

XPS bulletin

Issue 1 - September 2008



Xstrata Process Support: A technology services business

We are now well into our second year as a business unit in Xstrata Technology Services providing process support in extractive metallurgy, process mineralogy, process control and materials technology.

Internal & External Clients

We thought it timely to communicate in this format with our customers, both those we have known for a long time and those who are new. One of our roles is to facilitate technology networking and information exchange across the company. We hope that the articles we have included on projects completed, best practices implemented, and new developments will be interesting and useful.

As most know, we work for both Xstrata business units and also a range of external customers (see client list on back page). This model has served us well in that it helps us to keep our rates competitive, particularly for our largest customers. It also gives us access to others in the mining



Above: The Xstrata Process Support Centre, Sudbury, Ontario. XPS has over 60 employees in 4 key business areas.

world which is important in keeping abreast of new developments and adding to the value that we can bring to our clients. About 20% of our services are to external customers.

Adding Value

We currently have 60 employees based in Sudbury and Montreal, many with extensive experience in their technical fields, in projects and operations, and in our own testing and piloting facilities. We are here to add value to our customers. Where you think we can, please remember that in these busy times, our

work pipeline fills up quickly so contact us as early as possible to ensure we can meet your project schedules and operations needs.

Your Feedback

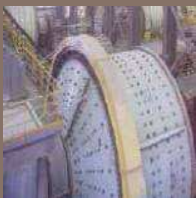
We welcome communication from any reader. If you have any suggestion on content or other feedback, or would like to contribute an article, let us know.

Frank McGlynn
Director
Xstrata Process Support



Leading professional service provider to the mining industry in four key areas:

Business Areas



Process Mineralogy
Norman Lotter



Extractive Metallurgy
Edgar Peek



Process Control
Phil Thwaites



Materials Technology
Wilson Pascheto

Characterizing the Bushveld Complex

Working with Eland Platinum

Xstrata's acquisition of the Eland operation located near Brits brings exciting opportunities within the South African platinum industry.

Portions of the Bushveld complex, historically considered marginal, are now proving to be viable and lucrative opportunities. The UG2 reef is being exploited further east than ever before and the need to understand the PGM and host rock mineralogy in this new environment is crucial.

The Process Mineralogy Group were invited to Eland operations in May of 2008 to undertake a sampling and testwork program. With the



Jorge Oliveira and Dom Fragomeni of XPS with Solly Terblanche and Stony Steenkamp of Eland Platinum on site at the Eland Core Shed.

assistance of Eland staff, numerous representative samples were taken from present and future ore horizons representing various reef environments and alteration profiles.

A program of QEMSCAN and EPMA analysis is currently underway coincident with a flotation and grind size optimisation program to provide data for continued process improvements and added value to the operation.

Information such as mineral alteration assemblage, reef mineralogy, PGM mineralogy, and grain size information will feed into the metallurgical program to assess opportunities for further optimization. We anticipate that this sampling, metallurgical and mineralogical expertise will provide substantial value to the newest member of the Xstrata Alloys division.

Contact: **Jorge Oliveira**

TESCAN Filters Environmental SEM in Mineral Science

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The TESCAN scanning electron microscope housed in the Mineral Science laboratory is a variable pressure or "Environmental" scanning electron microscope (SEM) equipped with an energy dispersive x-ray microanalysis system.

This type of SEM has the capability of analyzing samples in a positive pressure environment rather than under high vacuum as required by conventional SEMs. The advantage of this is that samples do not need to be carbon coated or sputter coated prior to entry into the sample chamber.

Samples that are non-conductive can be placed directly under the electron beam of the SEM without preparation.

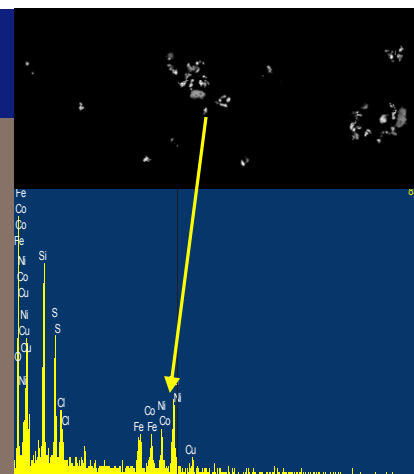
The examination of high volume air filters that are used to monitor air quality in and around Falconbridge,

close to the Xstrata Ni smelter are a particular challenge as the Co level must be constantly monitored.

Mineral Science has made use of the TESCAN SEM to identify particles that carry Co thereby identifying possible sources. Typically, most of the particles are natural mineral particles from wind blown sand, however particles of sulphide minerals (Ni concentrate smelter feed), stainless steel shavings (custom feed) and matte and slag (Smelter) have all been encountered.

This information helps the Environmental Group establish the likely source of any given exceedance and establish, for example if it coincided with unusually windy conditions. This ensures Xstrata Ni meets environmental regulatory requirements.

Contact: **Peter Whittaker**



A 5um smelter matte particle shows S, Fe, Co, Ni and Cu in its x-ray spectrum

XPS Crushing & Blending Plant

The Future of Lab Scale Sample Preparation

XPS Process Mineralogy is pleased to announce that the commissioning of the group's state of the art crushing and blending plant (CBP) is in the advanced stages and the equipment will be open for business by October 2008.

The first of its kind in the world, the XPS Crushing and Blending Plant brings the latest lab scale crushing and blending technology together into a single package capable of continuously processing up to 150kg/hr of drillcore ore rock.

"This technology is set to revolutionise the way we prepare samples ahead of downstream testwork here at XPS - Material of a top size up to 6 inches can be crushed, screened, blended and split into charges of any mass and any product particle size in a matter of hours rather than days" explains **Dave Middleditch**, XPS Metallurgist and Project Manager.

Superior Quality

The combination of the latest Rocklabs Boyd crusher technology with Hosokawa Micron B.V Vrieco blending technology is the key to providing homogenised, replicate benchscale charges for mineral processing testwork – the first, and one of the most essential steps in producing quality bankable and reliable data.

Quality is the cornerstone of XPS Process Mineralogy's business and the XPS CBP is capable of producing crushed and blended material



Ready to Rock: View of the primary jaw crusher and secondary screen platforms of XPS' new continuous crushing and blending plant.

with relative standard deviations for base metals of less than 5% at competitive prices.

Efficiency and Safety

This project is a prime example of combining improvements in health and safety standards with developing a technology that more efficient, cost effective and produces a product of superior quality.

Contact:
Dave Middleditch
Pat Carriere

XPS CBP Special Features

- Capable of processing up to 150kg/hr dry solids.
- Drillcore or 6 inch rock feed size.
- Any product (mesh) size can be achieved.
- Hosokawa Micron B.V Vrieco Blenders.
- Denver primary jaw crusher.
- Rocklabs Small Boyd Crusher.
- Vibrating Kason and Sweco screens.
- Spinning riffles and load cells ensure replicate samples are produced
- Designed in partnership with **Grant Aggregates**, Sudbury, Ontario.
- Open for business October 2008.



Members of the Process Mineralogy group during commissioning



Rare Earth Elements

A Rare Commodity

The Process Mineralogy Group has recently undertaken testwork on a rare earth element (REE) deposit. Great Western Minerals Group (GWMG) submitted samples to XPS from the Deep Sands Project for quantitative mineral analysis and metallurgical processing. The objectives of the program were first to define the REE department and complete compositional analyses of the REE mineral species, and then to test possible flowsheet options that would permit processing of the deposit.

The work involved mineral characterization using a combination of QEMSCAN and EPMA followed by a larger testwork program including gravity, magnetic and electrostatic separation.

The opportunity to work on a REE Mineral Sands project was a first for XPS. As a result of this project,



XPS Process Mineralogy's **Patricia Stack** operating QEMSCAN

XPS has developed new protocols for sample preparation of weakly radioactive materials, as well as a new QEMSCAN Species Identification Program designed for REE deposits and a microprobe analytical set up designed to mitigate REE x-ray overlap issues. QEMSCAN mineralogical analysis results provide valuable information for the separation flowsheet development in the REE Mineral Sands project.

XPS also had the opportunity to collaborate with both Laurentian

and Queen's Universities where some of the testwork was conducted.

After the successful conclusion of this test program, XPS is commencing a new ore characterization project for GWMG in the fall of 2008, under the direction of Bruce Fielder, from Melis Engineering.

Contact: **Lori Kormos & Simon Yu**

Expanding our Capability

The expansion of the Extractive Metallurgy Group's fluid bed capability.

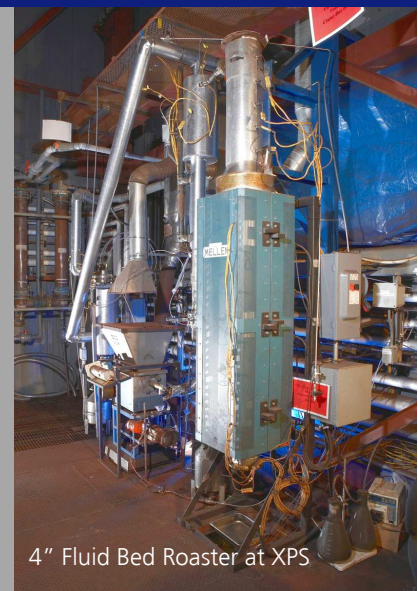
Extractive Metallurgy group has a long history of involvement in projects relating to fluid bed technology dating back more than 30 years, and played pivotal roles in piloting many of the processes now forming part of commercial plant flow sheets.

An increased demand for test work suited to the capabilities of the 4" roaster prompted a concerted effort by a small team of XPS' Extractive Metallurgy supported by Process Control personnel, to perform some essential upgrades to the equipment and at the same time add some useful additional features.

The newly refurbished 4" fluid bed is now able to handle batch or con-

tinuous feed, cyclone and bottom discharge, with facilities for mid-run sampling without disruption of the run, addition of water to the bed, neutral, oxidizing or reducing gas mixtures plus the ability to heat up under inert atmosphere. Complete automatic process control of bed temperature, gas composition and flow rates along with comprehensive data logging and continuous off-gas analysis, makes this a versatile tool for solid state thermal process test work.

The unit has just successfully completed a test campaign for our first client, with 5 more waiting for their slots. The 4" unit fills a vital gap between the 2" batch bed and the large 6" pilot plant unit, with 4x the capacity of the 2" and 1/4 of the throughput of the 6", and is ideally suited for path finding work with limited quantities of feed material.



4" Fluid Bed Roaster at XPS

For further information please Contact:

Arthur Barnes
Mark Laframboise

Process Modelling

A Core Expertise of the Extractive Metallurgy Group.

Process modelling is a key tool for the technical and economic assessment of a process. The Extractive Metallurgy group takes a unique approach to process modelling whereby experimental data is used to refine the initial model.

A typical model is built on METSIM™ platform in conjunction with FACTSAGE thermo-chemical software and this exercise requires an in-depth understanding of the process.

Experimental and plant data are then used to fine tune the model which can now provide valuable data on plant energy consumption, gas emissions, recovery and other key performance indicators. So far, several models have been developed for Xstrata clients; namely, Xstrata Copper - Rouyn; Xstrata Nickel - Sudbury and Falcondo, Dominican Republic.

Extractive Metallurgy Modelling Projects

- Feasibility Study for reductive roasting of sulphide concentrate (Factsage).
- Mapping of slag chemistry for IsaSmelt furnaces (Factsage).
- Process modelling of the conventional flow sheet for copper smelting and converting (Metsim).
- Hydrometallurgical treatment of spent catalyst (Metsim).
- Study on the calcine bank stability in electric furnace (Comsol).
- Logistical model for smelter converter aisle (Arena).



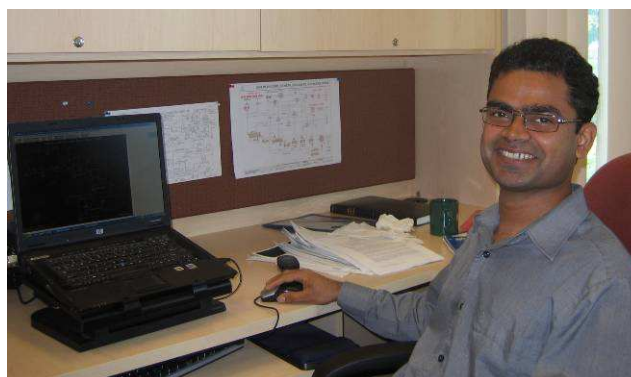
The Noranda Continuous Converter at Xstrata Copper's Horne Smelter, Rouyn-Noranda, Quebec.

As mentioned above, one of the recent applications of the Factsage software was in the modeling of the Noranda Converter (NCV) slag chemistry at the Horne Smelter in Quebec. The impact of a number of parameters on the operation of the Noranda converter and the slag liquidus was modeled using Factsage™. These included such parameters as Fe/SiO₂ ratio and minor components such as CaO, Al₂O₃, ZnO, MgO, and PbO. This study provided an additional tool for the Horne Smelter to develop operating strategies for the NCV, adapted to the different feed-stocks available from Xstrata mines/plants or other sources.

Other modeling tools that are used by the Extractive Metallurgy Group include Finite element Analysis (using COMSOL) and modeling of process logistics using ARENA. Logistical models have been developed for Xstrata's Sudbury smelter and also for the Horne smelter to help develop a strategy for increasing plant capacity with minimal capital investment.

Contact:

Pascal Courso
Phillip Mackey
Nagendra Tripathi (below)





Do not Expose to Heat or Dispose of in Fire!

Safe recycling of rechargeable batteries at Xstrata

We've all seen the warning labels on rechargeable batteries. Responsible disposal of these items is important both from a safety and environmental perspective.

The newly commissioned Calciner at the Xstrata Nickel Sudbury Smelter is now processing used and obsolete batteries from a variety of sources including cell-phones, laptops and hybrid cars. Automatic process control of this facility was identified early on in the project as being critical to success.

The Calciner removes water, plastics and other material from the feed by burning it in a large rotary kiln. The off gases are treated in a high temperature combustion chamber, in

order to oxidize any harmful gases produced. Adherence to strict environmental emissions criteria is thus critical in the control of this operation.

The XPS Process Control Group was part of the project team and developed the detailed control philosophy for the plant. It was this document that formed the basis of the functional specification which guided the



programming of the plant control system. During commissioning, the group was responsible for tuning of

controls and has since developed these further.

"Running on batteries can be a wild ride" says Erik Bartsch (XPS Process Control Engineer).

"Some of the batteries are obsolete but unused and so are still in their plastic packaging, this can result in large flare-ups which are challenging to control. Some of the batteries really do flare up quickly so the warning labels are there for a reason!" These rapid reactions require fast and effective draft and temperature controls; something the process control group is well positioned to deliver.

Application of this advanced technology will enable Xstrata Nickel to process 160,000 tonnes of recycled material this year. XPS is proud of their association with this world class recycling facility.

Contact: **Erik Bartsch**

XPS In Control

In preparation for the treatment of the new Nickel Rim South mine ore body, Xstrata's Strathcona Mill is undertaking numerous process improvement projects in different parts of the plant. Within the grinding circuit, several projects are under development.

The existing mill's grinding objective is to maximize throughput while achieving a consistent product of the desired size and density. A narrow size classification is also important in order to reduce losses in the flotation circuit through over or under grinding.

Strathcona Mill, in conjunction with the XPS Process Control Group, identified the need for a new control strategy. The team used the existing control platform and instrumentation.

"Our experience has demonstrated that gains can often be made by using what the plant already has. This was



the case in this project where the existing instrumentation and DCS were used to implement the new strategy", says Eduardo Nunez (XPS Process Control). "The main components are now up and running, the results are excellent and it has been well accepted at

every level in the mill. This brings the grinding circuit to the next level with a grinding control strategy applied consistently and safely pushing the circuit to the limits. It is like having your best operator on every shift!"

Contact: **Eduardo Nunez**

Hammer Spalling

A common type of failure - a safety concern...

Many cases of sledge hammers that eject chips during service have been reported. This topic is important because of the injuries that can result. In one particular case we analyzed the failure of one sledge hammer which was used to hammer onto another in order to minimize impact damage to a part. During the hammering process, a piece of the face of one hammer spalled off hitting an employee.

The sledge hammer failure was caused by the formation of hard, brittle untempered martensite structures prone to cracks and spalling.

It is known that bands of untempered martensite are produced by the rapid, concentrated shear strain associated with hammering. The brittle bands can fracture explosively,

expelling a chip either as a result of a tensile wave reflected back from the free surface of the hammer head or by a shock wave caused by a subsequent impact.

The possibility of spalling is increased when one hammer is used to strike another of the same high hardness. For that reason, the practice of using a hammer to hit another hammer of similar hardness is generally not recommended. The maximum allowable hardness of a struck tool should be lower than that of a striking tool. A softer object (tool, anvil, etc.) being struck by a harder hammer deforms plastically. Therefore, the struck tool is capable of undergoing more plastic deformation and this deformation increases the contact area between the struck and the striking tools during impact. The increased area of contact will distribute the stresses in the striking tool over a greater volume and for that reason the probability of spalling is reduced.



Above: The face of the hammer that chipped.

Below: Formation of untempered martensite bands.



Contact: **Mario Arenas**

Avoiding Costly Repairs During Plant Startup

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A Risk Management survey for the period 1996-2001 concluded there were a total of 70 million dollars in insurance claims, made as a result of major equipment failures, in what was then Falconbridge Ltd. The survey pointed out that the main causes of these failures were improper material selection, equipment design and workmanship.

The materials technology group has participated as a member of the owner's team during bankable feasibility, detailed engineering, construction and commissioning stages of major capital projects to provide expertise in: materials selection, review of procurement specifications, and quality control during fabrication and construction. Recent examples are Koniambo, the



Welder fabricating stainless steel pipe

Sudbury Smelter Calciner and the CCR Pentlandite projects.

Materials engineering goes beyond materials selection. If improperly fabricated, even the best material choice will likely fail. For this reason, good quality fabrication specifications, followed by thorough inspection during fabrication to en-

force these, are essential to achieving a successful start-up.

This quality assurance effort may cost of the order of 3% of equipment cost, which is significant. It is important that this cost be included when making the project estimate.

Contact: **Dan Falcioni**





Global Perspective

Since 2006 Xstrata Process Support has worked with many clients from all corners of the globe...



- Xstrata Nickel (Sudbury Operations)
- Xstrata Nickel (Raglan)
- Xstrata Nickel (Montcalm)
- Xstrata Nickel (Koniambo)
- Xstrata Nickel (Falcondo)
- Xstrata Nickel (Nikkelverk)
- Xstrata Zinc (Mt Isa)
- Xstrata Zinc (CE Zinc)
- Xstrata Zinc (BMS)
- Xstrata Copper (Mt Isa)
- Xstrata Copper (Northern Chile)
- Xstrata Copper (Collahuasi)
- Xstrata Copper (Antamina)
- Xstrata Copper (Horne Smelter)
- Xstrata Copper (CCR)
- Xstrata Copper (Kidd)
- Canadian Arrow Mines (Canada)
- Royal Nickel (Canada)
- Vale INCO (Canada)
- Vale (Brazil)
- Doe Run Mining (USA)
- Freeport McMoran (USA)
- IGE Nordic AB (Finland)
- Hard Creek Nickel (Canada)
- First Nickel (Canada)
- FNX (Canada)
- Mustang Minerals (Canada)
- Barrick Gold (Tanzania)
- Codelco (Chile)

- Anglo American (Chile)
- Richview Resources (Canada)
- Xstrata Alloys (South Africa)
- PGM Corporation (Canada)
- Barrick Gold (USA)
- Aquiline (Argentina)
- Lonmin (South Africa)
- Great Western Minerals (Canada)
- Spar Resources (Canada)
- Lac des Isles (Canada)
- Yamana Gold (Canada)
- Xstrata Technology (Australia)
- Bechtel (Canada)
- Hatch (Canada)
- MetChem (Canada)
- Micon (Canada)
- 5N Plus (Canada)
- Cabri Consulting (Canada)
- SGS Minerals Services (Canada)
- Jervois Young
- Newmont Metallurgical Services (USA)
- Norfolco (Canada)
- Nalco (Canada)
- Chemtrade (Canada)
- Flottec (USA)
- Norbord (Canada)

"Adding Value... Reducing Risk"



New Employees

- Kevin Chisholm** - GeoScientist
- Juan Anes** - Chief Metallurgist
- Arthur Barnes** - Chief Metallurgist
- Ryan Salemink** - Technician I
- Silvia Del Carpio** - Engineer in training
- Jennifer Danyliw** - Lab Coordinator
- Nagendra Tripathi** - Metallurgist
- Pat Greasley** - Business Development
- Mario Arenas** - Materials Engineer
- Swati Shrivastava** - Materials Engineer
- Mayooran Somonathan** - Extractive Metallurgist
- Thomas Davidson** - Materials Engineer

To Receive XPS Bulletin

IF YOU WOULD LIKE to receive a copy of the XPS Bulletin please e-mail your details to:

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Northern Ontario CMP



XPS will be coorganising the Northern Ontario Annual Canadian Mineral Processors meeting at the Howard Johnson in Sudbury on the 10th November 2008. We hope to see as many of you there as possible!



Ask us about our Mini Pilot Plant Services!
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