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Potential of phosphate deposits in Europe

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Interest for P and by-products in Europe

Phosphorus is an element that is essential for living plants and animals. It is mostly found as apatite sensu lato, which occurs mainly in sedimentary marine phosphorite. It is principally used to produce fertilizers (82% of the production), and is therefore particularly needed to satisfy the growing demand for food related to the growth of the world population. An increase in the phosphorus demand of about 2% per year is expected in the global market (EC 2015).

Most of the phosphorus (80%) is exploited from sedimentary phosphate deposits in North Africa, China, the Middle East, South Africa, the USA and Russia. Reserves are above 1,300,000 Mt for each of these countries, reaching 50,000,000 for the Moroccan deposits (EC 2015). Other phosphorite deposits of potentially economic interest occur on the continental shelf of the Atlantic, Pacific and Indian Oceans (Cook and Shergold 1986; Burnett and Riggs 1990; Valsangkar 2001). Igneous apatite deposits constitute another source of phosphorus, with major deposits being exploited in Finland, Russia, South-Africa, and Brazil (EC 2015).

Phosphate deposits and occurrences are widely distributed in Europe (Fig 1). Their ages vary from the Archean to the Pleistocene. However, Finland is the only country where phosphate rocks are notably produced (869,694 tonnes in 2011; Brown et al. 2013). Consequently, the EU is a net importer of natural phosphates, with an average of 4,000,000 tonnes of natural phosphate-rich material imported per year (EC 2015). In 2014, phosphate rock was added to the list of critical raw materials (CRMs) for the EU (EC 2014). Some of the CRMs represent key elements for the technological progress; in particular, in what concerns the production of carbon-free energy through wind turbines, solar panels, electric vehicles, and other industrial applications (EC 2015). With the CRMs list, the EU policy aims, among others, (1) to ensure European industrial competitiveness through a fair and sustainable supply of raw materials from global markets (EC 2014), and (2) to encourage the domestic production of these raw materials and new mining activities in the EU (EC 2016).

In addition to phosphorus, other CRMs can be recovered from phosphate deposits, such as rare earth elements (REEs) and fluorspar (the commercial name of fluorite). The EU is indeed a significant importer of compounds, metals and alloys of REEs

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MAIN FEATURES

An invitation: 14th Biennial SGA Meeting, Québec City, 20–23 August 2017.

The 14th Biennial SGA Meeting will be held in Québec City, Canada, August 20–23, 2017. The SGA Québec 2017 Organizing Committee cordially invites you to to participate to the first SGA Biennial Meeting to be held in North America and to contribute to an outstanding scientific program with several symposia and special sessions linked with short courses and field trips to famous mineral districts, from Northern Québec to Guiana. The scientific program covers cutting-edge research on major deposit types, large scale geological processes, high precision analytical techniques, the role of governmental geosciences organization in supporting exploration, and societal aspects of mineral resource development. This is a special year as we are celebrating the 175th anniversary of the Geological Survey of Canada, and the 150th anniversary of the foundation of Canada, in 2017.
The up-to-date information about the meeting can be found on our website: www.SGA2017.ca. For any question, please contact us at: info@sga2017.ca
The conference is jointly organized by Université Laval, the Geological Survey of Canada, the Ministère de l'Énergie et des Ressources naturelles du Québec, the Institut national de la Recherche scientifique Centre Eau Terre Environnement, the DIVEX network and Tourisme Québec. It will take place at the Québec City Convention Centre, one of Canada's top convention destinations, in the heart of the oldest city of North America.

About Québec City

Overlooking the St. Lawrence River from the top of Cap Diamant, Québec City will charm you with its lifestyle, its history and its diversified cuisine. Since 1985, the Old Québec's historical district has been on UNESCO's World Heritage List.
Cradle of French civilization in North America, the city was founded over four centuries ago and is today a busy seaport, an important center of services and research, a leading cultural city and, of course, the capital of Québec. It is also one of the safest cities in America. Nearby cafes, restaurants, parks and attractions are all yours to discover. We invite you to learn more about Québec at www.quebecregion.com.

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Registration

The registration is opened since January 15, 2017.

	Early Bird ($CAD) (Before May 15 2017)	Regular ($CAD)
SGA & EAG member	675 $	750 $
Non member	825 $	900 $
Student SGA & EAG member	275 $	350 $
Student non member	350 $	425 $

Important dates

January 15, 2017: Conference Paper (extended abstract) submission and registration
February 28, 2017: Deadline for Conference Paper (extended abstract) submission
February 28, 2017: Deadline for student grant and free fieldtrip / short course application
April 1, 2017: Conference Paper (extended abstract) revision notice
April 15, 2017: Final revised Conference Paper submission (extended abstract)
April 30, 2017: Final acceptance of Conference Paper (extended abstract)
May 15, 2017: Deadline for early-bird registration

Program

SGA Québec 2017 will unfold its detailed schedule for the various sessions, symposia, field trips and workshops in the coming months. We nonetheless have a preliminary menu to offer as an appetizer.

Conference Papers (extended abstracts) Submission

Conference Papers are submitted ONLINE only on the conference website at SGA2017.ca. Abstracts must be prepared using the SGA Québec 2017 template and must follow presentation guidelines. Abstract submissions will be received from January 15 to February 28, 2017. Authors will be informed of acceptance before April 30, 2017.

Symposia

Gold through time and space – SY01 – Benoît Dubé (Geological Survey of Canada); Richard Goldfarb (Colorado School of Mines), Robert Moritz (University of Geneva); Patrick Mercier-Langevin (Geological Survey of Canada)
Throughout Earth's history, major gold-forming events were highly episodic in response to evolving tectonic settings and metallogenic processes, resulting in an uneven endowment in both time and space. This symposium welcomes innovative contributions related to the distribution and formation of gold deposits irrelevant to types, settings, crustal levels, ages and genetic models. Considered presentations may include case studies, broader thematic and conceptual overviews as well as geological and exploration models. The spectrum of deposit types and settings covered through this symposium should provide the audience with an overview of the current understanding and future directions in research and exploration for gold deposits, including ideas on how to better target more prospective/better endowed areas. The symposium will feature a mixture of oral and poster presentations and include a number of keynote presentations.

Magmatic sulfide and oxide ore deposits in mafic and ultramafic rocks – a symposium in memoriam of the work and life of Prof. Hazel Prichard – SY02 – Sarah-Jane Barnes (Université du Québec à Chicoutimi); Michel Houlé (Geological Survey of Canada); Michael Lesher (Laurentian University); James Mungall (University of Toronto)
Mafic and ultramafic rocks contain much of the World's nickel, platinum-group elements, chrome, vanadium, titanium and phosphorus in the form of layers, pipes or lenses enriched in sulfides, chromite or Fe-oxides hosted by mafic and ultramafic rocks. This symposium welcome submissions: on all aspects of how these deposits form; on whether there is evolution with of the types of deposits with geological setting or time; on new exploration methods for these types of deposits and on how these deposits can be exploited. The symposium will feature a mixture of oral and poster presentations and include a number of keynote presentations.

IOCG-IOA ore systems and their magmatic-hydrothermal continuum: A family reunion? – SY03 – Louise Corriveau (Geological Survey of Canada); Hamid Mumin (Bradon University); Fernando Tornos (Centro de Astrobiologia, CSIC-INTA)
This symposium aims at highlighting our current understanding of IOCG-IOA deposits. It also aims at providing an opportunity to discuss major knowledge gaps and controversial ideas on the footprints, genesis and potential linkages amongst iron oxide-apatite and IOCG deposits, their variants, and certain skarns, porphyry deposits, albitite-hosted uranium or gold and other deposits associated with iron oxide and alkali alteration. Topics such as the critical conditions for ore genesis and linkages between IOCG and other deposits that are associated to IOCG in time and space will be put forward. Addressing these broad topics will provide a solid overview of these systems and trigger discussion on metal and fluid sources, transport and deposition mechanisms, and on the role and effects of deformation, metamorphism and metasomatism. The challenge is to provide a foundation for future breakthroughs and discoveries that will contribute to improve our understanding of these systems at various scales, and therefore help to solve some key questions that surround this enigmatic class of deposits, including those located in high-grade metamorphic terrains. Another objective of this symposium is to demonstrate how this knowledge can be used in exploration.

Critical and precious metal deposits: theory, experiment and nature – a symposium to recognize the work of A.E. Williams-Jones – SY04 – Iain Samson (University of Windsor); Robert Linnen (University of Western Ontario); Stefano Salvi (University of Toulouse)
This symposium is being convened to recognize and celebrate the contributions of Dr. A.E. (Willy) Williams-Jones to economic geology and geochemistry. Willy's research has had a significant impact on our understanding of a wide range of mineralizing processes and mineral deposit types. His contributions have been diverse, ranging from experimental, through theoretical, to field-based studies. We therefore invite presentations on the geochemistry of mineralizing processes, particularly those that integrate field, experimental or theoretical approaches to develop mineral deposit models.

Sessions

Geology, geodynamics and metallogeny of the Rhyacian (2.35 – 2.05 Ga) – S01 – Marc Bardoux (Barrick Gold Corporation); Richard Ernst (Carleton University)
The Rhyacian (2300–2050Ma) is a unique geological and metalliferous era. Following a first "Snowball" effect, the terrestrial atmosphere and hydrosphere were oxidizing (erosion and oxidation of sulphides) while fragments of the earlier supercontinent Kenorland converged and a rich biosphere developed on continental margins. The longest LIP cycle (7 stages) started forming on the periphery of Superia and Baltica cratons while gigantic clastic sedimentary sequences were filling basins on the margins of other Archean cratons. At the end of this era, very large gold systems (West Africa, Guiana) formed in the sedimentary basins by tectonic inversions while intracontinental, short-lived plume activity created the Bushveld complex (LIPs) and exceptional volumes of Ni-Cu-PGE mineralization. After a big freeze on surface, planet Earth was lithospherically very dynamic in the Rhyacian. We invite innovative papers that will address: 1) milestones of the geological history and geodynamics of the Rhyacian, as well as 2) papers that will specifically address its Au and Ni-Cu-PGE endowment in the perspective of its geological history on a global scale.

Ore-forming magmatic-hydrothermal processes along active margins – S02 – David R. Cooke (University of Tasmania – CODES); Thomas Bissig (University of British Columbia – MDRU)
Porphyry and associated epithermal deposits form by magmatic-hydrothermal processes and are normally emplaced near active plate margins. The latter include a variety of settings including accretionary orogens, island and continental arcs, each with its own combination of magmatic-hydrothermal deposit types. Back-arc or post-orogenic extensional settings may also host porphyry or epithermal deposits, many of which have a distinct alkalic flavour. In this session we seek contributions that describe porphyry and related deposits from a variety of tectonic settings and discuss ore forming processes, from the generation of fertile magmas through to emplacement of Cu (-Au, Mo, Ag) mineralization in the shallow crust. We also invite contributions on how the evolution of the tectonic setting after mineralisation led to preservation of ancient deposits. We particularly welcome papers that put the various porphyry deposit types into their tectonic context.

Exhalative mineral deposits: key controls on the quality (size and/or grade) of deposits and districts – S03 – Steve Piercey (Memorial University); Sarah Gleeson (Helmholtz Center, Postdam)
Ores in sedimentary and volcanic basins (e.g., VMS, SEDEX, Fe, sediment-hosted Cu) provide critical sources of base and precious metals globally. This session will examine controls on the quality of deposits and the various processes that influence size and grade, ranging from cratonic scale to nano-scale. Presentations that range from field-based through to microanalytical studies in areas such as (but not limited to): crustal and basin architecture, magmatism, structure and tectonics, fluid and metal sources, emplacement and depositional mechanisms, paleoceanography and basin redox, and models and modeling of ore forming processes, are encouraged.

Uranium deposits: from source to ore – S04 – Eric Potter (Geological Survey of Canada); Julien Mercadier (CNRS, Laboratoire GeoRessources)
As exploration shifts to greater depths and geological environments hosting economic uranium deposits evolve, new knowledge and tools are required to recognize the distal expressions of these systems and vector to ore. At the deposit scale, several key factors remain contentious and new research directions and ideas are needed to properly tackle these questions. Addressing these issues, this session is dedicated to uranium ore deposits research, from the recognition of fertile geological terranes and fluid pathways to ore genesis and preservation. Consequently, this session aims to cover a large variety of techniques, methods, models and concepts that will allow better targeting and understanding of uranium deposits. All contributions and topics are welcome, from km-scale geophysical or geochemical data to μm-scale in situ isotopic measurements.

Iron ore – deposit to global scale processes – S05 – James Conliffe (Geological Survey of Newfoundland and Labrador); Steffen Hagemann (University of Western Australia); Kurt Konhauser (University of Alberta)
Sedimentary iron formations are common in Archean and Paleoproterozoic sedimentary successions, and are host to > 90% of the world's economic iron ore deposits. In addition to their economic importance, sedimentary iron formations can provide information on the co-evolution of life and the surface environment on the early Earth. This session will deal with the sedimentology, stratigraphy and geochemistry of primary iron formations, implications for our understanding of the redox changes affecting the Archean and Paleoproterozoic atmosphere-hydrosphere-biosphere, and current perspectives on the formation of high-grade hypogene and supergene (> 55% Fe) iron ore deposits and districts.

The impact of the supercontinent cycle on ore formation – S06 – David Huston (Geoscience Australia); Bruce Eglington (University of Saskatchewan); Sally Pehrsson (Geological Survey of Canada)
It has been well documented for at least 30 years that the abundance certain types of ore deposits has waxed and waned throughout Earth's history. This periodicity is currently thought to be related to three processes of change: (1) irreversible changes of the Earth's atmosphere and hydrosphere, (2) irreversible changes to tectonic processes, and (3) episodic changes in geodynamic processes related to the assembly and break-up of supercontinents. The third process, which has been termed the supercontinent cycle, has an important control on the formation and preservation of a range of mineral deposit types, including volcanic-hosted massive sulphide deposits, orogenic gold and pegmatite deposits, amongst others. With recent greatly improved models for supercontinent formation back to the early Paleoproterozoic, the influence of the tectonic style of assembly on deposit abundance is also being recognized.

This session investigates the influence of supercontinent cycle and secular changes in tectonic style on not only the secular distribution of deposits, but also their characteristics and how changes in these characteristics may influence exploration.

Developments of geochronological methods and their application to date ore forming events – S07 – Fernando Corfu (University of Oslo); Bill Davis (Geological Survey of Canada); Robert Creaser (University of Alberta); Christopher Lawley (Geological Survey of Canada)
Geochronology is undergoing a steady progress due to technical improvements in instrumentation, analytical protocols and methodological refinements of the existing isotopic methods. Rapid, micro-analytical advances allow dating of complex mineral paragenesis at unprecedented resolution and provide part of the basis for linking mineral textures at the thin section scale to entire mineral systems. In the past decade the U-Pb system has been enriched by the addition of new generations of instruments and by refined techniques which have increased both the spatial resolution and time resolution. Argon remains of critical importance in evaluating the timing of alteration and mineralizing processes and Re-Os has consolidated its leading role in direct dating of sulfides as well as studying the development of petroleum systems. Other methods are undergoing a revival or offer great potential for the study of specific ore systems, for example Rb-Sr, U-Th-He, Lu-Hf. The session will showcase the advancements in these various fields highlighting the technical progresses, but focusing principally on novel applications to the ore genesis theme.

From fertility to footprints: New vectoring tools for mineral exploration – S08 – Alan Galley (Consultant); Jamie Wilkinson (Natural History Museum and Imperial College); Alan King (Consultant)
More effective mineral exploration in deep, remote and/or surficial covered environments requires a scalable approach that can recognize prospective terranes and belts, and the extended footprint of various types of ore systems in both bedrock and covered areas. Once these have been identified, the ability to better target the mineralized core to these systems must be developed. This requires a much more integrated roadmap in the use of both conventional and unconventional exploration tools. This session will endeavour to present international examples focused on achieving these objective.

Geometallurgy: risk reduction through communication, optimization and innovation – S09 – Sylvie Lévesque (COREM); Jean-François Wilhemy (COREM); Éric Pirard (Université de Liège); Julie Ann Hunt (Université de Liège)
Anticipating and managing inherent ore variability in mining operations and processing plants constitutes a challenge that requires the participation of all disciplines involved in the mining value chain. The level of communication between members of this chain is increasing and is leading to the development of new tools and methodologies that improve the level of ore characterisation and understanding of orebodies subtleties, particularly with respect to geometallurgical and processing domains. This session aims at providing the opportunity for all of those involved in the mining value chain (i.e. geologists, metallurgists, mining engineers, environmental engineers, analysts, etc.) to learn about advances and best practices in geometallurgy. Papers dealing with the geometallurgical characterization of ore deposits are welcomed, particularly those that present case studies and geometallurgical applications of new tools, techniques and technologies.

GSC@175: How can government promote exploration success? – S10 – David Huston (Geoscience Australia); Karen Kelley (United States Geological Survey); Patrick Mercier-Langevin (Geological Survey of Canada)
Academic institutions have long been known to play an important role in the development and refinement of models that have been used by the minerals (and petroleum) exploration industry to discover ore deposits. However, less well known is the role of government in exploration. Data and ideas provided by government agencies have played a key role in the discovery of many ore deposits, including major deposits such as Olympic Dam, Red Dog, and Lihir. This session draws together geoscientists from a range of Federal and State/Provincial government agencies to showcase the diverse approaches of these organizations to promote and assist exploration. The purpose of the session is to expose explorationists and academics to the different types of information available from government agencies and to gain feedback from industry and academia as to which approaches are most effective.

Resources development and perception / acceptability: The role of geosciences – S11 – Michel Malo (INRS, Centre Eau Terre Environnement); Michel Jébrak (Université du Québec à Montréal); Yann Gunzburger (Écoles des Mines de Nancy)
Mining development has become an increasingly major source of preoccupation in our society for the last few decades. Thus, the nature of the interactions between developers and the public in general has changed dramatically, more particularly over the past few years. Geoscientists, and perhaps more specifically exploration geologists are at the forefront of a paradigm shift in this context of heightened public awareness. As Qualified Persons, they are instrumental in the selection, definition/development and reporting of any mining project, including its potential impact on humans and the environment. Geologists are even more often than not the first, or among the first people in the field to interact with the local communities. Therefore, the exploration geologist immediate responsibility now goes well beyond the geology of an area or deposit; it also includes the social aspects of a development project, which implies a good understanding of the human and environmental aspects of any exploration and mining project. The session will discuss what are "social responsibility" and "social acceptability" in a resources development context, how it impacts on project development, and what should be the role of geologists and geosciences.

Gem research: Beautiful windows into earth's interior – S12 – Daniel Marshall (Simon Fraser University); Lee Groat (University of British Columbia); Gaston Guliani (CNRS Nancy)
Gem deposits, like their base and precious metal cousins, possess not only a beautiful array of precious gems, but like all deposits include alteration haloes, primary and secondary mineralisation. This session will explore not only the gems themselves, but new techniques for gem analysis, new exploration strategies, mineralogical data, tectonic settings, unique geology, and formational models for a wide range of gem deposit types based on field and laboratory studies.

General session (posters only) – GS01 – Pierre-Simon Ross (INRS, Centre Eau Terre Environnement); Patrick Mercier-Langevin (Geological Survey of Canada)
Papers that are relevant for the 14th Biennial SGA Meeting but do not fit within the symposia or sessions described above can be submitted to the poster-only general session that will allow for the meeting to cover a broader range of mineral deposits-related topics.

Field trips

A series of pre- and post-conference Field Trips were put together by the SGA Québec 2017 Organizing Committee in order to complement and enhance the scientific program of the 14th Biennial meeting. Eight Field Trips are offered, covering a wide spectrum of mineral deposits within numerous mining districts of Canada, United States, and South America.

All field trips have attendance fixed maximum number of participants. Registration is on a first-come first-served basis and no preregistration will be accepted. The organizing committee will ensure that a fair balance of participant's experience and affiliations is respected for each field trip.

Pre-conference

Physical volcanology and metallogenesis of the Ni-Cu-PGE deposits in the Cape Smith Belt, Québec, Canada – FT01 – Michael Lesher (Laurentian University); Michel Houlé (Geological Survey of Canada); James Mungall (University of Toronto)

This field trip provides an overview of the physical volcanology of komatiitic basalt magmatism in the Cape Smith Belt and associated Ni-Cu-PGE deposits. The Raglan (e.g., Katinniq) trend will be the main area of focus of this trip, however, the Expo Ungava Ni-Cu-PGE deposits within the South trend may also be visited. Surface tours will include exposures of komatiitic basalts, mineralized komatiitic peridotite lava channels, country rocks, and unmineralized differentiated sills. There will be several underground mine tours and examinations of drill cores.

Iron oxide and alkali alteration, skarn and epithermal mineralizing systems of the Grenville Province, Canada – FT02 – Louise Corriveau (Geological Survey of Canada); Olivier Blein (Bureau de Recherches Géologiques et Minières); Anne-Laure Bonnet (École Polytechnique de Montréal)

This trip will visit iron oxide, skarn, alkali and epithermal alteration zones and associated IOCG and affiliated mineralisation within the Bondy gneiss complex of the southwestern Grenville Province (Québec). Field attributes of this metasomatic system metamorphosed to granulite facies markedly contrast with non metamorphosed analog, the most significant difference being the development of widespread garnetites at the expense of magnetite-rich alteration types. An emphasis will be placed on the genetic linkages amongst the varied alteration types and styles of mineralisation, and the field protocols for the identification and exploration of such metamorphosed hydrothermal systems. Additional stops will provide an overview of the Grenvillian and pre-Grenvillian tectono-magmatic evolution of the region and the rheological contrast across its different domains as recorded by styles of magma emplacement and extent of deformation of dyke swarms.

Gold mineralization in the Guiana Shield, Guiana and Suriname, South America – FT03 – Marc Bardoux (Barrick Gold Corporation)

The objective of the "Gold mineralization in the Guiana Shield" field trip is to give participants an overview of the geology and metallogeny of the exceptionally well-endowed Guiana Shield with an emphasis on the geologic setting of gold. This field trip provides an overview of greenstone belts of Guiana and Suriname including three mine visits associated with gold deposits at the Karouni (Guyana), the Rosebel (Suriname), and Merian (Suriname) mines and core review followed by wrap up meeting and discussion on gold deposits on the last day.

Uranium deposits in the Western Athabasca Basin, Canada – FT04 – Eric Potter (Geological Survey of Canada); Sean Bosman (Saskatchewan Geological Survey); Colin Card (Saskatchewan Geological Survey)

The objective of the "Uranium deposits of the western Athabasca Basin" field trip is to give participants an overview of the geological settings, alteration mineralogy, and geophysical signatures of the recent discoveries from the western Athabasca Basin through exploration site visits, outcrop and drill core observations, and evening lectures. This will be achieved through field excursions to the Triple R, Arrow, and Shea Creek uranium deposits of the western Athabasca Basin, Saskatchewan.

Québec fortified city: geological and historical heritage – FT05 – Sébastien Castonguay (Geological Survey of Canada) and Parks Canada guide

This fieldtrip is a walk in old Québec City that provides an overview of the historical and geological heritage of the Québec City region. Insides Québec City's wall, the military presence echoes a past punctuated by the beat of war drums, and the various building stones testify for a diverse bedrock geology. Québec City, a UNESCO World Heritage Site, is the only city in North America to have retained the major parts of its defence system. This picturesque setting with its splendid views serves as the backdrop for an introduction to the region's billion-year-old geological evolution and rich history.

Post-conference

Precious and base metal deposits of the southern Abitibi greenstone belt, Superior Province, Canada – FT06 – Patrick Mercier-Langevin (Geological Survey of Canada), Benoît Dubé (Geological Survey of Canada), Jean Goutier (Ministère de l'Énergie et des ressources du Québec), Michel Houlé (Geological Survey of Canada), Pierre Pilote (Ministère de l'Énergie et des ressources du Québec), Howard Poulsen (Consultant), Sonia Préfontaine (Ontario Geological Survey), Stéphane de Souza (Université du Québec à Montréal), and Valérie Bécu (Geological Survey of Canada)

The objective of the "Precious and base metal deposits of the southern Abitibi greenstone belt" field trip is to give participants an overview of the geology and metallogeny of the exceptionally well-endowed southern part of the Archean Abitibi greenstone belt, with an emphasis on the geological setting and principal characteristics of greenstone-hosted quartz-carbonate Au veins, stockwork-disseminated Au deposits, synvolcanic Au and Au-rich VMS deposits, Cu-Zn-Ag-Au VMS deposits and komatiite-associated Ni-Cu-(PGE) deposits through exceptional exposures including mine visits, outcrop and drill core observations, and evening lectures.

Stratigraphic and metallogenic context of the Sokoman Iron Formation in the Labrador Trough near Schefferville, Québec-Labrador, Canada – FT07 - James Conliffe (Geological Survey of Newfoundland and Labrador), Carl Bilodeau (Ministère de l'Énergie et des Ressources du Québec), Alex Howe (Consultant)

This fieldtrip provides unique opportunity to visit the Paleoproterozoic Sokoman Formation, host to world-class iron ore deposits, including massive (>5 Gt) taconite deposits and numerous smaller high-grade sedimentary hosted iron ore deposits (site of active mining intermittently since 1954). The fieldtrip would be based in the Schefferville area, and would focus on studies of the regional and stratigraphic setting of the Sokoman Iron Formation, sedimentology and formation of Lake-Superior type banded iron

formations and genesis of high-grade (> 55% Fe) iron ore deposits. Participants would be taken on a number of tours highlighting the various features of the iron formation as well as the underlying and overlying stratigraphy, and visits to high-grade iron-ore deposits of presumed supergene and hypogene origin. This would be complimented by drill core observations and mine visits (dependent on company activity and permission).

Geologic setting and iron oxide deposits of the mesoproterozoic St. Francois Mountains, Southeast Missouri, USA – FT08 – Warren Day (United States Geological Survey), Cheryl Seeger (Missouri Geological Survey), Molly Starkey (Missouri Geological Survey), Thomas Schott (Doe Run Resource Corporation), Anne McCafferty (United States Geological Survey)
The field trip will focus on the regional geologic setting and nature of volcanism for the rocks that host the iron oxide-apatite (IOA) and iron oxide-copper-gold (IOCG) mineral deposits in the Mesoproterozoic St. Francois Mountain terrane of southeast Missouri, USA. The participants will examine drill core from several of the known deposits and visit outcrop examples of the least altered host rocks and the alteration mineral assemblages associated with the IOA and IOCG mineralizing systems. Newly acquired airborne aeromagnetic and radiometric geophysical data will be examined in the context of the regional geology to provide a holistic understanding of the rock type distribution, alteration, and location of known iron oxide ore deposits.

Short Courses

Pre-conference

Recent advances in the genesis of mafic and ultramafic ore systems - SC1. 2 days pre-conference short course: Friday August 18 and Saturday August 19, 2017. Leader: Stephen J. Barnes (CSIRO), James Mungall (University of Toronto).

High technology metals (REE, Nb-Ta, Li) – SC2. 2 days pre-conference short course: Friday August 18 and Saturday August 19, 2017. Leaders: Iain Samson (University of Windsor), Robert Linnen (Western University), Anthony Williams-Jones (McGill University)

Exploration geophysics – new methods, case studies, modeling – SC3. 2 days pre-conference short course: Friday August 18 and Saturday August 19, 2017. Leaders: Lyal B. Harris (INRS), Bernard Giroux (INRS), Christian Dupuis (Université Laval)

Linkages amongst iron-oxide alkali-altered systems : From metasomatism to orogenic metamorphism – SC4. 1 day pre- conference short course: Saturday August 19, 2017. Leaders: Louise Corriveau (Geological Survey of Canada), Hamid Mumin (Brandon University), Patrick Williams (Clump Mountain Geoscience Pty Ltd)

Detecting the alteration footprint around porphyry copper deposits – SC5. 2 days pre- conference short course: Friday August 18 and Saturday August 19, 2017. Leaders: Peter Hollings (Lakehead University), David Cooke (University of Tasmania, CODES)

Post-conference

Exploration management and targeting with 3D multidisciplinary models – SC6. 1 day post-conference short course: Thursday August 24, 2017. Leader: Gervais Perron (Mira Geoscience)

Field portable instrumentation – SC7. 2 days post- conference short course: Thursday August 24 and Friday August 25, 2017. Leaders: Marc Constantin (Université Laval), Paul Bédard (UQAC), Pierre-Simon Ross, (INRS)

Recent advances in micro-analytical techniques (LA-ICP-MS, CT …) applied to ore deposits – SC8. 2 days post-conference short course: Thursday August 24 and Friday August 25, 2017. Leaders: Sarah-Jane Barnes (UQAC), Charley Duran (UQAC)

Students

Students within a broad field of ore deposits research are invited and encouraged to submit abstracts and present their results at the SGA Québec 2017 Meeting. The meeting will offer a great opportunity for students to interact with leadings scientists, other young researchers and the industry in an inspired and informal environment. Attractive benefits are being offered to students to encourage their participation in SGA Québec 2017.

Reduced registration fees
The registration fee for all students is at a reduced level, SGA student members paying the lowest registration fee.

Student grants
To support participation of students at the conference, a limited number of grants are open for SGA students who are senior authors of accepted abstracts. Students from economically disadvantaged countries are prioritized. Student grant application form : Grant-Student-form-SGA2017 (http://sga2017.ca/wp-content/uploads/2016/10/Grant-Student-form-SGA2017dyn.pdf)

Free registration to field trips
Several pre- and post-conference field trips are offered. For students, one free registrations will be offered per trip. Free excursion application form : FieldTrip-Student-form-SGA2017 (http://sga2017.ca/wp-content/uploads/2016/10/FieldTrip-Student-form-SGA2017dyn.pdf)

Student Awards
The best student oral and poster presentations will be awarded a certificate and a prize of 250 Euro.

Accommodations for students
Québec City offers many possibilities for low cost accommodations. There are two youth hostels (Auberge internationale de séjour et Auberge de la paix), both in the Old City and less than 10 minutes walking distance from the Conference site. For the more socially-inclined, one can also find lots of Couchsurfing contacts nearby.

Contacts
Do not hesitate to contact the representative of the SGA Student Committee, Anna Vymazalová (anna.vymazalova@geology.cz), if you have any questions, comments or suggestions.

Social events

August 19: Icebreaker cocktail
August 20: Opening ceremony
August 22: Gala dinner at the glamorous Château Frontenac
August 23: Student awards and Closing ceremony

Exhibition

Showcase your organization or products at the meeting. Download our prospectus for more details (SGA2017.ca).
Contact us at info@sga2017.ca

News of the Society

SGA Ordinary Council Meeting, Geneva, Switzerland, April 3, 2017

J. Pašava (SGA Executive Secretary), Czech Geological Survey, Prague, jan.pasava@geology.cz

Massimo Chiaradia welcomed all Council members. Jorge Relvas (SGA President) welcomed Council Members and thanked Massimo Chiaradia for organization and the Department of Earth Sciences, University of Geneva for hosting the meeting. Then Council approved suggested agenda.

Minutes of previous Council Meeting (November 14, 2016, Brussels, Belgium)

After checking the actions, the Minutes were unanimously approved.

Reports of officers on Council

- 3.1. Report from President (presented by J. Relvas)
- 3.2. Report from Executive Secretary (presented by J. Pašava)
- 3.3. Report from Treasurer (presented by H. Frimmel)
- 3.4. Report from Promotion Manager (on behalf of P. Eilu presented by J. Pašava)
- 3.5. Report from Chief Editor, SGA News (presented by M. Chiaradia)
- 3.6. Report from Chief Editors, MD (presented by B. Lehmann)
- 3.7. Report from Chief Editor SGA Special Publications (on behalf of J. Slack presented by J. Pašava)
- 3.8. Report from the Chief Editor SGA website (presented by N. Koglin)
- 3.9. SGA Educational Fund (on behalf of K. Kelley presented by J. Pašava)
- 3.10. to 3.14 – Reports from Regional VPs (Asia – on behalf of Huayoung Chen presented by J. Pašava, Australia/Oceania – on behalf of R. Skirrow presented by J. Pašava, Europe – presented by S. Decree, Sub-Saharan Africa – on behalf of L. Greyling presented by H. Frimmel, North America – on behalf of S. Piercey presented by G. Beaudoin)

Council was sorry for all missing Reports.

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

H. Frimmel to transfer EUR 50,000 to the SGA Educational Fund.

J. Pašava and J. Relvas to adapt Guidelines for preparation of SGA Biennial Meetings emphasizing that SGA is a non-profit organization and that LOC has to follow local tax regulations.

J. Pašava to prepare a draft of MOU with LOC SGA 2019 (Glasgow, Scotland, UK).

P. Eilu to contact A. Buettner asking her assistance in preparation of 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, which resulted in reduced fee for SGA members when participating at Goldschmidt conferences).

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

M. Chiaradia resigned from the position of the Editor, SGA News. Council greatly appreciated his long-term involvement with SGA (Massimo was involved jointly with L. Fontboté in editing SGA Newsletter since the issue no. 1, which came out in June 1996) and asked him to work on a smooth transfer of SGA News Editorial duties to Jochen Kolb who has been nominated to replace him. Massimo accepted to work in close collaboration with Jochen until the end of his term, in December 31, 2017, and informed that the deadline for contributions to the upcoming SGA News no. 41 is May 15, 2017.

B. Lehmann to prepare a certificate for the "Mineralium Deposita Best Paper Award" according to Council decision. Four papers were suggested by the Mineralium Deposita Editorial Board to be considered by SGA Council and Council members in conflict of interest excused themselves from the presence when discussing and voting on this issue. The winning paper will be announced at the SGA 2017 Award Ceremony in Quebec City.

All Council members to help B. Lehmann and G. Beaudoin to identify suitable theme and authors for "milestone papers" for MD.

J. Slack to continue editorial efforts associated with 4 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; Agromining: Farming for Metals; and Supergene Mineral Deposits). The book on "Agromining" will be published and printed in time for display and sale at the 9th International Conference on Serpentinite Ecology (June 2017, Tirana, Albania).

N. Koglin to work with Blueways on introducing new website application for on-line application for SGA membership (approved estimated budget up to EUR 2,400) and website update (approved estimated budget up to EUR 6,500).

N. Koglin to introduce on SGA website by Council revised version of the text promoting the SGA EF which resulted from a joint effort by K. Kelley, A. Vymazalová, J. Relvas and N. Koglin.

N. Koglin, J. Pašava, H. Frimmel and Ch. Linge to work jointly on introducing a smooth and safe admission process to SGA via website.

S. Decree to contact EAG to find out if EAG would consider that SGA will look after organization and sponsorship of Mineral Deposit Theme at future Goldschmidt meetings.

R. Skirrow to address SGA Council on possible presence of Council members at the FUTORES II (nobody of Council members attending SGA Council Meeting in Geneva won´t be present at this meeting).

G. Beaudoin to inform S. Piercey on a desire of SGA Council to have manned SGA booth at the upcoming GAC-MAC Meeting (May 2017, Kingston, Canada).

Constitutional and By-Law changes

After introduction by J. Relvas, J. Pašava summarized all major changes which were suggested for revision in the present SGA Statutes and By-laws . Council was thankful for this update and after finalization of both documents approved them for further processing.

Actions: J. Pašava to prepare the final version of the Constitutional changes and send them to N. Koglin who will organize

electronic vote which must be open for 40 days from the day of announcement.
J. Pašava to send the final text of the SGA By-Laws to Council members for their vote (must be taken at least 60 days after the receipt of the final proposal.

Report from the Chairman of the Nominating Committee

The Report was presented by J. Relvas. After discussion Council approved suggested nominations of two Auditors who will be auditing SGA books for 2015-2016. Council also appreciated presentation of the status Report on nominations of SGA officers for SGA 2017 ballot and recommended to implement suggested changes.
Action: J. Relvas to work jointly with the members of the Nominating Committee on finalization of the list of nominated officers for 2017 ballot and to submit the final version for Council approval in due time.

SGA 2017 – update

The Report was presented by G. Beaudoin (Chair of the LOC). Abstract submission which was closed on March 6, 2017 resulted in submission of 422 abstracts with available 224 twenty minutes slots including keynote presentations and rest will be presented as posters (displayed for all 4 days of the meeting). A. Vymazalová reported the receipt of 75 applications from 25 countries for student support. After discussion Council approved the presented report with great thanks.
Actions: G. Beaudoin to keep SGA GA for 1.5 hrs.
J. Pašava to check bibliographic data proposed by LOC for Proceedings so that they would be acceptable for ISI Thomson Reuters coverage.
A. Vymazalová and J. Relvas to prepare a proposal for the distribution of SGA student support.

SGA 2019 – update

The Report prepared by A. Boyce (Chair, SGA 2019 LOC) was presented by D. Banks. The LOC decided to select a Professional Conference Organizing Agency (presently interviewing 3 PCO agencies). After discussion Council approved the Report with great thanks and the following motions:
D. Banks agreed to act as SGA Liaison with the SGA 2019 LOC.
J. Pašava to prepare a draft of MOU between SGA and LOC SGA 2019 for comments and signature.
A. Boyce to plan the beginning of the SGA 2019 Meeting after Goldschmidt 2019 (earliest on August 26, 2019).
J. Relvas to interact with EAG President to suggest that, for the future, there might be a better articulation between both Societies regarding the scheduling of their meetings in order to avoid overlapping in time.
A. Boyce to prepare a draft of SGA 2019 flyer for Council approval, subsequent printing and distribution to SGA 2017 participants (the latter in collaboration with G. Beaudoin).
A. Boyce to present an invitation to the SGA 2019 Meeting (Glasgow, August 2019) at the Closing and student awards ceremony of the SGA 2017 in Quebec City.

Progress report on membership drive from the last SGA Council Meeting

J. Pašava presented this Report on behalf of P. Eilu. The Society had 1220 paying members (to December 31, 2016). During the past six months, we received 207 new members: 1 corporate, 25 regular and 181 student members. 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 motions:
J. Relvas to address all RVPs with a request for their collaboration regarding non-renewing members.

Status of development of SGA Student and Young Scientist network including requests for Chapters 2017 budgets

The Reports were presented by A. Vymazalová . SGA has 11 student Chapters (Baltic, Barcelona, Colombia-Bucaramanga, Colombia-Bogota, Laval, Nancy, Morocco, Peru, Prague, Siberia and recently approved NW Russian). Council approved a proposal for a creation of a new Chapter in Turkey. A proposal for establishing Student Chapter in China is in preparation and indications on interest in getting one in Bolivia. After discussion Council approved the Reports with great thanks and also Chapter budgets for 2017 (Baltic – 4000 EUR, Barcelona – 2000 EUR, Colombia-Bogota – 800 EUR, Nancy – 2000 EUR, Morocco – 700 EUR, Prague – 4000 EUR, Siberia – 3000 EUR, and Turkey – 500 EUR).
Actions: A. Vymazalová to inform SGA Chapters about approved 2017 budgets.

SGA Awards – update

The report which was prepared by S. Piercey (Chair of the Award Committee) was presented by J. Pašava. After discussion Council approved the Report with great thanks.
Action: J. Pašava to distribute received nominations for SGA Awards to SGA Council members for electronic vote and inform J. Relvas on successful candidates.
J. Relvas to inform successful candidates on Council decision and to ask for their acceptance to get the awards.
H. Frimmel to organize award certificate for a winner of the SGA-Newmont Gold Medal.
B. Lehmann to prepare award certificate for a winner of the SGA Best MD paper award and SGA Young Scientist Award.

Requests for sponsorship

- Prague Chapter – Short Course on Gold Deposits – May 2018 – D. Groves (in preparation)
- Vth International Conference "Ultramafic-mafic Complexes, Geology, Structure, Ore Potencial (September 2–6, 2017 Gremyachinsk, Russia) – E. Kislov et al – request of EUR 2000 for SGA student participation and keynote speaker support – Council approved this request
- ECROFI XXIV (European Current Research on Fluid Inclusions) Nancy, France, 23–29 June 2017 http://2017.ecrofi.univ-lorraine.fr/ - J. Pironon – request of 3000 EUR – Council approved 1000 EUR for SGA student members support. Action: J. Pašava to inform applicants about Council decision.

Any other business

- 4th Short Course on African Metallogeny – 2017. Update on the development of the Short Course was provided by H. Frimmel based on a detailed info from P. Muchez and his team. Presently, forty participants (mostly representing academic institutions) subscribed to the course and Council greatly appreciated efforts of P. Muchez and his team in organizing this important economic geology educational event. The second Circular was distributed to applicants.

- SGA presence at the IAGOD 2018 Symposium – update. The letter offering SGA activities at the IAGOD 2018 Symposium was sent to the IAGOD President on November 21, 2016. SGA will wait for a reply from IAGOD on what would be acceptable so that we could start working with IAGOD on a successful meeting.
- SGA presence at Goldschmidt 2017 – possible SGA promotion via Springer booth or independent SGA booth – active involvement of SGA officers attending the Conference. Action: P. Eilu to discuss with A. Buettner and relevant Council members details on SGA promotion via Springer booth at the upcoming Goldschmidt 2017 (Paris) conference.
- Program of the SGA General Assembly (August 21, 2017 Québec City) – J. Pašava. The suggested program was presented by J. Pašava and Council approved it with great thanks:
  1 – Report of the President (J. Relvas)
  2 – Report of the Treasurer (H. Frimmel)
  3 – Report of the Executive Secretary on major past and future SGA activities (J. Pašava)
  4 – Report of the SGA Vice-President on SGA EF (K. Kelley)
  5 – Report on activities of SGA Chapters (Representatives of Chapters)
  6 – Presentation of the list of officers nominated for SGA 2017 ballot (J. Relvas)
  7 – Various
  Action: A.Vymazalová to inform Representatives of SGA Chapters to prepare brief (up to 2 min.) presentations on Chapter highlights.

Date and place of the next SGA Council meeting

(August 19, 2017 Québec City, Canada – 9–16 hrs., preceded by a joint Council dinner on August 18, 2017).

Informative list of past activities

- 11th „Ore deposit model and exploration“ workshop in China (November 6–11, 2016 Guiyang, China)
- 4th Freiberg Short Course in Economic Geology (IOCG and IOAD), Freiberg, Germany, December 7–10, 2016 – T. Seifert/J. Gutzmer; EUR 2,000 approved for SGA student participants.

Informative list of future activities

- proEXPLO 2017 – May 8–10, 2017 Lima, Peru – E. Ferrari et al. – SGA sponsored: D. Moncada SGA keynote speaker and SGA promotion with help of the Peruvian Student Chapter
- 4th SGA-SEG-UNESCO-IUGS Short Course on African Metallogeny – Rwanda (June 5–9, 2017 Kigali, Rwanda) – P. Muchez et al.
- FUTORES II Conference (4–7th June 2017 Townsville, Australia). D. Leach approved as SGA keynote speaker (USD 3,000), free booth from LOC
- Vth International Conference “Ultramafic-mafic Complexes, Geology, Structure, Ore Potencial (September 2–6, 2017 Gremyachinsk, Russia) – E. Kislov et al – request of EUR 2000
- Subduction Related Ore Deposits (September 23–26, 2017 Trabzon, Turkey – I. Uysal et al. – SGA sponsored – SGA keynote speaker (J. Relvas) and EUR 1000 for SGA student members support
- XXXV UNESCO-SEG-SGA Curso Latinoamericano de Metalogenia (November 2017 Buenos Aires, Argentina) – a long-term support of USD 2500 approved via a joint SEG-SGA agreemen
- RFG 2018 (June 16–21, 2018 Vancouver, Canada) – SGA session organized by J. Gutzmer.
- 15th IAGOD Symposium (August 28–31, 2018 Salta, Argentina) – invitation from IAGOD to suggest a mode of SGA presence
- 15th SGA Biennial Meeting (August 27–30 2019, Glasgow, Scotland, U.K.) – A. Boyce et al.

Applications to SGA for meeting sponsorship must be submitted to Jan Pašava, SGA Executive Secretary, on appropriate forms available at the SGA home page on Internet: www.e-sga.org

Other requests will be not considered.

Your suggestions and ideas for any topic of interest to SGA are welcome!
They can be addressed to any Council member or to

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

SOCIETY FOR GEOLOGY APPLIED TO MINERAL DEPOSITS

SGA COUNCIL 2017

President	J. Relvas (Portugal)
Vice-President	K. Kelley (USA)
Executive Secretary	J. Pašava (Czech Republic)
Treasurer	H. Frimmel (Germany)
Promotion Manager	P. Eilu (Finland)
Chief Editors	B. Lehmann (Germany) – MD European Office G. Beaudoin (Canada) – MD North America Office M. Chiaradia (Switzerland) – 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 (France)
N. Africa-Mid. East	M. Bouabdellah (Morocco)
North America	S. Piercey (Canada)
Sub-Saharan Africa	L. Greyling (S. Africa)
South America	D. Moncada (Chile)

Councillors: term ending on December 31, 2017

S. Roberts (U.K.)
S. Archibald (Canada, East Asia)
W. Maier (Finland)
A. Piestrzynski (Poland)
F. Hongrui (China)
J. Kolb (Denmark)
D. Huston (Australia)
E. Campos (Chile)

Councillors: term ending on December 31, 2019

A.S. André-Mayer (France)
D. Banks (UK)
P. Ledru (Canada)
S. Naumov (Russia)
B. Orberger (France)
Yongjum Lu (Australia)

Ex officio Members, SEG

President	L. Robb (UK)
Executive Director	B. G. Hoal (USA)

Ex officio Members, IAGOD

Secretary General	D. Lentz (Canada)
Regional Councillor, Europe	D. Holwell (U.K.)

LIST OF NEW SGA MEMBERS (January 1, 2017 – May 31, 2017)

65 Regular and 277 Student Members applied for membership during this period

REGULAR MEMBERS

Mr. Anthony Franco De Toni Québec CANADA
Mr. Michael Michaud Ontario CANADA
Mr. Richard Beckley Cottesloe AUSTRALIA
Mr. Julio César Zárate Huillca Lima PERU
Ms Christine Vaillancourt Ottawa CANADA
Mr. Ian Bliss Ottawa CANADA
Mr. Peter W. Stewart Dundas CANADA
Prof. Christian Schardt Duluth USA
Dr. Nicole Hurtig Wheat Ridge USA
Mr. Steven Hollis Dublin IRELAND
Dr. Hugh de Souza Toronto CANADA
Dr. Antonio Benedicto West Saskatoon CANADA
Mr. Daniel Hrabok West Saskatoon CANADA
Ms Amber Doney West Saskatoon CANADA
Mr. Tassos Grammatikopoulos Lakefield CANADA
Mr. David Quirt Warman CANADA
Dr. Richard Ernst Ottawa CANADA
Mr. Ryan Taylor Denver USA
Dr. Bjorn von der Heyden Matieland SOUTH AFRICA
Ms Lucie Mathieu Chicoutimi CANADA
Mr. Réjean Girard Québec CANADA
Mr. John Charlton Quebec CANADA
Dr. Sheida Makvandi Montréal CANADA
Mr. Khalifa Eldursi Saskatchewan CANADA
Dr. Richard Ernst Ottawa CANADA
Mr. David Quirt Warman CANADA
Mr. Gary Hurst Bisley United Kingdom
Prof. Eric Pirard Liège BELGIUM
Dr. Li Zenghua Saskatchewan CANADA
Mrs Sylvie Levesque Quebec CANADA
Mrs. Amina Wafik Marrakech MOROCCO
Mr. Nick Proulx Vancouver CANADA
Mr. Ngouan Herve Ekra Abidjan IVORY COAST
Prof. Xiaoming Sun Guangzhou PR CHINA
Dr. Zhang Dexian Changsha CHINA
Miss Anne McCafferty Denver USA
Prof. Daniel Kontak Sudbury CANADA
Ms Maria Emilia Della Giustina BRAZIL
Prof. Dr. Ömer Bozkaya Denizli TURKEY
Mr. Carlos Eduardo Ganade Rio de Janeiro BRAZIL
Miss Elena Anikina Moscow RUSSIA
Mrs. Juliana Charão Rio Grande do Sul BRAZIL
Dr. Ria Mukherjee Johannesburg SOUTH AFRICA
Dr. Steve Barnes Kensington AUSTRALIA
Ms Elena Amplieva Moscow RUSSIA
Dr. Esa Heilimo Kuopio FINLAND
Dr. Roisin Kyne Dublin IRELAND
Dr. Perumala Venkata Sunder Raju Telangana State INDIA
Mr. Ismael Solaz Alpera Las Palmas de Gran Canaria CANARY ISLANDS
Miss Suzanne Byron Vancouver CANADA
Mr. Pedro Jugo Sudbury CANADA
Mr. William Howard Calgary CANADA
Miss Johanna Paadar Kittilä FINLAND
Mrs. Keiko Hattori Ottawa CANADA
Mr. Giovanni Mongelli Potenza ITALY
Mr. John Hanchar St. John's CANADA
Mr. Carlos Villanes Lima PERU
Mr. Patrick Krolop Dresden GERMANY
Ms Audrey Bouvier London CANADA
Mr. Marcus Harden Georgetown GUYANA
Mr. James Conliffe St. John's CANADA
Miss Violeta Ramos Maia PORTUGAL

STUDENT MEMBERS

Mrs. Sarah Speight Lincoln CANADA
Miss Anna Firstova St-Petersburg RUSSIA
Mr. Igor Yakovlev Novosibirsk RUSSIA
Mr. Jose Alejandro Franco Victoria Bogota COLOMBIA
Mr. Camilo Uribe New Mexico USA
Mr. Jerry Olajide-Kayode Ibadan NIGERIA
Mr. Marc Anselme Kamga Ibadan NIGERIA
Mr. Yong-hua Cao Guangzhou CHINA
Mr. Zeinab Azadbakht Regina CANADA
Mr. Daniel Gerger Saskatoon CANADA
Mr. Mark Grant Ottawa CANADA
Ms Jessica Stromberg Ontario CANADA
Mr. Morteza Rabiei Regina CANADA
Mr. Jeong Geuk Kang Seoul KOREA
Ms. Taylan Akin Pamukkale TURKEY
Mr. Denis Ponomarev Novosibirsk RUSSIA
Ms. Merve Aydin Istanbul TURKEY
Ms. Yagmur Seda Ozkorkmaz Istanbul TURKEY
Mr. Matthew Valetich Canberra AUSTRALIA
Mr. Thomas Dols Oulu FINLAND
Mr. William Keyser Adelaide AUSTRALIA
Mr. Jon Gustafsson Lund SWEDEN
Mr. Olusegun Gbenga Olisa Ibadan NIGERIA
Adriel Sencia Gutierrez Lima PERU
Lidbert Alarcón Laime Lima PERU
Luis Alejandro Velasquez Martinez Lima PERU
Guido Yerson Almanza Olarte Lima PERU
Carlos Arroyo Huaraca Lima PERU
Arturo Ufrey Paniagua Ticona Lima PERU
Wualdo Arnaldo Blas Salazar Lima PERU
Leonardo Rey Castro Neira Lima PERU
Juan Miguel Ccalluco Aldazabal Lima PERU
Mayra Stephany Ccanchi Santiago Lima PERU
Celia Ancasi Vera Lima PERU
Richard Mijael Chacon Ttito Lima PERU
Jorge Luis Coaguila Heredia Lima PERU
Jelmer Dante Guerra Puyo Lima PERU
Frederieks Henrry Diaz Salas Lima PERU
Edilber Chipana Pari Lima PERU
Daniela Eliana Olivares Castro Lima PERU
Elisabeth Chira Suna Lima PERU
Juan Pablo Elliott Romero Lima PERU
Emely Ferata Chilo Lima PERU
Hanny Judith Farfan Nina Lima PERU
Karen Flores Contreras Lima PERU
Luisa Stephany Gonzalez Moreno Lima PERU
Guillermo Gabriel Mayna Gonzales Lima PERU
Carlos Alberto Gutierrez Alcántara Lima PERU
José Antonio Guznám Vizarreta Lima PERU
Jessica Katherine Ramos Flores Lima PERU
Joyce Victoria Quispe Juarez Lima PERU
Kadima Mejia Zanabria Lima PERU
Kenny Abelardo Ramos Quispe Lima PERU
Eder Elliot Lajo Aquirre Lima PERU
Alejandra Gabriela Loza Condori Lima PERU
Virgilio Luna Huachaca Lima PERU
Eduardo Adolfo Lupaca Adco Lima PERU
Marilyn Rosabeth Maldonado Manrique Lima PERU
Ana Paolaa Mamani Chuquitarqui Lima PERU
Mary Carmen Carpio Llica Lima PERU
Williams Rafael Mata Rimac Lima PERU
Miguel Humberto Quintana Hernandez Lima PERU
Geraldine Stephanie Peralta Valdivia Lima PERU
Porfirio Cáceres Quispe Lima PERU
Chris Anthony Quilca Huamani Lima PERU
Carlos Quillahuaman Muñoz Lima PERU
Milagros Yoselyn Quispe Carpio Lima PERU
Rene Alvaro Huallpa Laura Lima PERU
Renzo Miguel Velasco Gonzales Lima PERU
Kevin Leopoldo Retamozo Astupiñan Lima PERU
Richard Anthony Cabana Aguirre Lima PERU
Amanda Guadalupe Rodriguez Diaz Lima PERU
Raul Cesar Rodriguez Echevarria Lima PERU
Ronald Roberto Risco Pinedo Lima PERU
Valery HJoana Rosas Alvarez Lima PERU
Eduardo Percy Salcedo Mendoza Lima PERU
Samuel Cecilio Chucuya Mamani Lima PERU
Obdelia Ruty Sanca Yanque Lima PERU
Sarela Milagros Moriano Huillca Lima PERU
Seidy Ariana Torres Vargas Lima PERU
Jheiner Sotomollo Puclla Lima PERU
Hammer Edmundo Sulca Berdejo Lima PERU
Jhon Oliver Trebejo Inocente Lima PERU
Nilton Cesar Begazo Cansaya Lima PERU
Abraham Armando Velarde Valenzuela Lima PERU
Carmen del Rosario Villasante Huayhua Lima PERU
Roel Jocsan Yana Calizaya Lima PERU
Mr. Julien Dube Québec CANADA
Mr. Stefano Caruso Crawley AUSTRALIA
Miss Maria Smirnova Moscow RUSSIA
Miss Maria Turova Moscow RUSSIA
Miss Natalia Lebedeva Moscow RUSSIA
Miss Alina Korneeva Moscow RUSSIA
Mrs. Polina Leibham Novosibirsk Russian Federation
Mr. Maximilian Korges Potsdam GERMANY
Ms Emily Fallon Bristol United Kingdom
Mr. M´Hamed El Janati Marrakesh MOROCCO
Mr. Jean de Dieu Ndikumana Ibadan NIGERIA
Bihter Hepvidinli Istanbul University TURKEY
Duygu Isbil Istanbul University TURKEY
Aykut Eke Istanbul University TURKEY
Mukhtar Unyerkhan Istanbul University TURKEY
Yoel Baris Ozcelik Istanbul University TURKEY
Ms. Karahan Deniz Cemre Istanbul University TURKEY
Ms. Karahan Sanem Ceren Istanbul University TURKEY
Ms. Seyna Uzuner Istanbul University TURKEY
Seynur Künarlioglu Pamukkale University TURKEY
Maral Horoz Pamukkale University TURKEY
Mr. Nikita La Cruz Ann Arbor USA
Miss Brigitte Gélinas Ontario CANADA
Mr. Constantin Rossberg Freiberg GERMANY
Ms. Nuria Ali Nairobi KENYA
Mr. Paul Leach Cape Town South Africa
Miss Maposholi Mokhethi Lesotho South Africa
Mr. Mustafa Selman Arsay Denizli TURKEY
Mr. Mehmet Tufan Denizli TURKEY
Mr. Ömer Faruk Özkaya Denizli TURKEY
Mr. Irem Alköse Denizli TURKEY
Mr. Oktay Canbaz Denizli TURKEY
Mr. Ceyhun Yenipinar Denizli TURKEY
Mr. Hüseyin Kocatürk Denizli TURKEY
Mr. Metehan Keleş Denizli TURKEY
Bin Xiao Guangzhou CHINA
Jinsheng Han Guangzhou CHINA
Yu Zhang Guangzhou CHINA
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>>> page 1 Potential of phosphate deposits in Europe

(about 8,000 tonnes per year). Fluorspar, which is mainly used in the production of hydrofluoric acid, is imported to the EU at a level reaching 8–15 times the weight in export (EC 2015).

It has recently been put into the forefront that phosphate deposits represent a potential source of REEs (Christmann 2014; Ihlen et al. 2014; Emsbo et al. 2015; Goodenough et al. 2016). A recent evaluation of the USA sedimentary phosphate deposits even showed that their total REE contents are probably higher than any known resource (Emsbo et al. 2015). The total REE oxide concentration in sedimentary phosphorite can reach 0.15% (Notholt 1980; Christmann 2014). Almost all the REEs are contained in carbonate fluorapatite (francolite), where they substitute for Ca in the lattice (Jarvis et al. 1994; Emsbo et al. 2015). The variation in their concentration is commonly attributed to changes in ocean chemistry (e.g., Lécuyer et al. 2004; Emsbo et al. 2015). Magmatic apatite usually contains more than 0.35% REEs (Ihlen et al. 2014). The igneous apatite deposits generally have lower grades than their sedimentary counterparts, but the content of unwanted contaminants is normally lower (Ihlen et al. 2014; Ahokas 2015). Apart from the endowment in REEs in these deposits (whether they are sedimentary or igneous in origin; Fig 2), the key potential for production of REEs from apatite deposits is the easy extraction, compared to most conventional REE prospects (Pereira and Bilal 2012; Emsbo et al. 2015). This extraction is feasible during the production of phosphoric acid, as well as from phosphoric acid waste and from phosphogypsum (Christmann 2014, and references therein). Moreover, this process causes less damage to the environment (Emsbo et al. 2015).

Beside the REEs, phosphate rocks can contain up to 3–4% of F. The recovery of fluorine compounds is possible with all of the existing technologies in phosphate processing. Accordingly, phosphate rocks represent another possible source of fluorine (McKelvey 1967; Gorecki 1994). Fluorine is commonly recovered as fluosilicic acid, although processes transforming it into calcium fluoride do exist (McKelvey 1967; Ayres et al. 2001). In western USA, a V_2O_5 concentration reaching 0.2% has been documented in phosphate rocks. Through dedicated extraction processes a recovery of 85% of the vanadium is obtainable (Notholt et al. 1979; Notholt 1980). Uranium may be recovered from the huge amount of phosphogypsum produced by phosphate rock processing (Notholt et al. 1979; EC 2015). A content ranging from 0.005 to 0.02% U is common in sedimentary marine phosphate deposits (Notholt et al. 1979). Phosphogypsum itself has been considered as a possible substitute for natural gypsum, and could theoretically be used for the same purpose. However, its high trace element contents (e.g., U, Th, and Cd) would need to be removed by processing (Ayres et al. 2001). Nevertheless, phosphogypsum was used in plasterboard and in the cement industry in the past (Notholt et al. 1979).

In addition, it must be emphasized that black shale, which can contain significant amounts of elements, such as Be, Sb, V, Co, Ni, Mo, PGM, Cr and Zn (e.g., Huyck 1989), often host sedimentary phosphorite in the Paleozoic formations (Notholt et al. 1989). They are also interesting in regard to (precious) metals, which they may host (McKelvey 1967). It is worth mentioning that Be, Sb, Co, PGM, and Cr are also among the critical raw materials identified by the European Commission (2014).

Sedimentary phosphate deposits / occurrences

Most of the economic phosphorite deposits are considered to have formed on stable shelves and platforms below 500 m depth and at low paleolatitudes. They are commonly present as stratified deposits, with a thickness of more than 6 meters and with a P_2O_5 grade varying between 10 and 35% (Notholt 1980, and references therein). Phosphate is mostly present under the form of a carbonate fluorapatite called francolite. The latter generally occurs as (elongated) pellets shaped spherical-ovoid nodules. Apatite can also be enriched in authigenic microcrystalline phosphorite mud or forming nodular phosphates in conglomerate (Notholt 1980, and references therein). Deposits and occurrences presented below are listed according their age and stratigraphic distribution.

Paleoproterozoic sedimentary phosphate deposits are restricted to the Fennoscandian Shield, where the most important and exploited deposit is located in the vicinity of Lampinsaari, in Finland. This deposit is composed of lenticular beds of apatite-bearing dolomite, skarn and apatite-rich gneiss (Notholt and Brasier 1986). It comprises a resource of nearly 39 million tonnes grading at 2.6% P_2O_5 (Notholt et al. 1989) and yielding more than 230 ppm REE in the apatite concentrates (Rehtijärvi 1983). Paleoproterozoic phosphorites are also present in the Grythytte Slate in Bergslagen,

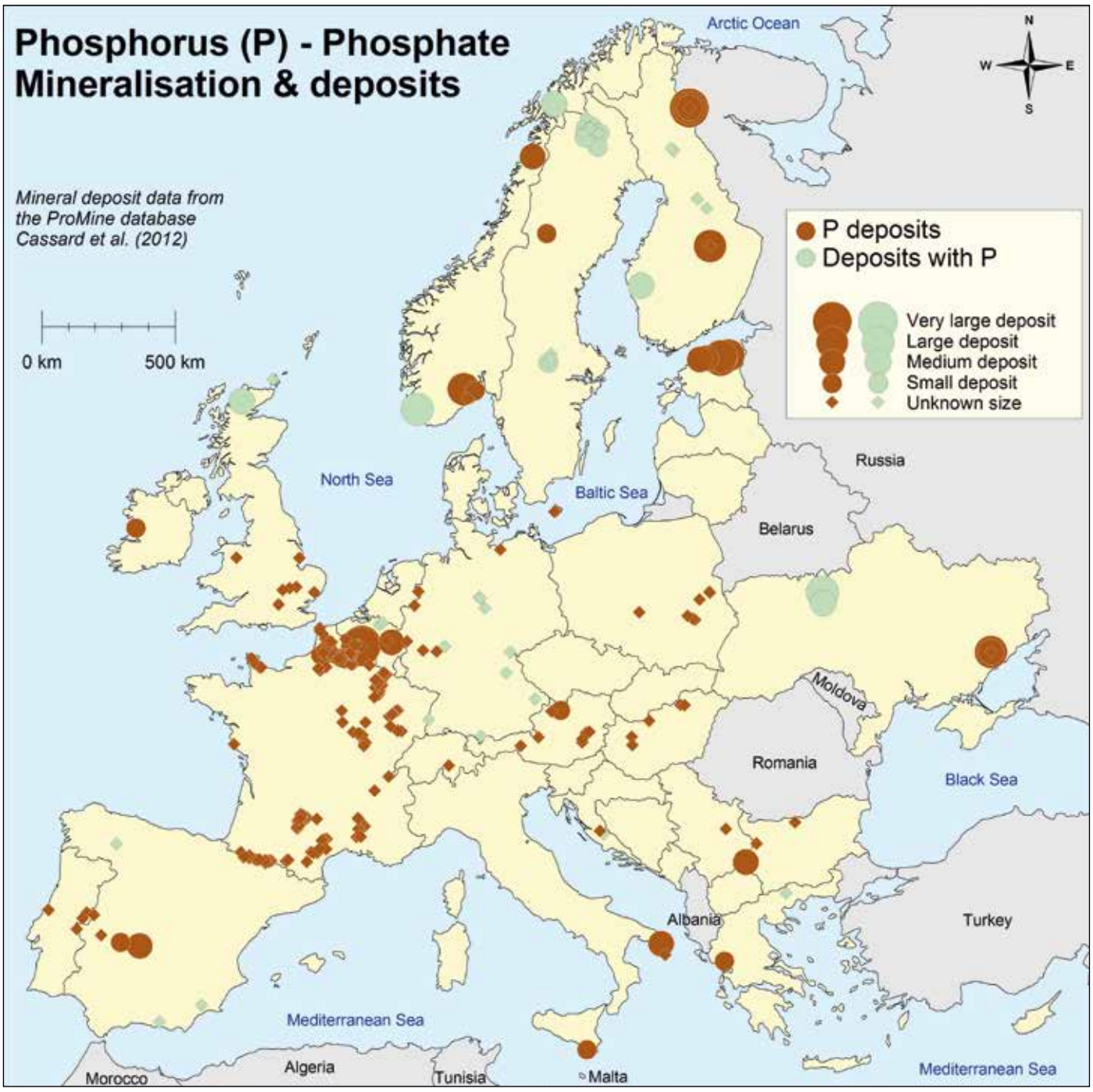

Fig. 1. Phosphate deposits in Europe (modified from Demetriades and Reimann 2014; source ProMine database Cassard et al. 2012). Deposit size: Small (>X) 2,000,000; Medium (>X): 20,000,000; Large (>X): 200,000,000; Very large (>X): 2,000,000,000 tonnes

whereas Neoproterozoic phosphorites occur in the basal arenitic sequence of the Visingsö Formation in Sweden (Notholt and Brasier 1986), and as pebbles and clasts in the Biskopaasen sub-marine fan in Norway (Ihlen et al. 2014).

Lower Paleozoic phosphorites, which constitute the majority of phosphorites in Europe, testify the presence of a phosphogenic province within the Avalon and the Baltic Platforms. These phosphorites are associated with glauconitic sediments or black shale (Notholt and Brasier 1986). Cambro-Ordovician phosphorites are ubiquitous and include the Early Cambrian Fontanarejo deposit in Spain (Alvaro et al. 2015), which consists of phospharenite and phospharenorudite (Gabaldon et al. 1987). The resources are of about 2,000,000 tonnes (Notholt et al. 1989), with about 190 ppm REE (Alvaro et al., 2015). The Lower-Middle Cambrian phosphorites of Scania (Sweden) comprise phosphorite clasts in basal conglomerates and in limestone beds. The phosphate clasts contain up to 1300 ppm REE. The Lower Cambrian phosphorites of La Montagne Noire (France) are made of phosphatic limestone, which is locally embedded in black shale, and contains up to 525 ppm REE (Alvaro et al. 2015). Cambrian phosphatic conglomerate was reported at Avevagge and Steinsviken in Norway (Notholt and Brasier 1986; Ihlen et al. 2014). Other Middle(-Upper) Cambrian phosphate horizons are described in the Frankenwald (Germany; Ludwig 1969 in Notholt and Brasier 1986), in the Stavelot-Venn Massif (Belgium, Germany; Graulich 1980; Paproth and Zimmerle 1980), and in southwestern France (Guérangé-Lozes and Alabouvette 1999). Ordovician phosphorites, under the form a metamorphosed

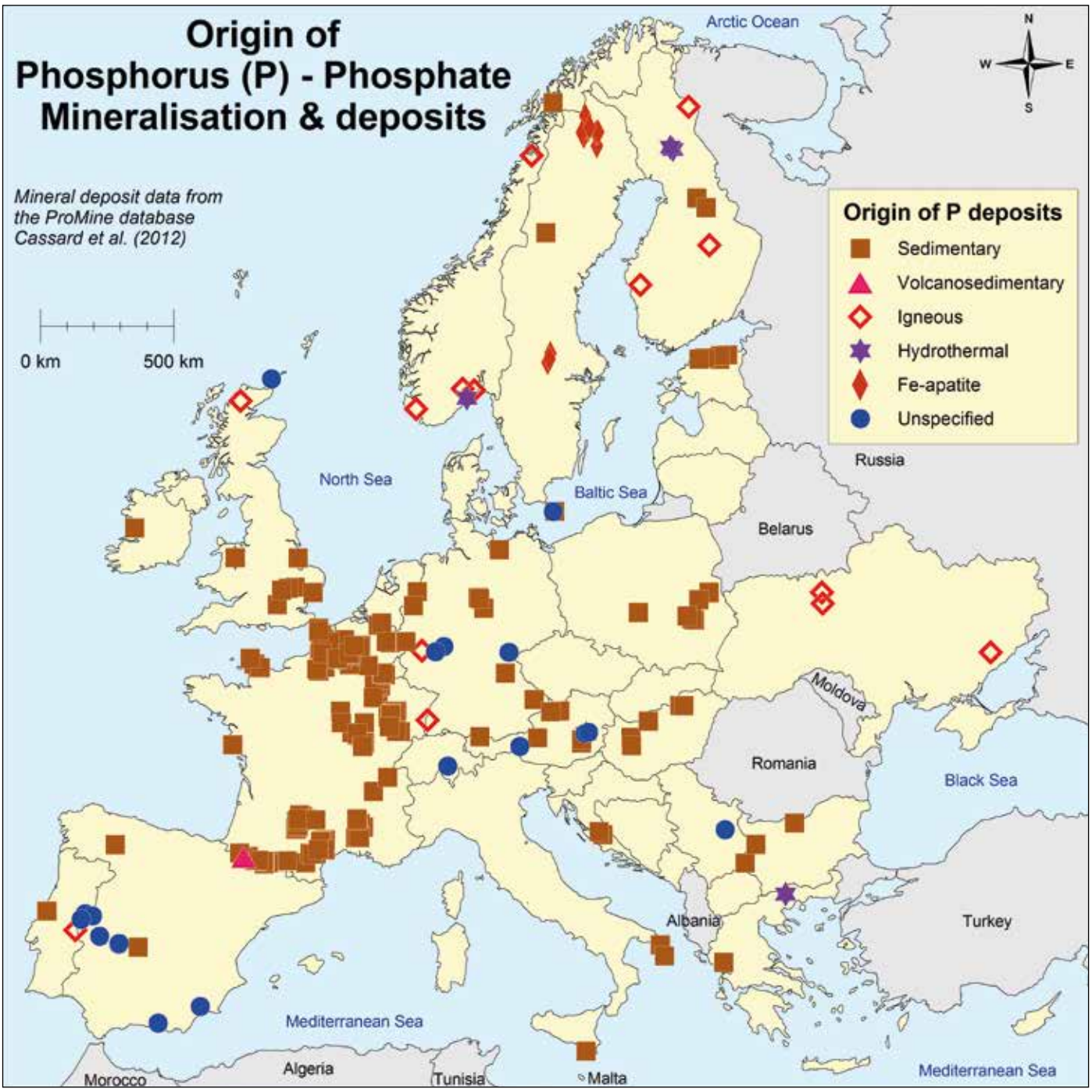

Fig. 2. Origin of European phosphorus and phosphate mineralization and deposits (source ProMine database Cassard et al. 2012).

phosphatic sandstone (Notholt et al. 1989), occur in Serbia. They are of economic interest, with estimated resources of 95 million tonnes with about 10% P_2O_5 (Torbica and Lapčević 2012). In northern Estonia, Cambrian-Ordovician sandstone with variable amounts of phosphatic linguloid brachiopod shells accounts for deposits of 750–800 million tonnes of P_2O_5 (Raudsep 1997), with average total REE contents of 1350 ppm. These beds are commonly associated with metal-rich black shale and glauconite (Hade and Soesoo 2013). In the UK, Upper Ordovician phosphatic nodule beds that have been reworked are present in Wales (Notholt et al. 1979). Ordovician glauconite-phosphorite shale is described in the Tasjo Lake area (Sweden; Notholt et al. 1989). Middle-Late Ordovician phosphatic concretions in terrigenous successions are also reported in France (Armorican Massif) and in Sardinia (Italy; Dabard and Loi 2012).

Phosphorites are encountered in Germany in association with shale, chert, and/or volcanic rocks of Silurian and Devonian age (Prapoth and Zimmerle 1980). Carboniferous sedimentary phosphate deposits have been described in Ireland, France, Spain, UK, Romania and Germany (Notholt et al. 1979, 1989). In Ireland (County Clare), Upper Carboniferous sedimentary phosphate rocks occurring in a condensed sequence were exploited with the production of 105,000 tonnes of phosphate. However, the deposit has estimated resources of 1.25 million tonnes at 20–25% P_2O_5 (Notholt et al. 1979). In the north Pyrenean fault zone (France), a chert bed of variable thickness (from a few to 20 meters) contains phosphate nodules (Notholt et al. 1979). In Germany, phosphorite nodules and layers are hosted within Dinantian black shale and chert in the area of the Rhenish Schiefergebirge and Harz Mountains (Paproth

and Zimmerle 1980). Analyzes of these phosphorite deposits including the Pörmitz phosphorite yield about 0.20% total REE+Y oxides (Struckmeier 1974 in Prapoth and Zimmerle 1980) and from 15 to 140 ppm of REE+Y in the Harz phosphorite deposits (Benda et al. 1962 in Prapoth and Zimmerle 1980).

Triassic phosphorite is rarely developed and is only present in Germany and Hungary (Paproth and Zimmerle 1980; Notholt et al. 1989). An important sedimentary phosphate unit of Upper Cretaceous age occurs throughout the Paris and Mons basin (France and Belgium). It is known that a significant phosphogenic episode prevailed at that time on the NE margins of the Anglo-Paris Basin (Jarvis 1992). In the Mons and Paris Basins, the deposits consist of phosphatic chalk (5–20% P_2O_5), enriched pockets of residual phosphates (24–39% P_2O_5), and phosphatic channel infills (12–30% P_2O_5) (Monchiardini 1989; Robaszynski 1989). The total resources in the Mons Basin have been estimated at 600–900 million tonnes of phosphate chalk averaging between 8 and 10.5% P_2O_5 (Robaszynski 1989), whereas those in the Paris Basin would reach 12-15 million tonnes at 7–14% P_2O_5 (Monchiardini 1989). In the UK, phosphorite deposits of a Mesozoic age are widespread (Notholt et al. 1979). The Cretaceous phosphate chalk at Taplow is considered to have an economic potential. Although the full extent of the deposit is not known, an estimation of the resources of its southwestern part yield 500,000 tonnes (Notholt et al. 1979). In addition, phosphatic nodules are concentrated in Cenomanian condensed glauconitic marls (Cambridge Greensand), with resources of 246,000 tonnes of crude phosphate rocks (Notholt et al. 1979). Other Mesozoic phosphorites occur in the Germany, the Iberian Peninsula, Poland (phosphates in massive limestone; Krajewski 1981), Hellas (as phosphorite and laminated/brecciated phosphatized limestone in the Ionian zone extending from Epirus in the north to Aetoloakarnania in the south; Tzifas et al. 2014), Ukraine (Kholodov 2008), and in the Balkan countries (phosphate-carbonate-chert horizons – with up to 30% P_2O_5 – in Albania and all over the Ionian zone; Ciko et al. 1999). In Lower Saxony (Germany), phosphate nodule beds are hosted in rocks from Upper Triassic to Middle Oligocene in age (Paproth and Zimmerle 1980). The most significant occurrence, the Lengede-Broitstedt deposit, is associated with iron ore and constitutes an economic source of phosphorus, with a grade of about 4% P_2O_5. It is thought to be derived from reworked Cretaceous deposits (Notholt et al. 1979). In Bavaria (Oberpfälz district), one of these comprise a soft phosphatic bed (associated with iron ore), that is commonly less than one meter thick and contains an average of 20% P_2O_5. The quantity of phosphorite is estimated to exceed 30,000 tonnes (Notholt et al. 1979). In the Jurassic and Cretaceous carbonate rocks of the Subbetic Zone (in Spain) glauconite and Ca phosphate peloids have been reported with size and morphology being controlled by the bioclasts (Jimenez-Millan et al. 1998). In East Greenland (Jameson Land and Scoresby Land), black shale of Jurassic age hosts phosphatic nodules (Notholt et al. 1979).

Tertiary sedimentary phosphate deposits/occurrences are present in Italy, Hellas, Belgium (Steurbaut and Nolf 1986; Louwye et al. 2010; Marquet and Herman 2012), Germany, and the UK (Notholt et al. 1989). In the region of Salento (Italy), the Miocene phosphate-rich sedimentary rocks (cf. Föllmi et al. 2015) commonly show a relatively low grade (3–4% P_2O_5). However, 60 million tonnes of phosphatic limestone, with a content of 7–8 % P_2O_5 are reported. In the same area, Upper Pliocene (?) nodular phosphate deposits could account for additional 10 million tonnes at grades in the range 10.5–20.5 % P_2O_5 (Notholt et al. 1979). Oligo-Miocene nodule-rich phosphatic formations also occur in Sicily (Cultrone et al. 2008). At Donnalucata, resources of 7 million tonnes at about 15% P_2O_5 have been estimated (Notholt et al. 1979). In Germany, the Lahn phosphorite deposits, which are often accompanied by Lower Tertiary Fe and Mn oxide ores, occur as lenses and partly as accumulation in dissolution cavities. They are spatially associated with weathered mafic pyroclastic rocks, which are thought to be the source of phosphorus (Germann et al. 1979; Notholt et al. 1979). The deposit would account for 750,000 tonnes of crude phosphate rocks with contents above 20% P_2O_5 (Notholt et al. 1979). A Lower Eocene deposit comprising septarian-type phosphorite nodules in clay is known in northern Germany (Prapoth and Zimmerle 1980). In addition, offshore Neogene phosphorite occurrences are described along the Galicia coast (Lucas et al. 1978).

Igneous phosphate deposits/occurrences

The igneous apatite deposits are mostly related to alkaline complexes and carbonatite, and to massif-type anothosite and monzonitic complexes (the latter two complexes carrying apatite-iron-titanium oxide, AITO, ores; Notholt et al. 1979; Ihlen et al. 2014; Goodenough et al. 2016). Most of these deposits are located within the Fennoscandian Shield. However, occurrences of igneous-related apatite deposits are also reported in Scotland where the pyroxenite of the Silurian Loch Borralan alkaline complex contains 2.31% P_2O_5 (Notholt and Highley 1981), and in Spain where post-Variscan hydrothermal quartz-apatite veins occur in the Central Iberian Zone (Vindel et al. 2014). In addition, small apatite-bearing carbonatite deposits are encountered in the Kaiserstuhl volcanic complex (Notholt et al. 1979). Deposits and occurrences in the Fennoscandian Shield presented hereafter are listed by country.

In Finland, the Siilinjärvi deposit is related to an Archean carbonatite complex. It accounts for 1617 million tonnes of phosphate rocks (Ahokas 2015; Yara 2016), with REEs as by-products of apatite (Goodenough et al. 2016). Apatite concentrates from Siilinjärvi exhibit total REE contents ranging from 2986 to 3820 ppm (Hornig-Kjarsgaard 1998). The phosphate reserves associated with the Devono-carboniferous Sokli carbonatite complex (Vartiainen and Woolley 1974) reaches 190 million tonnes (Ahokas 2015). Total REE contents measured in two apatite concentrates at Sokli are 4108 and 5569 ppm (Hornig-Kjarsgaard 1998). Besides Siilinjärvi and Sokli, phosphate deposits occur in the Paleoproterozoic gabbros of southern Ostrobothnia (Ahokas 2015; Kärkkäinen and Appelqvist 1999). At Kauhajärvi, low-grade Fe-Ti-P resources comprise igneous layers of 2 to 30 meters in thickness with 1 to 8 % apatite (Kärkkäinen and Appelqvist 1999).

In Sweden, apatite iron ores (AIO) are found in the northern Norrbotten district, northern Sweden, and in the Bergslagen district, south central Sweden. In the Bergslagen district, Paleoproterozoic AIO (magnetite and/or hematite) are hosted in felsic volcanic rocks. The Grängesberg mine produced 133 Mt with 44.5% Fe and 3.18% P_2O_5 during its lifetime. Estimated resources are 148 Mt. The apatite in the ores always carries REE, though very little have been recovered and resource estimates for the REE have not been published (Hallberg et al. 2016; Jonsson et al. 2013). In the northern Norrbotten district, the deposits at Kirunavaara and Malmberget have produced more than 1500 Mt with c. 60% Fe and 1.37% P_2O_5 during the last 110 years. Smaller deposits account for c. 100 Mt at

similar grades. Reserves and resources for the district are estimated at 2372 Mt of AIO ore (Hallberg et al. 2016). The ore is present as breccias and massive strata-bound bodies, together with intermediate types (Martinsson et al. 2016). Enrichment in REEs is observed in most of the ores, which commonly have total REE contents of 2000-7000 ppm, mainly concentrated in apatite (Frietsch and Perdahl 1995). Further to the north-east, in the Norrbotten greenstone, the Tjavelk magnetite skarn iron deposit accounts for 6.8 Mt, with an average content of about 2.98% P_2O_5 (Hallberg et al. 2016). In Sweden, apatite also occurs in association with alkaline complexes, as in the Neoproterozoic Alnö alkaline massif or the Kalix area (Kresten et al. 1977). The analyzes of the apatite concentrates from the Alnö complex yield high total REE contents of 6112 and 17,067 ppm (Hornig-Kjarsgaard 1998).

In Norway, some of the apatite deposits/occurrences are related to alkaline complexes. In the Fen carbonatite complex, apatite-rich facies are recognized among the nepheline syenite (with P_2O_5 content locally exceeding 2%), in the carbonatite (with up to 6.9% P_2O_5), and as apatite-rich cumulates (containing 29% apatite; Ihlen et al. 2014). Apatite concentrates from Fen are characterized by total REE contents varying between 3752 and 5220 ppm (Hornig-Kjarsgaard 1998). The Neoproterozoic to Cambrian alkaline complexes of the Seiland Igneous Province carry intrusions that can be enriched in apatite. For instance, the Tappeluft pegmatitic gabbro exhibits P_2O_5 contents ranging from 1.88 to 4.29%. The carbonatite massif rimmed by hornblende clinopyroxenite dykes that pertain to the Lillebukt Complex both contain an average content of about 3% P_2O_5. In these rocks, apatite is characterized by an enrichment in REE of a few thousands ppm (Ihlen et al. 2014). In the late Ordovician-Silurian Misvaerdal Complex measuring 8 km2, pyroxenite is the main carrier of apatite, with an average P_2O_5 content of 2.38% for the whole massif. Certain pyroxenite phases have estimated resources up to 30 Mt at 4.1% P_2O_5. Apatite shows total REE contents ranging from 1234 to 11,180 ppm (Ihlen et al. 2014). Another part of the Norwegian apatite deposits is associated with the Neoproterozoic anorthositic complexes. In the Rogaland Anorthosite Province, apatite occurs abundantly in the noritic Bjerkreim-Sokndal layered intrusion (BKSK), which contain 3 cyclic cumulate zones enriched in apatite, ilmenite and vadaniferous magnetite. The apatite rich zones are persistent for up to 10 kilometers along strike, with a thickness of several tens of meters (up to 170 meters). The average content in apatite is about 7.8–10.2%, depending on the zones position in the intrusion (Ihlen et al. 2014). The BKSK has resources of above 300 Mt, with averages in the range 8.0–10.2% apatite, 12.4–15.2 % ilmenite and 6.9–10.6 % V-magnetite for the individual cumulate zones. A maximum total REE content of 0.23% is reported for the apatite (Ihlen et al. 2014). Other Norwegian titaniferous phosphate deposits occur in monzonitic complexes. In the Paleoproterozoic Lofoten-Vesteralen Mangerite Complex, P_2O_5 contents of veins and dykes of nelsonite range between 2.75 and 4.23%, with a total REE content in apatite concentrates reaching almost 5000 ppm (Ihlen et al. 2014). In the Permian Larvik Plutonic Complex of the Oslo Paleorift, phosphate grade in patchy ultramafic apatite-ilmenite-magnetite ores is about ~4.5% P_2O_5. The Kodal deposit is a 20 m wide and 1900 m long zone of semi-massive pyroxenitic oxide lenses. It has resources of 70 Mt, grading at 4.9% P_2O_5. The total REE content of apatite from deposits associated with monzonite is generally above 6000 ppm, which makes REE an interesting by-product (Ihlen et al., 2014; Goodenough et al. 2016). Finally, apatite is present in Kiruna-type AIO ores and in metasomatic deposits. In the Mesoproterozoic Søftestad deposit, where the ore is dominated by magnetite, it may contain up to 8% P_2O_5 Remaining resources at Søftestad amount to ~0.5 Mt, containing 55% Fe and 3.9% P_2O_5 (Ihlen et al. 2014, and references therein). In the Bamble-Lillesand Block, apatite veins and lenses, from one decimeter to a few meters in thickness, are associated with regional metasomatism (Ihlen et al. 2014). About 250,000 tonnes of apatite have been produced in this area. Their REE content depends on the apatite type, but is normally about 5000–6000 ppm (Ihlen et al. 2014). An enigmatic apatite deposit is present at Rossavika, with pseudo-carbonatitic lenses yielding from 7.63 to 21.34% P_2O_5, and a low total REE content (measured in one sample) of 3806 ppm (Ihlen et al. 2014).

In Greenland, apatite occurrences occur in association with alkaline and carbonatite complexes as, for example, in the Qaqarssuk and the Precambrian Gronnedal-Ika complexes (Notholt et al. 1979; Pearce et al. 1997; Arvanitidis and Goodenough 2014; Paulick et al. 2015). Large REE resources are related to these complexes where part of these elements is hosted by apatite (Paulick et al. 2015; Goodenough et al. 2016). Potential for undiscovered apatite-iron oxide (AIO) and iron oxide-copper-gold (IOCG) also exist in Greenland (Paulick et al. 2015).

Prospects

It appears from this short review that much attention should be paid to the phosphate deposits in Europe. This is particularly true for the sedimentary phosphorite occurrences/deposits the majority of which have not been studied in any detail since the 1970–80's. The evaluation of the economic potential of the phosphate deposits (and their host-rocks), whether they are of sedimentary or igneous-related origin (Fig 2), could significantly contribute to a secure sustainable access to a large part of the elements listed as critical raw materials in Europe.

Detailed metallogenic studies of the phosphate deposits should include an up-to-date estimation of the resources/reserves, and a detailed mineralogical/geochemical characterization of the ores and their host-rocks, in order to also determine their potential for by-products. In addition, the development of new - or at least more efficient - metallurgical technologies and processes would enhance the recovery of these by-products.

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Colombia-Bogotá SGA Student Chapter: First steps towards the exploration of mineral deposits in the Colombian Territory

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For the SGA Student Chapter Colombia-Bogotá, 2016 was year full of activities such as fieldtrips, lectures for students, conferences, among others. The Student Chapter was committed to teach concepts about mineral deposits to all students regardless of their level of knowledge on the subject. This was accomplished through the program Young Learners in Ore Deposits, which was held every Friday starting on February 12th. In order to have an equilibrated group of students, the program started its first session with the basics concepts of economic geology and the main ore deposit types. Soon after the first sessions, the program started to deal with some of the main types of mineral deposits namely: chromites, Platinum group deposits, diamonds, nickel and copper deposits; and hydrothermal deposits. All of the mentioned sessions where given by the president, Héctor Ricardo Campos and vice-president, José Ricardo Tenjo. In order to prepare the chapter members for the first fieldtrip of 2016 to La Mina porphyry project the program paid special attention to porphyry Deposits.

On the other hand, two conferences were held in March 3rd and May 5th, respectively. Our conference cycle started with "Mining and Environment in Sensitive Ecosystems" given by Carlos Sarmiento from the "Instituto de Investigación de Recursos Biológicos Alexander Von Humboldt" and was followed by "Remote Sensors in Mining: Applications in Exploration, Exploitation and Mining Processing" given by the Geologist MSc, and PhD student Adriana Guatame from Delft University, Netherlands.

The first fieldtrip of 2016 was held from June 10th until June 13th. Nine student members of the Chapter visited one of the greatest Au/Cu porphyry Mineralization in Colombia, located in the Antioquia Department, is an exploration project managed by Bellhaven Copper & Gold Inc, called "La Mina Project". The accompaniment was given by the geologists William Pulido and Oscar Dávila, who offered us their knowledge, and taught us about this type of mineralization. Additionally, we performed

Session of the Young Learners in Ore Deposits Program.

Conference "Mining and Environment in Sensitive Ecosystems" given by Carlos Sarmiento.

Conference Remote Sensors in Mining Applications in Exploration, Exploitation and Mining Processing given by Adriana Guatame.

Fieldtrip to La Mina Project, Antioquia Deparment, Colombia.

the geological survey of the outcrops and the mineralogical characterization of this deposit. Furthermore, we had the opportunity to work with drilling cores and make an exercise of well logging. At the end, it turned up to be a highly rewarding fieldtrip.

A second fieldtrip was made from September 17th to September 20th. This time, a group of fourteen student SGA members visited an Au/Cu High-Sulfidation Epithermal Deposit at the Vetas-California Mining District, located in the Santander Department. This deposit is currently an exploration project managed by Eco Oro Minerals Corp., and is called "Angostura Project". The accompaniment was made by the geologist MSc Edgar Castiblanco, who offered us his knowledge at this type of mineralization. During the fieldtrip we performed the geological survey of the outcrops and mineralogical characterization of the deposit. We had the opportunity to get access to the main exploration tunnel, we recognized typical hydrothermal alterations, and we were allowed to collect samples. Furthermore, we attended a presentation given by the main exploration geologist of Eco Oro Minerals Corp, Alfonso Silva Duarte, before start logging drilling cores.

The last fieldtrip of 2016 year was held on November 1th, which was a one day fieldtrip to visit a copper mineralization related to a Sediment Hosted deposit located in the outskirts of the small town of Chiquinquirá. This deposit used to be an exploration project, but nowadays there are only abandoned tunnels, thanks to which we were able to take a close look to the mineralization of interest. We performed the geological survey of the outcrops and mineralogical characterization of this deposit by taking samples, making thin and polished sections, and geochemical analyses.

The year 2017 started with the planning of the activities to be carried out in the program Young Learners in Ore Deposits. The program began with a four-hour long mineralogy course directed by the geology student Iván Mateo Espinel, who is a SGA-SEG member with two years of experience in charge of the mineralogical collection of the Geoscience Department. This mineralogy course was a total success, this first event had a high attendance. Then the SGA-chapter president Ricardo Tenjo resumed the program with a lecture on general concepts of economic geology, which was followed by a series of lectures including: Granitoids and Related Mineralization, Ultramafic Hosted Magnesite Deposits, Mississippi Valle Type Deposits and an introduction to Skarn Deposits. SGA-chapter vice president Daniel Felipe Franco followed the program with a lecture on Industrial Minerals, and soon after the geologist and SEG member MSc. Andrés Felipe González gave a speech on IOCG Deposits. The next session was focused on preparing the student chapter members for the fieldtrip to "La Esmeralda" and "Río Frío" mines, in the Tolima Department, Colombia. The first one is a large scale limestone and marble deposit, the second one is a Cu Skarn deposit. The student and SEG member Julian Medina was in charge of a lecture on Genesis of Skarn Deposits, and was also our main guide throughout our fieldtrip. The program was followed by a series of lectures about: VMS Deposits, given by the SGA- chapter treasurer Pablo Enrique Porras; carbonatites, given by the ex-president Héctor Campos and finally a lecture of Environmental Remediation of Open Pit Mining given by the geology student Laura Alejandra Hernández.

A new conference cycle was also opened in the first semester of 2017 starting on February 1st with "Remediation of Mining and Environment in Eastern Germany" given by Dr. Friedrich-Carl Benthaus, from the LMBV Strategy and Development Lausitzer und Mitteldeutsche Bergbau-Verwaltungsgesellschaft mbH. Subsequently

Fieldtrip to La Mina Project, Antioquia Deparment, Colombia.

Fieldtrip to Angostura's Project, Departament of Santander, Colombia.

Fieldtrip to Angostura's Project, Departament of Santander, Colombia.

Presentation given by the exploration geologist MSc. Alfonso Duarte during the visit to the drill-cores.

Session of the Young Learners in Ore Deposits Program performed by the student Mateo Espinel.

1st Meeting of Student Chapters of Geosciences Department, National University of Colombia (UNAL).

1st Meeting of Student Chapters of Geosciences Department, National University of Colombia (UNAL).

Fieldtrip to "La Esmeralda Mine", CEMEX Colombia S.A., Tolima Department, Colombia. SGA and SEG UNAL Chapters.

a second conference was held on April 24th named "Mokrsko Gold Deposit: Significance of Cathodoluminescence Textures and Geochemistry of Hydrothermal Quartz and Introduction to the Metallogeny of Bohemian Massif, Czech Republic" given by the geologist and SEG member MSc. Vojtěch Wertich from the Masaryk University in Brno, Czech Republic.

Additionally, we participated on the 1st Meeting of Student Chapters of Geosciences Department at the National University of Colombia, where we showed to the public our work as a student chapter, this helped to establish contact and then official cooperation activities with the SEG Student Chapter UN Bogotá directed by the geology student Luis Felipe Mahecha and advised by the professor Juan Carlos Molano.

The most recent fieldtrip was held from April 9th to April 12th and was focused on the study of a large scale limestone and marble deposit and a related Cu-Au Skarn deposit, both of them located in the Payandé area, Tolima Department, Colombia. Several sessions of the Young Learners in Ore Deposits Program were focused to prepare the student members for this activity. We conformed a group of twenty two people, including seventeen SGA members, four SEG members, one of them a Czech Republic PhD Student from Masaryk University Brno, and the professor and scientist advisor of the SGA Student Chapter Colombia-Bogotá. Dr. rer. nat. Thomas Heinrich Cramer. We visited "La Esmeralda" open pit mine, which is managed by CEMEX Colombia S.A. and "Río Frío" mine, which currently is an inactive copper mine. There we had the opportunity to recognize metamorphic processes that has taken place at that area by identifying the intrusive igneous body which affected the marine sedimentary sequence of Payandé, and the resulting skarn and marble deposits. We also collected excellent mineral samples and received instruction by the professional staff of CEMEX about limestone as an industrial mineral, mine engineering and environmental remediation.

News from the Bucaramanga Student Chapter – Deposits Of The Coast And Peruvian Mountain

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The „I International Exchange SGA Perú – SGA Bucaramanga (Colombia)“ was an activity organized and managed by the two student chapters mentioned above. The version carried out in Peru began on September 12, 2016 with the conferences: „Types of Peruvian deposits and their distribution“ by Ing. Geologist (Ph.D) Rolando Carrascal Miranda, and „Peru Metalogenic Map : Production, reserves, and gold, silver and copper resources „, in charge of the ing. Geologist Jorge Acosta Ale. In addition to the intervention of the presidents of the chapters involved in the activity: Jesus Vilca De la Cruz (SGA Perú) and Danilo González Pacheco (SGA Bucaramanga - Colombia).

The field trip was made to show different examples of mineralizations occurring in peru, their field relationships, mineral alterations, and manifestations of ore minerals. Porphyry deposits of Copper, VMS, Skarn and “Cordilleranos type” were also visited, as well as a review of the geological units of the mineralizations and their geological history.

Photo 1: Inauguration of “Academic Exchange SGA Peru – SGA Bucaramanga (Colombia), in the photo members of the two chapters in the auditorium of the Geological Society of Peru (SGP). Photo by: Authors

The porphyry of Toro Mocho, is a porphyry of copper, related to miocene intrusive, characterized by dioritic, granodioritic and quartzomonzonitic stocks, overlaying by cordilleran veins. Porphyry is characterized by three stages of alteration defined as quartz veins with biotite and potassium feldspar, quartz – molybdenite veins, quartz – pyrite – sericite – molybdenite, quartz – molybdenite – pyrite. and quartz - pyrite – sericite veins, respectively. Cut by veins of mesothermal deposits containing Cu, Zn, Pb, Ag. (Bendezú, 2007).

Photo 2: Ing. Geologist (Ph.D) Rolando Carrascal, Miranda, explaining the mineralization style of the VMS Perubar deposit. Photo by Authors.

Photo 3: Open pit metal base mine in the Skarn at “Cerro de Pasco”. Photo by: Authors

Photo 4: Tunnel of the Pacoya mine, members of the SGA Bucaramanga and SGA Perú student chapters. Photo by: Authors.

Photo 5: Vein of cordilleran deposit, compoused of quartz, chalcopyrite and sphalerite. Photo by: Authors.

The VMS (Perubar) deposit was an open-pit mine for the exploitation of barite, which was later characterized by the deepening of the mining operations, later characterized as VMS by the occurrence of metals in Cu, Zn and Pb sulphides in lenticular bodies.

The Skarn of Cerro de Pasco forms part of a group of deposits of limestone replacement by processes of continental volcanic exhalation located on a rim of diatrema, the limestones are part of the mesozoic sedimentary belt, characteristically show typical alterations like the silicification, sericitization , Argilitization, alunitization, propylitization and epidotization, whose ores are located in lenticular bodies of Pb - Zn, Ag – Pyrite, Cu, Ag.

The Cordilleran deposits are structurally linked to tectonic orientations that favor the conditions for the generation of high law sharp veins, constituted by quartz and base metals, such as Cu, Zn, Pb, Ag with a thin halo of hydrothermal alteration, exploited in underground mining , As in the Pacoya mine.

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News from the Bucaramanga Student Chapter – Visit To The Western Emerald Frame And Saline Dome, Andean Region, Colombia

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In the framework of the "Academic Exchange SGA Peru - SGA Colombia" organize by the SGA student chapters from Peru and Bucaramanga, Colombia, a field trip was coordinate and carried out by the student chapter´s board of directors of the host university from August 22 to 27 of 2016, to the towns of Pauna and Zipaquirá, located in Boyacá and Cundinamarca departments respectively. These with the purpose of visiting the main emerald region of Colombia, as well as the great saline dome located in the central Colombian region.

As a preamble to the field trip, Professor Msc. Jesús Hernando Mendoza, gave a conference at the Universidad Industrial de Santander about the geological context of Colombia, in order to offer a previous geological knowledge of the region to the students of the SGA Peru chapter and let them know the economic importance in the mining development of Colombia.

The start of the field trip took place on August 23, with a stop at the Chicamocha Canyon, located about ~ 53 km from the city of Bucaramanga, where the different geological structures were observed, as well as a brief description of the units of the area. In the Chicamocha canyon we observed outcrops of the Chicamocha schist unit defined by Mantilla et al., (2016) as metapsamites, metapelites and metabasites.

Photo 1: Assistants of the student chapters SGA Peru and SGA Bucaramanga, Colombia; To the conference "Geology of Colombia and its metallogenic provinces" dictated by professor Msc. Jesus Hernando Mendoza.
Photo by: Authors

The visit to the Western Emerald frame was held on August 24 and 25 in the municipality of Pauna, in the department of Boyacá, located ~ 149 km from Tunja, the capital of the department and about 304 km from the city Of Bucaramanga. In this first part we visited the mine „La Pita", located ~ 2 hours from Pauna, by car in the mining district of Maripi. The visit to the mine was guided by the main geologist of the mine, and person in charge of the processes of exploration, exploitation and mineral benefit. As well as accompaniment of two of the five foremen of the mine. The mine is located towards the western side of the River Minero, as well as the main fault that bears the same name of the river. During the three days of the visit, the geologists of the mine shared the geological model of the deposit, tunnel maps and mine levels, as well as the processes related to the extraction, benefit and commercialization of emeralds in Colombia and the world.

Photo 2: Panoramic view of the Chicamocha canyon, photo taken from the viewpoint "Parque Natural Chicamocha".
Photo by: Authors.

Photo 3: Panoramic view of the mining complex of La Pita mine, Boyacá, Colombia. Photo by: Authors.

Photo 4: Photo of the group after the work done at the mine "La Pita", Boyacá, Colombia. Photo by: authors.

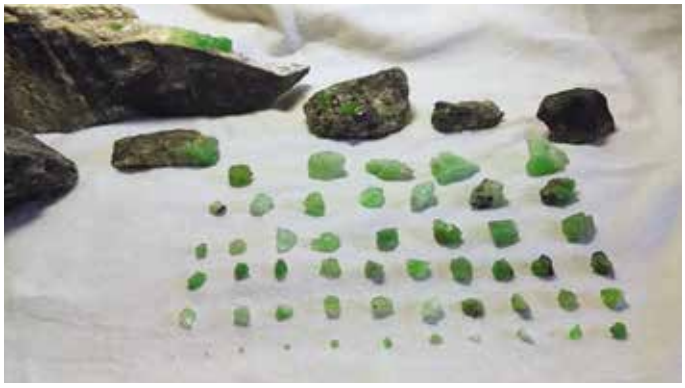

Photo 5: Murraya (used term which are known those crystals that have no economic value), mine La Pita, Boyacá, Colombia. Photo by: Authors.

Photo 6: Vein of ~ 30 cm thick, composed of calcite located in the rocks of the Muzo Formation, mine La Pita, Boyacá, Colombia. Photo by: Authors.

Photo 7: Photo taken inside the salt mine, section "miner's route", in the cathedral of salt. Zipaquirá, Cundinamarca, Colombia. Photo by: Authors.

The mineralization is located in the Muzo Formation (hauterivian – barremian) defined as a calcareous formation, composed of micrite, with intercalations of calcareous lodolite, as well as in a segment with black shales with concretions of micrites With pyrite (Ortega, 2007). The veins containing the emeralds are found as a product of the hydrofracturation in the rocks of the Muzo Formation, and for this sector they are structurally controlled by the Rio Minero fault. The veins are mainly composed of calcite, in addition to pyrite and sometimes emeralds. After finishing the visit to the western emerald frame, we went to the municipality of Zipaquirá, in the department of Cundinamarca, at a distance of ~ 130 km from the municipality of Pauna and ~ 44.8 km from the nearest city, Bogota, capital of the department And Colombia. There we went to the old salt mine, now cathedral of salt. The salt mine was formed about 200 million years ago, and a elevation to the surface in the late tertiary period about 30 million years ago. This salt dome was formed due to the rise of the salt through the sedimentary layers, of the crust, through a mechanism known as diapirism. The cathedral is an old salt mine, approximately ~ 200 m deep, this exploitation began with the ancient indigenous groups settled in the region of the salt dome 500 years ago. Later what was being exploited in the last century was discovered by Alexander Von Humbolt in 1801, who estimated reserves of one million cubic meters of halite.

In 1816 salt extraction was started from the hand of the miner Jacobo Wesner by subterranean galleries, later the levels „Guasá" (1834) and "Potosí" (1876) were opened. For 1978 the current level of extraction „Fabricalta" was opened under the supervision of Ing.. Jorge Castelblanco. The extraction systems used in this mine have been chambers and pillars, long chambers and the most modern method, dissolution in situ. For the year 1932, it was decided to build a cathedral, which was modified and expanded in 1991. Currently the cathedral is a reference tourist site in Colombia and the world, attracting thousands of people for their geological evolution and mainly for their religious interest.

The members of the SGA Bucaramanga student chapter, we would like to thank to the board of the SGA, as well as especially Anna Vymazalová and Jan Pasava, for all the support they have offered us over the years, without them it would not have been possible this field trip.

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Mantilla-Figueroa, L.C., García-Ramírez, C.A., y Valencia, V.A. 2016. Propuesta de escisión de la denominada 'Formación Silgará' (Macizo de Santander, Colombia), a partir de edades U-Pb en circones detríticos. Boletín de Geología, 38 (1): 33–50.

>>> FORTHCOMING EVENTS <<<

*** marks a new entry**

2017

July 16–21
XVI ICC International Clay Conference, Granada, Spain. Contact: http://www.16icc.org/

***July 24–26**
Iron Ore 2017, Perth, Australia. Contact: Rachel Magill; Phone: 03 96586100; Email: rmagill@ausimm.com.au; Event website: http://www.ironore.ausimm.com.au/

***July 25–August 3**
Summer school "Impacts and their role in the evolution of Life", Kuressaare, Estonia. Contact: Wolf Geppert; Phone: 08723691155; Email: wgeppert@hotmail.com; Event website: http://www.nordicastrobiology.net/Impacts2017

August 4–9
EMSMD – Magmatism of the Earth and related strategic metal deposits, Miass, Russia. Contact: Victor Zaytsev; e-mail: alkaline.conference@gmail.com; http://emsmd.ru/

August 13–18
Goldschmidt Conference, Paris, France. Contact: http://goldschmidt.info/2017/

August 14–18
IAVCEI 2017 Fostering Integrative Studies of Volcanism – Portland, Oregon, USA. Contact: http://www.iavcei2017.org for more information.

August 20–23
SGA 2017 – 14th Biennial Meeting of Society for Geology Applied to Mineral Deposit, Québec, Canada. Contact: http://sga2017.ca/

***September 2–6**
Ultramafic-Mafic Complexes: Geology. Structure, Ore Potential, Vth International Conference, Gremyachinsk, Lake Baikal, Russia. Contact: E.V. Kislov, evg-kislov@yandex.ru

September 2–9
18th Annual Conference of International Association for Mathematical Geosciences (IAMG2017), Perth, Australia. Contact: http://www.iamg2017.com

September 17–20
SEG 2017: Ore Deposits of Asia: China and Beyond, Beijing, China. Contact: http://www.seg2017.org

September 23–26
Subduction Related Ore Deposits, Trabzon, Turkey. Contact: I. Uysal, uysal.ibrahim@gmail.com

***September 25–27**
Fermor 2017 – Factory Earth – Volcanic and magmatic processes as drivers for natural resource formation, The Geological Society (Burlington House), Piccadilly, London. Contact: https://www.geolsoc.org.uk/fermor17#

***September 25–28**
granites2017@benalla, Benalla, Victoria, Australia. Contact: http://www.benallageology17.com.au

October 2–6
International Earth Science Colloquium on the Aegean Region, IESCA-2017, Izmir, Turkey. Contact: http://iesca.deu.edu.tr/

October 22
IGC-2016 – 35th International Gemmological Conference, Windhoek, Namibia. Contact: http://www.igc-gemmology.org/

October 22–25
The Geological Society of America (GSA) 2017 Annual Meeting, Seattle, United States. Contact: http://www.geosociety.org/meetings/

***November 7–16**
XXXV SEG-SGA-UNESCO Latin American Metallogeny Course, Geology and Geochemistry of magmatic and magmatic-hydrothermal ore deposits of the Central Andes. Contact: http://www.unige.ch/sciences/terre/latinometal/

***December 4–6**
15th Freiberg Course in Economic Geology, Skarn Deposits, Freiberg, Germany. Contact: Phone: +49-3731-392662, Fax: +49-3731-392610, E-mail: doreen.fischer@mineral.tu-freiberg.de

December 4–8
American Exploration and Mining Association Meeting, Sparks/Reno, Nevada, USA. Contact: http:// www.miningamerica. org

2018

***August 4–5**
Gordon Research Seminar – Geochemistry of Mineral Deposits, Waterville Valley, New Hampshire, USA. Contact: http://www.grc.org/programs.aspx?id=17631

***August 5–10**
Gordon Research Conference – Geochemistry of Mineral Deposits, Waterville Valley, New Hampshire, USA. Contact: http://www.grc.org/programs.aspx?id=13504

August 13–17 (Co-sponsored by SGA)
IMA 2018 – XXII Meeting of the International Mineralogical Association, Melbourne, Victoria, Australia. Contact: http://www.ima2018.com/

November 4–7
The Geological Society of America (GSA) 2018 Annual Meeting, Indianapolis, United States. Contact: http://www.geosociety.org/meetings/

2019

August
15th SGA Biennial Meeting, Glasgow, Scotland, UK. Contact: A. Boyce, email: Adrian.Boyce@glasgow.ac.uk

CONICET

IGeBA

XXXV SEG-SGA-UNESCO
Latin American Metallogeny Course

XXXV Curso Latinoamericano de Metalogenia
SEG-SGA-UNESCO

Departamento de Ciencias Geológicas

University of Buenos Aires (UBA), School of Geological Sciences
Ciudad Autónoma de Buenos Aires, Argentina
Course: November 7-10, 2017
Field Trip: November 11-16, 2017

GEOLOGY AND GEOCHEMISTRY OF MAGMATIC AND MAGMATIC-HYDROTHERMAL ORE DEPOSITS OF THE CENTRAL ANDES

Lecturer team:
Dr. D. Cooke (CODES, Australia); Dr. J. Hanchar (MUN, Newfoundland, Canada); Dr. C. Tassinari (USP, Brasil); Dr. F. Tornos (CSIC, España); Dr. N. White (Brisbane, Australia).
Dr. R. Alonso, (UNSa); Dr. Diego Guido (UNLP); Dra. N. Rubinstein (CONICET); Dr. V. Ramos (UBA); Dr. E. Zappettini (SEGEMAR).

Application: 1-31 July 2017

Course Coordination: Dra. Nora Rubinstein (CONICET)
Field Trip Coordination: Dra. Carolina Méndez (UBA)
International Coordination: Dr. Fernando Tornos (CSIC)
Technical Coordination: Dra. Anabel Gómez (CONICET, UBA)

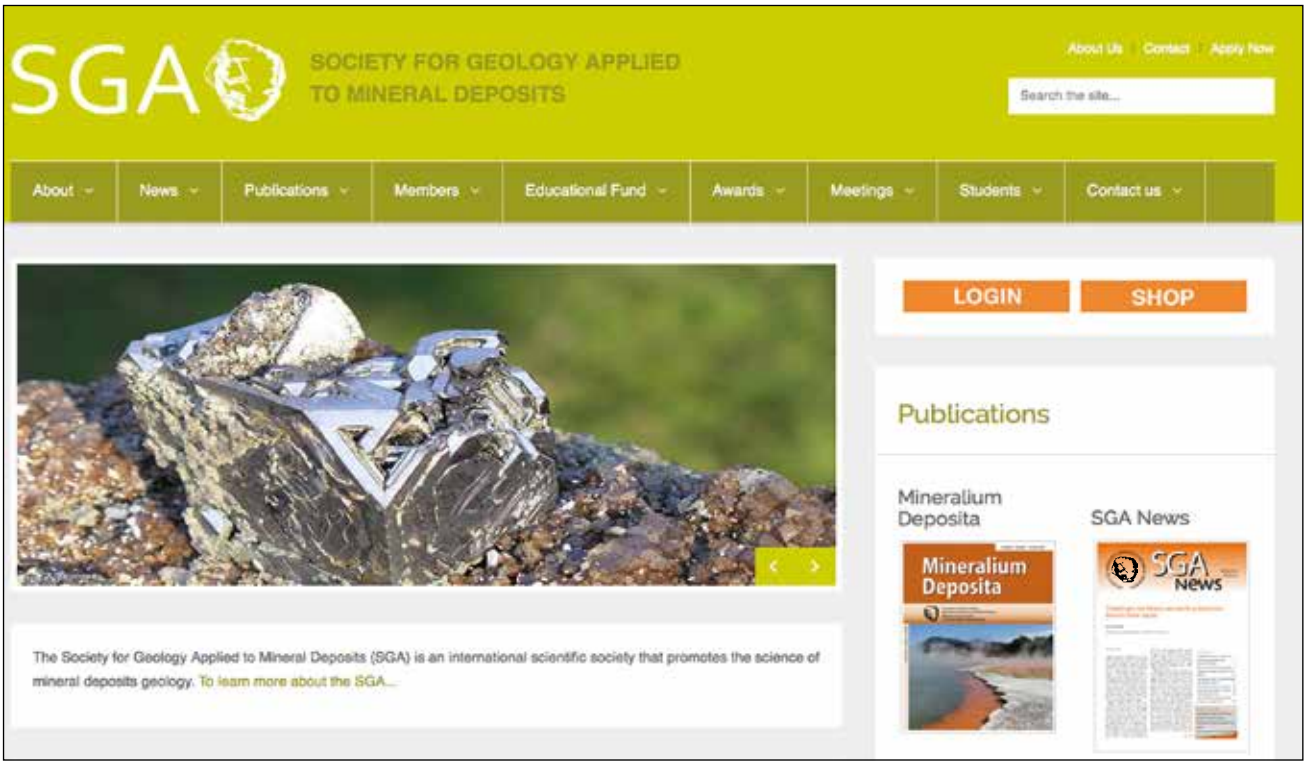
http://www.unige.ch/sciences/terre/latinometal/

Information on the course:
Dra. Anabel Gómez: **cursometalogenia2017@gmail.com**
Field Trip information:
Dra. Carolina Méndez: **clam2017campo@gmail.com**

The SGA website

Nikola Koglin , Chief Editor SGA website
Lehrstuhl für Geodynamik und Geomaterialforschung, Julius-Maximilians-Universität Würzburg, Am Hubland, 7074 Würzburg
email: nikola.koglin@uni-wuerzburg.de

http://www.e-sga.org



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15th

FREIBERG SHORT COURSE IN ECONOMIC GEOLOGY

December 04-06, 2017

Dr. Lawrence D. Meinert
United States Geological Survey (USGS)

Dr. Marco Roscher (Saxore Bergbau)
Tim Rödel (Halle University)

Skarn Deposits

Dr. Mathias Burisch / Dr. Jens Gutzmer / Dr. Thomas Seifert / Dr. Bernhard Schulz,
Division of Economic Geology and Petrology, Department of Mineralogy,
TU Bergakademie Freiberg, Brennhausgasse 14, D-09599 Freiberg/Germany,
Phone: +49-3731-392662, Fax: +49-3731-392610, E-mail: doreen.fischer@mineral.tu-freiberg.de

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Society for Geology Applied to Mineral Deposits (www.e-sga.org)

MEMBERSHIP APPLICATION FORM

I would like to become a member of the **Society for Geology Applied to Mineral Deposits** and to receive my personal copy of **Mineralium Deposita**. Membership fees will be due after acceptance of the membership application by the SGA Council. **- Type or Print! -**

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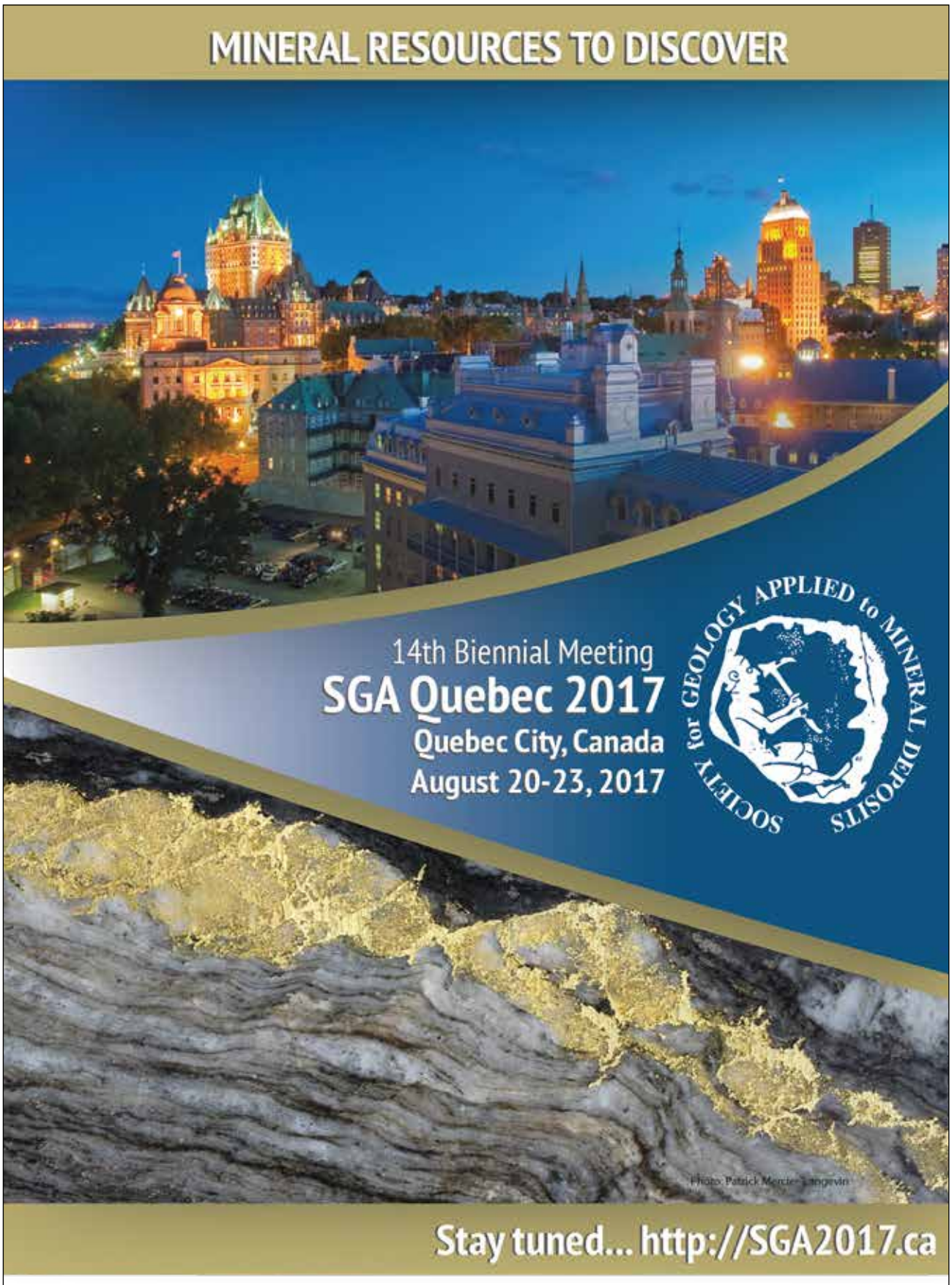
Phone: ++(420)-2-51085506, Fax: ++(420)-2-51818748, e-mail: secretary@e-sga.org.


MINERAL RESOURCES TO DISCOVER
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IMPORTANT DATES

>> January 15, 2017:	Abstract submission opening date
	Registration opening date
>> February 28, 2017:	Deadline for SGA Student grant applications
	Deadline for SGA Student free field-trip applications
	Abstract submission closing date
>> April 1, 2017:	Abstract revision notice
>> April 15, 2017:	Final revised abstract
>> April 30, 2017:	Final acceptance
>> May 15, 2017:	Deadline for early-bird registration
>> August 19, 2017:	Icebreaker cocktail
>> August 20, 2017:	Opening Ceremony; Student-Industry Event
>> August 21, 2017:	SGA General Assembly
>> August 22, 2017:	Gala Dinner, Chateau Frontenac
>> August 23, 2017:	Closing Ceremony

REGISTRATION	EARLY ($CAD) (before May 15, 2017)	REGULAR ($CAD)
SGA member	675 $	750 $
SGA non member	825 $	900 $
Student SGA member	275 $	350 $
Student non member	350 $	425 $

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Symposia

. SY01 : Gold through time and space

· SY02 : Magmatic sulfide and oxide ore deposits in mafic and ultramafic rocks

· SY03 : IOCG-IOA ore systems and their magmatic-hydrothermal continuum: A family reunion?

· SY04 : Mineral deposits: theory, experiment and nature - a symposium to recognize the work of A.E. Williams-Jones

Sessions

· S01 : Geology, geodynamics and metallogeny of the Rhyacian (2.35 - 2.05 Ga)

· S02 : Ore-forming magmatic-hydrothermal processes along active margins

· S03 : Exhalative mineral deposits: key controls on the quality (size and/or grade) of deposits and districts

· S04 : Uranium deposits: from source to ore

· S05 : Iron ore - deposit to global scale processes

· S06 : The impact of the supercontinent cycle on ore formation

· S07 : Developments of geochronological methods and their application to date ore forming events

· S08 : From fertility to footprints: New vectoring tools for mineral exploration

· S09 : Geometallurgy: risk reduction through communication, optimization and innovation

· S10 : GSC@175: How can government promote exploration success?

· S11 : Resources development and perception/acceptability: The role of geosciences

· S12 : Gem research: Beautiful windows into earth's interior

· GS01 : General session - posters only

Short courses

- SC1 : Recent advances in the genesis of mafic and ultramafic ore systems
- SC2 : High technology metals (REE, Nb-Ta, Li)
- SC3 : Exploration geophysics – new methods, case studies, modeling
- SC4 : Linkages amongst iron-oxide alkali-altered systems: from metasomatism to orogenic metamorphism
- SC5 : Detecting the alteration footprint around porphyry copper deposits
- SC6 : Exploration management and targeting with 3D multidisciplinary models
- SC7 : Field portable instrumentation
- SC8 : Recent advances in CT and LA-ICP-MS applied to mineral exploration

Field trips

- FT01 : Physical volcanology and metallogenesis of the Ni-Cu-PGE deposits in the Cape Smith Belt, Québec, Canada
- FT02 : Iron oxide and alkali alteration, skarn and epithermal mineralizing systems of the Grenville Province, Canada
- FT03 : Gold mineralization in the Guyana Shield, Guyana and Suriname, South America
- FT04 : Uranium deposits in the Western Athabasca Basin, Canada
- FT05 : Québec fortified city: geological and historical heritage
- FT06 : Precious and base metal deposits of the southern Abitibi greenstone belt, Superior Province, Canada
- FT07 : Stratigraphic and metallogenic context of the Sokoman Iron Formation in the Labrador Trough near Schefferville, Québec-Labrador, Canada
- FT08 : Geologic setting and iron oxide deposits of the mesoproterozoic St. Francois Mountains, Southeast Missouri, USA