



# SGA

January 2019  
Number 44

# News

## "Sediment-hosted Mn-U and Fe deposits" from exploration to processing

5<sup>th</sup> SGA-SEG-UNESCO-IUGS Short Course on African Metallogeny

Beate Orberger<sup>1</sup>

<sup>1</sup> University of Paris Sud, Orsay, France

This year, the short course on African Metallogeny was held in Gabon, in the mining city Moanda, located in the southeastern part of the country. The course was held from 10<sup>th</sup> to 14<sup>th</sup> October 2018, just at the beginning of the rainy season.

Moanda is intimately related to the COMILOG-ERAMET company, the second largest manganese producer in the world. The manganese is hosted in Paleoproterozoic black shales of Moanda and Franceville regions, which are unique places because the famous 2.1 Ga old fossils were discovered.

COMILOG-ERAMET is mining and processing manganese oxide ore, producing agglomerates, SiMn alloys for the steel industry and Mn-metal for the battery and fertilizer markets. Furthermore, the region of Moanda is famous for its natural nuclear reactor "OKLO". Uranium was mined for decades. At present, intensive exploration and mining projects are focused on iron deposits.

In 2016, the "Ecole des Mines et de la Métallurgie" (Mining and Metallurgy School) of Moanda, a partnership between the Gabonese government and COMILOG-ERAMET, was inaugurated. In September 2017, we decided with the support of the "Ministère de l'Équipement, des Infrastructures et des Mines" (Francis Mayaga-Mikolo and Antoine Mathurin Ango) to co-organize this short course with the "Ecole des Mines et de la Métallurgie" and COMILOG-ERAMET (Etienne Mvoula and Jean Pierre Lavigne).

Forty people from 8 countries met in Moanda, covering all sectors (companies, consultants, academia and government) that included engineers from several disciplines, economic geologists, prospectors and metallurgists. Ten lecturers from Gabon, France and Belgium shared their knowledge.



Fig. 1: Short course participants.

### CONTENTS

|   |    |   |    |
|---|----|---|----|
| "Sediment-hosted Mn-U and Fe deposits": from exploration to processing  | 1  | SGA student chapter in Freiburg, Germany  | 17 |
| International Conference on the Middle and Lower Yangtze Metallogenic Belt (MLYB) Hefei, China, July 9–14     | 5  | SGA Colombia – Bogotá: Reconnaissance of the old and new open doors for mineral exploration                                 | 19 |
| News of the Society   | 6  | Activities of the SGA Siberian Chapter in 2018: Field trip to the Sludyanka deposit, Baikal Lake                            | 20 |
| 2018–2019 SGA Activities in North America   | 9  | The Russian and Baltic SGA Chapters collaborative field trip to Kola Region   | 22 |
| 10 <sup>th</sup> Annual Meeting of the SGA Baltic Student Chapter – Oulu 2018                                 | 11 | Report from the Gold Short Course 2018 (led by Prof. David. I. Groves) and of the post-course field trip in Bohemian Massif | 24 |
| Field trip through Tertiary magmatic-hydrothermal deposits of Northern Greece                                 | 13 | Heritage stone excursion to the south-western part of the Bohemian Massif   | 28 |
| Graduate Short Course on Exploration Geology in Freiburg  | 15 | David I. Groves: Novel writer   | 32 |
| Mineral deposits of the Harz Mountains – Field trip report from the Black Forest – Alpine SGA Student Chapter | 16 | Guide to authors for the SGA News   | 33 |
| Columbian SGA student chapter visiting Black Forest – Alpine  |    | The SGA website   | 34 |

M. Etienne Mvoula, General Director of the “Ecole des Mines et de la Métallurgie”, welcomed the participants and lecturers, Prof. M. Moussavou introduced the Metallogeny and the famous fossils of the Francevillan basin.

The **first day** was dedicated to uranium with focus on its physical and chemical properties and the type of uranium deposits with special emphasis on deposits found in Canada and Niger. Uranium hydrometallurgical processing was also introduced. The natural fission reactions from OKLO were presented and discussed.

On the **second day**, manganese was the major topic (Kinsenge deposit in the Democratic Republic of Congo and the Francevillan Basin, Gabon). Lectures included also the physical and chemical properties of U and Mn as well as their industrial applications.

Engineers from COMILOG presented the Mn-processing from beneficiation, pyro- and hydrometallurgy. The iron deposits (Belinga in the NE of Gabon and prospects in the Francevillan basin were presented followed by a closing lecture on the Geology and Metallogeny of Gabon.

Excursions comprised the visit of the metallurgical complex CMM (COMILOG), the COMILOG Mn mine at Bangombé and the beneficiation plant as well as outcrops of the famous fossils.

Discussion continued during lunch, dinner and breakfast. The “Ecole des Mines et de la Métallurgie” is an ideal place to meet, providing a video equipped conference room, lodging and restaurant facilities within a few hundred meters distance. It is located at about 5 km from Moanda with a beautiful view on the Manganese oxide ore.

The “Ecole des Mines et de la Métallurgie” hosts a professionally equipped geotechnical laboratory, offering practical training for students, services for COMILOG and other companies in the region of Moanda.

A Gala dinner was organized the last evening with an excellent buffet composed of Gabonese and Western style food and



Fig. 2: Lecturers from left to right: Jacques Thiry (retired from ORANO), Maurice Pagel (UPS, Orsay, France), Mathieu Moussavou, (USTM, Franceville, Gabon); Beate Orberger (UPS, Orsay, France), Flore Mouele (COMILOG, Moanda), Christian Boupasia (COMILOG, Moanda, Gabon), Thierry De Putter (Africa Museum, Brussels, Belgium), Antoine Marthurin Ango (Councilor to the Gabonese government, Libreville, Gabon); Francis Mayaga-Mikolo (General-Director of Geological Survey, Libreville, Gabon).



Fig. 3: Participants and Jean Pierre Lavigne (Administrative Director, Ecole des Mines et de la Métallurgie).



Fig. 4: Production of SiMn alloy.



Fig. 5: M. Moussavou (Prof. USTM, left) explains the outcrops and the morphologies of the famous 2.1 Ga old fossils.



Fig. 6: Manganese oxide ore outcrop and visit to the beneficiation plant.



Fig. 7: View from the School on the outcrop of the Mn-oxide ore and the underlying Mn-carbonate-rich black shale.

# 15<sup>th</sup> SGA Biennial Meeting Glasgow 2019



The SGA Council and Local Organizing Committee  
extend you the warmest invitation to  
The University of Glasgow  
for the  
**15<sup>th</sup> SGA Biennial Meeting**  
**27-30 August, 2019**  
*Life with Ore Deposits on Earth*

## Key dates

|                                       |  |
|---------------------------------------|--|
| <b>January 14<sup>th</sup>, 2019:</b> | Registration and abstract submission open                |
| <b>March 11<sup>th</sup> 2019:</b>    | Abstract submission and student grant applications close |
| <b>April 29<sup>th</sup>, 2019:</b>   | Abstract and student grant acceptance notified           |
| <b>May 15<sup>th</sup>, 2019:</b>     | Early Bird & Field Trip registration closes              |
| <b>May 21<sup>st</sup> 2019:</b>      | Field Trip confirmation required                         |
| <b>June 17<sup>th</sup> 2019:</b>     | Short Course registration closes                         |

Visit our website at

[www.sga2019glasgow.com](http://www.sga2019glasgow.com)

for theme, field trip and short course details  
and regular updates

French wine. A traditional Gabonese dancing group energized the group, so we danced until midnight.

We all learned a lot from each other and we left with a new network and an excellent souvenir.

Thanks to the local organizing team, this short course was held in the spirit of cordiality and a very warm-hearted ambiance. COMILOG, SGA and SEG sponsored this short course.

The "Ecole des Mines et de la Métallurgie" is ready to organize another short course in 2 to 3 years.



Fig. 9: Gala dinner.



Fig. 8: The head of the geotechnical Laboratory and young engineer just graduated from the Mining school.

# SGA NEWS

No. 44 January 2019

CHIEF EDITOR  
 Jochen Kolb  
 Institute of Applied Geosciences  
 Karlsruhe Institute of Technology (KIT)  
 Adenauerring 20b  
 D- 76131 Karlsruhe  
 GERMANY

SGA News is a publication of SGA (Society for Geology Applied to Mineral Deposits) and appears twice a year.

SGA News can be also read in the SGA homepage on Internet:  
<http://www.e-sga.org>

CONCEPT AND PRINTING  
 WMXDesign GmbH  
 Heidelberg, Germany

LAYOUT  
 Jochen Kolb, Karlsruhe, Germany

PROOF READING  
 David M. Leng, Brantford, Ontario, Canada

DEADLINE FOR SGA NEWS No. 45  
 30 April 2019

SGA NEWS – MAILBOX  
 Prof. Dr. Jochen Kolb  
 Institute of Applied Geosciences  
 Karlsruhe Institute of Technology (KIT)  
 Adenauerring 20b  
 D- 76131 Karlsruhe  
 GERMANY  
 e-mail: [editor-sga-news@e-sga.org](mailto:editor-sga-news@e-sga.org)  
[jochen.kolb@kit.edu](mailto:jochen.kolb@kit.edu)



The SGA, MDSG, IOM3 and SUERC together with The Lord Provost of the City of Glasgow  
**Eva Bolander**  
 Scotland's First Minister  
**Nicola Sturgeon**  
 extend the warmest invitation to  
**The University of Glasgow**  
 for the  
**15th SGA Biennial Meeting 27<sup>th</sup> - 30<sup>th</sup> August, 2019**  
 (Ice Breaker Reception 26<sup>th</sup> August)

## THEMES AND SESSIONS

- Co-evolution of Life and Ore Deposits
- Mineral resources for green growth
- Advances in understanding hydrothermal processes
- New techniques for ore discovery
- New discoveries – new views: advances in the science of mineral exploration
- Magmatic-hydrothermal systems: from Porphyry to Epithermal
- Magmatic sulfide and oxide systems
- Gold – from orogeny to alluvium
- Economics of ore deposits
- The changing face of metal extraction - geology, biology and geomaterials
- Sustainable development of ore deposits
- Supergenes, gems and non-metallic ores
- Open session
- Young Geologist Forum - prospects in mineral deposits industries

@sga\_2019 @ #sga2019
www.sga2019glasgow.com
sga2019@abbey.ie

# International Conference on the Middle and Lower Yangtze Metallogenic Belt (MLYB) Hefei, China, July 9–14

Emily Beard<sup>1</sup>

<sup>1</sup> University of Nevada, Las Vegas, USA

The International Conference on the Middle and Lower Yangtze Metallogenic Belt (MLYB) was hosted at Hefei University of Technology in Hefei, Anhui, China, July 9–14, 2018, organized by Taofa Zhou, Fan Yu and Noel White.

The MLYB is one of China's most important and diverse metallogenic belts and is > 400 km long. Over 120 attendees from at least six countries attended talks and discussions during the first two days of the conference and 50 participated in the two days of field visits to five sites that followed. International perspectives and comparisons were given by Zhaoshan Chang and Simon Jowitt (USA), David Cooke and Roger Skirrow (Australia), Peter Hollings (Canada), Valentin Troll (Sweden) and Fernando Tornos (Spain) and the local perspective was given by noted Chinese experts.

The talks in the first two days ranged from very broad “this is what the MLYB is” or “this is what this deposit type is” presentations to “here are the very specific isotopes/fluid inclusions/various other geochemical analyses I used to analyze this material, and here's what I think it means” presentations. There were no simultaneous sessions, which eliminated the problem of deciding which of the various sessions to attend that is so often encountered at larger conferences.

The other major benefit of the size of the conference was that discussion was much more readily accessible. Are you uncomfortable asking a question in the slightly more formal setting of the official session? Ask it at lunch! Not sure if your question is stupid, irrelevant, or if you will be mocked for not knowing? Ask quietly at dinner. Unsure what you saw in a particular sample or confused about how that sample would have looked in situ? Ask someone on the bus. The size of the conference made the speakers accessible and allowed discussion of dissenting opinions to be heard. This was especially beneficial for early-career students with limited experience, as it showcased the known facts about controversial deposits and various ways these facts can be interpreted without highlighting any one interpretation as the Ultimate Truth. This was especially valuable for students trying to form a picture of these complex and somewhat confusing deposits.

After the two days of talks there were two days in the field visiting iron oxide apatite deposits in the Ningwu district and porphyry skarn deposits in the Tongling district. Once again, the small size of the group made all the difference. The field visits, rather than being highly structured events led by one person, were more of an in situ discussion session led by the person or persons most familiar with the site.

On top of being a wonderful educational experience, the conference was a unique travel experience. The hotel on the HUT campus offered a lovely view of a man-made pond that is almost 2,000 years old. The food was amazing, varied and served family style. Meals were exceptionally social and gave participants an op-



Fig. 1: Enthusiastic sampling of spectacular magnetite-apatite ore in the Gaocun open pit.



Fig. 2: Xinqiao Cu-Au-S-Fe deposit, a sulfide-rich deposit containing both stratabound sulfide ore and skarn.

portunity to interact with one another informally. Students shared research and educational experiences as well as comparing life in fairly distinct cultures. For example, while it wasn't covered in depth in any of the sessions, some informal discussions centered on mineral economics and how they vary from country to country and the way a different economic system affects what is considered economically viable. This provided an interesting and interdisciplinary look at the MLYB.

Overall the conference was one of the most memorable learning and overall experiences I have had as a geology student. I was exposed to a lot of new geological information, but I was also exposed to new people, ideas and ways to discuss science.

# News of the Society

SGA Ordinary Council Meeting, Würzburg, Germany, October 22, 2018

Jan Pašava<sup>1</sup>

<sup>1</sup> Czech Geological Survey, Geologická 6, 152 00 Praha 5, Czech Republic, jan.pasava@geology.cz

Hartwig Frimmel (host of the Meeting and SGA Treasurer) welcomed all Council members on behalf of the University of Würzburg. Karen Kelley (SGA President) welcomed all Council members and thanked H. Frimmel for organization of the meeting. Then Council approved the proposed agenda.

## Minutes of previous Council Meeting (April 17, 2018, Glasgow, UK)

After checking the actions, the Minutes were unanimously approved.

## Reports of officers on Council

- 3.1. Report from President
- 3.2. Report from Executive Secretary
- 3.3. Report from Treasurer
- 3.4. Report from Promotion Manager
- 3.5. Report from Chief Editor, SGA News
- 3.6. Report from Chief Editors, MD
- 3.7. Report from Chief Editor SGA Special Publications
- 3.8. Report from the Chief Editor SGA website
- 3.9. SGA Educational Fund
- 3.10. to 3.16 – Reports from Regional VPs (Asia, Australia/Oceania Europe, North Africa and Middle East, Sub-Saharan Africa, North America and South America)

Council was sorry for missing Reports.

Council was deeply sorry to receive a notice on planned resignation of N. Koglin (Chief Editor, SGA website) by the end of 2019 and greatly appreciated Nikola's invaluable contribution to SGA and her well-advanced notice on this decision.

After discussion, Council approved the presented reports with great thanks and the following motions:

K. KELLEY to work with SGA Council about identification of a suitable SGA speaker for SEG 2019 Meeting (Santiago, Chile) and inform J. Perello (Chair of LOC, SEG 2019) of this choice.

K. KELLEY with help of E. FERRARI (SGA RVP South America), and COUNCIL to secure manning SGA booth at SEG 2019.

J. RELVAS to provide promotional materials.

K. KELLEY to work with D. KIRWIN (SEG President 2019) and A. BOYCE (Chair, LOC SGA 2019) on identification of SEG plenary speaker for SGA 2019.

J. PAŠAVA to prepare a draft of Minutes and a Call for nominations for SGA elections for upcoming SGA News.

J. PAŠAVA to prepare a Report on SGA 2018 activities to IUGS SG.

J. RELVAS to contact A. Buettner (Springer) and discuss a possible SGA promotion via Springer booth at the 36th IGC (New Delhi, India, 2020).

ALL COUNCIL MEMBERS who help in promoting SGA and signing up new SGA members to make sure that the latest applications forms including GDPR and credit card payment requirements are used. In particular, the name of the applicant MUST BE THE SAME as the name of the credit card holder. We cannot process payments in the future, for which we do not have the explicit authority of the credit card holder. It's also important to use latest version of application forms (attached to website), asking for 3 digit credit card security code.

N. KOGLIN to adapt SGA website to make SGA-IUGS-UNESCO activities more visible.

N. KOGLIN to update a form on donations to SGA EF.

A. VYMAZALOVÁ to remind all Student Chapters to not forget to register for upcoming year.

J. RELVAS (with a help of design people from the Lousal Science Centre) to prepare several drafts of layouts for new portable SGA roll ups (Council would expect to have highlighted major benefits for joining SGA, SGA EF, MD and recent collaboration with EAG, GS, which resulted in reduced fee for SGA members when participating at Goldschmidt conferences). These roll ups should then be ordered and distributed in 2019 to all RVPs.

J. KOLB to remind A. Boyce to provide detailed info on SGA 2019 for upcoming SGA News 44 (deadline October 31) and also to remind Adrian or other members of the LOC that we would like a summary paper on geology and mineral deposits of UK to be published in SGA News 45 (deadline March 31, 2019).

G. BEAUDOIN and B. LEHMANN to contact Springer about decreasing technical quality of Mineralium Deposita and ask for taking actions towards improvements.

ALL COUNCIL MEMBERS to help B. Lehmann and G. Beaudoin to identify suitable theme and authors for "milestone papers" for MD.

J. RELVAS to continue looking after distribution of SGA promotional items upon request of SGA RVP's and possibly other Council members and SGA Student Chapters organizing SGA major and/or co-sponsored geo-events.

J. SLACK to continue editorial efforts associated with 3 SGA Special Publications, which are at different stages of preparation and report to next Council Meeting (Isotopes in Mineral Exploration; A Hydrothermal History of the Yilgarn Craton and its Relevance to Gold Exploration; and Supergene Mineral Deposits).

N. KOGLIN to work with A. MUELLER and other interested Council and SGA members on extension of Mineral Deposit Archive and Image Archive at SGA website.

N. KOGLIN to inform M. Spinosa (presently running SGA Twitter account) that he should provide login data to I. Pitcairn who will on behalf of SGA Council supervise the SGA Twitter activities.

N. KOGLIN and J. KOLB to adapt SGA website for e-submission of contributions to SGA News.

ALL COUNCIL MEMBERS to think of a suitable candidate for replacement of Nikola Koglin and to provide their nominations (without making any direct contact with them) to K. Kelly, J. Pašava and H. Frimmel as soon as possible, preferably before December 2018. The final decision will be made by SGA Council.

N. KOGLIN to reserve www.sga2023.com, www.sga2025.com and www.sga2027.com addresses for future SGA Biennial Meetings.

D. HUSTON and R. SKIRROW to work on the organization of the SGA field conference/workshop at Mt. Isa, Queensland, Australia for July/August 2020 and report to next SGA Meeting.

HUAYONG CHEN with X. SUN and other Chinese SGA members to try to set up a new Student Chapter in China.

ALL COUNCIL MEMBERS to provide D. Huston with names of relevant officers in mining companies who should be contacted to consider donations to SGA EF.

In order to avoid duplicates in fund raising efforts for SGA 2019, D. HUSTON to initiate communication with A. Boyce about on the companies approached for sponsorship for EF and SGA 2019.

S. DECREE to continue her deserving SGA liaison activities with EAG and GS and keep SGA EC informed on any progress.

G. BEAUDOIN to contact G. Tourigny on a possible organization of the 6th SGA Short Course on African Metallogeny in West African region.

G. TOURIGNY to continue efforts in setting up West African SGA Student Chapter.

### SGA 2019 – update (A. Boyce et al.)

The Report was delivered by A. Boyce. The follow up discussion of present Council members and A. Boyce and I. Butler via Skype resulted in the following motions:

- to secure payments of student grants to people from third world countries in cash from Conference budget and then debit SGA for this sum. The money to EU based people will be provided by SGA Treasurer's Office (not from SGA 2019 Conference budget) via money transfer,
- to prepare a brochure for sponsors,
- to advertise and implement reduced registration fees not only for SGA but also for EAG and GS members,
- to reserve a larger booth for SGA/Springer at prominent site and also complimentary booth for SGA 2021, SEG and IAGOD,
- to consider suitability of nominations of several session chairs as keynote speakers,
- to offer Open Session only for poster presentations,
- to communicate with D. Huston about which companies/institutions were contacted on behalf of LOC SGA 2019 for sponsorship,
- to invite D. Huston to actively be involved in the planned Short Course on Applications of isotope geochemistry to ore genesis and exploration,
- to consider splitting Session 2 (too broad) into several thematic sessions,
- to adapt timing for Opening Ceremony (SGA needs 1 hour for presentation of awards),
- to plan SGA GA on August 28, 2019 from 11:00 to 12:00 without any parallel sessions,
- to rename Closing Ceremony to Closing Ceremony with Presentation of Student Awards,
- to prepare and send to J. Kolb by October 31, 2018 a text – an invitation to the SGA 2019 meeting with all approved available information to be published in the upcoming issue of SGA News (44),
- to prepare and send to J. Kolb by May 1, 2019 a summary paper on geology and metallogeny of Scotland/UK to be published in SGA News (45),
- to send to G. Beaudoin/B. Lehmann a 1 page advertisement for SGA 2019 to be published in Mineralium Deposita,
- to send a ½ page SGA 2019 advertisement to Brian Hoal for SEG News,
- to make sure that copyright on all SGA 2019 published documents (Proceedings, Field trip guides etc.) is with SGA.
- to make sure that all needed bibliographic information will be on published Proceedings from the SGA 2019 Meeting (use an example of the Proceedings of the 17th SGA Biennial Meeting, Quebec City, Canada). This is very important for inclusion of SGA Proceedings on the list of Conference Proceedings by ISI Thompson Reuters
- to adapt important dates as follows:
  - January 14th, 2019: Registration and abstract submission open,
  - February 25th, 2019: Abstract submission closes and student grant applications close,
  - April 29th, 2019: Abstract and student grant acceptance notified,
  - May 15th, 2019: Early Bird, Field Trip & Short Course registration closes,

May 29th, 2019: Field Trip and Short Course confirmation given.

Council highly appreciated all efforts by the LOC and approved presented report with great thanks.

### SGA 2021 – update (T. Christie)

The brief report was presented by J. Pašava. After discussion Council approved the report with great thanks and the following motion:

T. CHRISTIE to prepare a flyer – an invitation to the 16th SGA Biennial Meeting (2021) to be distributed to participants of the SGA 2019 meeting in Glasgow and also a brief presentation to be presented at the SGA 2019 Closing Ceremony.

T. CHRISTIE to plan for SGA 2021 booth at the SGA 2019 Meeting in Glasgow (will be provided free of charge).

### Progress report on membership drive from the last SGA Council Meeting (J. Relvas et al.)

The report was presented by J. Pašava. The Society had 1,362 paid-up members by September 30, 2018. The period until September 30, 2018 shows a slight decrease of the overall membership, when compared with the end of 2017 (in total, -1.7%, from 1,386 to 1,362). This decrease is particularly significant regarding the number of regular members, which suffered a decrease of 8% (from 720 to 663). This was partly offset by a 6% increase in the student membership compared to 2017 (from 613 to 651). From March 20 to September 30, 2018, SGA attracted 224 new members: 10 regular, and 214 student members. There is a long-term trend of increasing number of student members and regular members with on-line subscription of MD at the expense of regular members with printed MD. It is important to attract student members to become regular members and to make regular membership more attractive. After discussion Council approved the report with great thanks and the following motion:

J. RELVAS to address all RVPs with a request for their collaboration regarding non-renewing members.

ALL COUNCIL MEMBERS to make sure that only the new version of SGA application forms (those requesting 3 digit credit card security number) and GDPR will be used when applying for SGA membership.

### Status of development of SGA Student and Young Scientist network (A. Vymazalová)

The Report was presented by A. Vymazalová. SGA has 14 student Chapters (Baltic, Barcelona, Colombia-Bucaramanga, Colombia-Bogota, Laval, Nancy, Morocco, Peru, Prague, Siberia, NW Russian, Western-Cape, Turkey and Black Forest-Alpine) and additionally two were created recently – Brazil and UK Chapter. Most of existing 16 Chapters are quite active and actively networking among themselves, organizing various meeting and field trips (particularly: Alpine-Black Forest, Baltic, Barcelona, Morocco, Prague, NW Russian, Siberia and Chapters in Peru and Colombia).

Action: A. VYMAZALOVÁ to inform all Chapters on the need of registration of all Chapter members for SGA membership.

### Requests for sponsorship

- Freiberg Short Course in Economic Geology (December 2018, Freiberg, Germany) – M. Buritsch et al. – EUR 3,000 approved for SGA student support (increased by EUR 1,000 compared to normally provided EUR 2,000 – a long term arrangement approved by Council)
- Workshop on "Seafloor Resources" (October 24th 2018, Karlsruhe Institute of Technology –KIT) – L. Richter – EUR 520 approved for SGA keynote by SGA EC

- 8<sup>th</sup> Russian young scientist scientific school New knowledge in ore-forming processes (November 26-30, 2018 Moscow, Russia) – requested EUR 1,400 (700 student support + 700 SGA keynote speaker A. Vymazalová)

Council approved these requests. J. PAŠAVA to inform organizers on Council decision.

### Any other business

- SGA new initiatives - update (D. Huston, K. Kelley and R. Skirrow)
- This item was covered under Report of President.
- Report on SGA - GS and SGA - EAG partnership including a possible role of SGA in Goldschmidt 2019 – Barcelona - update (S. Decree, K. Kelley)
- The Report was delivered by K. Kelley and S. Decree and also covered in Report of President and RVP Europe.
- Council greatly appreciated all activities and approved the Report with great thanks.
- Report on the 5<sup>th</sup> Short Course on African Metallogeny – Gabon (B. Orberger)
- The Report was presented by J. Pašava. This very successful activity focused on sediment-hosted Mn-Fe-U deposits was attended by 40 people from 8 countries. Ten lecturers from Gabon, France and Belgium gave presentations. Council greatly appreciated long-term efforts by Beate Orberger and her team and approved the Report with great thanks.
- **Action:** B. ORBERGER to send a brief Report on the Course to the upcoming issue of SGA News.
- SGA presence at the IAGOD 2018 Salta, Argentina (R. de Barrio/F. Tornos)
- The Report was given by Raúl de Barrio and Fernando Tornos. SGA has been one of the four co-sponsors of this meeting which attracted about ~350 researchers and professionals, mainly from Argentina and Asia. The participation of SGA included a one day pre-meeting short course on fluid inclusions organized by Daniel Moncada (Universidad de Chile), a booth, coordinated by Raul de Barrio (Universidad de La Plata), one SGA keynote presentation by Fernando Tornos on “Microbiology and the formation of ore deposits” and a scientific session sponsored by the SGA under the title “Magmatic-hydrothermal systems and the formation of ore deposits” (coordinated by David Lentz and Fernando Tornos). Council greatly appreciated SGA activities and promotion by R. de Barrio, D. Moncada and F. Tornos and accepted the Report with great thanks.
- Nomination of SGA officers for 2019 ballot (K. Kelley/J. Pašava)
- J. Pašava informed Council on planned schedule for the preparation of SGA 2019 ballot. Nomination Committee (K. Kelley-Chair)

should seek nominations from Council members and membership at large (announcement in SGA News) and the final nominations are received by Executive Secretary prior to February 1, 2019. The whole process of finalization of the list of nominated officers including approval by Council has to be done prior to July 1, 2019. The SGA ballot will then be called prior to October 15, 2019.

- **Actions:** K. KELLEY to submit a list of nominations to J. Pašava by February 1, 2019.
- J. PAŠAVA to submit suggested nominations for Council vote in spring 2019.
- Date and place of the next SGA Council meeting
- Next SGA Council meeting will be held in Pamukale, Turkey, with the following schedule:
  - April 14 (Sunday) – arrival of participants and a joint dinner,
  - April 15 (Monday) – Council Meeting – the precise venue to be determined,
  - April 16-17 – Field trip (including a visit to Kisladag Au deposit),
  - April 18 (Thursday) – departure of participants.

### Informative list of past activities

- Short Course on Gold Deposits (May 19-20, 2018 Prague, Czech Republic) – D. Groves-SGA speaker, organized by the Prague Student Chapter – EUR 3,000 approved
- Baltic Chapter – Short Course on Fusing geochemistry and structural geology for exploration, mining and research (May 24-25, 2018 Lulea, Sweden) – EUR 350 approved to lower costs associated with SGA student member participation
- 8<sup>th</sup> Geochemistry Symposium in Turkey 2-6 May (organized by Karadeniz Technical University) – sponsorship to SGA student members (up to 1,000 EUR) and keynote speaker (up to 1,000 EUR)
- RFG 2018 (June 16-21, 2018 Vancouver, Canada) – SGA session organized by J. Gutzmer *et al.* on Geometallurgy; a joint SGA/Springer booth
- Middle and Lower Yangtze Belt Conference (Hefei, China, 9-14 July 2018) – SGA co-sponsored
- Goldschmidt 2018 (August 12-17, 2018 Boston USA) – sponsorship to SGA session on "From Cradle to Grave: Isotopes in the Life Cycle of Mineral Deposits"- I. Ridley and R. Wanty – EUR 1,000 approved for keynote and/or SGA speaker
- 15<sup>th</sup> IAGOD Symposium (August 28-31, 2018 Salta, Argentina) – complimentary booth, SGA session on “Magmatic-hydrothermal mineralizing systems, SGA keynote presentation and a short course on fluid inclusions – R. de Barrio, F. Tornos, D. Moncada and others, EUR 3,000 approved for SGA speakers
- SEG 2018 Conference (September 22-25, 2018 Keystone, CO) – K. Kelley *et al.* – SGA speaker and complimentary booth

## PRICES FOR ADVERTISING IN SGA NEWS

1 page = 400 EUR | 1/2 page = 200 EUR | 1/4 page = 125 EUR | 1/8 page = 70 EUR

Before sending your advertisement contact SGA News (see address on page 2). Advertisement should be sent as attached files via e-mail to SGA News (see page 2). Credit card payments are welcome.

>>> SGA CORPORATE MEMBERS are offered the special opportunity to advertise for free on SGA News for a space of 1/4 of a page!!!

- XIX Peruvian Geological Congress (September 23-26, 2018 Lima, Peru) – SGA institutional partner – E. Ferrari *et al.*
- 5<sup>th</sup> Short Course on African Metallogeny (October 10-14, 2018 Moanda, Gabon) – B. Orberger *et al.*
- Workshop on Bergslagen – frontiers for ore genetic modelling and mineral exploration in a historic mining district – Stockholm, October 18, 2018 – I. Pitcairn - EUR 600 approved for SGA speaker
- XXXVI UNESCO-SEG-SGA Curso Latinoamericano de Metalogenia (23-25 May 2019 Lima, Peru and field trip, 26-29 May), the PUCP university (directly after PROEXPLO 2019)
- 15<sup>th</sup> SGA Biennial Meeting (August 25-29, 2019 Glasgow, Scotland, U.K.) – A. Boyce *et al.*
- SEG 2019 (October 7-10, 2019 Santiago, Chile) – in negotiation
- 38<sup>th</sup> IGC (March 2-8, 2020 New Delhi, India) – SGA sponsors the Theme 28: “Ore Forming Processes and Systems” – J. Pašava - SGA link
- SEG 2020 (date-TBD - Whistler, Canada)
- 16<sup>th</sup> SGA Biennial Meeting (November 14-18, 2021 Rotorura, New Zealand) – T. Christie *et al.*

### Informative list of future activities

- Freiberg Short Course in Economic Geology (December 2018, Freiberg, Germany) – M. Buritsch *et al.* – EUR 3,000 approved for SGA student support
- Annual workshop series on ore deposits 2019/Mines – SGA sponsored – D. Leach *et al.*

## 2018–2019 SGA Activities in North America

Graham Garth<sup>1</sup>

<sup>1</sup> Regional Vice-President, North America

SGA has participated in multiple conferences in North America through October of 2018. We had a booth at RFG2018 in Vancouver, British Columbia (shared with Springer) in June and the Society of Economic Geologists Meeting in Keystone, Colorado in September. There was significant interest in our Society from attending geoscientists and we attracted a number of new industry and student members. John Ashton, Chief Exploration Geologist for Boliden Tara Mines Limited, was the SGA invited speaker at the SEG conference and presented an excellent talk entitled “Discovery of the Tara deep Zn-Pb deposit in Ireland”. SGA also sponsored a session “Recent Advances in the application of dating, isotopic and trace element techniques to commercially relevant geomaterials” at the Goldschmidt Conference in Boston.

SGA is co-sponsoring an upcoming modular course entitled “The geology of hydrothermal ore deposits” to take place at Colorado School of Mines, Golden, Colorado, January 3-7, 2019. This course, intended for both graduate students and professionals, will provide a comprehensive overview of the geology, geochemistry, mineralogy, alteration, structure and exploration approaches for epithermal, porphyry and skarn, orogenic gold, sediment-hosted Pb-Zn

and VMS deposits. Presenters will include Zhaoshan Chang, Richard Goldfarb, Jeff Hedenquist, David Leach and Thomas Monecke. Further information and registration is available at: <https://www.eventbrite.com/e/geology-of-hydrothermal-ore-deposits-tickets-49856267438>. Discounted registration fees are available to SGA members. Contact Mary Carr ([mcarr@mines.edu](mailto:mcarr@mines.edu)) with questions.



Figure 1: SGA Ordinary Council Meeting held on April 22, 2018 in Würzburg, Germany.

First row from left: J. Pašava (SGA Executive Secretary), N. Koglin (Chief Editor, SGA website), G. Beaudoin (Chief Editor, Mineralium Deposita) and J. Slack (Chief Editor, SGA Special Publications).

Second row (standing) from left: J. Kolb (Chief Editor, SGA NEWS), S. Mikulski (SGA Council member), S. Petersen (SGA Council member), A. Vymazalová (SGA Vice-president for student affairs), K. Kelley (SGA President), S. Decree (SGA Regional Vice President Europe), I. Pitcairn (SGA Council member), H. Frimmel (SGA Treasurer), Ch. Linge (Assistant, SGA Treasurer), and B. Lehmann (Chief Editor, Mineralium Deposita). Photo by D. Kleinschrot.

# Reports from the SGA student chapters

| SGA chapter                 | President                      | E-mail                                | Website   | Chapter e-mail                          | Foundation |
|-----------------------------|--------------------------------|---------------------------------------|---|---|------------|
| <b>Prague</b>               | Jan Kulhánek                   | jan.kulhanek@natur.cuni.cz            | <a href="http://sga.cuni.cz/">http://sga.cuni.cz/</a>               | chapter_prague-user-group@natur.cuni.cz | 2002       |
| <b>Baltic</b>               | Krzysztof Foltyn               | krzyfoltyn@gmail.com                  | <a href="http://www.sga.agh.edu.pl/">http://www.sga.agh.edu.pl/</a> |   | 2009       |
| <b>Siberia</b>              | Anna Devyatiyarova             | anna13502@gmail.com                   | <a href="http://www.sib-sga.com">www.sib-sga.com</a>                | academ.sib.sga@gmail.com                | 2011       |
| <b>Barcelona</b>            | Júlia Farré de Pablo           | jfarredepablo@gmail.com               | <a href="http://www.bcn-sga-seg.cat">www.bcn-sga-seg.cat</a>        | student.chapter.ub.sga@gmail.com        | 2012       |
| <b>Colombia-Bucaramanga</b> | Luis Fernando Paez Sinuco      | fernandopaezsinuco@gmail.com          |   | sga.uis.bucaramanga@gmail.com           | 2012       |
| <b>Nancy</b>                | Nathanaël Kirch                | nathanael.kirch7@etu.univ-lorraine.fr | <a href="http://sganancy.wordpress.com">sganancy.wordpress.com</a>  |   | 2013       |
| <b>Peru</b>                 | Renzo Miguel Velasco Gonzales  | rvelascog@uni.pe                      |   | sgastudentchapter.peru@gmail.com        | 2013       |
| <b>Colombia-Bogota</b>      | Pablo Enrique Porras Hernandez | peporrash@unal.edu.co                 | <a href="http://www.sgabogota.org/">http://www.sgabogota.org/</a>   | sga.unalbogota@gmail.com                | 2015       |
| <b>Morocco</b>              | Zaineb Hajjar                  | zaineb.hajjar@edu.uca.ma              |   | sgachapter.mar-rakech@gmail.com         | 2015       |
| <b>Québec</b>               | François-Xavier Masson         | francois-xavier.masson.1@ulaval.ca    | <a href="http://segulaval.ca">http://segulaval.ca</a>               |   | 2016       |
| <b>Western Cape</b>         | Jorgina Akushika               | jorginaakushika@gmail.com             |   |   | 2017       |
| <b>North-West Russia</b>    | Evgenyi Eremenko               | st013196@student.spbu.ru              | <a href="https://nw-sga.com">https://nw-sga.com</a>                 |   | 2017       |
| <b>Turkey</b>               | Mehmet Tufan                   | mehmet.tfn@hotmail.com                |   |   | 2017       |
| <b>Black Forest-Alpine</b>  | Thomas Belgrano                | thomas.belgrano@geo.unibe.ch          |   |   | 2017       |
| <b>Brazil</b>               | Julia de Souza Pimenta         | juliaspim@gmail.com                   |   |   | 2018       |
| <b>United Kingdom</b>       | Jo Miles                       | amyles86@bgs.ac.uk                    |   |   | 2018       |

# 10<sup>th</sup> Annual Meeting of the SGA Baltic Student Chapter – Oulu 2018

Krzysztof Foltyn<sup>1</sup>, Thomas Dols<sup>2</sup>

<sup>1</sup> Faculty of Geology, Geophysics and Environmental Protection, AGH University of Science and Technology, 30-059 Kraków, Poland;

contact: kfolty@agh.edu.pl

<sup>2</sup> Oulu Mining School, Faculty of Technology, FI-90014 University of Oulu, Oulu, Finland

The SGA Baltic Student Chapter carries on the tradition of the annual meeting and in 2018, the 10th anniversary event was held in Oulu, Finland from May 2nd to May 5th. In addition to Baltic Student Chapter members, we also hosted a guest from the SGA Prague Student Chapter (Figure 1). The first day was dedicated to lectures and after registration, we had the pleasure to listen to four of them. The Fennoscandian Shield was named a Europe's Treasure Chest of Magmatic Metal Deposits as it contains significant concentrations of mafic-ultramafic intrusions emplaced in diverse tectonic settings, variable in sizes, shapes, degrees of deformation and mineral concentrations. It was a topic of the two talks: one by Prof. Eero Hanski (Oulu Mining School) who described the 2.05 Ga Kevitsa Ni-Cu-PGE sulfide deposit and komatiitic magmatism in Central Lapland and second one by Dr Shenghong Yang (Oulu Mining School) titled "PGE, Cr, V, Ti mineralization in mafic layered intrusions". We also had an opportunity to learn about EXpLORE – a new MSc exchange program between 4 universities (AGH University in Kraków, Luleå University of Technology, University of Oulu and TU Bergakademie Freiberg) thanks to an online video lecture with Dr Nils Jansson (Luleå University of Technology). Then Dr Tobias Bauer (Luleå University of Technology) highlighted the importance of structural geology in ore deposit studies in a presentation titled "Poly-phase structural controls on ore deposits in

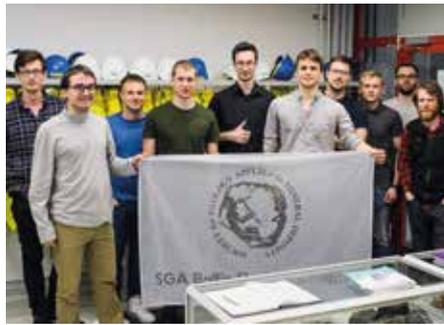


Figure 1. Participants of the meeting with Dr Tobias Bauer (Luleå University of Technology). Photo by P. Hodyl.

northern Sweden". The first day concluded with an ice-breaker party.

The next day we visited the automated concentrator mini-pilot facility at the Oulu Mining School (Figure 2 & 3) and saw some tools used by rock engineers to determine its strength. A stay in Finland wouldn't be complete without visit to the sauna and we ended our day at a sauna house in downtown Oulu.

For the next leg of our trip we traveled to Rovaniemi to visit core storage facilities of current exploration projects in the region. First, there was CD Capital's Suhanko Arctic Platinum. It consists of three large project areas in northern Finland, named Suhanko, Narkaus and Penikat and covers large undeveloped platinum, palladium and gold deposits with by-products of copper and nickel.

The Suhanko and Narkaus deposits are hosted by the 2.44 Ga old layered mafic



Figure 2. Preparing concentrate in a mini-pilot facility at the Oulu Mining School. Photo by P. Hodyl.

intrusive rocks of the Portimo complex (Iljina et al. 2015). All the intrusive rocks, including the Penikat intrusion located to the southwest, are intruded into the Archaean Basement and are exposed along or close to the erosional contact with the overlying Peräpohja schist belt. Suhanko is a contact-style PGE deposit while at Narkaus and Penikat mineralization occurs as narrower but higher - grade reefs. The reefs are developed along the contact between gabbroic footwall rocks and overlying ultramafic stratigraphic units. Offset-style palladium and copper-rich mineralization also occurs at Narkaus in granites of the Archaean Basement with the best developed example being the Kilvenjarvi deposit (Iljina et al. 2015). We had an opportunity to see several drill holes showing typical features of this deposit and get familiar with both styles of mineralization (Figure 4 & 5).



Figure 3. "Headquarters" of a mini-pilot facility at the Oulu Mining School. Photo by T. Dols.

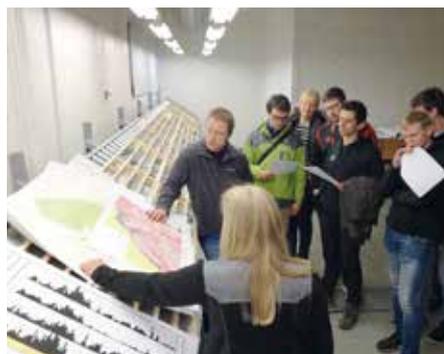


Figure 4. Introduction to the geology of the Narkaus Intrusion at the CD Capital's Suhanko Arctic Platinum facility. Photo by P. Hodyl.



Figure 5. Sulfides (mainly pyrrhotite and chalcopyrite), typical example of ore hosting assemblage in the Portimo complex, with quartz clasts. Photo by K. Foltyn.



Figure 6. Core logging exercises at the Mawson Resources facility. Photo by P. Hodyl.



Figure 7. Sample from the Rompas-Rajapalot area. Can you spot the gold?. Photo by T. Dols.



Figure 8. Chromitite boulders from the Kemi mine, some of them with green, fine-grained uvarovite. Photo by K. Foltyn.

Our next stop was a Mawson Resources facility. The company's flagship property is the Rompas-Rajapalot exploration project located in the northern part of the Paleoproterozoic Peräpohja belt, just south of the Arctic Circle in Finnish Lapland. It comprises various styles of gold mineralization ranging from localized high-grade Au pockets in uraninite- and pyrobitumen-bearing calcsilicate-carbonate-quartz veins in mafic metavolcanic rocks to disseminated gold grains in Fe-Mg-rich metasediments and quartz-tourmaline-sulfide-native gold veins (Ranta *et al.* 2018). The deposits have been termed "Rompas-type Au deposits" (Molnar *et al.* 2016) as recent studies have shown that some of them possess unique mineralogical, petrological and geochemical features which do not match those of orogenic gold deposits in Archean or Paleoproterozoic greenstone belts elsewhere. Mawson's employees introduced us to these deposits, gave us a quick training session of core-logging and practical tasks (Figure 6 & 7). On the way back to Oulu, we stopped in Loue, where right next to the E75 route there is a warehouse with a huge boulders of rocks from the Kemi mine, mainly massive chromite ore, locally with fine-

grained uvarovite (Figure 8) and kämmererite (Cr-bearing variety of clinocllore).

### Acknowledgments

We are extremely grateful to students from Oulu (especially Thomas Dols and Axel Cima) and lecturers who agreed to help us during this event: Prof. Eero Hanski, Dr Nils Jansson, Dr Shenghong Yang, Dr Tobias Bauer, Prof. Saija Luukkanen and Mr. Ilkka Hynynen. We want to thank management and employees of CD Capital's Suhanko Arctic Platinum and

Mawson Resources for their hospitality. We all would like to gratefully acknowledge the financial support from the SGA without which this event would not have been possible.

### References:

Iljina M., Maier W.D., Karinen T. (2015) PGE-(Cu-Ni) Deposits of the Tornionäränkäväära Belt of Intrusions (Portimao, Penikat, And Koillismaa) In: Maier W.D, Lahtinen R., O'Brien H. (ed) Mineral Deposits of Finland, Elsevier, Amsterdam, pp 133-162

Molnár, F., Oduro, H., Cook, N. D., Pohjolainen, E., Takács, Á., O'Brien, H., Pakkanen L., Johanson B., Wirth, R. (2016) Association of gold with uraninite and pyrobitumen in the metavolcanic rock hosted hydrothermal Au-U mineralisation at Rompas, Peräpohja Schist Belt, northern Finland. *Mineral Deposita* 51(5):681-702.

Ranta, J. P., Molnár, F., Hanski, E., & Cook, N. (2018) Epigenetic gold occurrence in a Paleoproterozoic meta-evaporitic sequence in the Rompas-Rajapalot Au system, Peräpohja belt, northern Finland. *Bull. Geol. Soc. Finland*, 90(1): 64-103

## SGA COUNCIL 2019

- |                                       |  |
|---------------------------------------|--|
| President                             | K. Kelley (USA)  |
| Vice-President                        | D. Huston (Australia)  |
| Executive Secretary                   | J. Pašava (Czech Republic)                                       |
| Treasurer                             | H. Frimmel (Germany)   |
| Promotion Manager                     | J. Relvas (Portugal)   |
| Chief Editors                         | B. Lehmann (Germany) - Mineralium Deposita, European Office      |
|                                       | G. Beaudoin (Canada) - Mineralium Deposita, North America Office |
|                                       | J. Kolb (Germany) - SGA News                                     |
|                                       | N. Koglin (Germany) - SGA website                                |
|                                       | J. Slack (USA) - Special Publications                            |
| Vice-President (Student Affairs)      | A. Vymazalová (Czech Rep.)                                       |
| Regional Vice-Presidents              |  |
| Asia                                  | H. Chen (China)  |
| Australia/Oceania                     | R. Skirrow (Australia)   |
| Europe                                | S. Decree (Belgium)  |
| N. Africa-Mid. East                   | M. Bouabdellah (Morocco)   |
| North America                         | G. Graham (USA)  |
| Sub-Saharan Africa                    | G. Tourigny (Canada/Ivory Coast)                                 |
| South America                         | E. Ferrari (Peru)  |
| Councillors through December 31, 2019 |  |
| Y. Lu (Australia)                     |  |
| D. Banks (U.K.)                       |  |
| A. S. André-Meyer (France)            |  |
| B. Orberger (France)                  |  |
| P. Ledru (Canada)                     |  |
| E. Naumov (Russia)                    |  |
| Councillors through December 31, 2021 |  |
| A. Idrus (Indonesia)                  |  |
| P. Mercier-Langevin (Canada)          |  |
| I. Pitcairn (Sweden)                  |  |
| S. Mikulski (Poland)                  |  |
| X. Sun (China)                        |  |
| S. Petersen (Germany)                 |  |
| T. Aiglsperger (Spain)                |  |
| G. Bozkaya (Turkey)                   |  |
| R. E. de Barrio (Argentina)           |  |
| Ex officio Members, SEG               |  |
| President                             | J. Bruce Gemell (Australia)                                      |
| Executive Director                    | B. G. Hoal (USA)   |
| Ex officio Members, IAGOD             |  |
| Secretary General                     | D. Lentz (Canada)  |
| Regional Councillor, Europe           | D. Holwell (U.K.)  |

# Fieldtrip through Tertiary magmatic-hydrothermal deposits of Northern Greece

Krzysztof Foltyn<sup>1</sup>, Sławomir Mederski<sup>1</sup>, Magdalena O óg<sup>1</sup>, K Jakub W grzynowicz<sup>1</sup>, Christos L. Stergiou<sup>2</sup>

<sup>1</sup> Faculty of Geology, Geophysics and Environmental Protection, AGH University of Science and Technology, 30-059 Kraków, Poland; contact: kfolty@agh.edu.pl

<sup>2</sup> Department of Mineralogy-Petrology-Economic Geology, Aristotle University of Thessaloniki, 54124, Thessaloniki, Greece

In September 2018, the SGA's Baltic Student Chapter organized a field trip to several ore deposits of the Balkan Peninsula (Figure 1), focusing on deposits related to Tertiary magmatic-hydrothermal activity.

First, just before the beginning of the excursion, two students had an unexpected chance to visit the Sivec mine near Prilep, Republic of North Macedonia, (previously known as FYROM: Former Yugoslav Republic of Macedonia) and took advantage of this opportunity. Ruby - the gem variety of the mineral corundum ( $Al_2O_3$ ) - can be found in these quarries, exploiting completely snow-white dolomitic marble of the Precambrian Pelagonian marble series. Basic pinacoid and hexagonal bipyramid of rubies occur in the calcite nests. With a little bit of luck, it's possible to find specimens up to several centimeters big (Figure 2) although they are rarely of gemstone quality. Additionally, calcite nests contain other accompanying minerals such as fluorite, rutile, micas, zoisite, achroite, pyrite, muscovite, illite, margarite, chlorite and kossmatite.

The first official day of the trip was dedicated to an ice-breaking meeting with members of the AUTH SEG Student Chapter at the School of Geology, Aristotle University of Thessaloniki. After a short presentation given by Krzysztof Foltyn (PhD candidate) on the mineral deposits in Poland, Associate Professor Dr Vasilios Melfos gave a lecture about the Oligocene-Miocene ore deposits and mineralization of the Serbo-Macedonian and Rhodope metallogenic province in Northern Greece. Then Christos Stergiou (PhD candidate) introduced us to the porphyry Cu-Au system of Vathi and presented the itinerary we were going to visit on the next day.

In the following days, joined by the students of the AUTH SEG Student Chapter and guided by Christos Stergiou, we visited the Vathi Cu-Au±U±Mo porphyry deposit (41°8'45.42"N 22°57'57.6"E) located in the Kilkis ore District of the Serbo-Macedonian metallogenic province in northern Greece (Figure 3). The main host rock is a trachydacite porphyry, while the ore and the



Figure 1. General map of the Balkan Peninsula showing the location of visited localities.

hydrothermal alteration is attributed to the intrusion of a subvolcanic quartz-monzonite stock (Figure 4). The emplacement of the magmatic rocks is structurally controlled by E-W, NW-SE and NE-SW trending groups of faults as a result of the Tertiary evolution of the Serbo-Macedonian massif. We had the opportunity to become familiar with hydrothermal alteration mineral assemblages in this area, mainly potassic and propylitic, extensively overprinted by sericitic alteration. One of the highlights was a characteristic phreatomagmatic breccia outcrop, consisting of angular fragments of the trachydacite porphyry and of the basement metamorphic rocks cemented by clays, white mica and quartz (Figure 5). Hematite, limonite and malachite can be spotted in these rocks and are a result of the intense supergene oxidation. Furthermore, the group had the chance to examine stockworks, sheeted, and D-type veins visible in the outcrops. The Vathi porphyry-style mineralization is exceptionally enriched in U and REEs and overall exhibits an unusual geochemical character.

Next, we visited one of the most important areas of Sb mineralization in Gree-



Figure 2. Ruby crystal from the Prilep mine, 2 cm in size. Photo by M. Sęk.



Figure 3. Some of the participants from SGA Baltic Student Chapter and AUTH SEG Student Chapter in Vathi. Photo by K. Foltyn.

ce - the shear zone-hosted Rizana deposit (41°03'06.7"N 23°13'48.8"E), which also is situated in the Kilkis ore district. This ore mineralization, exploited in the years 1931 – 1938, is composed mainly of massive stibnite with minor pyrite and arsenopyrite and is hosted by quartz veins crosscutting Paleozoic gneiss and amphibolite of the Vertiskos unit (Melfos and Voudouris 2012). Vaggelis Skoupras, a master student who is studying the Rizana mineralization, explained the history and geology of the site and then guided the group to outcrops and old excavations located on a slope of the Strymon valley in the Vertiskos mountains. He also explained, how this mineralization is related to the broader Neogene-Quaternary brittle geotectonic evolution of the Vertiskos unit. Different textures (massive, brecciated, disseminated) of stibnite ore of the Rizana deposit were observed during the visit (Figure 6).

During the second day in the field, under the supervision of Christos Stergiou, the group headed to the Maronia Cu-Mo-Re-Au porphyry mineralization (40°51'55.2"N 25°34'47.9"E) and skarn aureole of the Maronia pluton. This place is located on the coastal area of Thrace, in the eastern part of Northern Greece. Copper-Mo-Re-Au mineralization is hosted by microgranite porphyry. The porphyry system which exhibits a typical alteration and metal zonation (Melfos et al. 2002), outcrops in a spectacular manner at the seashore (Figure 7). The group saw the sodic-potassic and propylitic alteration with associated A- and B-type quartz stockworks and the sericitic and argillic hydrothermal alteration zones related to D-type veins. One of the most interesting features of porphyry occurrences in northeastern Greece (including Maronia) is the presence of molybdenite with the highest Re contents yet reported from a porphyry-type deposit (up to 4.7 wt % Re) (Voudouris *et al.* 2013). On the hills near to the ruins of the ancient city of Ismara, the group saw a skarn, which is formed along the contact between the Maronia pluton and the surrounding marbles (40°52'15.4"N 25°32'04.6"E). The skarn has a thickness varying from a few meters, where the intrusive body is dipping steeply, to more than 100 m. Students had a chance to collect nice specimens of grossular and vesuvianite (Figure 8). In addition, the group visited the major supra-detachment fault of Marmaritsa, which shapes the shoreline at an E-W trending direction (40°52'07.1"N 25°31'39.3"E).

Our last destination in Greece was the Perama Hill, epithermal Au-Ag-Te-



Figure 4. Explaining the features observed in the field in the context of geological map of the Vathi area. Photo by K. Foltyn.

Se deposit, located 5 km north of the North Aegean Sea coast (40°54'20.8"N 25°38'07.4"E), on the eastern margin of the Petrota graben. The high-sulfidation Au-Ag-Te-Se epithermal system, controlled by a N-NE trending graben fault, is hosted in silicic and argillic altered andesitic rocks and overlying sandstones. Within the Perama Hill deposit occurs a broad variety of sulfide-, sulfosalt- and telluride-bearing quartz-barite veins and stockworks. The proven and probable reserves include 9.697 Mt of ore at 3.13 g/t Au and 3.4 g/t of Ag and with a total of 0.975 Moz Au and 1.151 Moz Ag (Melfos & Voudouris 2017). Participants of the trip have an opportunity to observe the silicic alteration of the Perama sandstones at the Perama Hill with gold-bearing goethite, barite veins and breccias



Figure 6. An example of breccia stibnite ore from the shear zone hosted Rizana deposit. Photo by K. Foltyn.



Figure 7. Outcrop of the Maronia porphyry at the seashore with visible zones of alteration. Photo by M. Ožóg.



Figure 5. An example of phreatomagmatic breccia outcrop consisting of angular fragments of the trachydacite porphyry with malachite covering the surface. Photo by K. Foltyn.

(a high sulfidation-type enargite-bearing ore assemblage) (Figure 9).

On the way back to Poland, the group also stopped in two additional localities. First was a mine dump near Krushev Dol Mine near Madan (Bulgaria). This ore district is one of the best manifestations of vein type Pb-Zn mineralization in the world, famous for excellent specimens of galena and sphalerite. Second stop was in Brad town (Romania) to explore gold museum (Muzeul Aurului Brad), unique in Europe and containing a truly remarkable collection of native gold specimens.

### Acknowledgments

This trip wouldn't be possible without the help of Prof. Vasilios Melfos and the AUTH SEG Student Chapter and we are es-



Figure 8. Samples found in the Maronia skarn: white/pale green are vesuvianites, dark green are grossular garnets and the brown one are grossular-andradite garnets. Photo by K. Foltyn.



Figure 9. Quartz-barite veins and breccias at the base of silicified Perama sandstone, Perama Hill. Photo by K. Foltyn.

pecially grateful to Eftychia Petika (AUTH SEG SC President), Christos Stergiou and Vaggelis Skoupras for their invaluable help and guidance. We all would like to gratefully acknowledge the financial support from the SGA which helped us organize this excursion.

### References:

Melfos, V., Vavelidis, M., Christofides, G., Seidel, E. (2002) Origin and evolution of the Tertiary Maronia porphyry copper-molybdenum deposit, Thrace, Greece. *Miner Deposita* 37(6-7): 648-668

Melfos V., Voudouris P. Ch. (2012) Ge-

ological, mineralogical and geochemical aspects for critical and rare metals in Greece. *Minerals* 2(4):300-317

Melfos V., Voudouris P. (2017) Cenozoic metallogeny of Greece and potential for precious, critical and rare metals exploration. *Ore Geology Reviews* 89, 1030-1057

Stergiou C., Melfos V., Voudouris, P., Michailidis K., & Spry P. (2016) Mineralogical, geochemical and structural constraints of the Vathi porphyry Cu-Au±U±Mo mineralization, N. Greece. SEG 2016 Tethyan Tectonics and Metallogeny Conference September 25-28, 2016 Çeşme, Turkey

Voudouris, P., Melfos, V., Spry, P.G., Moritz, R., Papavasiliou, C., Falalakis, G. (2011) Mineralogy and geochemical environment of formation of the Perama Hill high-sulfidation epithermal Au-Ag-Te-Se deposit, Petrota graben, NE Greece, *Mineral Petrol* 103:79-100

Voudouris, P., Melfos, V., Spry, P.G., Bindi, L., Moritz, R., Ortelli, M., & Kartal, T. (2013) Extremely Re-rich molybdenite from porphyry Cu-Mo-Au prospects in northeastern Greece: Mode of occurrence, causes of enrichment, and implications for gold exploration. *Minerals*, 3(2), 165-191

# Graduate Short Course on Exploration Geology in Freiburg

Malte Junge & Katerina Schlöglová<sup>1</sup>

<sup>1</sup> Black Forest-Alpine SGA Student Chapter, Albertstr. 23B, 79104 Freiburg, Germany, malte.junge@minpet.uni-freiburg.de, katerina.schloeglova@minpet.uni-freiburg.de

The new SGA student chapter Black Forest-Alpine and the University of Freiburg organised and hosted a graduate short course, "Exploration Geology" on 19-22 March 2018, with 27 students and 1 industry participant (Figure 1) arriving from 18 institutes and six countries (Belgium, Finland, Germany, Sweden, Switzerland and UK). The short course offered theoretical background and practical training in exploration geology, with emphasis on litho-geochemistry, data processing and visualization and ore microscopy (Figure 2). The lectures on analytical methods, whole-rock and alteration geochemistry and statistical treatment of the data were given by Professor David Dolejs (Freiburg). Practical training included processing of geochemical data using data visualisation and modelling software packages GCDkit and ioGAS (Dr. Katerina Schlöglová, Freiburg) and an ore microscopy and interpretation session with Dr. Malte Junge (Freiburg). Case studies from exploration projects in Scandinavia and Greenland by Dr. Denis Schlatter (Helvetica Exploration Services GmbH, Switzerland) gave an impression on application of geological and geochemical tools and showed the participants an exploration geology as a profession. In addition to the course, a plenary lecture by Professor Hartwig Frimmel (University of Würzburg) entitled "How

Gold Became Concentrated to Ore Grade in the Earth's Crust" was sponsored by the SGA (Society for Geology Applied to Mineral Deposits) and supported the newly founded SGA student chapter "Black Forest-Alpine". The short course hosted a poster session, which gave the opportunity to participants to present and discuss their own projects. The program was concluded by a field trip to mine sites in the Schwarzwald (Teufelsgrund Pb-Ag-sulfide-fluorite-barite mine) and Kaiserstuhl (Fohberg phonolite with zeolite mineralization in the Hauri quarry and Orberg carbonatite with Nb mineralization). Due to large interest from students from many European countries in this course, the organizers are considering to run this course as a periodic event.



Fig. 1: Participants of the Exploration Geology short course (Photo: K. Schlöglová).

The next short course „Exploration Geology“ takes place on 18-21 March 2019 in Freiburg.



Fig. 2: Graduate short course Exploration Geology: (i) course introduction by Professor David Dolejs; (ii) plenary lecture by Professor Hartwig Frimmel; (iii) discussions during poster session; (iv) visit to the Hauri zeolite quarry, Bötzingen; (v) ore microscopy session; (vi) Teufelsgrund mine, Münsertal (Photos: K. Schlöglová).

# Mineral deposits of the Harz Mountains – Field trip report from the Black Forest – Alpine SGA Student Chapter

Lars Wihanto<sup>1</sup>, Thomas Belgrano<sup>2</sup>, Lisa Richter<sup>2</sup>

<sup>1</sup> Black Forest-Alpine SGA Student Chapter, University of Freiburg, Albertstr. 23B, 79104 Freiburg, Germany, larswiha@hotmail.de

<sup>2</sup> Institute of Geological Sciences, University of Bern, Baltzerstrasse 3, 3012 Bern, Switzerland, tombelgrano@gmail.com; lisa.richter@geo.unibe.ch

Late last year students from Freiburg, Karlsruhe and Bern came together to found the Black Forest – Alpine SGA Student Chapter. Although Germany is not the first place that comes to mind when students think of ore deposits, the chapter's first field trip was this May to the Harz Mountains in northern Germany. The Harz Mountains actually host one of the world's largest Pb-Zn deposits (Rammelsberg) and saw the first extraction from the Kupferschiefer, one of Europe's largest Cu deposits. The four-day field trip aimed to introduce the 17 students and staff participants from the Chapter (Figure 1) to the various types of ore deposits and the geological background of this historic mining district.

The first destination of this expedition was the famous type locality of the Kellwasser mass extinction event. Though not directly related to economic geology, this proved to be an interesting outcrop, composed of Devonian limestone sequences with two prominent dark bituminous bands, which can be found worldwide, marking the extinction event. A general introduction to the geology of the Harz was given here, though as it started to rain, we escaped back to the vans before we experienced a mass extinction of our own!

On the second day, all woke fresh from the previous evening's sport (schnitzel and beer challenge) for an underground mine tour through the Röhrigschacht (shaft) into the Kupferschiefer (Figure 2). This sediment-hosted Cu mineralisation has been extracted in the Mansfelder mining district of the lower Harz since 1200 A.D. Mineralisation is mainly hosted within an organic-rich shale that is situated at the contact between uppermost Lower Permian sediments and overlying Upper Permian transgressive sediments. The organic carbon-rich Kupferschiefer shale is interpreted to have driven precipitation of sulphide ores from metal-rich, oxidised brine. Over 60 Mt of copper ore was mined from the Kupferschiefer, which makes it one of the largest sediment-hosted

accumulations of copper ore worldwide. This district was continuously exploited for over 800 years and the Röhrigschacht mine shaft is one of the oldest in Europe, dating back to 1888.

Later that day we continued to another famous type locality of the Harz Mountains – that of harzburgite. This locality is part of a differentiated mafic intrusive complex that was emplaced during post-Variscan magmatism. Interestingly, this harzburgite formed as cumulates by settling of mafic phases to lower levels of the intrusive complex. This contrasts with harzburgite formation as residues from partial melting in peridotites.

On the third day, we visited the historic Samson mine, which is part of the St. Andreasberg silver-ore district and type locality of many peculiar minerals, including Samsonite ( $\text{Ag}_4\text{MnSb}_2\text{S}_6$ ). With a mineralisation age of 120 Ma, these deposits are the youngsters of the Harz Mountains. The mineralising fluids are interpreted to have been channelled along a corridor of faults related to the emplacement of the underlying Permian Brocken granite. Among the ore mineralisation is galena, sphalerite, chalcopyrite and tetrahedrite as microscopic inclusions in galena. These inclusions can host up to 20 wt.% Ag.

Our next destination was an outcrop of pillow lava that was extruded into the Rheno-Hercynian ocean during Devonian extension. The basaltic pillow lavas were hydrothermally altered to greenstones, otherwise known as spilites, rich in chlorite, due to interaction with seawater.

On the final day we enjoyed a guided tour through the largest mine in the Harz – the Rammelsberg deposit, situated in the northern Harz. Rammelsberg is a SEDEX-type deposit formed during deposition of mid-Devonian sediments. The mine produced more than 27 Mt of Pb-Zn-Cu ore until reserves were exhausted in 1988. Luckily for the miners, the main ore body was folded into steeply dipping syncline, resulting in a doubling of the ore horizon – 'zwei zum Preis von einem'! Apart from

the geology, the monstrous underground water wheels used to pump water around in the mine were testament to the ingenuity and long history of miners at Rammelsberg. In fact, it was the longest continuously extracted deposit on Earth.

The field trip was organized by Malte Junge, Lennart Fischer, Thomas Belgrano and Lisa Richter with the help of MSc students from the University Freiburg and financial support by the SGA. We would like to thank all the contributors and participants and especially SGA for making this field trip possible.



Fig. 1: Black Forest – Alpine SGA Student Chapter in front of the Röhrigschacht mine shaft (Mansfelder mining district). Back row from left: Wolfgang Zucha, Simon Reichenwallner, Tom Belgrano, Lennart Fischer, Tabea Schulze, Ludwik Zielinski, Lea Schwahn, Maximilian Oezkent, Jonas Kämpf, Karl-Heinz Hoffmann, Lars Wihanto, Niels Gies, Larynn Diamond. Front row from left: Malte Junge, Lisa Richter, Alannah Brett. Photographer: Katerina Schläglova.



Fig. 2: Kupferschiefer: Stratabound copper sulphide ore in organic-rich shale at the Röhrigschacht mine, Wettelrode. (Photo: Thomas Belgrano).

# Columbian SGA student chapter visiting Black Forest – Alpine SGA student chapter in Freiburg, Germany

Malte Junge<sup>1</sup>, Ivan Mateo Espinel Pachón<sup>2</sup>

<sup>1</sup> Black Forest-Alpine SGA Student Chapter, Albertstr. 23B, 79104 Freiburg, Germany, malte.junge@minpet.uni-freiburg.de, katerina.schloeglova@minpet.uni-freiburg.de

<sup>2</sup> SGA Student Chapter UNAL-Bogotá, Universidad Nacional de Colombia, Ciudad Universitaria. AA 14490. Av. Cra. 30, No. 45–03, Edificio 224-Laboratorio 245. Bogota D.C., Colombia, imespinelp@unal.edu.co



Fig. 1: Participants of SGA student chapter exchange meeting at the field trip in the Kaiserstuhl (Photo: Ivan Mateo Espinel Pachón).



Fig. 2: Participants of SGA student chapter exchange meeting at the field trip in front of the entrance to the Suggental mine (Photo: Ivan Mateo Espinel Pachón).

From 11 to 12 September 2018, members of the SGA student chapter from Bogotá, Colombia visited the Black Forest - Alpine student chapter in Freiburg, Germany. During this two-day exchange meeting, a seminar was organized with talks from members of both SGA student chapters about their current research projects. The seminar also included various talks about the geology and mining districts of Colombia and the presentations of the geoscience departments from both universities in Bogotá and Freiburg. On the second day, a field trip showing the regional geology and mine sites in the Schwarzwald and Kaiserstuhl was organized. During this field trip, the Orberg carbonatite with Nb-mineralization at the Kaiserstuhl was visited (Figure 1). The field trip was completed with an underground tour at Suggental in the Schwarzwald showing the medieval mining operations of the Ag- and barite-mineralisation (Figure 2). There was much discussion during these two days among the students of both chapters. Finally, both chapters exchanged samples in order to share a small piece of the geology of each country.

This meeting in Freiburg successfully created a new connection between these two SGA student chapters, offering the opportunity for future activities and further exchange between the Black Forest-Alpine and the SGA student chapter from Colombia.

# PACRIM 2019

AUCKLAND  
3-5 APRIL 2019

#pacrim2019

MINERAL SYSTEMS  
OF THE PACIFIC RIM

AusIMM  
CONFERENCE



This call for abstracts seeks the submission of practical and applied case studies for presentation at the Congress.

The organising committee encourages collaborative works and urges young professionals and students to make submissions and participate in the extensive and technical networking opportunities this Congress will offer.

The Congress will also offer a series of workshops and field trips in New Zealand and the western Pacific for professional development, and a full social program for additional networking opportunities.

We welcome abstracts with a geophysics and multidisciplinary focus that fall under any of the Congress themes.

#### CO SUPPORTERS



#### CONGRESS THEMES

- 1. Mineral System Understanding**  
Mineral system and exploration targeting; mineralisation processes; multi-scale characterisation: atoms to cratons; geometalurgy of PACRIM deposits; and data in geoscience.
- 2. Exploration, Mining Investment and New Project Developments**  
Advances in exploration techniques; and mining investment issues and examples and new project developments including technical and broader community interaction and social performance aspects.
- 3. Mineralisation Styles**  
Epithermal systems; IOCG and related deposits; magmatic Fe-Ti-Cr oxide and Ni-Cu-PGE sulphide deposits; orogenic Au; intrusion-related Au; porphyry deposits; skarn and replacement deposits; VMS/SEDEX and modern ocean floor systems; and sediment hosted/carlina style deposits.
- 4. Provinces and Case Studies**  
China, Malaysia, Vietnam and Laos; New Zealand, Western Pacific and eastern Australia; PNG, Indonesia, Philippines; Chile and South America; and Northern Pacific Rim (North America and Russia).

visit [pacrim.ausimm.com](http://pacrim.ausimm.com)

## Call for abstracts open

Abstract submissions for PACRIM 2019 are now open. Please submit your abstract not exceeding 300 words via the speakers portal on the conference website, [pacrim.ausimm.com](http://pacrim.ausimm.com)

 **DUE**  
**28** AUG  
2018

# SGA Colombia – Bogotá: Reconnaissance of the old and new open doors for mineral exploration

Pablo E. Porras, Milton A. Santos, Valentina Bocanegra and Daniel F. Solano<sup>1</sup>

<sup>1</sup> Department of Geosciences, Universidad Nacional de Colombia (UNAL) Ciudad Universitaria, AA 14490. Av. Cra. 30, No. 45-03, Edificio 224-Laboratorio 245. Bogota D.C. – Colombia. sga\_fcbog@unal.edu.co; peporrash@unal.edu.co; masantoss@unal.edu.co; vboanegrao@unal.edu.co

The SGA Student Chapter Colombia-Bogotá has had a full year of activities. Those activities involved the continuation of our Young Learners in Ore Deposits program, conferences with local and foreign lecturers, participation on national geoscience meetings, courses and fieldtrips - which have helped us to improve our mineral deposits and economic geology skills and knowledge.

This year the Young Learners in Ore Deposits program had a principal axis based on the understanding of supergene enrichment and sedimentary deposits, in which senior geology students participate actively. Also, the program has invited students of first and second years to participate in our activities giving them an introduction to general geology, ore deposits and economic geology (Figure 1).

On the other hand, we are fortunate to have the presence of renowned foreign lecturers in ore deposits, petrology and

geochemistry. They gave us a couple of lectures about pegmatite-related emerald and tourmaline deposits and new techniques of low U-Pb mineral phases dating (Figure 2). Additionally, six of our members represented us in the “XIII Semana técnica de la geología, ingeniería geológica y geociencias” organized by the Colombian Geological Society, they showed their research projects in ore deposits and petrological sciences, works such as “Petrological and geochemical comparison between Segovias’s Batholith and La Malena volcanic set, west of Puerto Berrio, Antioquia” and “Petrographic, mineralogical and physicochemical characterization of tailings of magnesite extraction and rock samples of Bolivar Ultramafic Complex, Valle del Cauca, Colombia” were presented to the geological community (Figure 3).

Two short courses for GIS novices were held in the months of March and August, where students from first year share space



Fig. 3: Our chapter members representing SGA in Colombian Geological Society meetings.

with senior geologists and develop skills in the application of GIS systems for exploration and geological mapping for ore deposits. Finally, some deposits and geological locales of interest were visited, among them Muzo and Chivor’s emerald deposits, Cauca’s archaeological park Tierradentro and our new exploration learning target: Colombia’s eastern region.

The localities of Muzo and Chivor are the two best examples to appreciate the difference between the western and eastern emerald belts of our country. Located in Boyaca’s Department, those fieldtrips took place in August and September, where we visited among others, the Cerro Coscuez and La Marina mines, emblematic for those kinds of emerald sedimentary-hosted mineralization. Furthermore, we visited the archaeological park Tierradentro, located on the Inzá village, Cauca’s Department; the purpose of this visit was creating a better understanding of the applied mineralogy to solve problems referred to the conservation of Pre Hispanic made structures such as the mineralogical alteration and structural debilitation, this fieldtrip was done in Sep-



Fig. 1: Young Learners in Ore Deposits program, sharing knowledge even outdoors.



Fig. 2: Conference of Professor Axel Gerdes, Low U-Pb mineral phases dating.



Fig. 4: Evaluating the volcano-sedimentary sequence in which Pre Hispanic figures were made.



Fig. 5: Our visiting Professor Heinrich

tember and involved eight of our current members (Figure 4).

Horn with our Professor Thomas Cramer and our crew. Pegmatitic dikes of nepheline syenite in San José del Guaviare.

To study our new exploration learning target, Colombia's eastern region, we made two fieldtrips, the first one was to San José del Guaviare City, located on Guaviare's Department. In these fieldtrips we identified the Sienita Nefelínica (Nepheline Syenite) of San José del Guaviare, migmatites from the Migmatitic Mitú Complex, be-

longing to our oldest known rocks (ca. 1.8 Ga) and some pegmatite bodies associated to the mentioned units. As a result of these fieldtrips, we consider the possible presence of Nb-Ta mineralization informally known as Coltán (COLumbite and TANtalite series) and REE associated to pegmatite and carbonatite bodies. This fieldtrip took place in March and was accompanied with our international partner Professor Heinrich Horn from Federal Minas Gerais University and five participants (Figure 5).

The second fieldtrip to this zone was held between more than 200 km on the riversides of the Orinoco River, where we recognized Parguaza's Granite (very extensive in this region) and some of its pegmatite bodies, the principal target in this case was looking for tin mineralization in placer and pegmatite deposits of cassiterite. We spoke with the aboriginal communities of the region in order to identify prospective zones. This fieldtrip was made with six members of the student chapter from 3rd year to Ph.D. students in July (Figure 6).

We, the Colombia-Bogotá SGA chapter are glad to share our experiences with you and are eager to return to these geological locations with more junior students from our chapter and, if it is possible, with more of our colleagues from the SGA organization. This could be the next step for further research in our country's remote regions, given that these areas are nowadays being explored again as a result of our peace efforts.



Fig. 6: Sharing and learning with people from Vichada in our trip across the Orinoco River.

## Activities of the SGA Siberian Chapter in 2018: Field trip to the Sludyanka deposit, Baikal Lake

Polina Bondarenko and Anna Devyatiyarova<sup>1</sup>

<sup>1</sup> Novosibirsk State University, Novosibirsk, Russia, V.S. Sobolev's Institute of Geology and Mineralogy, SB RAS, Novosibirsk, Russia

In June 2018 (18.06–22.06), six students of the Siberian Student Chapter visited the Sludyanka deposit, which is located near the North-West coast of Lake Baikal in the Irkutsk region, Russia. The deposit is situated 1,800 km from our native city of Novosibirsk.

The Slyudyanka deposit is a typical Mg skarn, REE hosted in granites and pegmatites, which has been exploited via open pit mining. A small open-pit mine located 500

m from the bank of the Slyudyanka River has exposed dolomite marble composed of a 50 m thick stratum with calcite marble in the bottom and biotite garnet and sillimanite gneiss in the roof. In the dolomite marble concordant pegmatite and granite bodies occur.

Fig. 1: A group picture of SGA students in a small town of Slyudyanka, Irkutsk region, Russia.



Moreover, rare relatively large pegmatite less often granite boudin with lazurite can be found mainly in the central part of the dolomite marble. Many of them are crossed by substitution zones, which develop mainly in the contact zone of pegmatite with dolomite marble and along cracks in pegmatite (granite). Such lazurite zones have a zonal structure: 1) pegmatite (core), 2) desilicified pegmatite, 3) diopside-lazurite zone, 4) phlogopite zone with grains of colourless hauyne and diopside.

Our field trip started in a small town called Slyudyanka that is located on the western shore of Lake Baikal. This place got its name from the deposit of mica (In Russian "slyuda" means mica). We visited three different old quarries of Mg-skarns at a distance of 5-10 km from each other. For three days, we walked the hiking trails and as a result found interesting mineralogical samples of most common minerals of the Slyudyanka deposit, such as mica (phlogopite), blue apatite and green diopside in calcite. This area was our main geological object to visit.

Further, we visited a place called in Russian Belaya Vyemka (White Extraction). This outcrop occurs on the shore of Baikal Lake caused by the construction of the Circum-Baikal Railway. This is one of the most prominent carbonate beds of the Sharyzhalgai series on the shores of the Baikal Lake. The most ancient rocks of the South-Western Baikal region are combined in this rock sequence. They form the Sharyzhalgai ledge, which is part of the Archean basement of the Siberian platform. Here, between stops of 107 and 102 km of the Circum-Baikal Railway, are the outcrops of the Sharalgai series of 1.5 km in length, which is very conspicuous by

its white color of the dolomite limestone.

For many years, this place has been attracting geologists with its mineral diversity. The collector can find excellent samples of a number of minerals in this area: spinel, apatite, lazurite, forsterite, phlogopite, diopside, scapolite, zircon etc. We spent all day exploring outcrops and taking samples. Here, students of the Siberian Student Chapter found specimens with blue and blood red spinel, forsterite, phlogopite and zircon.

In the very end of the field trip, we visited the museum of local lore. The

main hall is dedicated to the history of the Slyudyanka deposit. We were told in detail how the history of the discovery of the deposit began and about the famous geologists who worked in the field.

In general, the trip gave new practical and theoretical knowledge. Moreover, everyone was able to replenish their collection with valuable specimens, some of which may take their place in the geological museum of Novosibirsk State University.



Fig. 2: The sample of Mg-skarn with phlogopite (dark linen crystal), blue apatite and green diopside in calcite.



Fig. 3: A small euhedral crystal of greenish-blue apatite in calcite.



Fig. 4: Huge crystals of dark-green phlogopite from granite pegmatite.



Fig. 6: A specimen of typical Mg-skarn from Slyudyanka with blue spinel, pseudohexagonal, orange phlogopite and light-yellow forsterite in calcite.



Fig. 5: The panorama picture of the Belaya Vyemka (White Extraction) made of white marble, located on the shore of Baikal Lake. The outcrop has been opened by construction of the Circum-Baikal Railway.

# The Russian and Baltic SGA Chapters collaborative field trip to Kola Region

Maria Cherdantseva and Maria Shapovalova<sup>1</sup>

<sup>1</sup> Novosibirsk State University, Novosibirsk, Russia, V.S. Sobolev's Institute of Geology and Mineralogy, SB RAS, Novosibirsk, Russia



Fig. 1: A group picture of SGA students against a background of Khibiny Mountains.

The 5-day field trip to the Kola Peninsula took place from September 14 to 20. The field trip was organized by North-West Russia Chapter and in total 21 students from the Siberian and Baltic chapters participated. It is well known that the Kola region has a long geological history, which comes out in complex geological settings. As a result, the Kola region attracts many geologists of

broad interests because it has great resource potential, which has not been fully studied yet. During the field trip, we tried to observe different examples of mineralization occurring in the region. Alkaline intrusions with rare-earth mineralization, carbonatites and mafic-ultramafic intrusions with sulfide mineralization were visited. Furthermore, we had one-day excursion in two geological

museums located in the Kola Science Centre of the Russian Academy of Sciences, where we were able to observe a numerous variety of magnificent specimens of the mineralogical and the petrological collection.

All the geological sites visited are in the vicinity of Apatity. Therefore, it was the starting point of our trip. The first day of excursion, we visited the Khibiny Mountains,



Fig. 2: An old tunnel used for mining of apatite ores.



Fig. 3: Eudialyte crystals.



Fig. 4: Aegirine "bomb".

which are located in the central part of the Kola Peninsula. The Khibinky massif is a unique magmatic complex, which is famous by its rare types of rocks and minerals. The age according to He-Pb dating is defined as  $290 \pm 10$  million years. A characteristic feature of the Khibiny massif is a lopolith structure, which includes a complex of alkaline rocks such as khibinite, foyaite, iolite, urtite and many others. Generally, this massif was used for mining apatite ores. However, in these host rocks more than 100 minerals were first discovered. We visited one of the old mines, which hosts a pegmatite vein with huge nepheline and aegirine grains associated with rare lamprophyllite and eudialyte. Students were able to collect stunning samples of green aegirine embedded in a conic fan-like spray in alkaline matrix with pink eudialyte. Moreover, we climbed up to examine the outcrop of the dyke, made up of a rare rock type, named tinguaitite, which is the chemical analogue of iolite, but has an interesting structure, called "turtle structure" because it looks like a tortoise shell.

The second day, we visited an old mine of pyrrhotite ores. The ores were prepared for transportation to the factory, but suddenly the operation had been frozen due to financial problems and a huge amount of ore still lays on the slope. After collecting several samples of pyrrhotite ore, we went down to the valley, where nice samples of aegirine spherulites could be found in pebbles. Those aegirine spherulites, named "aegirine bombs", can contain analcime or katapleite in the core.

The third day was devoted to visiting of the Kovdor mine. First, we visited an office of the EuroChem Mining Company, which exploits this deposit and then a Chief Geologist made a short excursion for our group. We visited a quarry, where we were able to observe many structural features. We were told about the geological setting of this deposit and about the mining process. The Kovdor massif is a central-type oval caldera-like depression made up of multiphase igneous intrusions, which consist of ultrabasic alkaline rocks and carbonatites. It is one of the most interesting deposits not only in the Kola Peninsula, but in the world. More than 180 mineral species have been found within the Kovdor massif, 13 of them first time discovered there and 9 of them are endemic minerals. Unfortunately, we did not have a lot of time to visit the entire part of the open pit, but we had a chance to find nice samples of octahedral crystals of magnetite in carbonate matrix,



Fig. 5: Giant diopside crystals with aegirine rims.

which are typical samples of Kovdor carbonatites. In addition, we visited waste dumps of the deposit and collected samples of apatite ore, zoned phlogopite and giant crystals of green diopside.

The fourth deposit we visited is the famous Monchegorsk intrusion. The Monchegorsk pluton is a typical representative of the Paleoproterozoic ore-bearing layered intrusions on the Fennoscandian Shield. The excursion route consisted of four outcrops of different rock varieties of this deposit and was led by a geologist from the Kola Science Centre of the Russian Academy of Sciences. We were told about the genesis of Cu-Ni, Cr and PGE ore related to the layered mafic-ultramafic massifs. These have intruded into the supracrustal Archean complexes at the 2,500-2,400 Ma boundary and marked the productive phase of mantle plume activity at the Archean-Proterozoic boundary. The sulfide Cu-Ni mineralization makes up "hanging" bodies of disseminated ore in the layers of olivine-bearing rocks within the orthopyroxenites. Students were lucky to visit the productive "Horizon 330", which is located in the upper part of the Monchepluton section. It consists of olivine pyroxenite and monomineralic pyroxenite with disseminated sulfide ore and characterized by the highest PGE content. Furthermore, we visited the outcrop of ore veins of the main ore field NKT in the northern part of Mt. Nittis. We were able to observe the outcrops of tectonic zones in pyroxenite, where oxidized sulfide veins occur. It was also possible to observe in detail the structure of the dislocations, cutting the ultramafic rocks and sample oxidized pentlandite-pyrrhotite ore. Moreover, participants were glad to visit a dump of layered dunite rocks and examine the nice



Fig. 6: Students examine the "Horizon 330".



Fig. 7: Layered chromite ore.

banded texture of the Sopchezero deposit chromite ores. The last point we visited was the outcrop with massive sulfides, which is confined to the norite and olivine norite complex.

The members of Siberian Student Chapter are grateful to SGA for providing such opportunities to visit famous and interesting geological locales. We are also thankful to geologists of the Kola Science Centre of the Russian Academy of Sciences and the "EuroChem Mining Company", who led us on very informative excursions.

# Report from the Gold Short Course 2018 (led by Prof. David I. Groves) and of the post-course field trip in Bohemian Massif

Jan Kulhánek, Marek Tuhý, Dominik Brém, Rafael Baieta<sup>1</sup>

<sup>1</sup> SGA Student Chapter Prague, Faculty of Science, Charles University, Albertov 6, 128 43 Prague 2, Czech Republic; jan.kulhanek@natur.cuni.cz

## Short Course

During the 19–20<sup>th</sup> of May 2018, the SGA Student Chapter Prague organized the Gold Short Course led by Prof. David I. Groves from the Centre for Exploration Targeting, University of Western Australia (UWA). There was an icebreaker party organised in the Chlupáč's Museum of Earth History in the Faculty of Science, which was a great opportunity to experience its newly established exposition with a glass of wine (Fig. 1). This short course took place in the Faculty of Science, Charles University, Prague, Czech Republic, where 77 participants from 13 countries and 6 SGA Student Chapters came to attend lectures by Prof. Groves (Fig. 2, 3).

David I. Groves is an Emeritus Professor at UWA. He is considered a world leader in the research of ore deposits, particularly orogenic gold and IOCG deposits, and global metallogeny. At UWA, he helped to establish the Centre for Exploration Targeting. He has authored or co-authored more than 500 publications, mainly in the fields of Archean geology, komatiite-associated Ni-Cu deposits, orogenic gold deposits, the role of lithosphere in global metallogeny and prospection mapping. He was elected President of the SGA, SEG and the Geological Society of Australia and for his outstanding achievements during his career, he received both the SGA Newmont Gold Medal and the SEG Penrose Gold Medal.

Each day of the short course was focused on different topics in 4 lectures:

### 1<sup>st</sup> day – Orogenic gold deposits:

1<sup>st</sup> lecture: Introduction to orogenic gold deposits

2<sup>nd</sup> lecture: The crustal continuum and genetic models for orogenic gold deposits

3<sup>rd</sup> lecture: Critical factors controlling the formation of orogenic gold deposits

4<sup>th</sup> lecture: Exploration targeting for orogenic gold deposits



Fig. 1: Icebreaker party in the Chlupáč's Museum of Earth History. Photo by V. Santolík.

### 2<sup>nd</sup> day – Gold deposits on craton margins:

5<sup>th</sup> lecture: Introduction to intrusion-related gold deposits (IRGDs)

6<sup>th</sup> lecture: Nature of hybrid magmas and genesis of IRGDs

7<sup>th</sup> lecture: Carlin-type gold deposits of Nevada and China

8<sup>th</sup> lecture: Iron-oxide copper-gold deposits: nature and genesis

The SGA Student Chapter Prague is grateful and would like to thank Prof. Groves for leading this short course and we would also like to thank all our sponsors, who supported us during the organization of this event; especially the SGA Educational Fund for the financial support and the bakery Kabát, butchery Göer-gl, company Vitana and brewery Staropramen for their excellent catering (Fig. 4).

### Field trip

The post-course field trip took place during the 21<sup>st</sup>–23<sup>rd</sup> of May 2018 to various mineral deposits in the Bohemian Massif. On this trip participated 14 SGA members, besides the Prague Chapter's members also members of the Baltic, Black Forest and Moroccan chapters, and SGA members that don't belong to a student chapter.

### 1<sup>st</sup> day:

We visited the Jílové gold district, which is characterized by three main types of gold-bearing ore bodies differing in morphology: (1) veins representing the main type of mineralization mined in the past; (2) gold-bearing stockwork representing the type of mineralization of greatest economic importance; and (3) stockwork of irregular shape passing into impregnation zones, which are developed at the eastern margin of an albite granite body between the Šlojíř and Kocoury vein zones, forming the Klobásky ore zone in the southern part of the Jílové district (Pepř mine). Firstly, we visited two historical galleries, St. A. Paduán (Fig. 5) and St. Josef gallery, where it was possible to see historical styles of mining. Afterwards, we moved to the more recent Pepř mine with Václav gallery, which was finished during the second half of the 19<sup>th</sup> century, when underground exploration of the southern part of the Jílové district started. Since 2012, this mine is under control of the Montanika society, who is removing the obstacles and taking care of the mine and to whom we would like to thank for an excellent visit, especially to the leader of this mine tour Dr. Pavel Škácha (Fig. 6).



Fig. 2: Lecture by Prof. Groves. Photo by V. Santolík.

## 2<sup>nd</sup> day:

We moved to the Krušné hory Mts. (Erzgebirge) in the NW part of the Czech Republic and, in the morning, we visited the historical town Jáchymov, which is situated in an old, well-known mining district that has been operating since 1511. In the beginning, silver was mined in secondary cementation zones and in 1519, the first Šlik's Thaler was minted. This name was then transformed into the currency dollar. During the 16<sup>th</sup> century, 350 tons of silver were produced. In the 19<sup>th</sup> century, this was the deepest mine in the

world (665 m). After the discovery of uranium, local mines produced high quantities of this element and it was used mainly for glass and ceramics colouring. After the discovery of radium and the upcoming radium rush, the first radium spa was established (1906), which is still in operation. Because of this, Svornost mine is still operating and pumping the radioactive waters used for healing treatments (Fig. 7). The Jáchymov ore district is a typical example of the five-element vein deposits (Ag-Co-Ni-Bi-As) and U-formation formed as a medium temperature hydrother-

mal deposit in the Czech part of the Krušné hory Mts. Up to 430 minerals, both primary and supergene, have been discovered and described in Jáchymov up to now (latest figure counted by J. Plášil in February 2011). After the mine tour, we visited a local museum with a beautiful mineralogical collection from this area and with a historical collection related to the Jáchymov town.

The next stop was the historical mine Mauritius (Fig. 9) located near the town Horní Blatná, which has been an important mining centre for the past several centuries, mainly for tin and secondly for silver, iron, cobalt and manganese ores. The mine closed in 1944 and today provides well preserved historical galleries mined from the end of 16th century. The occurrences of tin ores are bound to the biotite granite of the Blatná massif that build the wider neighbourhood of the Blaten Hill. The granite is greisenized and enriched in mica, tourmaline, quartz, chlorite and especially cassiterite.

Close to the German border, we visited a skarn deposit called Zlatý Kopec, which is a lens-shaped body of diopside- and diopside-actinolite skarn in a chlorite-sericite phyllite complex. Ore minerals are cassiterite, sphalerite, chalcopyrite and magnetite, which we had the opportunity to collect on the heaps near the gallery Johannes.



Fig. 3: Group photo of all participants by V. Santolík.



Fig. 4: Food provider Michal Čurda with refreshments and sponsors logo. Photo by M. Tuhý.



Fig. 5: Historical gallery St. A. Paduán. Photo by L. Kyrč.



Fig. 6: Introduction speech by Dr. Škácha in front of Václav gallery. Photo by L. Kyrč.



Fig. 7: Taking bath in warm radioactive spring Běhounek directly in Svornost mine more than 500 m below the surface. Photo by L. Kyrč.

**3<sup>rd</sup> day:**

On the last day, we firstly visited an open-pit mine and a processing plant of gem-quality pyrope, which are famous under the name “Czech garnet”. The Czech garnet separating plant and the open-pit mine (Fig. 10), called Panské jámy, are situated close to the Podsedice village in the České Středohoří area (Central Bohemian Uplands – a neo-volcanic field in the north of Czech Republic). There are approved reserves with a garnet content of about 40 g/m<sup>3</sup>. Garnet is mined easily by excavators from alluvial sediments, but originally, garnet comes from near volcanic diatremes, whose breccia contains blocks of serpentinized peridotite rich in those garnets. After separating garnet with the proper size and quality, it is sent for cutting and subsequent use in the famous jewellery made by the company Granát Turnov.

Afterwards, we moved to the northern part of Krušné hory Mts., where we visited Krupka town surroundings in one of the youngest mining districts in this area named Knöttel (Bohosudov), situated on the east of Krupka area. The underground mining in this region started in the 18<sup>th</sup> century. The deposit formed in gneiss and was mainly exploited for tin and molybdenum. We started our tour close to the Barbora gallery, one of the molybdenum mine galleries exploited during World War 2. Then, we stopped near Siebenschläfer, a modern gallery with tin, copper and bismuth mineralization mined mainly for cassiterite. Next stop was on an old heap with high contents of native bismuth accompanied by chalcopyrite (Fig. 11). Another nearby stop was the Zwickeninge, an open-pit with small shafts and heap with secondary copper mineralization and the first place of surface mining of tin

and copper ores in the 13<sup>th</sup> century. We also visited an open-pit above Prokop gallery, molybdenum mine with quartz body and greisen vein with occurrences of molybdenite, fluorite, topaz etc. The last stop was at the place, where the quartz vein called Lukáš outcrops and where it was possible to find samples of green apatite crystals up to 1 cm, tin-rich mica zinnwaldite and some fluorite crystals.

Finally, we would like to thank all the leaders of the separate trips, especially Dr. Pavel Škácha from the Pepř mine in the Jílové district and Dr. Jakub Plášil and Dr. Viktor Goliáš for leading the trips to the Svornost mine in Jáchymov. Special thanks to the Svornost mine and the company Granát Turnov for allowing us to explore their mines and to all the sponsors mentioned above.



Fig. 8: Group photo in front of Svornost mine. Photo by L. Kyrč.



Fig. 9: Introduction talk in Mauritius mine. Photo by L. Kyrč.



Fig. 10: Collecting of small gem-quality pyrope in the open-pit mine near Podsedice village. System of cascades for cleaning processing waters. Photo by J. Mysliveček.



Fig. 11: Collecting samples on the heap rich in native bismuth. Photo by J. Mysliveček.

## SGA Member Benefits

Did you realize that you are entitled to order Springer books at a special discount of 40%?

Visit <https://www.springer.com/> for further details, to browse new books of interest, and to order at the discounted rate for SGA members.

Stay up-to-date with what is published in Mineralium Deposita!  
Sign up for the Table of Contents Alert at

<https://www.springer.com/earth+sciences+and+geography/geology/journal/126>

to receive an e-mail every time a new issue of the journal is published – with an overview of the articles published.

# Heritage stone excursion to the south-western part of the Bohemian Massif

Eliška Bršlicová, Marek Tuhý, Rafael Baieta<sup>1</sup>

<sup>1</sup> SGA Student Chapter Prague, Faculty of Sciences, Charles University, Albertov 6, 128 43 Prague 2, Czech Republic; brslicoe@natur.cuni.cz

The 2017 autumn field trip organized by the SGA Student Chapter Prague took its participants to some world-famous locations, such as Komorní Hůrka, Kössain, Stříbro and Kašperské Hory. We saw the heritage stones of the south-western region of the Bohemian Massif.

## Day 1:

We started the day with a visit to the Tis u Blatna quarry (Fig. 1), which is currently mined by GRANIO s.r.o. The special type of granite at this site is locally called “Czech Labradorite” due to its bluish hues that are caused by quartz. Afterwards, we visited localities near Horní Slavkov with Sn-W-Mo-Cu-rich quartz veins. The first locality, Huberův peň, used to be mined for Sn and W. The mineralization allows for fairly large crystals of cassiterite to be found alongside wolframite, green and violet apatite, chalcopyrite, topaz, molybdenite and violet fluorite. The second locality, Vysoký kámen, is a greisen-type deposit, where green, spheroid chalcocyanite-turquoise formed during decomposition. Finally, we visited the Štenská u Teplé

quarry, the only locality in Czech Republic where trachyte is mined.

## Day 2:

In the morning, we arrived to Komorní Hůrka (Fig. 2), one of the youngest volcanoes in the Czech Republic, with its age being estimated between 200 000 and 1 million years. Komorní Hůrka is a stratovolcano, with interchanging eruptions of basaltic lava and pyroclastic rocks, both tuff and volcanic bombs can be found at this locality. Afterwards, we moved to Marktredwitz (Fig. 3), where the highway cuts through rocks of granodioritic to gabbroic composition. The next point of interest was the Blue Granite of the Pfalzbrunnen quarry outside of Kössain. The granite has been mined for 100 years and is prized for its porphyric structure and fine quality.

## Day 3:

We visited Stříbro (Fig. 4), a famous Czech locality with Pb-Zn mineralization and a great history of mining. The first known document referring to the silver mines is

from the 12<sup>th</sup> century. Silver was mined in this area throughout the medieval ages and then around the 16<sup>th</sup> century, lead started being mined mainly. The veins contain multiple quartz generations along with galena, sphalerite, pyrite with marcasite and locally chalcopyrite. Then, we moved to the uranium deposit Damětica. It used to be a small mining operation. The upper part of the deposit is oxidized and it is possible to find uranium micas, such as uranocircite, autunite and torbernite, while the deeper parts of the deposit contain primary uraninite. Later, we visited an old marble quarry in Nezdice na Šumavě. The marble in the lower part of the quarry has a beautiful sky-blue colour and contains fine needles of wollastonite. We ended our day in Kašperské Hory, an area full of historical gold mines from the 10<sup>th</sup> and 14<sup>th</sup> century. The latest geological survey still shows deposits of gold with 5.6 ppm Au.

## Day 4:

We arrived early to Malenice (Fig. 5), where we observed migmatite and paragneiss boulders containing almandine. Both, tetragonal trioctahedral and rhombic dodecahedral crystals are found. Then, we explored the locality Sepekov and we found a group of hercynite-rich rocks, with varying content of phlogopite located at the contact of a gneiss-migmatite and tourmaline granite. We ended our field trip in Krásná Hora nad Vltavou at an extensive mineralization of gold and antimony veins stretching throughout the area. We searched around an old rock pile from the mineshaft Emilka, consisting of red stained granite with antimonite.



Fig. 1: Tis u Blatna quarry. Photo by M. Vopat.



Fig. 2: Goethe's adit for research purposes at Komorní Hůrka. Photo by M. Vopat.



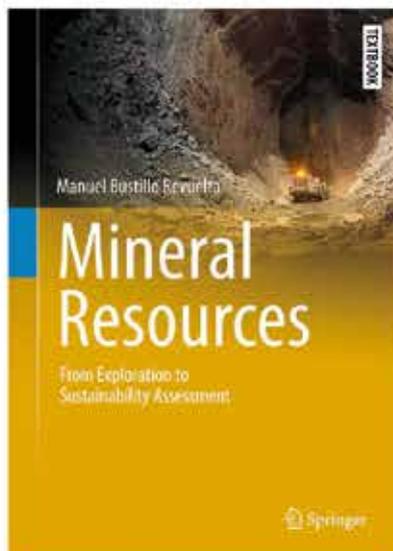
Fig. 3: Feldspars at Marktredwitz. Photo by M. Vopat.



Fig. 4: Stříbro, heap from Pb-Zn mine. Photo by J. Mysliveček.



Fig. 5: Malenice, paragneiss containing almandine. Photo by D. Brém.



1st ed. 2018, XIII, 653 p. 487 illus., 483 illus. in color.

#### Gedrucktes Buch

Hardcover

49,99 € | £39.99 | \$54.99

<sup>[1]</sup>53,49 € (D) | 54,99 € (A) | CHF 59,00

#### eBook

41,64 € | £31.99 | \$39.99

<sup>[2]</sup>41,64 € (D) | 41,64 € (A) | CHF 47,00

Erhältlich bei Ihrer Bibliothek oder [springer.com/shop](http://springer.com/shop)

#### MyCopy <sup>[3]</sup>

Printed eBook for just

€ | \$ 24.99

[springer.com/mycopy](http://springer.com/mycopy)

Manuel Bustillo Revuelta

# Mineral Resources

From Exploration to Sustainability Assessment

Reihe: Springer Textbooks in Earth Sciences, Geography and Environment

- Equips students to handle the diverse situations in mineral resource exploration, evaluation and exploitation
- Outlines each of the varied exploration methodologies and how to interpret the geochemical database results
- Numerous step-by-step examples help the reader to learn quickly about mineral resource evaluation
- Summarizes the basic guidelines to evaluate mining projects EIAs worldwide
- Outlines each of the main mining software programs for geological exploration and mining design

This comprehensive textbook covers all major topics related to the utilization of mineral resources for human activities. It begins with general concepts like definitions of mineral resources, mineral resources and humans, recycling mineral resources, distribution of minerals resources across Earth, and international standards in mining, among others. Then it turns to a classification of mineral resources, covering the main types from a geological standpoint. The exploration of mineral resources is also treated, including geophysical methods of exploration, borehole geophysical logging, geochemical methods, drilling methods, and mineral deposit models in exploration. Further, the book addresses the evaluation of mineral resources, from sampling techniques to the economic evaluation of mining projects (i.e. types and density of sampling, mean grade definition and calculation, Sichel's estimator, evaluation methods – classical and geostatistical, economic evaluation – NPV, IRR, and PP, estimation of risk, and software for evaluating mineral resources). It subsequently describes key mineral resource exploitation methods (open pit and underground mining) and the mineral processing required to obtain saleable products (crushing, grinding, sizing, ore separation, and concentrate dewatering, also with some text devoted to tailings dams). Lastly, the book discusses the environmental impact of mining, covering all the aspects of this very important topic, from the description of diverse impacts to the environmental impact assessment (EIA), which is essential in modern mining projects.

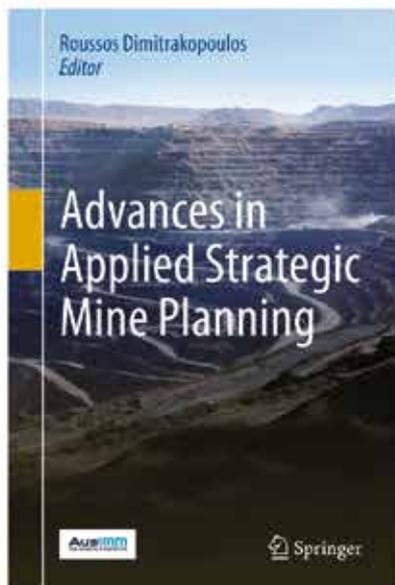
Erhältlich bei Ihrem Buchhändler oder – Springer Nature Customer Service Center GmbH, Haberstrasse 7, 69126 Heidelberg, Germany / Call: + 49 (0) 6221-345-4301 / Fax: +49 (0)6221-345-4229 / Email: [customerservice@springer.com](mailto:customerservice@springer.com) / Web: [springer.com](http://springer.com)

[1] € (D) sind gebundene Ladenpreise in Deutschland und enthalten 7% MwSt; € (A) sind gebundene Ladenpreise in Österreich und enthalten 10% MwSt. CHF und die mit [2] gekennzeichneten Preise für elektronische Produkte sind unverbindliche Preisempfehlungen und enthalten die landesübliche MwSt. Programm- und Preisänderungen (auch bei Irrtümern) vorbehalten. Es gelten unsere Allgemeinen Liefer- und Zahlungsbedingungen. Springer-Verlag GmbH, Handelsregistersitz: Berlin-Charlottenburg, HR B 91022. Geschäftsführung: Haank, Mos, Hendriks

40% Autorenrabatt lebenslang



Part of **SPRINGER NATURE**



Roussos Dimitrakopoulos (Hrsg.)

# Advances in Applied Strategic Mine Planning

- Addresses core aspects of the sustainable, responsible, and optimal development and utilization of Earth's mineral resources
- Presents both state-of-the art methods and major applications in the global mineral resources industry
- Includes contributions from international experts in the field

This book presents a collection of papers on topics in the field of strategic mine planning, including orebody modeling, mine-planning optimization and the optimization of mining complexes. Elaborating on the state of the art in the field, it describes the latest technologies and related research as well as the applications of a range of related technologies in diverse industrial contexts.

1st ed. 2018, XIII, 800 p. 385 illus. 262 illus. in color.

### Gedrucktes Buch

Hardcover

199,99 € | £175.50 | \$249.00

<sup>[1]</sup>213,99 € (D) | 219,99 € (A) | CHF 236,00

### eBook

166,59 € | £140.00 | \$189.00

<sup>[2]</sup>166,59 € (D) | 166,59 € (A) | CHF 188,50

Erhältlich bei Ihrer Bibliothek oder [springer.com/shop](http://springer.com/shop)

### MyCopy <sup>[3]</sup>

Printed eBook for just

€ | \$ 24.99

[springer.com/mycopy](http://springer.com/mycopy)

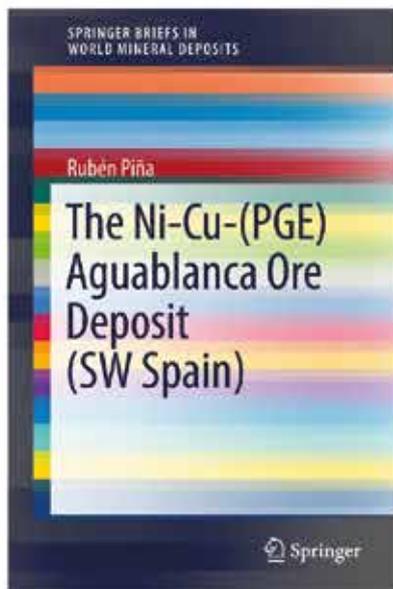
40% Autorenrabatt lebenslang



Erhältlich bei Ihrem Buchhändler oder – Springer Nature Customer Service Center GmbH, Haberstrasse 7, 69126 Heidelberg, Germany / Call: + 49 (0) 6221-345-4301 / Fax: +49 (0)6221-345-4229 / Email: [customerservice@springer.com](mailto:customerservice@springer.com) / Web: [springer.com](http://springer.com)

[1] € (D) sind gebundene Ladenpreise in Deutschland und enthalten 7% MwSt; € (A) sind gebundene Ladenpreise in Österreich und enthalten 10% MwSt. CHF und die mit [2] gekennzeichneten Preise für elektronische Produkte sind unverbindliche Preisempfehlungen und enthalten die landesübliche MwSt. Programm- und Preisänderungen (auch bei Irrtümern) vorbehalten. Es gelten unsere Allgemeinen Liefer- und Zahlungsbedingungen. Springer-Verlag GmbH, Handelsregistersitz: Berlin-Charlottenburg, HR B 91022. Geschäftsführung: Haank, Mos, Hendriks

Part of **SPRINGER NATURE**



1st ed. 2019, XVII, 78 p. 42 illus., 39 illus. in color.

#### Gedrucktes Buch

Softcover

54,99 € | £49.99 | \$69.99

<sup>[1]</sup>58,84 € (D) | 60,49 € (A) | CHF

60,50

#### eBook

44,02 € | £39.99 | \$54.99

<sup>[2]</sup>44,02 € (D) | 44,02 € (A) | CHF

48,00

Erhältlich bei Ihrer Bibliothek oder  
springer.com/shop

#### MyCopy <sup>[3]</sup>

Printed eBook for just

€ | \$ 24.99

springer.com/mycopy

Rubén Piña

## The Ni-Cu-(PGE) Aguablanca Ore Deposit (SW Spain)

Reihe: SpringerBriefs in World Mineral Deposits

- Presents the latest data on the Aguablanca Ni-Cu-PGE sulfide deposit in Spain
- Furthers our understanding of Ni-Cu-PGE sulfide deposits in general and the unique geodynamic evolution of the deposit in Aguablanca
- Offers a comprehensive description of the Ni-Cu-PGE sulfide deposit in Aguablanca

This book describes the Aguablanca Ni-Cu-PGE sulfide deposit, the first, and to date only, mineralization of this type in southwestern (SW) Europe. Since its discovery in 1993, this ore deposit has attracted the attention of the resource geology community due to its unusual geodynamic context, namely an active plate margin. The book focuses on the key features of the deposit and reports on the ore-forming processes that were most important for its formation.

40% Autorenrabatt lebenslang



Erhältlich bei Ihrem Buchhändler oder – Springer Nature Customer Service Center GmbH, Haberstrasse 7, 69126 Heidelberg, Germany / Call: + 49 (0) 6221-345-4301 / Fax: +49 (0)6221-345-4229 / Email: customerservice@springer.com / Web: springer.com

[1] € (D) sind gebundene Ladenpreise in Deutschland und enthalten 7% MwSt; € (A) sind gebundene Ladenpreise in Österreich und enthalten 10% MwSt. CHF und die mit [2] gekennzeichneten Preise für elektronische Produkte sind unverbindliche Preisempfehlungen und enthalten die landesübliche MwSt. Programm- und Preisänderungen (auch bei Irrtümern) vorbehalten. Es gelten unsere Allgemeinen Liefer- und Zahlungsbedingungen. Springer-Verlag GmbH, Handelsregistersitz: Berlin-Charlottenburg, HR B 91022. Geschäftsführung: Haank, Mos, Hendriks

Part of **SPRINGER NATURE**

# David I. Groves: Novel writer

Bernd Lehmann<sup>1</sup>

<sup>1</sup> *Mineral Resources, Technical University of Clausthal, Adolph-Roemer-Strasse 2a, 38678 Clausthal-Zellerfeld, Germany; bernd.lehmann@tu-clausthal.de*

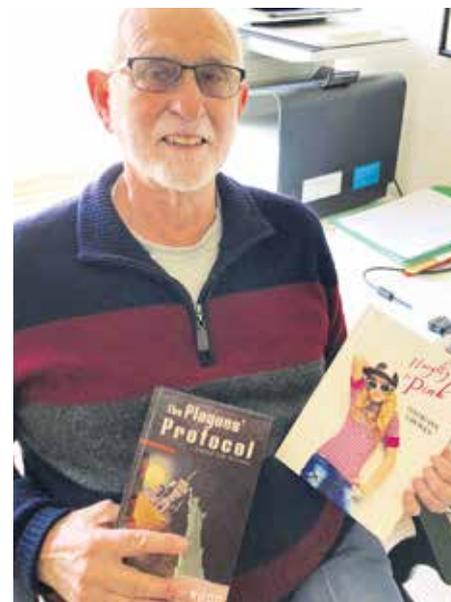
David Groves is a talented man. He is known as an eminent economic geologist who contributed important ideas on ore deposit geology and exploration, particularly on orogenic gold deposits and the role of the lithosphere in ore formation, and brought a holistic view to global metallogeny and mineral deposit targeting. He obtained the highest honours from the Society of Economic Geologists (SEG) and the Society of Geology Applied to Mineral Deposits (SGA), both of which he also served as President. The Australian Geoscience Council has just made him a National Geoscience Champion, the second after Roy Woodall, for his mentoring and promotion of geoscience.

Since his retirement as Director of the Centre for Global Metallogeny, the precursor to the Centre of Exploration Targeting, at the University of Western Australia, his prolific scientific writing, with about 500 authored or co-authored publications, is turning towards writing novels for the general public where the stories involve some geological deductions. His first commercially published novel was "The Digital Apocalypse" (Connor Court Publ., Ballarat 2015) about the consequence of environmental extremism. His latest novel "The Plagues' Protocol" (Austin Macauley Publ., London 2018) came out this year, now available as Paperback with Amazon and is an example of the successful adaptation of his broad multi-scale approach to forensic geological

studies into the creative writing of a cerebral thriller and mysterious crime novel.

Just as Frederick Forsyth wrote on the background of his many years as an international MI6 agent, David writes on his background of global travel and strong interest in natural sciences and history of the Earth. It turns out that his forensic style of thinking in ore deposit targeting can also be applied to develop the plots and solve the mysteries of conspiracies and crimes. "The Plagues' Protocol" portrays a series of extraordinary events, with unclear religious terrorist connotations, which unfold at iconic USA locations in 2023. The series of apparently unconnected crimes threatens the stability of the political system and the daily media frenzy enhances underlying fear in the population which may react more and more irrationally. It turns out that an Australian exploration geologist in Tanzania finds the common denominator for these crimes and instigates action by the US Government to resolve them.

The book is written on a general philosophical background of scepticism about our "fully serviced, socially engineered" modern society where perception has become more important than reality. The book demonstrates the dangers of a society totally dependent on a digital world, but also provides hope by the example of individuals able to break through the political-correctness barriers and speak the truth. There may be some occasional overdose of



David with his thriller book "The Plagues' Protocol" and his children's novel "Naughty in Pink", both published in 2018.

stereotype for some characters, especially female ones, but this should be permitted for retired gentlemen. In summary, congratulations, David, we wish you all the best for your literary career. Occasional excursions into the so-called non-fictional science world will continue to be welcome.

**APPLICATIONS** to SGA for meeting sponsorship must be submitted to Jan Pašava, SGA Executive Secretary. Please contact Jan Pašava for forms and further information.

Ideas and Suggestions for SGA-sponsored activities are welcome and should be addressed to Jan Pašava or any other member of the Council (see e-sga.org for list of members).

**Dr. Jan Pašava**  
SGA Executive Secretary

Czech Geological Survey  
Klárov 131/3  
CZ-118 21 Prague 1  
Czech Republic

Tel.: +420 2 5108 5506  
Fax: +420 2 518 18 748  
e-mail: jan.pasava@geology.cz

# Guide to authors for the SGA News

Jochen Kolb; chief editor SGA News

*Institute of Applied Geosciences, Karlsruhe Institute of Technology, Adenauerring 20b, 76131, Karlsruhe, Germany;  
editor-sga-news@e-sga.org*

There are three types of submission: (1) regular article; (2) reports of SGA student chapters; and (3) reports related to SGA. Regular articles should present scientific studies of the geology, mineralogy and geochemistry of mineral deposits or other topics related to mineral deposits. Reports of SGA student chapters should represent detailed description of activities. They must be reviewed by the scientific supervisor of the respective chapter prior to submission. Make sure that the field reports include the exact location (coordinates if available) of each station described. There is no restriction to the length of a contribution, but it should be concise and informative. All figures should be informative and of good quality. The language of SGA News is British English and all contributions need to be formatted as such. When submitting a text, do not include figures or tables and their captions. Present the latter at the end of the Word file and submit the figures separately, instead.

## Title and affiliations

Every submission needs to provide: (1) a concise and informative title; (2) the name(s) of the author(s); (3) the affiliation(s) and address(es) of the author(s); and (4) the e-mail address of the corresponding author.

## Text formatting

Manuscripts need to be submitted in Word. Use a normal, plain font (e.g., 10-point Times Roman) for text. Format the text as little as possible. For emphasis, use the format tools of Word (e.g., italics or capitals). Do not use the shift button for capitalizing a whole word. Do not use field functions, tab stops or other commands for indents, or the space bar. Do not insert extra lines between paragraphs; use the Word formatting tools instead. Use the table function, not spreadsheets, to make tables. Abbreviations should be defined at first mention and used consistently thereafter. Please always use internationally accepted signs and symbols for units (SI units).

## References

SGA News uses the style that is also used in Mineralium Deposita. Check [https://www.springer.com/earth+sciences+and+geography/geology/journal/126?detailsPage=pltdci\\_1060362](https://www.springer.com/earth+sciences+and+geography/geology/journal/126?detailsPage=pltdci_1060362) for further information.

## Figures and Tables

All figures and tables are to be numbered using Arabic numerals. They should always be cited in text in consecutive numerical order. The format in the text is "(Figure 1; Table 1)". For table and figure captions use "Fig. 1: xxxxx." and "Tab. 1: xxxxx."

Figures need to be submitted as separate files in jpg-format. They need to be formatted to fit the column format of SGA News: (1) 4 cm wide or (2) 8.3 cm wide for the 3-column part and 6.1 cm wide for the 2-column part. Make sure that the figures are of good quality.



# SGA Society for Geology Applied to Mineral Deposits

NEW MEMBERS from May 31, 2018 until September 30, 2018

36 student and 6 regular members applied for membership from May 31, 2018 until September 30, 2018.

**Student members 36:**

- |                  |                  |
|------------------|------------------|
| Canada 1         | Nigeria 2        |
| Czech Republic 1 | Poland 3         |
| Finland 1        | Russia 5         |
| Germany 9        | Spain 3          |
| India 2          | Sweden 1         |
| Iran 1           | Turkey 2         |
| Mexico 1         | United Kingdom 4 |

**Regular members 6:**

- Brazil 1
- Canada 2
- Finland 1
- Peru 1
- USA 1

## The SGA website

**Nikola Koglin , Chief Editor SGA website**

*Bundesanstalt für Geowissenschaften und Rohstoffe (BGR), Stilleweg 2, 30655 Hannover, Germany  
email: Nikola.Koglin@bgr.de*

<http://www.e-sga.org>

# DISCOVERIES IN THE TASMANIDES

25-26-27 September 2019 Wagga Wagga NSW



This will be the 7th incarnation of this iconic and unique event and will attract about 250 registrants including project geoscientists in the mining and exploration industry, service providers, plus government and academic specialists. This conference is renowned as a forum for exploration and mine case studies as well as scientific advances in understanding the tectonics and metallogenesis of the Tasmanides.

**Mines and Wines** is about presentations by geoscientists for geoscientists.

*For Information and updates visit [www.minesandwines.com.au](http://www.minesandwines.com.au)*


**Mines & Wines** event brought to you by
 


 Planning & Environment Resources & Geoscience
 



Sponsors welcomed

SGA membership forms can also be downloaded in 5 different languages from the home page of our website [www.e-sga.org](http://www.e-sga.org)

**Business Card**  
Staple HERE



Society for Geology Applied to Mineral Deposits ([www.e-sga.org](http://www.e-sga.org))

**APPLICATION FORM FOR NEW MEMBERS**

I would like to become a member of the **Society for Geology Applied to Mineral Deposits** and to receive my personal access to **Mineralium Deposita**. Membership fees will be due after acceptance of the membership application.

- Note that incomplete forms and those that are not legible will NOT be processed! -

|                        |  |
|------------------------|--|
| <u>Last name*</u>      |  |
| <u>First name*</u>     |  |
| Title                  |  |
| <u>Postal address*</u> |  |
|                        |  |
| Phone                  |  |
| <u>e-mail*</u>         |  |
| Academic degrees       |  |

\* mandatory fields

**Select your Membership Dues\***

- 75.00 EUR Regular Member (Printed copy + online access **Mineralium Deposita** and **SGA News**)
- 60.00 EUR Regular Member (Online access only **Mineralium Deposita** and **SGA News**)
- 10.00 EUR Student Member (Online access only **Mineralium Deposita** and **SGA News**, certificate required)
- 60.00 EUR Student Member (Printed copy + online access **Mineralium Deposita** and **SGA News**, certificate required)
- 60.00 EUR Senior Member (Printed copy + online access **Mineralium Deposita** and **SGA News**, after retirement, certificate required)
- 300.00 EUR Corporate Member (includes 3 printed copies of **Mineralium Deposita**) (for industry only, no academic)

Applications until September 30<sup>th</sup> will be processed for the current year. From October 1<sup>st</sup> membership starts with the following year.

**Donation for the SGA Educational Fund**

- I want to donate \_\_\_\_\_ EUR to the SGA Educational Fund and
  - agree that my (or company) name as donor will be published in SGA media/conferences
  - wish to remain anonymous

\*  I agree to the SGA data privacy policy as published at <https://e-sga.org/contact-us/data-privacy-policy>

If my application is approved, I authorize the "Society for Geology Applied to Mineral Deposits" to charge the above amount (please tick) to the given credit card:

VISA     MASTERCARD/EUROCARD

Card Holder\* \_\_\_\_\_ Expiry date (MM/YY)\* \_\_\_\_\_

Card No\* \_\_\_\_\_ 3-digit security code\* \_\_\_\_\_

Signature\* \_\_\_\_\_ Place and date: \_\_\_\_\_

(If you do not intend to pay by credit card, please make a note here and an invoice will be issued after acceptance of your application)

| Sponsor (SGA member): |       |      |           |
|-----------------------|-------|------|-----------|
| Name                  | Place | Date | Signature |
|                       |       |      |           |

Send the membership application form to:  
Dr. Jan Pašava, SGA Executive Secretary, Czech Geological Survey, Klárov 131/3, CZ-118 21 Praha 1, CZECH REPUBLIC  
Phone: ++(420)-2-51085506, Fax: ++(420)-2-51818748, e-mail: [secretary@e-sga.org](mailto:secretary@e-sga.org).

**Please note that bank charges will not be covered by SGA.**  
Version June 2018