GeoResources and Geomaterials

GeoResources and Geomaterials (G3)

Report 2020

Unidade de I&D ICT

Instituto de Ciências da Terra - FCT

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U.PORTO FACULDADE DE CIÊNCIAS UNIVERSIDADE DO PORTO

Instituto de Ciências da Terra
Institute of Earth Sciences

The GeoResources and Geomaterials – Group 3 is included in ICT structure, a multidisciplinary institution, organized into six research groups covering major areas of Earth Sciences and comprising a wide range of scientific expertise. The main objective of **GeoResources and Geomaterials Group** is aligned with the ICT mission which is to develop exceptional-quality research, promote technological development and support public policies in the area of Earth Sciences.

This report presents the main achievements produced by **GeoResources and Geomaterials - Group 3**, including publications, organization of events, outreach activities, and other outcomes.

The composition of the **Group 3 team** can be consulted at:

https://www.icterra.pt/g3/index.php/team/

The main goals of the **Group 3 team** can be consulted at:

https://www.icterra.pt/g3/index.php/about-us/

In a year which, due to unpredictability, has surprised us all, I would like to congratulate the G3 team and praise the effort to keep their activity as regular as possible, as this report indicates.

Helena Sant'Ovaia

GeoResources and Geomaterials Group Coordinator

Porto, 12th February 2021

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1. Selected publications

The criteria used to select the following publications was that the first author had to be a student.

Cardoso-Fernandes, J., Teodoro, A. C., Lima, A., Perrotta, M., Roda-Robles, E., 2020. Detecting Lithium (Li) Mineralizations from Space: Current Research and Future Perspectives. Appl. Sci. 10, no. 5: 1785. https://doi.org/10.3390/app10051785

Cruz, C., Góis, J., **Sant'Ovaia, H., Noronha, F.,** 2020. Geostatistical approach in the study of the magnetic susceptibility variation: Lamas de Olo Pluton case study. Journal of Iberian Geology: 1-11. https://doi.org/10.1007/s41513-020-00128-x

Gonçalves, A., Sant'Ovaia, H., Ribeiro, M.A., Noronha, F., 2020. The Esmolfe - Matança granite (Penalva do Castelo, Central Portugal): a keystone to understand the ascent and emplacement of magmas under low tectonic stress. J. Struct. Geol., 139, 104-143. https://doi.org/10.1016/j.jsg.2020.104143

Guimarães, R., Guedes, A., Valentim, B., 2020. Identification and characterization of Ti-spheres (titanspheres) in cork powder fly ash. Waste and Biomass Valorization 11, 2905–2923. https://doi.org/10.1007/s12649-019-00609-w

Maia, M., Moreira, N., Vicente, S., Mirão, J., **Noronha, F., Nogueira, P.,** 2020. Multi-Stage Fluid System Responsible for Ore Deposition in the Ossa-Morena Zone (Portugal): Constraints in Cu-Ore Deposits Formation. Geology of Ore Deposits 62, 508-534. DOI: 10.1134/S1075701520060094

Moura, H., Marques, M.M., Suárez-Ruiz, I., **Ribeiro, J.**, Cunha, P.P., **Flores, D.**, 2020. Geochemical study of the natural cokes from the Peñarroya-Belmez-Espiel Basin (Spain). Comunicações Geológicas 107, 101-104.
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Roseiro, J., Moreira, N., **Nogueira, P., Maia, M.,** Araújo, A., **Pedro, J.,** 2020. Depositional environment and passive-to-active margin transition as recorded by trace elements chemistry of lower-middle Palaeozoic detrital units from the Ossa-Morena Zone (SW Iberia). Comunicações Geológicas, 107, Especial II, 39-46. https://www.lneg.pt/wp-content/uploads/2020/07/05_Roseiro-et-al-2020_final_39-46.pdf

2. Publications

A. Books, chapters in books and articles

A1. Books and chapters in books

Boaventura, R., Moita, P., **Pedro, J.**, Mataloto, R., Almeida, L., **Nogueira**, **P.,** Máximo, J., Pereira, A., Francisco Santos, J., Ribeiro S., 2020. Moving megaliths in the Neolithic - a multi analytical case study of dolmens in Freixo-Redondo (Alentejo, Portugal). In: Boaventura, R., Mataloto, R., Pereira, A. (Eds.), Megaliths and Geology, Archaeopress, pp. 1-24, ISBN: 9781789696417.

Duarte, I., Pinho, A., **Lopes, L.**, Sábio, R., Jorge, M., 2020. Subsidence Hazard in Limestone Cavities: The Case of "Grutas da Moeda" (Fátima, Central Portugal). In: Fernandes F., Malheiro A., Chaminé H. (eds) Advances in Natural Hazards and Hydrological Risks: Meeting the Challenge. Advances in Science, Technology & Innovation (IEREK Interdisciplinary Series for Sustainable Development). Springer, Cham. First Online 03 January 2020, Online ISBN 978-3-030-34397-2. DOI https://doi.org/10.1007/978-3-030-34397-2_13. Print ISBN 978-3-030-34396-5.

Lima, A., Morris J., Esperancinha S., 2020. CHAPTER 6. GEOETHICS AND GEORESOURCES. E-Book Teaching Geoethics - Resources for Higher Education, Vasconcelos, C., Schneider-Voß, S., & Peppoloni, S. (Eds.). U.Porto Edições. https://doi.org/10.24840/978-989-746-254-2 p. 73-83

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Sant'Ovaia, H., Cruz, C., Gonçalves, A., Noronha, F., 2020. Anisotropia da Suscetibilidade Magnética em granitos variscos portugueses: 20 anos de investigação. In: Abrantes, I., Callapez, P. M., Correia, G. P., Gomes, E., Lopes, B., Lopes, F. C., Pires, E., & Rola, A. (Eds.), *Uma visão holística da Terra e do Espaço nas suas vertentes naturais e humanas. Homenagem à Professora Celeste Romualdo Gomes*. Coimbra: CITEUC. pp. 125-146. © CITEUC, 2020 DOI: http://doi.org/10.5281/zenodo.4409264.

A2. Articles in peer-review Journals (ISI and Scopus)

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Badenhorst, C., **Santos, C.,** Lázaro-Martinez, J., Bialecka, B., Cruceru, M., **Guedes, A.**, **Guimarães, R., Moreira, K,** Predeanu, G., Suárez-Ruíz, I., Cameán, I., **Valentim, B.,** Wagner, N., 2020. Assessment of

graphitized coal ash char concentrates as a potential synthetic graphite source. Minerals 10(11), 986. https://doi.org/10.3390/min10110986

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A3. <u>Articles in national peer-review Journals</u>

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B. Conference proceedings

B1. International conference proceedings

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B2. National conference proceedings

Cardoso-Fernandes, J., Lima, A., Roda-Robes, E., **Ribeiro, M.A., Teodoro, A.C.**, 2020. Pathfinder analysis for lithium (Li) exploration in the Central Iberian Zone (CIZ). X Congresso Jovens Investigadores em Geociências, LEG 2020, Estremoz, Livro de Actas.

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Lima, L., Calvo, J., **Noronha, F.,** 2020. Escombreiras a construir para deposição dos resíduos mineiros resultantes da exploração da brecha Santa Helena (Borralha). Jornadas do ICT 2020, Braga

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Oliveira, A., Martins, H.C.B., Sant'Ovaia, H., 2020. Geochemical study of two compositionally contrasting veins of the Lamas de Olo region (Celorico de Basto). Livro de Atas do X Congresso de Jovens Investigadores em Geociências, LEG 2020, Estremoz, 20 de novembro de 2020, pp. 16-19.

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C. Reports

Hensen, C., Adao, H., Arn, S., Batista, L., Belosa, L., Bodenbinder, A., Cherednichenko, S., Domeyer, B., Duarte, J., Glombitza, C., Kaul, N., Koppe, M., Li, J., Liebetrau, V., Müller, T., **Nogueira**, **P.,** Nuzzo, M., Petersen, A., Schmidt, M., Schmidt, J.N., Schmidt, T., Sroczynska, K., Stelzner, M., Terrinha, P., Warnken, N., Weber, U.W., 2020. M162- Exploring subsurface fluid flow and active dewatering along the oceanic plate boundary between Africa and Eurasia (Gloria Fault). GEOMAR Helmholtz-Zentrum für Ozeanforschung Kiel. 189p.

Lima, L., Calvo, J. 2020. Informe del trabajo realizado por personal técnico. Estancias en el Instituto de Ciências da Terra (FCUP) y en Cartif, 2020. "Escombreiras a construir para deposição dos resíduos mineiros resultantes da exploração da brecha Santa Helena (Borralha)". 89 pp.

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Nogueira, P., Roseiro, J., Maia, M., Moreira, N., 2020. Final Technical Report – ZOM3D: "3D Metallogenic Models of the Ossa-Morena Zone: Valorization of the Alentejo mineral resources". University of Évora (Portugal), July 2020, 134 p. and 7 appendixes.

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Ramos, V., Andersen, J., Rollinson, G., Crane, R., Littler, K., Coggan, J., Bailey, I., 2020. WP T2: Biomimetic materials for MI Microstructural properties. Deliverable T2.2.1 of the project Marineff, January 2020: 47pp.

Santos, P., Flores, D., 2020. Coal mining wastes: assessment, monitoring and reclamation of environmental impacts through remote sensing and geostatistical analysis - CoalMine - POCI- 01-0145-FEDER-030138. (www.fc.up.pt/coalmine/). Scientific Progress Report, Fundação para a Ciência e a Tecnologia, Ministério da Educação e Ciência, 2020.

3. Completed PhD Thesis

Cruz, C., 2020. Post-tectonic Variscan magmatism from Northwest Iberia. Implications for W-Mo metallogeny. Case study of Lamas de Olo Pluton. PhD thesis (published). Faculdade de Ciências da Universidade do Porto, Universidade de Aveiro, Portugal, 252 pp. https://hdl.handle.net/10216/129301. (Supervisors: **H. Sant'Ovaia**, **F.Noronha**).

4. Completed MSc Thesis

Amorim, P., 2020. Cartografia Geológica, Estratigrafia e Paleontologia da Região de Rates e São Félix de Laúndos. Mestrado em Geologia, Faculdade de Ciências da Universidade do Porto. (Supervisor: **Helena Couto**).

Araújo, J., 2020. Assinatura Geoquímica e Proveniência dos Sedimentos Depositados em Albufeiras Dominicana. Mestrado em Engenharia Geológica, Universidade de Évora. (Supervisor: **Pedro Miguel Nogueira**).

Candeco, L. 2020. Apoio transversal na componente de Geologia em projetos de natureza Geotécnica. Mestrado em Geologia, Faculdade de Ciências da Universidade do Porto. (Supervisors: **Maria dos Anjos Ribeiro**, Raquel Pais).

Carvalho, A. M., 2020. Geophysical and Geological Exploration Applied to Sb Mineralizations. Mestrado em Geologia, Universidade do Porto. (Supervisors: Rui Moura**, Alexandre Lima**).

Jesus, J., 2020. Modelação da Fenologia da Vinha a partir de técnicas de Deteção Remota - PhenoEngine. Mestrado em Sistemas de Informação Geográfica e Ordenamento do Território, FLUP. (Supervisor: **Ana Teodoro**).

Lagoela, R., 2020. Estudo de solos para aplicação forense através da realização de análises não destrutivas *in situ* e em laboratório. Mestrado em Geologia, Faculdade de Ciências da Universidade do Porto. (Supervisor: **Alexandra Guedes**).

Marques, J., 2020. Caraterização geológica e metalogénica do campo filoniano da Freixeda. Mestrado em Geologia. Faculdade de Ciências da Universidade do Porto. (Supervisor: **Iuliu Bobos**).

Martins, V., 2020. Estudo Hidropedológico e Hidrogeoquímico na Área da Mina de Carvão de São Pedro da Cova (N de Portugal). Mestrado em Geologia, Faculdade de Ciências da Universidade do Porto. (Supervisors: Jorge Espinha Marques, **Joana Ribeiro**).

Moreira, P., 2020. Classificação e mapeamento de zonas precisas para a produção de uvas na região Demarcada do Douro com base em indicadores topoclimáticos. Mestrado em Engenharia Agronómica, Faculdade de Ciências da Universidade do Porto. (co-Supervisors: **Ana Teodoro, Lia Duarte**).

Queirós, M., 2020. Estudo hidrogeológico no setor de Drave (Serra de S. Macário - Norte de Portugal). Mestrado em Geologia, Faculdade de Ciências da Universidade do Porto. (Supervisors: **Jorge Espinha, Lia Duarte,** Catarina Mansilha).

Sá, I.M., 2020. The use of XRF for Lithium exploration. Mestrado em Geologia, Faculdade de Ciências da Universidade do Porto. (Supervisors: **Alexandre Lima,** Diana Guimarães).

Santos, G.M., 2020. Borehole exploration in the Neves Corvo mine: current state of knowledge. Mestrado em Geologia, Faculdade de Ciências da Universidade do Porto. (Supervisors: **António Moura,** Nelson Pacheco).

Silva, J.C., 2020. A Study of The Spectral Signatures of Lithium Minerals of Fregeneda-Almendra Aplite-Pegmatite Field. Mestrado em Geologia, Faculdade de Ciências da Universidade do Porto. (Supervisors: **Ana Claudia Teodoro, Alexandre Lima**).

Silva, J.C., 2020. Ground validation of satellite exploration of pegmatitic Li indices from Portugal. Mestrado em Geologia, Faculdade de Ciências da Universidade do Porto. Trabalho em colaboração com a Universidade de Lorraine, França. (**Supervisor**: Ana Teodoro).

Vicente, S., 2020. Caracterização Geoquímica, Mineralógica e Petrográfica da Mina de Mociços. Mestrado em Engenharia Geológica, Universidade de Évora. (Supervisors: **Pedro Miguel Nogueira**, João Xavier Matos).

5. PhD, research, post-doc fellowships and researcher contracts signed in 2020

Alexandra Mota: research grant under the ESMIMET project.

Carla Carvalho: FCT PhD grant.

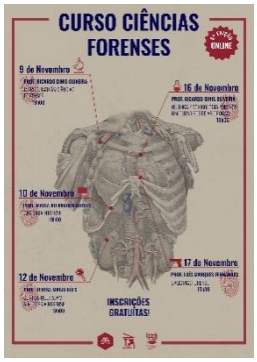
Filipa Dias: FCT PhD grant.

Jessica Torres: FCT PhD grant.

Sónia Gonçalves Pereira: FCT/ICT PhD grant.

6. Postgraduate courses

(i) **Alexandra Guedes** participated in the “VI Curso de Ciências Forenses”, FCUP, 10 November 2020 and presented the thematic “Geologia Forense”. 190 participants.



(ii) **Helena Sant’Ovaia e Maria dos Anjos Ribeiro** participated in a short-term training course organized by the Portuguese Association of Teachers of Biology and Geology: "Deformation and metamorphism - Register of associated processes. An approach to teaching-learning in an E-learning context". April 2020. 250 participants.

7. Scientific Events/ Field trips/ Conferences organization

(i) In July the Portuguese team of the **ERA MIN project LIGHTS** did an international meeting with colleagues from France, Spain, and Portugal to the Pegmatite field of Almendra-Fregeneda, collecting many samples and measures for research during the one-week field trip.

(ii) In July 2020, Portuguese and French teams of the **Aureole** project participated in fieldwork in the Catromil area.

(iii) **Ana Claudia Teodoro:** Program Committee do EPIA 2020, "EPIA'20 Thematic Track on Geospatial Artificial Intelligence", 2020.

(iv) **Ana Claudia Teodoro:** Program Committee do International Conference on Geographical Information Systems Theory, Applications and Management, 2020.

(v) **Ana Claudia Teodoro:** Scientific Committee of the SPIE Europe Remote Sensing "Earth Resources and Environmental Remote Sensing/GIS Applications X", 2020.

(vi) **Ana Claudia Teodoro:** Technical Program Committee of the IEEE/IGARSS International Geoscience and Remote Sensing Symposium (IGARSS), 2020.

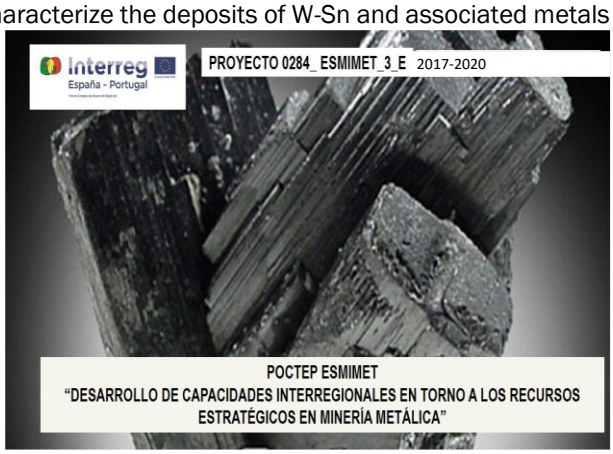
(vii) **Ana Claudia Teodoro:** Scientific Committee of the 3rd Conference of the Arabian Journal of Geosciences, 2020.

(viii) **Helena Sant'Ovaia:** Scientific Committee of X CJIG LEG 2020 – Estremoz.

8. Nacional and International Projects

(i) **Projeto 0284_ESMIMET_3_E**

Supported by INTERREG España- Portugal/ Fundo Europeu de Desenvolvimento Regional, ESMINET-Desarrollo De Capacidades Interregionales En Torno A Los Recursos Estratégicos En Minería Metálica. The project aims, among other objectives, to characterize the deposits of W-Sn and associated metals in Castilla y León – Spain - and the Northern and Central regions -Portugal - with the purpose of establishing possible prospecting guides that are universally applicable in the exploration of this type of deposits.



Principal Investigator FCUP: **Fernando Noronha**; Participants: **Alexandra Guedes, Iuliu Bobos, Helena Sant'Ovaia, Alexandra Guedes.** Grant holders: **Luis Lima, Alexandra Mota Fernandes;** Collaborators: **Ana Marta Gonçalves, Cláudia Cruz, Sara Leal.**

(ii) **ERA-MIN Joint Call 2019: MOSTMEG**

Predictive models for strategic metal rich, granite-related ore systems based on mineral and geochemical fingerprints and footprints. 2020-2023.

Principal Investigator FCUP: **Alexandra Guedes** (FCUP). ICT Participants **Violeta Ramos** and **Bruno Valentim**.

The main goal of MOSTMEG project is to develop and validate predictive models for strategic metal-rich, granite-related ore systems by refining available concepts and exploration strategies, using mineral and geochemical criteria as pathfinders or vectors to mineralized systems. Such systems may range from quartz-lodes, breccia pipes and skarns enriched in W-Sn-F(-P-Bi-Sb-Cu)-bearing mineral associations, greisenized granite cupolas and aplite-pegmatite-hosted mineral assemblages incorporating Sn-Ta-Y-F(-W-Nb) or Li-Cs-Be-Ta(-P-Rb).

ERA-MIN 2
RESEARCH & INNOVATION PROGRAMME ON RAW MATERIALS TO FOSTER CIRCULAR ECONOMY

(iii) **ERA-MIN/0002/2017 project: DEASPHOR**

Design of a product for SUBSTITUTION of phosphate rocks. ERA-MIN2 Join Call 2017.

Project Coordinator: **Bruno Valentim**; Participant: **Alexandra Guedes**.

The main objective of this project is the recycling of phosphorus from aviary litter ash as a substituting material of phosphate rocks. However, aviary litter ash is not economically attractive to substitute phosphate rocks, and also composed by materials that are impurities of the P2O5 extraction process. Therefore, novel solution is proposed to produce P-rich concentrates from aviary litter ash.

ERA-MIN 2
RESEARCH & INNOVATION PROGRAMME ON RAW MATERIALS TO FOSTER CIRCULAR ECONOMY

(iv) **ERA-MIN/0003/2018 project: NEXT-LiB**

Novel Circular Economic Approaches for Efficient Extraction of Valuables from Spend Li-ion Batteries. ERA-MIN Joint Call 2018.

Principal Investigator FCUP: **Bruno Valentim;** Participant: **Alexandra Guedes.**

The project aims to develop and demonstrate efficient processes and innovative techniques for the extraction of metals and separation of graphite from spent LIBs and to overcome the barrier and obstacles which limit the recovery efficiency.

(v) **ERA-MIN/0005/2018 – AUREOLE**

tArgeting eU cRitical mEtals (Sb, W) and predictibility of Sb-As-Hg envirOnmentaL issuEs - Project Fundação para a Ciência e a Tecnologia (Lisboa) 2019-10 to 2022-09.

Participants: **Alexandre Lima, Maria dos Anjos Ribeiro, Lia Duarte, Helena Sant'Ovaia.**

Antimony (Sb), a critical metal for Europe strategic for the European (EU) aircraft industry & battery manufacturing plants, is widely used in industrial operations. Its most promising use may be for rechargeable Li- & Na-ion batteries. The project is based on disruptive concepts: i) new 3D large-scale metallogenic model integrating deep-seated processes to determine the spatial distribution of ore deposits; ii) the use of mineral prospectivity data weighted by surface data to determine the probability of environmental risk over large areas. Despite a high EU potential, the knowledge on Sb remains poorly constrained. EU remains under the threat of the Chinese supply. In parallel, metalloids (Sb, As, Hg) of geogenic origin are recognised as a global threat for human health. Then, a large-scale identification of these areas should be a priority. In this 3 years project, it will produce i) a new 3D metallogenic model that will contribute to the understanding of the mineralizing processes; ii) a new understanding of surface processes that control the mobilisation & transport of metalloids; iii) a new large-scale mineral prospectivity and iv) a new large-scale environmental risk assessment by weighting mineral prospectivity with earth surface properties.

(vi) **ERA-MIN/0001/2017 – LIGHTS**

Solução integrada de dados hiper espetrais obtidos in situ e com recurso a plataformas aéreas para prospeção de lítio - Project Fundação para a Ciência e a Tecnologia (Lisboa)2018-05 to 2021-04.

Participants: **Ana Claudia Teodoro, Alexandre Lima, Maria dos Anjos Ribeiro.**

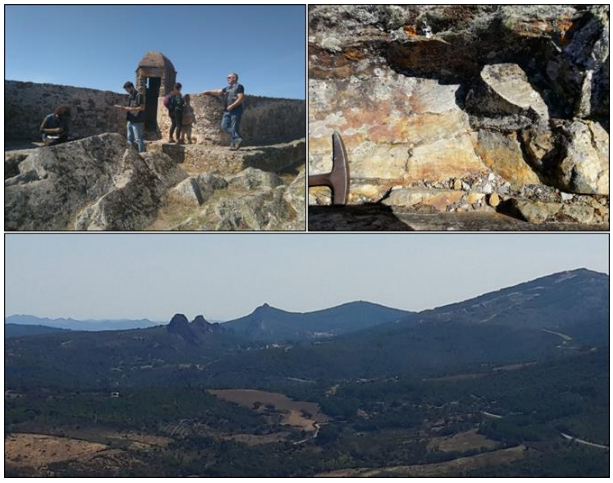
The LIGHTS project brings together world-leading industrial and research organizations to develop new methods and tools for drone-based lithium exploration. Has two main goals: to develop a software for easy and fast detection of lithium-host minerals combining drone-borne remote sensing data and field observations, and to understand how pegmatitic Li-deposits are formed. This is critical to establish how remote sensing and field observations can be used to unveil lithium deposits.

(vii) **ALT20-08-2114-FEDER-000216) – CIMarvão**

Interpretive Centre and Gates of the Natural Park of Serra de São Mamede.

Participants: **Jorge Pedro.**

The CIMarvão project intends to build an interpretive centre in order to preserve and disseminate the geodiversity, biodiversity and cultural heritage of the Natural Park of Serra de São Mamede.

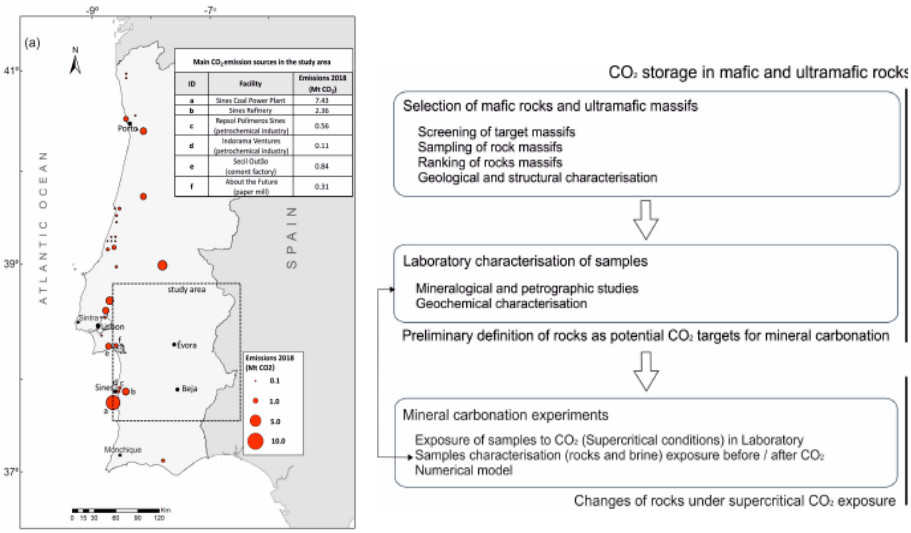


(viii) **PTDC/CTA-GEO/31853/2017 – InCarbon**

In situ carbonation for reduction of CO2 emissions from Power and industrial sources in Alentejo.

Participant: **Jorge Pedro.**

The InCarbon project based on the principles of CO2 capture and storage technologies, aims to study the potential of in situ mineral carbonation in mafic and ultramafic rocks in Alentejo. It fits into climate change and mitigation technologies by studying a process that allows the industrial and power sectors to reduce their greenhouse gas emissions.



(ix) **Cost Action: OC-2016-1-20419**

MULTI-modal Imaging of FOREnsic SciEnce Evidence tools for Forensic Science". 2017/2021. FCUP.

Participant: **Alexandra Guedes.**

The main objective of this Action, entitled 'MULTI-MODAL IMAGING OF FORENSIC SCIENCE EVIDENCE (MULTI-FORESEE)- TOOLS FOR Forensic Science', is to promote innovative, multi-informative, operationally deployable and commercially exploitable imaging solutions/technology to analyse forensic evidence. Forensic evidence includes, but not limited to, fingermarks, hair, paint, biofluids, digital evidence, fibers, documents and living individuals.

(x) **CoalMine - POCI- 01-0145-FEDER-030138**

Projeto "Resíduos de exploração de carvão: avaliação, monitorização e recuperação de impactos ambientais através de deteção remota e analise geoestatística" - CoalMine - POCI- 01-0145-FEDER-030138. (www.fc.up.pt/coalmine/).

Leader: **Deolinda Flores**. Participants: **Ana Cláudia Teodoro, Joana Ribeiro, Lia Duarte, Jorge Espinha.**

CoalMine is a project financed by FCT (AAC no 02/SAICT/2017) developed by a consortium consisting of ICT (Porto and Évora Poles) and Requimte. This project aims: (i) to identify and characterize the environmental impacts caused by the São Pedro da Cova coal mine waste pile (self-burning since 2005) in surrounding soils and waters; and, (ii) to monitor the combustion temperature and mass movements through remote sensing using unmanned aerial vehicles.

(xi) **Project POCI-01-0145-FEDER-022151- C4G**

Colaboratório para as Geociências, Roteiro Nacional de Infraestruturas de Investigação de Interesse Estratégico.

FCUP. Participant: **Alexandra Guedes.**

The Collaboratory for Geosciences (C4G) is a distributed research infrastructure of the Portuguese Roadmap, the only one dedicated to Solid Earth Sciences, with the objective of sharing scientific resources in order to optimize the creation and diffusion of scientific knowledge in Portugal and internationally.

(xii) **GREENPEG**

New Exploration Tools for European Pegmatite Green-Tech Resource - H2020-SC5-2018-2019-2020 (Proposal number: SEP-21059772).

GREENPEG started contributing to a number of European agendas by developing and validation of new cost-effective exploration approaches to unlock domestic critical mineral resources. GREENPEG outcomes will contribute to both the Action Plan on Critical Raw Materials as part of the new EU Industrial Strategy, the European Green Deal, and the EU COVID-19 Recovery Plan for Europe ensuring resilience through a secure and sustainable supply of critical raw materials. www.greenpeg.eu.

Workpackage leader: **Ana Claudia Teodoro**; Participants: **Alexandre Lima.**

(xiii) **Project PIPA - GUIFARQ II**

Projeto de Investigação Arqueológica de Guifões

Helena Couto was scientific consultant for the area of Geology and Geological Characterization of Materials, project from Universidade de Letras da Universidade do Porto (2019 - 2022).

(xiv) **International Geological Correlation Project 653 (2016-2020)**

The onset of the Great Ordovician Biodiversification Event do IGCP (International Geoscience Programme) – Project co-lead by Thomas Servais, David Harper, Olga T. Obut, Cristian Rasmussen, Alycia Stigali and Zhang Yuandong, IUGS/UNESCO International Geoscience.

Helena Couto is member.

(xv) **CALCINATA**

Produção de argamassa à base de cal a partir da calcinação de lamas carbonatadas provenientes da indústria das rochas ornamentais (mármores e calcários)", com referência nº 72239 cofinanciado pela "do Alentejo 2020, Portugal 2020 e União Europeia através do Programa "Fundo Europeu de Desenvolvimento Regional (FEDER)" 072239/Portugal 2020. Data de aprovação | 17-12-2020; Data de início | 01-09-2020; Data de conclusão | 31-03-2023.

Participant: **Luís Lopes.**

(xvi) **ANTECIPA**

Modelos de previsibilidade de Rochas Ornamentais em obra e em exploração. ALT20-03-0246-FEDER-000070.

Participant: **Luís Lopes.**

(xvii) **InCarbon**

Carbonatação IN-SITU para redução de emissões de CO_2 de fontes energéticas e industriais no Alentejo. PTDC/CTA-GEO/31853/2017.

Participant: **Luís Lopes.**

(xviii) **LITHOS**

Laboratory for Innovation and Technological Hub for Ornamental Stone, referência ALT20-03-0246-FEDER-000036, financiamento Portugal 2020.

Participant: **Luís Lopes.**

(xix) **INOVSTONE 4.0 – LISBOA-01-0247-FEDER-024535**

Tecnologias avançadas e software para a pedra natural; 10/SI/2016 - I&DT Empresarial (Programas Mobilizadores).

Participant: **Luís Lopes.**

(xx) **BRO-CQ – Controlo de Qualidade de blocos em Rochas Ornamentais.**

Projecto nº 17659 –33/SI/2015 – I&DT Empresarial (Copromoção), Portugal 2020. Copromotor – Metalviçosa, Fabricação de Máquinas Industriais, Lda.

Participant: **Luís Lopes.**

9. Scientific dissemination

(i) "X Feira das Profissões". **Alexandra Guedes** presented the Course of Geology at Colégio Novo da Maia. January 2020.

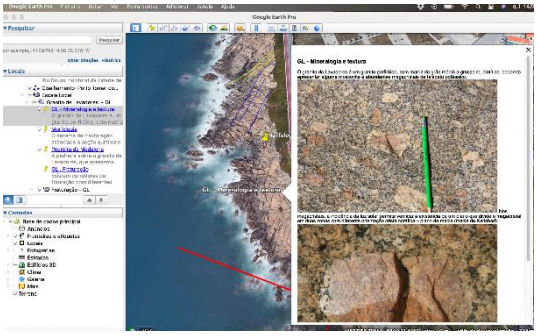
(ii) Mostra UP. **Alexandra Guedes** presented the Course of Geology using the Zoom platform. 23 July 2020.

(iii) **Helena Couto** collaborated as a scientific adviser with the Canelas Geological Interpretation Center (CIGC), **Arouca Geopark.**

(iv) **Ângela Almeida** and **Maria dos Anjos Ribeiro** collaborated in **Scientific Culture Day**, 25 November celebration which this year was dedicated to honor the poet António Gedeão and his poem "Pedra Filosofal".

(v) CoalMine Project workshop held in **partnership with Eco-Escolas Project of Carolina Michaelis Secondary School,** including 2 conferences ("A escombreira de São Pedro da Cova – um laboratório ao ar livre" and "Noções (e conceitos) sobre navegação e posicionamento por satélite"), a fieldtrip of the Carolina Michaelis Secondary School's students to the São Pedro da Cova waste pile. Students carried out activities of soil and water sampling in the field, explored the analytical methodologies and procedures used, as well as the environmental monitoring techniques. Participants: Ana Cláudia Teodoro, Lia Duarte, Joana Ribeiro, Jorge Espinha Marques, Deolinda Flores.

(vi) **Partnership ICT with "Agrupamento de Escolas de Rio Tinto nº3"** - Clubes de Ciência Viva na Escola: several activities were carried out: 3 conferences, 1 article, 1 virtual fieldtrip, and 2 projects. Participants: **Fernando Noronha**, **Deolinda Flores, Helena Couto, Maria dos Anjos Ribeiro, Cláudia Cruz, Pedro Nogueira, Helena Sant'Ovaia.**



10. Awards and Distinctions

António Oliveira: “Honorable mention award Prof. Doutor António Ribeiro” - Distinction attributed to the scientific research work “Geochemical study of two compositionally contrasting veins of the Lamas de Olo region (Celorico de Basto)” presented at the "X Congresso de Jovens Investigadores em Geociências, LEG 2020", which took place between the 20th and 22nd of November 2020, at the Estremoz Pole of the University of Évora.

Cláudia Cruz: “Award Prof. Doutor António Ribeiro” - Distinction attributed to the scientific research work “Anisotropy of out-of-phase magnetic susceptibility: a non-standard approach for magnetic subfabrics determination” presented at the "X Congresso de Jovens Investigadores em Geociências, LEG 2020", which took place between the 20th and 22nd of November 2020, at the Estremoz Pole of the University of Évora.

Lia Duarte: Prémio Melhor Estágio Norte da Ordem dos Engenheiros with the theme: "Improving risk management models in GIS through open source development and applications", October 2020.

Luís Lopes: Eleito Presidente da Associação Portuguesa de Geólogos.