



FLEXIBLE TRAINING MODELS: A RESPONSE TO THE CURRENT NEEDS

THE BCN-SGA STUDENT CHAPTER:

A tool for insertion to research and laboral world in metallogeny

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- 1. ABSTRACT:** The activity of the BCN-SGA Student Chapter is evaluated. Established in 2012 it has grown up to 69 members, organizing 2 international workshops, 8 seminars, numerous visits to museums, activities stimulating the use of English in social events and microresearch projects. The results of these microprojects are 15 presentations in scientific congresses. These activities enhance teamwork skills and demonstrate that students can develop high quality research during the whole of their formation.
- 2. RESUM:** Avaluem l'activitat del BCN-SGA Student Chapter. Creat el 2012 amb uns 20 membres, ha crescut fins els 69, ha organitzat dos workshops internacionals, seminaris, visites a museus, activitats que fomenten l'ús de l'anglès científic, propostes lúdiques i microprojectes de recerca. Els resultats dels microprojectes són 15 presentacions en congressos científics. Constatem que potencia la companyonia i les capacitats d'organització i de treball en grup i demostra que els estudiants poden fer recerca de qualitat durant tots els seus estadis formatius.
- 3. KEYWORDS:** student association, mineral deposits, research, participation, team /
PARAULES CLAU: associació d'estudiants, dipòsits minerals, recerca, participació, equip

4. DEVELOPMENT:

a) Background and objectives

The Society for Geology Applied to Mineral Deposits (SGA) is an international scientific society that promotes scientific activities concerning mineral deposits. Its worldwide membership is composed of more than 700 members which include researchers, professionals, non-graduate students from the university, as well as other members from industries and governments interested in Economic Geology, Mineral Resources, Industrial Minerals and environmental aspects related to Mineral Deposits.



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The SGA has a special programme to encourage the formation of Student Chapters, which are organisations of students who are involved in the investigation of ore deposits. The sponsored activities are diverse. These include all the aspects of the formation (seminars, workshops, courses, conferences, field trips, visits to museums, etc.) and the introduction to research (funding research projects, congress attendance, publications, etc.) in addition to social events. The student chapters are worldwide characterised to be self-managed, so students are totally involved in the activities. Hence, they must obtain fundings, organize the events and carry out the research. Nonetheless, they have academic advisors, who are responsible of the following of an ordered routine in the association. Of course, these activities are voluntary and absolutely independent of any regular teaching activity at the faculty.

The Barcelona SGA Student Chapter (BCN-SGA SC) was founded by SGA student members from the Faculty of Geology of the Universitat de Barcelona (UB) in summer 2012. Since then, this association has been largely supported, both financially and scientifically, by the SGA and the SGR 444 “Mineral Resources: Ore deposits, Applications and Sustainability” which resulted in the nomination of the BCN-SGA SC advisors: Dr. J.C. Melgarejo and Dr. J. Proenza, both members of the SGR444. The BCN-SGA SC is formed by undergraduate (2nd, 3rd and 4th year), MSc and PhD students.

The aim of this association is to create a meeting point for knowledge and research in the field of Mineral Deposits and Economic Geology in the Faculty of Geology of the UB, involving not only professors, lecturers and PhD students, but preferentially undergraduate students. The activities organised by the BCN-SGA SC are expected to encourage young scientists as well as to inspire undergraduate students to develop research projects related to Mineral Deposits and Economic Geology.

The aim of this contribution is to evaluate the results of this association in these past 2 years of activity.



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b) Results: Activities of the student chapter

1) Workshops

The BCN-SGA SC has organised two workshops to encourage the students to broad their knowledge on Ore Deposits and related topics. Funding was achieved from grants from the SGA (travels and accommodation for the senior speakers, renting of buses or cars for the field trips) and from external sponsors (catering and other social activities). The Faculty of Geology of the University of Barcelona allowed the use of the classrooms and other spaces to undertake these activities.

The three-day “Pegmatite Workshop” was the first activity organised by the BCN-SGA SC. Over 50 people participated in this activity, developed at the Faculty of Geology of the University of Barcelona, which attracted students and professors from the faculty and from other universities. The workshop comprised the next units:

- a. a comprehensive two-hour lesson on the basics of pegmatites imparted by MSc Sandra Amores, covering sample observation of pegmatite characteristic minerals and textures in hand sample (fig. 1) and thin sections (fig. 2). This lesson was gratefully acknowledged by the students, especially by those who did not know much about pegmatites.



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Fig. 1. MSc student Sandra Amores showing how to identify the pegmatite-forming minerals in hand sample to the members of the student chapter, during the introductory sessions to the Pegmatite Workshop.



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Fig. 2. MSc student Sandra Amores in a practical demonstration where pegmatite-forming minerals in thin/polished sections were identified with optical microscopes for the members of the student chapter, during the introductory sessions to the Pegmatite Workshop.

- b. six lectures (one hour each) given by international senior speakers (fig. 3). The scientific session was held on October 11th with six outstanding talks given by our national and international invited lecturers. The diverse program included new findings from Lithium pegmatites exploration and exploitation in northern Portugal (Barroso-Alvão case study, by Dr. A.M. Lima, Univ. do Porto, Portugal); an example of a complete evolution from granitic to highly evolved pegmatitic facies (Pinilla de Fermoselle rare element pegmatite, Spain, by Dra. E. Roda, Euskal Herriko Unibertsitatea, Basque Country), geochemical zoning and evolution in pegmatite fields (example from Giraul River, Angola, by Dr. J.C. Melgarejo, Univ. Barcelona, Catalonia), description of fluid inclusions in pegmatites (Cap de Creus case study, by Dra. P. Alfonso, Univ. Politècnica de Catalunya, Catalonia), pegmatites as source of



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raw materials (Dr. S. Martínez, Univ. Barcelona, Catalonia) as well as new experimental data from rare element pegmatites and its comparison with natural rocks (Dra. M. van Lichtenvelde, Univ. Paul Sabatier de Toulouse, France).



Fig. 3. Aspect of a session during the lectures by the international senior speakers whilst the Pegmatite Workshop.

- c. a one-day field trip to the Cap de Creus pegmatites, lead by Dr. Joan Carles Melgarejo and Dra. Pura Alfonso (fig. 4). The trip was attended by 50 members and several outcrops of representative rare-element pegmatites were visited.



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Fig. 4. Studying the relationships between pegmatites and the geological context in the Cap de Creus pegmatite field, in the fieldtrip held during the Pegmatite Workshop.

The UB reported the activities performed during this workshop in a video (http://www.ub.edu/ubtv/ubtv_veurereg.cgi?G_CODI=02957&G_USCODI=97695&IDIO_MA=ALL&G_LLISTA=cerca), and an explanation of the field work geology by some members of the Student Chapter was broadcasted by TV3 in the programme “El Medi Ambient”.

The second workshop took place between the 19th -20th of September 2013. It was devoted to “Ore deposits related to acid magmatism” and it included: a) a two-hour introductory lesson given by Prof. B. Lehmann (chief editor of *Mineralium Deposita*); b) a one-day session of lectures, all of them given by international specialists in this topic; c) field trips to visit hydrothermal deposits in Conca de Barberà and Priorat areas. In the workshop Dr Antonio Arribas (Escuela Superior de Minas de Madrid, Spain), one of the senior figures of the metallogeny in Spain, was honoured and named honorific advisor of the Student Chapter.



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The workshop included an enlightening two-hour introductory lesson entitled “Felsic magmatism and hydrothermal systems” by Prof. Bernd Lehmann (Technical University of Clausthal – Germany) (Fig. 5).



Fig. 5. Image of the introductory lesson to the II workshop “Ore deposits related to acid magmatism” by Prof. B. Lehmann (Technical University of Clausthal – Germany). The title of the lesson was “Felsic magmatism and hydrothermal systems”.

The main day of the workshop consisted of lectures given by international experienced specialists on this topic (Fig. 6). Thus, the talk by Prof. José Mangas (Universidad de las Palmas de Gran Canarias, Spain), entitled “Spanish Sn deposits associated to Hercynian granitic intrusives” explained the three stages of formation registered in the Spanish deposits deduced from the study of fluid inclusions; Prof. Mangas also emphasized the economic potential of tin mines, most of them closed, in countries such as Spain, Portugal, Germany or the Czech Republic. Prof. F.M.P. Noronha (Universidade do Porto) moved from tin to tungsten deposits with the talk entitled “Tungsten ore deposits in Central Iberian Zone”; all the audience could enjoy his talk in which the Panasqueira mine was clearly the



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main topic. Prof. B. Lehmann (Technical University of Clausthal – Germany), with his talk “Granite-related rare-metal mineralization”, explained the geochemistry of tin and tantalum in the magmatic-hydrothermal system and their concentration mechanisms. Finally, Dr. H. Leal-Mejía (University of British Columbia - Canada) explained the evolution of the Phanerozoic acid magmatism in the Colombian Andes and its relation with Gold Deposit genesis.



Fig. 6. A moment of the talk given by Dr. J. Mangas in the spanish Sn-W hydrothermal deposits.

The fieldtrip, developed in a region of great geological and metallogenetic interest, included a first day in which different outcrops and mines near the Bellmunt del Priorat town were visited. In addition, the participants walked next to the Siurana River to see the pre-Cambrian rocks outcropping and containing small concentration of sulfides. Different abandoned mines, some of them now converted into wine cellars or touristic mines, were



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also visited. Mines such as "La Serrana", a stratabound Mn mine, "Règia" mine and "Eugènia" mine (mainly mined for Pb until the 70s) and "Linda Mariquita" barite mine were visited. The visit to the underground work of the Eugènia mine was possible thanks to the collaboration with the Museu de les Mines de Bellmunt (Town Council of Bellmunt del Priorat; fig. 7).



Fig. 7. Explanation of hydrothermal alterations inside the tunnels of the Eugenia mine in Bellmunt del Priorat, during the field trip to the Priorat domain.

During the second day other mineralized areas such as the occurrences in the "Mas del Mestre" area, close to Falset, and some outcrops close to Valls town were visited. At the end of the second day, a summary of the regional tectonic, magmatic and metallogenic setting was carried out by Dr. J.C. Melgarejo; the graphic material he presented was really helpful in order to understand the complexity of the geologic history of the area.



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Another fieldtrip led by Dr. J.C. Melgarejo, to the Barberà Basin (Conca de Barberà) took place. During this one-day fieldtrip the attendants could observe the quartz-wolfram veins in hercinian granitoids, polymetallic sulphide mineralisation's (Pb-Zn-Cu-Au-PGE-Bi-Te-As-Ni-Co-V-Cr), barite veins and 16th century alum mines. Mineralogical and petrographical aspects of the ores and host rocks were combined with geochemistry, fluid inclusion data and large-scale tectonics, in order to have a broad view of the visited ore deposits and their environment.

Besides organising workshops, the BCN-SGA SC also promotes the attendance to other courses offered by foreign universities, and several members of this association participated in other international workshops: one related to *Uranium Ore Deposits* in Nancy (France; 1 student) and other related to “*Gold deposits: from theory to exploration practice*” in Prague (Czech Republic; 8 students). This experience not only did train them on specific topics but also encouraged international student exchange.

2) Lectures

Several talks given by specialists from all over the world about the most diverse topics were organized by the BCN-SGA SC. The list includes:

- Dr. R.F. Martin (McGill University, Montreal, Canada), 2 conferences: Punctuated anorogenic magmatism and its links with metallogeny; Femic magma: a new player in the game
- Dr. C.E. Nelson (Senior consulting geologist), 2 conferences: The Pueblo Viejo deposit: characteristics and genetic models; The role of the geologist in a junior mining company
- Dr. J.A. Batista Rodríguez (Universidad Autónoma de Coahuila, Escuela Superior de Ingeniería, México): Scope of the geophysical methods during the prospection of ophiolite related mineral deposits.



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- Dr. F. Gervilla Linares (Dept. Mineralogía y Petrología, Instituto Andaluz de Ciencias de la Tierra, Universidad de Granada, Spain): The Ni-Cu-PGE Keivitsa deposit, Northern Finland: an example of hydrothermal remobilization of the platinum group elements.
- Dr. G. Garuti (Dept. of Applied Geosciences and Geophysics, University of Leoben, Austria): Massive sulfide deposits of the northern Apennine ophiolites (Italy).
- Dra. F. Zaccarini (Dept. of Applied Geosciences and Geophysics, University of Leoben, Austria): Electron microprobe and Raman spectroscopy applied to the identification of platinum group minerals (PGM).
- Dr. C. Canet Miquel (Dept. Recursos Naturales, Instituto de Geofísica & Dept. Geoquímica, Instituto de Geología, Universidad Nacional Autónoma de México, México): The Sonora stratiform barite deposits: relation and analogy with the methane cold seeps.
- Dr. C.E. Nelson (Recursos del Caribe SA): Hot Spring Gold Deposits of the Circum-Pacific Region.
- Dr. A. Camprubí i Cano (Centre of Geosciences and the institutes of Geophysics and Geology, Universidad Nacional Autónoma de México, México): IOCG deposits in Mexico: more questions than answers?
- Dr. J. M. González Jiménez (Geochemical Evolution and Metallogeny of Continents (GEMOC), Dept. Earth and Planetary Sciences; Macquarie University, Australia): Origins of platinum-group minerals in upper mantle rocks.
- Dr. A. García Casco (Departamento de Mineralogía y Petrología - Instituto Andaluz de Ciencias de la Tierra, Facultad de Ciencias, Universidad de Granada, Granada, Spain): X Ray analysis: work strategy and applications



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3) *Development of research*

One of the aims of the Student Chapter is to favour the development of voluntary research by the students. This research is independent of regular studies. Under the supervision of the SGR444 professors, several groups of students developed microprojects of research, all of them consisting of: a) planning and preparation of the research; b) field trip to study in situ the geology of a mineral deposit and to carry out a representative sampling (fig. 8), c) study of its mineral associations using all the necessary techniques, as optical microscopy (transmitted and reflected light), SEM-EDS, XRD, XRF, EMP, LA-ICP-MS, Raman microprobe, fluid inclusions and stable or radiogenic isotopes, c) evaluation of the results, processing of the data, comparison with the bibliography; d) extracting conclusions and d) presentation of the results of the research. These tasks were realised during several weekends in order to avoid interferences with lessons.





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Fig. 8. Explanation about how to develop a sampling at the Brunita mine, near La Unión (Murcia, Spain) during the preparation of a research activity.

4) *Presentation of results in national and international conferences*

In August (12th-15th 2013) 23 members of the BCN-SGA SC attended the 12th SGA Biennial Meeting at the University of Uppsala, Sweden, and presented their research results both as posters (fig. 9) and oral communications (Acedo et al., Aiglsperger et al., 2013a; Aiglsperger et al., 2013b; 2013; Amores et al., 2013; Arbiol et al., 2013; Arqués et al., 2013; Artiaga et al., 2013; Cardona et al., 2013; Colomer et al., 2013; Sanmartí et al., 2013; Pujol et al., 2013; Soler et al., 2013; Torres-Cueva et al., 2013; Torró et al., 2013; Villanova et al., 2013). The extended abstracts of these communications (4 pages), after reviewed by 2-3 anonymous referees, were published in the conference's Proceedings. This conference was also an opportunity for mining companies to promote themselves and to look for students who were seeking for future jobs or internships, which was very positive for the students. The participation of the BCN-SGA SC was possible thanks to the financial support of the SGA and the SGR444. It is scheduled to participate in the next SGA Biennial Meeting in Nancy (France).



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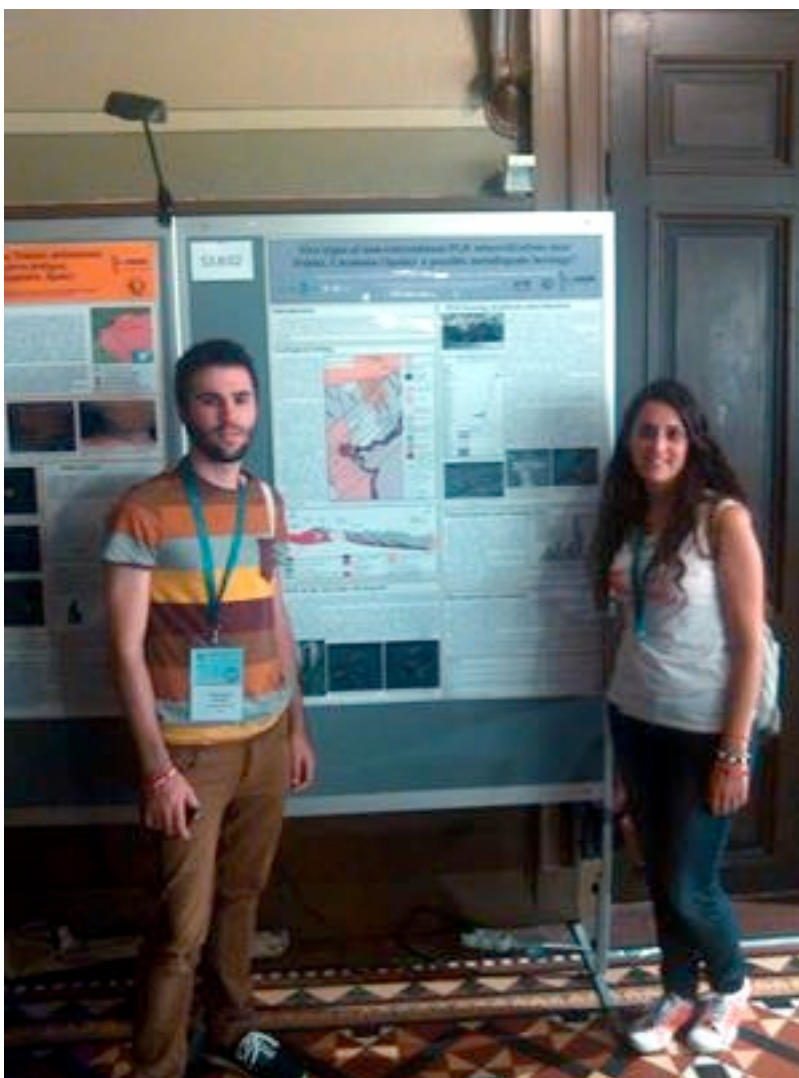


Fig. 9. Two students of the BCN-SGA SC presenting the results of their research during the SGA meeting held in Uppsala, Sweden.

5) Other activities

In connection with the exhibition about High Tech Materials held at our Faculty, the BCN-SGA Student Chapter organized a workshop on “Geological side of High Tech Metals (HTM)” on February the 12th 2014. It consisted of several talks devoted to a better understanding of the geological side of these materials. The activity was thought as a understandable explanation about the importance of these elements and materials as



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essentials for our society. The critical importance of the HTM for the European Union was introduced by Dr. J.A. Proenza. Conventional and non-conventional deposits were explained by Marc Campeny and Thomas Aiglsperger respectively. Finally, a debate entitled Mining YES/NO?, moderated by Dr. J.C. Melgarejo, discussed beyond 1 hour topics about the convenience of mining in the widest sense.

In July 2013, the BCN-SGA SC organised a one-day meeting at the Faculty of Geology. This event consisted of four sessions of 10-minute talks in which most of the Student Chapter members explained their current research projects in English (fig. 10). Well received by professors and proved to be positive for the students, the activity was a success and will be repeated annually. Other activities arranged in order to stimulate the use of English among the students included the so-called *Cineforum*, which takes place once a month and enables the students to share ideas and discuss opinions in English after watching a movie.



Fig. 10. A student discussing with the other students the results of her research.



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The students created the T-shirts of the BCN Student Chapter. The main theme of its design, voted between the drafts presented by the student members, is the Gaudí-style hammer which is the official logo of the association, combined with the sentence “All you need is Ore” making reference to the popular song by The Beatles.

In addition, cultural and social activities included a visit to the Natural History Museum in Barcelona and celebrations.

6) *Membership increase*

The number of members has gradually increased right from the beginning and exhibits today a total of 69 members.

c) *Conclusions*

The BCN-SGA SC has become a helpful tool to bring closer professional science as well as mining companies to the university students. During these two years the experience of the SC has been very fruitful and the achievements and benefits provided by the association can be summarized into the next points:

- The BCN-SGA SC is completely managed by the students, so they are actively involved in the organization of activities providing a valuable learning in their decision-making.
- The BCN-SGA SC provides a valuable link between the student members and both different academic institutions and private companies. Until now, two students of the SC have been granted with scholarships to carry out their master studies in the University of Geneva thanks to their experience gained in the association.
- The acceptance of the results of the microresearch projects in peer-reviewed publications demonstrates that undergraduate students can develop research of quality, in particular if this research is coordinated with consolidated research groups. Hence,



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the BCN-SGA SC has proved to be a very active and friendly participative organisation which introduces the students to high quality and up-to-date research.

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5. REFERENCES

Acedo, A.; Galindos, M.; Pastor, M.; Segura, R.; Amores, S.; Melgarejo J.C. (2013): Ag-Hg vein deposits hosted by Triassic dolostones from the Mina de la Guerra Antigua, Villahermosa del Rio (Castelló, Spain) In Jonsson, E. et al. (ed). Mineral deposit research for a high tech world 3, Proceedings of the 12th Biennial SGA Meeting, 12–15 August 2013, Elanders Sverige AB Uppsala, Sweden, 1224-1227 ISBN 978-91-7403-207-9.

Aiglsperger, Th., Proenza, J.A., Lewis, J.F.; Zaccarini, F.; Garuti, G.; Rojas-Purón, A.; Longo, F; Chang, A. (2013a) Platinum group elements in different types of Ni-laterite profiles from the northern Caribbean: a geochemical comparison. Proceedings In Jonsson, E. et al. (ed). Mineral deposit research for a high tech world 3, Proceedings of the 12th



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Biennial SGA Meeting, 12–15 August 2013, Elanders Sverige AB Uppsala, Sweden, 933-936

Aiglsperger, Th., Proenza, J.A., Lewis, J.F.; Zaccarini, F.; Garuti, G.; Rojas-Purón, A.; Longo, F; Chang, A. (2013b) Rare earth elements and scandium in different types of Ni-laterite profiles from the northern Caribbean: a geochemical comparison. In Jonsson, E. et al. (ed). Mineral deposit research for a high tech world 4, Proceedings of the 12th Biennial SGA Meeting, 12–15 August 2013, Elanders Sverige AB Uppsala, Sweden, 1683-1686

Amores, S.; Bertran, O.; Buireu, F.; Febrer, M.; Melgarejo, J.C.; Enrique-Gisbert, P.: (2013): Stable isotope studies of carbonate – hosted ore deposit in Cerro Minado, Huércal – Overa (Spain). In Jonsson, E. et al. (ed). Mineral deposit research for a high tech world 2, Proceedings of the 12th Biennial SGA Meeting, 12–15 August 2013, Elanders Sverige AB Uppsala, Sweden, 604-607.

Arbiol-González, C.; Conesa, N.; Canals, A.; Proenza, J.A.; Melgarejo J.C.; Cardellach, E. (2013): Two types of non-conventional PGE mineralizations near Poblet, Catalonia (Spain): a possible metallogenic heritage. In Jonsson, E. et al. (ed). Mineral deposit research for a high tech world 3, Proceedings of the 12th Biennial SGA Meeting, 12–15 August 2013, Elanders Sverige AB Uppsala, Sweden, 1232-1325.

Arqués Farré, L; Cacho Amorós, A.; Artiaga Torres, D.; Torres Cueva, B.; Torró, L.; Melgarejo, J.C.; Ramiro Condori, R.; Guevara, N.; Arce, O. (2013): The Huanuni Sn-W-Pb-Zn-Ag vein deposits, Bolivia: structure and mineralogy. In Jonsson, E. et al. (ed). Mineral deposit research for a high tech world 3, Proceedings of the 12th Biennial SGA Meeting, 12–15 August 2013, Elanders Sverige AB Uppsala, Sweden, 1236-1238.

Artiaga, D.; Torres, B.; Torró, L.; Tauler, E.; Melgarejo, J.C. (2013): The Viloco Sn-W-Mo-As deposits, Bolivia: geology and mineralogy. In Jonsson, E. et al. (ed). Mineral deposit research for a high tech world 3, Proceedings of the 12th Biennial SGA Meeting, 12–15 August 2013, Elanders Sverige AB Uppsala, Sweden, 1239-1242.



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Cardona, S.; Torr , L.; Campeny, M.; Andreu, E.; Melgarejo, J.C.; Proenza, J.A.; De Witt, M.; Bruchs, J.M.; Lewis, J.F. (2013): Proterozoic metallogeny in the NW border of Botswana. In Jonsson, E. et al. (ed). Mineral deposit research for a high tech world 3, Proceedings of the 12th Biennial SGA Meeting, 12–15 August 2013, Elanders Sverige AB Uppsala, Sweden, 1247-1250.

Colomer, J.M.; Andreu, E.; Torr , L.; Proenza, J.A.; Melgarejo, J.C.; Chavez, C.; del Carpio, R.; Espaillat, J; Lewis J.F. (2013): Mineralogy, textures and new sulphur isotope data of the Cerro de Maim n VMS deposit ores, Dominican Republic. In Jonsson, E. et al. (ed). Mineral deposit research for a high tech world 2, Proceedings of the 12th Biennial SGA Meeting, 12–15 August 2013, Elanders Sverige AB Uppsala, Sweden, 518-521.

Pujol, N.; Andreazini Sabat , A.; Schamuells, S.; Amores Casals, S; Villanova-de-Benavent, C.; Torr , L.; Melgarejo, J.C.; Manteca, J.I. (2013): Primary and secondary deposits from the Crisoleja area (Pb-Zn-Ag-Sn), La Uni n, Murcia, Spain. In Jonsson, E. et al. (ed). Mineral deposit research for a high tech world 3, Proceedings of the 12th Biennial SGA Meeting, 12–15 August 2013, Elanders Sverige AB Uppsala, Sweden, 1307-1310.

Sanmart  Rodr guez, L.; Gaya Man s, A.; Molina Trevi o, C.; Amores Casals, S.; Villanova-de-Benavent, C.; Torr  i Abat, L.; Melgarejo, J.C.; Manteca, J.I. (2013): The mineral association in the Emilia and Brunita Pb-Zn-Ag-(Sn) deposits, La Uni n, Murcia, Spain. In Jonsson, E. et al. (ed). Mineral deposit research for a high tech world 3, Proceedings of the 12th Biennial SGA Meeting, 12–15 August 2013, Elanders Sverige AB Uppsala, Sweden, 1311-1314.

Soler, J.; Farr , J.; Portell, L.; Jou, S.; Corrales, O.; Amores, S.; Villanova, C.; Torr , L.; Melgarejo, J.C.; Manteca, J.I. (2013): The San Jos  and Gloria Pb-Zn-Ag-Sn deposits, La Uni n, Murcia: An approach to the mineral sequence. In Jonsson, E. et al. (ed). Mineral deposit research for a high tech world 3, Proceedings of the 12th Biennial SGA Meeting, 12–15 August 2013, Elanders Sverige AB Uppsala, Sweden, 1315-1318.



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Torres, B.; Artiaga, D.;Torró, L.; Tauler, E.; Melgarejo, J.C. (2013): The Poopó Sn-Ag-Zn-Pb vein deposit, Bolivia: structure and mineralogy. In Jonsson, E. et al. (ed). Mineral deposit research for a high tech world 3, Proceedings of the 12th Biennial SGA Meeting, 12–15 August 2013, Elanders Sverige AB Uppsala, Sweden, 1327-1330.

Torró, L., Proenza, J.A., Melgarejo, J.C., Carrasco, C.A., Domínguez, H.S., Nelson, C. & Lewis, J.F. (2013): Alteration mineral domains under Loma la Cuaba: new insights as to the origin of the mineralization in the Pueblo Viejo district. In Jonsson, E. et al. (ed). Mineral deposit research for a high tech world 2, Proceedings of the 12th Biennial SGA Meeting, 12–15 August 2013, Elanders Sverige AB Uppsala, Sweden,590-593.

Villanova, C., Proenza, J.A., Galí, S., Tauler, E., García, A., Lewis, J.F., Longo, F. (2013) “Garnierite” ore and Ni-serpentine mineralizations from the Falcondo Ni-laterite deposit (Dominican Republic): An approach from quantitative XR element imaging. In Jonsson, E. et al. (ed). Mineral deposit research for a high tech world 1, Proceedings of the 12th Biennial SGA Meeting, 12–15 August 2013, Elanders Sverige AB Uppsala, Sweden,379-382.