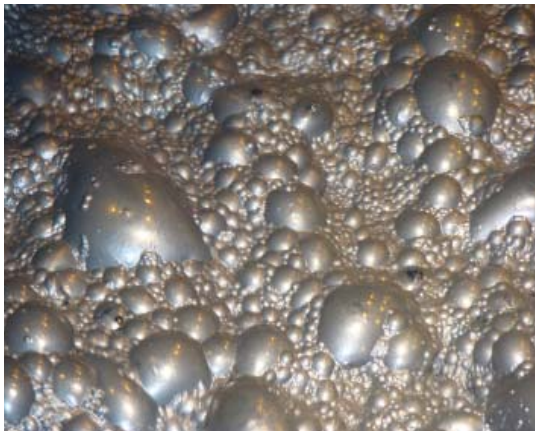
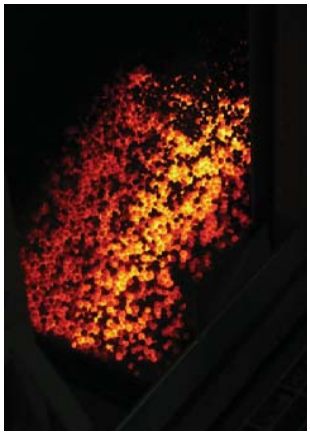
CODES
ARC CENTRE OF EXCELLENCE IN ORE DEPOSITS

Geometallurgy Short Course




23 October- 3 November 2017

A comprehensive overview of practical geometallurgy: From deposit characterisation and Grade Engineering to improved management of mine waste

UNIVERSITY of TASMANIA

CODES, ARC Centre of Excellence in Ore Deposits,
University of Tasmania CRICOS Provider Code 00586B

Geometallurgy involves a quantified and comprehensive approach to ore characterisation in terms of critical processing attributes such as blasting, crushing, grinding, liberation, recovery and environmental management. Key outcomes of increased geometallurgical knowledge are improved forecasting, reduced technical risk, enhanced economic optimisation of mineral production, and improved sustainability. The course introduces a range of techniques for 'early-stage' (e.g., exploration, pre-feasibility) collection of geological information that is relevant to mining engineers and metallurgists. The program includes lectures, practical exercises, site visits and a range of computer-based modelling exercises.

Registration fees cover the cost of course notes and a 3 day field trip to the west coast, visiting the ALS Minerals and Geochemistry Laboratories in Burnie and mineral processing plants at the Savage River (iron ore) and Renison (tin) mines.

Participants are responsible for air travel to/from Hobart and accommodation in Hobart. Participants must bring safety boots and a laptop computer with Microsoft Excel installed. It is recommended that all participants are familiar with the use of Microsoft Excel. Instruction in the use of other software (e.g. ioGas) will be provided during the course.

Geometallurgy is offered as a unit of the national Minerals Geoscience Masters program.

MGM Minerals Geoscience Masters

Invited Presenters

Steve Walters is Research Director at CRC ORE with over 30 years' experience across multiple facets of the global minerals industry, including exploration and mining geology, corporate research and geometallurgy. Steve played a key role in establishing and managing the AMIRA P843 GeM(III) project - the largest ever university-based geometallurgy research program.

John Glen is the Manager of the ALS Metallurgy Laboratory in Burnie, Tasmania. John has over 30 years' experience in metallurgical testwork spanning gravity separation, flotation, and several leaching techniques. John is regarded as a world-expert in tin metallurgy and has developed novel processes enabling metal recovery from complex ore bodies.

Angus McFarlane is the Research Program Director at CSIRO Mineral Resources, Chile. Angus has over 20 years experience in mineral processing, and has a broad technical interest in linking the fundamental characteristics of minerals to their processing behaviour. Angus is regarded as a global expert in hydrometallurgy and heap leaching, with experience across many commodities.

Naomi Boxall is a Postdoctoral Fellow in the Bioprocess Technology and Environmental Engineering team at CSIRO Land and Water, Perth. Naomi has over 10 years' research expertise in mining and industrial biotechnology, microbiology, resource recovery and waste treatment. Her PhD focussed on the biological treatment of organic waste produced by Bayer processing.

Luke Keeney is the Implementation General Manager at CRC ORE, and is a technical specialist with over 10 years' global experience in integrated mining related base metal and hard rock environments. Luke has worked in a variety of roles covering open pit slope design, geometallurgical research and consulting and has extensive practical and laboratory experience.

Michael Scott is a Project Evaluation Specialist at CRC ORE and focusses on the evaluation of Grade Engineering strategies and emerging innovations and technologies. Michael has a background in commerce, mining engineering and mining economics working across multidisciplinary teams with a strength for business case development and strategic planning.

Ron Berry is an Associate Professor at the University of Tasmania. Ron has worked on many aspects of geometallurgy since 2005 through the GeM^{III} project (leader from 2011-2012) and CRC ORE. Ron has expertise in automated mineralogy, image processing and numerical methods and has supervised several PhD and masters students in this discipline.

David Green is a senior geologist at Mineral Resources Tasmania with over 20 year's experience. David works closely with hyperspectral mineralogy datasets produced by the HyLogger™ to characterise ore bodies for a range of geological and metallurgical outcomes. David has additional expertise in geoinformatics (GIS), geochemistry and structural geology.

UTAS presenters: Anita Parbhakar-Fox, Angela Escolme, Nathan Fox, Sebastien Meffre, Robert Scott, Cassady Harraden, Laura Jackson, Sean Johnson, Karsten Goemann, Sandrin Feig, Thomas Rodemann

MASTER OF ECONOMIC GEOLOGY: THE MOST COMPREHENSIVE MASTERS DEGREE IN MINERAL EXPLORATION AND MINING GEOLOGY ANYWHERE IN THE WORLD

This course work-based Masters program is aimed at geoscientists seeking a thorough update on advances across the spectrum of economic geology applied to mineral exploration. The Master of Economic Geology at UTAS is part of the national Minerals Geoscience Masters program, jointly offered by the University of Tasmania, the University of Western Australia and James Cook University, in conjunction with Curtin Business School at Curtin University.

Course structure

The Masters course can be completed in either of two ways:

- Option 1: Completion of 6 course work units and a minor research thesis. Four of the course work units must be undertaken at CODES; the remaining two may be completed at either CODES or the other participating universities. Duration: 18–24 months full-time; up to 30 months part-time (flexible in recognition of industry participants).
- Option 2: Completion of 8 course work units, at least 4 of which must be undertaken at CODES. Duration: up to 30 months part-time (flexible in recognition of industry participants).

Course content

Participating universities offer up to seven intensive short course style units annually, or in rotation over a two-year period. Most units are two weeks in duration.

Courses offered by CODES

- Ores in magmatic arcs – Indonesia (KEA707/KEA706): 20 – 31 Mar, 2017
- Ore deposit geochemistry, hydrology and geochronology (KEA709/KEA704): 12 – 24 Jun, 2017
- Geometallurgy (KEA711/KEA702): 23 Oct – 3 Nov, 2017
- Volcanology and mineralisation in volcanic terrains (KEA708/KEA703): next offered March 2018
- Exploration in brownfield terrains (KEA710/KEA705): next offered June 2018
- Ore deposit models and exploration strategies (KEA712/KEA701): next offered October 2018

Fees

UTAS tuition fees are approx. $2262 per unit (8 in total) for domestic students and $7312 (AUD) per unit for full-fee paying overseas students. Field-based courses have additional costs. Fees vary for units taught at other MGM partner institutions. International students should refer to http://www.international.utas.edu.au/ or contact the Masters Coordinator for more information (see below for contact details).

Entry Requirements

A BSc (Hons), or a BSc (majoring in geoscience) with at least two years industry experience. English language proficiency requirements also apply.

For further information contact:

Dr Robert Scott, Masters Coordinator, CODES, Private Bag 79, Hobart 7001, Australia
Tel: +61 3 6226 2786; Fax: + 61 3 6226 2547
E-mail: Robert.Scott@utas.edu.au
Website: www.codes.utas.edu.au/masters

Preliminary Program

Monday October 23
Introduction to geometallurgy (Anita Parbhakar-Fox/ Angela Escolme)
Participant introductions
Description and use of tools, analytical equipment and sample preparation (Nathan Fox, Anita Parbhakar-Fox, Angela Escolme, David Green, Cassady Harraden, Laura Jackson)

Tuesday October 24
Application of LA-ICPMS to Geometallurgy (Sebastien Meffre)
Demonstration of tools (Nathan Fox, Angela Escolme, Anita Parbhakar-Fox, Cassady Harraden, Laura Jackson, Sean Johnson)
Tours of UTAS analytical facilities and Mineral Resources Tasmania (MRT) core storage facility (Sean Johnson, Karsten Goemann, Sandrin Feig, Thomas Rodemann, David Green)

Wednesday October 25
Core logger imaging; Calculating mineralogy (Ron Berry, Angela Escolme)
Introduction to Geometallurgy project (Ron Berry)
Data analysis using ioGas (Robert Scott/ Sebastien Meffre)

Thursday October 26
Comminution and rock behaviour (Steve Walters, Luke Keeney)
Grade Engineering (Steve Walters, Luke Keeney)
Sampling statistics (Luke Keeney, Michael Scott)

Friday October 27
Financial modelling and Risk Analysis (Michael Scott)
Metal recovery (John Glen)

Saturday October 28
Heap leaching (Angus McFarlane)
Bioleaching (Naomi Boxall)

Sunday October 29
Day off (Afternoon: Optional session for Geometallurgy project)

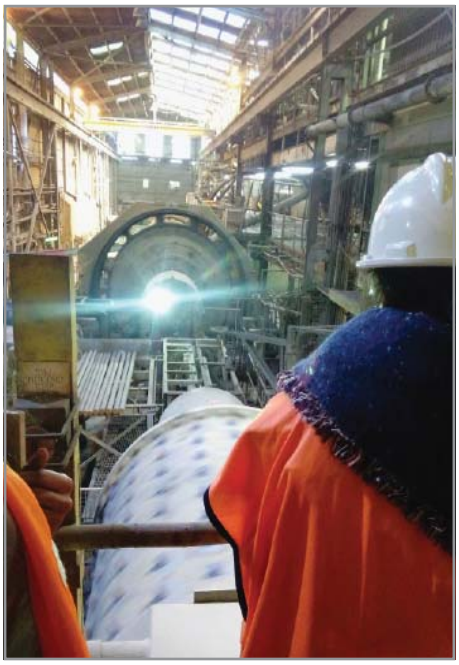
Monday October 30
Environmental aspects of geometallurgy (Anita Parbhakar-Fox, Laura Jackson)
Private study (work on project, presentation)

Tuesday October 31
Drive to Burnie
ALS Minerals and Geochemistry Laboratories, Burnie (ALS Global staff)

Wednesday November 1
Savage River (Iron Ore) mine plant (Grange Resources staff)
Savage River environmental geology (Anita Parbhakar-Fox)
Drive to Tullah

Thursday November 2
Renison (Tin) mine plant (Metals X Ltd staff)
Queenstown environmental geology (Anita Parbhakar-Fox)
Return to Hobart

Friday November 3
Student presentations



Geometallurgy

23 October—3 November 2017

REGISTRATION FORM

Please complete and return to:
Dr Robert Scott
Masters Coordinator
CODES/Earth Sciences
University of Tasmania, Private Bag 79
Hobart, Tasmania, Australia 7001
Ph: +61 3 6226 2786
Fax: +61 3 6226 2547
Email: Robert.Scott@utas.edu.au
ARC Centre of Excellence in Ore Deposits
University of Tasmania

PERSONAL DETAILS

Title—Please highlight (Prof / Dr / Mr / Mrs / Ms / Miss)
First Name: .....
Last Name: (family name): .....

Preferred Name (for use on name tag): .....
Position: .....
.....
Company / University: .....
.....
Address: .....
.....
City: ..... State: ..... Postcode: .....
Country: .....
Phone (work): ..... Fax: .....
Phone (home): .....Phone (mobile / cell): .....
Email: .....
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Dietary requirements / allergies / other health issues: .....
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Next of kin (name and contact details): .....
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REGISTRATION FEES

All fees are in Australia dollars (AUD). Please indicate ☑

MGM Masters students **$ 350** ☐
(not including tuition fee)

Industry participants (6 or more days,
incl. field trip) **$ 3600 + GST** ☐

or _____ days at $660 per day Total **$ _____** ☐
(max 6 days)

Industry participants, please circle dates:
October 23 24 25 26 27 28 29 30 31 Nov 1 2 3

Participants are responsible for air travel to/from Hobart and accommodation in Hobart during the course. Travel in Tasmania (e.g. Mineral Resources Tasmania core storage facility; three-day fieldtrip to western and northwestern Tasmania) will be by minibus. Accommodation (two nights) and breakfast/dinner in Burnie and Tullah is included in the registration fee.

Payments

Full payment must be received by 23 October 2017.
Please tick payment option ☑

☐ **Credit card**
Upon receipt of your registration form you will be provided with a payment reference number and web address for on-line payments.
Please note: Credit card details cannot be accepted by email.

☐ **Cheque or bank draft**
Please make cheques and bank drafts payable to "The University of Tasmania". Bank drafts must be made out in Australian currency.

☐ **Invoice**
Invoices can be issued on request. Please specify name and address against whom the invoice is to be raised (or email this information to Robert.Scott@utas.edu.au).....
.....
.....

☐ **Purchase Order**
UTAS account number.....

Please retain a copy of this form for your records and email, post or fax original to Dr Robert Scott