MAR 2025 vol 10.1

the Applied Mineralogist

OF THE MINERALOGICAL SOCIETY

Web: www.minersoc.org/amg.html
X: https://twitter.com/amg_min
Email: amgminsoc@gmail.com

From our editors...
Welcome to the March 2025 issue of the Applied Mineralogist! We celebrate the bursaries the AMG group has given in order to provide fantastic opportunities for early career scientsts. Test your mineral knowledge with the new crossword puzzle and discover the winner of #thinSectionThursday.

In this issue, Anna Szreter shares their experience attending the Arctic Tectonics and Volcanism course at the University Centre in Svalbard, Longyearbyen. Next, Daniel Dodoo, a PhD student at the University of Melbourne, discusses his research on the impact of platy morphology on the floatability of gangue minerals. Finally, Katie O'Neill from the University of Bristol presents her work on synthesizing magnetite nanoparticles for the recovery of strategically important metals from waste streams.

Thanks to all those who contributed to this issue. We hope you enjoy this month's publication.

AMG BURSARY REPORT

Anna Szreter

Arctic Tectonics and Volcanism course at Longyearbyen

Svalbard has always been a remote and inaccessible place, as portrayed in the trilogy of works of fiction by Philip Pullman (His Dark Materials); Ilona Wiśniewska's non-fiction work: White. The Cold Island of Spitsbergen; the diary of Dutch navigator and cartographer, Willem Barentsz; and as described in the reports of scientific expeditions. Thanks to the Applied Mineralogy Group bursary, which covered the flights there and back, it suddenly became reachable. In April and May 2024, I got the opportunity to participate in the Arctic Tectonics and Volcanism course at the University Centre in Svalbard, known as UNIS, in Longyearbyen, coordinated by Grace Shepard

Highlights

Edited by: Christian Bishop

Every study programme begins with some kind of safety training. Fire routes, assembly points, handling alarms. In the Arctic, this was extended to driving snowmobiles, firing flares, setting up tents, and packing and unpacking rescue equipment on the sledges. There were three days in which to gain priceless skills for anyone who, like me, does fieldwork in the Arctic as a part of their project. Having been instructed how to survive on Svalbard, then came the time for geology.

Grace Shephard introduced us to the Svalbard geology, Arctic tectonics and taught us how to use G-Plates software in plate tectonics analyses. Going deeper, Ágnes Király gave lectures on mantle structure, heat flow and geodynamic models. Another tool, IsoplotR, was part of Danny Stockli's practical classes on geo- and thermochronology. Carmen Gaina gave classes on the Arctic basins and ridges surrounding Svalbard and palaeobathymetry, while Jan Inge Faleide shared his knowledge about the Barents Shelf. From more sedimentary topics, the course moved on to volcanism. Morgan Jones explored the relationships between volcanism and magmatic systems, volcanism and climate, climate and palaeoclimate. Grace Shephard gave a lecture about the High Arctic Large Igneous Province (HALIP), while Karthik Iyer provided us with practical skills, introducing Silli 1D software for modelling thermal effects of igneous intrusions. Thanks to the broad tectonic and volcanic context, we explored Svalbard's geology, stratigraphy, and palaeoenvironments, guided by Aleksandra Smyrak-Sikora, an Arctic expedition member and UNIS lecturer for 12 years. The course was extended with a workshop on graphic design, scientific illustration and colourmaps, led by Fabio Crameri. Finally, virtual tools for exploring the Svalbard landscape: VR Svalbard and Svalbox, were introduced by their developer and contributor, Rafael Horota.

Discussing all these topics in the Arctic, while seeing the geological events recorded in the steep stripy mountains behind every window, was enjoyable and engaging. But this was not the reason why the course was held in Longyearbyen. The reason was fieldtrips. Dictated by the unpredictable weather, modified compared to the original plan, three of them took place in the 2024 course edition. On the 22nd of April we went to Sassendalen to see the Permian-Triassic boundary. The oldest formations in our itinerary, were interbedded by sills and cut by abrupt or gentle, barely noticeable faults. Sometimes an icefall would cover the rocks of interest, elsewhere a narrow gorge would provide a perfect section through them. One of the most organic-rich rock formations in the world was our last stop. The second fieldtrip on 24th of April took us to the top and around the Botneheia mountain. We also moved forward in time, to Cr deposits cut by impressive HALIP intrusions. Lots of diabase and deciphering local volcanism was balanced by spotting the 'celebrity' rock – Templet, featured on a famous book cover. The endpoint of the last field trip on 26th of April was at Barentsburg. Standing comfortably on the frozen fjord, we examined thoroughly the tectonics of the sea cliffs alongside the mining village. This continued our journey towards the youngest, Paleocene-Eocene record. In a broad valley called Reindalen we took a last group photograph with a picturesque deltaic system recorded on the hillside behind. All three trips provided us with a valuable insight into the petrography, stratigraphy, palaeoenvironments, tectonics, volcanism and surface processes that have shaped and are still shaping this northern archipelago.

Sassendalen field trip on April 22nd, stop 4 – looking at Kapp Starostin formation with its finely layered, muddy part in the top and limestone rich, massive part in the bottom. Botneheia and Kapp Toscana formations build up the hills in the distance. A river flowing under the glacier forms an icefall in the background.

The final exam took the form of an individual project. Engaging several scientists as supervisors enabled a broad choice of topics, allowing students to gain experience in tools useful in their own work while delving into some aspect of the Arctic geology. Calculating the volume of volcanic bodies, interacting with 3D terrain models, exploring Svalbard-specific databases, operating various GIS software are only some of the examples. Even public engagement was a possibility, as some of the topics encompassed geotourism. I completed a digitisation project, employing QGIS and G-Plates to digitise available palaeoenvironment and palaeostratigraphy maps and quantify the changing environments over the area of current Barents Shelf through geological time.

Everyone completed the course equipped with relevant knowledge, digital tools and Arctic fieldwork skills. And maybe a few connections with students and academics sharing the same passion. I formed many fond memories, from experiencing the midnight sun and the fjord filled with ice to short hikes and endless snowy mountains spreading in all directions. It is the knowledge that leads us, but the passion that drives us. And AMG provides students the opportunity to reach for both. Thank you for that.

Midnight sun in Longyearbyen.

AMG BURSARY REPORT

Daniel Dodoo

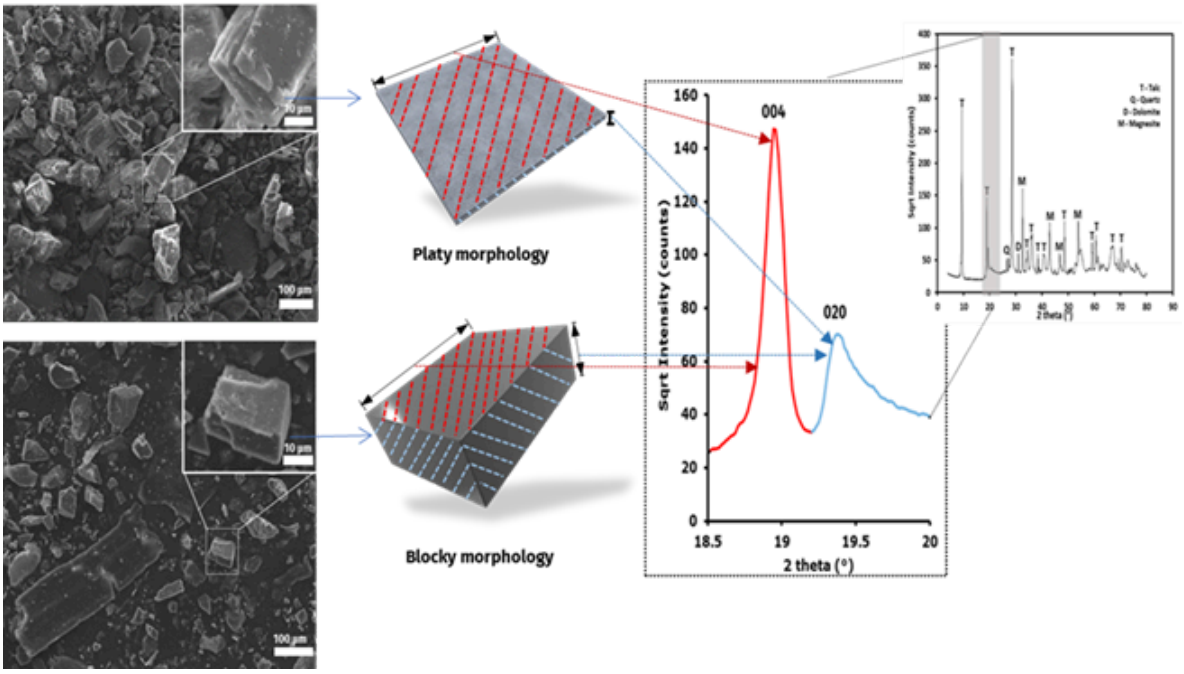
European Mineralogical Conference attendance 2024

My name is Daniel Dodoo, a PhD student in the Department of Chemical Engineering at the University of Melbourne in Australia. I am grateful to the Applied Mineralogy Group of the Mineralogical Society of the UK and Ireland for their Postgraduate Student Bursary Award, which allowed me to attend the EMC conference 2024 in Dublin. The University of Melbourne and the Australian Research Council (ARC) Centre of Excellence for Enabling Eco-Efficient Beneficiation of Minerals (https://coeminerals.org.au/) covered only my flights and accommodation. So, I used the award to cover all expenses incurred during my stay in Dublin, which allowed me to fully enjoy the experience and the conference. I used the award to cover my transportation costs, ensure that I arrived at the site on time, and purchase meals after every day of the conference. I had a wonderful time and had the opportunity to gain valuable skills and network connections.

I was also very excited to talk about a part of my research that I had titled, “Understanding the impact of platy morphology on the flotability of gangue minerals from X-ray diffraction patterns: A talc case study.” I am working on a collaborative project between the University of Melbourne, University of Queensland, and CSIRO as part of the ARC Centre of Excellence for Enabling Eco-Efficient Beneficiation of Minerals. The project is looking to solve a really tough problem in minerals beneficiation, namely being able to predictively determine the extent to which talc minerals will cause productivity loss in base metals beneficiation.

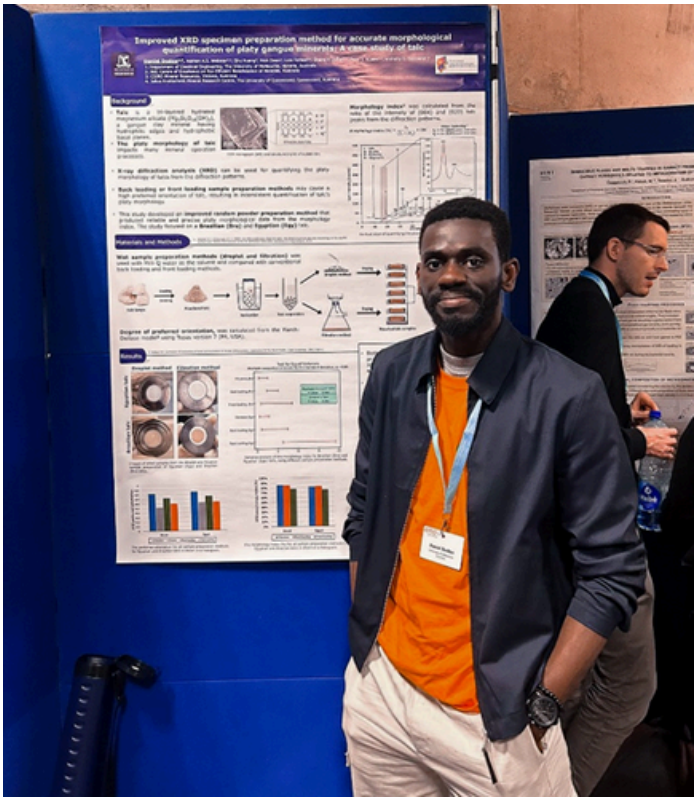
In my research that I presented, I used X-ray diffraction to determine the orientation of the crystal plane obtained from XRD patterns of the talc peak intensity between the 2θ range of 19° to 21°. This was used to quantify the morphological index (MI) of the talcs, a measure of their aspect ratio; the higher the MI, the more platy the talc was. The XRD results revealed that the particle morphology of talc ranged from platy to blocky, depending on its geological location. The flotability of the talcs varied based on their MI in a flotation test conducted on talc ground to a particle size of 106 µm to 53 µm. The talcs with the highest MI, regarded as highly platy, were more floatable than the other talcs, and the reverse was true for those with the lowest MI. This suggests that the flotability of various talcs is affected by their varying degrees of platiness, and the XRD-determined MI of talc could be a straightforward tool for predicting and understanding the flotability of talc.

Aside from the oral presentation, I also did a poster presentation titled, “Improved XRD Specimen Preparation Method for Accurate Morphological Quantification of Platy Gangue Minerals: A Case Study of Talc." This work detailed a simpler and more efficient method for accurate analysis of platy minerals, such as talc, to minimise preferred orientation. It involved a filtration step that



An illustration of quantifying the morphology of talcs from XRD pattern.

makes use of various solvents, and the dried filter cake after the filtration was placed on a glass zero background mount. The filtration method was reproducible and produced consistent morphological quantification results compared to the backpressed method. I am already incorporating some of the insightful comments and advice from the conference into my research. In sum, I was able learn a lot of valuable knowledge by going to a lot of excellent mineralogy talks and posters and forming collaborations with other speakers. The AMG bursary award made my stay in Dublin and the conference extremely comfortable and memorable.



AMG BURSARY REPORT

Katie O'Neill

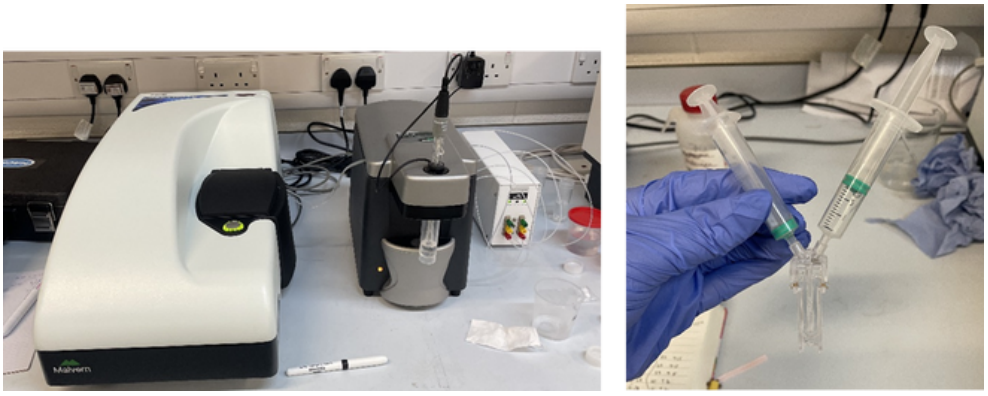
Synthesising magnetite nanoparticles at the Camborne School of Mines

The bursary I received provided a valuable opportunity to advance my research on synthesizing magnetite nanoparticles (MNPs) for the recovery of strategically important metals. This work addresses critical challenges in sustainable resource management by exploring innovative materials for metal recovery from environmental and anthropogenic waste streams. Specifically, the bursary allowed me to visit the Camborne School of Mines, University of Exeter in July 2024, where I used their new zetasizer to determine the point of zero charge (PZC) of my synthesized MNPs. The facility's instrumentation enabled precise measurements, providing insights that were not accessible with the equipment available at my home university.

Understanding the PZC of magnetite is crucial for optimizing its performance as a sorbent material. The PZC defines the pH at which the surface charge of the nanoparticles is neutral, influencing their interaction with metal ions in solution. By identifying this property, I could refine the conditions under which magnetite is most effective at adsorbing target metals such as cobalt, nickel, and zinc. This knowledge is particularly important for tailoring the material to specific applications in metal recovery and environmental remediation.

During my visit to Camborne, I conducted zeta potential measurements across a range of pH values (3–11). I found that the PZC of my synthesized materials was within the expected range for magnetite, but with slight variations depending on the synthesis method. These findings will inform the development of more efficient recovery systems, ensuring that the nanoparticles can selectively target and adsorb metals under varying environmental conditions.

The bursary not only supported a critical aspect of my PhD but also contributed to my professional development highlighting the importance of interdisciplinary collaboration and the value of accessing specialized facilities to achieve research goals. This collaborative experience also allowed me to discuss my work with experts in the field, gaining valuable feedback and inspiring new ideas for future work. I am deeply grateful for this funding, which has been instrumental in progressing my work on MNPs and their applications in metal recovery.



Zetasizer (left) used to determine the point of zero charge of synthesised MNPs.

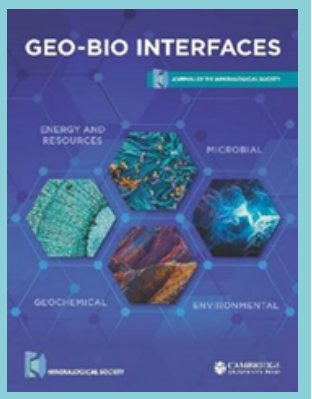
GEO-BIO INTERFACES

The Mineralogical Society of the UK and Ireland + Cambridge University Press

https://www.cambridge.org/core/journals/geo-bio-interfaces

If you would like to contribute please contact the editors:

- **Jon Lloyd University of Manchester, UK. jon.lloyd@manchester.ac.uk**
- **Annette Engel University of Tennessee-Knoxville, USA. aengel1@utk.edu**
- **Hailiang Dong China University of Geosciences - Beijing, China. dongh@miamioh.edu**



WORDSEARCH

R	N	N	M	I	N	E	R	A	L	S	A	T	N
R	G	O	L	D	D	T	Z	A	T	I	N	M	T
A	E	T	I	S	A	R	B	E	T	N	O	M	R
E	C	M	L	M	B	T	A	E	L	T	I	M	Z
T	A	V	L	U	N	I	I	V	A	M	M	U	I
I	L	A	A	S	V	E	O	V	I	L	E	D	N
N	E	N	T	C	P	I	T	T	D	T	N	N	N
A	D	A	E	O	S	O	V	S	I	P	E	U	W
T	O	D	M	V	I	I	D	I	G	T	V	R	A
I	N	I	U	I	L	T	M	U	A	N	E	O	L
T	I	N	U	T	V	A	I	C	M	N	U	C	D
E	T	I	N	E	E	T	I	O	I	E	I	T	I
E	E	T	B	A	R	I	T	E	A	T	N	T	T
E	T	E	T	C	C	O	P	P	E	R	S	E	E

BARITE
VIVIANITE
MINERALS
MUSCOVITE
MONTEBRASITE
GOLD
ZINNWALDITE
COPPER
VANADINITE
CALEDONITE
CORUNDUM
TIN
SILVER
TITANITE
DRAVITE
SPODUMENE
METAL
BIOTITE
TUNGSTEN

#THINSECTIONTHURSDAY

AND THE WINNER IS ....

SIMON ALLPORT (1816-1897)

SIMON WAS AN EARLY PIONEER OF PETROLOGICAL MICROSCOPY (IMAGE COURTESY OF @LAPWORTHMUSEUM WHO SHARED THIS PHOTO OF SIMON'S HANDMADE THIN SECTIONS)

GET INVOLVED

If you would like to become more involved in the AMG, then we are looking for you! Student Representative positions are currently available. If you would like to be considered for a committee spot please email our chair, Martin Smith martin.smith@brighton.ac.uk.

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

Please note there are two bursary application deadlines each year: 15th April and 15th October. 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 by the remit of the AMG. Further guidelines on how to apply can be found at:

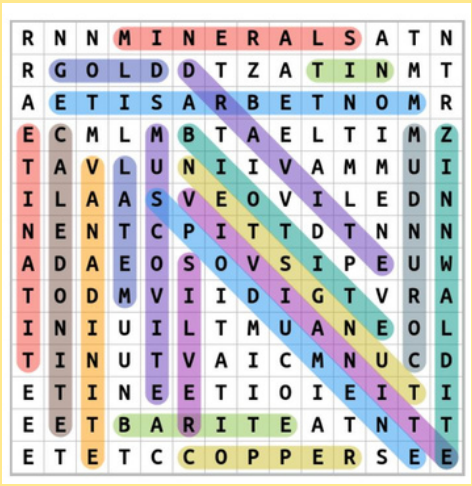
www.minersoc.org/amg-funding

Don't forget to keep posting with ***#ThinsectionThursdays, #FieldworkFridays, #MineralMondays,*** *and* ***#AppliedMineralogy*** *for your chance to be featured.*

Please forward any articles, comments or notices of events and conferences to amgminsoc@gmail.com.

Find all previous issues of the Applied Mineralogist at:
www.minersoc.org/amg-applied-mineralogist

CROSSWORD ANSWERS



Interested in joining the Mineralogical Society and Applied Mineralogy Group?
https://www.minersoc.org/

Upcoming Events:

EGU general assembly 27th April - 02nd May 2025

Goldschmidt: 6-11th July 2025

International Clay Conference: 18-23rd July 2025

SGA: 3-7th August 2025