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Mining - smelting - recycling, is the German demand and supply of raw materials resilient?

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Abstract

Recently, the world economy is experiencing raw material supply delays and price increases for resources such as cooper or steel (Hubik, 2021). Rapidly growing economies and the growing world population, which is striving for higher living standards and a transition towards clean energy, will increase the competition on raw materials (Monopol-kommission, 2020). In this context, global demand for metallic raw materials will likely double by 2060 (OECD, 2019). Recycled products contribute to satisfy the growing demand, but will not spare the deployment of primary resources. In the past 19 years, from 2000 until 2018, the manufacturing industries in Germany produced one quarter of the German gross value added annually and generated a positive foreign trade result

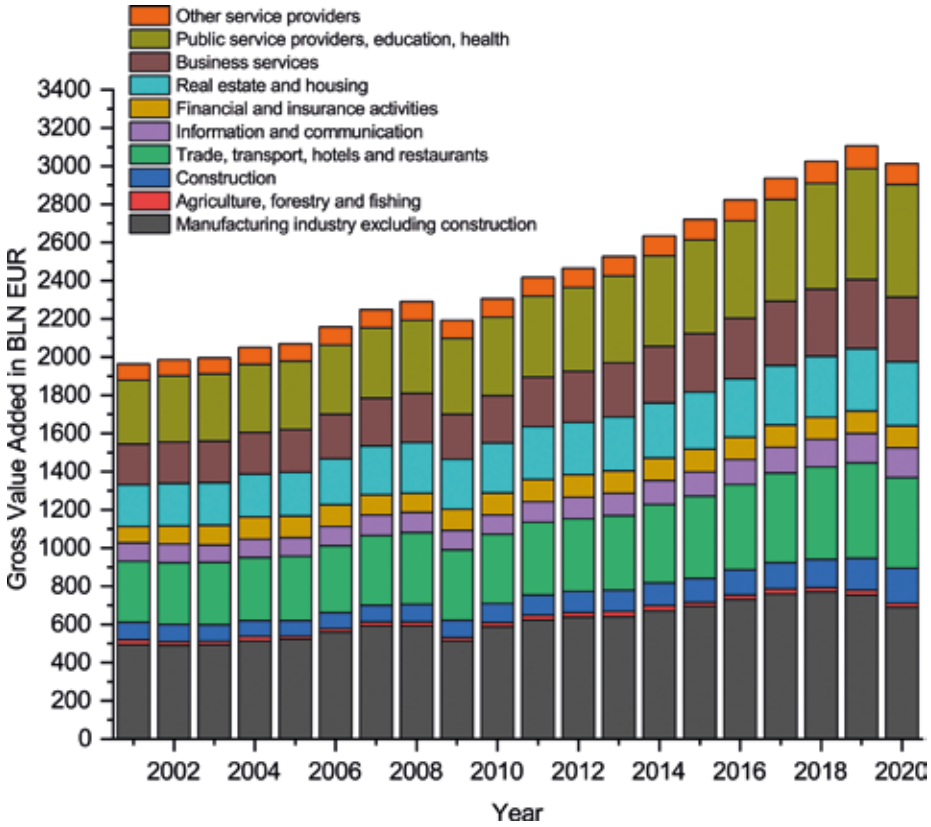

Fig. 1 *German gross value added development (Statistisches Bundesamt, 2021a)*

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Fig. 2 *Map of Germany, the federal state Baden-Württemberg is marked gold (Land Baden-Württemberg, 2021)*

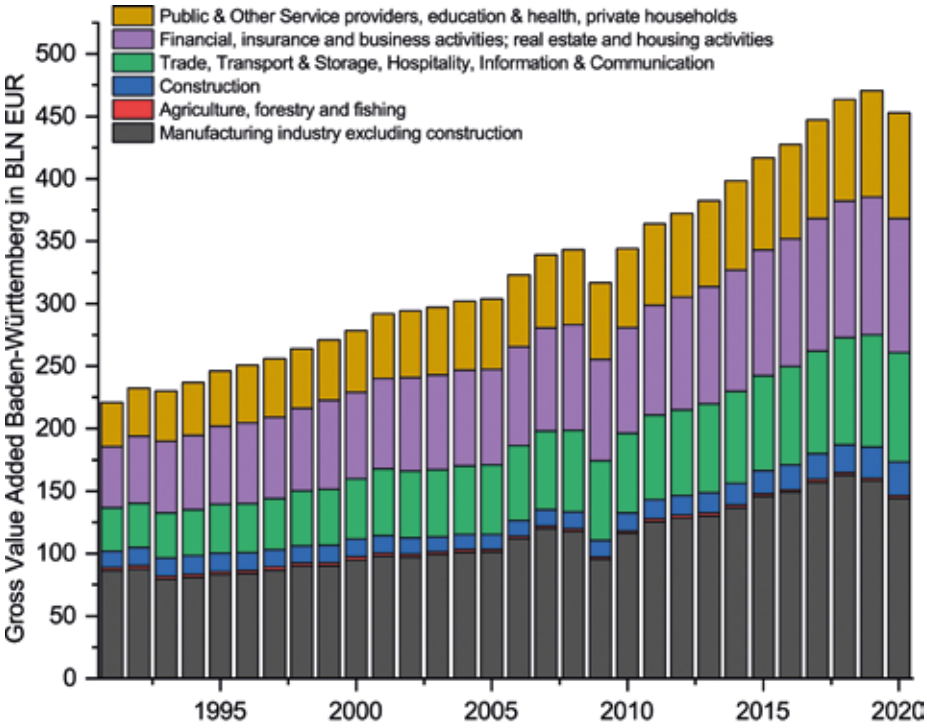

Fig. 3 *The development of gross value added in Baden-Württemberg over the past 20 years (after Statistisches Landesamt Baden-Württemberg, 2021)*

each year (Statistisches Bundesamt, 2021a, b). Thus, as an export-orientated industry nation, Germany depends on raw material imports. However, compared to other leading producing countries, Germany's raw material strategy differs noticeably. There are different approaches how to counter the competitive raw material demand.

Necessity of a resilient resource strategy, Germany needs raw materials

Germany is the world's 3rd largest net export and import nation, with an export volume totaled US$ 1.44 trillion (OEC, 2021). Exported manufactured goods include machinery, motor vehicles and motor vehicle parts as well as chemical products. Those three categories, which belong to 15 product categories in the external trade statistics, generated two thirds of the monetary generated positive foreign trade. The manufacturing industries are an important pillar in the German economy. Until 2018, they had been responsible for one quarter of the German gross value added annually (Fig. 1). In 2020, Germany imported 74 Mt of ores, metals and metal products, which are 20 Mt less than in 2017 (Statistisches Bundesamt, 2021c). The COVID-19 pandemic impacts supply chain resilience and challenges the world's and Germany's economy (Hubik, 2021; Lund et al., 2020; Huth et al., 2020). This includes pharmaceutical products and computer chip shortage, increasing raw material prices and supply bottlenecks such as for copper and steel. Additionally, trade routes may be a risk, such as the container ship wedged in the Suez Canal in March 2021, which blocked 450 ships (Russon, 2021).

Lacking global metal mining companies and mining activities, the German economy depends on primary and secondary raw materials, on semi-finished products as well as on the corresponding supply chains.

Example Baden-Württemberg, leading federal state in exports

The federal state of Baden-Württemberg led the seven out of 16 German states that recorded net exports (Statstisches Bundesamt, 2021d) (Fig. 2). Baden-Württemberg's innovative products are exported worldwide. The state hosts 13% of the German population and generates 15% of the German gross domestic product (GDP), which was 2020 with approximately 500 billion EUR similar to the GDP of Belgium (Statistisches Bundesamt 2021e, 2021f; International Monetary Fund, 2021). In 2020, motor vehicles and motor vehicle parts, machinery, metal products, electrical equipment as well as chemical and pharmaceutical products accounted for 82.3%, 156.3 billion EUR, of Baden-Württemberg's export. The same sectors imported in the same period 14 billion t of products and materials (Statistisches Bundesamt, 2021g).

Following an economic decline during the global financial and economic crisis of 2008/2009, gross value added in Baden-Württemberg rose by an average of 3.5% each year until 2019. The manufacturing sector in Baden-Württemberg continued to account a higher gross value added percentage of 31.9% in 2020, compared to the nationwide 22.9% (Statistisches Bundesamt, 2021a; Statistisches Landesamt Baden-Württemberg, 2021). Due to the COVID-19 pandemic, the gross value added decreased by 3.6% in Baden-Württemberg from 2019 to 2020 (Fig. 3).

Three global challenges affecting resilient resource strategy

1. The competition for raw materials will continue to increase

Global demand for metallic raw materials will more than double by 2060 (Fig. 4) due to growing world population and welfare (OECD, 2019). By 2060, there will be another 2 to 3 billion people on the planet (UN, 2019). The global economy will continue to grow and so will the associated increase in global prosperity, especially outside Europe (Fig. 5) (Guillemette & Turner, 2018).

Renewable energies, the shift towards e-mobility and advancing digitalization will also significantly raise the demand for more and higher-quality raw materials. For example, the consumption of copper and rare earth elements per capita will continuously increase due to the expansion of the power grid and new

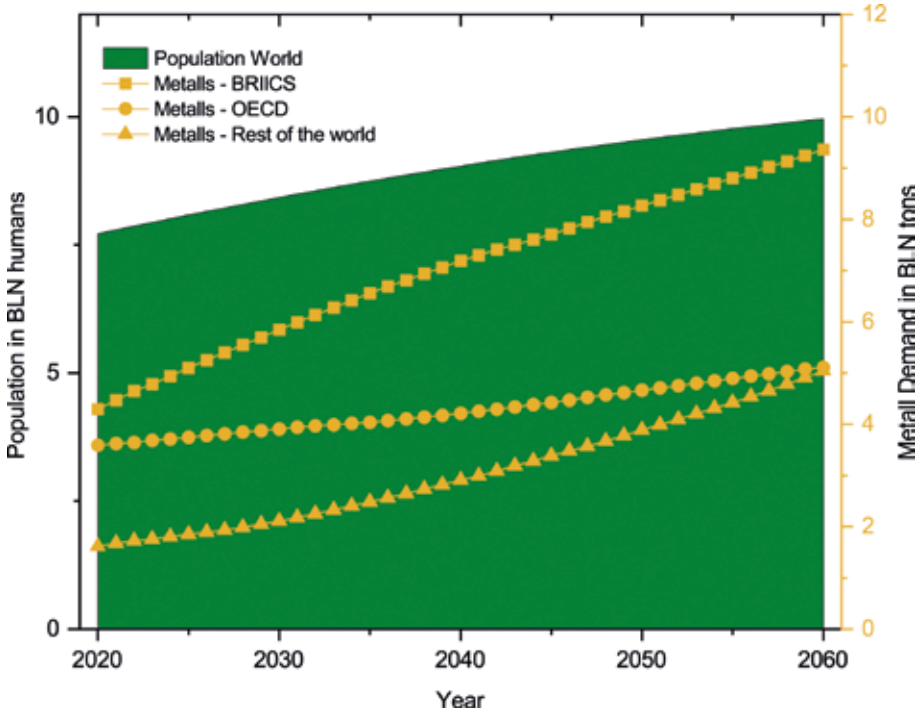

Fig. 4 *OECD development forecast of demand for metallic commodities and UN world population forecast (after OECD, 2019; UN, 2019)*

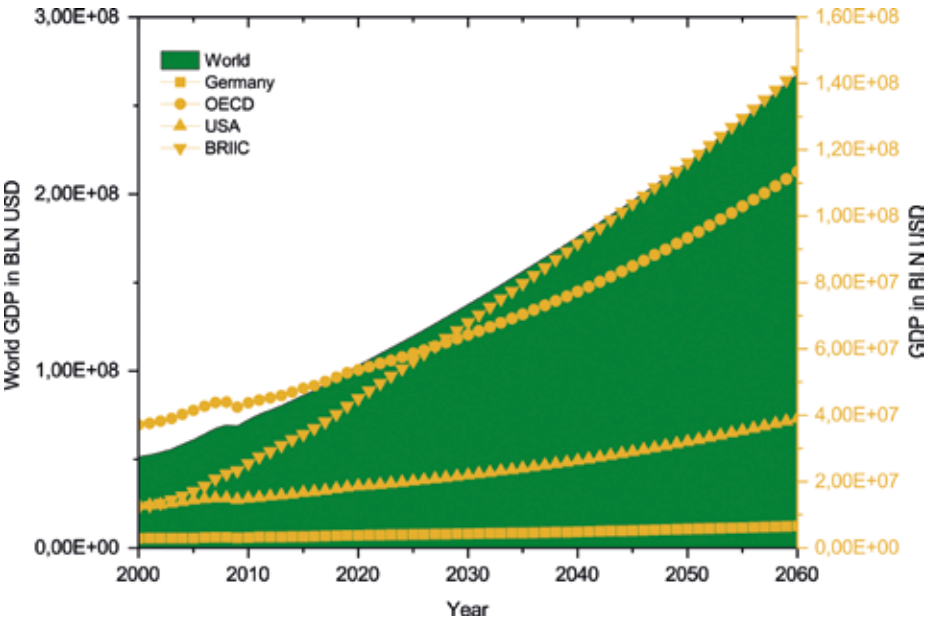

Fig. 5 *OECD long-term GDP forecast. BRIIC – Brazil, Russia, India, Indonesia, China (OECD, 2021)*

technologies (Tab. 1).

Market conditions will continue to shift as a result of the rapidly growing demand for raw materials in the BRIIC countries (Fig. 5), and companies will likely face increasing competition for (critical) raw materials (Fig. 4). The supply of raw materials as well as their demand are influenced by social, technological, economic, ecological, political, legal and ethical factors (STEEPLE analysis) (Hilgers et al., 2020). Increasing international protectionist market conditions require resilient supply chains of raw materials for a competitive development of the European economy (BDI, 2018a).

2. Different countries follow different raw material strategies

The raw material strategies of the leading producers of high-end goods (China, Japan, South Korea, USA and Germany) differ noticeably. Germany secures access to primary raw materials exclusively through bilateral agreements between companies. Large companies who are internationally active in metal ore mining and raw materials trading do not exist in Germany anymore. As part of the Critical Raw Materials Action Plan, the EU set a statement with founding the European Raw Material Alliance (ERMA) in September 2020. Further action aims at exploring critical raw materials within the EU, diversifying raw material supplies with selected or supporting recycling and circular economy (COM, 2020).

Other non-European producing countries maintain the complete value chain, including strategic stockpiling of metallic raw materials such as China, Japan, South Korea and the United States (Hilgers & Becker, 2020; Acatech, 2017). The amount of Chinese investments in foreign mines and metallurgy have been more than US$ 126 billion in the past ten years (AEI, 2020). The supply of raw materials will ultimately determine competitiveness on the international market.

3. Recycling and mining need the full range of smelters and refineries

The existence of smelters and refineries for major metals such as aluminum, chromium, copper, iron, manganese, nickel, rare earth elements, tin, titanium or zinc allows extraction of other metals as byproducts from ores and scrap metals (Reuter et al., 2019). The exploration and extraction of primary raw materials, as well as the extraction of secondary raw materials, require significant, long-term investments and knowledge (Wellmer et al., 2008). The long-term investments in exploration-smelting-refining-recycling is opposed by shorter innovation cycles requiring new raw materials. Recycling contributes to a notable extent to some raw materials in Germany. For example, 2019 steel was produced to 45% from scrap and copper was made to 44% out of secondary material, while in the EU, the share of End-of-Life recycling input rate (EoL-RIR) of copper was 17% in 2014 (BGR, 2020; Passarini et al., 2018). However, for many metals, recycling rates are much lower because of economical, technical, ecological and legal reasons. Furthermore, recycling requires the full range of various smelters to process scrap and primary raw materials (Reuter, 2018). Overall, recycling rates and qualities will not be able to cover fully domestic demand, because products and thus raw materials will be exported and innovation will require new alloys for new products at different qualities.

Raw materials for selected future technologies in tons	2013	2035
Electromobility		
Copper for electric traction motors for hybrid, electric and fuel cell vehicles	n.a.	5,000,000
Lithium for lithium-ion high-power electricity storage systems	607	110,000
Cobalt for lithium-ion high-power electricity storage systems	1,200	110,000
Renewable energies		
Copper for wind turbines	103,000	244,098
Silver for solar thermal power plants	12	536
Digitalization		
Gallium for high-performance microchips	38	86
Germanium for fiber optic cables	56	118
Indium tin oxide (ITO) in display technology	130	274
Rare earth metals for selected future technologies in tons	**2013**	**2035**
Solid oxide fuel cells (SOFC)		
Yttrium	0.7	5
Lanthanum	10	80
Cerium	2	20
Automatic piloting of motor vehicles		
Neodymium	0	16
Yttrium	0	1,004
High performance permanent magnets		
Dysprosium / Terbium	2,000	7,200
Neodymium / Praseodymium	28,900	62,400

Tab. *1 Raw material and rare earth metal demand in tons for selected future technologies in comparison 2013 and 2035 (Marscheider-Weidemann et al., 2016)*

Three strategic approaches to resilient raw material supply

1. Encourage investment along the value chain

One investment-intensive strategy is to establish, acquire a stake in or enter into a long-term contractual relationship with an internationally active exploration and mining company. Examples from German car manufactures are BMW who signed a multi-annual contract with the Argentinian lithium supplier Livent or Volkswagen who did so comparatively with Ganfeng Lithium Co. Ltd., a Chinese large corporation that offers lithium resource development, refining and processing as well as battery manufacturing and battery recycling (Berlin, 2021; Volkswagen AG, 2021). Domestic companies in the raw materials sector increase the resilience of supply chains and contribute to the development of new, environmentally friendly export technologies. Keeping smelters and refineries in the country not only ensures that raw material concentrates are processed to the highest environmental standards, but also enables recycling and expands the recovery of critical raw materials. By expanding the spectrum of smelting and refining, critical elements such as rare earth elements can be processed and new technologies developed. The proportional acquisition or long-term business relations with a smelting and refining company represent a further possibility to secure raw material quantities. After the termination of the raw material businesses of globally recognized companies such as Metallgesellschaft AG (2000) or Preussag AG (1997), there is no globally operating German mining company left, which could supply specific raw material. While globally acting large enterprises ensure raw material supply via B2B contract flanked by German UFK credits, medium-sized companies need assistance, such as the provision of market data and trends provided by the German resource agency DERA.

2. Promote technological innovation

The promotion of technological processes as well as product innovations will further reduce the amount of raw materials and substitute some raw materials. Similarly, reuse, remanufacturing and recycling can be increased. Recycling, however, must be considered on a material-specific basis, considering economic and environmental costs (Schmidt et al., 2020). Studies by the Federal Ministry of Economic Affairs and Energy show that by efficient usage of resources, small-size enterprises could already cut costs by up to 200,000 EUR per year (Bundesministerium für Wirtschaft und Energie, 2021). The application of blockchain technology can ensure the transfer of information throughout the supply chain and avoid loss of knowledge across sectors. The ability to offer innovative, market-leading technologies in exploration, production, processing, smelting and refining establishes access to raw materials. Technology leadership can further be supported through demonstrators.

3. Evaluate stockpiling and promote free trade

The storage of critical raw materials can be governmental as well as private. The possibilities to secure raw materials range from the ownership of natural deposits, operating the smelting-refining-recycling process or stockpiling for industry production. Stockpiling is a way to counteract the volatility of raw material supply and is used in sector specific strategies (Schmid, 2020). The risk is that the stocks bind capital too long that could be invested differently. In Germany, commodity storage is not mandated by industry nor is it practiced by government, except for certain quantities of crude oil, diesel, gasoline and fuel oil. Whether strategic or economic reasons would require the government to stockpile raw materials needs to be explored. Additionally, Germany could consider free-trade deals with important raw material resource supplier countries. A secured and fair access to raw materials is essential for the German industry, which depends on imports of raw materials (BDI, 2018b).

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News of the Society

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Due to continued COVID-19 restrictions, the e-Council Meeting was organized on April 15, 2021 from 12,00 to 16,00 CET via Zoom (J. Kolb is thanked for technical preparation of this meeting).

After welcoming, the Agenda was handled by J. Pašava (SGA Executive Secretary). Council members received all reports in advance and more discussion was spent on items that needed council decision. At the end of the e-meeting all submitted Reports were approved with great thanks.

Roll call and Apologies

Present on-line: D. Banks, G. Beaudoin, S. Bouhlel, G. Bozkaya, C. Conde, S. Decrée, H. Frimmel, P. Garofalo, G. Graham, D. Huston (SGA President), J. Kolb, P. Ledru, B. Lehmann, C. McCuaig, S. Mikulski, E. Naumov, J. Pašava, S. Petersen, I. Pitcairn, N. Saintilan, J. Slack, G. Tourigny and A. Vymazalová.

Apologies for absence: R. de Barrio, T. Christie, E. Ferrari, A. Idrus, P. Mercier-Langevin, B. Orberger, Y. Song, X. Sun

1. Summary of previous e-Council Meeting (October 22, 2020)
2. Reports of officers on Council:

2.1. Report from President

2.2. Report from Executive Secretary

Council decision not needed

After discussion, Council approved the presented reports with great thanks.

News: SGA 2020 Activity Report was sent to IUGS on time.

2.3. Report from Treasurer

Council decision needed:

- It is suggested that a new SGA account at PostFinance Bank shall serve explicitly the SGA Educational Fund and it is suggested to transfer an amount of EUR 100 000.- in total onto this account as soon as it has been opened.
- It is suggested to request from the student chapters to report their existing members by mid-January at the latest. This will ease the processing of student memberships and will give enough time to send reminders to student members before end of January.

Actions:

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

- H. Frimmel to finalize money transfer so that SGA would keep the total amount of EUR 100 000.- on a new SGA Educational Fund account at the PostFinance Bank in Zurich.
- A. Vymazalová to inform SGA Chapter Representatives to report their existing members to the SGA Treasurer´s office by mid-January at the latest. Delay in reporting will result in increased membership fee payment.

2.4. Report from Promotion Manager

Council decision needed:

We could design more (and not so expensive) promotional material as little presents to our members as a reward after 10, 15, 20... years of membership. To avoid high shipping costs, these gifts could be fetched during our biennial meeting.

Actions:

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

S. Decrée to order an additional set of neon safety jackets (precise number is subject to approval by the SGA Treasurer) and to prepare a proposal for a new set of promotional items which could be presented to SGA members at the occasion of their 10, 15, 20…… years of membership.

2.5. Report from Chief Editor, SGA News

Council decision needed:

A need for another person as associate editor to help with contributions from Spanish-speaking countries. Any suggestions are welcome.

Actions:

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

J. Pašava to send names of possible Spanish-speaking persons provided by C. Conde to J. Kolb.

J. Kolb to acknowledge the receipt of contributions to SGA News to senders.

2.6. Report from Chief Editors, Mineralium Deposita

Council decision not needed

We are seeking suggestions for new Editorial Board members with varied expertise.

News: B. Lehmann informed Council on the recent invitation of N. Saintilan to the Mineralium Deposita Editorial Board.

2.7. Report from Chief Editor SGA Special Publications

Council decision not needed

News: Besides other projects, the second edition of the published book "Agromining: Farming for Metals" (2021), like the first edition, is receiving many downloads from the Springer web site. A book on "Mineral Deposits and Occurrences in the Arabian-Nubian Shield" by H. Ahmed is underway, since early 2020. In January of this year, a book proposal on "Metallogeny of Mexico" by A. Camprubí, E. Centeno-García, C.E. Nelson, and N. Cano, was approved and is under preparation.

2.8. Report from the Chief Editor SGA website

Council decision needed:

- There has been some discussion about whether all SGA abstract volumes should be available through free download to everybody. Abstract volumes for some of the biennial meetings are available for free externally from the host institutions websites. I think it would seem a good idea to change having the SGA abstract volumes available as free download to everybody. I would suggest having a separate subheading in the Publications page after SGA News where website visitors can go directly to the Abstract volumes for SGA biennial meetings.
- There has also been some discussion about whether or how we list other information such as job opportunities and more personal information such as obituaries. Should we organise an extra page, for example a drop-down menu from the News page with specific sub-headings such as job postings etc.?
- Discussion with Blueways regarding the update of the SGA membership application on-line forms to enable members to

sponsor the SGA Educational Fund is ongoing. I have waited to see if there is a larger package of website changes that require Blueways to carry out such as those listed above but it will be arranged this spring.

Actions:

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

I. Pitcairn to create a separate subheading in the Publications page after SGA News where website visitors (not only SGA members) can go directly to the Abstract volumes for SGA biennial meetings for free download (this applies to volumes to which SGA holds copyright or permission from publisher).

I. Pitcairn to organize an extra page (for example a drop-down menu from the News page) with specific sub-headings such as job postings etc.

I. Pitcairn to discuss with Blueways implementation of any requested changes directly without waiting for larger packages of website changes.

Council approved that the Chief Editor, SGA Website can hire any person to help him in his "everyday" website update (reward a subject of discussion with SGA Treasurer).

2.9. SGA Educational Fund

Council decision not needed

News: Council greatly appreciated financial contribution of John Slack and Rojas Arancibia Rodrigio Galleguillos to the SGA Educational Fund.

2.10. to 2.16 - Reports from Regional Vice Presidents (Asia, Australia/Oceania, Europe, North Africa and Middle East, Sub-Saharan Africa, North America, South America)

Council decision not needed

Australia/Oceania: A new student chapter has been formed at the Centre for Exploration Targeting in the University of Western Australia. This is an exciting development as the UWA/CET chapter is the first SGA chapter in Australia.

Sub-saharan Africa: Two chapters (Ivory Coast, Senegal), SGA Virtual Seminar 2020 "African Metallogeny" Green Metals for a Sustainable Society (November 4-6, 2020). SGA Panel Discussions: Impact on COVID-19 on Raw Material sectors planned for April 2021. West African Exploration Initiative (WAXI) Stage 4 in finalization.

South America: Five chapters (Brazil, La Plata, Peru, Colombia/Bogotá, Colombia/Bucaramanga). Continued support of E. Ferrari to the Peru Chapter, promotion of SGA at proEXPLO 2021. SGA promotion in the XII Congreso Argentino de Geología Económica (October 28, 2020) – R. de Barrio.

Actions:

G. Graham to organize SGA promotion (budget of up to EUR 1,000) related to the short course at the Colorado School of Mines (January 2022) in the form of either 1) sponsoring student attendance, or 2) funding a sponsored evening event for students and other attendees during the short course.

I. Pitcairn to adapt SGA renewal membership application forms attached to website to allow approval of providing names and email addresses of applicants to SGA Regional Vice Presidents.

3. The 16th SGA Biennail Meeting – update

Council decision not needed

New dates approved by Council: March 28-31, 2022. Contingency plans are being developed for various COVID-19 scenarios impacting international travel.

LOC seeks suggestions from Council for:

- Sessions and convenors
- Keynote speakers

Action:

All Council members are encouraged to contact T. Christie on recommendation of keynote speakers, sessions and convenors.

4. The 17th SGA Biennial Meeting – update

Council decision not needed

Expected dates: August 28 – September 1, 2023 (Zürich), necessary conference rooms under negotiation with ETH headquarters (final decision expected in late May, 2021).

Action:

N. Saintilan to inform Council on a decision of the ETH headquarters

5. Report from the Chairman of the Nominating Committee

Council decision needed

Do we want/could we consider any extension of services to all Council due to pandemic?

Action:

D. Huston to finalize the list of nominated officers for SGA election and send it to J. Pašava for next administration by the end of April.

J. Pašava to prepare a proposal for SGA Executive Council on a possible discussion on extension of the present SGA Council term by 3 months.

Following up on this item, the SGA Executive Council suggested and Council approved in late May 2021 that the SGA General Assembly (GA) which has to meet every two calendar years (doesn´t need to be attached to SGA Biennial Meetings), will be called virtually prior to October 15, 2021 with the following agenda:

- Presidential Report
- Treasurer´s Report and proposed future budget
- List of proposed Officers for SGA ballot and Council request for extension of service of the current President and Vice-President till the end of March 2022

6. Report from the Chairman of the Award Committee

Council decision needed later

Two valid nominations for the SGA-Newmont Gold Medal, seven valid nominations for the SGA Young Scientist Award, and one valid nomination for the SGA-KGHM Krol Medal were submitted by the deadline of March 31, 2021. All nominations will be distributed to Council for e-vote. There will be a separate Council vote on the award for the best paper published in Mineralium Deposita.

Actions:

I. Pitcairn to send a link to a Dropbox folder with all nominations for all SGA awards to Council by April 20, 2021.

All Council members to send names of their preferred candidate for individual SGA awards to I. Pitcairn with a copy to J. Pašava by May 31, 2021.

7. Progress report on membership drive from the last SGA Council Meeting

Council decision not needed

A certain drop in the number of members is noticeable and probably reflects a combination of the usual lower numbers in even years when no SGA Biennial Meeting takes place and a certain drain due to the Covid19-pandemic and the resulting serious curtailment of SGA activities.

Tab. 1 Chapter requests and suggestion for funding in 2021

Year of foundation	No. of members in 2021	Chapter name	Received in 2020	Left from last year/s (EUR)	Request for 2021	Suggestion of support for 2021
2009	24	**Baltic**	**3500**	4050**	0	0
2012	24	**Barcelona/SEG**	**0**		900	900
2017	?	**Black Forest-Alpine**	**0**	1000	0	0
2018	5	**Brazil**	**500**	900	0	0
2015	16	**Colombia-Bogota/SEG**	**2000**	0	2000	1500
2012	50	**Colombia-Bucaramanga**	**3000**	0	3000	2500
2019	6	**Ivory Coast**	**0**	0	3600	500
2015	5	**Laval/SEG**	**0**	0	0	0
2020	5	**La Plata/SEG**	**500**	490	0	0
2019	30	**Moscow**	**2500**	1900	0	0
2013	12	**Nancy**	**2000**	0	2000	2000
2017	6	**NW-Russia**	**2000**	2000	0	0
2016	81	**Peru**	**2000**	700	0	0
2002	51	**Prague**	**3500**	3400	0	0
2020	10	**Senegal**	**500**	500	1000	1000*
2011	9	**Siberia**	**2000**	2750**	0	0
2017	?	**Turkey**	**0**	200	0	0
2018	20	**UK**	**300**	280	0	0
2019	11	**Urals**	**0**	0	1000	1000
2021	9	**UWA - Australia/SEG**	**500**	500	0	0
						9400

** approved, it is suggested that first the remaining budget from 2020 is spent and reported.*
*** Reimbursement from Glasgow is reflected in the Chapter budget.*

8. Status of development of SGA Student and Young Scientist network

Council decision needed

The following Table 1 with the list of existing 20 Chapters summarizes the support they received last year, number of members, current financial statement, requests for 2021 and suggested financial support for Council consideration.

Following a broad communication with various Chapter members and representatives, and based on their reports, here are some ideas/suggestions/comments for Council for further consideration and discussion:

- As there are already 20 Chapters and they use various social media to communicate and promote their activities (Facebook, Twitter, Instagram, You Tube channel, etc.), I thought that it would be good to have some kind of interactive map on the SGA website where Chapters will be marked and cross-linked.
- Students asked for possibility of sending a notice when SGA News are published and to receive more information from Society? Also, they asked if they can receive a confirmation from the Editor when they sent the article.
- There was a request if SGA proceedings from Biennial meetings could be available on-line to SGA members directly from the web-site.
- Students asked for possibility of having something like SGA mentoring program. Also, if some Council members would be willing to give an on-line lecture to SGA Chapters. Probably, we could think of making a list of SGA lectures and topics that could be offered to students.
- There is also an idea of some kind of research grants for Chapters. Grants for students within Chapter group (about 3-5 students), one is responsible and the results must be published at least in SGA News. Grants of approx. 500-1000 EUR, maximum 1 per year, available only to Chapters with more than 10 members.

But on the other hand, we should not compete with SEG on this.

- There is also a lot of interest for industry and practically oriented courses and workshops.
- Following the on-line meeting with all Chapters, we created a collective e-mail: sga-student-chapter-representatives@googlegroups.com covering 75 Representatives from all Chapters. If anybody from the Council would have some info aimed at students please feel free to use it.

Actions:

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

A. Vymazalová to inform SGA Chapter representatives of the approved budgets for 2021.

I. Pitcairn to send an alert on publishing SGA News to Student Chapters members.

I. Pitcairn in collaboration with A. Vymazalová to create an interactive map where Chapters would be marked and cross-linked.

J. Pašava to ask all Council members for considering SGA mentoring and lectures on different economic geology topics to be offered to SGA Chapters and provide such a list to A. Vymazalová who will send it to SGA Chapters.

SGA Council approved that only students who have been SGA members at least for one year preceding the SGA Biennial Meeting are eligible to apply for SGA travel grants.

9. Requests for sponsorship

None.

10. Any other business

- SGA future activities with respect to COVID-19 (D. Huston et al.)
- SGA new initiatives – update on SGA Sub-committee on New Initiatives (D. Banks et al.)

We need to look to how we can best retain our position as a premier society, retain our membership when numbers of students entering the profession is diminishing and adapt to a more electronic world. This is why D. Banks on behalf of a group consisting of K. Kelley, C. McCuaig, T. Aiglsperger, B. Orberger and A.S. André-Mayer, and in reaction to various changes caused by the pandemic presented new ideas for Council consideration.

Actions:

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

D. Banks to prepare a proposal for recognizing people who have made a significant contribution to ore deposit research over many years in the form of SGA Fellowship (including a list of criteria).

SGA Council to continue supporting Ore Deposit Hub activities on both speakers and student chapters levels.

All Council members are encouraged to provide their on-line lectures/videos etc. to A. Vymazalová who will make them accessible to SGA Chapters.

- SGA Mobility Grant – update (T. Aiglsperger)

11. Date and place of the next e-SGA Council meeting (fall 2021– timing to be decided).

12. Informative list of past activities

- 38th IGC (March 2-8, 2020 New Delhi, India) – SGA sponsors the Theme 28: "Ore Forming Processes and Systems" – J. Pašava/A. Vymazalová - SGA link – cancelled
- Short Course "From Concept to Oil - The E&P Lifecylce" (May 2020, Würzburg) – H. Frimmel – SGA in-kind sponsorship approved by Council - postponed
- III. Symposium on Precambrian geology and metallogeny (May 25 to 29, 2020 in San Ignacio de Velasco, Bolivia) – USD 2,500 approved by SGA Council to support SGA keynote speakers - postponed
- QUARTZ2020 International Symposium (June 7-12, 2020 Tonsberg, Norway) – SGA sponsored – a budget of up to 1,000 EUR approved by SGA Council for SGA student membership support - postponed
- Inaugural SGA Field Conference Mount Isa and Cloncurry, Queensland (20-24 July 2020) – D. Huston and. V. Lisitsin – postponed
- SEG 2020 (September 12-19, 2020 - Whistler, Canada) – postponed
- ORE DEPOSIT HUB lecturing

13. Informative list of future activities

- 16th SGA Biennial Meeting (March 28-31, 2022 Rotorua, New Zealand) – T. Christie et al.

President's Corner

Like most of the rest of the world, the curse "may you live in interesting times" continues to affect SGA. The uncertainty associated with COVID-19, combined with advances in technology, has changed the way we do business and connect with each other. Although SGA Council has not had a face-to face meeting since the SGA biennial meeting in Glasgow, August 2019, we have found that much of Council's business can be conducted via Zoom meetings, although with either very early mornings or very late nights for some participants. A benefit of this is that the meetings are now much more focussed. Importantly, however, business can still be conducted and decisions made.

These changes are also affecting other aspects of SGA, most notably the next SGA biennial meeting in Rotorua in March next year. Tony Christie and his team are exploring options for a face-to-face meeting, a hybrid face-to-face/electronic meeting and an electronic meeting. The inaugural SGA field workshop, originally planned for July 2020 in Mount Isa, Australia, was delayed initially until July 2022 and may have to be delayed further until July 2023 due to uncertainties related to international travel.

The benefit of the changes, however, has been the development of new ways of communicating. These include workshops for African students on issues relevant to Africa that were organised by Beate Orberger and her collaborators. These activities form part of SGA's role in association with the IUGS to provide economic geology educational programs in Africa and other places around the world. We continue to support the Ore Deposits Hub and their webinars. SGA will continue to evolve as technologies make communications easier in general but challenges such as COVID-19 restrict many face-to-face activities.

David Huston
President
May 2021

Open for Applcation The SGA Mobility Grant

Get ready for SGA networking! Do you know about a SGA member who runs a laboratory that could answer open questions of your research? Then the SGA Mobility Grant can help to bring you together! The SGA Mobility Grant offers an opportunity for regular SGA members to apply for money to travel to a facility with SGA background.

Applicants have to be in good standing for at least 3 continuous years (i.e. paid up membership fees; up to 2 years of student membership count) and apply by sending their request following a template to the SGA Mobility Grant coordinator (thomas.aiglsperger@ltu.se).

The application template is available at https://e-sga.org/home/.

Learning and sharing! That's the spirit of the SGA Mobility Grant.

SGA COUNCIL 2021

President	D. Huston (Australia)
Vice-President	D. Banks (U.K.)
Executive Secretary	J. Pašava (Czech Republic)
Treasurer	H. Frimmel (Germany)
Promotion Manager	S. Decrée (Belgium)
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	G. Beaudoin (Canada) - Mineralium Deposita, North America Office
	J. Kolb (Germany) - SGA News
	I. Pitcairn (Sweden) - SGA website
	J. Slack (USA) - Special Publications
Vice-President (Student Affairs)	A. Vymazalová (Czech Rep.)
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Europe	D. Holwell (U.K.)
N. Africa-Mid. East	S. Bouhlel (Tunisia)
North America	G. Graham (USA)
Sub-Saharan Africa	G. Tourigny (Canada/Ivory Coast)
South America	E. Ferrari (Peru)

Councillors through December 31, 2021

A. Idrus (Indonesia)
P. Mercier-Langevin (Canada)
S. Mikulski (Poland)
X. Sun (China)
S. Petersen (Germany)
T. Aiglsperger (Sweden)
G. Bozkaya (Turkey)
R. E. de Barrio (Argentina)
T. Christie (New Zealand)

Councillors through December 31, 2023

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P. Garofalo (Italy)
P. Ledru (France/Canada)
E. Naumov (Russia)
B. Orberger (France)
N. Saintilan (Switzerland)

Ex officio Members, SEG

President	J.S. Cline (USA)
Executive Director	B. G. Hoal (USA)

Ex officio Members, IAGOD

President	Sean Mc Clenaghan (Ireland)
Secretary General	J. Xian (China)

SOCIETY FOR GEOLOGY APPLIED TO MINERAL DEPOSITS

The great digital movement: take-home messages from open online seminars

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Lockdowns across the world steam-rolled the normalcy of our lives over a year ago, and the challenges of navigating a global pandemic still leave us longing for in-person meetings and relationships. The pandemic is still raging across different parts of the world, but as we watch and wait, hopeful from home-offices, we can also ask ourselves which adaptations are here for the long haul? In December, 2019 – no, not last year – the concept of Zooming-in was only for Google Maps. We would see our colleagues in different time zones only at occasional conference meetings or field excursions. We could not imagine the hardships ahead, nor did we realise the positive digital potential that existed at our fingertips. As this potential became clear, Ore Deposits Hub, a global platform for free talks on economic geology, was born.

Floods of positive feedback motivated our early career volunteer team over the last year, and Ore Deposits Hub Wednesday seminars hosted diverse scientific discussions that bridged the borders and inequalities that are often unavoidable for in-person events. Our early adoption of digital tools in March 2020 was met enthusiastically by more than 3500 subscribers in the first 3 months. An emergent surprise was that more than half of these subscribers were from industry and government sectors. Thanks to digital word-of-mouth, we had reached well beyond our mostly academic networks and stumbled upon a fertile corner of science communication. We now reach nearly 7000 subscribers, and have had an average live attendance of ~140 people at each of our 84 sessions so far. We connect speakers, hosts and participants from all different disciplines of minerals geoscience from across the globe (Fig. 1). Open scientific communication and science–industry connections are our primary goals; goals that we share with our organizational cosponsors: the SGA, SEG and IAGOD. These societies saw the potential of Ore Deposits Hub and their early support was instrumental to the platform's success.

As December 2020 blinked into view, with it came new challenges: Zoom-fatigue, hybrid home-office lives and digital calendars that were fuller than ever, and the growing need for formal recognition of digital professional development hours. On this basis, we made three important adaptations from ODH-2020 to ODH-2021: (1) We reduced our sessions to one hour, scheduled every other week, (2) we added more dynamic "Research Exchange" sessions, and (3) we started providing personalised certificates for recording professional development hours.

The results of these adaptations are clear, with meeting attendance up ~50% from autumn of last year, and between 30–50% of participants downloading certificates of attendance. This demonstrates the importance and demand for digital meetings in the professional development mix, setting the bar for digital learning platforms and prompting recognition of such time, by industry and professional organizations.

As well as these key changes, we have continued to leverage the networks of our speakers, hosts and subscribers to seek out speakers from a diverse range of backgrounds and locations, and to improve minority representation in our schedule. To strengthen our vision for diversity in geoscience, we also continue to collaborate with the organisation EDIG (Equity, Diversity & Inclusion in Geoscience; at iCRAG).

Ore Deposits Hub does not plan to replace conferences and their immersive environment, but our sessions contrast and highlight the challenge of translating pre-pandemic in-person conferences to the digital space. Creative attempts by other organisations at this translation include virtual pico-talks, Pokemon-style conference halls using "Gather", "Discord" rooms and recorded talks. While these are evolutionary and admirable, they have introduced challenges in the form of digital security and somewhat clunky scientific exchange. Stringent digital security, live presentations and live discussions, we believe, are essential to vibrant digital platforms. Organisers of digital events such as London Natural History Museum's – 'Can mining make the world a greener place?', and the 'Responsible Raw Materials' conference follow these principles and bring a new world of accessible, global discussions.

Our latest take on adapting to the digital space is our new "Research Exchange" format. It combines our original "Deep Dive" lectures and the fast-action conference pace, to bring talks and discussions on one topic from multiple perspectives. We invite two to three researchers, professionals or students as well as occasional guest panelists to present on a single topic, followed by a long, interactive discussion in the classic Ore Deposits Hub style. So far, we have hosted productive exchanges on: "New technologies applied to mineral exploration", "Colloidal & Particulate Gold Transport", and "Sediment-Hosted Copper".

Another important aspect of Ore Deposits Hub and other successful digital events is their lasting archives of resources. Such archive channels (e.g. hosted on YouTube) provide learning possibilities for geologists in different time zones, stuck on trains, alternatives for those who have field, lab or fam-

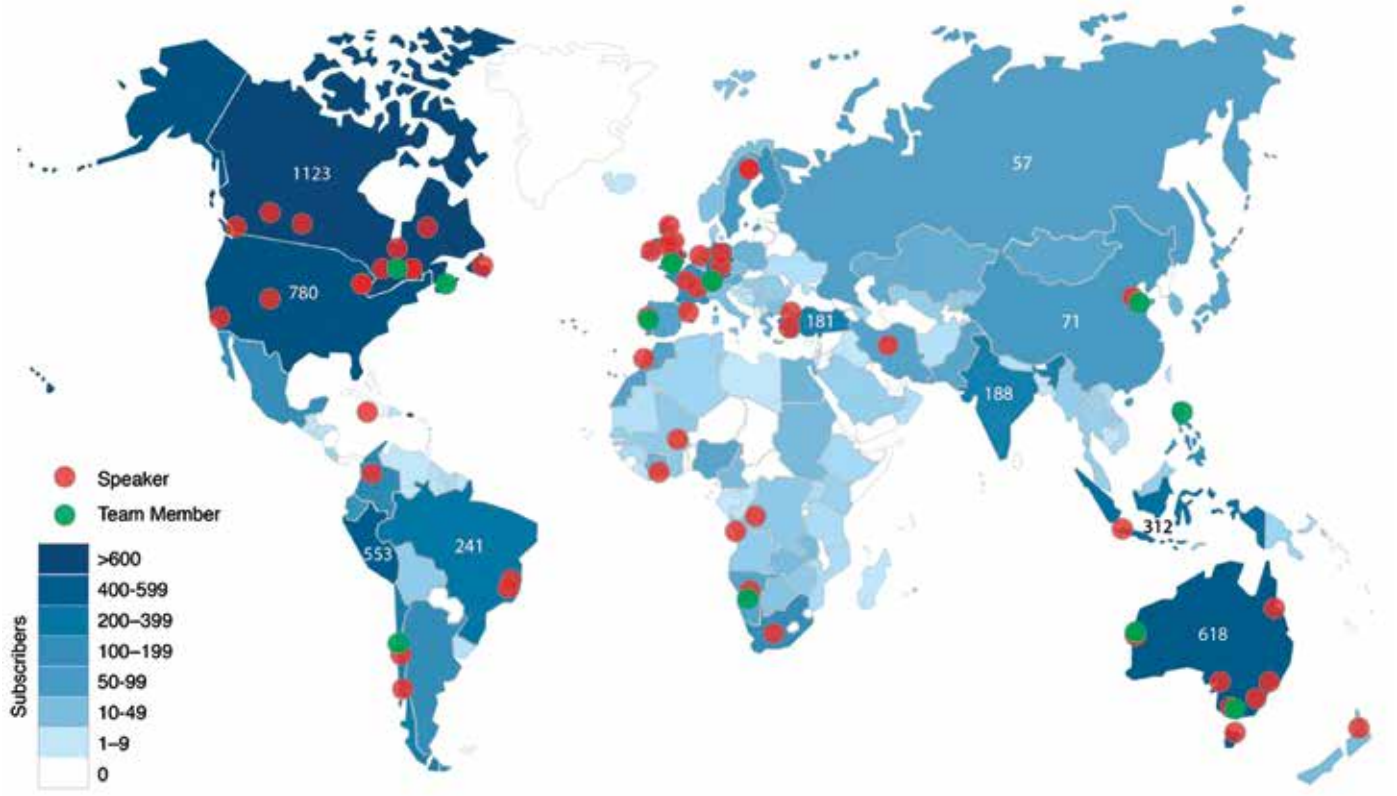

Fig. 1 The network of Ore Deposits Hub subscribers, speakers and our team members across the world

ily responsibilities, and they offer engagement for the multi-media immersed generation currently graduating. Perhaps less obviously, these preserve the musings of our most senior colleagues that are not often recorded and are a snapshot of our current ore deposit knowledge. The Ore Deposits Hub team and the global minerals community owe a great debt to the scientists and industry professionals who took the leap of faith to become early contributors to publicly available multimedia, thank you to all our speakers!

In addition to the adaptations to our regular Wednesday sessions, we noticed the pandemic's shattering impact on networking opportunities for the current generation of students and immediately saw the need for change. To help students connect with industry professionals, our team along with members of the SGA and the SEG Student Committee, have co-organised an interactive virtual half day event, the "Exploration Career Kickstarter", on 27th May, 2021. We look forward to a collaborative event, where SGA and SEG members introduce the benefits of the societies and student peer networks, followed by keynotes from Miguel Arenas (Teck), Lucy Crane (Cornish Lithium) and Susan Lomas (Lions Gate Geological Consulting & Me Too Mining). Speakers and the panel discussion will cover the university to industry transition, challenges and strategies for young geologists, how to market yourself and exploration with a family. Finally, networking rooms will connect the early-career geologists with professionals, in a direct Q&A discussion. With this event, we hope to build a new standard for networking, one accessible to students without high travel costs.

As the stresses and pressures of the pandemic continue to ebb and flow, we should not dismiss the bright screens we carry, for they connect us and science across borders in a way previously never imagined. In a quiet moment, return instead to consider the question of which pandemic adaptations will we keep in the post-pandemic-era? The Ore Deposits Hub team grew up in an evolving digital world, and now we have seen the potential for digital platforms. As we step out of the pandemic, we ask you to consider the positive adaptations and steps towards inclusivity that organisations and individuals have made over the past year. Hardship, stress and grief weigh heavily on all of us, but we should not return to a world as unconnected and non-inclusive as the one we came from. Let's create our new normalcy – a digital age of connections between diverse voices and open science that is full of potential. As a great naturalist once said, "It is not the strongest of the species that survives, nor the most intelligent that survives. It is the one that is most adaptable to change" (C. Darwin).

Reports from the SGA student chapters

SGA chapter	President	E-mail	Foundation
Prague	Štěpán Jaroměřský	jaromers@natur.cuni.cz	2002
Baltic	Krzysztof Foltyn	krzyfoltyn@gmail.com	2009
Siberia	Anna Devyatiyarova	anna13502@gmail.com	2011
Barcelona	Pol Suñer	pol.sunyer@gmail.com	2012
Colombia-Bucaramanga	Fabian Samuel Reyes Santos	samuelrt97@hotmail.com	2012
Nancy	Alix Hauteville	alix.hauteville@etu.univ-lorraine.fr	2013
Peru	Saul Romero Enriquez	presidente.sgastudent.peru@gmail.com	2013
Colombia-Bogota	Daniel Felipe Solano Gil	dfsolanog@unal.edu.co	2015
Laval	Ana Carolina R. Miranda	acrmiranda1@gmail.com	2016
North-West Russia	Evgenyi Eremenko	st013196@student.spbu.ru	2017
Turkey	Fatih Ozbas	fatih.ozbas@istanbul.edu.tr	2017
Black Forest-Alpine	Alannah Brett	alannah.brett@geo.unibe.ch	2017
Brazil	Julia de Souza Pimenta	juliaspim@gmail.com	2018
United Kingdom	Lauren Tuffield	ltuff@bgs.ac.uk	2018
Ivory Coast	Sahy Anthelme Veh	vehsahy@gmail.com	2019
Moscow	Maria Komarova	ivanchenko.marija@gmail.com	2019
Urals	Daria Kiselova	podarenka@mail.ru	2019
La Plata	Morena Pagola	morenapagola@gmail.com	2020
Senegal	Malick Faye	fayepapmalick@gmail.com	2020
UWA-Australia	Anne Brandt Virnes	anne.virnes@research.uwa.edu.au	2021

SGA Student Chapter Peru: PDYM and Second National Meeting

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Due to the spread of Covid-19 in Peru, most activities and events planned for 2020 had to be cancelled. These activities included face-to-face lectures, excursions and the Second National Meeting of the SGA Peru Student Chapter to be held in the city of Cusco. However, to keep the activities of the Student Chapter ongoing and to provide an alternative to face-to-face events, we decided to focus on two central activities for the 2020 period: the Digital Platform of Mineral Deposits (PDYM, in its Spanish acronym) and a virtual version of the Second National Meeting of the SGA Peru Student Chapter.

Digital Platform of Mineral Deposits (PDYM)

The PDYM corresponds to a virtual platform that allows geology students from Spanish-speaking countries that are members of the SGA to access regular conferences on ore deposits. It was conceived as a Spanish equivalent of another SGA-promoted platform: The Ore Deposits Hub. Although PDYM was created in Peru, we have received the collaboration and advice of several international universities. The list of conferences presented can be found in table 1 and on our website: https://www.pdym.org/.

The virtual conferences are carried out via Zoom and have been organized into four blocks:

1. Analytical techniques in exploration geology;
2. Deposits associated with magmatic processes;
3. Deposits associated with magmatic-hydrothermal and hydrothermal processes;
4. Deposits associated with surface processes.

Since March 2020, twenty-three lectures have been presented with an average audience of 60 attendees per talk and 24 more lectures are planned to be presented during 2021.

The lectures are being recorded and are accessible to all SGA members as didactic and teaching support material. However, to protect copyrights, we share them through the Vimeo platform, which allowed us to create a closed channel that can only be accessed by SGA members upon request (to access our Vimeo channel and view the previous talks, please complete the following form: https://www.pdym.org/charlas-anteriores).

Second National Meeting of the SGA Peru Students Chapter

The Second National Meeting of the SGA Peru Student Chapter took place on December 18 and 19, 2020. Unlike the first edition, this year the event was held virtually via Zoom; students from the

Fig. 1 Schedule of the Second National Meeting of the SGA Peru Students Chapter

11 universities that make up the Student Chapter participated.

The Second National Meeting had seven main objectives:

- To present the Society for Geology Applied to Mineral Deposits (SGA) and its Peruvian Student Chapter, including its core objectives, to other students that may be interested in joining us;
- To present our previously established objectives and management direction guidelines and revisit them;
- To promote the participation of students from the different universities that are part of the Student Chapter;
- To encourage leadership based on the experience of leaders of previous councils of our Student Chapter;
- To promote dissemination of technical and/or scientific geological knowledge and to encourage the execution of technical-academic work related to mineral deposits and economic geology by our student members;
- To define the 2021 board of directors of our Student Chapter.

To give an effective response to the proposed objectives, a two-day agenda was established (Fig. 1) directed by the 2020 board of directors and advised by our academic (Dr. Lisard Torró) and industrial (MBA. MSc. Eugenio Ferrari) sponsors. The agenda began with the workshop entitled "SGA Peru Student Chapter: Who are we and where do we go?", followed by the election of the board of directors for 2021. The second day followed with a presentation of the benefits of SGA membership and a round table entitled "Leaders who form leaders" in which three former presidents of the Peruvian Student Chapter and the president of the SGA UIS Student Chapter (Colombia) talked about their experience and challenges faced during their terms of office; the meeting closed with the presentation of technical works by the members of the Peruvian Student Chapter.

Thanks to the active participation of the attendees during the aforementioned activities, it was possible to carry out a fruitful National Meeting, which is called to enhance the growth of the Student Chapter, to strengthen its union and to direct efforts in a satisfactory direction.

SGA News

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http://www.e-sga.org

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Speaker	wTopic	Date
Ph. D. Antoni Camprubí Universidad Nacional Autónoma de México	Fluid inclusions in the study of mineral deposits	04/28/2020
Ph. D. Jean Vallance Pontificia Universidad Católica del Perú, Perú	Hydrothermal alteration	05/05/2020
Ph. D. Esteve Cardellach Universitat Autònoma de Barcelona, España	Stable isotopes	05/12/2020
Ph. D. Massimo Chiaradia Université de Genève, Suiza	Geochronology of mineral deposits	05/19/2020
Ph. D. Mercè Corbella Universitat Autònoma de Barcelona, España	Numerical modelling of mineral deposits	05/26/2020
Ph. D. Leduar Ramayo Quantec Geoscience	Geophysics for explorers. An introduction to geophysical methods applied in mining exploration	06/09/2020
Fis. Juan Casas INGEMMET	GIS and Remote Sensing applied to mineral resources	06/11/2020
MSc. Keller Guerra Exploraciones Antakana Freeport	Geochemical prospection of mineral deposits	06/16/2020
MBA. José Lopes Nexa Resources	Estimation of resources and reserves	06/23/2020
Ph. D. Joaquín A. Proenza Universitat de Barcelona, España	Ophiolitic and stratiform chromite deposit	07/02/2020
Ph. D. Cristina Villanova Universitat de Barcelona, España	Magmatic Ti-Fe-V-P deposits	07/08/2020
Ph. D. Rubén Piña Universidad Complutense de Madrid, España	Orthomagmatic Ni-Cu deposits	07/16/2020
Ph. D. Marc Campeny Museu de Ciències Naturals de Barcelona, España	Deposits associated with carbonatites and alkaline rocks	07/21/2020
Ph. D. Montgarri Castillo-Oliver Macquarie University, Australia	Diamondiferous kimberlites	07/27/2020
Ph. D. José María González Giménez Universidad de Granada, España	Magmatic deposits of Platinum Group Elements	07/31/2020
Ph. D. Sandra Amores Universidad de Granada, España	Deposits associated with granitic pegmatites	08/20/2020
Ph. D. Jean Vallance Pontificia Universidad Católica del Perú, Peru	Tin porphyries and related polymetallic mineralization in Bolivia	09/28/2020
Ph. D. Fernando Tornos Universidad Complutense de Madrid, España	General aspects of magnetite- (apatite) and IOCG systems	09/30/2020
Ph. D. José María González Giménez University of Texas at El Paso, USA	High sulfidation epithermal deposits	10/16/2020
Ph. D. Antoni Camprubí Universidad Nacional Autónoma de México, Mexico	Intermediate and low sulfidation epithermal deposits	10/23/2020
Ph. D. Lisard Torró i Abat Pontificia Universidad Católica del Perú, Peru	Volcanogenic massive sulfide deposits	11/18/2020
Ph. D. William Chávez Escuela de Minas de New Mexico, USA	Porphyry Cu-Mo deposits	12/03/2020
Ph. D. Kierran Maher Escuela de Minas de New Mexico, USA	Skarn deposits	12/08/2020

SGA UK Chapter goes virtual!

Lewis Banks[1*] and Jo Miles[1]

1 British Geological Survey, Nottingham, UK
** lba@bgs.ac.uk*

Due to the inability to meet face-to-face in 2020, the SGA UK Chapter went virtual and have continued to do so into 2021! While we have been unable to continue with our planned in-person events, we have organised a series of virtual workshops allowing people to upgrade their geology knowledge and skills from their own home. Thus far, we have had the pleasure of hosting workshops with AuScope and Micromine, both of which were fascinating and insightful. We are excited for what 2021 brings.

AuScope

The SGA UK Chapter has collaborated with CSIRO to deliver a virtual workshop demonstrating the capability of the AuScope National Virtual Core Library (NVCL). Led by Drs. Carsten Laukamp and Jessica Stromberg from CSIRO, the attendees were introduced to the capabilities of the online database that hosts over 1 million metres of digitised core from around Australia. This includes a range of mineralisation styles and the virtual ability to inspect and characterise core.

We were introduced to hyperspectral data collection, including data interrogation and interpretation over a vast range of scales, from drill-core to space. We explored how hyperspectral data can be used to inform and support ore deposit research and exploration, and case studies were demonstrated from both, green- and brown-field ore deposits. Our hosts fully demonstrated the capability of the NVCL (Fig. 1) and its freely accessible data. Finally, we delved into precious metal, base metal and lithium deposits of differing genesis and chemistry and how the electromagnetic spectrum can be used to help us answer key questions surrounding ore genesis.

AuScope finally encouraged everyone to use the Discovery Portal for their own research and invited future collaboration with any current or future projects. This workshop was recorded and is available to view at the SGA UK Chapter website (www.sgastudent.co.uk).

Further information and access to the portal can be found at www.auscope.org.au/nvcl.

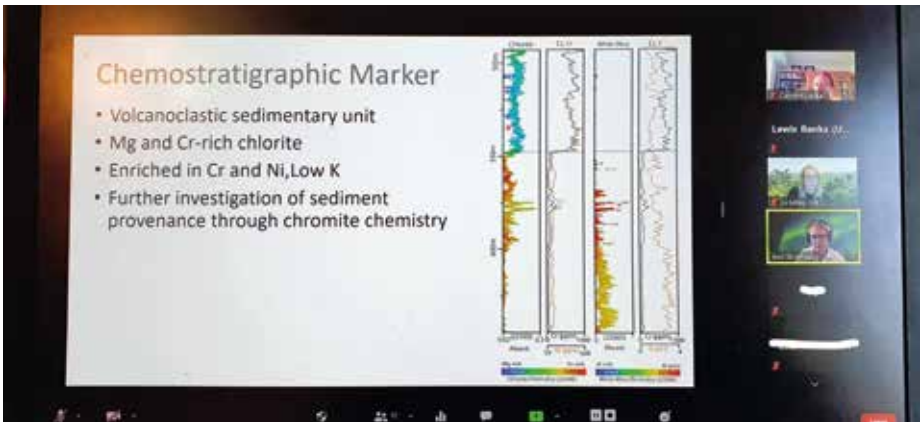

Fig. 1 Dr. Jessica Stromberg talking us through how to utilise NVCL HyLogger Datasets in the AuScope Discovery Portal for ore deposit research and exploration

Micromine

In collaboration with Micromine, the SGA UK Chapter held a 3-day workshop for attendees to learn how to utilise the ubiquitous Micromine software. Micromine is an industry software package that students may come across in their future geology-related careers. The aim was to bring novices and existing users speed up-to-speed with how to use the software and equip them with the skillset to apply their knowledge to their own projects, if they so wish.

Led by Training and Support Consultant Dr. Tom Pratelli, the workshop attendees were familiarised with data importation, manipulation and presentation of exploration data on their own, personal devices. With a focus on drillhole data, Dr. Pratelli showed us modelling techniques for the data in real time, allowing us to learn whilst our host demonstrated its applicability. Dr. Pratelli demonstrated everything from the Visex interface, filtering and form sets, to creating wireframes, importing GIS data and outputting a global reference estimate (Fig. 2).

Micromine was very generous to allow our attendees to obtain two-week personal licences for free, so that all those who registered onto the workshop were able to follow along and ask questions as they went. The two-week licences also meant that attendees could then take that they had learnt and apply it to their own studies in their own time. All those in attendance were issued a certificate of completion from Micromine.

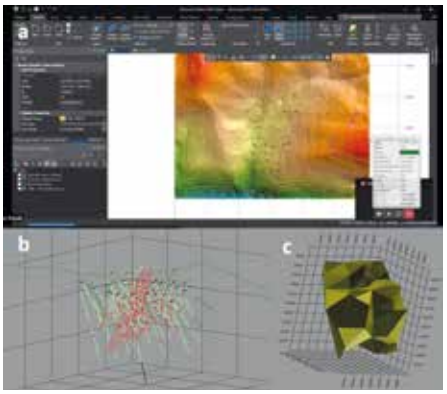

Fig. 2 a) Using and interacting with the Micromine Visex visualisation window. b) Visualising exploration drillhole data by lithology and its interaction with fault structures in the deposit. c) Midway through visualising the ore body

The future!

We have more virtual workshops planned for 2021, as well as hopefully being able to put on our in-person events that we have had to postpone. Please keep an eye out on our website, Twitter (@uk_sga) or Facebook pages for announcements!

Acknowledgements

We would like to thank Dr. Tom Pratelli at Micromine, and Drs. Jessica Stromberg and Carsten Laukamp at AuScope for both, their time and effort in making these virtual workshops as brilliant as they were. We would also like to thank both organisations for providing their time, resources and expertise.

Looking for ghosts in the West Australian Outback

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While Australia is well-covered in terms of SEG student chapters, we identified significant vacuum with respect to the SGA equivalent. So, at the end of January 2021 we were happy to announce the birth of a new SEG-SGA student chapter at the University of Western Australia (UWA). Apart from being the first SGA student chapter in Australia, we are in fact also the first to enter the territory of Australasia. We are building upon the knowledge and connections of the existing SEG student chapter here at UWA, creating a world-wide connective hub for students and researchers to engage and generate excellence. Our chapter is comprised of 20, mainly PhD-level members, hailing from 12 different countries. At the end of February, we advertised our student chapter at the UWA Club Carnival (Fig. 1), a day, where all the university clubs can advertise their club activities and recruit new members. It was a successful day with two new members joining our chapter. In the beginning of March, we held our first sundowner and BBQ together with Woolnough Society, the geology undergraduate student club of UWA, to welcome new members and to get to know one another.

Fig. 1 The 2021 SEG-SGA-UWA executive committee advertising our chapter activities during the UWA Club Carnival. From left to right: Sumail (Vice-president), Anne Brandt Virnes (President), Maria Cherdantseva (Secretary) and Ravi Schreefel (Treasurer). Photo by Sumail

On Saturday the 6th of March, we ran our first short fieldtrip to the Toodyay Phantom Quartz locality, located in the Shire of Toodyay, ~100 km NE from Perth, Western Australia. Led by Dr. Kailah Thorn of the Edward de Courcy Clarke Earth Science Museum and SEG-SGA's own Sean

Fig. 2 Group photo of SEG-SGA and Woolnough students (not all present in the photo) together with Prof. Tony Kemp and daughter Genevieve (right). Photo by Dr. Kailah Thorn

Fig. 3 The hunt for the most perfect, transparent, terminated and phantom-bearing quartz grain is on. Photo by Maria Cherdantseva

Fig. 4 Example of transparent, almost inclusion-free, euhedral and terminated quartz with green-grey phantoms. Photo by Dr Kailah Thorn

Fig. 5 Genevieve Kemp, aided by her father, Prof. Tony Kemp, judged the contenders for best phantom quartz crystal. Photo by Maria Cherdantseva

Standen, 25 students from both, SEG-SGA and Woolnough Society set out for a day of hunting for the most perfect phantom quartz crystal (Figs. 2 and 3). On a hill top approximately 300 meters WSW of the Pelham Lookout in Toodyay is a locality of beautifully transparent, colourless, euhedral and terminated quartz grains, some of which contain an earlier, green-grey quartz crystal, a so-called "phantom" (Fig. 4). Some grains show multiple stages of crystal growth evidenced by up to five phantom crystals within one grain. Free grains, washed clean by recent rain, could be found in the topsoil, whereas rocks with aggregates of open-space growing grains could be found digging towards the bedrock. The source of the phantom quartz crystals is yet unknown and to date no research has been conducted to reveal, how they formed. However, the group speculated that they formed from hydrothermal fluids, possibly related to pegmatites, interacting with quartzites. Aided by her father, Genevieve Kemp (10-year-old) acted as judge in the competition for the title of best phantom quartz crystal at the end of the day (Fig. 5).

In spite of the current pandemic, Western Australia has been doing well in terms of keeping COVID-19 out of the state. Therefore, we have been able to plan several activities during 2021, which can be carried out within the state. A highlight of the year will be a week-long fieldtrip in July or August to several significant geological sites in WA, including the Murchison River Gorges and Jack Hills, the latter being the site of the oldest zircons known on Earth (e.g. Froude et al., 1983; Kemp et al., 2010) and the oldest rocks in Australia (3.75 Ga). We also plan to visit the historical Poona emerald mine as well as active gold mines around Mount Magnet. Our fieldtrip will be joined by professors Tony Kemp and Marco Fiorentini, who will hopefully (!) impart lots of interesting geological knowledge. We would like to thank both SGA and SEG for support to carry out our activities. Stay tuned for our fieldtrip report later this year.

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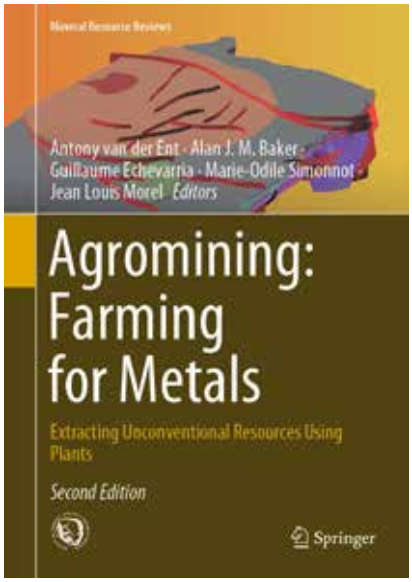
Kemp AIS, Wilde SA, Hawkesworth CJ, Coath CD, Nemchin A, Pidgeon RT, Vervoort JD, DuFrane SA (2010) Hadean crustal evolution revisited: New constraints from Pb–Hf isotope systematics of the Jack Hills zircons. Earth and Planetary Science Letters 296:45-56. doi: https://doi.org/10.1016/j.epsl.2010.04.043.



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This second and expanded edition of the first book on agromining (phytomining) presents a comprehensive overview of the metal farming & recovery of the agromining production chain. Agromining is an emerging technology that aims to transform the extraction of sources of target elements not accessible by traditional mining and processing techniques. Agromining, which is based on sustainable development, uses hyperaccumulator plants as 'metal crops'farmed on sub-economic soils or minerals wastes to obtain valuable target elements.This volume is edited and authored by the pioneers in the rapidly expanding field of agromining and presents the latest insights and developments in the field. This book provides in-depth information on the global distribution and ecology of hyperaccumulator plants, their biogeochemical pathways, the influence of rhizosphere microbes, the physiology and molecular biology of hyperaccumulation, as well as aspects of propagation and conservation of these unusual plants. It describes the agronomy of metal crops and opportunities for incorporating agromining into rehabilitation and mine closure, including test cases for agromining of nickel, cobalt, manganese, arsenic, selenium, cadmium, zinc, thallium, rare earth elements and platinum group elements. Since the first edition was published, there have successful nickel agromining field trials in the tropics (in Malaysia and Guatemala), and these are presented in a dedicated case study chapter. Other new chapters focus on the processing of bio-ore for elements other than nickel, such as rare earth elements and cadmium, and on agromining from industrial wastes such as tailings, and industrial by-products and sites.

Guide to authors for the SGA News

Jochen Kolb; chief editor SGA News

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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 (10-point Times) 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=pltci_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 at a resolution of 300 dpi. 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.

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).

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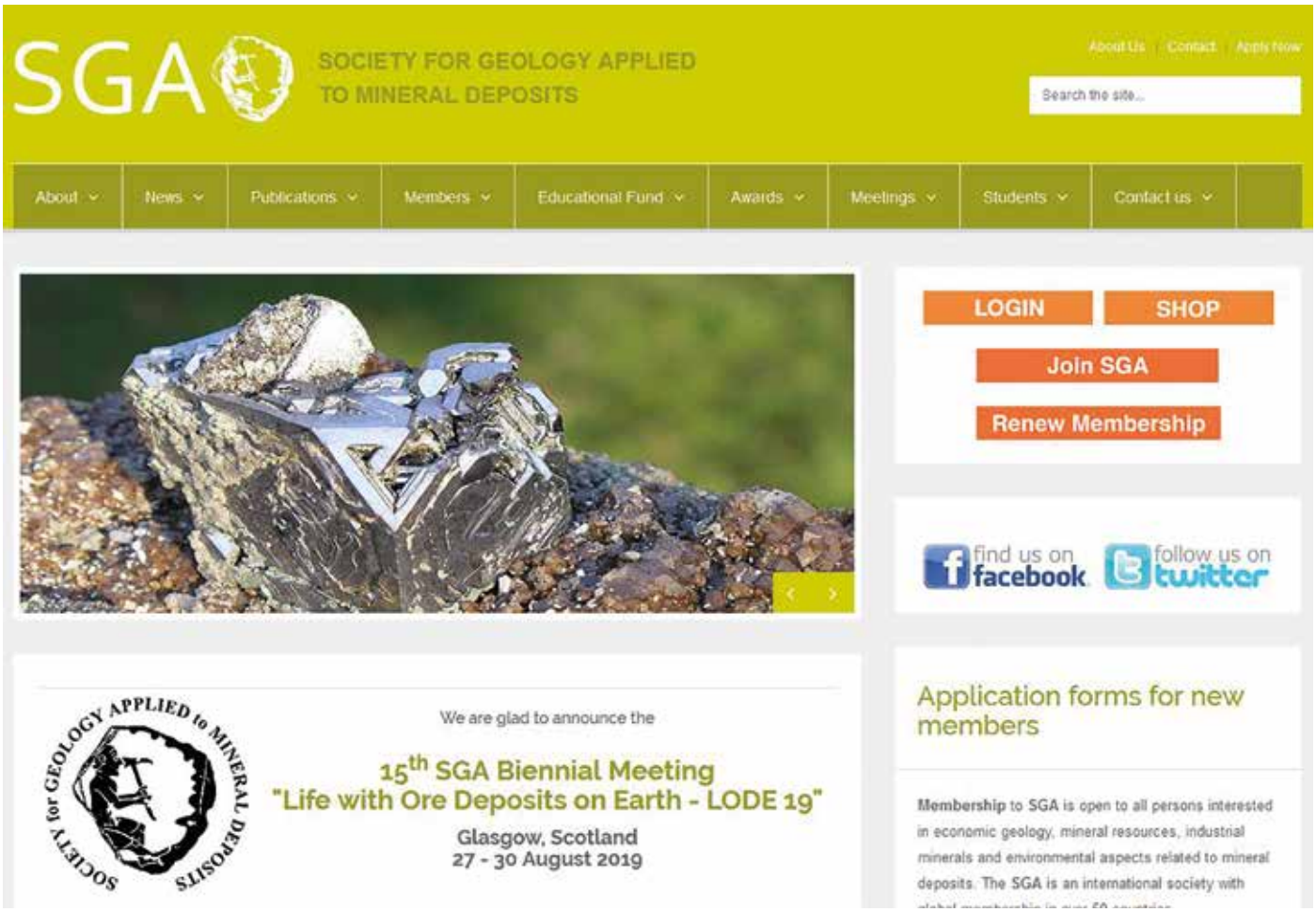

SGA
Society for Geology Applied to Mineral Deposits

New Members from December 01, 2020 until March 10, 2021

45 Student and 3 Regular Members applied for membership from December 01, 2020 until March 10, 2021.

Student members 45:
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Ethiopia 1
France 8
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Namibia 1
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Russia 3
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Sweden 2
Switzerland 1
United Kingdom 6

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Chile 1

International Association on the Genesis of Ore Deposits

16th Quadrennial Symposium

14th - 18th August, 2022

DUBLIN 2022

International Association on the Genesis of Ore Deposits

16th Quadrennial Symposium

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From Discovery to Recovery: Innovations in Resource Development for a Critical Future

- Highlighting innovations in exploration, mining and metallurgy.
- Research developments in the refinement of ore deposit models.
- State of the art techniques for the characterization of Raw Materials

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www.iagod.org **Convention Centre Dublin – August 14th – 18th 2022**

16TH BIENNIAL MEETING

SGA 2022

THE CRITICAL ROLE OF MINERALS IN THE CARBON-NEUTRAL FUTURE

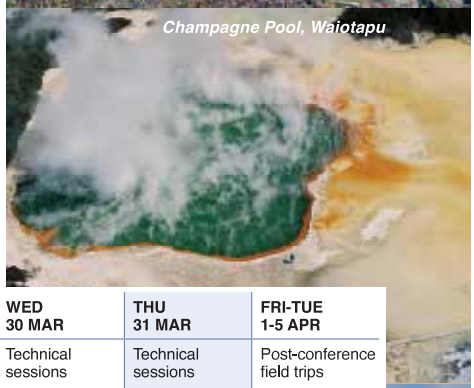
Invitation

Welcome to the 16th Biennial Meeting of the Society for Geology Applied to Mineral Deposits (SGA) which will take place 28-31 March 2022 in Rotorua, New Zealand (www.rotoruanz.com).

With a population of 68,000, Rotorua is a thriving city with an economy focused around tourism, retailing, forestry and manufacturing. It is often referred to as the 'Lake District' because of the number of fishable lakes within its boundaries. Rotorua was historically New Zealand's first tourism destination, because of thermal features such as the Pink and White Terraces (destroyed in the 1886 Tarawera eruption).

Rotorua is the heartland of Māori culture, with Māori making up approximately 35% of the population in the Rotorua district. SGA delegates will have the opportunity to experience the warm spirit of Māori culture with a traditional Māori pōwhiri (welcome), concert and hangi (food cooked in an earth oven).


Rotorua Caldera


Champagne Pool, Waiotapu

Meeting Venue

The conference venue is the Rotorua Energy Events Centre located on the steamy edge of Lake Rotorua, in the immaculately manicured and picturesque Government Gardens. The cities major hotels and central business district lie just a few minutes walk away and the venue is only a 15 minute taxi ride from the airport. The centre has extensive free car parking.

Programme

The meeting will feature presentations on topics related to mineral deposit research, exploration, sustainable development and environmental and social performance aspects related to mineral deposits. The oral and poster presentation sessions, and pre- and post-conference short courses and field trips provide a comprehensive programme.

	WED-SAT 16-26 MAR	SAT 26 MAR	SUN 27 MAR	MON 28 MAR	TUE 29 MAR	WED 30 MAR	THU 31 MAR	FRI-TUE 1-5 APR
Day	Pre-conference field trips Saturday workshops	Pre-conference field trips Workshops	Workshops Registration begins 3 pm	Technical sessions Exhibition	Technical sessions Exhibition	Technical sessions Exhibition	Technical sessions Exhibition	Post-conference field trips Friday-Saturday workshops
Evening			Welcome Function	Industry/ Students Function	Three optional social events	Gala Dinner	Farewell Dinner	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Champagne Pool at Waiotapu with Artists Palate sinter (left) and Au-bearing orange precipitate (right)

SHORT COURSES AND WORKSHOPS

PRE-CONFERENCE

Predictive geometallurgy - 1-day (26 March), presented by Jens Gutzmer, Lucas Pereira, Max Frenzel, and Raimon Tolosana Delgado (Helmholtz Institute Freiberg for Resource Technology)

Exploration geochemistry: applying the fundamentals (AAG) - 1-day (27 March), presented by David Cohen (University of NSW) and Dennis Arne (Telemark Consultants)

Advances in the science of and exploration for magmatic Ni-Cu-PGE-Au-Te deposits: from the classic to the unconventional - 2-days (26-27 March), presented by David Holwell (University of Leicester), Marco Fiorentini (UWA), Daryl Blanks (University of Leicester) and Joshua Chong (UWA)

Fundamentals of spectral reflectance for mineral exploration and mining - 2-days (26-27 March), presented by Jonathan Cloutier and Lejun Zhang (CODES, UTas), and Jessica Stromberg and Carsten Laukamp (CSIRO)

Porphyry Cu-Ag deposits - 2-days (26-27 March), presented by David Cooke (UTas)

Structural interpretation of geophysical data - 2-days (26-27 March), presented by Lyal Harris (INRS-ETE)

POST CONFERENCE

Geology, genesis and exploration of epithermal ore deposits - 1-day (1 April), presented by Stuart Simmons (Hot Solutions)

An introduction to machine learning and multivariate data analysis - 1-day (1 April), presented by Michael Gazley (RSCMME), Shawn Hood (GoldSpot) and Matt Cracknell (UTas)

Structural geology of orogenic gold deposits: primary and secondary controls on ore distribution in deposits and districts - 2-days (1-2 April), presented by Stephen Cox (Australian National University) and David Rhys (Panterra Geoservices)

Enhancement and structural interpretation of geophysical data at the prospect to lithospheric scale: applications to mineral exploration - 2-days (1-2 April), presented by Lyal Harris (Institut National de la Recherche Scientifique - Eau Terre Environnement, Québec)

Fusing geochemistry and structure in 3D for best practice exploration, mining and research geology - 2-days (1-2 April), presented by Nick Oliver (HCOVGlobal Consultants and James Cook University) and Dale Sims (Dale Sims Consulting)

TECHNICAL PROGRAMME AND ABSTRACT SUBMISSION

During the four-day technical programme there will be plenary sessions, up to four streams of concurrent sessions, and separate poster sessions.

The main theme for the conference is *The Critical Role of Minerals in the Carbon Neutral Future* and Abstract submissions are encouraged on this and other topics related to mineral deposit research, exploration, sustainable development and environmental and social aspects related to mineral deposits.

Concurrent session topics are listed at https://confer.eventsair.com/sga2022/technical-programme. Abstracts for consideration for inclusion in the technical programme and publication in the conference proceedings volume must be submitted by 13 September 2021. There is a choice of submitting either an Abstract (max 300 words) or a Short Paper (Max 4 pages, including an abstract of max 200 words). Information on the submission process, document formatting and templates are provided at https://confer.eventsair.com/sga2022/call-for-abstracts

TRADE EXHIBITION

The Trade Exhibition provides a forum for companies and organisations to exhibit their products and services. It is open throughout the conference and is the venue for lunches, morning and afternoon tea/coffee, and some evening functions.

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Mt Tarawera


Southern Alps

FIELD TRIPS

NEW ZEALAND

Orogenic and placer gold deposits of the South Island – 7-day, pre-conference (19-25 March) field trip providing an overview of the geological setting and visits to gold deposits, including the Macraes gold mine which has produced >5 Moz Au since 1990.

Volcanic features of the Taupo Volcanic Zone – 2-day, pre-conference (26-27 March) tour of andesite stratovolcanoes and rhyolite domes, calderas and ignimbrite deposits.

Volcanic features of the Rotorua area – 1-day, post conference (1 April) tour viewing rhyolite domes, calderas and ignimbrite deposits.

Epithermal environments of the North Island – 5-day, post conference (2-6 April) field trip visiting active volcanoes and geothermal systems of the Taupo Volcanic Zone and epithermal Au-Ag deposits in the Coromandel Peninsula, Hauraki Goldfield.

AUSTRALIA

Arc-and orogenic-associated mineral systems in Victoria – 5-day, pre-conference (21-25 March) field trip visiting porphyry-style and world-class orogenic gold deposits, including underground mine tours of selected orogenic gold deposits (e.g. Fosterville, Stawell, and Costerfield).

Metallogenic evolution of the Yilgarn Craton, Western Australia – 7-day, pre-conference (19-25 March) field trip visiting classic geological localities of both nickel and gold deposits showcasing the deposit style diversity and focusing on mineral system formation from regional to deposit scales.

VHMS and Sn deposits of Western Tasmania: from exploration to remediation – 5-day, post conference (2-6 April) field trip visiting several Cambrian VHMS and Devonian granite-related deposits (e.g. Hellyer, Mt Lyell, Henty and Rosebery-Hercules VHMS, Renison Sn and Kara Fe-W skarn).

INDONESIA

Porphyry and epithermal systems of the Sunda-Banda Arc – 8-day, pre-conference (18-25 March) field trip examining the geology and mineralisation that characterise the Sunda-Banda arc. It includes site visits to porphyry Cu-Au and high-sulphidation epithermal gold deposits, modern hydrothermal systems on an active volcano (Mt Ijen), and exploration projects on Lombok and Sumbawa.

NEW CALEDONIA

Geology, and Ni and Cr deposits of New Caledonia – 10-day, pre-conference (16-26 March) field trip visiting outcrops of the main tectonostratigraphic units of the island's geology, and active nickel and chromite mines. The tropical island scenery and French colonial features make this tour highly suitable for accompanying persons.

STUDENTS

Students are invited to attend and encouraged to submit abstracts and present their research results at the 16th SGA Biennial Meeting which offers a great opportunity for them to interact with leading scientists, other young researchers and the industry in an informal environment. Incentives include discounts, prizes and opportunity to apply for travel grants.

ACCOMPANYING PERSONS PROGRAMME

Sunday - Government Gardens, Rotorua Museum, Te Puia Māori cultural centre and Whakarewarewa Māori village

Monday – Rotorua amphibious Duck tour and Skyline gondola and café

Tuesday – Orakei Korako thermal park and Huka Falls cruise

Wednesday - Hobbiton movie set, Mills Reef winery and Mount Maunganui and beach

Thursday - Lake Rotorua cruise, Mokoia Island, Wingspan Birds of Prey and Redwoods treewalk

KEY DATES

1 September 2021
Online registration open

13 September 2021
Deadline for abstract submission

15 December 2021
Deadline for early bird registration

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SGA

Society for Geology Applied to Mineral Deposits (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! -

Last name*	
First name*	
Title	
Postal address*	
Phone	
e-mail*	
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 30th** will be processed for the current year. **From October 1st** 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.

Please note that bank charges will not be covered by SGA.

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