XPS Bulletin ISSUE 10 – SUMMER 2013



Welcome to the Summer 2013 edition of the *XPS Bulletin*.

XPS has been building and acquiring expertise in a number of technical areas and I am pleased to announce that **Virginia Lawson** has recently joined XPS as General Manager, Process Mineralogy.



Virginia Lawson General Manager, Process Mineralogy

Virginia has over 25 years of experience in mineral processing operations, project management, engineering and research. Over the last 10 years, Virginia has held positions with Vale (formerly INCO) and was most recently Manager Mineral Separation Technology – Canada where she was responsible for providing technical support for Voisey's Bay Concentrator, Thompson Mill, Clarabelle Mill and Matte Separation. As a technical manager with Vale, she evaluated, established the business case and implemented process concepts which improved recovery at Clarabelle, including the installation of a brownfields project to install Cu/Ni separation and the installation of more flotation capacity and IsaMill regrinding at Clarabelle Mill. Prior to joining Vale, Virginia has held positions of increasing responsibility with Mount Isa Mines and has worked in the gold industry at Central Norseman and Carpentaria Gold in Australia.

XPS is very pleased to have Virginia on board and we welcome all colleagues and friends to contact Virginia at *vlawson@xstrataps.ca* to discuss your mineral processing and quantitative mineralogy challenges and needs.

In order to improve, refine and expand our laboratory capabilities, **Gregg Hill**, has been appointed Manager, Laboratory Services. Gregg will have responsibility for all aspects of the laboratory and pilot plants including lab systems, work pipeline management, planning and lab efficiency. Gregg has over 20 years of experience in operations and laboratory management and leads a team of experienced technicians and technologists in execution of your testwork and pilot plants.

Norm Lotter, Consulting Metallurgist will work closely with Virginia and Gregg in delivering mineral processing project management, flowsheet and product development and consulting services.

Phil Thwaites, Manager Process Control Group and EIT Program, Wilson Pascheto, Manager Materials Technology, Mika Muinonen, Manager Extractive Metallurgy and **Patrick Greasley**, Manager Business Services will continue in their functions and respective areas of specialization.

XPS manages an Engineer in Training Program and we have recently hired several graduates into our Process Control group and also have added capability in other technical areas of high specialization and value delivery.

Glencore Xstrata Merger

This past May, the merger of Glencore and Xstrata was completed creating a vertically integrated leader in the natural resources sector. XPS is proud to be part of Glencore and look forward to working within this new dynamic organization.

Our owner has changed but our mandate remains the same in delivering high quality, metallurgical consulting and testwork services, on an independent basis, to the global minerals industry.

We hope you enjoy the summer edition of the *XPS Bulletin* and welcome any comments/questions or feedback.

Dominic Fragomeni Director, XPS



Failure Analysis 101

While much of the world was enjoying the peace of the holiday season, XPS Materials Technology was busy diagnosing a critical failure of a key piece of production equipment for one of our clients.

On December 27th 2012, a main supply line providing oxygen to a production converter in a smelter failed and the vessel was required to shutdown resulting in lost production. XPS Materials Technology was called in and responded immediately to the failure and began a process of diagnosis to prevent a re-occurrence.

The stainless steel 23 cm diameter supply line was composed of an interlocking U-shaped internal lining, corrugated pipe, steel mesh and interlocking U-shaped external lining. The pipe installation, cross section of the pipe sections and the failed section are shown in the attached figures. The line is fastened to the vessel, and the vessel and the line have a requirement to move during operation requiring some flexibility. The question was... how did it fail? Was the line over-pressured? Was it the wrong material or was the material incorrectly specified? Did the material degrade during operation or was it improperly fabricated? Was there mechanical damage, temperature or corrosive damage?

XPS Materials Technology went to work using a combination of laboratory testing, SEM analysis, interviews with operations and mechanical personnel and visual observations on the failed sections.



Oxygen Line pipe installation

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Look us up on SAMSSA

XPS can also be found on the Sudbury Area Mining Supply & Service directory



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Pipe cross-section



Pipe failed section



Damage to pipe outer surface

The corrugated pipe had clearly failed and there was significant abrasive wear and deformities on the outer surface.

The materials were properly specified and retained their original structural and mechanical properties as verified by Scanning Electron Microscope (SEM) measurements.

XPS engineers determined that:

- Repeated stretching and movement caused heavy abrasion between the corrugated pipe OD and the mesh ID surfaces over a 2.1 m length.
- The heavy abrasion reduced the thickness of the corrugated pipe to less than half of its original, resulting in much less load capacity.
- An explosive rupture of the pipe resulted from this reduced load capacity.
- No other abnormality regarding material and service condition were found.

XPS recommendations included:

- The pipe has a finite life due to abrasive wear. Replace the pipe at a fixed service time interval. Stamp the installation date on the flange name plate of each section.
- Move the clamp further up and leave a longer flexible pipe for free movement. Use textile type strapping to replace the metal/rubber in use.

The client implemented all of XPS's recommendations and no further failures have occurred to date. XPS experience and technical capabilities resulted in a clear diagnosis of the failure to prevent a reoccurrence.

Shawn Yu Materials Engineer syu@xstrataps.ca



SEM image showing original austenitic steel

XPSFloat[™] for Better Flotation Cell Level Control at Cerro Bayo Ag-Au Mine, Southern Chile

Proper flotation cell level control is one of the most important yet overlooked parameters in a mineral processing plant, especially in new plants. Upstream flow disturbances, improperly sized actuators, poor controller tuning, including dead time between control actions and responses, and improperly selected/commissioned instruments all contribute to the problem in maintaining cell level – a key control of one of the main concentrator KPIs (key performance indicators) ... concentrate grade and metal recovery.

The XPS Process Control group has many years of experience in all aspects of flotation cell level control optimization and recently, in collaboration with global instrument supplier E+H (Endress and Hauser), is marketing a 'best practices solution' - a unique and simple sensor device to measure flotation cell level accurately and consistently.

XPSFloat[™] consists of a conical float device made of a robust, self cleaning material combined with a float target and, typically, an E+H (non contact) ultrasonic measurement sensor. The float device "floats" on the pulp/froth interface while the level sensor and target work in tandem to measure the cell level, accurately all the time. The level signal is delivered in real time to either the plant DCS or PLC (control) system which is often paired with a control loop to change actuator position and maintain a consistent pulp level. The practice is not new, but XPSFloat[™] is unique



XPS Float installation

in its ability to maintain reliable, trouble-free measurements in this normally rugged environment. Better measurements lead to better control and are a requirement for optimal metallurgy.

The Cerro Bayo district is located in Southern Chile, just inside the border with Argentina approximately 130 kilometers south of Coyhaique. Mandalay Resources operate gold-silver mining operations in the region and recommenced mining and processing and subsequently shipped its first concentrate in February, 2011. The mine reopened with about three years of mine life but, by the end of 2011, exploration had doubled reserves to support a sixyear mine life. Ramp-up to the currently planned 1,200 tonnes ore per day was completed in the fourth quarter of 2012 with planned expansion to 1,400 tonnes per day by the first quarter of 2014. (*www.mandalayresources.com*).

Mandalay Resources was looking for instrumentation upgrading assistance to improve their flotation cell level control and selected Sedgman, Chile – one of the largest Chilean engineering and EPC/EPCM companies in the mining industry, to help them together with E+H (Endress+Hauser), Chile Ltda. Following stand fabrication, with a local fabricator, and with the support of Sedgman the units were installed and commissioned on the plant flotation cell, as shown in the figure. The XPSFloat[™] is part of level control best practice that is being implemented by XPS Process Control.



Flotation Level Control – Best Practice Example

Additional XPSFloat[™] components have also gone to Europe and to Australia through the E+H office and sales network. Contact Phil Thwaites at XPS or your local E+H instrument supplier for more information on XPSFloat[™].

Phil Thwaites (XPS), Manager, Process Control Group Cristian Aravena (E+H Chile), Jens Hundrieser (E+H Global Primaries+Metal Industry)

Underground Mobile Equipment Data Management at Xstrata Nickel's Nickel Rim South Operations

On-board data management systems are offered by most underground mobile equipment manufacturers. These datasets (engine and performance data) are quite useful for proactive maintenance, troubleshooting and other maintenance-related decision-making purposes. However the challenge is that each of these systems is unique and proprietary, and does not use common communication protocols; hence data collection and analysis can become expensive and in some cases impossible.



At Xstrata Nickel's Nickel Rim South operations (NRS), an intelligent solution has recently been developed and implemented in order to collect and analyze underground mobile equipment data and then integrate the datasets into a single data historian. This has been possible in collaboration with Symboticware Inc., which is based in Sudbury (Ontario), Canada. The solution developed by Symbotic-

SYMBOT unit

ware is called "SYMBOT" and it offers a vendor-agnostic open platform for data collection, integration and analysis.

So what is this SYMBOT? It provides an open hardware (shown above)/software (Linux-based) platform for flow of information using IREDES and OPC-UA standards. The other intelligent feature of the SYMBOT solution is its "store-and-forward" feature.



Underground network connectivity is typically limited. When a mobile equipment moves underground, it experiences intermittent connectivity. When this happens, the SYMBOT, which is mounted on the mobile equipment, stores the data. When a hotspot in the Wi-Fi infrastructure is sensed, it transmits the data to the data collector, thereby ensuring that there is no gap in the data.

At NRS, six SYMBOT units have been installed on six Load-Haul-Dump (LHD) trucks. Reliability of data transfer from LHDs to the data historian (PI) has been demonstrated successfully. A typical flow of information is shown on the flow chart on the left. The units are mounted inside the LHD cab under the driver's seat. The datasets are collected by "Symview" – a data collector provided by Symboticware Inc. Work is under progress to integrate the datasets directly into PI.

The figure below shows the installation of a typical SYMBOT unit.



SYMBOT installation

At the time of writing this article, datasets pertaining to sixteen (16) parameters (for e.g., engine RPM, engine oil pressure, fuel consumption rate, etc.) are collected on PI. The trends are available on PI SharePoint for stakeholders to monitor the data. A typical trend displaying four parameters for LHD862 is shown below.



SYMBOT/PI trend

This is another example of how XPS continues to expand its services to include underground operations.

The next article will illustrate how the stakeholders effectively use the data for maintenance and various decision-making purposes......stay tuned!!!

Tara Rana Process Control Engineer trana@xstrataps.ca

Information flow from LHD to PI

XPS and Reserve/ Resource Modeling

Recently, the Process Mineralogy group has had the opportunity to work closely with Xstrata Nickel to support geological modeling and ore reserve/resource estimation of complex footwall orebodies in the Fraser Mine camp in Onaping, Ontario. This particular ore environment is a narrow vein mining environment where the massive Cu-rich veins are erratic and often very challenging to model and interpret. This type of geological modeling project represents an expansion of services from typical mineralogical analysis and geometallurgical support projects carried out by XPS geoscientists. It drew upon the sound XPS principles of detailed process review, process improvement and project execution coupled with past working experience in this field within the Process Mineralogy group.

The challenge of the project was to take a historical polygonal Reserve/Resource estimate and help transform it into a dynamic 3-D working model which could be more readily used for mine planning, grade control, forecasting and longer term strategic planning. Working closely with Xstrata Nickel site geologists and senior personnel, existing methodologies and interpretations were reviewed and modified where needed to enhance the interpretation and complete an updated ore reserve/resource estimate.

The results were scrutinized and validated through rounds of peer reviews and the final estimate provided to Xstrata Nickel along with an enhanced plan polygonal interpretation and model moving forward. Upon completion of this project, XPS and Xstrata Ni have expanded the project in 2013 to include ongoing modeling support in the narrow vein ore environment as well as in the Ni-rich contact ore environments at Fraser Morgan which involves additional geostatistical and modeling methodologies to be applied.

We welcome the diversity and new challenges that these projects bring to the XPS Process Mineralogy platform and plan to continue to advance our capabilities in this area. We also believe there are synergies and added value with advanced 3-D modeling capabilities and its integration with core XPS projects in the areas of representative sample selection and future inputs into geometallurgical block modeling.

Jorge F. Oliveira Chief Geoscientist, Process Mineralogy joliveira@xstrataps.ca



Oblique sectional View, Projected Reserve/ Resource Polygonal model

Plan view and oblique sectional view of narrow vein ore environment



University of Utah Sampling Course participants, March 2013.

Ongoing Professional Development

Many of our younger engineers at work in mineral processing are chemical engineers who were taught mineral processing in their undergraduate studies. At Xstrata Process Support, we recognize and address this issue with a series of short courses. From time to time, short courses are prepared and presented either at XPS or at client sites for both Xstrata employees and external parties. In January 2013, we presented a short course on sampling, flotation and process control to 15 candidates at XPS. These candidates comprised our Engineers-in-Training, some of our clients such as at Young-Davidson in North Ontario, and Ivanplats in Johannesburg. A class photo (right) shows the course candidates, with lecturers Phil Thwaites (XPS), Prof. Dee Bradshaw (University of Queensland), and Dr. Norm Lotter (XPS).

In March 2013, a sampling course was presented at the University of Utah, Salt Lake City, to a class of 30 candidates, of whom 20 were from the local metallurgical industry at Barrick, FLSmidth and Rio Tinto. The class had many favourable comments and rated the course very highly. The class photo (above), shows the candidates with host Prof. Jan Miller (University of Utah) and lecturer Dr. Norm Lotter.

For more details, please contact Dr. Norman O. Lotter, Consulting Metallurgist, at nlotter@xstrataps.ca. These courses are portable, can be tailored to your specific needs, and may be presented anywhere in the world.

Dr. Norm Lotter Consulting Metallurgist nlotter@xstrataps.ca



XPS Short Course on Sampling, Flotation and Process Control participants, January 2013.

"Appropriate, I have been able to assess what can be done better at my plant"

"I think the course material is quite relevant with practical use and clear delivery"

"Very nice. I enjoyed the step-by-step tutorials".

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XPS Gears Up for Ring of Fire Furnace Campaign

Xstrata Process support is gearing up for another chromite smelling campaign to evaluate the ore from the massive Ring of Fire chromite discovery located in the James Bay Lowlands of Northern Ontario. The focus of the campaign in June will be to demonstrate that ore will achieve similar high recovery and consistent grade during a continuous run and compare results to the initial shorter duration tests at XPS and tests on larger samples performed using larger scale equipment.

The plan includes operation of the XPS state of the art DC Arc piloting facilities for ~10-12 days continuously until all of the ore and blended flux has been processed. XPS has set up the furnace and has an operations plan which includes data collection, progress reporting, metallurgical samples for mass balance and operating data to support the campaign objectives.

The 350 kW DC Arc furnace at XPS was installed in 2011-2012 and is available for electric furnace piloting and smelting of a broad range of feed types.

Mika Muinonen Manager, Extractive Metallurgy mmuinonen@xstrataps.ca



XPS Employee Operating the DC Arc Furnace

XPS Wins NSERC Synergy Award for Innovation

Having the tool for the right job is, of course, vital to any industry.

Xstrata Process Support is a proud co-recipient of the NSERC 2012 Synergy Award. Arthur Pelton, Patrice Chartrand and Christopher Bale of the Chemical Engineering Department at the École Polytechnique de Montréal, and In-Ho Jung of the Department of Mining and Materials Engineering at McGill University with the support and collaboration of industry partners including XPS, have created the powerful and versatile thermochemical simulation software called FactSage. It allows users to perform complex chemical equilibrium calculations using a vast, critically evaluated database, saving time and costs associated with physical experimentation. In many cases XPS can define the optimum processing conditions using FactSage and follow

up with confirmatory test work. Dead-ends and low yield test conditions are eliminated focusing lab testing on viable conditions, saving clients money without compromising results.

XPS provides clients with thermodynamic modeling using this powerful tool to support development and optimization projects. The software is one of the largest, fully integrated database computing systems in chemical thermodynamics in the world. Run on a personal computer, it is used in fields as diverse as materials science, metallurgy, glass technology, nuclear waste disposal, solar energy storage, combustion and ceramics by over 500 industrial, governmental and university laboratories in 43 countries.



XPS and ALS Team Up with HPAL Pilot Plant

XPS and ALS Metallurgy are teaming up to provide state of the art HPAL (High Pressure Acid Leach) piloting services at the ALS Metallurgy pilot facilities in Perth, Western Australia. The HPAL pilot plant being installed was originally located at XPS in Sudbury and was used successfully to pilot HPAL flow sheets for Koniambo and Ivory Coast. With the Xstrata work completed, it made sense to locate the pilot facilities closer to the nickel laterite mines in the region.

Although there have been some commercial challenges with HPAL, there are also recent technical successes as the technology matures. Experience has demonstrated that HPAL can be a commercial success but requires piloting to mitigate risk and to properly define the engineering design criteria for each project.

XPS and ALS bring their respective strengths to the table to provide pilot plant services to new HPAL operations, or those who are looking to optimize. Together, XPS and ALS provide a strong team with hydrometallurgical, materials technology and processing expertise to provide HPAL piloting services to the region. The pilot plant equipment has been located in the new facility in March with installation and commissioning activities ongoing. XPS is actively engaged in the commissioning activities.

Mika Muinonen, Manager, Extractive Metallurgy mmuinonen@xstrataps.ca



The XPS HPAL Autoclave at ALS Metallurgy at their facility in Perth, Western Australia

Please contact XPS to assist in your extractive metallurgy process development.

Arthur Barnes Principal Metallurgist abarnes@xstrataps.ca



Arthur Barnes accepts the award on behalf of XPS from His Excellency The Right Honourable David Lloyd Johnston, Governor General of Canada





EIT Experience at BMS

XPS has been managing an Engineer in Training program (EIT) for over 15 years. The objective of the XPS EIT program is to recruit, develop, and retain engineering talent as a viable means of supporting longer term succession planning across the metallurgical operations. The Engineer Development Program is intended to give new hires broad exposure and training across the various Glencore Xstrata metallurgical sites. In a two-year time frame, the mentored EIT is exposed to a diverse range of assignments in order to provide a foundation for career development while providing value to the organization. Each EIT's program is unique and the success of the program is dependent upon Glencore Xstrata operations and technology businesses providing supervised rotations/projects at their operating concentrators, smelters, refineries and testing facilities.

Alison Cummings, one of the XPS EIT's, recently documented her experience at the Brunswick operations of Glencore Xstrata Zinc. We hope you enjoy her article and welcome comments and questions on this unique program.

My first two rotations in the EIT program were based out of Bathurst, New Brunswick. I arrived to the small city on the northeast coast of New Brunswick in February. I started with 6 months at the Brunswick Smelter in Belledune, followed by 6 months at the Brunswick Mine Concentrator.

My first role at the smelter was in the Furnace department, focusing on the Short Rotary Furnaces (SRFs). The two short rotary furnaces reprocess various feeds to produce a saleable product. Since the SRFs produce a saleable product, the department was working towards ISO 9001 certification. One of my main projects at the Smelter was to help improve the quality management system – including internal auditing, training operations, SOP reviews, and documenting non-conformances. In November 2012, the SRF was ISO 9001 certified!

After four months with the SRFs, I was moved to the Refinery to help commission the Vacuum Induction Retort (VIR) Expansion project. I acted as a liaison between the Project team and the Operations team. I helped to modify the drawings to "as built", identified and labeled the piping and valve systems, and covered the night shift for commissioning. Commissioning was a great experience, mostly because I've realized I learn the most when things don't go as planned. We had to work out the kinks during commissioning, but the troubleshooting kept me wide awake on my night shifts and the last cycle of the commissioning phase was extremely smooth and on spec!

I moved to Brunswick Mine Concentrator in September and I was responsible for the Copper Separation circuit. I was told it was good for learning because it responds to changes quickly and it's a "small, stable circuit". When I got there the copper tails were high and the level on the 3rd cleaner was not in control. When I thought the problem was fixed by pressure cleaning the tailings line, the problem returned over and over again. It made for an interesting project, highlighting the importance of using controls for air to the individual cells.

Later, I had the Copper Lead circuit and On Stream Analyzer (OSA) added to my responsibilities. I realized what they meant about the responsiveness of Cu Sep, when I was working with a much larger, slower to respond circuit like Cu-Pb. The OSA allowed me to get my hands dirty, climb around under the cells with the pipefitters, and troubleshoot samples. There were two OSAs at Brunswick - one Courier that had been replaced in recent years and an ancient one that took up an entire room for a mechanical head to move along the samples. The older OSA required significant attention and maintenance, so I learned a lot about the OSA system. The experience level of the people at Brunswick was another reason I learned so much. They were willing and excited to teach me. Even with mine closure around the corner, everyone was helpful, positive, and focused.

No doubt about it, I got some excellent work experience with Xstrata Zinc. The experience I had in the Maritimes was better than just work experience though. I travelled to the Bay of Fundy to walk the ocean floor, Moncton for Magnetic Hill, Grand Manan for whale watching, Charlottetown for Cow's Ice Cream and Anne of Green Gables, Nova Scotia for the Keith's Brewery and Peggy's Cove... to name a few. I found charm in the small town life - running into someone I know at the grocery store every time, traffic lights that flash red after a certain hour because there is no traffic, and my 2 bedroom waterfront apartment for next to nothing in rent. I picked up a few East Coast sayings, but my French improved only slightly. I saw a moose for the first time. I loved the smell of the salt water, and I shoveled a lot of snow. Most importantly, I met some incredible people. Everyone says that people out East are friendly, but it's such an understatement. I'm on to new adventures, but I will take what I've learned from Brunswick with me where I go next and I can look back to some very happy memories.

Alison Cummings, XPS EIT acummings@xstrataps.ca

Phil Thwaites, Manager, Process Control EIT Program pthwaites@xstrataps.ca

XPS Completes Albion Process[™] Certification

XPS has successfully achieved Albion Process[™] certification and conduct test work for clients. The Albion Process[™] allows XPS to provide an even broader spectrum of processing technologies for evaluation of refractory gold and base metals.

This proprietary technology of Xstrata Technology is a combination of ultrafine grinding and oxidative leaching at atmospheric pressure. The feeds are based on precious metal concentrates. The sulphides in the feed are oxidized and liberated, allowing the wanted metals to be recovered by conventional means.

The certification process was facilitated under the direction of Xstrata Technology (XT) who license the technology. XT was very thorough in ensuring that client's test data reflects Albion capability and that data can be properly scaled up. The certification process included confirming oxygen uptake capacity of the Hyper-sparger™, demonstrating the automated process controls and data acquisition systems, and then finally achieving target sulphur oxidation and gold extraction of an Umpire Sample.

Albion Process capabilities enhance the suite of services that XPS can provide to clients. Our capabilities in roasting and pressure oxidation will allow clients to test and contrast several technologies to select the best one for their ore type.

Mika Muinonen, Manager, Extractive Metallurgy mmuinonen@xstrataps.ca

Sandra Kuula, Technologist skuula@xstrataps.ca



XPS Albion Leach Apparatus XPS M4 Isa Mill

XPS Director Awarded CIM Fellowship

"We are here tonight to celebrate the true leaders of the Canadian mining industry – the men and women who are making a difference in our industry – something we, as Canadians, do not do often enough," said outgoing president, Terence Bowles, at the black-tie event.

Bowles handed out CIM fellowship plaques and recognized 50year CIM members. He also announced CIM's Distinguished Lecturer awards. The John T. Ryan safety trophies, special recognition and various other national awards were also presented over the course of the evening.

Dominic Fragomeni, Director, Xstrata Process Support was awarded a CIM Fellowship. Dominic's nomination was initiated by the Canadian Mineral Processors Society of CIM (CMP) and supported by his peers. The award recognizes outstanding contributions to the minerals industry and to CIM. Dominic was given a plaque during the Annual Awards Gala and would like to say, "I am extremely grateful for the recognition by my peers at CMP. I so enjoyed the time working closely with colleagues and friends at CMP and encourage active participation in our professional associations."

It was a wonderful evening. Canadian talk show host and gala emcee Mike Bullard warmed up the crowd for the Jersey Kid and the Gemtones, who capped off the show with classic American hits. The gala also included a silent auction, with proceeds split between the education initiative, Mining 4 Society, and the Canadian Mining and Metallurgical Foundation



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