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To **Members FEMP**
Alumni EMC, EMEC, EGEC programs


From Hans de Ruiter, Director FEMP

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Please find following the latest developments of FEMP in the third (and final) newsletter of 2011. If you have any questions or remarks, please contact me at j.j.deruiter@tudelft.nl

Membership

Femp is happy to announce that Boliden Mineral AB joined FEMP in September 2011

	<i>Boliden Mineral AB</i> SE-936 81 <i>Boliden</i> <i>Sweden</i>	<i>Mr. Craig Griffiths</i> Craig.Griffiths@boliden.com www.boliden.com
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Boliden is a leading European metals company. The main metals are zinc and copper. The operations are conducted in two Business Areas: Mines and Smelters. Boliden has approximately 4,400 employees and the turnover amounts to approximately SEK 37 billion annually Boliden is the third largest copper metals supplier and the third largest zinc metals supplier in Europe.



Boliden's operations focus on the initial stages of the processing chain, in other words exploration, mining and milling, smelting, refining and recycling. Metal recycling is a field in which Boliden is a global leader and is also a growing sphere within their operations.



The main metals are zinc and copper. Other important metals produced include lead, gold and silver. The company conducts operations in the business areas Mines and Smelters.

Educational matters

The number of students for the year 2011-2012 is:

EGEC: 12 Students
EMEC: 13 Students
EMC: 20 Students

These figures include the following number of Erasmus Mundus EMMEP students (2011-2013):

EGEC: 3
EMEC: 2
EMC: 2

The students originate from:

EMC	EMEC	EGEC
Finland	China	Belgium
Germany	Germany	Colombia
Indonesia	Ghana	Germany
Iran	Mauritania	Hungary
the Netherlands	the Netherlands	the Netherlands
Poland	Nigeria	Nigeria
United Kingdom	Poland	Philippines
	United Kingdom	Poland
	Zambia	United Kingdom

Including the 50 new students, the total number of participants of the FEMP programs since 1996 is 600, of which about 560 have an accurate e-mail address.

Future of FEMP

The Erasmus Mundus EMMEP program is now in its 4th year. Brussels one-sidedly changed the contract in 2009. This means significantly less financial benefits, while the requirements of work performed by the consortium (especially the coordinating party) increases. In the fall of 2011 it was unanimously decided by the 6 partners not to apply again with the current format of the program.

During 2010-2011 members of a small working group generated ideas for possibilities to replace the funding, now received from Erasmus Mundus and also to attract non EU students in the future (after 2013).

At the annual meeting of 2011 the future of FEMP was discussed at two occasions:

Academics workshop future FEMP

11 academic members of FEMP held a workshop to evaluate the contents and structure of the current FEMP programs. Subsequently ideas were generated to act as basis for a conceptual plan for a future program at a higher level than the current one.

The main conclusion was:

- Let the students work within a multi-cultural environment
- Promote a holistic approach to solving complex real problems
- Foster Lifelong learning
- Provide experience with working in multi-disciplinary teams
- Have courses been given by an international group of teachers in different countries

Industrial members discussions future FEMP

Prior to the FEMP Industrial Advisory Board Meeting a dinner for the 35 industrial representatives was hosted by Barrick Gold Corp. on Thursday evening 3 November in Mons. During the dinner the industrial representatives discussed amongst each other the future development of FEMP, after Erasmus Mundus will be finished. This was the basis for the break-out session which was held the next day.

During the IAB meeting of FEMP on 4 November in Gosselies, the 35 industrial representatives were asked to discuss in small groups 5 questions regarding requirements for a revised and improved FEMP program. Following is the summary of the recommendations by the groups.

1. What skills will be required for mining professionals in the future?

Regarding hard skills emphasis should be put on greater incorporation of technology in underground mining with focus on rock mechanics, ventilation, equipment and the use of IT. The soft skills will have to reflect the international and multi-cultural environment in which the professionals will be working. They should have a good ability to communicate and speak different languages and work in teams. They should also be mobile and flexible, have intercultural abilities, social responsibility, a good feeling for economics and finance, community and stakeholder relations, deal with environmental issues and have strong leadership / managerial skills.

Subjects dealing with logistics, supply chain and materials management, risk management and HSEC should be dealt with.

2. What would the future program design look like ?

The program should have a two year curriculum and include a compulsory internship, or have a co-op structure. Industry should guarantee sufficient places for internships. The program should cater to European and non-European participants.

Industry should be more integrated into the program regarding teaching specialties and by offering projects. Students should have frequent contact with the industry. Two types of programs should be made available (MSc and MBA).

There should be high standard entry and selection criteria for the students. Teaching should be of excellent quality by academics from high ranking universities. The degree should be a FEMP degree, not a degree from one single university.

3. What criteria should be applied to the selection of future candidates?

Selection of students should be based on broad criteria including grades, extra-curricular activities, communication skills, languages, motivation, leadership potential, team players, intercultural abilities. They should have a holistic attitude.

4. How should the program(s) be funded to ensure quality, quantity, sustainability?

Funding needs to come from member companies and should be tiered with industry privileges for higher level tiers. Industry can also have greater impact, aside from funding, industry professionals could for example participate in lectures as support in kind.

5. What are critical success criteria for the future program, how will we know it is working and sustainable?

The program should have a very high international reputation to educate the best and brightest students for the mining industry. It should change from European to International recognition with its own degree. There should be feedback to the program from Industry how students are carrying out internships and thesis projects. Graduates should give feedback how they are progressing in their careers. Their successes should be highlighted.

Annual meeting and reunion 2011

Caterpillar hosted this year's reunion of the EMC, EMEC and EGEC programs which coincides with the annual meeting of FEMP (Federation of European Mineral Programs) and its IAB (Industrial Advisory Board).

Besides 50 students and 70 alumni, 60 representatives of the industrial and academic FEMP members were present. The event was again an excellent opportunity to strengthen the FEMP network.



The venue took place at the Caterpillar plant in Gosselies and during the evenings in Mons, both places are about 50 km South of Brussels (Belgium).

On Thursday 3 November business meetings of the academic FEMP members were held, while Barrick Gold Corp. hosted a dinner meeting for the industrial FEMP members. In the evening First Quantum sponsored a welcome event at the hostel in Mons.

The students arrived on Thursday afternoon and participated in a plant tour in Gosselies. On Friday afternoon 4 November the workshop took place at the premises of Caterpillar. In the morning the business meeting of the FEMP's Industrial Advisory Board (IAB) was held at the same place. Students and alumni of the three programs joined around lunchtime. On Thursday afternoon and Friday morning Caterpillar offered plant tours.



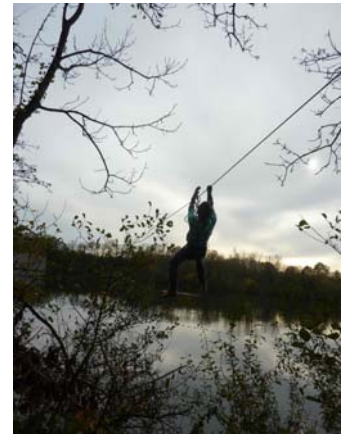
All participants joined at 13.00 for lunch, followed by a short introduction by the Industrial members of FEMP about their company. Between 15.00 and 18.00 the workshop "Mining in 2020" was presented by Dave More, Rien Pouls, Ard Wormeester and Andreas Keller. The Workshop topics were:

- Room and Pillar in 2020 (Pouls)
- New mining methods for seams in 2020 (Keller)
- Surface mining in 2020 (Dave or Arend?)
- Hard rock mining in 2020 (Arend or Dave)
- From mine to mill (Mike Buxton of TU Delft)
- Future developments in mass extraction, Block Caving (Allan Moss of Rio Tinto)

The conclusions of the workshop are at the end of the newsletter.



In the evening there was a buffet dinner and drinks, offered by **Caterpillar**, at the hostel "Auberge de Jeunesse du Beffroi" in Mons. Most of the 180 participants were present.



On Saturday 5 November a program with outdoor activities was offered at Ecpark Adventures in Tournai. 70 students and alumni participated in three hours of activities on cables between trees, including a thrilling strumming experience across a lake (and back).

Workshop – Mining in 2020

The workshop "Mining in 2020" was presented by Caterpillar staff. The topics were:

- Room and Pillar in 2020 (Rien Pouls)
- New mining methods for seams in 2020 (Andreas Keller)
- Surface mining in 2020 (Dave Mohr)
- Hard rock mining in 2020 (Arend Wormeester)
- From mine to mill (Mike Buxton of TU Delft)
- Future developments in mass extraction, Block Caving (Allan Moss of Rio Tinto)

All links to detailed information, pictures, participants, etc. can be found at the FEMP website: <http://www.femp.org/femp-reunion/>

Annual meeting and reunion 2012

Outotec will be hosting the 2012 FEMP annual meeting and reunion from 25 – 27 October. At this moment the choice of the location is being hold. There are two alternatives:

1. In the area of Frankfurt (Germany).
2. At the ferry Stockholm – Helsinki – Stockholm (40 hours).

The most likely option is the ferry.

Employment situation

The job market for new graduates and for those with experience is very good. During 2011 FEMP has mailed 68 positions for employment or internships around.

Websites and information

The new website of FEMP is now operational. Emphasis has been put on possibilities for the industry and for the alumni to include job opportunities, CV's, etc. on the web site.

Information, articles, etc. about education and research are accessible through the website of the Society of Mining Professors (www.mineprofs.org). It contains various presentations and articles about education and research in the directory: www.mineprofs.org/info .

Course Summary and Annual Report

The latest course summary and annual report can be downloaded from: <http://www.femp.org/2011/08/course-summary-and-annual-report/> Hardcopies can be ordered by e-mail from Marja Roep (m.g.roep-vanderklis@tudelft.nl).



Date: 21 December 2011

Subject: Final Conclusions FEMP workshop

Following you will find a brief summary of the most important conclusions of the workshops "Mining company of the future" held during the FEMP reunion at Caterpillar in Gosselies on November 4th, 2011.

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Introduction

During the FEMP/IAB meeting and reunion (3rd to 5th November 2011) a workshop was held with the participants. The participants were divided into 6 groups, each with a different topic and guided by a Group Leader, the topics were:

- Future developments in mass extraction (Prof. Martens)
- Utilization of Longwall Information in 2020 (A. Keller)
- Surface mining in 2020 (D. Mohr)
- Hard rock mining in 2020 (A. Wormeester)
- From mine to mill 2020 (M. Buxton)
- Room and Pillar in 2020 (R. Pouls)

Some guidelines were given on the objectives of the workshop, these were among others:

- What can the future developments have as an effect on human resources?
- What are the effects on educational requirements?
- What other challenges are we expecting in the future?
- What are your expectations?
- Identify subjects for thesis and university research?
- Further objectives were to be discussed within the different workshop groups.

Results of the Workshop

As a general comment it has to be mentioned that the time allocated to the Workshop was relative limited, which did not give the groups much time to discuss the topics in detail. This specially applied to the workshops in which some general information had to be given in the first part of the work shop. Reason being that due to time constraints only of the first 4 (above mentioned) topics an introduction presentation was made in the first part of the workshop.

Following is a summary of the results from the different groups (please note not all of the documents were received after the individual group presentations). As far as possible the results are summarized under the "Topic Guidelines" as a lot of the results from the groups were "identical".

Human Resources:

- Shift in skills
 - higher level of automation requiring more skilled maintenance staff and engineers
 - Operators have to start to understand what "automation" means (what are for example limitations, what can it do)
 - Operators are becoming controllers of systems (supervisors of more than one piece of equipment)
 - The typical UG "miner" will disappear and will become a multi-skilled person
- Possibly a reduction of personnel in mines but with higher skills
- How to keep people at remote mine sites
- How can we make "mining" interesting to people
- A better understanding of all process is required by those involved.
- Further education during the career will become more important as technical developments are occurring more faster



Educational requirements:

- Improve knowledge about automation (what can you achieve with it, limitations, advantages)
- More involvement of industry, technical developments in the industry are ahead of what is been trained at Universities. Presentations/lectures by engineers from manufacturers and mine operators can help to overcome this.
- Integration of different faculties, i.e. a mining engineer does not require to write programs but should have a general background. Instead of doing projects only within the department it may be a good idea to have projects involving different departments

Challenges:

- UG mining conditions will become more difficult (temperature, ground pressure etc) on equipment and humans. Cooling will be a requirement UG.
- Environmental impact on water, air etc
- How far can automation go? In case of a break down is there still a person needed or do we develop special vehicles to retrieve broken down equipment.
- Project development are taking much longer than in the past, how do we maintain continuation in the project as people come and go.
- To develop hardware/sensors to detect/scan ore/seam properties to improve automation or other processes such as amount of explosives, improving LW automation etc, cutting of material
- How to handle all the information successfully. Linking databases, real time data.
- Can we develop “intelligent” equipment, which learns from it’s own mistakes
- Effects of automation on (mining) regulations (such as emergency measures, rock stability, ventilation, road width etc). Issue would be to convince the authorities in accepting automation as a part of the system. For example humans are not required to work in certain areas as it is fully automated or only under certain conditions (equipment is not working etc)
- Can we use equipment, such as Shearers, to collect data
- It is possible to automate batch transport (i.e. Continuous Miner – Coal Hauler – Feeder Breaker, there may be too many variables). We will need a lot of algorithm for this

Expectations:

- Mining will be safer
- More cost efficient
- More “greener” production
- Less damages to equipment in case they are not controlled by humans (i.e. human error is eliminated)
- Improvements in extraction rates and quality
- Certain areas in the mine may see never a human
- Better information on the health of equipment = preventive maintenance
- Automation may lead to:
 - Less break down (because equipment can only be used up to certain “levels”. An operator can try to force a bucket into a muck pile, causing damage to the equipment)
 - No stoppages because of for example coffee breaks. Less time lost because of travelling.
 - Blasting can be done also during hauling and loading
 - “Lower” standards if people are not working in certain areas (dust, temperature, ventilation)
- Mining companies and equipment suppliers will work more closely together
- Mining companies will start to use less suppliers as the systems are becoming more complicated requiring a lot interaction
- “Decisions” will be transferred from the operator to the “machine/equipment”
-



- Maintenance people may require to have special suits for heat and higher dust concentrations
- Data collected by suppliers from their equipment can be used to optimize equipment being supplied to other companies
- Data collected in certain activities in the mine can have a positive influence on other activities as this information can be used to optimize this activity
- Diesel will be replaced by electric or hybrid engines especially UG
- Mining authorities may be interested in the online monitoring to obtain more data and reduce accidents

Thesis

- What types of mining related software will be needed in the future
- NOTE: A number of thesis can be compiled out of the responses

Special comments to workshop topics

- Surface Mining
 - Can automation of hauling have an effect on open pit design (ramps, width of roads etc)
 - Autonomous mining will require defined operational zones (boundaries will however move)
 - Automation can lead to higher hauling capacity
 - Road maintenance need to be reviewed (can this be done autonomous?)
 - System should not shut down completely if somewhere in the system something happens
- Mine to Mill
 - Use of feed information during extraction to optimize the short term results
 - Can only be successful if a good communication system exists between different activities
 - Requires continuous information on the feed (mineralogy, mixture, properties, grades etc)
- Hard Rock Mining requirements/developments
 - Completely automated mine Drill, loading of blast holes
 - Continuous Telescopic Rock Feeder
 - Combined scaling (requires visual inspection) and rock bolting machine maybe drill and charge
 - Truck loading automation module
 - Smaller drifts if ventilation requirement is reduced
- Longwall
 - Fully automated longwalls require many parameters (such as rock pressure, cutting resistance) to be able to be effective, new sensors etc are required (see also challenges)
 - Fully automated LW will give a higher productivity and better safety.
 - How can we convince new operators about automated longwalls.
- Future developments in mass extraction
 - Development speed will have to increase to keep
 - Improvements in shaft haulage
 - New extraction technologies are required