Preliminary Program

Third International Conference
on
MINERALS BIOPROCESSING
AND
BIORECOVERY/BIOREMEDIATION IN MINING

August 25-30, 1996
Big Sky, Montana

Co-Chairs
Nural Kuyucak
Water and Earth Science Associates, Ltd.
Ontario, Canada

William Costerton
Montana State University
Bozeman, Montana

ENGINEERING FOUNDATION
345 East 47th Street
New York, NY 10017
1-212-705-7836 - Fax: 1-212-705-7441
E-mail: engfnd@aol.com

SUNDAY, AUGUST 25, 1996

4:00 pm - 7:00 pm  Registration
7:00 pm - 8:30 pm  Dinner
8:30 pm - 10:00 pm Opening Reception

MONDAY, AUGUST 26, 1996

7:00 am - 8:30 am  Breakfast
8:30 am
Welcome and Conference Overview
Nural Kuyucak, Co-Chair
Bill Costerton, Co-Chair
Allen Laskin, Engineering Foundation

SESSION I: ACID MINE DRAINAGE AND TAILINGS MANAGEMENT

Session

Chairs:

Prof. R. Lawrence
Prof. P. Beckett
<table>
<thead>
<tr>
<th>Time</th>
<th>Session No.</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:00 am</td>
<td>M-1</td>
<td>A Full-Scale Porous Reactive Wall for the Prevention of Acid Mine Drainage: Installation and Initial Results</td>
<td>Shawn G. Brenner and David W. Blowes, University of Waterloo, CANADA</td>
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<tr>
<td>9:30 am</td>
<td>M-2</td>
<td>Treatment of Mine Drainage Water Using In situ Reactive Walls: Laboratory and Small Scale Field Trials</td>
<td>David W. Blowes, University of Waterloo, CANADA; Carol J. Ptacek, Environment Canada, Ontario, CANADA</td>
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<tr>
<td>10:00 am</td>
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<td>Coffee Break</td>
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<tr>
<td>10:30 am</td>
<td>M-3</td>
<td>Biologically Supported Water Covers to Prevent Acid Mine Drainage</td>
<td>Pascale St-Germain, Noranda Technology Centre, Quebec, CANADA; Nural Kuyucak, Water and Earth Sciences, Ontario, CANADA</td>
</tr>
<tr>
<td>11:00 am</td>
<td>M-4</td>
<td>Bacterial Processing of Zinc Containing Tailings and Industrial Products</td>
<td>G.I. Karavaiko, O.E. Aseyeva, V.P. Piskunov, Russian Academy of Science, Moscow, RUSSIA; V.V. Panin and L.N. Krylova, Moscow Institute of Steel and Alloys, RUSSIA</td>
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<tr>
<td>11:30 am</td>
<td>M-5</td>
<td>Cleaning of Acid Mine Drainage from a Uranium Means of a Passive Treatment System</td>
<td>V.I. Groudeva, University of Sofia, BULGARIA; S.N. Groudev, University of Mining and Geology, Sofia, BULGARIA</td>
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<tr>
<td>12:00 noon</td>
<td>M-6</td>
<td>Field Application of a Cyanobacterial Mat System for Sequestration of Toxic Metals from a Mine</td>
<td>Joseph P. Gould, Peter Phillips and Judith, Microbial &amp; Aquatic Treatment Systems Inc., Atlanta, GA, USA</td>
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<tr>
<td>12:30 pm</td>
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<td>Lunch</td>
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<td>2:00 pm</td>
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<td>Cash Bar</td>
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<td>5:00 pm</td>
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<td>Dinner</td>
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<tr>
<td>6:00 pm</td>
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<td>SESSION I: ACID MINE DRAINAGE AND TAILINGS</td>
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<tr>
<td>7:30 pm</td>
<td>M-7</td>
<td>Formation and Persistence of Biobarriers Formed by Ultramicrobacteria</td>
<td>Bill Costerton, Randy Hiebert, Bryan Warwood, MSE Technology Applications, Butte, MT, USA</td>
</tr>
</tbody>
</table>
Progress in Establishing Wetland Plants in Permanently Flooded Uranium Tailings

Sharo Peppin Willanen, Peter Beckett and Gerard Courtin

Laurential University, Ontario, CANADA

SESSION II: APPLICATION OF BIOTECHNOLOGY IN THE MINERALS INDUSTRY

Session Chairs:
Prof. G. Hansford
Prof. Gluibal

Potential of Biotechnology in the Mining and Minerals Industries

R.W. Lawrence
University of British Columbia, CANADA
R. Poulin
Univrsite Laval, Quebec, CANADA
M. Kalin
Boojum Research, Toronto, CANADA
G. Bechard
CANMET Biotechnology, Ottawa, CANADA

Microbial Application in the Mining Industry

Peggy J. Arps
Applied Microbiology and Biotechnology, Inc.
Glenwood Springs, CO, USA

Discussion and Social Hour

TUESDAY, AUGUST 27, 1996

7:00 am - 8:30 am Breakfast
8:30 am - 12:00 noon SESSION III: BIOOXIDATION AND BIOLEACHING OF NON-FERROUS MINERALS

Activity of Thiobacillus Ferrooxidans in an Electrolytic Cell

F.K. Crundwell and P.I. Harvey
University of the Witwatersrand
Johannesburg, South Africa

Towards a Novel Bioleaching Mechanism

Wolfgang Sand, T. Gehrke, R. Hamilton, and A. Schippers
University of Hamburg, GERMANY

Bioleaching of Sulfide Minerals in Stirred Tank Reactors Operated in a Variety of Modes

M. Bock
Federal Institute for Geosciences and Natural Resources, Hannover, GERMANY;

Bioleaching of Sulfide Minerals in Stirred Tank Reactors

C. Gomez
Universidad Complutense, SPAIN;
R. Winterberg
ContraCon, Cuxhaven, GERMANY

Coffee Break
Operated in a Variety of Modes
Yashuhiro Konishi and Satoru Asai
University of Osaka, JAPAN

11:00 am T-5 Mechanism and Kinetics of Bioleaching Sulphide Minerals
G.S. Hansford
University of Cape Town, SOUTH AFRICA

11:30 am T-6 Optimal Design of Bioleaching Processes
Graham Andrews
MMBD Consulting, Gresham, OR, USA

12:00 noon T-7 Issues in Bioleaching: To Inoculate or Not to Inoculate
R.G. Frew
Cominco Research, Trail, B.C., CANADA

12:30 pm - 2:00 pm Lunch
2:00 pm - 5:00 pm Ad hoc sessions/free time
5:00 pm - 6:00 pm Cash Bar
6:00 pm - 7:30 pm Dinner

SESSION IV: PROCESSING OF GOLD MINERALS
Session Chairs:
Prof. W. Sand
Prof. C. Gomez

7:30 pm T-7 A New Alternative to Cyanidation: Biocatalyzed Bisulfide Leaching
R.M. Hunter, F.M. Stewart, M. Darsow, M. Fogelsong, D. Mogk, E. Abbott and C. Young
Yellowstone Environmental Science, Inc., Bozeman, MT, USA

8:00 pm T-8 An Integrated Biotechnological Approach to Gold Processing - An Indian Experience
K.A. Natarajan
Indian Institute of Science, Bangalore, INDIA

8:30 pm T-9 An Integrated Mineralogical Approach to the Biooxidation of Sulphide-Bearing Refractory Gold Ores
U. Agha
University of Western Ontario, CANADA;
L.S. Chryssoulis
AMTEL, London, Ontario, CANADA;
A. Margaritis
University of Western Ontario, CANADA;
R. Dunne
Newcrest Mining Limited, AUSTRALIA

9:00 pm T-10 Heap Biooxidation - Bioleaching of a Refractory Gold-Bearing Ore
S.N. Groudev and I.I. Spansova
University of Mining and Geology, Sofia, BULGARIA;
V.I. Groudeva
University of Sofia, BULGARIA

9:30 pm - 10:30 pm Discussion and Social Hour

WEDNESDAY, AUGUST 28, 1996

7:00 am - 8:30 am Breakfast
SESSION V: BIOSORPTION OF METAL IONS

Session Chairs:
Prof. R. Smith
Prof. Asai

8:30 am  W-1  Adsorption of Hexavalent Chromium on Chitosan Beads: Sorption Isotherms and Kinetics
S. Bosinco, E. Guibal, J. Roussy
Ecole de Mines d'Ales, FRANCE;
P. Le Cloirec
Ecole de Mines de Nantes, FRANCE

9:00 am  W-2  Biosorption of Copper by Pseudomonas Syringae
I.B. Beach
University of Portsmouth, UK
S.L.S. Wood and G.G. Greesey
Center for Biofilm Engineering,
Montana State University, USA

9:30 am  W-3  Biosorption of Rare-Earth Elements
A.A. Korenevsky, V.V. Sorokin and G.I. Karavaiko
Russian Academy of Sciences, Moscow, RUSSIA

10:00 am  W-4  Biosorption of Toxic Metals by Free and Immobilized Biomass: Determination of Equilibrium Kinetic Parameters
F. Veglio, F. Beolchini, A. Gasbarro, B. Corain
Universita degli Studi de L'Aquila, ITALY

11:00 am  W-5  Chitosan Gel Beads as a New Biosorbent for Molybdate Removal
C. Milot, E. Guibal
Ecole de Mines d'Ales, FRANCE
J. Roussy and P. Le Cloirec
Ecole de Mines de Nantes, FRANCE

11:30 am  W-6  Ion Exchange Basis for Biosorption and Bioremediation of Heavy Metals
D.R. Crist
Georgetown University, Washington, DC., USA
R.H. Crist, K. Oberholser, J. Bennett, and J. Erikson
Messiah College, Grantham, PA, USA

12:15 pm - 1:45 pm  Lunch
1:45 pm - 5:00 pm  Ad hoc discussions/free time
5:00 pm - 6:00 pm  Cash Bar
6:00 pm - 7:30 pm  Dinner

SESSION V: BIOSORPTION OF METAL IONS (continued)

Session Chairs:
Prof. R. Smith
Prof. Asai

7:30 pm  W-7  An Overview of the Studies about Heavy Metal Adsorption
Yesim Sag and Tulin Kutsal
Hacettepe University, Ankara, TURKEY
Sorption of Heavy Metal Ions onto Nonliving Water Hyacinth Roots
R.W. Smith, G.X. Wang and M.C. Fuerstenau
University of Nevada at Reno, USA

**SESSION VI: FUNDAMENTAL AND APPLIED MICROBIOLOGY**

Session Chair:
D.R. Crist

Physiological and Genetic Characteristics of Thiobacillus Ferrooxidans Strains Used in Biohydrometallurgy
G.I. Karavaiko, T.F. Kondratyeva, L.N. Muntyan, T.A. Pirorarova
Russian Academy of Science, Moscow, RUSSIA

**THURSDAY, AUGUST 29, 1996**

7:00 am  8:30 am  Breakfast

8:30 am  SESSION VII: MINERAL PROCESSING
Session Chair: Prof. S.N. Groudev

8:30 am  TH-1  Effect of a Water Soluble Faction from *Mycobacterium Phlei* on the Surface Characteristics and Flotation of Apatite and Dolomite
University of Nevada-Reno, USA

9:00 am  TH-2  Mechanical Dissolution by Acidophilic Bacteria and Reductive Mechanisms
D. Barrie Johnson, A.M. Toni, Bridge and Paula Bacelar-Nicolau
University of Wales, UK

9:30 am  TH-3  Immobilization of Heavy Metals in Landfill Biomass
Hugh Ballard
City Engineer's Department, Cape Town, SOUTH AFRICA

10:00 am  Coffee Break

10:30 am  SESSION VIII: BACTERIAL REDUCTION AND METALS REMOVAL
Session Chairs:
L. Macaskie
Prof. F. Veglio

10:30 am  TH-4  Sulfate-Reducing Bacteria Demonstration Project at the Lilly/Orphan Boy Mine
Marietta Canty
MSE Technology Applications, Inc.
Butte, MT, USA

11:00 am  TH-5  Bacterial Reduction and Removal of Technetium from Solution
J.F. Lloyd, L.E. MacAskie
School of Biological Sciences
University of Birmingham, UK;
11:30 am

**TH-6 Involvement of Exopolymers Produced by Sulphate Reducing Bacteria in the Deterioration of Carbon Steel**

Iowna B. Beach
University of Portsmouth, UK
Vitaly Zinkevich, Rudi Tapper, Rolf Grubner and Recap Avci
Montana State University, USA

12 noon - 1:30 pm

**Lunch**

1:30 pm

**SESSION IX: MICROBIAL ENHANCED OIL RECOVERY**

Session Chair: W. Costerton

**TH-7 Characteristics of the Microbial Communities Occurring in Slops from the Petroleum Industry**

Institute of Biology of the Romanian Academy, Bucharest, ROMANIA

2:00 pm

**TH-8 Microbial Systems for Enhancement of Oil Recovery Used in Romanian Oil Fields**

I. Lazar
Institute of Biology of the Romanian Academy, Bucharest, ROMANIA

3:00 pm - 4:00 pm

**SESSION X: POSTERS**

(Cookies and Lemonade served)

**Acid Generation Remediation by Heterotrophic Loading Through the Use of PX100 - A Biological Growth Media**

Dawn M. Peach and James E. Sharp
MBX Systems, Inc., Tucson, AZ, USA

**Bioleaching and Leaching of Manganiferous Minerals**

F. Veglio and L. Toro
Universita degli Studi di L'Aquila, ITALY

**Chemical and Biological Destruction of Cyanide in Heap Leach Operations**

Peggy J. Arps
Applied Microbiology and Biotechnology, Inc., Glenwood Springs, CO, USA

Michael G. Nelson
EIMCO Processs Equipment Company, Salt Lake City, UT, USA

Edwin B. Kroeger
University of Alaska, USA
5:00 pm - 7:00 pm  Free Time
7:00 pm  Conference Banquet

FRIDAY, AUGUST 30, 1996

7:00 am - 8:30 am  Breakfast
8:30 am  Field Trip (optional)

FIELD TRIP

Conference registrants are invited to undertake a full day field trip which will take them from Big Sky on Friday morning replete with delicious box lunches provided by the hotel. The trip will include a tour of the Center for Biofilm Engineering, including the new Time of Flight SIMS facility, conducted by the Director himself!

The tour will then move on to the extensively mined area surrounding Butte, Montana, where operations dating from the 1860s have removed billions of dollars worth of gold and copper, for a tour of what is known as the country's largest Superfund site!

The field trip will finish with a tour of the facilities of the Western Environmental Technologies Office (WETO), which is a DOE site managed by MSE, and which is the contractor for a large joint DOEEPA program in Mine Waste Management.

The field trip will return to Bozeman so that participants can catch flights at the airport or linger in the beautiful Valley of the Flowers and tour scenic wonders such as the Beartooth Plateau and Yellowstone Park, without necessarily returning to Big Sky.