



**Instituto de Ciências da Terra**  
**Institute of Earth Sciences**

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**Report**

**2019**



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**ICT is a multidisciplinary institution**, organized into six research groups covering major areas of Earth Sciences and comprising a wide range of scientific expertise and a high laboratory intensity level justified by the many facilities allocated to their activities. ICT mission is to develop exceptional-quality research, promote technological development and support public policies in the area of Earth Sciences.

**Research Groups:**

G1 - Atmospheric Sciences Water and Climate

G2 – Energy

G3 – GeoResources and Geomaterials

G4 – Geoconservation and Geoscience Education

G5 – Environmental Monitoring and Remediation for Sustainability

G6 – Lithosphere Dynamics

**Webpage - <http://www.icterra.pt/>**

## **G1 - Atmospheric Sciences Water and Climate**

The main scientific objectives of Group 1 are related to Atmospheric Sciences, Environment and Climate and their implications in the future of the planet and health issues, focusing in the Mediterranean area and Climate Change, largely dealing with the following topics:

- Clouds, precipitation, aerosols, gases and solar radiation
- Air and water quality and health impacts
- Potammology, Limnology and lake-atmosphere interactions
- Numerical Weather Prediction and Climate models
- Surface fluxes of moment, energy, water and CO<sub>2</sub> and the Atmospheric Boundary Layer
- Palynology, Agronomy and Health
- Meteorology and Fire
- Environmental and Health Risk Assessment

During 2019 most of these topics were addressed by the team through ongoing research projects. The main results achieved are briefly described here:

- Development of a multi-sensor-model approach to measure and understand the emission, long-distance transport and dispersion and aging processes of smoke from wildfires. The methodologies rely on the collaborative work of an extensive network comprising active and passive remote sensing techniques and different models. It was found that the spread of extremely high amounts of wildfire smoke injected into the upper troposphere and lower stratosphere caused enhanced concentrations of ice-nucleating particles for several months, which may serve as a long-lasting reservoir able to trigger heterogeneous ice nucleation and thus possibly influencing cirrus formation. Natural hazards in a changing climate, such as severe wildfires combined with pyrocumulonimbus activity and major desert dust outbreaks, may occur more frequently and detailed network profile observations as the ones adopted are required to support weather and climate research and forecasting.
- Development of a new shutter to be included in ultraviolet spectrometers that measure solar

radiation with adequate resistance and reliability for this spectral region. This original technological piece was object of a patent request in 2019, currently pending.

- Establishment of a new multiple-stage process for the collection and processing of airborne Cyanobacteria, present in air-water interface emissions, for environmental air quality monitoring purposes. This original multiple-stage method was object of a patent request in 2019, currently pending.

- Two new freshwater diatom species were described from Portuguese watercourses: *Nitzschia transtagensis* E.Morales, Novais, C.E.Wetzel, Morais & Ector sp. nov. and *Fragilaria misarelensis* Almeida, C.Delgado, Novais & S.Blanco. This contribution to the taxonomy of benthic diatoms can further improve the ecological status assessment of Portuguese watercourses, as required in the Water Framework Directive (The European Parliament & European Council, 2000).

### **Selected publications**

Novais, M.H., Marchã Penha, A., Morales, E.A., Potes, M., Salgado, R., Morais, M., 2019. Vertical distribution of benthic diatoms in a large reservoir (Alqueva, Southern Portugal) during thermal stratification. *Science of the Total Environment* 659, 1242-1255  
<https://doi.org/10.1016/j.scitotenv.2018.12.251>

Obregón, M.A., Rodrigues, G., Costa, M. J., Potes, M. Silva. A.M., 2019. Validation of ESA Sentinel-2 L2A Aerosol Optical Thickness and Columnar Water Vapour during 2017–2018. *Remote Sens.*, 11(14), 1649. <https://www.mdpi.com/2072-4292/11/14/1649>

## G2 – Energy

The main objectives of Group 2 are related to energy capture, conversion, transport and storage, with a special focus on solar energy, as well as reducing the environmental impacts of energy exploration and use. The activity of the Energy group covers the following topics:

- Energy capture and conversion

Solar energy resource, solar concentration technologies and solar collector development and testing, solar thermal receivers modelling and optimization, photovoltaic solar energy, biomass energy and hybridization of energy sources;

- Energy storage and energy production management

Thermal energy storage in concentrated solar power (CSP) systems, storage of electrical energy in batteries, storage in geological formations (CAES), geothermal developments and heat pumps, energy production and storage management;

- Flow structures and energy transfer

Fluid flow under special pressure and temperature conditions, optimization of flow and heat transfer structures, structural theory applied to energy conversion and storage systems, optimization of thermal systems and equipment;

- Decarbonization and energy efficiency

Geological storage of CO<sub>2</sub>, decentralized production and decarbonization, photovoltaic energy in agriculture, air conditioning systems with renewable energy, process heat (solar) in industry, energy efficiency and rational use of energy.

These topics were addressed during 2019 through ongoing research projects and work plans of post-graduation thesis. The research activity in solar energy is also framed in the Renewable Energy Chair (CER - Cátedra Energias Renováveis), as described in more detail below. The main results achieved are briefly described as follows:

- Solar radiation modelling and solar energy resource assessment using both radiative transfer models and ground-based measurements. Solar radiation was modelled using libRadtran,

SMARTS and numerical weather prediction models (Meso-NH and IFS/ECMWF). The effect of the atmospheric variables and aerosols concentration on the solar irradiance, with a special focus in the direct normal irradiance (DNI), were considered and the circumsolar component was also determined. A Typical Meteorological Year (TMY) for Evora was generated using the 2003-2018 data series from the ICT measuring stations, and then used to produce a solar energy resource map in Alentejo region through an Artificial Neural Network (ANN) that corrects the predictions of the Meso-NH model for the typical months that compose the TMY. A network of ten measuring stations scattered in the region was used to assess the solar energy resource and to validate the models results. A collaboration was established with colleagues of Group 1 on this topic.

- Development of a research infrastructure in the field of Molten Salt driven Concentrated Solar Power (CSP) and Thermal Energy Storage (TES), and design of a dual MS-TES system. Research on industrial process heat solar collectors and applications was also conducted, with the conclusion of the national project SHIP based on a quasi-stationary concentrator designed by CER-UE. Research on PV system maintenance and system control and optimization was carried out through the development of PV module repair techniques, EES and system control strategies, as well as irrigation applications based on solar energy. Water treatment related activities were developed with the design of photocatalysis driven water treatment pilots and comparing direct irradiation and PV driven UV lamp systems.
- Research activity was carried out on the development of low-carbon energy and industry in Southern and Eastern Europe, with a focus on eight regions considered promising for carbon capture, utilization and storage, to encourage and support initiatives within each region and produce local development plans and business models tailored to industry's needs. Regarding the reduction of CO<sub>2</sub> emissions, a project on a site screening process for mafic and ultramafic rocks in southern Portugal is ongoing, which can provide a mineral carbonation opportunity



for the Sines cluster. Research is focused, first and foremost, in the Sines sub-volcanic massif, located immediately adjacent to the CO<sub>2</sub> sources.

- Research is also ongoing in the identification of flow regimes in tubes including the conditions that promote annular or dispersed flows, and the study of the oil/water separation process in porous tubes due to viscosity and surface tension. The analytical modeling of the effective permeability of porous tubes subject to intermittent potential and acoustic waves is being developed, as well as a CFD study on immiscible liquid-liquid separation using porous tubes in different situations, and a study on the separation of non-miscible liquids in networks of parallel porous tubes and in tree-shaped networks of porous tubes.

#### *Renewable Energy Chair (CER - Cátedra Energias Renováveis)*

Created in 2010, the Renewable Energies Chair at the University of Évora (CER-UE) has the mission of developing technological solutions and applications of solar energy for the decarbonization of different economic sectors. At the core of INIESC, the National Research Infrastructure in Solar Energy Concentration, University of Évora's Renewable Energies Chair develops research along the main vectors defining the role of solar energy technologies as a solution for the Energy Transition: PV or CSP power generation; thermal or electrical energy storage; solar energy for energy supply to Industry and Agriculture; solar resource and Energy system integration strategies.

With expertise in non-imaging optics (NIO) the CER-UE is involved in different solar concentrator developments making use of NIO concepts, including the development of innovative (patented) concepts of Etendue Matched Concentrators increasing the performance of the line-focus Linear Fresnel Reflector concept or stationary or quasi-stationary Compound Parabolic Concentrator for medium temperature applications.

With its solar concentration activities coordinated within INIESC, the National Research Infrastructure on Solar Energy Concentration, part of the National Roadmap of Research Infrastructures and lead by CER-UE, having LNEG, IP as partner institution, activities in CER spread also to photovoltaic (PV) and

electricity storage (EES) related activities, with focus on agricultural and community/quarter based applications and on the study of different EES technologies and combined hybrid EES systems.

The RE Chair integrates the main R&D European Solar Thermal networks: EU-Solaris, EERA JP-CSP, INSHIP ECRIA and SFERA and has specific R&D agreements with DLR and Fraunhofer ISE.

Along 2019, CER-UE activities included:

a) important advances in the development of an important research infrastructure in the field of Molten Salt driven Concentrated Solar Power (CSP) and Thermal Energy Storage (TES): within INIESC cooperation with the German funded projects HPS2 and MS-OPERA, the solar MS loop under construction at Évora Molten Salt Platform (EMSP) got into its final stage of construction, with the completion of the solar loop hydraulics, solar field installation and electrical works conclusion. Within project NEWSOL a final decision on the location and design of a dual MS-TES system (concrete solid storage and thermocline storage) has been taken, leading to its final design and beginning of construction;

b) industrial process heat collectors and applications: conclusion of the national project SHIP with commissioning of a pilot SHIP plant at an industrial company in Évora (KEMET) based on a quasi-stationary concentrator whose design was led by CER-UE, along with the ongoing participation in the H2020 INSHIP ECRIA;

c) PV system maintenance and system control and optimization: development of PV module repair techniques, EES and system control strategies, irrigation applications in projects AGERAR, GRECO and PEARL-PV;

d) deployment of water treatment related activities: initial design of photocatalysis driven water treatment pilots, comparing direct irradiation and PV driven UV lamp systems in project EERES4WATER;

e) capacity building activities: in projects GRECO and ENBRAIN.

Besides these activities in ongoing projects, in 2019 participation in three new projects has started:

- **SFERA-III- Solar Facilities for the European Research Area – Third Phase, H2020, Grant Nº 823802:** activities of the European Advanced Concentrating Solar Power research infrastructures, including networking and cooperation between research infrastructures, transnational access to European researchers to technological and research infrastructures, and joint research activities;
- **ALFR-Alentejo - Installation, testing and analysis of an Advanced Reflective Linear Fresnel concentrator for electricity production by means of solar thermal storage, Alentejo 2020, Contract nº 039487:** development of a pilot ALFR concentrator for MS operation;
- **POCITYF - Positive Energy CITY Transformation Framework (H2020):** smart city -oriented project, whose major goal is to deliver a set of Positive Energy Blocks – a limited geographic area whose average local renewable generation is greater than its consumption - in the lighthouse cities of Evora and Alkmaar.

Still along 2019, three MSc and three PhD students have concluded their thesis based in works developed in CER-UÉ.

### **Selected publications**

**Barreto, G., Canhoto, P., Collares Pereira, M.,** 2019. Three-dimensional CFD modelling and thermal performance analysis of porous volumetric receivers coupled to solar concentration systems. Applied Energy 252, 113433. <https://doi.org/10.1016/j.apenergy.2019.113433>

**Osório, T., Horta, P., Collares-Pereira, M.,** 2019. Method for customized design of a quasi-stationary CPC-type solar collector to minimize the energy cost. Renewable Energy, 133, 1086-1098. <https://doi.org/10.1016/j.renene.2018.10.110>

### **G3 – GeoResources and Geomaterials**

Within the GRG the research focuses on two main areas (Georesources and Geomaterials), namely: (i) LCT pegmatites and deposits of rare elements associated with granites for the identification of genesis, age and mode of occurrence to improve exploration programs and processing technologies, and to improve and develop methods of evaluation of industrial wastes to promote recycling; and, (ii) the characterization of natural and anthropogenic geomaterials for the promotion of critical metals recovery, in the scope of geoarchaeological and architectural and civil engineering purposes, and in studies of soils and sediments for forensic applications.

LCT pegmatites and deposits of rare elements associated with granites:

Multidisciplinary studies are under development on mineralization in the Iberian Variscan Belt. The research aims to study rare-element deposits (Li, Sn, Nb, Ta, W, Mo, Au and REE) and their relationship with hydrothermal alterations together with the determination of the genesis P-T-X conditions. Considering the strategic importance of Li, the study of pegmatites evolution and the structural control of the veins is in progress. A multidisciplinary approach on the petrophysical, geophysical, and geochemical characterization of granite bodies and their emplacement mechanisms are currently being performed in areas where mineralizations occur.

Geomaterials characterization:

Organic petrology and geochemistry studies are under development on: i) coals, black shales and fly ash as non-conventional deposits of critical materials; ii) coals and coal waste containing environmental sensitive elements (including toxic chemicals) and affected by spontaneous combustion; iii) organic matter in soils to obtain helpful information for the sustainable management of soils and land use, mainly the ones affected by wildfires; iv) solid bitumen to identify fluid migration pathways and thermal history of sedimentary basins.

Geological methods are being applied on the characterization of geomaterials for different purposes:

i) forensic investigation with studies on surface soil and sediments to pursue the database within the protocol with Police Scientific Laboratory; ii) ornamental rocks for industrial uses; iii) geoarchaeology research in the sourcing and characterization of lithic material; and, iv) characterization of ores giving indications for ore processing.

Remote sensing and image processing are a complementary tool for geological and environmental applications with the development of GIS tools in open source code.

GRG studies are linked with other ICT groups to reinforce the strategy framed in the goal nº 12 UN SGD, mainly connected with G5 with research in the Iberian Variscan Belt and the G1 and G6 providing the geomaterials characterization to assess air, soil and water pollution and exposure to toxic chemicals.

### **Selected publications**

**Gonçalves, A., Sant’Ovaia, H., Noronha, F.**, 2019. Emplacement mechanism of Caria-Vila da Ponte Pluton (Northern Portugal): Building and internal magmatic record. *Journal of Structural Geology* 124, 91–111. DOI: 10.1016/j.jsg.2019.04.009.

**Valentim, B.**, Abagiu, T.A., Anghelescu, L., **Flores, D.**, French, D., **Gonçalves, P.**, **Guedes, A.**, Popescu, L.G., Predeanu, G., **Ribeiro, J.**, **Santos, A.C.**, Slăvescu, V., Ward, C.R., 2019. Assessment of landfilled Oltenia lignite bottom ash (Romania) as a source of rare earth elements. *International Journal of Coal Geology* 201, 109-126. <https://doi.org/10.1016/j.coal.2018.11.019>.

## **G4 – Geoconservation and Geoscience Education**

This research group has two main research aims: i) to develop scientific methods and expertise on geodiversity and geoheritage in order to promote geoconservation, and ii) to improve the conceptual framework on geoscience education and to develop tools to help teachers of different school levels.

The main results achieved in 2019 in the field of geoconservation were the following:

- Characterization of mining heritage in Minas State (Brazil) and proposals for its conservation;
- Definition of management principles for the geoheritage in Alto Ribeira State Park (São Paulo, Brazil);
- Organization of the Geological Heritage and Geoconservation Symposium, a national event that brought together the Portuguese geoconservation community to define national future strategies;
- Organization of a workshop integrated in the annual conference of the Geological Society of America (Phoenix, USA);
- Strengthen of the internationalisation with the publication of a paper on the role of geodiversity on the assessment of ecosystem services with a big international team (Schrodt et al., 2019).

On the Geosciences Education domain, the main results are:

- Research about problem-based learning focused on a case study on environmental geology;
- Start of the project "Partnerships for pathways to Higher Education and science engagement in Regional Clusters of Open Schooling" funded by Horizon 2020;
- Production of educational resources on teaching geoethics by the international team, under the scope of the "Geoethics Outcomes and Awareness Learning" Erasmus + Project, coordinated by ICT-UPorto;
- Organization of 2 scientific events: 1st International Congress of History for Science in Education (1CIHCE) and XVIII National Meeting on Science Education (XVIII ENEC) & III International Seminar on Science Education (III ISSE).

### Selected publications

Činčera, J., Mikusiński, G., Binka, B., Calafate, L., Calheiros, C., **Cardoso, A.**, Hedblom, M., Jones, M., Koutsouris, A., **Vasconcelos, C.**, Iwińska, K., 2019. Managing Diversity: The Challenges of Inter-University Cooperation in Sustainability Education. *Sustainability*, 11(20), 5610. <https://doi.org/10.3390/su11205610>

Schrodt, F., Bailey, J., Kissling, W.D., Rijdsdijk, K.F., Seijmonsbergen, A.C., Ree, D., Hjort, J., Lawley, R.S., Williams, C.N., Anderson, M.G., Beier, P., Beukering, P., Boyd, D.S., **Brilha, J.**, Carcavilla, L., Dahlin, K.M., Gill, J.C., Gordon, J.E., Gray, M., Grundy, M., Hunter, M.L., Lawler, J.J., Monge-Ganuzas, M., Royse, K.R., Stewart, I., Record, S., Turner, W., Zarnetske, P.L., Field, R. 2019. To advance sustainable stewardship, we must document not only biodiversity but geodiversity. *Proceedings of the National Academy of Sciences*, v. 116, nº 33, 16155-16158. <https://doi.org/10.1073/pnas.1911799116>

## **G5 – Environmental Monitoring and Remediation for Sustainability**

The aim of the Group 5 is to generate and disseminate scientific knowledge in the wide-ranging domain of the Environment. Environmental systems under pressure are being studied worldwide, in view of the UN SDG. Therefore, contributions to the advancement and application of knowledge arise in the perspectives of monitoring environmental changes as well as of remedial measures for sustainability.

For that, the following environmental topics were among the most important addressed issues:

- Monitoring, conservation and remediation of water, sediments, soil and ecosystems, as focal points of environmental changes (climate, pollution, forest fires,...).
- Mine wastes in circular economy – reactivity and valorization for sustainability of mineral sector.
- Environmental implications of system interfaces, such as mineral-water-ecology interactions.
- Environmental impact of land uses, such as mining and urbanization.
- Monitoring and Assessment vulnerability of mountain, estuarine and coastal systems.
- Methodological tools for environmental monitoring of endangered systems
- Modelling of contamination processes.
- Assessing potential relationships between the environment and human health.

Collaboration with other institutions was essential to accomplish the Group strategy as it increased the research and funding potential. Also, interface between the poles was strengthened by collaboration through FCT projects, student's supervision and other informal interactions inside the group.

Internationalization was another goal for 2019, which was achieved by reinforcing the extensive network of researchers, many already co-authors and by applying to international funding (INTERREG, ERA-MIN, EGU, NERC, AKDN, World Bank, and International Mining Companies). Research in development nations also continued, pursuing UN SDG.



Moreover, G5 members still involved in transdisciplinary international groups of recognized importance, such as the Society of Environmental Geochemistry and Health, International Mine Water Association, International Council for the Exploration of the Sea (ICES). They integrated scientific and organization committees of international conferences like SEGH 2021 - 38th International Conference on Environmental Geochemistry and Health, International Mine Water Conference, International Association for Mathematical Geosciences, XII Congresso Ibérico de Geoquímica, XV Congresso de Geoquímica dos Países de Língua Portuguesa. Also include editorial board of specialized journals like Mine Water and the Environment, Minerals (guest editor), and Environmental Geochemistry and Health). Furthermore, members of G5 participate and coordinate specialized seminars and workshops around the world, namely “Geostatistics for Earth and Environmental Sciences” (Portugal), and “Environmental mineralogy applied to mine wastes” (Chile and Mongolia).

Also, G5 presented an application for an EGU summer school that should involve the main scientific skills of the group and include most of its members. The proposal, with the title “Effective tools for environmental monitoring and modelling of mine sites”, should bring together international scientific community around G5-ICT, promoting its international position in 2020.

The results of the research are expressed by the high degree of internationalization and excellence of scientific production (more than 25 indexed ISI/ Scopus papers and more than 40 international proceedings, resulting in a total of about 90 publications (8 per PhD member). The following domains deserve special mention by their contribution to these results:

- Assessment of contamination by mining activity was achieved for paradigmatic coal and metal mining regions through collaboration with an extensive international network of researchers (Portugal, Spain, Brazil, Colombia). A PhD thesis was initiated promoting cooperation between ICT poles through co-supervision and interaction with mining company (AngloGoldAshanti). Also, the planning of a scientific work on characterization of the contamination of mining area after a serious environmental disaster took place during 2019, with work beginning in January 2020. This work

will be developed by a post-doc of the Federal University of Ouro Preto, in the AmbiTerra laboratory, in the Pole of Évora, with the collaboration of colleagues of the Pole of Braga.

- Hydrogeochemistry and hydropedological features of mine wastes and mineralogy of nanoparticles formed in acid mine drainage, through FCT projects, which also reinforce cooperation between poles.
- Water, soil and sediment quality in semi-arid and tropical climates that contributed for knowledge advancement on sediments reuse as nutrients, pursuing sustainable use of soil in countries like Cape Verde and Dominican Republic.
- Important developments were achieved in the use of unmanned aerial vehicles (UAV's) for topographical monitoring of coastal dynamics and vegetation after forest fires.
- Investigation on dust biogeochemistry and mineralogy is underway to assess potential hazards associated with human exposure to ambient dust. It is key information supporting risk management and decision-making and aims at steering to pragmatic plans of action that improve the quality of the indoor environment. With the Home-Biome project, the citizen science becomes an important part of our current research.

### **Selected publications**

**Gomes, P., Valente, T.,** Geraldo, D., Ribeiro, C., 2019. Photosynthetic pigments in acid mine drainage: Seasonal patterns and associations with stressful abiotic characteristics, *Chemosphere*, 239. DOI: 10.1016/j.chemosphere.2019.124774.

**Neiva, A.M.R., Albuquerque, M.T.D., Antunes, I.M.H.R.,** Carvalho, P.C.S., Santos, A.C.S., Boente, C., Cunha, P.P., Henriques, S.B.A., Pato, R.L., 2019. Assessment of metal and metalloid contamination in soils through compositional data - the old Mortórios uranium mine area, Central Portugal, *Environ Geochem Health*. <https://doi.org/10.1007/s10653-019-00347-x>

## **G6 – Lithosphere Dynamics**

The Lithosphere Dynamics (LD) is studied at different temporal and spatial scales and is the main goal of research of the groupe. Research encompasses multidisciplinary geological and geophysical studies: structural mapping combined with advanced microscope digital analysis and geochemistry; seismic, geoelectric, magnetic, gravimetric and high precision down hole temperature measurements methods to infer the internal complex structure of oceanic and continental lithosphere. Such combination of techniques will be used mostly in 3 main approaches:

- i. We concentrate our efforts in the Meso-Cenozoic Portuguese continental crust and its oceanic extension
- ii. Understand the geodynamical context of magmatic, metamorphic and deformation processes.
- iii. Seismic hazard using a new methodology combining seismic source studies and ground motion modelling with a 3D velocity model covering a wide geographic area (western part of the Eu-Nu plate boundary, Africa and Ibero-Maghrebian area) and a range of topics within the field of active tectonics
- iv. The scientific capacity in the field of the Earth interior structure led to invitations for some members to be engaged in the emerging area of Archaeological Geophysics, in which they participate in multidisciplinary teams that study archaeological sites.
- v. In recognition of the work done in the study of the cryosphere in Antarctica using geophysical methods for several years, members have been invited for international projects in that area, namely projects of the Peruvian Polar Program.

Identification and summary description of several contributions and results deemed most important provided in 2019 by the researchers who belong to the DL (G6) are listed, in this report, through several national and international projects (15) and international publications (21 articles in peer review Journals) were carried out in the domain of Lithosphere Geodynamics, competitively funded,

in collaboration with international network of researchers (European, Mediterranean and African countries, and others).

The major achievements are the following:

**I & II. Meso-Cenozoic Portuguese continental crust and its oceanic extension and Understand the geodynamical context of magmatic, metamorphic and deformation processes.**

- $^{87}\text{Sr}/^{86}\text{Sr}$  applied to age discrimination of the Palaeozoic carbonates of the Ossa-Morena Zone; Petrographic and geochemical characterization of coal from Santa Susana Basin, Portugal; Water Supply and Access to Safe Water in Developing Arid Countries.
- Review of the geological framework of Penedono gold mineralization, in the Central-Iberian Zone, associated with crustal recycling processes during the Variscan orogeny; Structural description and geodynamic significance of the Ediacaran Calzadilla ophiolite from the Ossa-Morena Zone (Cadomian orogeny); Geochemical and geochronological characterization of the Cambrian rift-related magmatism from the Coastal Block (Moroccan Meseta); Discussion on the validity of the application of detrital zircon U-Pb geochronology data to stratigraphic correlation studies of Appalachian-Variscan synorogenic basins.

**III. Seismic hazard using a new methodology combining seismic source studies and ground motion modelling.**

- Seismological studies and seismotectonic implication on the Ibero-Maghrebien:  
Review on the destructive and historical 1790 Oran (NW Algeria) earthquake;  
Revisiting the Laalam (Eastern Algeria) March 20, 2006 (Mw 5.1) earthquake;  
Human Losses and Damage Expected in Future Earthquakes on Faial Island – Azores;  
A novel interpolation method for InSAR atmospheric wet delay correction.

**IV. Archaeological Geophysics**

- Studying the Construction of Floor Mosaics in the Roman Villa of Pisões (Portugal) Using Noninvasive Methods: High-Resolution 3D GPR and Photogrammetry.

## **V – Long term landscape evolution.**

- Collaborative research between Portuguese and United Kingdom (UK) researchers concerning the transition from endorheic to exorheic drainage reorganization at continental scale, geoarchaeological studies, absolute dating and studies of crustal movements through geomorphological references (marine platforms and fluvial terraces).

## **VI. Cryosphere studies**

- Estudio de resistividades eléctricas en el permafrost y acuífero Machu Picchu, Punta Crepín, Bahía Almirantazgo, Isla Rey Jorge, Antártida.

## **New topics not planned in the group's initial project: Engineering**

- Wind power with energy storage; Stress, pressure and fatigue on aircraft maintenance personnel; Decision making for sustainable aggregation of clean energy; Implementation of a YBCO superconducting ZFC-magnetic bearing prototype; Finite strain analysis of limestone/basaltic magma interaction and fracture: Low order mixed tetrahedron and remeshing; A Dimensional Reduction Algorithm and Software for Acyclically Dependent Constraints; A detailed study on the Fe-doped TiO<sub>2</sub> thin films induced by pulsed laser deposition route.

Conclusion: In addition to the results of the group (DL) obtained through scientific productions, the members of the team represented the ICT at different levels, national and international, as coordinators of many national and international projects (15), as experts at the level of national and international committees as, for example, the European commission. They participated in numerous national and international congresses/workshops (58) and they also organized many scientific events (11). Finally, the G6 also trained 4 doctoral students.

## **Selected publications**

**Fontiela, J., Rosset, P., Wyss, M., Bezzeghoud, M., Borges, J.F., Cota, R.F., 2019.** Human Losses and Damage Expected in Future Earthquakes on Faial Island – Azores, September 2019, Pure and Applied Geophysics, pp 1–14, <https://doi.org/10.1007/s00024-019-02329-7>

**Moreira, N., Pedro, J., Santos, J.F., Araújo, A., Dias, R., Ribeiro, S., Romão, J., Mirão, J., 2019.**

$^{87}\text{Sr}/^{86}\text{Sr}$  applied to age discrimination of the Palaeozoic carbonates of the Ossa-Morena Zone (SW Iberia Variscides). *International Journal of Earth Sciences (Geol Rundsch)*, 108(3), 963–987.

<https://doi.org/10.1007/s00531-019-01688-9>



## **ICT Post-Graduation Programmes**

ICT offers an interesting variety of courses covering a wide range of Master's and PhD's in Earth Sciences. They are research-based programs that offer solid formation joining fundamental knowledge in Earth Sciences with applied skills covering priority areas and training and skills to undertake professional employment in the area of Earth Sciences.

### **PhD Programmes**

#### **- Earth and Space Sciences – University of Évora**

It is a PhD programme that provides advanced knowledge in four areas of specialization, on the Earth, Atmosphere and Space subsystems and on the methodologies of observation, monitoring and modelling of these subsystems, with marked interdisciplinary potential in emerging domains - from Natural and Technological Risks to development of technologies with a broad application spectrum.

#### **- Mechatronics Engineering and Energy – University of Évora**

This PhD programme provides advanced training in different areas of specialization, with strong interdisciplinary potential in emerging fields, from product design engineering, instrumentation, automatic control and process supervision, to the development of application spectrum technologies to Mechatronic Engineering, the energy efficiency of Processes, the capture, conversion and concentration of Energy.

#### **- Geology - Geoconservation, Environmental Geology and Geological Resources – University of Minho**

This programme has the overall objective to offer, in a research environment, training in advanced areas of Geology. In this context, the aim of this course is to train highly qualified human resources in the field of Geology and subjects of recognized interest for the development of research activities, theoretical or experimental, or use in areas of industry and services.

#### **- Earth Sciences – University of Porto**

It is a PhD programme that aims to train broadly educated Earth scientists able to compete at an international level for careers in academia, research, government, and industry. All the facilities and



equipment necessary for modern studies in the Earth Sciences are available for the use of students in the FCUP and ICT. The fields available for advanced training by research in this doctoral degree include: Geological Resources and Geomaterials; Geodynamics; Petrology and Geochemistry; Applied Geology and Exploration Methods; Hydrology/ Hydrogeology; Coastal and Marine Geology; Stratigraphy and Sedimentology.

#### **- Environmental Sciences and Technology – University of Porto**

The PhD programme in Environmental Sciences and Technology provides the following core competencies: ability to understand and solve problems in new situations or in wide and multidisciplinary contexts, whether in the scope of scientific research, or in professional specialization; to acquire knowledge in the field, by means of research, innovation or professional skills; ability to conceive, design and develop scientific research in Environmental Science and Technology, identifying appropriate research methods for solving complex problems, in new situations that require the use of multidisciplinary knowledge.

#### **- Surveying Engineering – University of Porto**

The PhD programme in Surveying Engineering aims to provide high level education in the field of Surveying Engineering. During the course the students should acquire a solid and advanced knowledge in the field of surveying Engineering, the required skills to perform autonomous and advanced research on a topic of scientific and technological relevance.

#### **- Teaching and Dissemination of Science – University of Porto**

The PhD Programme in Science Education and Dissemination aims to provide advanced training for science teachers and communicators. The diversity and range of experiences, skills and subject areas of the Faculty of Sciences is a major advantage to secure a solid and balanced range of opportunities for advanced training through research in science teaching and outreach. The programme addresses issues associated with education, communication and/or public outreach, but it deliberately remains closely linked to the each of the corresponding scientific areas in any of the physical and natural sciences.

## Completed PhD Theses

1. Alvarez, C.I., 2019. Remote Sensing applied to the study of environment-sensitive chronic diseases: A case study applied to Quito, Ecuador. Doutoramento em Engenharia Geográfica. Faculdade de Ciências da Universidade do Porto. (Supervisor **Ana Cláudia Teodoro**).
2. Badenhurst, C., 2019. Char extracted from coal ash as a replacement for natural graphite - Charphite. Johannesburg University. (Supervisors Nicola Wagner, **Bruno Valentim**).
3. **Baikova, E.N.**, 2019. Wireless energy transfer: study of electric field emissions. Electrical and Computer Engineering PhD, Universidade Nova de Lisboa. (Supervisor **R. Melicio**).
4. **Chimouni, R.**, 2019. Modélisation du séisme d'Oran de 1790. Universidade des Sciences et Technologie Houari Boumedienne, Algiers, Algeria. (Supervisor **M. Bezzeghoud**).
5. **Conceição, R.**, 2019. Soiling in Solar Energy Conversion Technologies: Assessment and Mitigation. Mechatronics and Energy Engineering PhD, University of Évora (Supervisors **M. Collares Pereira, H.G. Silva**).
6. **Fialho, L.**, 2019. Photovoltaic generation with energy storage integrated into the electric grid: Modelling, simulation and experimentation. Mechatronics and Energy Engineering PhD, University of Évora (Supervisor **M. Collares Pereira**). <http://hdl.handle.net/10174/25361>
7. **Fontiela, J.**, 2019. Microzonation of the central group of the Azores. Earth and Space Science PhD, Universidade de Évora. (Supervisor **M. Bezzeghoud**).
8. Garcia, K.L., 2019. Terra – um planeta em mudança; da compreensão da tectônica de placas à procura de novas metodologias de divulgação científica. Earth and Space Science PhD, Universidade de Évora. (Supervisor **R. Dias**).
9. Martinez, J.E., 2019. Patrimônio geomineiro do Brasil: inventário e valorização no Caminho dos Diamantes (Estrada Real, Minas Gerais). PhD in Sciences (Geology), University of Minho (Supervisors **J. Brilha, J.M. Brandão**).
10. **Osório, T.**, 2019. Linear solar concentrators: new testing tools and facilities, application to novel CPC-type collectors for Industrial Process Heat. Mechatronics and Energy Engineering PhD, University

of Évora (Supervisors **M. Collares Pereira, P.A.S.R. Horta**).

11. Pinto, T., 2019. A aprendizagem baseada na resolução de problemas no Ensino Superior: um estudo no âmbito da Geologia e Ambiente. PhD in Science Teaching and Dissemination, University of Porto (Supervisors **C. Vasconcelos**, G. Dias).

12. **Rodrigues, F.M.**, 2019. Modeling electrical energy consumption for short-term forecasting in the domestic sector. Sustainable Energy Systems PhD, **Portugal MIT Program**, IST. (Supervisor **R. Melicio**).

13. Santos, P., 2019. Patrimônio Geológico na área do Parque Estadual Turístico do Alto Ribeira (PETAR), Vale do Ribeira, SP – Brasil: a capacidade de carga na definição de estratégias de gestão para o uso público de sítios geológicos. PhD in Sciences (Geology), University of Minho (Supervisor **J. Brilha**).

## Nacional and International Projects

**COST action: CA18235 – “PROfiling the atmospheric Boundary layer at European scale”.** Daniele

Bortoli and Maria João Costa part of the proponent’s team, MCs of Portugal. Supported by European Cooperation in Science and Technology: Brussels, BE. 2019-2023.

This Action aims at: Capacity building of instrument operators to improve the use of state-of-the-art Atmospheric Boundary Layer profiling instruments; Fostering coordination between operational agencies and academia to tailor measurement



networks for well identified applications; Enhancing pan-European research coordination to develop new products and tools for data assimilation and long time series reanalysis; Identifying knowledge brokers enabling rapid exchange between academia, operational agencies, industry and end-users to ensure full exploitation for societal benefit.

**COST action: CA18226 – “ADOPT- New approaches in detection of pathogens and aeroallergens”.**

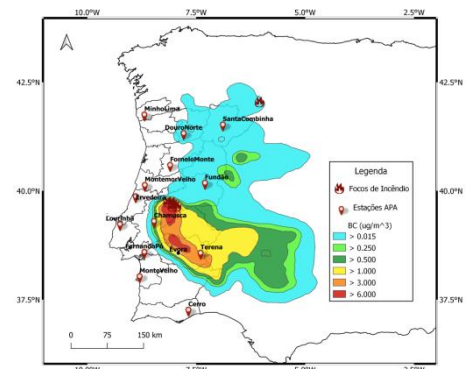
Célia Antunes and Helena Ribeiro part of the proponent’s team, MCs of Portugal, Ana Costa MCs substitute of Portugal. Integration in WK2 and WK3. Supported by European Cooperation in Science and Technology: Brussels, BE. 2019-2023.

This COST action will establish an interdisciplinary network of experts currently involved in the detection of bioaerosols using both existing methods as well as upcoming technologies such as real or near real-time technologies from atmospheric chemistry and physics or eDNA methods used in molecular biology.

**CILIFO – Centro Ibérico para la Investigación y Lucha contra Incendios Forestales.** 0753\_CILIFO\_5\_E.

EU- INTERREG V A España Portugal (POCTEP). PI at University of Évora: Rui Salgado. 2019-2022.

The project aims at: reinforcing and combining cooperation, work procedures and training between devices for the Prevention and Extinction of Forest Fires in the cooperation area of the Euroregion Alentejo-Algarve-Andalusia. Promoting the creation of durable and quality employment in the area; reducing the economic cost of fires creating rural economy linked to the landscape. Improving the capacity of response to forest fires of administrations and authorities involved in the fight against them in the three participating regions.



**LEADING – Land use changes and mitigation of global warming.** PTDC/CTA-MET/28914/2017. EU – Portugal 2020 / Alentejo 2020 – FEDER Team members: Rui Salgado, Miguel Potes. 2019-2022.

Climate change is one of the most important challenges facing humanity in the 21st century. The objective of the project is to establish robust biophysical impacts of land use changes (LUC) on climate across Europe, from regional to local spatial scales and time scales from a few days to multi-decadal. A pilot region in the south of Portugal is chosen to investigate the local impacts of land use changes.



**AdaptAlentejo – Predicting ecosystem-level responses to climate change.** POCI-01-0145-FEDER-030793. EU – Portugal 2020 – FEDER. Team members: Rui Salgado, Miguel Potes. 2019-2022.

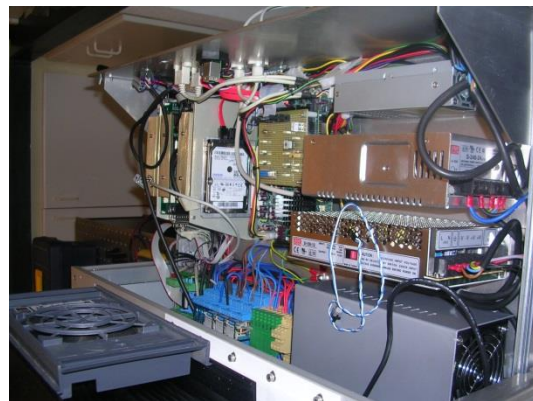
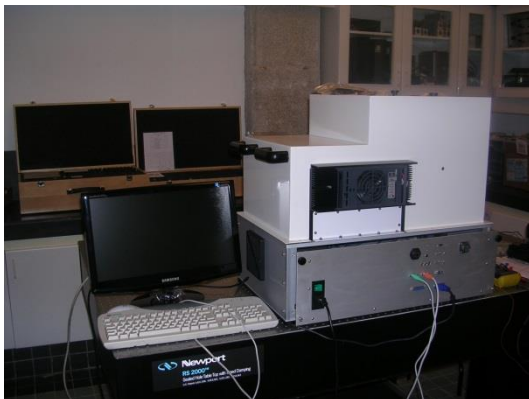
Freshwater ecosystems are particularly vulnerable to climate change. Unravelling the links between food web structure and GHG emissions is critical to be able to predict how aquatic ecosystems may potentially be enhancing greenhouse gas emissions, leading to further global warming. AdaptAlentejo will address this challenge by combining multiple disciplines (physiology, biogeochemistry and geophysics) to answer simple, though complicated to questions: (1) can aquatic species adapt to

increased temperatures? Does temperature change how they interact with each other? Do those changes have impacts at ecosystem-level.

**EUMETNET AutoPollen Programme: “Proof-of-Concept for a European automatic pollen monitoring network using high temporal-resolution real-time measurements”.** Célia Antunes and Helena Ribeiro. 2018-2022. This programme aims to establish a proof-of-concept for automatic pollen monitoring networks across Europe.

**TOMQAQA: Multispectral Observation Techniques for Air Pollution and Water Quality Assessment.** PTDC/CTA-MET/29678/2017. Supported by National Funds through FCT - Foundation for Science and Technology (239.400,80 EUR). PI: Daniele Bortoli. 2018-2022.

The projects aims are twofold: the setup of an Air Quality measurement station (AQS) with remote sensing equipment developed at the University of Évora; the development, setup and deployment of a new underwater spectrometric system for the assessment of concentrations of dissolved gases with marked absorption features in the UV-Vis-NIR spectral range in lakes, river and sea environments.



**AquaQ2 -Demonstrador de sistema de aquisição, tratamento e interpretação de dados de qualidade de água e recursos hídricos recolhidos em rede de sensores”** - ALT20-03-0145-FEDER-039494. Financiado pela EU- Portugal 2020/ Alentejo 2020 - FEDER. PI at IP Beja: **Patrícia Palma**. 2019-2021.

The project is the design and implementation of a demonstration system for the recognition of water quality standards and quantity of water resources. The system is subdivided into the following subsystems: a pattern recognition subsystem, using deep learning techniques used in artificial

intelligence, which provides the users with high-level processed information, obtained from continuously collected data and saved in a secure way coded as blockchain; a data aggregation subsystem using microcomputers commonly used in IoT (Internet of Things) for data collection and transmission; and a subsystem for the remote collection of signals from sensors, used for the acquisition of information on physical-chemical parameters of water quality and quantity. The pattern recognition system uses research results in the area of water quality and management and forecasting of water resources to generate information that assists in the evaluation and the sustainable and efficient use of water resources. The project results in a system that shows the application of IoT, artificial intelligence (deep learning) and blockchain (data security) in the area of water quality management and water resources.

**NORTE-01-0247-FEDER-033647 - "GesPSA Kiwi - Integrated operational tool to the sustainable management of *Pseudomonas syringae* pv. *Actinidiae*".** Funded by Fundo Europeu de Desenvolvimento Regional (FEDER), Programa Operacional Regional do Norte (NORTE2020). Team members: Ilda Abreu, Helena Ribeiro. 2018-2021.

This project aims combining a multidimensional Integrated Operational Tool to improve the management of kiwi Orchards and increase their productivity, even in the presence of the bacteria. The ICT members integrated in the project are in charge of analyse the impact of Psa3 on male performance and on production of viable pollen.

**NanoSen-AQM: Development of gas nanosensors for air quality monitoring.** SOE2/P1/E0569. EU-INTERREG-SUDOE. Team members: Daniele Bortoli, Maria João Costa. 2018 – 2021

The main challenge of the project is the monitoring of ambient air pollution and the real-time air quality information to the public in a sustainable way. The goal is to develop an electronic system based in low cost and low



consumption sensors and validate the system in different locations of the Sudoe territory, based on certified instruments for measuring air pollutants.

**FitoFarmGest - Sustainable management of phytopharmaceuticals in olive groves, vineyards and arable crops in the area of influence of Alqueva**", PDR2020-101-030926. Financiado pela EU- Portugal 2020/ Alentejo 2020 - FEDER. PI at IP Beja: Patrícia Palma. 2017-2021.

This project aims to increment the sustainable use of pesticides and fertilisers, in irrigated agriculture areas agriculture areas (Alqueva area), contributing to improve the quality of production, protection and conservation of the soils the quality of water resources and the biodiversity. For achieve this goal several tasks are proposed as: (i) the assessment of the dynamics of fertilizers and the main pesticides groups; (ii) the identification a group of indicators (physic-chemical and/ or biological) that better assess the sustainable use of the production factors (fertilizers and pesticides), to improve their monitoring use and to ensure a better protection of the human population and ecosystems; and (iii) the elaboration of Guide of Good Practices about the sustainable management of production factors.



- **COST action: CA151113 – “SMIRES – Science and Management of Intermittent Rivers and Ephemeral Streams**”. Manuela Morais is part of the proponent’s team, MCs of Portugal, Integration in WK4. Supported by European Cooperation in Science and Technology: Brussels, BE. 2017-2020.

This COST action pretends to generate networking, capacity building and knowledge synthesis in IRES science and management, bringing together academics and water managers, early-career and established researchers, and scientists from different countries to pursue a common goal. SMIRES



members share diverse experiences and expertise to enable the development of novel and sometimes unexpected multi-disciplinary solutions that meet key challenges in IRES science and management.

Leader of the **Consortium AMIGO** with the Portuguese higher education institutions that are members of the Network of REALP (Network of Environmental Studies of Portuguese Speaking Countries, i.e University of Lisbon, University Nova de Lisboa, University of Aveiro and Instituto Politécnico de Tomar) under the ERASMUS + Program, Action 1, KA108 “Accreditation of Higher Education Mobility Consortia” to encourage mobility (in and out) of teachers, technical staff and students. In 2019 the Consortium AMIGO Obtained a funding of 485 970,00 €. Manuela Morais

National project funding by Portuguese Environment Agency, APA “**Classification Criteria for the Status of Inland Surface Water Bodies**”. The project was developed in consortium with Matos and Fonseca & Associados-Estudos e Projetos, University of Aveiro, University of Évora, University of Coimbra, University of Trás os Montes and Alto Douro and the Instituto Superior de Agronomia. Manuela Morais. Contract value 138 852.12 €

**Engage SKA – ENabling Green E-science for SKA** – Capacitation and Sustainability of Portuguese participation in the SKA with radioastronomy as an Innovation Open Living Lab. E-ciência Sustentável: Capacitação e Crescimento Inteligente para uma Participação Portuguesa no Square Kilometer Array com Radioastronomia como Laboratório Aberto à Inovação”, ROTEIRO/0041/2013. Financiado pela Fundação para a Ciência e Tecnologia. PI at IP Beja: Patrícia Palma. 2017-2020.

The project sets up a capacitation and sustainability plan for Green e-Science Infrastructure fostering Portugal participation in the ESFRI SKA project along the Big Data and Green Power axis, that will act as a driver for smart and sustainable growth along some of the less developed regions of Portugal taking radioastronomy as an Innovation Open Living Lab. SKA is a global, unparalleled project not only because of its ambitious scientific goals, its overwhelming infrastructure



(spreading through 3 continents, capable of outputting more data than the entire World Internet traffic) but because it will be built through phases, each giving the opportunity for transformational science with cutting-edge technology. In 2016, the European Commission classified SKA as na ESFRI Landmark project. Portugal has secured key contributions in the SKA consortia, having a strong opportunity to effectively participate in the construction and scientific exploration phases.

**LIFENoWaste - Management of biomass ash and organic waste in the recovery of degraded soils: a pilot project set in Portugal**”, com ref. LIFE14 ENV/PT/000369. Financiado pela EU - LIFE. PI at IP Beja: Patrícia Palma. 2016-2020.

The project aims to evaluate, demonstrate and disseminate the sustainable use of ash (from forest biomass residues combustion) combined with organic waste materials (sludge from the pulp and paper industry or compost) to regenerate degraded soils from mining areas, in compliance with the EU ‘Thematic Strategy for Soil Protection’. The project also aims to reduce the impact of wastes from the pulp and paper industry on the environment, while making better use of valuable resources according to the ‘end-of-waste’ criteria, while also contributing to the mitigation of greenhouse gas (GHG) emissions.

**HYDROREUSE: Tratamento e reutilização de águas residuais agroindustriais utilizando um sistema hidropónico inovador com plantas de tomate**”, com referência ALT20-03-0145-FEDER-000021. Financiado pela EU – Portugal 2020/ Alentejo 2020 – FEDER. PI at IP Beja: Patrícia Palma. 2016-2020.



The main objective of the HYDROREUSE project is to develop new alternatives for the management of the main agro-industrial wastewater produced in the Alentejo region. For this purpose, an innovative treatment reuse line will be proposed that comprises low-cost and environmentally friendly technologies, namely new pre-treatment, innovative dual-function hydroponic system and oxidation. This approach will allow the recycling of water, organic matter and nutrients from pre-treated agro-industrial wastewater using a hydroponic system for the growth of tomato plants, which reduces the costs associated with

commercial fertilization and allows the treatment of wastewater. The HYDROREUSE project operates in different and important sectors, namely, in the management of agro-industrial wastewater by reducing the pollution of these effluents through a biological system. Another important area comprises water management in agriculture, providing new sources of water and nutrients in regions characterized by a drought crisis such as the Alentejo region. This project also focuses on environmental sustainability through the reuse of pre-treated wastewater. The characterization of fruits obtained in a hydroponic system fed with pre-treated agro-industrial wastewater will allow to determine the impact of this strategy on the quality of tomatoes and public health, and consequently the viability of reusing wastewater in the production of food crops. This project will make it possible to change the state of the art, determining the feasibility of reusing wastewater for fruit production in a hydroponic system and the efficiency of removing nutrients and organic matter from wastewater using.

**ALOP (Alentejo Observation and Prediction systems): Observation, prediction and alert systems in atmosphere and in water reservoirs of Alentejo.** ALT20-03-0145-FEDER-000004. EU – Portugal 2020 / Alentejo 2020 – FEDER. PI: Rui Salgado. Team members: 12 members of G1 group at Évora pole. 2016–2019.

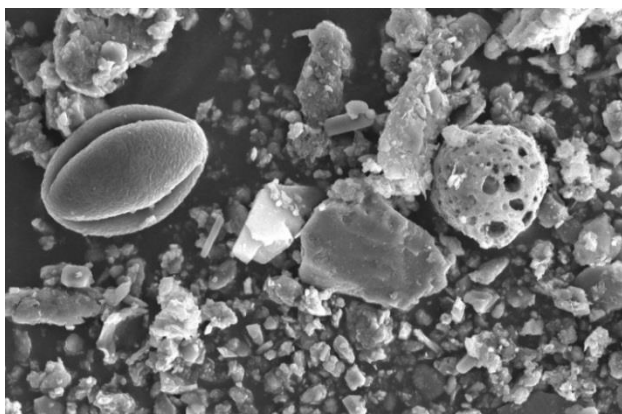
The ALOP Project aims to develop a multi-functional activity in the domain of the interaction of atmosphere, water and ecosystems, in the atmosphere and water reservoirs of Alentejo, which contemplates the observation, prediction and alert of risk



situations. It is intended to develop tools of observation, forecasting and alert in the fields of meteorology and water (quantity and quality), in an integrated way, at the regional scale.

**“Pollensorb - Physicalchemical characterization of atmospheric particulate matter sorbed to allergenic airborne pollen”**. PTDC/ATPEAM/0817/2014. Supported by National Funds through FCT -

Foundation for Science and Technology (181.762,00 EUR). PI: Helena Ribeiro, Team members: Ilda Abreu, Célia Antunes, Ana Costa. 2016-2019.



This project was conducted in 3 cities: Porto, Guarda and Évora. It aims to develop a long-

term monitoring and description of particulate matter (physical properties, chemical composition, amount and source apportionment) of inhalable PM sorbed to airborne pollen and the association between peak airborne pollen levels, sorbed PM characteristics and the number of daily emergency room hospital admissions.

**NANOFERTIL - Effect of soil (in)organic constituents on the efficacy, fate and phytoavailability of fertilizer and plant protection manufactured nanomaterials”** com ref. PTDC/AGR-PRO/6262/2014.

Financiado pela Fundação para a Ciência e Tecnologia. PI at IP Beja: Patrícia Palma. 2016-2019:

The goal of the project is to address essential gaps in knowledge about how soil properties, soil organic and inorganic constituents as well as properties and concentration of manufactured nanomaterials (MNMs) affect the spatial and temporal behaviour of nanopesticides and nanofertilizers in soils. This project is also focused on the training of researchers in advanced analytical techniques that allow an efficient characterization of MNMs in various matrices.

**DNI-ALENTEJO "Measurement and evaluation of Direct Normal Irradiance in the Alentejo" (A2020, ALT20-03-0145-FEDER-000011)**

The project DNI-ALENTEJO "Measurement and evaluation of Direct Normal Irradiance in the Alentejo: its interaction with local atmospheric effects and their implications for regional mapping of this energy resource" aims to continue and expand the operation of an existing network of meteorological stations, designed and implemented for the study of Direct, Global and Diffuse Solar Irradiance and

its relation with the meteorological variables. The objective is the enhancement of knowledge and investment in the energy (solar and thermoelectric) and environmental sectors in Alentejo region, Portugal. Data collection and its analysis will be employed for the development of solar energy assessment and forecasting in the long, medium and short-term with adequate statistical quality.

**GRECO - Fostering a Next Generation of European Photovoltaic Society through Open Science (H2020, grant agreement nº 787289)**

GRECO is a multinational research project which its main goal is putting Open Science and other Responsible Research and Innovation (RRI) approaches into action in a research project in the photovoltaic sector. It tries to demonstrate how knowledge coalitions comprising researchers, civil organizations, citizens, governments, industry and non-profit organizations may adopt RRI approaches such as Open Science. To do this, GRECO sets out a framework where citizens actively participate in the process of research, development and innovation both in the design of new photovoltaic solutions and in the provision of data.

**EERES4WATER - Promoting Energy-water Nexus resource efficiency through Renewable Energy and Energy Efficiency (INTERREG Atlantic, project. EAPA\_1058/2018)**

EERES4WATER aims to enhance the institutional, technical and framework to promote the direct use of renewable energy sources and energy efficiency in the water cycle by influencing related policies and introducing new processes and technologies. Those improvements were meant to bring the Atlantic Area to the forefront of strategies, policies and utilization of RES and energy efficiency as well as sustainability.

**AGERAR – Renewable energies storage and management for domestic and commercial applications (EU INTERREG V, 0076\_AGERAR\_6\_E)**

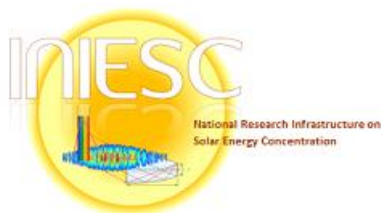
AGERAR has the general objective of promoting criteria of energy efficiency and sustainability in commercial and residential microgrids, increasing the use and improving the management of renewable energies. To achieve this objective, the project decided to work on public policies and regional development programs. Universities, Technological Centers and Regional Agencies

developed and evaluated technical solutions to promote energy efficiency and sustainability criteria, through the sharing of knowledge and experimental facilities.

**PEARLPV – Performance and Reliability of Photovoltaic Systems: Evaluations of Large-Scale Monitoring Data (EU COST Action, CA16235)**

The PEARLPV's main objective is to improve the energy performance and reliability of photovoltaic solar energy systems in Europe leading to lower costs of electricity produced by photovoltaic systems, by a higher energy yield, a longer life time, and a reduction in the perceived risk in investments in photovoltaic projects. The aim of the project is the formation of an inclusive network of system photovoltaic researchers and experts, from 36 countries.

**INIESC – National Research Infrastructure Solar Energy, 01/SAICT/2016, nº 22113**



INIESC is focused on thermal conversion of solar energy at medium and high temperature and aims at the development of solar energy concentration technologies. The establishment of INIESC enables an ideal framework for the activities already in progress by both partners (Renewable Energies Chair and LNEG) at computational, laboratorial, infrastructural and capacity building levels.

**ENBRAIN - Building capacity in Renewable and sustainable ENERGY for Libya, Erasmus + KA2 programme, nº 586221**



**ENBRAIN**  
Building capacity in Renewable  
and sustAINable ENergy for Libya

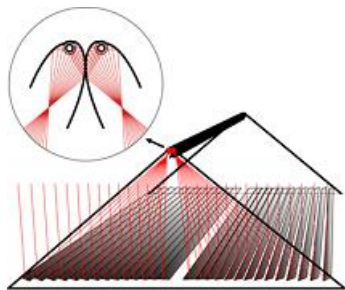
ENBRAIN is an exchange of good practices and cooperation project, that aims to capacity building in the field of Higher Education. If, nowadays, we face a sustainability challenge, there's still an imperative necessity of energy to develop countries. Thus, educational institutions are a fundamental player to create and empower new professional and future generations able to cope and implement the new paradigms, crucial to achieve a transformative change.

**NEWSOL – NewStOrage Latent and sensible concept for high efficient CSP Plants (H2020, grant agreement nº 720985)**



The project's main objective is to develop advanced materials solutions based on innovative storage media and concepts for Concentrated Solar Power (CSP) up to validation in field of their performance by real time monitoring. This will be supported by an innovative thermal energy storage design based on the combination of new functional and advanced materials into two innovative plant architectures: single tank thermocline storage and concrete type module.

**ALFR Patente, ALT20-03-0145-FEDER-040164**



This project aims to support a European Patent Application No. 3524901 (19161768.7) "LINEAR REFLECTIVE SOLAR CONCENTRATOR DESIGNED FOR DIRECT OPERATION OF SALT MOLTEN AS HEAT TRANSFER FLUID IN EVACUED PIPES". The present invention relates to an Advanced Linear Fresnel Reflector type solar concentrator developed at the Renewable Energies Chair of University of Évora to produce dispatchable electricity at temperatures above 500° C and using molten salts as heat transfer fluid and storage media.

**SHIP – Solar Heat for Industrial Processes (POCI-01-0247-FEDER-017857)**

The SHIP project aimed at demonstrating the integration of solar technologies for medium temperature industrial processes, by projecting, installing, testing and validating a system, assuring in this way its proximity/readiness to the market. This system consists in an innovative solution, resulting from previous R&D activities of the consortium partners (MCG, INEGI, OnControl, U. Évora and KEMET Electronics Portugal).

**INSHIP – Integrating National Research Agendas on Solar Heat for Industrial Processes (H2020)**



INSHIP aims at the definition of a ECRIA engaging major European research institutes with recognized activities on SHIP, into an integrated structure that could successfully achieve the

coordination objectives of: more effective and intense cooperation between EU research institutions; alignment of different SHIP related national research and funding programs; acceleration of knowledge transfer to the European industry, to be the reference organization to promote and coordinate the international cooperation in SHIP research.

**CASPER – Separação de crude e água salgada por meio de tubos porosos, e aumento da permeabilidade ao escoamento (ALT20-03-0145-FEDER-029624)**

Research on the identification and mapping of flow regimes in tubes, including the conditions that promote annular or dispersed flows, and the study of the oil/water separation process in porous tubes due to viscosity and surface tension. The analytical modelling of the effective permeability of porous tubes subject to intermittent potential and acoustic waves is being developed, as well as a CFD study on immiscible liquid-liquid separation using porous tubes in different situations, and a study on the separation of non-miscible liquids in networks of parallel porous tubes and in networks of porous tubes in the shape of a tree.

**SFERA-III- Solar Facilities for the European Research Area – Third Phase, H2020, Grant Nº 823802**



The overall objective of SFERA-III is to carry on with the work done during the SFERA 1 and SFERA 2 projects and reinforce the sustainability of the activities of the European Advanced Concentrating Solar Power research

infrastructures. The activities to achieve those goals include networking and cooperation between research infrastructures, transnational access to European researchers to technological and research infrastructures, and joint research activities.

**ALFR-Alentejo - Installation, testing and analysis of an Advanced Reflective Linear Fresnel concentrator for electricity production by means of solar thermal storage, Alentejo 2020, Contrato nº 039487**

The goal of this project is to implement the construction, testing and analysis of an Advanced Linear Fresnel Reflector solar concentrator prototype for thermal electricity production and coupling it to

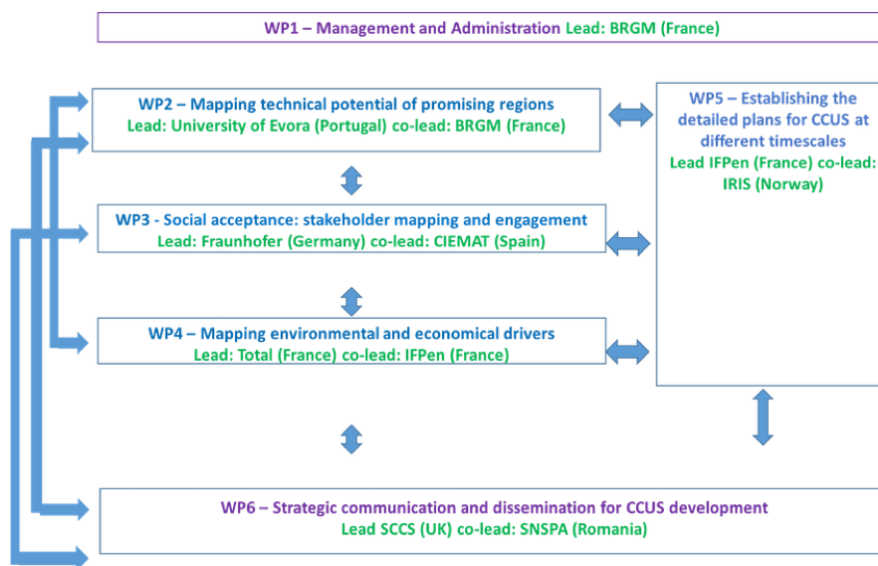


thermal storage systems with mixtures of molten salts. This operation and its data collection are crucial to the crowning of the development of this technology, which aims at a substantial reduction of costs in the production of electricity via solar thermal to a LCOE (Levelized Cost of Electricity) of USD 8¢/kWh.

### **STRATEGY CCUS - Strategic planning of Regions And Territories in Europe for low-carbon energy and industry through CCUS.** Ação de Coordenação e Suporte. Horizonte 2020 da Comissão Europeia.

2019-2021

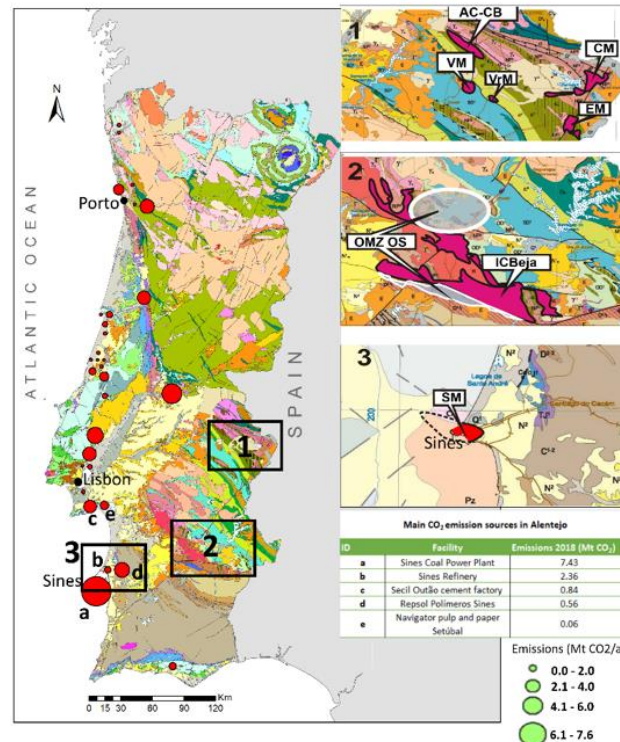
STRATEGY CCUS is an ambitious three-year project funded by the European Union to support the development of low-carbon energy and industry in Southern and Eastern Europe. We are focusing on eight regions considered promising for carbon capture, utilisation and storage (CCUS). We aim to encourage and support initiatives within each region by producing local development plans and business models tailored to industry's needs.



### **INCARBON – In situ Carbonation for reduction of CO<sub>2</sub> emissions from energy and industrial sources in Alentejo.** Financiada pela FCT, projeto PTDC/CTA-GEO/31853/2017. 2018-2020.

The project InCarbon intends to conduct a site screening process for mafic and ultramafic rocks in southern Portugal that can provide a mineral carbonation opportunity for the Sines cluster. Research is focused, first and foremost, in the Sines sub-volcanic massif, located immediately adjacent to the CO<sub>2</sub> sources, outcropping along 300 km onshore and offshore and mostly composed of gabbro's and

diorites. Other mafic formations occurring in Southern Portugal, such as the olivine-gabbros, peridotites and pyroxenites rocks of the Beja, Alter do Chão, Campo Maior, Elvas, Veiros and Vale Maceira massifs, will also be ranked according to a uniform set of criteria.



### POCITYF - Positive Energy CITY Transformation Framework (H2020)

POCITYF is a smart city-oriented project, whose major goal is to deliver a set of Positive Energy Blocks – a limited geographic area whose average local renewable generation is greater than its consumption - in the lighthouse cities of Evora and Alkmaar, and in the fellow cities of Granada, Bari, Celje, Ujpes, Ioannina and Hvidovre. The creation of Positive Energy Blocks and Districts aims to transform those cities' mixed-urban environments, with a strong emphasis on cultural and historical protected areas, into cheaper, healthier, more accessible and reliable spaces for their citizens.

**"CoalMine - Coal mining waste: evaluation, monitoring and recovery of environmental impacts through remote detection and geostatistical analysis"**, with reference POCI-0145-FEDER-030138, 2018-2021, co-financed by: COMPETE 2020, Portugal 2020 and European Regional Development Fund. 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.



**C4G** - distributed research infrastructure that promotes the networking and the sharing of equipment, data, collections and tools in Solid Earth Sciences (SES). Participates in the ESFRI project European Plate Observing System, promoting Portugal as a service provider in the international research arena. Research fellow in the GT8 – Geomathematics, Computation and Modelling and GT12 – Geo-resources, exploitation and processing - <http://www.c4g-pt.eu/>.

**Development of New models for the genesis of Rare Metal (W, Nb, Ta, Li) Ore deposits from the European Variscan Belt and valorization of low grade and fine grained ore and mine tailings**

**NewOreS** - ERA-MIN/0002/2014. FCT. Responsible: Fernando Noronha. Team: Alexandre Lima, Alexandra Guedes, Helena Cristina Martins, Helena Sant'Ovaia, Iuliu bobos, Maria dos Anjos Ribeiro. Finalized in 2019. Devoted to the: i) development of new models of ore deposition relevant for the W-Sn (Nb-Ta-Li) mineralisations, and intend to propose of new exploration guides for this type of mineralization, by building a fully comprehensive model for the behaviour of metals during crustal magmatic events, and ii) by understanding the behaviour of these metals at the hydrothermal stage, thanks in particular to by refinement of the in-situ analysis of trace elements especially Nb and Ta in oxides ( $\text{SnO}_2$ ,  $\text{FeWO}_4$ ) and in fluid trapped as fluid inclusions, and by building a new thermodynamic

database for Nb and Ta species. iii) Finally, a major goal is the development of new flow sheets for the processing of low grade and fine-grained ores and tailings, in particular from a major W mine (Panasqueira) from already mined deposits thanks to new intensive flotation devices, the combination with centrifugal gravity separation, and search to develop a new energy saving mineral processing.

**“Desarrollo de capacidades interregionales en torno a los recursos estratégicos en minería metálica”**

- **ESMIMET** - 0284\_ESMIMET\_3\_E. INTERREG V A España-Portugal (POCTEP) 2017-2020. Responsible: Fernando Noronha. Team: Helena Sant’Ovaia, Maria dos Anjos Ribeiro, Iuliu Bobos, Alexandra Guedes, Ana Cláudia Teodoro. Aims to generate a network of scientific and technical knowledge around the development of metallic mining capacities in an area between the South of Galicia and the North of Extremadura, more specifically North and Centre of Portugal and Castilla y León (<https://www.esmimet.eu/pt/>).

**“Lightweight Integrated Ground and Airborne Hyperspectral Topological Solution” - LIGHTS - ERA-**

MIN/0001/2017. Responsible: Alexandre Lima. Team: Maria dos Anjos Ribeiro, Ana Cláudia Teodoro. The general objectives of the project are: To develop a software for easy and fast detection of lithium-host minerals combining drone-borne remote sensing data and field observations; 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.

**“Argeting eU cRitical mEtals (Sb, W) and predictibility of Sb-As-Hg enviroNmentalL issuEs” - AUREOLE**

– ERAMIN2. Responsible: Alexandre Lima. Team: Maria dos Anjos Ribeiro, Helena Sant’Ovaia, Ana Cláudia Teodoro, Rui Moura, Lia Duarte. The AUREOLE project approach is based on 2 concepts: i) development of a large scale 3D metallogenic model integrating deep processes to determine the spatial distribution of ore deposits; ii) the use of surface data weighted mining data to determine the probability of environmental risk in large areas.

**“Coal char as a substituting material of natural graphite in green energy technologies” - CHARPHITE**

- ERAMIN/0005/2015. Responsible: Bruno Valentim. Team: Alexandra Guedes, Joana Ribeiro, Deolinda Flores. The project aims to demonstrate, by a detailed fundamental and applied

investigation, the technical feasibility to utilize fresh and reclaimed landfilled CHAR derived from fly ash and bottom ash as a substitute for graphite-based materials in green energy applications.

**“Design of a product for SUBSTITUTION of phosphate rocks” - DEASPHOR - ERA-MIN/0002/2017.**

Responsible: Bruno Valentim. Team: 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 P<sub>2</sub>O<sub>5</sub> extraction process. Therefore, novel solution is proposed to produce P-rich concentrates from aviary litter ash.

**“Novel Circular Economic Approaches for Efficient Extraction of Valuables from Spent Li-ion Batteries” - NEXT-LIB - ERA-MIN/0003/2018.** Responsible: Bruno Valentim. Team: 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 recover efficiency.

**Cost Action “MULTI-modal Imaging of FOREnsic SciEnce Evidence - tools for Forensic Science” - OC-**

2016-1-20419-. Researcher ICT: 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, fingerprints, hair, paint, biofluids, digital evidence, fibers, documents and living individuals.”

**Cost Action PEsticide Risk AssessMent for Amphibians and Reptiles - CA18221 - (PERIAMAR).** COST

ACTION. Researcher ICT: Ana Cláudia Teodoro

**PTRIAD- healTh Risk and social vulnerability to Arboviral Diseases in mainland Portugal (PTDC/GES-OUT/30210/2017).** FCT. Researcher ICT: Ana Cláudia Teodoro.

**“Fiber Laser Plasma spectroscopy system for real time element analysis” - FlapSys: FEDER-301165.**

FCT. Researcher ICT: Ana Cláudia Teodoro. FlapSys will develop an advanced spectroscopy system that will enable the real time identification and quantification of elements in minerals and other complex

samples. The system will rely on Laser induced breakdown spectroscopy (LIBS), supported by a Fiber Laser with unique features, that will enable a more compact system with higher performance, suitable for operation underwater or on ground, and capable of very high spatial resolution.

**DevelOpment of PaloP knowLEdge in Radioastronomy – DOPPLER** - FCT. Researcher ICT: Ana Cláudia Teodoro. Aga Khan Development Network (AKDN) – Portugal Collaborative Research Network in Portuguese speaking countries in Africa.

**MARINEFF (MARine INfrastructures EFfects)** – VA INTERREG France (Channel)-England co-financed by the European Regional Development Fund. Researcher ICT: Violeta Ramos. The Marineff project is a collaboration between France and the UK with the goal of developing coastal infrastructure to enhance and protect the ecological status of cross-channel coastal waters. The project aims to produce new ecological enhancement units to improve the ecological status of coastal and transitional watercourses, as well as professionals and stakeholders in the process.

**“Modelação e Predição de Acidentes de Viação no Distrito de Setúbal” - MOPREVIS** – POCI-01-45-FEDER-03013 . Responsible: Pedro Nogueira. Crash accidents are one of the major problems in modern societies not only because of the high number of victims but also by the high costs associated. The World Health Organization predicts that, without sustained action, in 2030 road traffic crashes will become the seventh leading cause of death. Moreover, it estimates that in most countries road traffic crashes costs represents about 3% of their Gross Domestic Product.

**ZOM3D “Modelos Metalogénicos 3D da Zona de Ossa Morena: valorização dos recursos minerais do Alentejo”** - ALT20-03-0145-FEDER-000028. Responsible: Pedro Miguel Nogueira. The project intends to create a metallogeny model for the mineral deposits of the Ossa Morena Zone, that to function as a database for researching and mineral exploring companies in Alentejo region and allows to rationalize costs and means in geological prospecting operations. The model is based on a set of classic geological maps and in the form of 3D digital cartography and should include lithostratigraphic, mineralogical, geochemical, geophysical and structural information that will allow to the identification of the most favourable target resources and their locations.

**Partnership for Sustainable Development and Social Innovation – PASSION.** Ref. PPI/APM/2019/1/00096/DEC/01. Portugal, Polónia, Islândia, Reino Unido, Suécia e Grécia. 149820.75€. 2019 – 2021. NAWA - The Polish National Agency for Academic Exchange Clara Vasconcelos, Coordenadora Nacional (25%).

**Partnerships for pathways to Higher Education and science engagement in Regional Clusters of Open Schooling – PHERECLOS.** Ref. Grant agreement ID: 824630. Portugal, Austria, Polónia, Holanda, Dinamarca, Turquia, Filândia, Itália, Colômbia, Roménia e Reino Unido. 1. 497 820,75 €. 2019–2022 Horizon 2020. Clara Vasconcelos, Investigadora (10%).

**Geoethics Outcomes and Awareness Learning – GOAL.** Ref. 2017-1-PT01-KA203-035790. Portugal, Espanha, Itália, Israel, Austria e Lituânia. 240.373,00 €. 2017 – 2020. Erasmus Plus. Clara Vasconcelos, Coordenadora Internacional (40%).

**COST CA15113 – SMIRES – Science and Management of Intermittent Rivers and Ephemeral Streams:** 2017/19. [http://www.cost.eu/COST\\_Actions/ca/CA15113](http://www.cost.eu/COST_Actions/ca/CA15113). Includes the occurrence, distribution, drivers and hydrological trends of IRES; The effects of flow alterations on IRES functions and ecosystem services; The interaction of aquatic and terrestrial biogeochemical processes.

**DEHESA - Sustainability of groundwater resources and ecosystems in hard rock water-limited areas of the Western Iberian Peninsula in the context of climate and land use/cover changes.** EUROPA INVESTIGACIÓN 2019 PROGRAMA ESTATAL DE I+D+I ORIENTADA A LOS RETOS DE LA SOCIEDAD (Espanha).

**C4\_WP2.7 | Bioclimatic modelling, landscape structure, biodiversity and climate changes - Cloud Computing Competence Centre,** financed by the P2020, <http://wordpress.ubi.pt/c4/cloud-applications>. This lineworks on floristic and faunistic diversity in Portugal trough statistical analysis in order to relate indicators linked to biological communities with biophysical attributes and agroforestry models.

**"Nano-MINENV - minerals with environmental relevance in systems contaminated by acid drainage: properties and reactivity at the nanometric scale"** financed by the European Regional Development Fund (ERDF) through the Competitiveness and Internationalization Operational Programme - COMPETE 2020 and by National Funds through FCT - Foundation for Science and Technology under the project POCI-0145-FEDER-029259. The main aim to understand the role of nanoparticle in mine waters. Scientific coordination.



**International Council for the Exploration of the Sea/Conseil International pour l'Exploration de la Mer, Working Group on Marine Sediments in Relation to Pollution (WGMS).** The Working Group on Marine Sediments in Relation to Pollution (WGMS) conducts work on sediment related science and advice. -<https://www.ices.dk/community/groups/Pages/WGMS.aspx>.

**TERRAMATER - “Medidas innovadoras de recuperación preventiva en áreas quemadas”/Universidade do Minho, projeto 0701\_TERRAMATER\_1\_E, financiado pelo Fundo Europeu de Desenvolvimento Regional – FEDER, através do Programa INTERREG V A España Portugal (POCTEP).** The main goal is to recover burned areas, reducing soil losses and increasing resistance to fire through the development and application of organomineral. <https://www.terramaterpoctep.eu/>. Leadership of the Portuguese team.

**Use of reservoir sediments as nutrients for agricultural soil fertilization in the Dominican Republic.** Ministry of Higher Education, Science and Technology (MESCyT), under the 2015 call for proposals of the National Fund for Scientific and Technological Innovation and Development (FONDOCYT) (2016-



2019). Cooperation with the Institute of Hydraulic Resources of the Dominican Republic (INDHRI). Scientific coordination and leadership of the Portuguese team.

**MINEPLAT** (Portugal 2020; 2016-2020) – Project aiming to assess the potential in mineral resources of the continental shelf between Setubal and Odeceixe and the relation of their occurrences with the Quaternary evolution of this physiographic unit. The data acquisition included the bathymetric, ultra-high-resolution seismic reflection and magnetic survey and the sampling of the loose sedimentary cover.

**TAGUSGAS** (FCT; 2018-2021) – After the discovery of the Tejo delta landslide (8 ky) and the proximity of such hazard with the occurrence of free gas in the delta sediments, this project aims to characterize the type and origin of gas present in the sediments, the geotechnical properties of the sediments, and the role of the gas in facilitating the development of landslides, triggering tsunamis with a direct influence in the surrounding areas.

**D4Ss** (FCT; 2018-2021) - The goal of this project is to investigate the bottom-up effects of the different sediment biogeochemistry conditions on food web structures of the benthic assemblages in estuarine and marine sediments.

**MEDSALT** – (COST Action CA15103 Management Committee member) – This CA aims to create a scientific network that will address the causes, timing and emplacement mechanisms of the ‘salt giant’ on Earth focusing in the late Miocene (Messinian) salt layer in the Mediterranean basin as a representative case-study.

**NextSea** – The main objective is the creation of bases for the new generation of monitoring, planning and management of coastal regions, with a view to promoting and monitoring more resilient marine ecosystems. <https://cbma.uminho.pt/project/next-sea/?mode=grid>

**CLIMALERT** - The CLIMALERT project emerges to provide climate information in a format that prospective users find it easy to understand and/or incorporate into decision-making. Main goal of the project is co-developing innovative tools – web and mobile apps – to predict and mitigate impacts due to extreme climate events, namely drought and floods, by implementing new long-term

preparedness plans of actions that may significantly reduce the risks and vulnerabilities to relevant stakeholders for the agriculture and water management sectors. <http://climalert.eu/>.

**AERIS** (end 2020).

**Los terrenos aloctonos del SW del Macizo Iberico: distribuicion, geocronologia y fuentes isotopicas;**

Ref: CGL2016-76438-P; Ministerio de Economía, Industria y Competitividad, Espanha. This scientific project is led by Universidad Complutense de Madrid.

**Evaluacion del reciclagem cortical y generacion de magmas graníticos en Iberia Central;** Ref:

PGC2018-096534-B-I00; Ministerio de Ciencia, Innocavion y Universidades, Espanha. This scientific project is led by Conselho Superior de Investigações Científicas.

**Project P74 - Design, location and processing of a regional array in SW Portugal - Europe**, under the framework of SERA - “Seismology and Earthquake Engineering Research Infrastructure Alliance for Europe” (SERA — H2020-INFRAIA-2016-2017/H2020-INFRAIA-2016-1).

**SSN-Alentejo, High-Density Seismic Monitoring Network for a High Spatial Resolution of the Seismic Activity in Alentejo**, FCT, Ministry of Science, Technology and Higher Education, Portugal, Portugal, PTDC/CTA-GEF/31260/2017.

**CoLAB Forestwise** – Associação para o Laboratório Colaborativo para a Gestão Integrada Floresta e do Fogo. Membro da Assembleia Geral do Colab, representante da Universidade de Évora. Após ter sido publicamente apresentado em março de 2018 através da assinatura de um memorando de entendimento com a FCT, o Laboratório Colaborativo (CoLAB) ForestWISE, foi formalmente constituído através da sua escritura notarial que decorreu no dia 29 de setembro de 2018 no Porto.

**CoLAB DTx, Digital Transformation** - Members of the CoLAB General Assembly (Manuel Pereira dos Santos) and Secretary of the Strategic and Supervision Commission, representing the University of Évora. After being publicly presented in June 2018, the Collaborative Laboratory (CoLAB) DTx, led by the University of Minho, was constituted by a notarial deed in September 2018 in Braga.

**Protocolo de colaboração entre a Escola de Ciências e Tecnologia da UÉ e a Tecnidelta** – prestação de serviços para desenvolver uma plataforma de simulação e análise de sistemas de vibração para

modelar o comportamento dinâmico de sistemas vibratórios reais partindo do exemplo de um moinho de café, 2017-2019.

**EMSO-PT – European Multidisciplinary Seafloor and Water Column Observatory** – Portugal, Research Infrastructure – Roteiro, Fundação para a Ciência e Tecnologia (FCT) – Ministério para a Ciência, Tecnologia e do Ensino Superior (Portugal), 2015-2019).

**FIRE** - PTDC/GEO--GEO/1123/2014 - Fogo Island volcano: multi-disciplinary Research on 2014 Eruption.

**Requalification of Villa Romana de Pisões** ALT20-14-2019-01.

**INNOACE Innovación abierta e inteligente en la EUROACE, EP** - INTERREG V A España Portugal (POCTEP), Task 8.- Métodos no invasivos en Arqueología y Agricultura de Precisión para la revalorización del Patrimonio y el desarrollo de una actividad agraria productiva y sostenible (IAM-CSIC, CICYTEX y Universidad de Évora).

**Geothermal gradient and heat flow maps of Mexico**, 2015- 2019.

**Settlement between the 5th and 1st millennium BC between the Tagus and Zêzere rivers in today's Beira Baixa (Mesopotamos)**, 2015-2019.

**BRO-CQ - Quality Control of Ornamental Stone Blocks.**

**HYDROPERMA** (Permafrost studies in Maritime Antarctica). 2018-2019.

**Estudo da variação paleoclimática e hidrogeológica na região de Figuiç** (Marrocos Oriental) utilizando diagrfias de temperatura em furos. 2017-2019.

**Anisotropia microtextural (nanotextural) de mármore e granitos:** Implicações na deterioração da pedra utilizada na construção.

**INOVSTONE 4.0 – Tecnologias Avançadas e Software para a Pedra Natural.**

**Estudio de resistividades eléctricas en el permafrost y acuífero Machu Picchu**, Punta Crepín, Bahía Almirantazgo, Isla Rey Jorge, Antártida. 2018-2020.

**ANSAAR:** Budget for Accessible and New System for Agriculture Application and Research.

**POCITYF:** A POsitive Energy CITY Transformation Framework.

**High-Density Seismic Monitoring Network for a High Spatial Resolution of the Seismic:** PTDC/CTA-GEF/031260/2017.

**Técnicas de Observações Multiespectrales para a Avaliação da Qualidade da Água e Poluição do**  
**Ar:** PTDC/CTA-MET/029678/2017.



## Scientific Events

**Jornadas do ICT** - Participation and organization of scientific dissemination activities promoted by the research group in which I work - Instituto de Ciências da Terra (ICT), Évora Pole.

**XII Congresso Ibérico de Geoquímica and XX Semana da Geoquímica** that took place at the University of Évora from September 23 to 25, 2019.

**IX Congress of Young Researchers in Geosciences**, LEG 2019 that took place at the Estremoz Pole of the University of Évora in November 2019. Includes two days of oral presentations, invited speakers and poster sessions and a geological excursion to the Iberian Pyritic Strip.

**Workshop ALOP- “Sistemas de observação, previsão e alerta na atmosfera e em reservatórios de água do Alentejo”** for stakeholders. 12 December 2019, IP Beja, Portugal.

Session for presentation and discussion of project results regarding: Improve knowledge of the state of the atmosphere and water reservoirs; Implement satellite remote sensing techniques, for obtaining water quality estimates; Assess the



environmental risk of potentially toxic pesticides and metals in the water and sediments of the Alqueva reservoir and detect the occurrence of undesirable species; Quantify the effects of the Alqueva reservoir on the local climate; Know and model the flows of water, energy and carbon at the water / atmosphere interface; Test and develop molecular techniques with a view to developing methodologies for alerting point pollution events and cyanobacterial blooms.

**III Congresso Luso-Extremadurense**, 25 and 26 November 2019. Évora, Portugal.

**Jornadas de Património Geológico e Geoconservação**, 2-3 de May 2019, University of Minho.



**Workshop “Geoethics’ Syllabus and Geoethics in Georesources and Geoparks”**, Project Erasmus+ GOAL, 14 - 18 January 2019, University of Porto.



**Workshops within the InCarbon project**- plans for scientific dissemination and construction of a website to disseminate the theme of the project.

**Annual Soil Science Meeting 2019 (EACS 2019): “Soil - a priority target for combating desertification”**. 17 June, Beja (Portugal).

**Organization committee of the Engineering Week**, March 19 to 21, Superior School of Technology, of the Castelo Branco Polytechnic Institute of Castelo Branco.

**Participation in the UN Climate Change Conference – COP25, Forest Fires and Climate Change**. Palacio de Congresos IFEMA, Espacio Mare Nostrum (Zona Verde), 11 December 2019, Madrid, Spain.

**Participation in the Launch day of project CILIFO** (Centro Ibérico para la Investigación y Lucha contra Incendios Forestales). Universidad de Huelva, 19 June 2019, Huelva, Spain.

**Participation in the Science Meeting 2019** - Encontro com a Ciência e a Tecnologia, Centro de Congressos Lisboa, Portugal, 8-10 julho 2019.

**Participation in the Commemoration conference of the World Water Day: Water is a Collective Responsibility for Sustainable Development**. Organised by the Corporación del Acueducto y Alcantarillado de Santo Domingo (CAASD), Santo Domingo, Dominican Republic, 25-26 May 2019.

**Participation in the XXI Meeting of the Network of Environmental Studies of the Countries of Portuguese Language: Science, Technology, Society and Environment in the High Education.**

Organisation of the Network of Environmental Studies of the countries of Portuguese Language, Moçâmedes, Namibe, Angola, 2-5 May 2019.

**Participation in the Aerosol Clouds and Trace Gases Research Infrastructure (ACTRIS), Remote Sensing Workshop**, 18-22 November 2019, National Council of Research (CNR), Rome, Italy.

**Participation in the Aerosol Clouds and Trace Gases Research Infrastructure – Preparatory Phase Project (ACTRIS-PPP)**, November 4-8, 2019, Helsinki, Finland, Participant as National Contact Person.

**Participation in the Aerosol Clouds and Trace Gases Research Infrastructure - EU Project 2015-2019, ACTRIS-2 Final Event**, April 01-04, 2019, Darmstadt, Germany.

**Participation in the PROfiling the atmospheric Boundary layer at European scale (PROBE)**, COST action: CA18235, Kick-off and First Management Committee Meeting, COST head quarter, 29 October, Brussel, Belgium. Participation as MC Portuguese member D. Bortoli

**Participation in the Arctic Science Summit Week (ASSW2019)**, Business meetings of Atmospheric Working Group (AWG) and Open meetings of International Arctic Sciences Council (IASC) May 22-29, 2019 in Arkhangelsk. Participant as Portuguese delegate for the AWG.

**Participation in the Meso-NH Meeting.** Participation in the 10th Meso-NH User's Meeting, 7-8 October 2019, OMP, Toulouse. The purpose of the meeting is to exchange information on on-going scientific projects with the Meso-NH model (<http://mesonh.aero.obs-mip.fr/mesonh54/TenthUsersMeeting>).





**Participation in the 1st e 2nd “Workshop on Eddy Covariance flux measurements in Portugal”,** Instituto Superior de Agronomia (ISA), 23/07/2019 and 05/12/2019. These Workshops brought together research groups that are dedicated to the quantification and understanding of greenhouse gas (GHG) emissions in Portugal, quantifying the impact of their temporal variations on critical ecosystems for the national economy. Specifically, in eucalyptus, assembled from cork and holm, pasture and reservoirs.



**Participation in the Summer School2019 GRASP-ACE** (Generalized Retrieval of Atmosphere and Surface Properties - <https://www.grasp-open.com/summer-school-2019/>). It is the first algorithm developed for the characterization of the properties of the atmosphere, adding for such observations a wide variety of remote sensing instrumentation.



**Participation in the 9th International Scientific-technical Conference on Environmental Engineering, Photogrammetry, Geoinformatics.** 17-20 setembro em Lublin (Polónia).

**Participation in the 5th International Conference of Wastes: solutions, treatments, opportunities.** 4 - 6 September, Lisbon (Portugal).

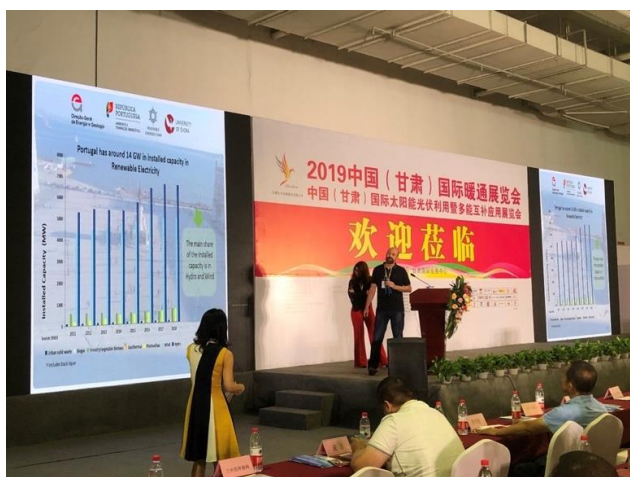
**Participation in the 11th APMG Meteorology and Geophysics Symposium and 20th Portuguese-Spanish Meteorology Meeting,** Cascais, 25 to 27 March 2019. Cascais, Portugal.

**Participation in the 27th IUGG General Assembly.** 8 - 18 July 2019. Montréal, Canada.

**Participation in the 6th workshop on “Parameterization of Lakes in Numerical Weather Prediction and Climate Modelling”.** 22 to 24 October 2019. Toulouse, France.

**Participation in the Centro Internacional de Investigação Climática e Aplicações para a CPLP e África (CIICLAA).** Participation of Rui Salgado, representing the University of Évora and ICT at the Forum on Climate / Variability and Climate Change - Impacts on the Economy at CPLP and Africa, and at the 2nd meeting of the General Council. Cidade da Praia, Cabo-Verde, 24 - 27 September 2019.

**2019 Seminar on Solar and Wind Energy Applications for the countries along the Belt and Road Initiative (16<sup>th</sup> July to 9<sup>th</sup> August).** The researcher Luís Fialho participated in the seminar and technical visit to the People's Republic of China (PRC), at the invitation of the Portuguese Ministry of Economy. The seminar took place at the Gansu Natural Energy Research Institute and included technical visits to the photovoltaic module production industries, production of wind generators, hydroelectric plants and one of the largest photovoltaic plants in the world, in Gansu. This visit also included a presentation at the International Clean Energy Industry Development Forum 2019.



**Participation in the Kick of Meeting SFERA-III.** The Kick of Meeting of SFERA-III project took place in Almeria, Spain. After two first phases successfully implemented, the SFERA-III pretends to facilitate the close cooperation between the European CST (Concentrating Solar Thermal) research institutions, to improve and share parts of their infrastructure and to coordinate their research in the field of CST.

**ENBRAIN project's meeting.** During the days 26 and 27 of February, the second mid-term meeting of ENBRAIN project took place in Évora. The host partner was the University of Évora (UÉ). The event welcomed a total of 24 partners from Politecnico di Torino (POLITO), Mediterranean Universities

Union (UNIMED), University of Tripoli (UoT), Zawia University (ZU), Misurata University (MU), Sirte University (SU) and Sebha University (SeU).



**Participation in the 15th SGA Biennial Meeting, Glasgow, August 2019.**

**Participation in the 6ª Reunión del Grupo Ibérico de Petrología, Geoquímica Y Geocronología:**

Granitos del Oeste de Galicia Tour, held in Galicia from 13 to 15 September.

**Participation in the Magiber XI, which took place in Condeixa-a Nova, from September 4 to 7.**

**Participation in the 71st International Committee of Coal and Organic Petrology ICCP Meeting, The Hague, Netherlands, 2019.**

**Participation in the XIV Congresso dos Jovens Geocientistas, Departamento de Ciências da Terra da Faculdade de Ciências e Tecnologia da Universidade de Coimbra, Portugal, 2019.**

**“Geoheritage: Concepts and Methods for Sharing Earth’s Legacy for Economic, Societal, and Scientific Advancement”.** Org. Geological Society of America (Phoenix, USA), 20-21 September 2019.



**Participation in the geoENV2020 Scientific Committee**, Parma, Italy, July 1-3, 2020 - <https://2020.geoenvia.org/>

**Participation in the 20th Annual Conference of the International Association for Mathematical Geosciences**, August 10 - 16, State College, Pennsylvania, USA.

**Participation in the Scientific campaign for study of acid sulfate water and soils** (field survey and sampling campaign), Collaboration with University of Kuala Lumpur, Malaysia.

**Participation in the 20th Annual Conference of the International Association for Mathematical Geosciences**, August 10 - 16, State College, Pennsylvania, USA.

**Coordination of the Special Thematic Session “Fluid Flow, Energy Transfer and Design”**. Coordination of the Special Thematic Session “Fluid Flow, Energy Transfer and Design” by Miguel, A.F. in the 15th International Conference on Diffusion in Solids and Liquids, Athens, Greece.



## **15th International Conference on Diffusion in Solids and Liquids - DSL2019**

Mass Transfer, Heat Transfer, Microstructure & Properties,  
Nanodiffusion & Nanostructured Materials

**Officiating opening/chair in the seminar on “Renewable energy day”**, October 2019, University Kuala Lumpur, Malaysia.

### **Technical Inspection and Commissioning Tests of the Montes Velhos Photovoltaic Plant of the Roxo Beneficiaries Association**

The Renewable Energies Chair carried out the technical inspection and commissioning tests of the Montes Velhos photovoltaic plant. This independent technical inspection allowed the detection and correction of non-conformities in the commissioning phase of this plant by



Efacec. Thermographic and visual inspection of all equipment in this plant was carried out, in addition to the plotting of I-V curves of the photovoltaic sets and solar tracking tests.

**Erasmus Mobility at the University Degli Studi di Parma, Italy**, where took place working meetings aiming the preparation of a PRIMA proposal H2020, focusing on the Thematic Area 1: Integrated and sustainable management of water arid and semi-arid Mediterranean areas, 25-29 de March, Parma, Italy.

**International Credit Mobility (ICM) at the University Al-Quds, Palestine** where took place working meetings aiming the preparation of a co-collaborative bachelor in civil engineering, 17-23 February, Jerusalem, Palestine.

**Erasmus Mobility at the University of Kuala Lumpur, Malaysia** where took place working meetings aiming the preparation of a scientific cooperation and scientific expeditions for study of acid sulfate soils. October 2019.

**Erasmus Mobility at the National University of Mongolia**, where took place working meetings aiming the preparation of a scientific cooperation. May 2019.

**Erasmus+ Teaching Mobility Erasmus** at the Department of Geochemistry and Hydrogeology, University of Bremen, Bremen (Alemanha), where took place working meetings aiming the preparation of a project proposal and laboratory facilities, 05-11 May 2019.

**International Credit Mobility (ICM) at the Faculty of Urban Planning and Management, Polis University (Tirana, Albania)** where took place working meetings aiming the preparation of a collaborative academic degree and master and research project proposal, 04-08 November 2019.



## Outreach and Other Activities

**Estremoz Ciência Viva Science Centre** - Interactive exhibitions and experimental activities concerning Earth Sciences processes in the Estremoz Ciência Viva Science Centre (19 903 visitors in 2019, 7 days per week).

**Taking secondary school students to the field with a geologist** in cooperation with the Estremoz Ciência Viva Science Centre (903 students in the 2018-2019 school year).

**“Sustentabilidade Insustentável”**, debate organized by the ICT- Institute of Earth Sciences and Sociedade Harmonia Eborensis (video available at <https://youtu.be/ypS23g3wdhA>).

**Preparation and participation in the Field Campaign “Atmosphere-Ocean-Island-Biogeochemical Interactions in the Macaronesian region (POS533-AIMAC)”**, This expedition took place aboard the research vessel RV Poseidon and offered the opportunity to investigate the dynamic processes both atmospheric and oceanic near islands in the Macaronesian region. It departed from Mindelo, Cabo Verde and ended in Funchal, Madeira, February 2019.



**2019 Alqueva Observation Field Campaign** in the framework of ALOP project. Most of G1 members participated.

This observational field campaign in the fields of meteorology and water (quantity and quality) at regional level had the following the objectives: Improve knowledge of the state of the



atmosphere and reservoirs in the region with special emphasis on the study about Alqueva – the

strategic water reservoir of Alentejo; Test models that can predict the amount of water and the evolution of biological and chemistry water quality in lakes, with application on the management of water resources; Understand the water, energy and carbon (CO<sub>2</sub> and CH<sub>4</sub>) fluxes in the interface fresh water / atmosphere; Evaluate the effects of global warming on the quantity and quality of water (ecological and chemical quality quality); Identify and test technologies for rapid assessment of potential risk situations.

**Geodynamic excursion to Pyrenees - "Nine field days in the Pyrenees":** in the context of the Geosciences PhD course of Porto University; from the Variscan shear zones of Cap Creus to the alpine evolution the Aragon region - 29th June-7th July.



**ZOM 3D Spring Course and GGET field meeting.** Field course held in the Summer School style, promoted under the ZOM-3D project, in partnership with the specialty group of the Geological Society of Portugal - GGET (Group of Structural and Tectonic Geology). Two field days, visiting different tectonostratigraphic sectors of ZOM and their respective metallogenic conditions.

**Field trips to the Lavadores-Madalena Complex**, of secondary school students, carried out with the support of the members of the Núcleo de Geologia da UP. In this context, Maria dos Anjos Ribeiro coordinated and carried out preparatory visits with the monitors, members of the Núcleo de Geologia da UP.



**Field campaign: Geological mapping and lithogeochemical sampling in the Trás-os-Montes sector.**



Field campaign: Geological mapping and lithogeochemical sampling in the Trás-os-Montes sector of significant importance for the correlation and unification of the Parautochthonous and Lower Allochthonous units of the Galicia-Trás-os-

Montes Zone.

**Field campaign in Algeria: Applied Geophysics to Archeology in Tipaza (Algiers, Algeria)**

An ICT team participated in the first days of December in geophysical research applied to Archeology



in the Roman city of Tipasa- Algeria. In this first collaborative work with Algerian colleagues at the Houari-Boumedienea University of Science and Technology, the ICT team composed of Rui Oliveira, Bento Caldeira and José Borges participated in a Georadar survey to detect structures in the archeological field of the city of Tipasa. Another larger scale campaign is being prepared, in an area of central Algeria, for the



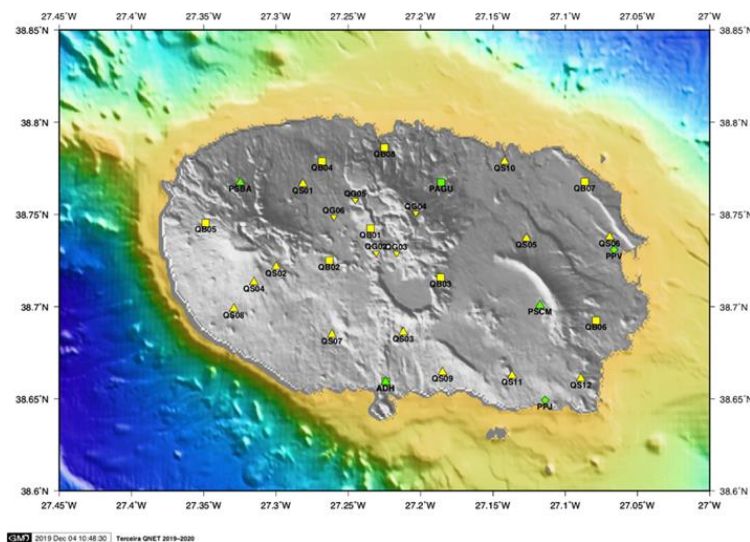
production of a 3D model of a Roman fortress covered by desert sands.

**Two Field campaigns in Spain: Applied Geophysics to Archeology.** Two Geophysical prospecting campaigns applied to Archeology in Spain in collaboration with the Archeology center of Mérida and the University of Extremadura, one in the area of Zalamea (Serena) in a Roman complex and the other in Botija (Cáceres) in a large prehistoric village.

**Field campaign in Peniche Península 2019.** Field survey and collecting samples for Electro Spin Resonance dating of marine deposits.

**Field campaign in the Antarctica Peruvian Station Machu Picchu** to study the space and time evolution of permafrost near the station.

To do the **tomography of the Terceira Island** was created a consortium amongst the Institute of Earth Sciences (ICT – University of Évora) Institute Dom Luiz (University of Lisbon and The Portuguese Institute for Sea and Atmosphere (IPMA) to install a seismic network that start operating in August 2019 until August 2020. The temporary seismic network comprises 30 sensors. The network will allow study induced seismicity. The consortium is coordinated by João Fontiela.



**Study of the macroseismic effects of the 9th July 1998 Faial earthquake ( $m = 6.0$ ).** The first phase of this study consisted of a survey with Lidar and Drone of structures affected by the earthquake whose rotational seismic effects are visible. In this first phase, the ruins of the Farol da Ribeirinha and the Torre da Igreja da Ribeira Funda (Faial) were identified.

**Geophysical survey at the Losal mine** using 2D and GPR seismic tomography. This survey aims to characterize the geological structure in the upper layers of a gallery where a muon detector is installed. This action took place as part of a project involving ICT and the Particle Laboratory (LIP), which aims to develop joint techniques of geophysics and muonic observation.



**Campaign to collect data on old photovoltaic installations in Europe.** The campaign collected data on photovoltaic installations in Europe with more than 10 years of exposure to the sun, within the scope of the GRECO project (H2020). The defective or damaged modules detected will be repaired or replaced at no cost to the participants.



**Workshop em Ciências da Terra da Atmosfera e do Espaço (WCTAE),** Universidade de Évora, Évora, Portugal, 30 January 2019. This Workshop is organized within the scope of the Seminar of the PhD program in Earth and Space Sciences and the Master in Earth and Atmospheric Sciences of the University of Évora. In this workshop, research articles produced by students attending that course are presented as oral communications. WCTE assumes itself, since its first



edition in 2013, as a space for sharing knowledge and science communication training.

**Workshop of the Doctoral Program in Geosciences** that took place on April 15 and 16, 2019 at FCUP.

This workshop was organised within the Doctoral Program in Geosciences activities.

**PhD student's seminar** entitled "Granites: types, origins and orogeny" promoted by Prof. Antonio Castro Dorado of Universidad Complutense, which took place in October 2019. Organized by Helena Sant'Ovaia.

Mini-course: "**Avaliação Ecotoxicológica do Efeito de Contaminantes nos Ecossistemas Aquático e Terrestre**". IP Beja.

Workshop on **identification of freshwater macroinvertebrates**, organized by the Portuguese Society for the Study of BIRDS (SPEA) at the Interpretative Space of Lagoa Pequena, Sesimbra, October 2019.

Workshop "**Science and Citizens in Action for the Knowledge and Valorization of Temporary Rivers**" organized by citizens of Saboia, Odemira. The workshop took place at the Savoy School and had 10 participants, June 2019.

**ENBRAIN Training, 8<sup>th</sup> to 10<sup>th</sup> October 2019.** Three training sessions in Tunisia for participants from Libyan Universities on the topics "Photovoltaic Technologies and electrical storage", "Thermal Solar Technologies" and "Concentrated Solar Power Systems".



**Training Module "Solar Photovoltaic Energy" - Course "Fundamentals of Renewable Energies" for the Directorate of Natural Resources and Santomean Energy (DGRNE), 1<sup>st</sup> to 13<sup>th</sup> April 2019.** This training module aimed to develop skills in the field of renewable energies. The University of Évora

continues to deepen its relationship with São Tomé and Príncipe, thus contributing to the cooperation and development of this Portuguese-speaking African country.

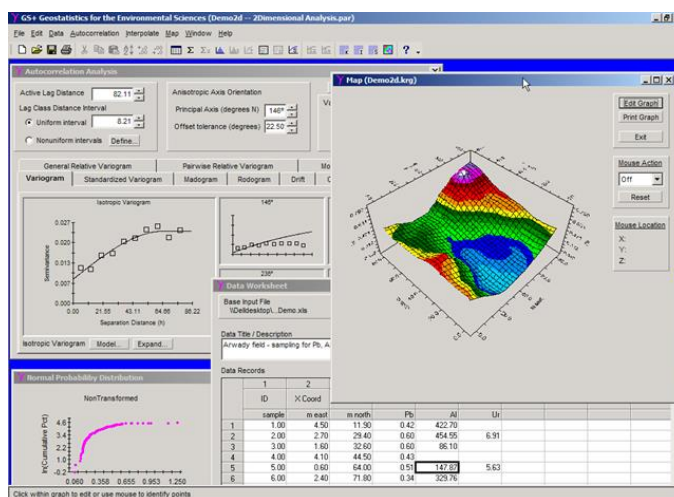
**Webinar on Tonatiuh software for ENBRAIN partner.** This webinar was a follow-up of the course "Concentrated Solar Power Systems" that took place during the Training Session in Tunis. The goal of the webinar was to explain in more detail the main features of the raytracing software Tonatiuh.

**Course "Lithium: genesis of deposits, mineralogy, classification and geochemistry",** promoted by Alexandre Lima that took place in Minas Gerais, Brazil, from March 11 to 16, 2019. The course consisted of lectures and field activities, with a total of 16 participants.

**"Techniques of Geochemical Data Treatment in R (RStudio)".** Workshop held within the framework of the XII Congresso Ibérico de Geoquímica and XX Semana de Geoquímica in 2019. Organized by Pedro Nogueira and Miguel Maia.

**"Geostatistics for Earth and Environmental Sciences":** Workshop integrated in the I Jornadas da Ciência - "[Science] - Concentrates Knowledge", 14 March, Gualtar Campus, University of Minho, Braga. The main objectives were: (i)

introduce to the student the concept of regionalized variable, type of variables commonly studied in Earth and Environmental sciences, (ii) introduce to the student some basic concepts in Geostatistics, namely model of spatial



continuity and linear kriging interpolator; (iii) teach how to use software for geostatistics.

**Organization of a short course (20h) in Environmental Management Systems: ISO 14001 (2015)** - addressed to managers and other staff without training in the area of environmental certification and who want to acquire or improve their knowledge in the area.

**Participation in the training school Economics of Sustainable Water Management of Intermittent Rivers and Ephemeral Streams in accordance to the Water Framework Directive (WFD),** the

Millennium Ecosystems Assessment (MEA) and Sustainable Development Goals of the UN Agenda 2030, in the framework of the Cost action: CA151113 – “SMIRES – Science and Management of



Intermittent Rivers and Ephemeral Streams” 2017-2020 (<https://www.smires.eu/training-school-on-economics-of-sustainable-water-management-of-intermittent-rivers-and-ephemeral-streams/>). The objective of this training school is to allow participants to be able to understand in depth the economics of IRES management and implications for sustainable development.

**Geoscience teacher training course** entitled: "The geology and mineral resources of the Ossa Morena Zone: geological crossover between Portalegre and Serpa" with the participation of about 50 teachers, 8 to 10 July. Teacher training course centered on the structure and geodynamic evolution of the Ossa-Morena Zone. The course was characterized by a practical training and consisted in a geotraverse between Portalegre and Serpa.

Lectures, field work and production of documentation for scientific and pedagogic support of Highschool teachers. **Workshop on Climate and Climate change** included in the 7th edition of the Physics and Chemistry Teachers Meeting (CCPFC/ACC-103297/19). September 2019.

**Workshop "The rocks are transparent - observations under the microscope"** – Agrupamento de Escolas Padre Benjamim Salgado. (DCT, April 2019).

**Physics workshop with smartphone at the 7th meeting of CF teachers**, 5 and 6 September 2019 (2 sessions).



**"FROM THE GEOLOGICAL MAPS TO THE GEOLOGY OF PORTUGAL; A PRATICAL APPLICATION OF THE GEOLOGY FUNDAMENTAL PRINCIPLES"** a two-day practical course for Geology and Biology school teachers (43 participants), in association with the Estremoz Science Centre, 13-14 Jul.

During 2019, supported Odemira Secondary School for the **"National Competition of Young Scientists"**. The group of students supervised won the 1st prize on the competition, Ciência VIVA initiative.

**Colloquium / debate at Escola Manuel Ferreira Patrício** (Grouping of Schools Manuel Ferreira Patrício) on "Rivers Temporary: its ecological reconsideration for sustainable management", March 2019.

Participation in lifelong activities addressed to teachers training (**C. Vasconcelos, J. Brilha**).

**Activities with students and teachers of Natural Sciences** in the school group nº2 of Beja within the scope of the Scientifically probable program.

ICT representative in the project **"Scientifically Probable"** which involves the monitoring of outreach activities in the area of Geophysics with schools in the region.

**"UM HORIZONTE AQUI TÃO PERTO"** (<http://www.horizonte.cge.uevora.pt/>) , promovido em parceria entre a escola Secundária de Severim de Faria de Évora e o Departamento de Física da Universidade de Évora, com o os objectivos de aproximar a Escola da Universidade; proporcionar aos alunos finalistas do Ensino Secundário um primeiro contacto com o Ensino Superior; proporcionar aprendizagens e aquisição de competências complementares às dos Currículos do Ensino Secundário. Dissemination conference to high school students: **"Groundwater, the hidden resource: problems and solutions"**. Severim de Faria High School, Évora, 10 and 28 May 2019. A. Chambel.

Dissemination conference to high school students: **"Groundwater, the hidden resource: problems and solutions"**. Group of Schools of Santo António, Santo António da Charneca, Barreiro, 17 May 2019. A. Chambel.

**XXXIX Course of Geosciences Professors** update (APG, September and November 2019), participation of Fernando Noronha as guest speaker.

**Geologia Sociedade e Ambiente.** 4º Encontro de Ciência Cândida Madureira. 8-9 May. Famalicão. The above meeting was also a Teacher's Improvement Course.



**European Researchers Night. Activity: "Concentration of the sun's rays", 27th September 2019.**

Demonstration of the operation of a non-image reproducing optics for solar concentration, using ray tracing techniques, in this case visualized with the use of lasers.



**Ideas contest: "Open science and solar energy".** The Renewable Energies Chair promoted the Ideas Contest on open science in solar energy. This challenge pretended to share the best ideas within the solar energy community, linking citizens' needs to researchers.



**World Café Évora "Open science and photovoltaic energy", May 29, 2019.** Public chatting and discussion, without the need for any technical knowledge, about open science and photovoltaic energy, in a Café environment. These World Café's are promoted by the European project GRECO.



**Mostra UP and FCUP Open Days**, in 2019, participation of all G3 members.

Collaboration with the **Centro de Interpretação Geológica de Canelas (CIGC), Arouca Geopark**. Helena Couto was responsible for the scientific advice and the inventory and classification of fossils in the Valério quarry.

**Dia do Asteroide**, FCUP June 28th, Helena Couto belonged to the organizing committee and dynamized the presentation " À volta de meteoritos: extinção versus origem da vida".

**"Conversation with the Scientist - the Geologist"**, event that took place on November 15th, Ciência Viva Gaia School, Biological Park of Gaia/Câmara Municipal de Gaia, promoted by Helena Couto.

**Junior University, U.Porto Jr**, 2019: participation of members Helena Couto, Alexandra Guedes and Helena Sant'Ovaia, as coordinators of different activities.

**"Exposição sobre a Exploração Mineira de Ouro em Valongo"**, which took place in 2019 at the **Municipal Museum of Valongo**. Alexandre Lima was responsible for the scientific supervision of this exhibition.

**Collection of videos on Geology and Mineral Resources**, which was organized and coordinated by

Pedro Nogueira (collection available at:

[https://www.youtube.com/playlist?list=PLjXW71R3c4MZeHdf\\_NHBqfJpKTbGyddzy](https://www.youtube.com/playlist?list=PLjXW71R3c4MZeHdf_NHBqfJpKTbGyddzy)).



**The geology and mineral resources of the Ossa Morena Transversal geological zone between Universidade Portas Abertas-UPA 2019.** Activities: #1 - Use of the electrical properties of the subsoil in the prospection of geological resources; #2 - Geological phenomena and climate change. (DCT, March 2019).



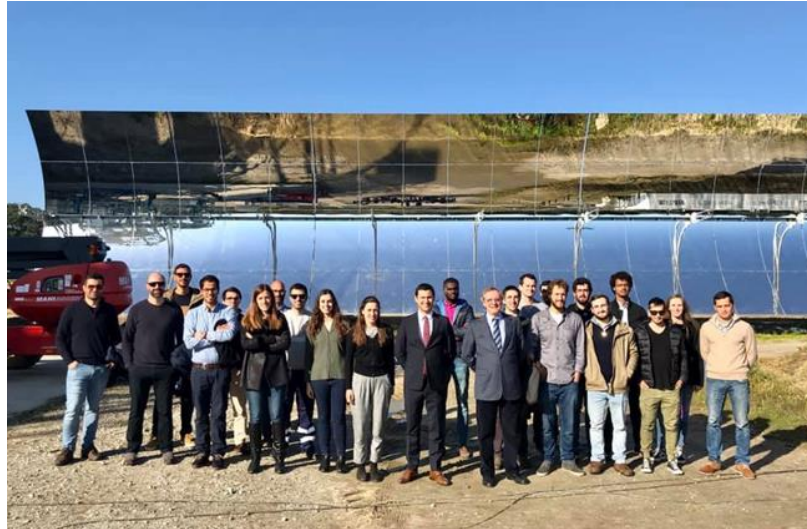
**Member of the round table “What if it was Today?”** An evocative meeting of the 50th anniversary of the 1969 earthquake: “Earthquake of 28 February 1969: What if it was today?” - University of Évora, 13 March 2019.

**Noite Europeia dos Investigadores - Ciência na Cidade.** Electrical properties of the underground - simple experiments and use of Georadar. (Braga, September 2019).



**Conference “A Geologia e o Património Construído”** within the discipline “Arte e História do Minho” of the Universidade Sénior de Braga. (Braga, May 2019).

**Visit of the Secretary of State for Energy to the Renewable Energy Chair, 25<sup>th</sup> February 2019.** The Secretary of State for Energy, João Galamba, visited the infrastructures of the Renewable Energies Chair, highlighting the research capacity of this research unit which has been developing research mainly around Solar Energy and its applications, also meeting with students and researchers.



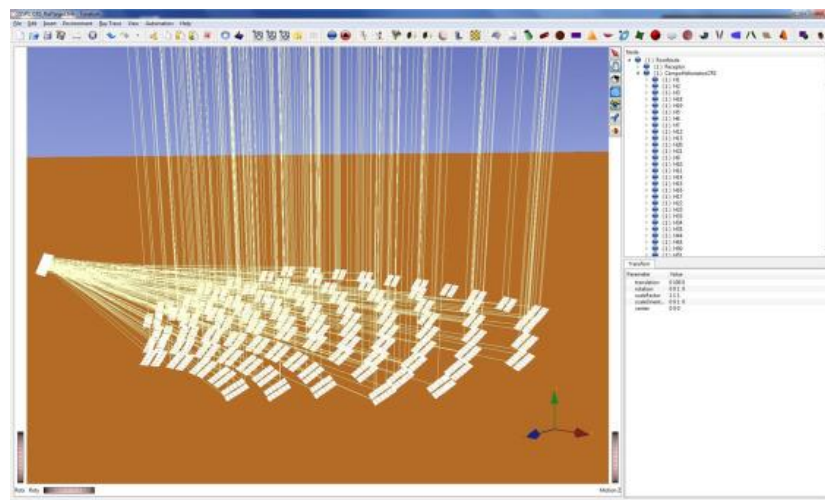
**DGEG and Delegation of Morocco visit Renewable Energy Chair, 18<sup>th</sup> September 2019.** A delegation from DGEG and representatives of institutions and government of Morocco visited the experimental facilities of the Renewable Energies Chair. This visit aims to strengthen cooperation on energy and sustainability between these countries.



**AICEP and journalist visit Mitra's facilities of the Renewable Energies Chair.** AICEP and the Editor-in-Chief of the professional magazine ESI-Africa started their visit to associations and projects in the renewable energies sector, with a visit to the experimental facilities at the Pólo da Mitra (Valverde).



**Solar Energy Engineering students visited EMSP and PECS facilities, 15 November 2019.** A group of students of the MSc in Solar Energy Engineering (University of Évora) visited the Évora Molten Salt Platform (EMSP) and the PECS (Solar Concentrators Testing Platform) at Mitra's manor.



**1st Summer School and Doctoral Colloquium of SFERA-III.** The lecture “New concepts of line focus and point focus collectors” was delivered at CNRS facilities in Odeillio, France, by Diogo Canavarro.



Alexandra Guedes participated in the **Specialization Course in Forensic Skills**, Faculty of Medicine, University of Porto, 3 May 2019 with the lecture "Forensic Geology".

**Academy of Sciences** on the theme "Potentialities of Portugal in Lithium Minerals" communication presented by Fernando Noronha, on February 21, 2019.

**Tertúlia dos Carrancas** with the presentation "The Valuation of Marine Resources", in May 2019, by Fernando Noronha.

**“XXVI Encontro Nacional da Sociedade Portuguesa de Química”** held between 24 and 26 July 2019 at the Faculty of Sciences of the University of Porto. In this meeting António José Moura presented a paper entitled " Os Recursos Geológicos e a Tabela Periódica".

**Intervention in the media:** Fernando Noronha participated in “Biosfera” (RTP-2)- intervention about lithium; in the “Sociedade Civil” (RTP-2) - intervention about gold in Portugal; in Porto Canal - intervention about lithium.

**Clarification session on lithium exploration in the municipality of Montalegre** in the Câmara Municipal de Montalegre (1 June 2019), participation of Fernando Noronha.



**Conference “Água Produto da Natureza, Matéria-prima crítica”. I FÓRUM ENERMETER - A tecnologia de medição como suporte da sustentabilidade e eficiência no uso da água, Altice Forum Braga, Braga, May 2019.**

**Conference “Exploração de recursos geológicos – cenários típicos de degradação ambiental e oportunidades de valorização sustentável”. Jornadas de Biologia-Geologia, February 2019.**

**Discussion panel on current issues in the Environment area. Jornadas de Biologia-Geologia, February, 2019.**

**Lecture- Pereira, D.I. 2019. Oportunidades e desafios para o Turismo de Interior. 1º Seminário Internacional sobre Turismo de Interior. 25 Jan 2019. Macedo de Cavaleiros, Portugal.**

**Lecture- Pereira, D.I. 2019. Testemunhos geológicos das oscilações climáticas no norte de Portugal. 2º Congresso Transfronteiriço de Meteorologia e Alterações Climáticas, 16 Nov, Paredes de Coura, Portugal.**

**Lecture- Pereira, D.I. 2019. Da Geodiversidade à Geoconservação: a estratégia em Portugal. Workshop Ibero Brasileiro sobre Áreas Protegidas. Laboratório da Paisagem Guimarães, 22-23 May 2019.**

The image displays three posters for international events. The first poster on the left is for the 'I Seminário Internacional Sobre Turismo de Interior' held on January 25, 2019, in Macedo de Cavaleiros, Portugal. It features a collage of images related to tourism and interior development. The middle poster is for the '2º CONGRESSO TRANSFRONTEIRIÇO DE METEOROLOGIA E ALTERAÇÕES CLIMÁTICAS' held on November 16, 2019, in Paredes de Coura, Portugal. It includes a detailed program of events, including sessions on meteorology, climate change, and the environment. The third poster on the right is for the 'workshop Ibero Brasileiro sobre Áreas Protegidas' held on May 22-23, 2019, in Guimarães, Portugal. It features a background image of a forest and text indicating the workshop's focus on protected areas and landscape management.

**Meeting “Challenges for the Communication of Science in the 21st Century”.** Renato Henriques was a member invited to discuss the challenges facing the Portuguese Science Communication, May 2019.



**Lecture "Villa Romana de Pisão: Yesterday, Today and Tomorrow"** included in the Beja Romana festival (May 2019), UNESCO Center of Beja and visit to the Roman Villa of Pisão.

**Lecture “When the Earth Shakes”** at the invitation of the School of Alvito; on the 15th of November 2019.

**Seismic Risk in the District of Évora - Lecture within the scope of the dissemination action “A Terra Treme”** organized by the National Emergency and Civil Protection Authority of Évora in collaboration with the André de Gouveia School, November 15, 2019.

Lecture by invitation at the Professional School of Moura **“Living with Penguins: stories of Scientists in Antarctica”**.

Trainer at the 7th Physics and Chemistry Teachers Meeting. **Workshop “Living with Penguins: Stories of Scientists in Antarctica”**, September 5 and 6, 2019.

#### **Invited Speakers:**

**"Symposium on Mining Engineering and Geo-Resources"**, FEUP June 2019. Fernando Noronha was a guest speaker.

**Evento Ciência e Cidadania**, 2019 that took place at the ECVA of the University of Trás-os-Montes e Alto Douro that took place in Vila Real from February 25 to March 1, 2019. In this event Helena

Sant'Ovaia was a guest speaker and presented the lecture "Seismic activity and seismic risk in Portugal".

Chambel, A., 2019. How droughts affect natural water systems and thus the production of water? Conference to Commemorate World Water Day: Water a Collective Responsibility for Sustainable Development, Aqueduct and Sewer Corporation of Santo Domingo (CAASD), Santo Domingo, Dominican Republic, 25-26 March 2019.

Chambel, A., Cupeto, C., 2019. Water and Climate Change in Mediterranean Countries. Cycle of conferences and debates "Sustainability in ADN", 100% ADN, Évora, 8 May 2019.

Chambel, A., 2019. Groundwater Governance. Lecture at the University Agostinho Neto, Luanda, Angola, 26 April 2019.

Chambel, A., 2019. The transversality of water in the Sustainable Development Goals (SDGs). Talks, Active Citizenship for the SDGs: A Heritage Without Borders, 7th National Meeting of the UNESCO Network of Associations, Centers and Clubs, Évora, 25 October 2019.

Chambel, A., 2019. Practical aspects of sustainable water use in a context of water scarcity. Open Day: Vale do Guadiana Natural Park, Seminar "Challenges for Biodiversity Conservation in Climate Change Scenarios", Mértola, 18 November 2019.

Chambel, A., 2019. The influence of geotechnical works on groundwater in the context of climate change. International Seminar on "Geotechnical Solutions to Interregional Environmental Problems Portugal-Spain" (SIGAUBI2019), Covilhã, 25-26 November 2019.

Palma, P., 2019. Participation by invitation, at the Workshop Regional de Inovação na Agricultura: Olivicultura, with the presentation of the Fitofarmgest project. 5 November, Elvas.

Palma, P., 2019. Participation by invitation at the Agri Innovation Summit (AIS 2019), with the presentation of the FitofarmGest project. 25 and 26 June. Lisieux (France).

Palma, P., 2019. Participation by invitation in the ebook "Visualización de la Actividad Científica Femenina en la Euroregión Algarve-Andalucía". Authors: Inés Nores, María Franco, Filomena Fonseca.

Edited by the Huelva University. ISBN: 978-84-943471-6-0.

Salgado, R., 2019. Surface-atmosphere interactions and the impact of lakes on climate. In symposium "A Tribute to Joël Noilhan", Météo France, Toulouse, France, 21 March 2019.

Borges J. F., 2019. "The velocity structure of the Mitidja Basin from Ambient Noise" - Plenary session, Thematique Sismologie, Nanosciences-Nanotechnologies, et Oncologie - École Nationale Polytechnique Argel - Argélia, 1 a 5 de dezembro de 2019.

Borges, J.F., 2019. "The deep velocity structure of the Mitidja Basin from inversion H/V spectral ratio of ambient noise data", under the Ecole Thematique Sismologie, Nanosciences-Nanotechnologies, et Oncologie - bilateral Luso-Algerian cooperation agreements for scientific research, 01 to 05 December 2019, Ecole Nationale Polytechnique Algiers-Algeria.

Two conferences (Bento Caldeira, 2019) in Algeria: "H/V ratio curves from seismic noise recordings" and "ModelHvsr inversion of H/V curves of ambient noise", under the Ecole Thematique Sismologie, Nanosciences-Nanotechnologies, et Oncologie - bilateral Luso-Algerian cooperation agreements for scientific research, 01 to 05 December 2019, Ecole Nationale Polytechnique Algiers-Algeria

Dias, R. 2019. "Sustentabilidade; para além da visão dos políticos e economistas", integrada na sessão Poder, Sociedade e Cultura Científica do encontro nacional Ciência 2019 da Fundação para a Ciência e Tecnologia.

António Correia, Geohazards in Azores and Maritime Antarctica. International Conference on Silk-roads Disaster Risk Reduction and Sustainable Development. May 11-12, 2019, Beijing, CHINA.

Manso, M., Bezzeghoud, M., Borges, J., Caldeira, B., Fontiela, J., Ayadi, A., 2019. "High-density seismic network for monitoring Alentejo region (Portugal) and Mitidja basin region (Algeria)", 2nd Conference of the Arabian Journal of Geosciences (CAJG 2019), Sousse, Tunisia, 25 to 28 November 2019.





## Awards and Distinctions

**Rui Dias**, eleito membro correspondente da Secção de Ciências da Terra e do Espaço da Academia de Ciências de Lisboa.

**Patrícia Palma**, 2019: Award +INOVAÇÃO for the FitoFarmGest (PI: Patrícia Palma), in the “MAIS ALQUEVA MAIS VALOR 2019” competition.

**Sara Leal** (PhD student), Paralab Prize for the best oral presentation at the “XII Congresso Ibérico de Geoquímica e XX Semana da Geoquímica” held at the University of Évora from 22 to 25 September.

**Marcela Rodrigues** (PhD student), BERALT Prize for the best poster at the “XII Congresso Ibérico de Geoquímica e XX Semana da Geoquímica” held at the University of Évora from 22 to 25 September.

**Joana Fernandes** (PhD student), "Best Student Paper Award 2019", presented at the “Earth Resources and Environmental Remote Sensing/GIS Applications” conference, Strasbourg, France, 2019.

**Ana Claudia Santos** (PhD student), "Student Poster Presentation Award" presented at the "World of Coal Ash Conference 2019" and awarded by the "American Coal Ash Association (ACAA) Ed Foundation".

**Luís Fialho** Scientific Award Mário Quartin Graça 2019 - Technologies and Natural Sciences.

**Helena Ribeiro et al.**, Thematic Poster Session Winner, with the presentation. – Can airborne populus seeds be a potential cause of pollen allergies? An aerobiological study. EAACI Congress 2019 - Congress of the European Academy of Allergy and Clinical Immunology, 1-5 June 2019, Lisbon, Portugal.