

## [International Biohydrometallurgy Symposium \(IBS\) 2017:](#) [Report](#)

The [22nd International Biohydrometallurgy Symposium \(IBS 2017\)](#), organised by [Dechema](#) and sponsored by [Newmont](#), was held at [TU Bergakademie Freiberg](#) in Germany from September 24-27, 2017. MEI was a media partner and was represented by **Amanda Wills**, who reports below:

### **Sunday 24 September**

After arriving late on Saturday evening, I found myself with the day free to explore the university and mining town of [Freiberg](#) whilst a 1-day short course, "Bioremediation of Mining Sites" was being taught by **Sabine Willscher** of the University Halle, Germany, **Andrea Kassahun** of WISMUT GmbH, Germany, and **Friedrich-Carl Benthaus** of LMBV mbH, Germany.

Freiberg (the name means "Free Mountain") was founded in the 1180s and now has a population of about 40,000. The Technical University Bergakademie is the world's oldest school of mining and attracts students from Germany and abroad, giving the town a youthful, cosmopolitan feel. It has an attractive medieval center, several excellent museums, four [Silbermann organs](#) and a plethora of cafes serving delicious German cakes.



Freiberg's main square

At 5pm I arrived at the [TU Bergakademie Freiberg Klub Haus](#), where the conference was being held, and after a quick and easy registration, it wasn't long before I'd bumped into some familiar faces. I was pleasantly

surprised to find all 3 of MEI's consultants for [Biohydrometallurgy '18](#) already there: **Sue Harrison** of the University of Cape Town, **Chris Bryan** of the University of Exeter, and **Patrick d'Hugues** of BRGM in France. I also bumped into **Keiko Sasaki** of Kyushu University, who is one of the organisers of IBS 2019 in Fukuoka, Japan. Keiko and I had met at the train station in Dresden the night before whilst trying to puzzle out the ticket machine and we'd had an interesting trip culminating in a lovely local family giving us a lift to our hotels.

We were then directed to the main hall, where **Wolfgang Sand**, of Donghua University, China, welcomed the IBS series back to Germany (the first symposium took place in Wolfen-büttel, Germany, in 1978, and was it held in Frankfurt in 2007) and welcomed us all to the IBS. After thanking the organisers and presenting them with gifts, Wolfgang informed us that there had been over 200 registrations. In fact there were 210, from 36 countries, with 51 oral presentations and 167 posters. Wolfgang then introduced us to **Michael Schlömann**, Director of the Institute of Biosciences at TU Bergakademie Freiberg, who was dressed in the traditional uniform of a mining official, which is worn at the university on formal occasions. Michael presented an introduction to the history of Freiberg, and talked about biohydrometallurgy at TU Bergakademie Freiberg and the setting up of the [Biohydrometallurgical Center for Strategic Elements](#).



Left to right: Wolfgang Sand, Michael Schlömann, and Axel Schippers  
(photos: Nadja Eisen)

Next up was **Axel Schippers**, Head of Geomicrobiology at the Bundesanstalt für Geowissenschaften und Rohstoffe (BGR), Germany. Axel filled us in on some technical points such as how the poster sessions would work and how the final papers would be chosen for publication, and thanked **Mariekie Gericke** of Minek, South Africa for all her work as secretary of the IBS committee, as she has now stepped down.

Following all the introductions, **Paul Norris** of the University of Exeter presented the Honorary Lecture, entitled "*Progress in Biohydrometallurgy over the last thirty/thirty-five years?*". This was a partly autobiographical look at the work carried out over the years following the 1983 IBS and began with an analysis of the papers presented at that conference. For example, in 1983 *Leptospirillum* was mentioned in one paper, but by 1993 was mentioned in 10. Paul warned against repeating research from the past due to misclassification of organisms or an unwillingness to read work which isn't available on the internet.



Paul Norris presented the Honorary Lecture, "Progress in Biohydrometallurgy over the last thirty/thirty-five years?"  
(photo: Nadja Eisen)

Following Paul's talk, we all retired downstairs, where finger foods and German beers were on offer, as well as the chance for everyone to catch up with each other.



Socialising at the Welcome Reception

## Monday 25 September

Today began with a session on "Tank Leaching" and the first of ten keynote lectures. **Patrick d'Hugues**, Head of the Waste and Raw Material Unit at BRGM, France, presented, "*Bioleaching in stirred tanks reactors to process Kupferschiefer type of ore: A review*", in which he gave an overview of the work performed on this topic in the last decade and discussed new insights and future developments for the integration of bioprocess options in the metallurgical treatment of black-shale type ores.

Following on from Patrick, there were presentations from **Sabrina Hedrich**, of BGR, Germany, on, "*Effect of temperature ramping on stirred tank bioleaching of a copper concentrate*", **Elizabeth Watkin**, of Curtin University, on "*Incorporation of indigenous microorganisms increases leaching rates of Rare Earth Elements from Western Australian Monazite*", **Zahra Manafi**, of Islamic Azad University, Iran, on "*Optimisation of copper bio leaching operation by moderately thermophilic consortia in Iranian Babak Copper Company (IBCCO)*", and **Agathe Hubau**, of BRGM, France, on "*Establishment of an iron-oxidising culture of acidophilic microorganisms for bioleaching of waste electrical and electronic equipment (WEEE)*".



Left to right: Patrick d'Hugues, Elizabeth Watkin, and Sabrina Hedrich  
(photos: Nadja Eisen)

During the coffee breaks, delegates were encouraged to view the posters, which were situated in two locations: in the conference room itself and downstairs. Due to the number of posters accepted, authors were permitted to keep their poster up for one day before taking it down to make way for the next one. This ensured a steady stream of visitors to view the posters.



The poster sessions were well attended  
(photos: Nadja Eisen)

After coffee, the "Heap Leaching" session kicked off with a keynote from **Jochen Petersen**, of the University of Cape Town, entitled, "*Unravelling the complexity of heap bioleaching*". This was followed by **Ruiyong Zhang** of BGR with "*Reduction of iron(III) ions at Elevated Pressure by Acidophilic Microorganisms*", **Denis Shiers** of CSIRO with "*The impact of heap self-heating on microbial activity during the bioleaching of lowgrade copper sulfide ores*", **Tatsuya Shinkawa** of Japan Oil, Gas and Metals National Corporation with "*Bio-heap Leaching of Primary Copper Sulfide Ore by JOGMEC*", **Biao Wu** of the General Research Institute for Nonferrous Metals, China with "*Nickel bioleaching at elevated pH: research and application*", and **Ali Ahmadi** of Isfahan University of Technology with "*Biodesulfurization of a coarse-grained high sulfur coal in a full-scale packed-bed bioreactor*".

Lunch was then served both upstairs and down before the afternoon sessions started, which were dedicated to "Innovative Methods". **Miao Chen** of CSIRO presented, "*Characterization and localized insight into leaching of sulfide minerals*" as a keynote in the first session, and after coffee, **Cecilia Demergasso** of the Universidad Católica del Norte presented the keynote, "*From knowledge to best practices in bioleaching*".

Before coffee, the keynote was followed by **Radek Vostal** of TU Bergakademie Freiberg with "*Method for the recovery of Indium from*

*diluted bioleaching solutions*", **Mark Roberts** of Cardiff University with *"Changes in Metal Leachability through Stimulation of Iron Reducing Communities within Waste Sludge"*, **Bernhard Dold** of Luleå University of Technology with *"Bioleaching Magnetite and Hematite through Reductive Dissolution in Seawater"*, and **Keishi Oyama** of Kyushu University with *"Mechanism of silver-catalyzed bioleaching of enargite concentrate"*.

After coffee, finishing off the day, were **Xiaotao Huang** and **Sha Deng** of Central South University, China with *"Investigation of controlled Redox Potential with pyrite during chalcopyrite bioleaching by mixed moderately thermophiles"* and *"Bioleaching of chalcopyrite with two different metallogenic types: A mineralogical perspective"* respectively, and **Tomasa Sbaffi** of the University of Exeter with *"Microbial community composition in mine waste, comparing sites in Cornwall and Western Devon"*.

There then followed bids for the honour of hosting IBS 2021, one from Perth, Australia and one Cape Town, South Africa. Delegates voted, and the winner was Perth.



All that was left was to relax with a beer!

## **Tuesday 26 September**

The first session was focused on "Molecular Methods / Biofilms" and began with a keynote from **Jinlan Xia** of Central South University, China entitled *"In-situ characterization and molecular mechanisms evaluation of interfacial interaction between minerals and bioleaching microorganisms"*.



Jinlan Xia presented "*In-situ characterization and molecular mechanisms evaluation of interfacial interaction between minerals and bioleaching microorganisms*"  
(photo: Nadja Eisen)

Jinlan was followed by **Roberto Bobadilla-Fazzini** of Codelco Tec with "*Mineralogical Dynamics of Primary Copper Sulfides Mediated by Acidophilic Biofilm Formation*", **Elizabeth Watkin** of CSIRO with "*Acidihalobacter prosperus, a halophilic acidophile, has unique mechanisms to survive high chloride concentrations at low pH*", **Mauricio Diaz** of the University of Chile with "*Molecular regulatory network involved in biofilm structure development by Acidithiobacillus thiooxidans includes Pel exopolysaccharide machinery*", **David Holmes** of the Fundacion Ciencia & Vida, Santiago with "*Genomic Insights into the Evolutionary Mechanisms and Dynamics of Extreme Acidophiles*", and **Soren Bellenberg** of the Universität Duisburg-Essen with "*Computational analysis of chalcopyrite-attached bacteria, automated cell counting, and quantification of biofilm formation*".



Jinlan Xia (centre) with his group from Central South University, China  
(photo: Nadja Eisen)

After the first coffee break, a session on "Metal Recovery" started with a keynote presented by **Mohammad Ranjbar** of Shahid Bahonar University of Kerman, Iran, entitled "*Bioelectrochemical Leaching of Copper Sulfide Minerals*". Next up was **Susan Reichel** of G.E.O.S. Ingenieurgesellschaft with "*Microbial Production of Schwertmannite: Development from Microbial Fundamentals to Marketable Products*", **Jarno Mäkinen** of VTT Technical Research Centre of Finland with "*Rare Earth Elements recovery and sulphate removal from phosphogypsum waste waters with Sulphate Reducing Bacteria*", **Francisco Remonsellez** of Universidad Católica del Norte with "*Diversity of thermophilic iron- pyrite-oxidizing enrichments from solfataric hot springs in the Chilean Altiplano*", **Ling Tan** of Central South University with "*Comparative Analysis of Functional Gene Diversity of Acid Mine Drainage and Its Sediment by Geochip Technology*", and **Hongying Yang** of Northeastern University, China, with "*Bio-oxidation Process for Gold Concentrates with a High Arsenic Content using Thermophilic Bacteria*".



Clockwise from top left: M Ranjbar, J Mäkinen, F Remonsellez and L Tan  
(photo: Nadja Eisen)

The first session after lunch was dedicated to "Biosorption / Bioremediation" and the keynote lecture was given by **Anna Kaksonen** of CSIRO, "*Recent advances in biomining and microbial characterisation*". Anna was followed by **Antonio Ballester** of the Universidad Complutense de Madrid with "*Biogenic iron compounds for hazardous metal remediation*", **Masahito Tanaka** of Kyushu University with "*Optimization of Bioscorodite Crystallization for Treatment of As(III)-bearing Wastewaters*", **Jan Weijma** of Wageningen University with "*Chemical vs. Biological Crystals, all the same?*", and **Yasuhiro Konishi** of Osaka Prefecture University with "*Microbial Recycling of Precious and Rare Metals Sourced from Post-consumer Products*".

After coffee, sessions resumed with "Innovative Methods", with a keynote given by **Jonathan Lloyd** of the University of Manchester entitled, "*Putting subsurface microbes to work; metal recovery and biosynthesis of functional metallic nanoparticles*". Jon was followed by **Ivan Nancucheo** of the Universidad San Sebastián with "*Reductive dissolution of a lateritic ore containing rare earth elements (REE) using Acidithiobacillus species*", **Elizabeth Watkin** of CSIRO with "*Incorporation of indigenous microorganisms increases leaching rates of Rare Earth Elements from Western Australian Monazite*", and **Linlin Tong** of Northeastern University, China with "*The Mechanism of In and Ge Occurrence in Sphalerite Crystal and the Influence on Properties: a DFT (Density*

Function Theory) Simulation".

Delegates were then free to prepare themselves for the evening's Conference Dinner at the [Tivoli Concert Hall](#).



Traditional music was played at the Conference Dinner at the Tivoli Concert Hall



Delegates enjoyed the fine food and wine at the Conference Dinner  
(photos: Nadja Eisen)

## Wednesday 27 September

The last day began with another session on "Tank Leaching". The keynote was presented by **Frank Roberto** of Newmont Mining, entitled, "*Copper Heap Bioleach Microbiology – Progress and Challenges*".



Frank Roberto of Newmont Mining presented a keynote on "*Copper Heap Bioleach Microbiology – Progress and Challenges*" (photo: Kirby FG)

In a change to the programme, Frank was followed by **Carmen Falagan** of the University of Bangor with "*pH dictates the relative toxicities of cationic metals and anions (other than sulfate) to acidophilic bacteria*", who was then followed by **Siti Khodijah Chaerun** of the Institut Teknologi Bandung with "*Bioleaching of supergene porphyry copper ores from Sungai Max Gorontalo of Indonesia by an iron- and sulfur oxidizing mixotrophic bacterium*", **Paivi Kinnunen** of the VTT Technical Research Centre of Finland with "*Comparison of reductive and oxidative bioleaching of jarosite waste for valuable metals recovery*", **Anna Potysz** of the University of Wroclaw with "*Feasibility of metal extraction from waste metallurgical slags in the presence of *Acidithiobacillus thiooxidans**", and **Aleksandr Belyi** of with "*Production*

*Development of Olimpiadinskoe Gold Processing Plant through BIONORD® Technology Processing".*



Clockwise from top left: Carman Falagan, P Kinnunen, S Chaerun and A Potysz (photos: Kirby FG)

After coffee, a session on "Biosorption / Bioremediation" began with **Sabine Matys** of Helmholtz-Zentrum Dresden-Rossendorf presenting "*Development of Metal Ion Binding Peptides Using Phage Surface Display Technology*", followed by **Romy Auerbach** of the Fraunhofer Projectgroup IWKS of Fraunhofer ISC with "*Recycling of Florescent Phosphor Powder Y2O3: Eu by Bioleaching by Means of Acidithiobacillus ferrooxidans*", **Davor Cotoras** of the Universidad de Chile with "*Integrated Sulfate Reduction and Biosorption Process for the Treatment of Mine Drainages*", **Ana Santos** of Bangor University with "*The use of algal biomass to sustain sulfidogenic bioreactors for remediating acidic metal-rich waste waters*", **Marina Belykh** of the Irkutsk Research Institute of Precious and Rare Metals and Diamonds with "*Detoxification of Heap after Gold Leaching Using Biodegradation*", **Robert Huddy** of the University of Cape Town with "*Analysis of Microbial Communities associated with Bioremediation Systems for Thiocyanate-laden Mine Water Effluents*", and **Sabine Willsher** of the University Halle-Wittenberg with "*pH and Soil Additive-Depending Uptake of Various Metals and Metalloids by Helianthus tuberosus from a Uranium Containing Test Field Site*".



Delegates could spend lunch and coffee breaks viewing the day's posters  
(photos: Kirby FG)

A second session on "Molecular Methods / Biofilms" began after lunch, with **Mark Dopson** of Linnaeus University presenting a keynote on "*Optimizing Acidophile Biofilm Formation for Metal Sulfide Dissolution: The SysMetEx Project*"; the SysMetEx project uses three acidophile model species (*Acidithiobacillus caldus*, *Leptospirillum ferriphilum*, and *Sulfobacillus thermosulfidooxidans*) to investigate the rate of biofilm formation and subsequent copper recoveries with the ultimate aim of reducing the lag time between heap initiation and the first recovery of copper.

Following on from Mark was **Malte Herold** of the University of Luxembourg with "*Leptospirillum ferriphilum – Genome, Transcriptome, and Proteome of a Biomining Model Species*", **Simone Schopf** of TU Bergakademie Freiberg with "*Mineral Specific Biofilm Formation of Acidibacillus ferrooxidans Hütt2*", **Mario Vera** of Pontificia Universidad Católica de Chile with "*Comparative genomics of iron oxidizing acidophiles of the Acidiferrobacteraceae family*", and **Jiri Kucera** of Masaryk University with "*Proteins Binding to Immobilized Rusticyanin Detected by Affinity Chromatography*".

The last session was on "Molecular Methods / Biofilms" and consisted of **Sue Harrison** of the University of Cape Town presenting "*Inhibition kinetics of iron oxidation by Leptospirillum ferriphilum in the presence of thiocyanate in bioremediated cyanidation tailings waste water*" followed by **Mariekie Gericke** of Mintek with "*The Mondo Minerals Nickel Sulfide Bioleach Project: From Test Work to early Plant Operation*".

Then it was time to find out who had won the Best Poster competition.



Winners of the Best Poster competition

**Wolfgang Sand** and **Michael Schlömann** concluded events with closing speeches which expressed how well it had gone, and what a nice atmosphere there had been - a true meeting of friends.

I would like to take this opportunity to congratulate Dechema and the IBS local organising committee on a well run conference. I'm now looking forward to visiting Japan in 2019!