From the AMG committee

Hello and welcome to the December edition of *Applied Mineralogist*! This Christmas edition includes student bursary reports on fieldwork in Canada & South Africa, a special feature on ‘Bismuth - the critical metal newbie’, together with conference previews and post-views! Also included is our #AppliedMineralogy twitter winner, our Christmas crossword and all the events to keep you up to date. Tweet us at @amg_min if you can complete the crossword!

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**Bursary Report: Georgian Manuc, University of Leeds, on fieldwork in Newfoundland, Canada.**

Thanks to the AMG for selecting me as one of the recipients for the bursary, which allowed me to carry out a 5 week field campaign in the Baie Verte Peninsula of Newfoundland, Canada.

The objective was to investigate the structural settings and the geochemical characteristics of multiple orogenic gold occurrences in the Newfoundland Appalachians. The aim is to establish the structural history of the Baie Verte Line in relation to the genesis of gold mineralization. The project runs in collaboration with Prof. Stephen Piercey from the Memorial University of Newfoundland (MUN) and Anaconda Mining Inc. (AMI).

The northern part of the Baie Verte Peninsula hosts numerous orogenic gold occurrences in three prospective gold trends (Scrape, Goldenville & Deer Cove). The entire area is under exploration and development by AMI. All the deposits are located along, or in the vicinity of secondary structures (Scrape & Deer Cove thrusts) of the Baie Verte Line, a major crustal-scale shear zone that separates the Laurentian margin from the different island arcs accreted during the Taconic Orogeny. The host lithologies consists of altered ultramafic rocks, mafic intrusives and volcanoclastics.

In the first week, Dr. Taija Torvela (primary supervisor) joined me in the field, training me in structural mapping and efficiency. We were accompanied by Prof. Stephen Piercey and chief geologist David Copeland (AMI) who provided us with the perfect field introduction into the local geology. The following two weeks were focussed on mapping and taking structural measurements (Fig.1) along the main regional structures. During this period, samples were collected for geochemical and microstructural analysis from both vein and wall-rock material. The last two weeks were used for mine site work and logging of cores, some of which intersected the main regional structures (Fig. 2). Core samples were collected from high-grade zones and will be used for fluid inclusions analysis.

Using the collected data, paleostress analysis will be conducted in order to understand the evolution of the stress field during ore deposition. Petrography together with scanning electron microscopy and cathodoluminescence imagery, will be used for providing a detailed characterization of the veins’ textures and paragenesis. Fluid inclusion analysis will be used to pin-down the physiochemical characteristics of the mineralizing fluids involved in the formation of each deposit.

**Fig. 1. Georgian taking structural measurements in the field.**

**Fig. 2. Georgian core logging at the Baie Verte core shack.**

**Fig. 3. Daryl presenting at the Platinum Symposium 18.**

**Fig. 4. Daryl at the Sandsloot open pit on the Platteef.**
Bursary Report: Daryl Blanks, University of Leicester, on the Platinum Symposium, South Africa.

Thanks to the student bursary award from the AMG, I was given the opportunity to present my PhD research at the 13th International Platinum Symposium in Polokwane, South Africa this July (Fig. 3). The conference was organised by the University of Witwatersrand and was well attended with over 200 academic and industry delegates from around the world. The symposium ran over six days and included fantastic morning fieldtrips to various localities along the Platreef, which included visits to Ivanplats, Anglo American Platinum and Platinum Group Metals exploration and mine sites where we had the opportunity to see and touch (1) Merensky Reef and UG2 mineralisation (Fig. 4).

During the conference, I presented a talk in the session 'PGE-Cu-Ni sulphur rich magmatic processes' on the findings from the first year and a half of my PhD research on the Munali nickel sulphide deposit in Zambia. The talk focused on the unusual carbonate rich nature of magmatic sulphide mineralisation at Munali and introduced new isotopic data providing constraints on the source of different styles of carbonate, with potential implications for the involvement of more exotic melts in Ni-Cu-PGE genesis. The talk was well received, with lots of questions and insightful discussions and was awarded third place in the best student talk awards. Additional highlights from the conference included seeing the world’s largest open pit platinum operation at Mogalakwena, along the northern limb of the Bushveld, as well as a special potjie dinner accompanied by lions.

Attending the conference was an incredible experience as I was able to participate in the ongoing debates on the various aspects involved in the genesis of the Bushveld complex, showing that there are many questions still to be answered in the formation of Ni-Cu-PGE magmatic sulphides.

#AppliedMineralogy @R_Siddall

From your #ThinSectionThursdays & #MineralMondays, our #AppliedMineralogy winner is... Dr. Ruth Siddall (@R_Siddall)

We have here a fireworks night special of tourmaline 'explosions' in Luxullianite rock, which derives its name from the village of Luxulyan in Cornwall, UK, from where it was first discovered.

To the left, we have the image in XPL and under a tint plate to the right to generate the great colours! The rock hosts radial, acicular tourmalines alongside orthoclase and quartz phenocrysts immersed in a matrix of quartz, feldspar, and mica.

Special Feature: BISMUTH - the critical metal newbie! by Eimear Deady, British Geological Survey

A newcomer to the critical metals fold, bismuth (Bi) was first recognised as 'critical' by the European Commission in 2017 [1]. Even though, as early as 2011, critical metal assessments led by the British Geological Survey (BGS) in the UK listed bismuth as a critical metal [2]. Raw materials are identified as critical where they are both of economic importance and have a risk of interruption to supply. The designation of bismuth as a critical metal is particularly due to the EU's 100% reliance on imports of primary refined Bi metal, with a purity of at least 99.8%. Its use in dissipative applications such as pigments and pharmaceuticals mean it is very difficult to recover and therefore has low recycling rates of 1%. The significant risk of supply interruption and its overall economic importance all contributed to the classification of a critical metal [3].

Bismuth, at an estimated 8 ppb by weight, ranks 69th in elemental abundance in the Earth's crust, which is about twice as abundant as gold. Bismuth is used as a non-toxic, environmentally friendly 'green' substitute for lead in alloys, being especially useful in water pipes and meters, hunting ammunition, fishing equipment and in paint. Certain characteristics of bismuth, such as its low melting point, has resulted in the development of bismuth alloys with tin and cadmium for the production of triggering devices for fire detectors and extinguishers. However, the main uses of bismuth are in chemical production. Bismuth sub-salicylate is used as a treatment for stomach upset as the medicine “Pepto-Bismol". In cosmetic applications the pigment bismuth oxychloride (BiClO) gives a pearlescent sheen to make-up.

Bismuth mineralisation can occur in various geological settings and although primary deposits of Bi exist, such as Tasna in Bolivia, these are not the typical sources for bismuth. Currently, the two main sources of Bi metal are lead and tungsten extraction and processing, with 50 to 60% coming from lead processing (refining). Bismuth mineralisation is predominantly associated with tungsten, copper, gold and lead skarn deposits, however it is also exploited as a by-product of tin pegmatites, and magmatic-hydrothermal mineralisation related to granites [4]. Bismuth mineralisation in hydrothermal vein deposits, for example the tungsten-greisen systems found in southwest England, includes the primary mineral phases bismuthinite (Bi₂S₃) and native Bi and secondary mineral phases such as russellite (Bi₂WO₄) resulting from the alteration of primary bismuth minerals and wolframite ([Fe, Mn]WO₄). The deportment of bismuth in these deposits types can be complicated (Fig. 1) and is the topic of ongoing research at the BGS.

What can we expect for the future of Bi? The outlook is
optimistic, especially as more development occurs in the area of nontoxic replacements for lead, and other new applications. Global demand for bismuth is estimated to grow at 4–5% per year, thanks to high demand in pharmaceutical applications (EC, 2017b).

References

Fig. 1. (right). Element map of bismuth mineralisation in a greisen system from southwest England. Russellite (red), wolframite (yellow) and chalcopyrite (green) with quartz (blue) ©UKRI.

Fig 2. (below). Synthetic bismuth mineral specimens are widely available, these exhibit hopper-like structures in pseudocubic crystals ©UKRI

SEG Conference Round-Up, Keystone, Colorado, September 2018
Jamie Price, Cardiff University

Academics and industry representatives from across the globe arrived in Colorado, ready to attend the SEG (Society of Economic Geologists) Conference 2018. The conference was hosted in the idyllic setting of Keystone, nestled high in the Rocky Mountains and offered an excellent location for a geological meeting. The conference title, ‘Metals, Minerals, and Society’, provided a focus on traditional precious and base metals, contemporary energy and technology minerals and the increasing relevance of mining and economic geology to society.

Prior to the start of the conference, a number of workshops were organised, shining a spotlight on topics such as the application of structural geology in precious metal-bearing systems, resource domaining in Leapfrog software and the uses of geophysics for explorationists. These courses were a perfect excuse for an extra few days in Keystone! The conference opened with a lively icebreaker reception, giving participants the chance to enjoy a few beers whilst catching up with old friends and making some new contacts, before an early start the next morning for the first of many interesting presentations. A neat idea introduced this year were 3-minute speed talks, allowing a brief project summary from those presenting posters.

My personal stand-out presenter during the meeting was Don Taylor, who gave a fantastic talk outlining his role in discovering the world-class Zn-Pb-Ag Taylor deposit, Arizona (named after him and sold this year for $2.1 billion!). If that talk didn’t give existing and aspiring exploration geologists the chills then you’re in the wrong business! Other key talks were given by John Ashton on the use of seismics to discover an impressive deep resource at the Navan Pb-Zn mine, Ireland, Susan Lomas on the #MeTooMining movement in the mining industry and John Walsh with a faultless pun-filled talk on fault-controlled fluid flow in sediment-hosted deposits. Each evening, the presentations were followed by an informal poster presentation in the main exhibition area, with local ales and tasty food provided, as well as stands from major mining companies, geological-related businesses and SEG student chapters. Lots of chance to pick up ‘mining SWAG’ including caps, sunglasses, frisbees, hand warmers and my favourite - free use of a portable XRF!

A diverse range of field trips both followed and preceded the conference, to local destinations such as the Cripple Creek Au-Te mine and the Bingham Canyon Cu and global destinations including the Kamchatka mining district of eastern Russia. I, no doubt along with many others, left the conference feeling refreshed and enthused after an excellent few days in the Rockies. Congratulations to Ollie Higgins and Andrew Martin, amongst others, for winning student prizes. Many thanks are extended to SEG for hosting the conference and providing generous support for student presenters worldwide to attend the meeting. Next stop Santiago, Chile in October 2019!
The **Applied Mineralogy Group** (AMG) is convening the 3rd International Critical Metals Meeting in Edinburgh in 2019. This conference aims to bring together researchers, both academic and industrial, who are working at different stages along the life cycle of critical metals. Session themes will include the Geology and Resources of Critical Metals, Critical Materials for Low Carbon Transport, Life Cycle Analysis and Ethical Sourcing of Critical Metals.

We are delighted to announce that Dr Evi Petavratzi and Mr Gus Gunn of the British Geological Survey will co-convene a session on 'Critical Materials for Low Carbon Transport' at the conference. Co-authors on the recent "**Briefing note on raw materials for batteries in electric vehicles**", Gus and Evi are at the forefront of highlighting the challenges associated with securing the supply of the critical raw materials required for the EV battery industry.

The conference will be preceded by a one day field trip on Monday the 29th of April 2019 to the east coast of East Lothian and Traprain Law, led by Dr Kathryn Goodenough (BGS).

Keynote speakers include David Merriman (Roskill) and Ben Katz (PACT). Online registration will open in early 2019 and close on the 22nd of March. Further details can be found on our webpages: [www.minersoc.org/3rd-international-critical-metals-conference.html](http://www.minersoc.org/3rd-international-critical-metals-conference.html).

**Notices**

**Get Involved**

If you would like to become more involved in the AMG, elections are held yearly at the AGM. Spaces for Student Representatives come up regularly. If you would like to be considered for a committee spot please email Eimear Deady (Secretary).

**AMG Postgraduate Bursaries**

The AMG provides bursaries for postgraduate students in the disciplines of **Applied Mineralogy, Crystallography, and Petrology and Geochemistry**. Bursaries are intended to support conference attendance and associated travel costs, although other activities may be considered. Application guidelines can be found at [www.minersoc.org/amg-bursaries](http://www.minersoc.org/amg-bursaries).

Please note there are two bursary application deadlines each year: 1st March and 1st September. Requests for funding must be received well in advance of the event to allow for consideration by the committee.

**Funding**

We welcome applications from both individuals or organisations for funding in support of events covered in the AMG remit. Further guidelines on how to apply can be found at [www.minersoc.org/amg-funding](http://www.minersoc.org/amg-funding).

**Editorial**

Thank you to those who have contributed to this issue of Applied Mineralologist. Please forward any articles, comments or notices of events and conferences to amgminsoc@gmail.com. All previous issues of Applied Mineralologist are available at [www.minersoc.org/amg-applied-mineralologist](http://www.minersoc.org/amg-applied-mineralologist).

Thanks for reading; our next Applied Mineralologist will be out in March. Keep up on what is happening in the meantime by following us on twitter @amg_min.

**Calendar**

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**About Us**

Founded in 1963 by Norman F.M. Henry, the AMG is a special interest group of the Mineralogical Society of Great Britain and Ireland. We encourage and promote the study and research of mineralogy applied to ores and related industrial mineral materials. This encompasses: ore microscopy, fluid inclusions, nuclear minerals, coals, refractories, slags, ceramics, building materials, nuclear waste disposal, carbon capture and storage, down-hole borehole alteration, and mineral-related health hazards.

Minerals in a Sustainable Future, British Geological Survey, Keyworth, UK, 13th June 2019

Joint-hosted by the Applied Mineralogy Group & the Environmental Mineralogy Group - Annual Research in Progress Meeting

We are inviting posters and oral presentations in any branch of applied and environmental mineralogy and biogeochemistry, including: sustainable mining, resource recovery from waste (mine tailings and industrial wastes), low energy ore (bio-) processing, environmental issues related to mineral extraction and land remediation.

We are pleased to announce our two fantastic keynote speakers: Mr Andrew Bloodworth (BGS Science Director for Minerals and Waste) and Dr Ronan Courtney (University of Limerick).

The meeting will also include a demonstration of a chosen imaging or analytical electron microscopy-based technique and/or a guided Geological walk.

Registration opens in April 2019

Participant cost £10

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Mineral Deposit Studies Group (MDSG) Winter Meeting Camborne School of Mines, University of Exeter, Falmouth, UK, 2nd-4th January 2019

The Mineral Deposits Studies Group (MDSG) winter meeting is being held at the Camborne School of Mines (University of Exeter), at the Penryn Campus in Cornwall, on the 2nd–4th January. Come and enjoy the early January weather in the South West, and soak up some science!

Talks this year are themed around the composition of the host rock unit, in the broadest sense. For example, “Felsic Rocks” encompassing porphyry copper deposits and Sn-W mineralisation in granites. We’re also planning a field trip (location TBC, but probably somewhere underground where it’s less wet and windy) and an SEG student chapter short course.

See our website (www.mdsg2019.co.uk) for more details. We also owe a mention of thanks to the AMG, who have continued to sponsor the meeting, and are regular attendees. Thanks! And we look forward to welcoming you in Falmouth in early January!

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Across
1. N, P, K, Ca, Mg, S, B, Cu, Mn, Mo and Zn... all for what?! (9,4)
2. Like a present, but inside a rock! (5)
3. One Prof brings frankincense, another bring myrrh, the last brings... (4)
4. A holy rare earth element (7)
5. Replaced by an Eagle in the Pear Tree (8)

Down
1. Sorosilicate discovered at the Christmas Mine (7)
2. Closest Ni-Cu-PGE Mine to the North Pole (9)
3. Minerals are falling, all around us! (9)
4. Rock band underwent some metamorphosis (5)
5. There is a lot of tasty mineral deposits in that country (6)
6. The Grand Canyon has them working on the orthogneiss (5)
7. Tin, oxygen, tungsten (4)

Have a go at our Xmas Special Crossword!

Tweet us at @amg_min for any more clues!