

**TUESDAY, AUGUST 24, 2004, P.M.**

**SESSION 36: FIFTH INTERNATIONAL SYMPOSIUM ON WASTE PROCESSING AND RECYCLING IN MINERAL AND METALLURGICAL INDUSTRIES**

WASTE MANAGEMENT; TAILINGS AND EFFLUENT TREATMENT

Sponsors: Hydrometallurgy, Non-Ferrous Pyrometallurgy, Iron and Steel Sections and Environment Committee of the Metallurgical Society of CIM and the Environmental Society of CIM

Room: Chedoke A

Chairmen: M. KALIN, Boojum Research Toronto, Ontario, Canada, and J.M. ZINCK, CANMET, Ottawa, Ontario, Canada

PAPER 36.1 — 14:00 (KEYNOTE)

EMERGING TECHNOLOGIES IN MINE WASTE MANAGEMENT.

J. ZINCK, CANMET, Ottawa, Ontario, Canada

The management of mine wastes generated by active and inactive mining is an ever more challenging issue. The cost to manage and treat mine wastes, including tailings waste rock, treatment sludge and slag, is estimated at over \$50 Billion in Canada and the US alone. Cost-effective technologies are required to meet both short and long term challenges and increasing environmental standards. This paper will provide an overview of novel and conventional technologies to manage mine waste particularly in the areas of waste stabilization, treatment and disposal technologies.

PAPER 36.2 — 14:50

MICROBIAL GEOENGINEERING IN ACID ROCK DRAINAGE (ARD).

L. WARREN and E. HAACK, McMaster University, Hamilton, Ontario, Canada

Bioremediation may represent an environmentally effective and economically beneficial mitigative strategy for the mining industry, which is still in its scientific infancy. Microbial biofilms are powerful geochemical reactors that are controlled by bacterial activity. Field investigation of naturally occurring, ARD associated biofilms characterizing: (1) microgeochemical gradients (pH and O<sub>2</sub>), (2) metal fractionation, and (3) microbial communities, indicates biofilms are highly effective metal sponges seasonally accumulating metals up to six fold over water concentrations, through bacterially controlled biomineralization. These results provide novel insight into bio-geochemical processes that may be harnessed for remediation strategies for ARD environments.

COFFEE BREAK — 15:15 – 15:40

PAPER 36.3 — 15:40

IMPROVING PORE WATER QUALITY IN REACTIVE TAILINGS WITH PHOSPHATE MINING WASTES.

M. KALIN, Boojum Research Limited, Toronto, Ontario, Canada

Inactive tailings deposits are frequently the source of ground water contamination due to transport of tailings pore water. In general, covers on tailings aim to reduce infiltration of atmospheric water, but it is difficult to maintain the integrity of such covers over the long term. If amendments to the tailings surface could be made, which improve the tailings pore water chemistry and reduce significantly the acid generation in the vadoze zone improvements in the contaminant generation from tailings could be achieved. A suitable amendment to tailings might be phosphate mining wastes, which through their release of phosphate will bind oxidized iron. The results of laboratory experiments suggest that phosphate reduces acid generation and improve pore water quality in tailings. Its addition to the tailings surface may lead to an effective tailings cover reducing ground water contamination.

PAPER 36.4 — 16:05

FIXATION OF ARSENIC IN THE FORM OF SCORODITE – A SOLUBILITY STUDY

M-C. BLUTEAU and G.P. DEMOPOULOS, McGill University, Montréal, Québec, Canada

Arsenic reports in the effluents of many non-ferrous metallurgical operations. The production of scorodite, a crystalline ferric arsenate, is considered as an attractive option for the fixation of arsenic from aqueous effluents. However, scorodite solubility and long-term stability in the pH region of interest for tailings disposal have not been thoroughly investigated. In this study the long-term stability of scorodite in the pH 5 to 9 region and the mechanism of scorodite dissolution were studied. Construction of eh-pH diagrams indicated that scorodite stability is highly dependant on the nature (stability) of co-existing iron-hydroxide/oxyhydroxide. It was also found that when scorodite dissolves, a ferrihydrite phase having very small particles size (nano-scale) forms and that the growth and crystallization of this material are delayed by the presence of arsenate even under accelerated (75°C) ageing conditions.

Around neutral pH and ambient temperature (22°C) scorodite seems to reach an equilibrium with ferrihydrite after 48 weeks yielding soluble arsenic concentrations < 5 ppm.

PAPER 36.5 — 16:30

REGENERATION OF HYDROCHLORIC ACID AND PRODUCTION OF SALEABLE GYPSUM BY REACTION OF SPENT CALCIUM CHLORIDE LEACH SOLUTIONS AND SULPHURIC ACID.

A. AL-OTHMAN, T.C. CHENG and G.P. DEMOPOULOS, McGill University, Montréal, Québec, Canada

One critical issue in chloride hydrometallurgy is the regeneration of the lixiviant HCl that is currently achieved by pyrohydrolysis. In this paper, a low temperature HCl regeneration process was investigated which regenerates HCl, and produces saleable gypsum. This process promises to reduce the generation of wastes by the reaction of spent calcium chloride leach liquors with sulfuric acid solution at low temperature (40 – 60 °C). Experiments were performed to determine the optimum conditions of the reaction in terms of temperature, reagent concentrations, rate of reagents addition, mixing and seeding/recycling to produce marketable gypsum and HCl with practical strength.