

# THE VICTORIAN GEOLOGIST



July 2014

THE GEOLOGICAL SOCIETY OF AUSTRALIA

Victoria Division

General Meeting

Thursday 31st July at 6:15 p.m.

## **Student Night**

**Farah Ali**

**Environmental Geoscience, La Trobe University**

**Caitlin Gionfriddo**

**Biogeochemistry, The University of Melbourne**

**Estephany Marillo Sialer**

**Geochemistry, The University of Melbourne**

**Stefan Vollgger**

**Economic Geology, Monash University**

**Fritz Loewe Theatre, School of Earth Sciences, University of Melbourne**

Talk will be preceded by drinks from 5:30 pm in the 4th floor tearoom, cost \$2

Students who have been sponsored by the GSAV in the past year to attend conferences will be presenting an aspect of their research. All speakers are PhD candidates at their respective universities.

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**STUDENT ABSTRACTS AND BIOS****Caitlin Gionfriddo**

*Caitlin is a second-year PhD candidate in the School of Earth Sciences at the University of Melbourne. She completed her Masters degree in Geology at the University of Melbourne in 2012 and holds a Bachelors of Science in Chemistry from the University of South Carolina. Her research interests include mercury biogeochemistry in contaminated mine sites, geothermal systems, and Antarctic sea ice.*

**Antarctic sea ice: a source of methylmercury in the Southern Ocean**

The long-range atmospheric transport of inorganic mercury from northern latitudes, and an active atmospheric cycling of mercury following polar sunrise, results in the deposition of mercury to sea ice covered waters of the Southern Ocean. Sea ice covered waters and the fauna that inhabit them tend to have inflated concentrations of the bioaccumulative neurotoxin, methylmercury, compared to open ocean waters. However, the role of sea ice in the mercury cycle of the Southern Ocean is poorly understood, particularly the production of methylmercury. Presented here are results from an atmospheric and sea ice sampling campaign in the East Antarctic sea ice zone aimed at identifying sources and sinks of mercury in the Southern Ocean.

Snow, sea ice, brine, and seawater samples were analysed for total and methylmercury. Samples were collected from five ice stations between 64- 65°S and 113- 122°E during the Sea Ice Physics Ecosystem eXperiment (SIPEX) II over a nine week voyage, from September to November 2012. Atmospheric in-situ gaseous mercury measurements were collected over the duration of the voyage, and are used to identify contributing sources of inorganic mercury. The spatial and temporal resolution of the sampling campaign is the first of its kind for mercury in the Southern Ocean, and the first study to combine "snow-sea-ice-seawater" mercury profiles with atmospheric mercury data for Antarctic pack ice. The results address the biogeochemical cycling of mercury in polar environments, and show sea ice to be a source of methylmercury in the Southern Ocean.

**Estephany Marillo Sialer**

*Estephany is a PhD candidate in the Isotope and Trace Element Geochemistry research group in the School of Earth Sciences at the University of Melbourne. She completed a Masters of Science at Montanuniversitaet Leoben, Austria.*

 **$^{206}\text{Pb}/^{238}\text{U}$  matrix induced bias in LA-ICP-MS: A multivariate study**

Many studies acknowledge the occurrence of systematic discrepancies between U–Pb ages determined in zircons in situ by laser ablation inductively coupled mass spectrometry (LA-ICP-MS) and the benchmark analytical method ID-TIMS. Presented here are results from detailed investigations into the ablation characteristics of zircons that suggest an underlying mechanism responsible for these age biases relative to ID-TIMS. It is demonstrated that there are small but

## STUDENT ABSTRACTS AND BIOS

significant differences in the amount of material removed by the laser between different zircons and that the observed systematic age bias is strongly correlated with the offset in ablation rates between zircons. Multivariate analysis of all possible parameters involved in the ablation process (zircon chemistry, crystallographic orientation, accumulated radiation damage, topographical and morphological data, and ablation cell spatial variations) is used to identify the most important causes of these artifacts, and thus provide a means of correcting the results.

### Farah Ali

*Farah Ali is a PhD candidate in Environmental Geoscience at La Trobe University. She has a Bachelor of Science degree majoring in statistics and environmental geoscience, and graduated with first class honours in environmental geoscience. Her PhD research has a focus on minimising the acidity generated from mine wastes.*

#### **The influence of biotite/phlogopite dissolution on AMD neutralisation at the Brukunga Pyrite Mine, South Australia**

Brukunga Pyrite Mine is an abandoned pyrite mine in South Australia, 40 km NE of Adelaide. The mine was operational for 20 years and mined for pyrite and pyrrhotite within mica schists until 1972. As a result of mining the sulphide ore was exposed to the atmosphere, which caused acid mine drainage (AMD) production. A characteristic of the AMD at this site is the high magnesium levels (250 - 2000 ppm) found in surface water and groundwater. The AMD is collected in a central pond, which has magnesium concentrations of about 350 ppm, and treated using lime neutralisation which removes the heavy metals and reduces the magnesium concentrations, by approximately 325 ppm.

Analysis of 38 surface water and groundwater samples, 14 waste rock samples and 3 tailings samples showed that the waste rock dumps are responsible for the abundance of Mg in the contaminated water through the attack on phlogopite and biotite, which are the only magnesium-bearing minerals in the waste rock and tailings.

Dissolution of these minerals by the AMD releases not only magnesium, but also iron, potassium, aluminium and silicon into solution. However, Fe, K and Si are being removed through acid releasing precipitation, which reduces the neutralising capacity of phlogopite and biotite dissolution.

The sludge formed by neutralisation of the AMD at Brukunga is composed of gypsum, ettringite and amorphous ferric oxide-hydroxide. Ettringite precipitation has the added benefit of absorbing vanadium oxoanions into its structure. The sludge contains ~2 wt% magnesium, accounting for the reduction in Mg concentration of the water as it passes through the treatment plant. XPS analysis of the sludge indicates that magnesium carbonate (magnesite) is present, and the treatment plant water is saturated with respect to this mineral.

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**STUDENT ABSTRACTS AND BIOS****Stefan Vollgger**

*Stefan Vollgger finished a BSc in Applied Geosciences / Economic Geology in 2007 and a MSc in Economic Geology in 2010 at the Montanuniversitaet Leoben, Austria. He also worked part-time for an Austrian mining consultancy (mineIT) throughout his study time. In 2011 he commenced his PhD at Monash University, focusing on the relationship between deformation and mineralisation. He is applying state-of-the-art technologies and workflows such as 3D implicit geological modelling and UAV assisted close-range photogrammetry to gain a better understanding of structural control on mineralisation.*

**Understanding the relationship between deformation and mineralisation – a 3D geological modelling approach**

Tectonic processes are the main drivers for the deformation of Earth's crust. This deformation is reflected in structures such as folds, faults and shear zones. These structures are important for the formation of ore deposits because they allow the effective transport of hydrothermal fluids, which are able to carry metals at certain conditions. Such fluids can be trapped physically within structures such as dilational jogs or extensional veins that act as low pressure sites into which fluids migrate preferentially. If mineralisation is controlled by such structures, ore bodies would show distinct geometries, follow a certain trend / orientation and would spatially be located where traps were formed. Consequently, analysis of ore body geometries, associated spatial relationships and related structures provide fundamental clues to the genesis of ore deposits. It is important to establish consistent and accurate 3D geological models to visualise and analyse ore delineation and geological structures in order to understand the controls on mineralisation processes.

In our research, we are using two quite different state-of-the-art technologies: implicit 3D geological modelling and UAV assisted close-range photogrammetry. Implicit 3D geological modelling allows us to look at the spatial distribution of mineralisation by interpolating drillhole data. Additionally, it can directly process structural measurements in 3D to form structural trend surfaces. UAV assisted close-range photogrammetry is a technique, where a remote controlled unmanned aerial vehicle (UAV) is employed to capture high resolution aerial photographs (sub cm resolution). These images are then used to compute a photorealistic 3D model which allows us to precisely analyse and measure geometry, location and orientation of geological structures, which might host the next major ore deposit.

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**JUNE PUZZLE 9-LETTER WORD: CARBONATE**

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## THE JUNE MEETING

### **GSAV meeting: Biology, molecules & geology: Biogeography in the southwest Pacific (Zealandia)**

The June GSAV meeting brought a different topic to usual with Professor David Cantrill, chair of the GSAV, speaking on the studies of biogeography in the southwest Pacific using biological markers. Zealandia is a sunken landmass off the southeastern shelf of Australia, and includes the present continents of New Zealand and New Caledonia. Phylogenetic trees were created for many of the known species present on these islands, and were augmented by well documented and representative fossil records. The pattern of distribution of species on these islands has been debated by biologists, with species derived from either vicariance or dispersal. Originally, it was thought that most of the species in New Zealand and New Caledonia were present due to dispersal after the Oligocene when rising sea levels drowned the Zealandia land mass; however, studies now show that vicariance also plays a significant role. Many plant species in New Zealand and New Caledonia are considered to be remnant Gondwanan elements, as the high level of endemism at the genus level contains many primitive plant types. Furthermore, the limited fossil record in New Caledonia contains a very strong Australian connection in the abundant plant fossils found in Oligocene-Miocene limestones. Overall, studies show that dispersal and vicariance have each played a role in the species distribution in the southwest Pacific, and now it needs to be determined the degree to which each process has contributed.

I would like to thank Professor David Cantrill for his illuminating talk, and encourage members to attend the July meeting for the GSAV student night. It promises to be fascinating!

*by Karen Kapteinis*

## SELWYN SYMPOSIUM 2014: THE NULLARBOR PLAIN: RECENT ADVANCES

The Selwyn Memorial Lecture was introduced in 1984 by the Geological Society of Australia (Victoria Division) to commemorate the work of A.R.C. Selwyn, the first Government Geologist of Victoria. In recent years the Lecture has often followed a symposium, involving invited speakers on a significant theme for Australian Geology, to celebrate Selwyn's work. The Symposium and Selwyn Lecture will be held on the theme of The Nullarbor Plain: Recent Advances

The Symposium will be held from 9 am to 5 pm on Friday 3 October at the University of Melbourne. It is being held the day following the major international workshop Karst Research 7 (KR7) also hosted at the University of Melbourne (Sept 29 – Oct 2).

The Selwyn Lecture will be held after the Symposium and Prof. Paul Williams (University of Auckland) has agreed to be the speaker. Paul is a world renowned karst researcher who has extensive understanding of karst and its relationships to palaeo-climates in the southern hemisphere.

For enquiries contact Susan White, [susanqwhite@netspace.net.au](mailto:susanqwhite@netspace.net.au).

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

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.

**Eligibility**

Applicants must be members of the GSA and enrolled in a full-time degree at a Victorian Tertiary institution and undertaking research in Geology. The scholarship will be awarded to assist with conference travel for honours and postgraduate students, who are presenting (either poster or talk) at the conference.

Honours and postgraduate students that receive this scholarship will be required to submit a report for publication in 'The Victorian Geologist' newsletter following to 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.

Students who have previously received a GSAV research scholarship are not eligible. Scholarships and bursaries from other sources are acceptable.

Applications forms can be scanned and emailed to: [secretary@vic.gsa.org.au](mailto: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 can be found by contacting Barbara Wagstaff ([wagstaff@unimelb.edu.au](mailto:wagstaff@unimelb.edu.au))

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**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 Kieran Iles at [kiles@student.unimelb.edu.au](mailto:kiles@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 2014 talks will be held in the Fritz Loewe Theatre, Earth Sciences Building, University of Melbourne.

July 31st:

**Monthly Meeting:** Student Night

Farah Ali, Caitlin Gionfriddo, Estephany Marillo Sialer, Stefan Vollgger

August 28th:

**Monthly Meeting:** Barbara Wagstaff

Dating Dinosaurs

September 25th:

**Monthly Meeting:**

TBA

October 3rd:

**Selwyn Symposium:** See page 5 for details



Please welcome our newest members

Visit the GSAV on [www.vic.gsa.org.au](http://www.vic.gsa.org.au) or the GSA on [www.gsa.org.au](http://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](mailto:tag@gsa.org.au)



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#### Newsletter deadline:

First Friday of the month except Dec & Jan  
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