

THE VICTORIAN GEOLOGIST



February 2012

THE GEOLOGICAL SOCIETY OF AUSTRALIA
Victoria Division

Next General Meeting

Thursday 23rd February at 6:15 p.m.

Phytomining

Dr. Scott M Keeling
Mining Plus Pty. Ltd

Fritz-Loewe Theatre, School of Earth Sciences, The University of Melbourne
Preceded at 5:30 p.m. by drinks and nibbles in the tea room, 4th floor. Cost \$2

Talk will be followed by time for discussion

Phytoextraction of heavy metals is a relatively new technology that has potential applications for the remediation of many contaminated sites around the world. The technology also has significant applications in the minerals industry for the treatment of low-grade ores and metalliferous mine waste. This presentation will explore the potential to remove heavy metals, in particular nickel, cobalt and gold, from a variety of substrates using both accumulator and non-accumulator plant species. The potential for phytoextraction of nickel and cobalt will concern the well known nickel (and cobalt) hyperaccumulators *Alyssum bertolonii* and *Berkheya coddii*. Chemically induced gold phytoextraction will explore a variety of plant species and soil amendments of ammonium thiocyanate and ammonium thiosulphate.

The results of these phytoextraction investigations will be discussed in terms of their economic potential based upon current commodity prices. The various limitations to the technology will also be outlined. Excluding the cost of cultivation and metal production, of which the latter has a potential revenue stream via the production of thermal power, the following brief extrapolations can be drawn. The economic cut off material within the Minara Resources Limited Murrin Murrin open pit mines could be phytomined for its contained nickel and cobalt using both *Alyssum bertolonii* and *Berkheya coddii* to produce a combined metal value of US\$2,530 and US\$2,780 per hectare per crop, respectively.

The Tui Mine tailings in New Zealand could be phytomined for gold using a variety of root vegetable plant species using both thiocyanate and thiosulphate amendments. These plant species responded to thiocyanate treatment by recovering between 1.8 and 24.3 ounce of gold per tonne of dry weight plant material for a value of between US\$3,080 and US\$43,381 per hectare per crop. These same plant species responded to thiosulphate treatment by recovering between 1.1 and 45.8 ounce of gold per tonne of dry weight plant material for a value of between US\$1,980 and US\$79,940 per hectare per crop.

WELCOME BACK

The GSAV welcomes all our new and existing members to 2012. We have year full of interesting talks from a range of fields planned for the year, starting with Dr. Scott Keeley giving us a talk on the relatively new field of phytomining.

As usual, remember that the GSAV is here to promote everything geo-related so if you come across an interesting story, piece of research or have something else to share by all means email them to me at mbliss@student.unimelb.edu.au by the first Friday of the month and I'll endeavour to get them into the newsletter.

CONFERENCE REPORT

GSAV Student Scholarship Recipient

Jill Lynch

PhD Candidate, School of Earth Sciences, University of Melbourne

Seasonal changes transform our planet, creating spectacular wildlife events. Few events are as magnificent as the migration of thousands of animals. One of the planet's most remarkable annual migrations occurs in a small corner of the western United States. Each December, more than 20,000 humans from all corners of the earth gather briefly in a 65,000 square meter area in the center of San Francisco, before once again dispersing around the globe. Despite the great distances that many individuals travel, this epic encounter lasts only a week.

What drives this ambitious journey to the Bay Area? Correlation with seasonal temperature changes alone does not seem to explain the phenomenon. San Francisco, being surrounded by the icy cold Pacific Ocean and the San Francisco Bay, has a particularly unpredictable and foggy climate. As Mark Twain once said "the coldest winter I ever saw was the summer I spent in San Francisco." A temperature dependent explanation is particularly counterintuitive when considering the migration of Southern Hemisphere inhabitants, who emigrate just as summer begins, to head for the Northern Hemisphere winter. Indeed, there is more to this peculiar migration pattern than a desire for warmth and sunshine.

Thanks to the funding support of GSA-Victoria, I set out to gain access to this exclusive group of humans, in order to study this fascinating phenomenon. San Francisco hosts nearly 16 million tourists per annum, so a thorough understanding of the unique behaviors attributed to the December migrants is of utmost importance. My first observation, upon arrival in San Francisco, was an abundance of humans holding long tubes under their arms, which they referred to as "posters." I mimicked this strange mannerism with a poster of my own to remain inconspicuous as I made my observations in the streets of San Francisco and at the hub of the grand encounter: the Moscone Center.

Native San Franciscans are distinguished by their relatively larger quadriceps and gastrocnemius muscles that have developed by walking and cycling up hilly terrain over decadal timescales. Tourists are identified by hypertrophic leg muscles and a distinct look of apprehension about their whereabouts, appearing, at times, to be lost. They rely extensively on street maps, and are often observed striking a pose for photographic purposes. The migrants that flood the streets in December, however, are not your typical tourist and can be easily distinguished by certain peculiar behaviors. For example, the migrants seldom take a photograph without what they refer to as a "scale", which may be a coin or perhaps even another person. Rather than a map, these individuals tend to use an aerial photograph and compass (with clinometer, of course) to find their way. You may not find these migrants at iconic locations, such as the Golden Gate Bridge or Fisherman's Wharf, but they can be readily found examining high way road cuttings and outcrops or testing their Seismograph iPhone App. Others can be identified by an easy test that involves questioning them about the weather. Native San Franciscans and tourists may respond with "Well, the weather channel says..." while the migrants will most likely pull out their laptop and show you a computer model while explaining that San Franciscan weather is harder to predict than global climate change. A word of caution: this may also prompt them into reverting to their native "computer-programming" language, which can be compared to Greek. In such a case, it may be necessary to excuse yourself by apologizing that you have to run to an "Understanding Early Neoproterozoic Transitions" session. Do not worry; they will understand what this means.

These strange traits classify these migrants as a special breed of humans, known as Earth Scientists. As I entered the Moscone Center, I, at last, found the motivation behind this great migration: the American Geophysical Union Fall Meeting. This meeting is the largest annual scientific conference in the world! A majestic gathering of great scientific minds that converge to discuss all matters related to the earth and space sciences, including oceanography, geography, atmospheric sciences, astrobiology and climate change.

I was able to enter this exclusive world, by presenting a poster at the AGU entitled "Modern stromatolites in a saline maar in the Western District of Victoria, Australia: a possible analogue for Precambrian marine carbonates." This drew some attention from many geobiologists, an incipient breed of earth scientists who study microbe-mineral interactions. Aided by my background research, I was able to answer many questions about my poster topic and be accepted into this scientific community. Through these interactions, I gained valuable insights into the activities of these scientists in their native habitats, who kindly offered advice on microbial and molecular experiments that they utilize to study microbialites and which would be beneficial to my research. I also revisited several earth scientists that I had worked with last year during an expedition to the South Pacific Ocean and was pleased to be able to discuss our post-cruise progress with each other.

Throughout the week, thousands of scientists shared with each other their specialized research and knowledge through posters, presentations, and meetings. As the brief encounter drew to an end, we dispersed from San Francisco to return to our respective corners of the world, bringing with us new knowledge, fresh ideas and motivation to conduct new experiments until we can meet again during another epic migration.

Geology of GOLD course

19-23 March 2012

School of Earth Sciences, University of Melbourne



This is a 5-day course of lectures, practical sessions and a field trip, devoted to the Geology of Gold.

It is suitable for geologists in the mineral industry or government with early exploration or mining experience who want a broad coverage of gold geology as well as some of the latest research ideas and how they apply to mineral exploration.

The course also serves as an Honours and Postgraduate course for students interested in entering the mineral industry. Interaction between the various groups of participants has become a much-valued feature of the week since this course was first run in 1995.

The course covers all major types of gold deposits with emphasis on Archaean deposits of Western Australia and state-belt deposits of the Victorian gold provinces. Porphyry, epithermal, Carlin and Witwatersrand gold are all covered, with discussion of current ideas on each. An overnight field trip takes participants through the heart of the Victorian gold province visiting several past producers and some new operations.

Geochemistry, structural geology, metamorphic petrology, megolith and deposit geology are covered at a level to enable participants to take their place in industry and government teams and make a contribution in all of these areas. An emphasis of the course is on a holistic approach that uses all applicable fields of geology to address gold issues.

COURSE LEADER: Professor Neil Phillips

PRESENTERS INCLUDE: Dr Martin Hughes, Dr Andrew Tomkins, Professor Janet Hergt, Jonathan Law, Professor Roger Powell and Dr Iain Pitcairn.

COST FOR INDUSTRY PARTICIPANTS: AUD\$750 that includes overnight field trip. Numbers will be limited due to the field component, and registrations are likely to close early.

REGISTRATION: Kerry Grieser, School of Earth Sciences, University of Melbourne
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3-D Laser Map Shows Earthquake Before and After

Science Daily Feb 9, 2012 (www.sciencedaily.com)

Geologists have a new tool to study how earthquakes change the landscape down to a few inches, and it's giving them insight into how earthquake faults behave. In the Feb. 10 issue of the journal *Science*, a team of scientists from the U.S., Mexico and China reports the most comprehensive before-and-after picture yet of an earthquake zone, using data from the magnitude 7.2 event that struck near Mexicali, northern Mexico in April, 2010.

"We can learn so much about how earthquakes work by studying fresh fault ruptures," said Michael Oskin, geology professor at the University of California, Davis, and lead author on the paper. The team, working with the National Center for Airborne Laser Mapping (NCALM), flew over the area with LiDAR (light detection and ranging), which bounces a stream of laser pulses off the ground. New airborne LiDAR equipment can measure surface features to within a few inches. The researchers were able to make a detailed scan over about 140 square miles in less than three days, Oskin said. Oskin said that they knew the area had been mapped with LiDAR in 2006 by the Mexican government. When the earthquake occurred, Oskin and Ramon Arrowsmith at Arizona State University applied for and got funding from the National Science Foundation to carry out an immediate aerial survey to compare the results.

Co-authors John Fletcher and graduate student Orlando Teran from the Centro de Investigación Científica y de Educación Superior de Ensenada (CICESE) carried out a traditional ground survey of the fault rupture, which helped guide planning of the aerial LiDAR survey and the interpretation of the results.

From the ground, features like the five-foot escarpment created when part of a hillside abruptly moved up and sideways are readily visible. But the LiDAR survey further reveals warping of the ground surface adjacent to faults that previously could not easily be detected, Oskin said. For example, it revealed the folding above the Indiviso fault running beneath agricultural fields in the floodplain of the Colorado River.

"This would be very hard to see in the field," Oskin said.

Team members used the "virtual reality" facility at UC Davis' W.M. Keck Center for Active Visualization in Earth Sciences to handle and view the data from the survey. By comparing pre- and post-earthquake surveys, they could see exactly where the ground moved and by how much.

The survey revealed deformation around the system of small faults that caused the earthquake, and allowed measurements that provide clues to understanding how these multifault earthquakes occur. The 2010 Mexicali earthquake did not occur on a major fault, like the San Andreas, but ran through a series of smaller faults in Earth's crust. These minor faults are common around major faults but are "underappreciated," Oskin said. "This sort of earthquake happens out of the blue," he said.

The new LiDAR survey shows how seven of these small faults came together to cause a major earthquake, Oskin said. Ken Hudnut, a geophysicist with the U.S. Geological Survey and co-author on the paper, made the first use of airborne LiDAR about 10 years ago to document surface faulting from the Hector Mine earthquake. But "pre-earthquake" data were lacking. Since then, NCALM has carried out LiDAR scans of the San Andreas system (the "B4 Project") and other active faults in the western U.S. (a component of the EarthScope Project), thereby setting a trap for future earthquakes, he said.

"In this case, fortunately, our CICESE colleagues had set such a trap, and this earthquake fell right into it and became the first ever to be imaged by 'before' and 'after' LiDAR. It is a thrill for me to be on the team that reached this important milestone," Hudnut said.

The post-event dataset collected by the team is publicly available through <http://opentopography.org/>.

STUDENT FUNDING OPPORTUNITIES**Geological Society of Australia (Victoria Division) Student Research Scholarships**

The GSAV are pleased to offer up to \$10,000 per year in scholarships available to honours and postgraduate students for assistance with travel costs associated with conferences and field work.



The scholarship is valued at up to \$500 for travel within Australia and \$700 for travel outside of Australia. The number of and value of the scholarships awarded each year is made at the discretion of the GSA(Vic) committee.

Funding will not be granted retrospectively and applicants are asked to submit forms no later than 6 weeks prior to their trip to give the committee time to consider the application.

Students that receive this scholarship are required to submit a report for publication in the newsletter, "The Victorian Geologist", following their trip. A presentation may also be requested by the committee, which will consist of a short, 10-15 minute presentation prior to the monthly seminar.

Applications forms can be scanned and emailed to: secretary@vic.gsa.org.au

or mailed to:

Geology Research Scholarships Victoria
Geological Society of Australia (Victoria Division)
GPO Box 2355
Melbourne VIC 3001

More information including eligibility criteria can be found on the form and by contacting Barbara Wagstaff (wagstaff@unimelb.edu.au)

Something interesting to share? Want to see your name in print?

Don't be bashful, contribute to the GSA(V) monthly newsletter!

If there are any events, happenings, news, or views that would be of interest to the membership, please send your details and information to Matt Bliss at mbliss@student.unimelb.edu.au

We'd be glad to hear from you

FORTHCOMING SEMINARS AND EVENTS

to be presented at
GSA (Victoria Division) meetings

Note: unless otherwise indicated, all 2011 talks will be held in the
Fritz Loewe Theatre, Earth Sciences Building, University of Melbourne.

March 29	TBA
April 26	TBA
May 31	TBA
June 28	TBA

Please join the GSAV in welcoming our new members



Stefan Vollgger
Simon Travers

Visit the GSAV on www.vic.gsa.org.au or the GSA on www.gsa.org.au
• Renewing your GSA membership is easy - it can now be done online. •

CONSIDER CONTRIBUTING TO TAG!

It is member contributions which make TAG a member magazine – please keep the contributions coming and assist with informing all of the membership (not just your Division) about your activities.

Please send your news to: tag@gsa.org.au



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Print Post No. PP381827/0025
Registered Publication No. VBH 2135

If undelivered return to:
The Geological Society of Australia Inc.
GPO Box 2355
Melbourne VIC 3001

PRINT POST APPROVED