



WESTERN AUSTRALIAN SCHOOL OF MINES

Newsletter | August 2011



DIRECTOR'S WELCOME

DISTRIBUTION OF MONEY AND THE DEBATES AUSTRALIA HAS TO HAVE

The fantastic news in the politics surrounding mining schools and regional education is that the recent State Government budget has identified \$20 million to rebuild and extend Agricola Residential College in Kalgoorlie. Also Curtin will be submitting a proposal to the Federal Government under the \$500 million Education Investment Fund for improvement to infrastructure in Kalgoorlie.

Planning is also progressing for a new building on the Bentley Campus to provide much needed and improved accommodation for the Applied Geology and Spatial Sciences departments.

Several quite different debates are happening in Australia and the outcomes of each will have significant influences on the future of resource development. Firstly, energy provision – including nuclear power and uranium mining – that is inextricably linked to the proposed minerals and carbon taxes. Having participated in the recent Uranium 2011 Conference in Perth and the associated public forum, it is clear the emotion that uranium mining generates in an often scientific-illiterate general public. However, this public votes and as Minister Norman Moore has stated – why politically try to alter “no uranium mining legislation” in many eastern states; when mineral taxation

and the redistribution of GST adjusts the state’s income anyway. Of course, much of the money to be redistributed comes from resource projects in WA.

Secondly, skilled migration to Australia. Yes, there is a huge skill shortage in WA, especially in the mining-related professions. However, there is no huge surplus of such quality people anywhere in the world just waiting to come to Australia; and should we be robbing the developing world of the same people they need to generate wealth to climb out of poverty?

Finally, the debate on the funding of higher education and in particular mining schools. Clearly, this is the means to domestically address the skills shortage by growing our capacity to educate more domestic and international students. Here I welcome the submissions to the review from the Minerals Council of Australia and the AusIMM. The latter, highlighted the benefits of reviving the School of Mines model.

I look forward to continuing these interesting debates and I am sure many others at Diggers and Dealers in Kalgoorlie at the beginning of August.

In what is turning into a very busy winter, we have also welcomed our first 10 AusAID-funded scholars from across Africa; these will be joined by a further nine scholars in September, when all will be attending the Africa DownUnder conference in Perth. WASM will be exhibiting at this conference as part of our evolving international strategy.

Keep warm and I hope you, unlike me, have avoided the first of the flu bugs.

Cheers
Steve

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Prof John H Taplin, Dr Jianhong (Cecilia) Xia, Dr Doina Olaru and Dr Renlong Han received \$33,687 over three years as part of an ARC Linkage Project entitled Modelling and Evaluating the Joint Access Mode and Train Station Choice. The project, which is being conducted in collaboration with University of Western Australia, Department of Planning, Department of Transport and Public Transport Authority of Western Australia, will be examining the following premise: Transit-oriented development (TOD) aims to fight sprawl and provide a mix of land-uses. Local solutions adapted to low-density cities, such as park-and-ride (PnR), are required but PnR is seen as conflicting with TOD principles. The group will study the viability of PnR as an alternative mode, reducing car use and increasing transit ridership. Discrete choice multivariate analysis and spatial modelling are applied to assess accessibility, choice of travel and willingness-to-pay for PnR provision in order to estimate parking charges.

The research will provide a better understanding of location advantage, PnR site selection and potential for

multi-level parking. One objective is to assess the impact of rising petrol price using the improved STEM model.

For further information contact Dr. Jianhong (Cecilia) Xia at c.xia@curtin.edu.au



Figure illustrates the distributions of Park'n'Ride facilities in Perth.

Wyatt, T. (2007) The need to view Park'n'Ride as a complementary part of TOD in Perth, UDIA Transport & Development Forum.

NEWS FROM THE DEPARTMENT OF EXPLORATION GEOPHYSICS

During the past quarter, staff and senior students have been very productive resulting in nine journal publications, 13 conference/poster papers, public presentations and convened a workshop. We are also proud to report on some honours and awards bestowed on staff and students.

PUBLIC PRESENTATIONS

Boris Gurevich presented two papers at the EAGE Workshop on Naturally & Hydraulically Induced Fractured Reservoirs: from NanoDarcies to Darcies from April 10-13, in Nafplio, Greece. They were Signatures of Fracture and Stress Induced Anisotropy by Pervukhina, M., and B. Gurevich, and Frequency Dependent Anisotropy of Porous Rocks with Aligned Fractures by Gurevich, B., R.J. Galvin, and T.M. Mueller. Andrew Squelch gave a presentation titled An Evolving Interest in 3D Visualisation at the 3D Visualisation: Evolution of Thought Seminar, held in the ARRC Auditorium on April 11.

On May 19 and 20, the Curtin Reservoir Geophysics Consortium hosted a two day short course which focussed on

the Modern Methods Used in Seismic Imaging. The course was presented by visiting Professor John Bancroft from CREWS, University of Calgary. The course was held in the ARRC Auditorium and was attended by 15 industry participants and 12 students.

RESEARCH VISITS

Anton Kepic was invited by the China University of Geosciences (CUG) to speak at the International Workshop on Mineral Exploration at Depth and Under Cover, held April 18-23, Wuhan, China. He gave a presentation entitled Mineral Exploration with the Seismic Reflection Method.

HONOURS/GRANTS/AWARDS

Congratulations to Boris Gurevich who has been greatly honoured by being elected a Fellow of the Institute of Physics, in recognition of his personal contribution to the advancement of physics, as a discipline and a profession.

Congratulations to four geophysics students who received AusIMM Awards of Academic Excellence for their excellent academic achievements during 2010. The students are: Mr Gavin Jones – Best First Year Student,

Mr Grant Fryer – Best Second Year Student, Mr Jason Valuri – Best Third Year Student and Mr Jeremy Smith – Best Fourth (Honours) Year Student.

SOUNDING OUT SWAN RIVER

By Michael Kuhn

Students from the Department of Spatial Sciences together with the assistance from McMullen Nolan Group Pty Ltd. have performed a hydrographic survey of parts of the Swan River, close to the Perth CBD. This was made possible through an agreement between McMullen Nolan and Curtin University to assist the department in their undergraduate program by providing hydrographic equipment and expertise.

As part of their Bachelor of Surveying course the students were given the opportunity to learn firsthand about the execution of hydrographic survey work with the aim to obtain the depth of the Swan River near the Barrack Street Jetty. Using sophisticated equipment such as an echo sounder (derives water depth via timed sound pulses) and Real Time Kinematic GPS (provides positions with cm-accuracy), the students were able to collect their own data for later processing as part of an assignment in their Hydrographic Surveying unit.

CARTOGRAPHY STUDENT MAPS AUSTRALIAN ALPS WALKING TRACK

By Dr Robert Corner

During the summer break of 2009/2010, final year cartography student Stuart Galton walked the full 650km of the Australian Alps Walking Track through the Australian Alps National Park. As he walked he made a record of his progress in a GPS track log. These data were then used in his final year cartography project. The project, which was supervised by Dr Robert Corner, involved devising a method for creating a set of dedicated track maps that provide a walker with all the spatial information required throughout the journey. Map One of the series was produced, along with templates of maps Two to Six as a proof of concept. The entire project, from processing the spatial data, to writing the report was done entirely with Free Open Source Software (FOSS).

This set of maps has the potential to fill a gap between the standard 1:100,000 Natmap topographic map sheets, which are too general, and the very large scale maps in guide books, which do not maintain broader scale situational awareness.

Stuart's project involved developing skill in using FOSS ranging from specialised GIS tools and scripting languages to vector graphics editors for the final production.

Considerable thought went into the overall aesthetics of the final map, as this plays an important part in its function. Symbology, colour schemes and labels were all created from scratch, keeping in mind the cartographic conventions that a map reader expects.

In order to make the map as usable as possible to a walker, a number of extra pieces of information were included into the map. Walking distances and change in elevation can be hard for a walker to derive from a conventional map, so this information was added in an easy to use format. A locality diagram showing adjoining sheets, and a universal grid reference diagram were also features of the maps. In addition, an index map showing the entire track at a 1:1,000,000 scale was included to assist with planning.

Stuart was awarded the Whelans Spatial Information Services prize for the best final year cartography project at the Department of Spatial Sciences Prize Giving in May.

SPOT IMAGE GRANT FOR SPATIAL SCIENCES STUDENT

Department of Spatial Sciences MSc (Geospatial Science) student Dunstan Matekenya from Malawi has been awarded a data grant by the French satellite remote sensing company SPOT.

SPOT, a leading supplier of satellite imagery and geo-information, run an annual grants scheme known as Planet Action which was launched in 2007. Its core mission is to support non-commercial local projects acting on Climate Change-related issues by providing geographic information and technology to NGOs, universities, research centres etc. for projects in developing countries.

Dunstan has been at Curtin on study release from his employer the National Statistical Office of Malawi. He has returned to his home town, Zomba, to work on his project and dissertation which are being supervised by Dr Robert Corner.

Dunstan is investigating the relationship between malaria outbreaks and a range of environmental factors such as vegetation condition, standing water and meteorological conditions. He applied for and has been granted 10 SPOT Image scenes in order to assist with this work. These images would have cost in the order of \$15,000 if they needed to be obtained through commercial channels, which would have rendered the project unviable.

The work is concentrating on the under five age group of patients as being at

highest risk. Malaria is the major cause of death in children in this age group in Malawi, accounting for 17% of deaths.

For further information about this work contact Dr Robert Corner at R.Corner@curtin.edu.au or see the Planet Action web site at <http://www.planet-action.org/web/3-home.php>.

WASM WOMBATS

The international mining competition is an annual event showcasing the strength, wit, and stamina of mining university students worldwide. The WASM Wombats have a long history in this competition, and are renowned for taking training and game day quite seriously.



Victorious Men's A-team with trophies

This year the games were hosted in March by the Mackay School of Mines at Reno, Nevada, and the Wombats sent three men's teams and one co-ed team from Kalgoorlie. The games lasted for three days, and competitors endured through snow and ice. The competition includes seven events: hand steeling, hand mucking, track set, gold panning, air legging, surveying, and swede sawing. This was the most successful year for the Wombats to date, with men's teams placing 1st, 2nd, and 12th, while the Co-ed team maintained their title, again taking out 1st place.

After the games the teams took some time to enjoy the American lifestyle, visiting Lake Tahoe, Las Vegas, Cancun, and San Francisco.

Sites visits to Leeville and Cortez were also made possible, where the group toured the pits, underground, and plants to learn some of the differences that exist between American and Australian gold mining operations. Thanks go to Newmont and Barrick for their hospitality.

Next year the competition will be held in England for the first time by the Cambourne School of Mines. Thanks to all of our sponsors, particularly Westrac, Rio Tinto, and Barrick for their assistance in making the 2011 trip possible, and hopefully next year can be equally successful.

WASM'S WORLD-CLASS MINING CONTRIBUTIONS TO SME HANDBOOK

By Roger Thompson

The American Society for Mining, Metallurgy and Exploration, Inc. (SME) published what is widely regarded as the mining engineers' foremost handbook on the state of the art in mining, world-wide. It is updated every 15 years and is now in its third edition. Leading authorities in their field of engineering are, by invitation only, requested to submit a section of the book in their field of engineering research specialisation. For the third edition, some 150 of the worlds mining industry experts were invited to contribute, and WASM staff submitted four sections to the book, by Andrew Jarosz (Mine Surveying), Mahinda Kuruppu (Mine Infrastructure), Roger Thompson (Mine Haul Road design), and Nimal Subasinghe (Mineral Processing).

WASM's contribution to the handbook was the highest from any Australian mining school or department, and second only to the University of British Columbia (Canada) contributions. In total, academics delivered approx one-third of the specialist sections, of which 25% were from Australian academics – WASM alone representing 30% of these contributions.

Prof Thompson notes that WASM's contributions underscore the depth and extent of world-class mining research expertise here in the Goldfields - and also the key role local industry plays in supporting research and engineering developmental work, where site access, experimental facilities and opportunities for implementation and monitoring of research in an operating environment are highly valued.



From left to right: Nimal Subasinghe, Roger Thompson, Andrew Jarosz and Mahinda Kuruppu

WASM MINE ROAD RESEARCH SHOWCASES IN QUEENSLAND

Prof Roger Thompson, from WASM's Department of Mining Engineering and Mine Surveying, presented two keynote addresses at two recent Queensland mining conferences.

The Queensland Mines Safety and Health (May 31), mines inspectorate,

arranged a one day mining industry workshop in Rockhampton on mine road design, construction and maintenance practices with a focus on controlling uncontrolled movements of vehicles at surface coal mines.

Prof Thompson comments that surface coal mines were 'targeted' for this workshop primarily due to the fact that there is a predominance of semi-permanent haul roads often constructed out of inferior or marginal quality 'local' materials. In the past year, the number of high potential incident reports of uncontrolled movements due to wet roads (rain and dust suppression watering) exceeded those for metalliferous mines and quarries by a factor of 10.

Prof Thompson was invited as a keynote speaker and technical facilitator. Roger's area of expertise is centred on surface mining transportation productivity issues and the provision, rehabilitation or improved design and management of mine haul roads. He has a number of research interests in this area and two in particular were considered to be of significant benefit to Queensland's recovering and expanding mining industry. Aligned to the theme of the workshop were presentations on; "the structural design of new or up-grading and re-design of existing haul roads for larger vehicles"; and "functional design, selection or modification of mine road wearing course material".

The workshop was attended by 106 delegates from the Queensland surface mining community, with representatives from most of the key industry groups.

Additionally, Prof Thompson presented a 'best-practice' paper on road design tyre-wear issues at the IQPC Tyre Procurement and Management Strategies Conference in Brisbane (May 24-25). The conference also featured and was chaired by Prof Guy Callender, Chair of Leadership in Strategic Procurement from the Curtin Business School.

MINING EXPERTISE DELIVERY FOR AFRICA

Education and Training International (ETI) in collaboration with the Western Australian School of Mines (WASM) have organised and will deliver two 12-week short courses to African scholars. The first course commenced in June 2011.

Funded by AusAID as part of the Australia Awards for Africa, and managed on their behalf by GRM International, the courses will bring around 20 representatives of Ministries of Mines from across Africa (Morocco to South Africa) to Perth and Kalgoorlie.



The first group of African Scholars during their visit to Barrick's Granny Smith Mine

"The courses will focus on mining regulation and management using both the Kalgoorlie and Bentley campuses of Curtin University," said Professor Steve Hall, Director of WASM.

"The courses have been developed following pre-course visits to Togo, Malawi and Namibia, including meetings with Government, industry and many NGOs," said Judith Uren, Director of International Projects with ETI.

The collaborative approach and complementary skills across TAFE and Higher Education helped in securing the project, plus the significant number of Perth-based mining companies with projects across Africa. The courses will cover policy development, mineral finance, socio-economic issues, workforce gender balance as well as technical topics in mining, environmental impact, health and safety. In addition, it is expected scholars will attend the Africa DownUnder conference in Perth.

RESEARCH COLLABORATION WITH WASM

By Dr Denis Yan (METS Consulting Metallurgist)

Article provided by Mineral Engineering Technical Services Pty Ltd (METS) Gazette (issue 30).

Engineering students at WASM have a research project requirement as part of their final year of study. The topics of research are strongly aimed towards areas of practical interest to the industry; industry involvement is strongly sort. METS supports WASM by providing staff time to act as external supervisors on projects of interest to METS and the mining industry. METS Consulting Metallurgist, Dr Denis Yan, an Adjunct Associate Professor with WASM, provides a scholarship each year to assist a student in their research programme.

In 2010, Jonathan Floyd was supported on a topic examining the effect of titanium in the salt roast-water leach extraction of vanadiferous titanomagnetites. Magnetite is an inverse spinel structure where Fe³⁺ ions occupy the tetrahedral sites and Fe²⁺ and Fe³⁺ occupying the octahedral sites. Ti⁴⁺ can substitute for the Fe³⁺

in the octahedral positions and the charge difference is compensated for by divalent ions. Complete substitution of Fe³⁺ by titanium leads to the mineral ulvospinel (Fe²⁺ 2TiO₄) (one end of the ulvospinel-magnetite solid solution series referred to collectively as titanomagnetites or titaniferous magnetites). Other tri-valent cations such as V³⁺, Cr³⁺, and Al³⁺ can substitute for the Fe³⁺ in the magnetite or titanomagnetite structure.

When the vanadium substitution is significant (>1%) the vanadiferous titanomagnetites can be a viable ore resource for vanadium. To extract the vanadium from these ores, the tri-valent vanadium ion (V³⁺) must be oxidised to the penta-valent ion (V^{2O5}) and reacted with a sodium salt to form a water soluble sodium metavanadate. Vanadium recovery from the salt roast extraction process is influenced by the titanium content of the titanomagnetites. Vanadium recoveries can vary from 60% to 95% depending on the source of the titanomagnetite. This project investigated the influence the titanium content has on the recovery of vanadium in the salt roast process.

If you have any events or research news for our next issue or would like further information on any stories from this newsletter, please email wasmmarketing@curtin.edu.au

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