Australia.

Start-Up and Operation of the Modernized Pirdop Smelter: *W. Enrico*¹; P. Wattel²; ¹Umicore Med, Bulgaria; ²Umicore Copper Belgium, Belgium.

Improvement of the Recent Operation of Converter Furnace at Tamano Smelter: *T. Maruyama*¹; N. Furui¹; T. Sunamoto¹; ¹Hibi Kyodo Smelting Co. Ltd., Japan.

Asset Management of Oxygen Plants and Industrial Gas Supplies for Oxygen-enhanced Copper Smelting: *N. Moore*¹; R. Hutchison¹; S. Meholic¹; L. Gluns²; ¹Air Products and Chemicals Inc., USA; ²Air Products GmbH, Germany.

The Influence of Reverb Furnace Smelting Products Composition on Copper and Minor Element Distribution: *N. Mitevska*¹; Z. Zivkovic²; ¹Copper Institute, Yugoslavia; ²University of Belgrade, Yugoslavia.

Storage and Feeding of Dry Copper Concentrates into Bath Smelting Vessels: *P. Chacana*¹; R. Valenzuela²; D. Goodwill³; A. del Campo⁴; F. Cabrejos⁴; ¹Codelco Chile, Chile; ²ENAMI, Chile; ³Jenike & Johanson Ltd., Canada; ⁴Jenike & Johanson Chile, Chile.

Expansion Project and Progress in the Sumitomo Metal Mining Toyo Smelter and Refinery: *Y. Ojima*¹; K. Nagai¹; M. Takebayashi¹; T. Kudo¹; ¹Sumitomo Metal Mining Co. Ltd., Japan.

Development of Autogenous Copper Smelting Processes in Russia and CIS Countries: *A. Tarasov*¹; V.M. Paretsky¹; ¹State Research Institute of Non-Ferrous Metals "Gintsvetmet", Russia.

Blister Copper Production Using Autogenous Smelting of Copper Nickel-Containing Concentrate. Some Peculiarities of the Process: *L.S. Tsemekhman*¹; L.B. Tsybulov¹; A. Tarasov²; M.S. Fedorov¹; D.B. Maksimov¹; ¹Gipronickel Institute, Russia; ²State Research Institute of Non-Ferrous Metals "Gintsvetmet", Russia.

The Phase III Expansion of Altonorte Copper Smelter, Chile: *T. Smith*¹; M. Strachen²; S. Miranda³; J. Arrián³; ¹SNC-Lavalin Europe Ltd., United Kingdom; ²SBC-Lavalin Chile S.A., Chile; ³Noranda Chile Ltda., Chile.

The COP KIN System Part II: Performance and Benefits – A Worldwide Overview: *J. Rigby*¹; A. Filzweiser²; ¹RHI-Canada, Canada; ²RHI-Ag, Non Ferrous, Austria.

Determination of Liquid Phase Levels in Pyrometallurgical Reactors: *C. Acuña*¹; G. Agüero²; ¹Codelco Chile, Chile; ²Universidad Técnica Federico Santa María, Chile.

Slag Treatment at Noranda's Altonorte Smelter: *E. Mast*¹; V. Barrera¹; J. Callejas¹; F. Robles¹; ¹Noranda Chile, Chile.

Copper Smelting in KGHM Polska Miedz S.A.: J. Dobrzanski¹; W. Kozminski¹; ¹KGHM Polska Miedz S.A., Poland.

Copper Smelting in the Americas: 1995-2003 Productivity and Environmental Gains in a Diverse Technological Landscape: *C. Diaz*¹; T.A. Utigard¹; ¹University of Toronto, Canada.

Recent Operation at Huelva Smelter: *J. Contreras*¹; ¹Atlantic Copper, Spain.

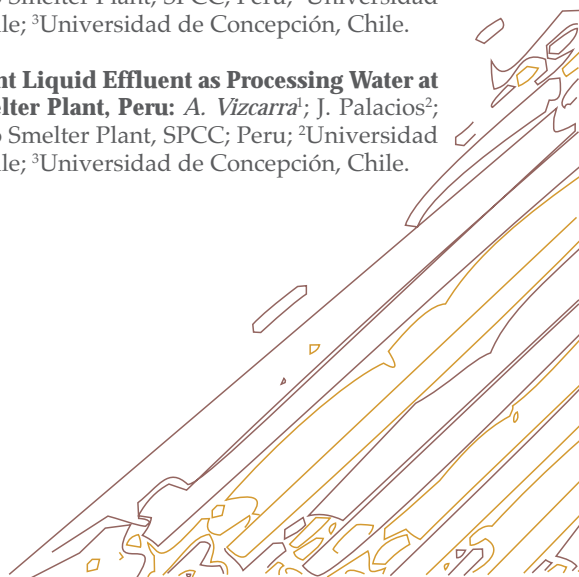
Pay Close Attention to Water in Copper Concentrate for Smelting Furnaces and Solutions for the Caused Problems: *S. Chen*¹; ¹Kumera Technology Center, Finland.

Direct Solids Injection In Ultra-Dense Phase Mode – Recent Projects And New Applications: *V. Schemmann*¹; O. Antola¹; P.C. Guillaume¹; ¹PAUL WURTH Non Ferrous Technology, Luxembourg.

Debottlenecking Pyrometallurgical Process Lines by Ultra-Modern Waste Heat Boiler Upgrades: *O. Piehl*¹; M. Blanke¹; ¹Oschatz GmbH, Germany.

Analysis, Characterization and Distribution of Impurities at Ilo Copper Smelter, SPCC, Perú: *M. Pizarro*¹; J. Palacios²; M. Sánchez³; ¹Ilo Smelter Plant, SPCC; Peru; ²Universidad de Atacama, Chile; ³Universidad de Concepción, Chile.

Use of Acid Plant Liquid Effluent as Processing Water at Ilo Copper Smelter Plant, Peru: *A. Vizcarra*¹; J. Palacios²; M. Sánchez³; ¹Ilo Smelter Plant, SPCC; Peru; ²Universidad de Atacama, Chile; ³Universidad de Concepción, Chile.



Opportunities and Limitations of Processing of Copper Secondaries in Primary Copper Smelters: *N.L. Piret¹*; ¹Piret & Stolberg Partners, Germany.

Sterlite Tuticorin Smelter: Update on Operational Improvements: *M. L. Gupta¹*; N. Thirugnanam¹; J. Bravi¹; ¹Sterlite Copper (India) Ltd., India.

Design and Startup of Acid Plant Tail Gas Scrubber: S. Hay¹; Y. Watanabe²; B. Wiggins²; F. Porretta²; ¹Port Kembla Copper, Australia; ²Hatch Australia Pty, Australia.

Primary Copper Production-A Survey of Operating World Copper Smelters: *V. Ramachandran¹*; J. Chuanyu²; C. Diaz³; T. Eltringham⁴; T. Lehner⁵; P.J. Mackey⁶; C.J. Newman⁷; A. Tarasov⁸; ¹Consulting Engineer, USA; ²Hatch China, China; ³University of Toronto, Canada; ⁴BHP Billiton Base Metals, USA; ⁵Boliden Mineral AB, Sweden; ⁶Noranda Inc. Technology Centre, Canada; ⁷Kennecott Utah Copper Corporation, USA; ⁸Gintsvetmet, Russia.

Revamp of the Umicore Copper Smelter / Bulgaria on a Lump Sum Turnkey Basis: *W.A. Enrico¹*; D. Panayotidis¹; M. Köneke²; J.P. Nepper²; ¹Umicore Med, Bulgaria; ²Lurgi Metallurgy, Germany.

Flash Furnace Upgrading Project at Chuquicamata Smelter: *C. Caballero¹*; F. Rojas¹; N. Pérez¹; J. Etcheverry¹; ¹Codelco Chile, Chile.

Recent Developments At ENAMI's Hernan Videla Lira Smelter: *J.A. Sanhueza¹*; O.C. Rojas¹; P.A. Rojas¹; ¹Empresa Nacional de Minería, Chile.

The Elimination of Arsenic from Copper using Calcium Flux: *A. Akberdin¹*; A. Akberdin¹; Kh. Kuzgibekova¹; D. Medikhanov¹; U. Konurov¹; A. Kim¹; ¹The Chemical-Metallurgical Institute, Kazakhstan.

Best Available Sulphuric Acid Technology for Copper Smelters. A State-of-the-Art Review: *P. Lüdtker¹*; H. Müller¹; ¹Outokumpu - Lurgi Metallurgie GmbH, Germany.

Development of Slag Cleaning Process and Operation of Electric Furnace in Las Ventanas Smelter: *A. Moreno¹*; G. Sánchez¹; A. Warczok²; G. Riveros²; ¹ENAMI, Las Ventanas Smelter & Refinery, Chile; ²Universidad de Chile, Chile.

Vessel Integrity

Study of Refractory Lining Destruction around Tuyere Line in Sarcheshmeh Copper Smelter Converters: *S. Kahani-Nejad¹*; M.H. Parsa²; M. Askari³; ¹McGill University, Canada; ²Teheran University, Iran; ³Sharif University of Technology, Iran.

Gaseous Corrosion of Mag - Chrome Lining in Copper Refining Anode Furnace: *R. Sharifi¹*; A. Rahami; H. Khanlari; ¹Sarcheshmeh Copper Complex, Iran.

A Composite Furnace Module Taphole for Electric Furnace Slags: *A.K. Kylo¹*; N.B. Gray¹; D. Montgomerie²; M.D. Shapiro³; D. Geekie³; G.F. Marx³; ¹The University of Melbourne, Australia; ²Olympic Dam, Australia; ³Bateman Titaco, South Africa.

Designing Water-Cooled Copper Fingers for Copper Smelting: *G. Plascencia¹*; T. Utigard¹; ¹University of Toronto, Canada.

Chromite Refractories-Copper Melts Interaction: *L.N. Ertseva¹*; N.L. Voikhanskaya¹; L.S. Tsemekham¹; ¹Gipronickel Institute, Russia.

Evaluation and Characterization of Basic Refractories for the Copper Industry: *M. Rigaud¹*; E. Kosê¹; K. Cherif¹; S. Palco¹; V. Kovac¹; ¹University of Montreal, Canada.

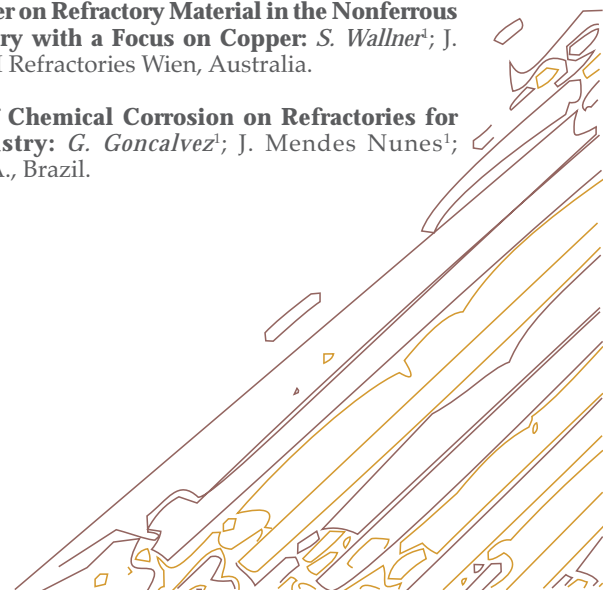
Enhancing the Campaign Life of the Inco Flash Furnace at the Copper Cliff Smelter: *R. Lawson¹*; P. Lee²; ¹Copper Cliff Smelter Complex, Canada; ²Inco Technical Services Ltd., Canada.

Reactions of an Olivine-Like Slag with Mag-Chrome Refractories: *F. Al Musalami¹*; R. Bradt¹; ¹University of Alabama, USA.

Kennecott Flash Converting Furnace Design Improvements: *C. Newman¹*; M.M. Weaver¹; ¹Kennecott Utah Copper Corporation, USA.

Wear Parameter on Refractory Material in the Nonferrous Metals Industry with a Focus on Copper: *S. Wallner¹*; J. Kleicker¹; ¹RHI Refractories Wien, Australia.

Evaluation of Chemical Corrosion on Refractories for Copper Industry: *G. Goncalvez¹*; J. Mendes Nunes¹; ¹Magnesita S.A., Brazil.



Technology Development

Removal of Arsenic, Antimony and Mercury from Copper Concentrates by Roasting Process: *I. Imris*¹; ¹Technical University of Kosice, Slovak Republic.

An Investigation of Burner Designs for High-Grade Copper Concentrate Smelting: *G. Caffery*¹; A.A. Shook¹; J. Grace²; G.A. Eltringham¹; ¹BHP-Billiton, Australia.

Optimizing the Metallurgical Efficiency of an Inco Flash Furnace Process Treating Copper-Nickel Concentrates: *P. Lee*¹; M.O. Fezzani¹; W.G. Bacon¹; ¹Inco Technical Services Ltd., Canada.

Utilization of Magnetohydrodynamic Phenomena in Slag Cleaning: *A. Warczok*¹; G. Riveros¹; V. Montenegro¹; ¹Universidad de Chile, Chile.

Rate of Slag Reduction with Natural Gas: *G. Riveros*¹; A. Warczok¹; D. Espínola¹; ¹Universidad de Chile, Chile.

Fire Refining of Molten Copper from As, Sb and Bi by Basic Oxidation with Less Corrosion of Refractories: *M. Reza Sarhady*¹; H. Yoozbashzadeh²; ¹NICICO R&D Center, Iran; ²Sharif University of Technology, Iran.

Copper Recovery from Converter Slags: *A. Moemfi*¹; R. Vagar¹; S. R. Allahkaram¹; ¹NICICO R&D Center, Iran; ²Teheran University, Iran.

Minor Elements Elimination in Copper Smelting by Vacuum Calcination of Concentrate: *R. Harris*¹; J. Roumeliotis¹; C-Y. Jiang¹; ¹McGill University, Canada.

Development of the El Teniente Converter technology: *H. Schwarze*¹; J. Achurra²; C. Díaz³; ¹Empresa Nacional de Minería, Chile; ²Metallurgical Consultant, Chile; ³University of Toronto, Canada.

Pyrorefining of Blister Copper by a Novel In-Situ Melt-Scrubbing Process: *M. Zamollao*¹; ¹Noranda Technology Centre, Canada.

Improving the Slag Quality in Flash Smelting of Copper Concentrates: *R. Parada*¹; R. Parra²; ¹Compañía Minera Disputada de Las Condes, Chile; ²Universidad de Concepción, Chile.

Direct Production of Blister Copper from Concentrates in a Cyclonic Reactor: *I. Wilkomirsky*¹; R. Parra¹; ¹Universidad de Concepción, Chile.

Value Metals Recovery from Copper-Nickel Concentrate Smelting Slags: *M.R. Rusakov*¹; *L.S. Tsemekhman*¹; A.G. Ryabko¹; L.B. Tsybulov¹; L.A. Pavlina¹; M.V. Kniyazev¹; V.B. Fomichev¹; A.A. Riumin¹; ¹Gipronickel Institute, Russia.

Process Modelling and Control

Process Modeling and Intelligent System in Copper Smelter - The Concept of Future Smarting Smelter: *X.J. Guo*¹; ¹Hatch Associates, Canada.

Application of Computational Heat and Fluid Flow Analysis to Design for the Slag-cleaning Furnace in the Mitsubishi Process: *A. Kaneda*¹; S. Okabe¹; O. Iida¹; N. Hasegawa¹; ¹Mitsubishi Materials Corp., Japan.

Effect of Combustion Gases on the Rate of Oxidation and Reduction of Liquid Copper: *T. Marin*¹; G. Riveros¹; A. Warczok¹; T. Utigard²; ¹Universidad de Chile, Chile; ²University of Toronto, Canada.

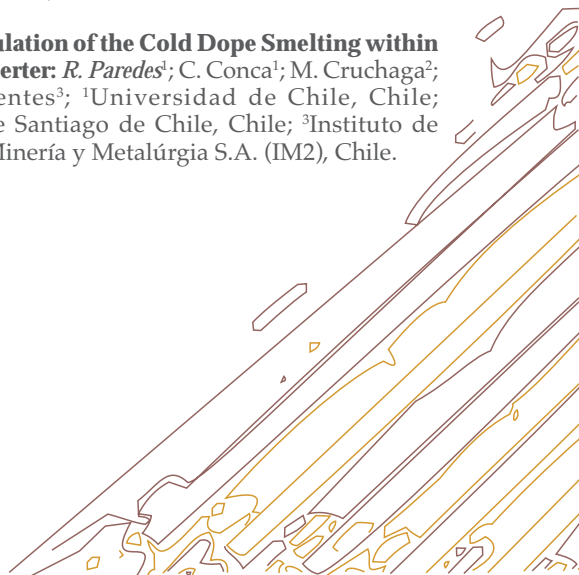
Modeling of Impurity Distribution between Mattes and Slags: *R. Reddy*¹; J. Font¹; ¹University of Alabama, USA.

MHD Stirring of Copper Slags: *A. Alvarez*¹; L.F. Mujica¹; R. Fuentes¹; ¹Instituto de Innovación en Minería y Metalurgia S.A. (IM2), Chile.

Process Simulator for The Teniente Continuous Slag Cleaning Process: *G. Alvear*¹; H. Jara¹; H. Santander¹; G.I. Riveros²; A. Warczok²; D. Cordero³; ¹Instituto de Innovación en Minería y Metalurgia S.A. (IM2), Chile; ²Universidad de Chile, Chile; ³Codelco Chile, Chile.

Flow Patterns in an Improved and not Improved Waste-Heat Boiler at Chuquicamata Smelter: *R. Fuentes*¹; P. Ruz¹; M. Rosales¹; H. Jara¹; M. Cruz¹; A. Moyano²; F. Rojas²; ¹Instituto de Innovación en Minería y Metalurgia S.A. (IM2), Chile; ²Codelco Chile, Chile.

Numerical Simulation of the Cold Dope Smelting within a Teniente Converter: *R. Paredes*¹; C. Conca¹; M. Cruchaga²; P. Ruz³; R. Fuentes³; ¹Universidad de Chile, Chile; ²Universidad de Santiago de Chile, Chile; ³Instituto de Innovación en Minería y Metalurgia S.A. (IM2), Chile.



Oxygen Efficiency Calculation in Teniente Converters: *M. Rosales*¹; P. Ruz¹; R. Fuentes¹; A. Moyano²; ¹Instituto de Innovación en Minería y Metalurgia S.A. (IM2), Chile; ²Codelco Chile, Chile.

Gravity Waves in the Teniente Converter: *M. Rosales*¹; P. Ruz¹; R. Fuentes¹; A. Valencia²; A. Moyano³; J. Bobadilla³; ¹Instituto de Innovación en Minería y Metalurgia S.A. (IM2), Chile; ²Universidad de Chile, Chile; ³Codelco Chile, Chile.

Mathematical Model for Copper Infiltration in a Refractory Floor: *P. Ruz*¹; R. Fuentes¹; A. Moyano²; ¹Instituto de Innovación en Minería y Metalurgia S.A. (IM2), Chile; ²Codelco Chile, Chile.

Physical Simulation of Refractory Wear: *P. Ruz*¹; R. Fuentes¹; M. Rosales¹; A. Moyano²; A. Soto²; ¹Instituto de Innovación en Minería y Metalurgia S.A. (IM2), Chile; ²Codelco Chile, Chile.

Accretion Growth in Metallic Fluid Media: *P. Ruz*¹; R. Fuentes¹; M. Rosales¹; A. Badillo²; C. Conca²; ¹Instituto de Innovación en Minería y Metalurgia S.A. (IM2), Chile; ²Universidad de Chile, Chile.

A New Mathematical Study of a Compressible Fluid in a Tuyere: *J. San Martín*¹; F.Z. Saouri¹; A. Benaddi¹; C. Conca¹; R. Fuentes²; Patricio Ruz²; ¹Universidad de Chile, Chile; ²Instituto de Innovación en Minería y Metalurgia S.A. (IM2), Chile.

Effect of Minor Components on the Viscosity of Copper Smelting Slags and its Relation to the Liquids Surface: *F. Kongoli*¹; I. McBow¹; S. Llubani¹; R. Harris²; ¹FLOGEN Technologies Inc., Canada; ²McGill University, Canada.

The COP KIN System Part I: Fundamentals and Mathematical Modeling: *A. Filzweiser*¹; J. Rigby²; ¹RHI-Ag, Austria; ²RHI-Canada, Canada.

Modelling of Flash Smelter Operations at the Chagres Smelter: *A. Luraschi*¹; P. Durán²; R. Parada²; ¹CADE-IDEPE Servivios de Ingeniería, Chile; ²Compañía Minera Disputada de Las Condes, Chile.

CFD Modeling of Peirce-Smith Converters Leaks and Off Gas Flow: *A. Steiner*¹; J. Larrondo¹; R. Subiabre²; P. Durán²;

¹CADE-IDEPE Servivios de Ingeniería, Chile; ²Compañía Minera Disputada de Las Condes, Chile.

Thermal Simulation of the Heat Transfer in a Peirce Smith Converter for the Validation of the Wear Mechanism in the Tuyere Zone: *Ch. Goñi*¹; V. Bazán¹; R. Parra¹; L.F. Verdeja²; ¹Universidad de Concepción, Chile; ²Universidad de Oviedo, Spain.

Modeling and Simulation of Melting and Conversion Process In Modified Teniente Converter: *A. Zuñiga*¹; ¹Southern Perú Copper Corporation, Peru.

Fundamentals

Thermodynamic Properties of Metalloid Elements in Copper Smelting: *K. Itagaki*¹; M. Hino¹; A. Zakeri¹; D. Mendoza¹; ¹Tohoku University, Japan.

Investigation of Interphase Tension in Matte-Slag System: *A. Tarasov*¹; V.S. Sorokina¹; V.A. Generalov¹; ¹State Research Institute of Non-Ferrous Metals "Gintsvetmet", Russia.

Investigation of Slag Composition with the Objective to Reduce Losses of Copper in the Process of Autogenous Smelting: *V.M. Paretsky*¹; A. Tarasov¹; ¹State Research Institute of Non-Ferrous Metals "Gintsvetmet", Russia.

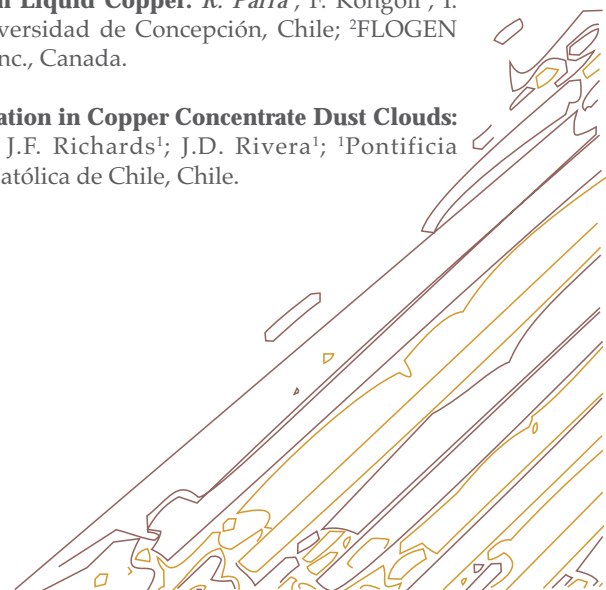
Interaction in Ternary Copper-Sulfur-Oxygen Melts: *V.A. Bryukvin*¹; A. Tarasov¹; V.M. Paretsky¹; ¹State Research Institute of Non-Ferrous Metals "Gintsvetmet", Russia.

Study of Equilibrium between Blister Nickel-Containing Copper and Iron-Silicate Slag: *L.B. Tsybulov*¹; M.S. Fedorov¹; A. Tarasov²; ¹Gipronickel Institute, Russia; ²State Research Institute of Non-Ferrous Metals "Gintsvetmet", Russia.

Diagrams of Structure and Composition of Metallurgical Products Containing Cu, Ni, Fe, S: *L.N. Ertseva*¹; ¹Gipronickel Institute, Russia.

Equilibrium Relations in Cu₂O-FeOx-SiO₂ System Saturated with Liquid Copper: *R. Parra*¹; F. Kongoli²; I. McBow²; ¹Universidad de Concepción, Chile; ²FLOGEN Technologies Inc., Canada.

Flame Propagation in Copper Concentrate Dust Clouds: *O. González*¹; J.F. Richards¹; J.D. Rivera¹; ¹Pontificia Universidad Católica de Chile, Chile.



Experimental Studies on Particle Temperatures in Flash Smelting of Copper: *T. Laurila*¹; R. Oikari¹; T. Pöyhönen¹; T. Joutsenoja¹; R. Hernberg¹; T. Ranki-Kilpinen²; T. Ahokainen²; J. Vaarno³; P. Taskinen³; ¹Tampere University of Technology, Finland; ²Outokumpu Technology Oy, Finland; ³Outokumpu Research Oy, Finland.

Stability Analysis for the System Fe-As-S-O as a Representation of Arsenic Neutralization by Use of Iron Oxide during Smelting: *Ch. Goñi*¹; E. Balladares¹; R. Parra¹; M. Sánchez¹; ¹Universidad de Concepción, Chile.

Copper, Nickel and Cobalt Losses in Copper-Nickel Concentrate Smelting Slags: L.B. Fokeeva¹; M.V. Knyazev¹; L.B. Tsybulov¹; A.A. Ryumin¹; A.G. Ryabko¹; P.S. Seryogin¹; L.N. Ertseva¹; L.S. Tsemekhman¹; ¹Gipronickel Institute, Russia.

Electrorefining and Electrowinning

Refinery Operations and Improvements

Electrolyte Impurity Control at Chinchpada Refinery of Sterlite in Industries (India) Limited: *B.P. Kamath*¹; A.K. Mitra¹; S. Radhakrishnan¹; Kiran Shetty¹; ¹Sterlite Industries (India) Limited, India.

Copper Anode Verticality – Achieving Optimum Results from Anode Preparation Systems: *J. Bosscher*¹; R. Van Tol¹; V. Carter¹; ¹Aisco Systems Inc., Canada.

Chuquicamata Copper Refinery of Codelco: *F.J. Coddou*¹; ¹Codelco Chile, Chile.

The Hard Task of Keeping High Current Efficiencies at High Current Densities: *I. M. Santos Moraes*¹; ¹Caraíba Metais S.A., Brazil.

Recent Improvements at the Atlantic Copper Refinery: *J. Contreras*¹; A. Alonso¹; C. Ortiz¹; M. Palacios¹; ¹Atlantic Copper, Spain.

Falconbridge's Kidd Copper Refinery – Birthplace of the Kidd Process an Update on the Refinery, and Latest Developments in the Kidd Process™: *J. Detulleo*¹; P. Donaldson¹; ¹Falconbridge Ltd., Canada.

Advanced Tankhouse Systems by Outokumpu: *M. Marttila*¹; L. Palmu¹; H. Viryanen²; ¹Outokumpu Technology, Finland; ²Outokumpu Research, Finland.

Productivity Improvements at the Toyo Copper Refinery: *S. Matsubara*¹; Y. Ojima¹; K. Sakamoto¹; ¹Sumitomo Metal Mining Co. Ltd., Japan.

Continuous Copper Strip Casting for Rolled Startersheets: *B. Knolle*¹; ¹Lamitref Industries n.v., Belgium.

Copper Production at INCO Ltd.'s Ontario Operations in 2003: *C. Clement*¹; B. Bichel¹; M. Winship¹; D. Hall¹; B. Roberti¹; ¹Copper Business, INCO Ltd., Canada.

Electrolytic Copper Refining – 2003 World Tankhouse Operating Data: *T. Robinson*¹; J. Quinn²; W. Davenport³; G. Karcas⁴; ¹Phelps Dodge Mining Company, USA; ²Phelps Dodge Miami Inc., USA; ³University of Arizona, USA; ⁴CTI ANCOR Europe, Greece.

Mexicana de Cobre, Metallurgical Plants, a New challenge: *J.H. Meza V*¹; J.M. Velásques¹; ¹Grupo México, Mexicana del Cobre, Mexico.

The Link between Operational Practice and Maximising the Life of Stainless Electrodes in Electrowinning and Electrorefining Applications: *J. Weston*¹; W. Webb¹; ¹Mount Isa Mines Limited, Australia.

Anodes, Anode Slimes and Anode Slimes Processing

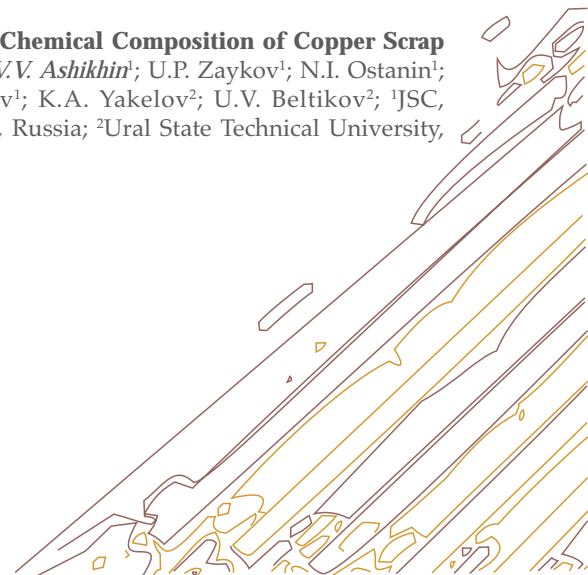
The Behavior of Tellurium During the Decopperizing of Copper Refinery Anode Slimes: *T.T. Chen*¹; J.E. Dutrizac¹; ¹CANMET, Canada.

The Control of Antimony and Bismuth in Copper Electrolytes by Lead Additions to the Anodes: J.E. Dutrizac¹; T.T. Chen¹; ¹CANMET, Canada.

The Recovery of Tellurium from Copper Refinery Slime: *S. Wang*¹; B. Wesstrom¹; J. Fernández¹; ¹Phelps Dodge Mining Company, USA.

Improving the Previsibility of the Anode Slime production by the “Six Sigma” Methodology: *E. Machado Alcântara*¹; ¹Caraíba Metais S.A., Brazil.

Fractional and Chemical Composition of Copper Scrap Anode Slime: *V.V. Ashikhin*¹; U.P. Zaykov¹; N.I. Ostanin¹; K.A. Plekhanov¹; K.A. Yakelov²; U.V. Beltikov²; ¹JSC, Uralelectromed, Russia; ²Ural State Technical University, Russia.



A Diagnostic Leaching Study of Silver in Copper Anode Slimes: *J.B. Hiskey*¹; S.C. Campin²; ¹University of Arizona, USA; ²Philips Semiconductors, USA.

Morphological and XRD Characterization of Kupferglimmer in Copper Anode Slimes: *J.B. Hiskey*¹; S.C. Campin²; ¹University of Arizona, USA; ²Philips Semiconductors, USA.

Removal of Selenium, Arsenic and Tellurium, from Anode Slimes: *M.C. Hernández*¹; O. Benavente¹; F. Hevia¹; J. Viñals²; A. Roca²; ¹Universidad Católica del Norte, Chile; ²Universidad de Barcelona, Spain.

Copper Anode Slime Treatment Method form Outokumpu: *O. Järvinen*¹; H. Virtanen²; J. Kortelainen²; ¹Outokumpu Technology Oy, Finland; ²Outokumpu Research Center Oy, Finland.

Characterization and Electrochemical Behavior of Commercial Copper Anodes under Simulated Conditions of Electrorefining: *C. Vargas*¹; G. Cifuentes¹; O. Bustos¹; C. Rodríguez²; R. Morales¹; ¹Universidad de Santiago de Chile, Chile; ²Outokumpu Indepro Ingeniería Ltda., Chile.

Electrorefinery Process Control

Electromembrane Processing of Sulphate Solutions of Copper Smelting: *A. Mustafinova*¹; K. Zhumashev¹; K. Omarov¹; ¹The Chemical-Metallurgical Institute, Kazakhstan.

Cleaning of Copper Electrolyte from Arsenic and Antimony by Insoluble Sulphates: *K. Omarov*¹; A. Zharmenov¹; K. Zhumashev¹; A. Mustafinova¹; ¹The Chemical-Metallurgical Institute, Kazakhstan.

Reasons for Irregular Anode Dissolution: *V.M. Rudoy*¹; K.A. Plekhanov¹; K.A. Yakelov²; V.M. Koriakin¹; N.I. Ostanin¹; V.V. Ashikhin¹; ¹JSC, Uralelectromed, Russia; ²Ural State Technical University, Russia.

JSC “Uralelectromed”. Electrolytic Copper Quality Control: *I.P. Demin*¹; K.A. Plekhanov¹; V.M. Koriakin¹; V.V. Ashikhin¹; U.P. Zaykov²; N.I. Ostanin²; V.M. Rudoy²; ¹JSC, Uralelectromed, Russia; ²Ural State Technical University, Russia.

Taking Refinery to Control: New Techniques for Monitoring and Control of Copper Refinery: *A. Rantala*¹; M. Korpi²; H. Virtanen²; ¹Outokumpu Technology Oy Mineral Processing, Finland; ²Outokumpu Technology Oy, Finland.

Performance of Intercell Bars for Electrolytic Applications: A Critical Evaluation: *G. Vidal*¹; A. Pagliero¹; E. Wiechmann¹; ¹Universidad de Concepción, Chile.

Numerical Study of the Copper Electrodeposition Process Analysis of Current Density and Potential Distribution in Vertical Electrodes: *J.C. Salas*¹; M. Rosales¹; ¹Instituto de Innovación en Minería y Metalurgia S.A. (IM2), Chile.

Automation Platform – Applications in Electro-Refining and Future Development: *I. Brodeur*¹; P. Briol¹; P.C. Guillaume¹; ¹PAUL WURTH Non Ferrous Technology, Luxembourg.

Electrorefining Reactions

Investigations on Copper Electrorefining at High Current Densities: *M. Stelter*¹; H. Bombach¹; ¹Freiberg University of Mining and Technology, Germany.

Electrochemical Study and Control of Additives on the Process of Copper Refinery of the Sarcheshmeh Copper Complex: *S. Daneshpajouh*¹; A. Fadaeizadeh Bidari¹; B. Rezaei²; ¹Sarcheshmeh Copper Complex, Iran; ²Isfahan University of Technology, Iran.

Behavior of Dissolved Arsenic in the Electrolyte Purification Process in the Electrorefining of Copper: *O. Forsen*¹; A.E. Antila¹; Lin Zhu¹; ¹Helsinki University of Technology, Finland.

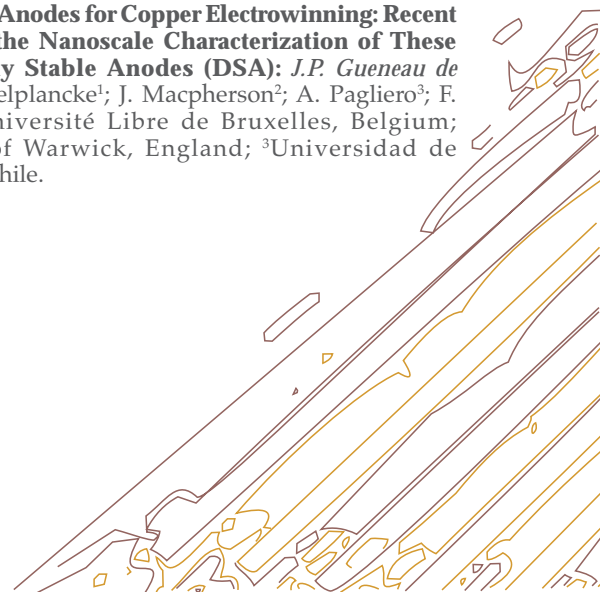
Effects of Polymer Additives on Copper Electrorefining: *H. Nakano*¹; S. Oue¹; T. Ohgai¹; T. Akiyama¹; H. Fukushima¹; ¹Kyushu University, Japan.

Nucleation and Growth Characteristics of Copper Deposition on Permanent Cathode Materials: *M. Arenas*¹; R.G. Reddy¹; ¹University of Alabama, USA.

Cathodic Current Density Distribution Caused By Geometrical Electrode Conditions in a Copper Refining Cell: *Iris Bacher*¹; P. Paschen¹; ¹University of Leoben, Austria.

Electrowining Fundamentals

Ti/TiO₂/Metal Anodes for Copper Electrowinning: Recent Advances in the Nanoscale Characterization of These Dimensionally Stable Anodes (DSA): *J.P. Gueneau de Mussy*¹; J.L. Delplancke¹; J. Macpherson²; A. Pagliero³; F. Vergara³; ¹Université Libre de Bruxelles, Belgium; ²University of Warwick, England; ³Universidad de Concepción, Chile.



Thermodynamics and Kinetics of a Copper Electrowinning Cell Based on Reactive Electrodialysis: *L. Cifuentes*¹; R. Glasner¹; G. Crisóstomo¹; S. Montecinos¹; J.M. Casas¹; ¹Universidad de Chile, Chile.

Electrowinning Operations

Production of Quality Electrowon Copper with High Current Densities: *J. Campbell*¹; M. Cerpa¹; O. Durand¹; ¹Sociedad Minera Cerro Verde S.A.A., Peru.

Copper Electrowinning in Cobalt-Free Electrolyte Using Mesh on Lead Anode: *M. Moats*¹; K. Hardee¹; C. Brown¹; ¹ELTECH Systems Corporation, USA.

Cathode Physical Quality Digital Inspection: *M. Telias*¹; P. Reinoso¹; D. Alvear²; ¹Instituto de Innovación en Minería y Metalurgia S.A. (IM2), Chile; ²Codelco Chile, Chile.

Lead Anode Corrosion in Copper Electrowinning; Operational Experience at Girilambone Copper Company and Nifty Copper Operation: *K. Dudley*¹; D.J. Readett¹; ¹Straits Resources Ltd., Australia.

The Fenix Hydromet Iron Control System for Purification of Copper Electrowinning Solutions: *R. Shaw*¹; D. Dreisinger²; T. Lancaster³; G. Richmond⁴; M. Tomlinson⁵; ¹FENIX Hydromet, Australia; ²University of British Columbia, Canada; ³Westem Metals Copper Ltd., Australia; ⁴Westem Metals, Australia; ⁵Ausenco Limited, Australia.

Copper Electrowinning on Bleed Electrolyte at Radomiro Tomic using EMEW Technology: *V. Escobar*¹; T. Treasure²; R. Dixon³; ¹Codelco Chile, Chile; ²Electrometals Technologies, Ltd., Chile ³Blumos S.A., Chile.

Electrolytic Copper Electrowinning – 2003 World Tank House Operating Data: *T. Robinson*¹; J. Jenkins²; S. Rasmussen³; M. King¹ W. Davenport⁴; ¹Phelps Dodge Mining Company, USA; ²Phelps Dodge Morenci Inc., USA ³Sociedad Contractual Minera El Abra, Chile; ⁴University of Arizona, USA.

Successful Industrial use of Quillaja Saponins (Quillaja Saponaria Mol.) for Acid Mist Suppression in Copper Electrowinning Processes: *R. San Martín*¹ A.F. Otero¹; P.C. Muñoz²; A. Cruz³, V. Escobar³, C. Espinoza³; ¹Pontificia Universidad Católica de Chile, Chile; ²Desert King Chile Ltd., Chile; ³Codelco Chile, Chile.

Hydrometallurgy

Process Development

Process Innovation for the Summo Terrazas Copper-Zinc Project: *V. Ness*¹; G. Parkinson²; ¹Jacobs Engineering, USA; ²Summo Minerals Corporation, USA.

New Analyzer Technology for Process Monitoring and Control: *M. Kongas*¹; K. Saloheimo¹; ¹Outokumpu Mintec Oy, Finland.

Copper Hydrometallurgy – Current Status, Potential Applications and Preliminary Economic Comparison versus Smelting and Refining: *J. Peacey*¹; X.J. Guo; E. Robles; ¹Hatch Associates, Canada.

Operational Changes at Phelps Dodge's Morenci Mine: *M. O'Brian*¹; ¹Phelps Dodge Morenci Inc., USA.

Heap and Bacterial Leaching

New Solution Application Technology on Secondary Sulfide Heap Leaching: *O. Bernal*¹; G. Velarde¹; ¹Sociedad Minera Cerro Verde S.A.A., Peru.

Intensive Heap Leaching of Copper Ores: *N. Zhalgasuly*¹; M.T. Toktamysov¹; A. Aldangarov¹; F.K. Shadyev¹; S.S. Retayev¹; ¹Kunayeys Institute of Mining, Kazaeshtan.

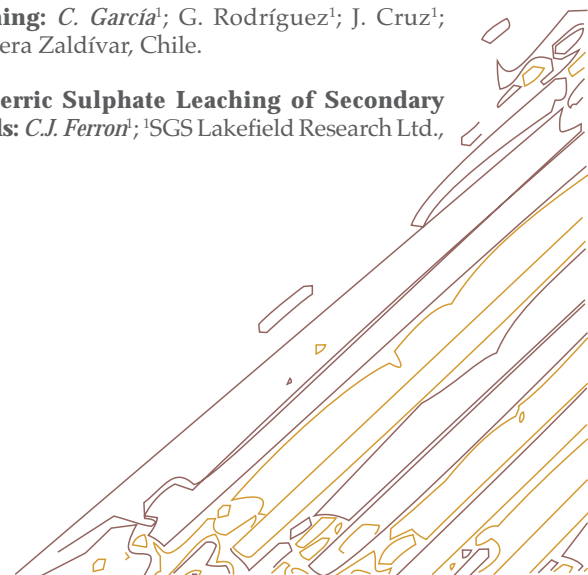
Drip Emitters Placement Effect: *G. Rodríguez*¹; J. Cruz¹; C. García¹; ¹Compañía Minera Zaldívar, Chile.

An Experimental Study of Malachite, Atacamite and Chrysocolla Interaction with Reactive Gangue during Sulphuric Acid Leaching: *U. Kelm*¹; S. Helle¹; ¹Universidad de Concepción, Chile.

Particle Size Distribution for Copper Heap Leaching Operations as Established from 3D Mineral Exposure Analysis by X-Ray MicroCT 85: *J.D. Miller*¹; C.L. Lin¹; C. García²; ¹University of Utah, USA; ²Compañía Minera Zaldívar, Chile.

Double Remining: *C. García*¹; G. Rodríguez¹; J. Cruz¹; ¹Compañía Minera Zaldívar, Chile.

Regenerated Ferric Sulphate Leaching of Secondary Copper Minerals: *C.J. Ferron*¹; ¹SGS Lakefield Research Ltd., Canada.



Mechanism and Kinetics of Chalcopyrite Passivation during Bacterial Leaching: *A. Tshilombo*¹; D. Dixon¹; ¹University of British Columbia, Canada.

Genetic Identification and Temporal Dynamics of Microorganisms from a Demonstrative Dump of a Marginal Copper Sulphide Bioleaching Project: *C. Demergasso*¹; P. Galleguillos¹; L. Escudero¹; V. Zepeda¹; D. Castillo²; E.O. Casamayor³; ¹Universidad Católica del Norte, Chile; ²Minera Escondida Ltda., Chile; ³Consejo Superior de Investigaciones Científicas (CSIC), Spain.

Modelo de Balance Poblacional del Proceso de Aglomeración Mineral de Cobre en Tambor Rotatorio Batch: *R. Collao*¹; N. Parra²; M. Herrera²; N. Heresi²; A. Figueroa³; ¹Universidad de Chile, Chile; ²Instituto de Innovación en Minería y Metalurgia S.A. (IM2), Chile; ³Centro de Investigación Minera y Metalúrgica (CIMM), Chile.

Estudio del Efecto de los Parámetros del Proceso en la Aglomeración de un Mineral de Cobre en Tambor Rotatorio: *N. Parra*¹; M. Herrera¹; N. Heresi¹; R. Collao²; A. Figueroa³; ¹Instituto de Innovación en Minería y Metalurgia S.A. (IM2), Chile; ²Universidad de Chile, Chile; ³Centro de Investigación Minera y Metalúrgica (CIMM), Chile.

Column Leach Tests with ROM Ore and their Application in Plant Design and Operation at Lomas Bayas: *R. Barrera*¹; S. Bustos¹; L. Tamelin²; N. Clavería²; M. Jo²; ¹SGS Lakefield Research, Chile; ²Compañía Minera Falconbridge, Chile.

Effect of Raffinate Chemistry on Acid Consumption and Copper Recovery: *J. Uhrrie*¹; ¹Phelps Dodge Mining Company, USA.

New Acid Percolation Technology with Additives for Copper Clay Ores: *E. Montejó*¹; M. Prometa¹; M. Bozán¹; J. Estrada¹; E. Arias¹; G. Cuervo¹; ¹Centro de Investigaciones para la Industria Minero Metalúrgica (CIPIMM), Cuba.

Application of Electric Conductivity for Best Agglomeration and Recognition of Fines/Clays in Ore for Leaching Process: *G. Velarde*¹; ¹Sociedad Minera Cerro Verde S.A.A., Peru.

The El Abra Leach Testwork Program: *R. Hernández*¹; W.J. Schlitt²; M.E. López³; ¹Kvaerner, Chile; ²Kvaerner, USA; ³Sociedad Contractual Minera El Abra, Chile.

Metallurgical Development of the Morenci MFL Project: *J. Uhrrie*¹; L.E. Wilton¹; E.A. Rood¹; D.B. Parker²; J.R. Lamanna²; ¹Phelps Dodge Mining Company, USA; ²Phelps Dodge Morenci, Inc., USA; ³Phelps Dodge Morenci, Inc., USA.

Tintaya Implements a New, Cost Effective Stacking System on Their On/Off Oxide Heap Leach Pad, Commissioning the World's First Super Portable® - Stacker System: *G. M. Bernard*¹; R. Kelly¹; ¹Terra Nova Technologies, Inc., USA.

Metallurgical Results of the Escondida Sulphide Bioleaching Test Dump: *D. Castillo*¹; P. Smithson¹; E. Becerra¹; ¹Minera Escondida Ltda., Chile.

Analysis of Commercial Heap Leaching Data: *G.M. Miller*¹; ¹Sinclair Knight Merz, Australia.

Geocoat Heap Leaching of Chalcopyrite Concentrates at High Temperatures Using Extremely Thermophilic Microorganisms: *T.J. Harvey*¹; M.D. Bath¹; ¹GeoBiotics, LLC, USA.

Leaching of Concentrates

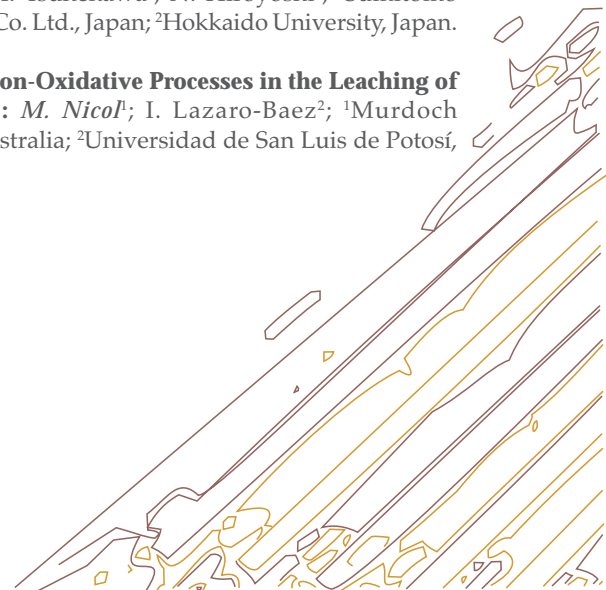
Activox® - From Concept to Commercialization: *H. Evans*¹; G. Johnson¹; ¹Western Minerals Technology Pty. Ltd., Australia.

Wider Applications for the Mt Gordon Ferric Leach Process: *D. Dreisinger*¹; K. Baxter²; T. Lancaster³; G. Richmond³; ¹University of British Columbia, Canada; ²Bateman Engineering Pty Ltd., Australia; ³Western Metals Ltd., Australia.

The Application and Economics of Industrial NSC Pressure Leaching to Copper Ores and Concentrates: *C. Anderson*¹; ¹Montana Tech, USA.

Improvement of Chalcopyrite Leaching in Acidic Sulfate Solutions by Redox Potential Control: *H. Okamoto*¹; R. Nakayama¹; M. Tsunekawa²; N. Hiroyoshi²; ¹Sumitomo Metal Mining Co. Ltd., Japan; ²Hokkaido University, Japan.

The Role of Non-Oxidative Processes in the Leaching of Chalcopyrite: *M. Nicol*¹; I. Lazaro-Baez²; ¹Murdoch University, Australia; ²Universidad de San Luis de Potosí, Mexico.



Outokumpu HydroCopper™ Process - The Design, Implementation and Operation of the Demonstration Plant: *R. Leimala*¹; O. Hyvärinen¹; M. Hämäläinen¹; M. Jyrälä¹; ¹Outokumpu Research Oy, Finland.

Appliance of Hydrometallurgical Processes for Obtaining Copper and Complementary Concentrates from Sulphide Concentrate in RTB Bor Copper: *M. Ristic*¹; B. Ristic¹; ¹University of Belgrade, Yugoslavia.

Contribution to the Researches of Kinetics of Copper (II) Sulphide and Iron (III) Sulphides Oxidation in Chalcopyrite Mineral with Hydrogen-Peroxide in a System [CuFeS₂-H₂O₂-H₂O]: *M. Ristic*¹; B. Ristic¹; ¹University of Belgrade, Yugoslavia.

New Insights on the Chalcopyrite Chemical Leaching by Fe³⁺ in the Presence of Ag⁺: *E.M. Córdoba*¹; A. Ballester¹; M.L. Blázquez¹; F. González¹; J.A. Muñoz¹; ¹Universidad Complutense de Madrid, Spain.

Thermal Treatments of Chalcopyrite Concentrates to Enhance Leaching Rates of Them by a HCl Solution: *T. Takasu*¹; H. Itou¹; T. Nakamura²; ¹Kyushu Institute of Technology, Japan; ²Tohoku University, Japan.

The Mount Gordon Ferric Leach Process - Design, Installation and Effect on Costs of the Float Plant and Expanded Milling Circuit to Treat Lower Grade Feed Stocks: *G. Richmond*¹; J. Glen¹; T. Lancaster²; B. Weekes²; ¹Western Metals Ltd., Australia; ²Western Metals Copper Ltd., Australia.

A Step Forward in Technology of Treatment of Copper Concentrate Calcine after Iron-Bearing Matte Separation with Copper Production: *M.I. Kalasnikova*¹; I.M. Shneerson¹; E.M. Vigdorchik¹; E.E. Zhmarin¹; M.V. Keskinova¹; ¹Gipronickel Institute, Russia.

Recovery of Non-Ferrous and Noble Metals from By-Products of Metallurgical Production: *I.M. Shneerson*¹; A.Y. Lapin¹; T.Y. Kositskaya¹; N.F. Ivanova¹; ¹Gipronickel Institute, Russia.

Selective Leaching of Copper Sulfides from Products with High Contents of Platinum Group Metals: *T.N. Greiver*¹; I.M. Shneerson¹; G.V. Glazunova¹; T.V. Vergizova¹; P.A. Goncharov¹; M.A. Lastochkina¹; ¹Gipronickel Institute, Russia.

The Intec Copper Process, Technical Update and Commercialization Status: *J. Moyes*¹; K. Rodgers¹; J.L. Huens¹; ¹University of Sydney, Australia.

Synthetic Chalcocite Pressure Leaching: *A. Morales*¹; J.F. Hevia¹; D. Sierra¹; ¹Universidad Católica del Norte, Chile.

The Anglo American Corporation University of British Columbia (AAC/UBC) Chalcopirite Copper Hydrometallurgy Process: *D. Dreisinger*¹; J. Steyl²; P. Dempsey³; ¹University of British Columbia, Canada; ²Anglo American Research Laboratories, South Africa; ³Anglo American Base Metals, South Africa.

Modified Ecuprex® Process: a Suitable Approach for Chalcopyrite Based Concentrates Hydrometallurgy: *M. Olper*¹; M. Massimo¹; ¹Engitec S.r.l., Italy.

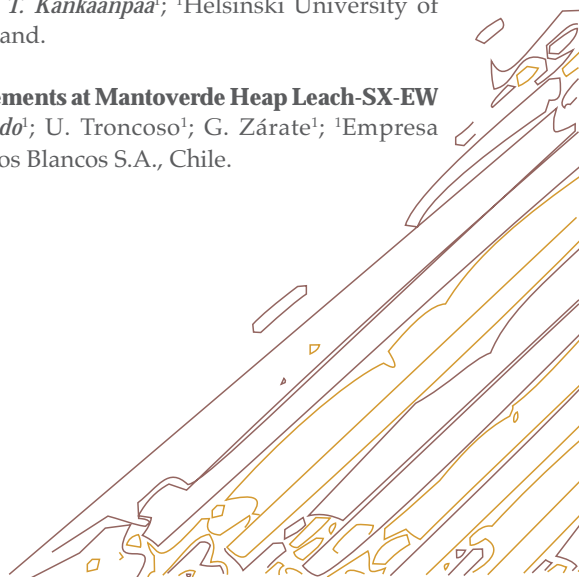
An Overview of Copper Concentrate Leaching Developments by Phelps Dodge: *J.O. Marsden*¹; R.E. Brewer²; W.W. Hazen³; ¹Phelps Dodge Corporation, USA; ²Phelps Dodge Mining Company Process Technology, USA; ³Hazen Research, Inc., USA.

Solvent Extraction

The Functional Use of Masonry and Membrane Systems for the Copper Processing Industry: *R. Aliasso*¹; T. Crandall²; D. Malone³; J. Van der Merwe⁴; ¹Stebbins Ingeniería Chile Ltda., Chile; ²The Stebbins Engineering and Manufacturing Company, USA; ³Stebbins Africa, South Africa; ⁴Stebbins Australia, Australia.

Studying Phase Separation in a Solvent Extraction Settler by Using CFD: *T. Kankaanpää*¹; ¹Helsinki University of Technology, Finland.

Process Improvements at Mantoverde Heap Leach-SX-EW Plant: *L. Trincado*¹; U. Troncoso¹; G. Zárate¹; ¹Empresa Minera de Mantos Blancos S.A., Chile.



The Use of Highly Selective Extractants to Minimize Iron Transfer in Copper Solvent Extraction Plants: *O. Tinkler*¹; C. Maes¹; ¹Avecia Inc., USA.

Outokumpu's SX Technology – In Ideal Tracks: *B. Nyman*¹; P. Pekkala²; J. Lyyra²; ¹Outokumpu Research, Finland; ²Outokumpu Technology, Finland.

On the Kinetics of Phase Separation for Solvent Extraction: *M. Salamanca*¹; G. Álvarez¹; ¹Avecia Chile Ltda., Chile.

Solvent Extraction of Copper From High-Tenor Pressure Leach Solutions Using A New Modified Aldoxime: *K.C. Sole*¹; A. Feather²; ¹Anglo American Research Laboratories (Pty) Ltd, South Africa; ²Cognis Corporation, Ireland.

Dynamic Chloride Balance in Copper Solvent Extraction Plants: *L. Gutierrez*¹; J. Menacho¹; ¹De Re Metallica Ingeniería, Chile.

Modern Solvent Extraction Circuit Design: *J. Menacho*¹; Y.I. Zivkovic¹; ¹De Re Metallica Ingeniería, Chile.

Oxime Degradation Chemistry in Copper Solvent Extraction Plants: *C. Hurtado-Guzmán*¹; J. Menacho¹; ¹De Re Metallica Ingeniería, Chile.

Solvent Extraction of Copper from Nitro - Fluorosilicic Acid Leach Solutions of Copper Anodic Slimes: *K. Elamar*¹; E. A. Jdid²; P. Blazy²; ¹Faculté des Sciences et Techniques Guéliz, Morocco; ²LEM-GRESO, France.

Jameson Cell Current Design and Improved Organic Recovery: *W. Anderson*¹; E. Manalapig; ¹MIM Holdings, Australia.

Innovations in the Field of Non-ferrous Metal Processing: *R. Link*¹; M. Schwarze¹; ¹SMS Meer GmbH, Germany.

Parallel Flows in Solvent Extraction as a Solution to Leaching: C. Garcia¹; H. Arias¹; J. Campos¹; M. Rojas¹; D. Prins¹; J. Whittaker¹; H. Hein²; G. Araya²; ¹Compañía Minera Zaldivar, Chile; ²Cognis, Chile.

Effects of Nitrate on Cu SX Circuits: A Case Study: *M. Virring*¹; D. Eyzaguirre²; ¹Cognis Corporation, USA; ²Cia Minera Lomas Bayas, Chile.

Advanced Mixer Settler Designs That Will Optimize Tomorrow's Large Flow Production Requirements: *M.A. Giralico*¹; Bernd Gigas¹; ¹LIGHTNIN, USA.

Impurity Control and Recovery

Recovering Rhenium and Radiogenic Osmium from Copper Production By-Products: *Z. Abisheva*¹; A.N. Zagorodnyaya¹; A. Sharipova¹; ¹Institute of Metallurgy and Ore Benefication, Kazakhstan.

Process for Removal Arsenic from Enargite Contained in Copper Concentrates: *A. Roca*¹; J. Viñals¹; O. Benavente²; M.C. Hernández³; O. Herreros⁴; ¹Universitat de Barcelona, Spain; ²Minera Escondida, Chile; ³Universidad Católica del Norte, Chile; ⁴Universidad de Antofagasta, Chile.

Recovery of Rhenium from Weak Acids of Copper Metallurgy: *A. Chmielarz*¹; G. Benke¹; Janusz Wojtowicz¹; Krystyna Anyszkiewicz¹; ¹Institute of Non-Ferrous Metals, Poland.

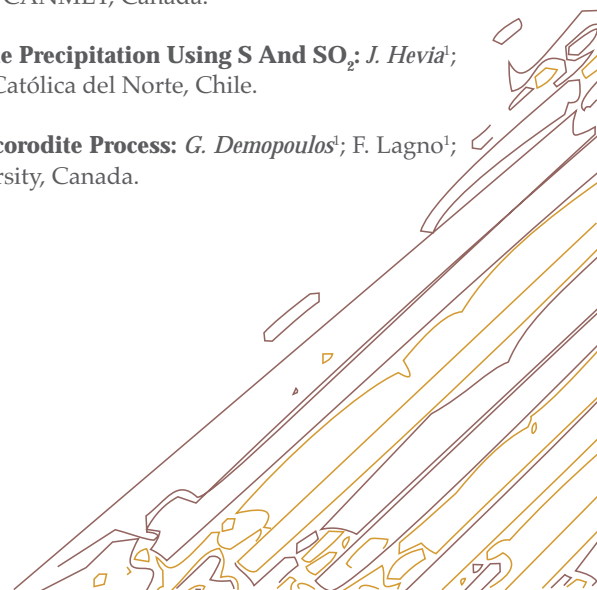
Processing of Acid Discharges from Rare Metal Production: *A.A. Zharmenov*¹; K.K. Niazbekov²; A.S. Mukusheva²; ¹National Center of the Republic of Kazakhstan, Kazakhstan; ²Subsidiary State Enterprise Zhezkazganredmet, Kazakhstan.

Copper Arsenides as a Sustainable Feedstock for the Copper Industry: *C.J. Ferron*¹; Qiankun Wang¹; ¹SGS Lakefield Research Ltd., Canada.

The Leaching of Enargite in Acidic Sulphate and Chloride Media at Atmospheric and Elevated Pressures: *P. Riveros*¹; J.E. Dutrizac¹; ¹CANMET, Canada.

Copper Sulfide Precipitation Using S And SO₂: *J. Hevia*¹; ¹Universidad Católica del Norte, Chile.

The McGill Scorodite Process: *G. Demopoulos*¹; F. Lagno¹; ¹McGill University, Canada.



Modelling and Simulation

Understanding the Factors that Drive and Limit Copper Leaching in Heaps: *D. Dixon*¹; J. Peterson²; ¹University of British Columbia, Canada; ²University of Cape Town, South Africa.

A Comprehensive Copper Stockpile Leach Model: Parameter Variance and Sensitivity: *C.R. Bennett*¹; M. Cross¹; J.L. Uhrie²; C. Green²; J.E. Gebhardt³; ¹University of Greenwich, United Kingdom; ²Phelps Dodge Mining Company, USA; ³Process Engineering Resources Inc., USA.

Simulador Dinámico de Plantas LIX-SX-EW: *M. Carrasco*¹; N. Parra¹; L. Fuentealba¹; C. Araya²; ¹Instituto de Innovación en Minería y Metalúrgia S.A. (IM2), Chile; ²Consultor, Chile.

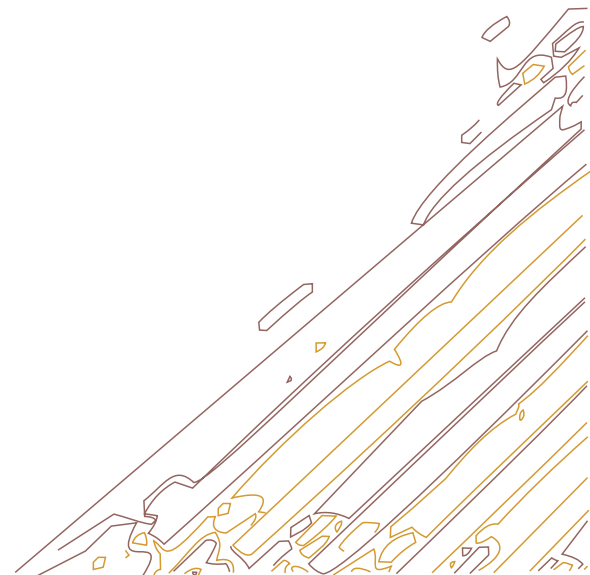
Mechanisms of Catalytic Leaching of Chalcopyrite: *H. Miki*¹; N. Hiroyoshi¹; S. Kuroiwa¹; M. Tsunekawa¹; T. Hirajima¹; ¹Hokkaido University, Graduated School of Engineering, Japan.

Kinetics and Mathematical Modeling of Leaching Process of Precipitated Copper in Sulfuric Acid Solutions: *M.I. Kalashnikova*¹; E.M. Vigdorichik¹; E.E. Zhmarin¹; I.M. Shneerson¹; P.M. Saltykov¹; E.G. Saltykova¹; ¹Gipronickel Institute, Russia.

Aqueous Speciation of Electrowinning Solutions: *J. Casas*¹; G. Crisóstomo¹; L. Cifuentes¹; ¹Universidad de Chile, Chile.

Model of Copper Electrowinning by Reactive Electrodialysis in Lab Conditions: *J. Casas*¹; G. Crisóstomo¹; J.M. Castro¹; L. Cifuentes¹; ¹Universidad de Chile, Chile.

Metallurgical Tests Methodology: N. Mendoza¹; ¹Novatec S.A., Chile.



ORGANIZING COMMITTEE

Honorary Chairman

Nelson Pizarro, Codelco-Chile, Chile

Chairman

Gustavo Lagos, Pontificia Universidad Católica de Chile, Chile

Manager

Raúl Fuentes, IIMCh, Chile

Carlos Barahona, Consulting Engineer, Chile

Pablo Botteselle, ICA Latinoamerica, Chile

Sergio Bustos, Lakefield Research Chile S.A., Chile

Juan Camus, Codelco-Chile, Chile

Ricardo Cortés, Editec Ltda., Chile

Carlos Díaz, University of Toronto, Canada

David B. Dreisinger, University of British Columbia, Canada

John E. Dutrizac, CANMET, Canada

David George, Rio Tinto Technical Services, USA

César O. Gómez, McGill University, Canada

Antonio Luraschi, CADE-IDEPE, Chile

Phillip J. Mackey, Noranda Technology Centre, Canada

Jorge Menacho, De Re Metálica Ingeniería Ltda., Chile

Christopher J. Newman, Kennecott Utah Copper, USA

Norbert Piret, Piret & Stolberg Partners, Germany

Claudio Queirolo, Codelco-Chile, Chile

V. Ramachandran, Consulting Engineer, USA

Patricio Riveros, CANMET, Canada

Mario Sánchez, Universidad de Concepción, Chile

Mahi Sahoo, CANMET, Canada

Hernán Sierralta, PROCOBRE, Chile

Iván Valdés, COCHILCO, Chile

Anthony E.M. Warner, Inco Technical Services Limited, Canada

Elías Yuri, Minera Escondida Ltda., Chile



COPPER 2003 / COBRE 2003

CO-SPONSORS

Asociación de Industriales de Antofagasta
Associazione Italiana di Metallurgia, AIM
Australasian Institute of Mining and Metallurgy, AusIMM
Centro de Estudios del Cobre y la Minería, CESCO
Centro de Investigación Minera y Metalúrgica, CIMM
Centro Minería, Pontificia Universidad Católica de Chile
Comisión Chilena del Cobre, COCHILCO
Departamento de Ingeniería de Minas, Universidad de La Serena
Departamento de Ingeniería de Minas, Universidad de Atacama
Departamento de Ingeniería de Minas, Universidad de Chile
Departamento de Ingeniería de Minas, Universidad de Santiago de Chile
Departamento de Ingeniería Metalúrgica, Universidad Católica del Norte
Departamento de Ingeniería Metalúrgica, Universidad de Concepción
FLOGEN Technologies Inc.
GDMB - Society for Mining, Metallurgy, Resource and Environmental Technology
Gintsvetmet Institute, State Research Center of the Russian Federation
International Council of Mining and Metals, ICMM
International Wrought Copper Council, IWCC
Mining and Materials Processing Institute of Japan, MMIJ
Ministerio de Minería de Chile
SF2M - Société Française de Métallurgie et de Matériaux
The International Copper Study Group, ICSG
The Minerals, Metals and Materials Society, TMS

CONTRIBUTORS

Aur Resources Chile Ltda.
Codelco Chile
Compañía Minera Zaldívar
Compañía Minera Doña Inés de Collahuasi S.A.
Empresa Minera de Mantos Blancos S.A.
Minera Escondida Ltda.
Minera Los Pelambres
Phelps Dodge Mining Services, Inc.

Co-Organizers



Instituto de Ingenieros
de Minas de Chile



Canadian Institute of Mining
Metallurgy and Petroleum