AusIMM New Zealand Branch Visiting Lecture Programme 2012

Tony Christie, 22/11/12

This report relates to the grant from AusIMM Services of Aus$5000 of "Performance based funding" toward the New Zealand Branch's visiting lecturer programme.

BACKGROUND

In 2009, the New Zealand Branch of the AusIMM established a Visiting Lecturer Programme to fund a visit by a prominent scientist from the northern hemisphere to provide short courses and lectures at several centres in New Zealand. The programme seeks to provide a focus for AusIMM members to meet earlier in the year than the AusIMM New Zealand Branch Annual Conference (typically August), and to fulfil the education objectives of the AusIMM. In late 2010, the New Zealand Branch agreed to host two visiting lecturers per year from 2011, one from the northern hemisphere and one from Australia.

In 2012, the visiting lecturer from the northern hemisphere was Jeremy Richards from the University of Alberta, Edmonton, Alberta, Canada, and the visiting lecturer from Australia was Bruce Craven, a Consulting Geophysicist with Southern Geoscience Consultants in Perth. This 2012 programme was described in an article in the AusIMM Bulletin:

> Christie, A.B.; Mauk, J.L. Craw, D. 2012: AusIMM New Zealand Branch Visiting Lecturer Programme. *The AusIMM Bulletin 2012 (4):* 25-26.

JEREMY RICHARDS - NORTHERN HEMISPHERE VISITING LECTURER

Jeremy presented a short course and two lectures at various locations throughout New Zealand during April-May as shown in Table 1. Although the Auckland and Wellington lectures had low attendance numbers, they were "quality audiences". The Nelson lecture generated more than two hours of discussion following the lecture.

Table 1: Itinerary for Jeremy Richards, April-May 2012

Date	Location	Presentation	Attendance
Monday 30	University of Auckland	Short course (1½-day, day 1)	22 (Fig. 1)
Monday 30	Simpson Grierson, Auckland	Evening Lecture B	13
Tuesday 1	University of Auckland	Short course (1½-day, day 2)	22
Wednesday 2	Waihi	Lecture A at the Waihi mine	12
Thursday 3	GNS Science	Short course (1-day)	16
Thursday 3	Simpson Grierson, Wellington	Lecture B	12
Friday 4	Golders, Nelson	Lecture B	20
Monday 7	GNS Science, Dunedin	Short course (1-day)	18
Tuesday 8	Macraes mine, Otago	Lecture A at Macraes mine	10

Short course: Tectonomagmatic controls on porphyry and epithermal mineralisation

This one day (Wellington and Dunedin) and one and one half day (Auckland) short course covered the following topics:
1. Arc Magmatism. Petrogenetic and metallogenic processes in arc magmatism, and models of crustal interaction (e.g., MASH processes), using examples of northern Chilean magmatism and porphyry Cu formation.
2. Arc Tectonics and Magma Emplacement. Magma buoyancy and tectonic stress conditions constrain the way in which arc magmas first pool at the base of the crust and then rise towards the surface. Pre-existing structures may localize the ascent and emplacement of magmas in the upper crust under transpressional (or transtensional) stress fields. Examples from Chile and Argentina were reviewed.
3. Upper Crustal Magmatic Processes. Mid-to-upper crustal magma chamber processes that result in formation of shallow-level apophyses and the focusing of volatile release were reviewed. The scale of magmatism required to supply metal to large porphyry Cu deposits was examined, and compared with observations from active and fossil magmatic systems.
4. Porphyry Cu-forming Processes. Processes of volatile exsolution and release in the cupola zone, and the resultant processes of hydrothermal alteration and mineral deposition were described.
5. Epithermal and Post-Subduction Deposits. The link between porphyries and shallow-level epithermal and fumarolic systems was discussed. Porphyry and epithermal ore formation in post-subduction settings was reviewed as a new exploration target.

Figure 1: Jeremy Richards (at front near the centre in a blue shirt) and Auckland short course participants (plus photographer Tony Christie), 1/5/12.

Lecture A: Tectonomagmatic controls on porphyry and epithermal mineralisation

This was a condensed (1 hour) version of the short course topic. The lecture at Waihi focussed on epithermal deposits to suite the audience.

Lecture B: Sustainable development and the minerals industry

Jeremy discussed the widespread public perception of the minerals industry as dirty and exploitative, and interested only in profit. This may have had some truth in the distant past, but the industry has greatly improved its environmental record, and is now working to improve its record of interaction with stakeholders and broader society. Although mining of non-renewable resources is in itself an unsustainable activity in the long term (due to resource depletion), in the short to medium term it can be part of an overall drive towards societal sustainability. The most obvious contribution is the materials the industry produces, upon which modern society is literally built. But it can also contribute by further reducing its environmental impact, and ensuring that the profits from mining activities fairly benefit not only the company, but also all levels of society, from national and provincial governments, to local communities and individual stakeholders.

Site visits

During his mine visits, Jeremy was given an underground tour at Trio-Union at Waihi and an underground and open pit tour of Macraes. He also visited Waiotapu thermal park to see epithermal mineralisation forming in a geothermal environment.

BRUCE CRAVEN - VISITING LECTURER FROM AUSTRALIA

Bruce Craven visited New Zealand between 22 July and 4 August and gave a two-day short course at four locations as listed in Table 2.

Table 2: Itinerary for Bruce Craven, July-August 2012

Date	Location	Local organiser	Attendance
23-24 July	GNS Science, Dunedin	Simon Cox (GNS Science)	18 including 9 students
26-27 July	Tai Poutini Polytechnic Reefton Campus	Peter O'Sullivan (Minerals West Coast)	18 (no students)
30-31 July	Te Papa, Wellington	Tony Christie	26 including 2 students (Figs 2-4)
2 – 3 August	University of Auckland	Ingo Pecher (University of Auckland)	14 including 5 students

Short course: Integration of geophysics into exploration and regional or project mapping

This two day short course covered the following topics:

Introduction

- Geophysical Techniques for Exploration and Mapping
- Methods / Physical Properties (Magnetics, Radiometrics, Gravity, Electromagnetics, Terrain Data, Remote Sensing, Radar)

Aeromagnetics

- Basic Physics, Magnetization and Physical Properties
- Acquisition and Processing Procedures
- Observation Methodologies
- Integration Methodologies
- Quantitative / Automated Methodologies and their Role
- Interpretation Strategies
- Example Data sets and Practical Exercises

Radiometrics

- Basic Physics and Physical Properties
- Acquisition and Processing Procedures
- Observation Methodologies
- Integration Methodologies
- Quantitative / Automated Methodologies and their Role
- Interpretation Strategies
- Example Data sets and Practical Exercises

Gravity

- Comparison of Gravity with Aeromagnetics
- Density; controls and properties
- Acquisition and Processing Procedures
- Observation Methodologies
- Integration Methodologies
- Quantitative / Automated Methodologies and their Role
- Interpretation Strategies
- Example Data sets and Practical Exercises

Electomagnetics (EM)

- Conductivity; controls and properties

- Acquisition and Processing Procedures
- Observation Methodologies
- Integration Methodologies
- Quantitative / Automated Methodologies and their Role
- Interpretation Strategies
- Example Data sets and Practical Exercises

Other Methods, Data and their Contributions
The Importance of Geology to Successful and Broader Interpretation

Bruce included descriptions and discussion of several airborne geophysical surveys in New Zealand, including the Government funded Northland survey and the Reefton (CRA) and Macraes (Macraes Mining) surveys. Of particular interest was how the Northland data could be manipulated to enhance its application in mineral exploration. This was done by working with the data live on screen. Bruce also conducted several practical exercises that were worked on by short course participants in groups of 2 to 5.

Figure 2. Bruce presenting at the Wellington (Te Papa) short course.

Figure 3. Bruce explaining a concept during one of the practical exercises at the Wellington short course.

Figure 4. Wellington short course participants (except photographer Tony Christie). Bruce is 6th from left.