

# **PORTUGAL**

**SECÇÃO PORTUGUESA DAS UNIÕES INTERNACIONAIS  
ASTRONÓMICA E GEODÉSICA E GEOFÍSICA  
(SPUIAGG)**

**INTERNATIONAL ASSOCIATION OF GEOMAGNETISM AND AERONOMY  
IAGA**

## **NATIONAL REPORT**

**2011 – 2015**

**PRESENTED TO THE XXVI GENERAL ASSEMBLY  
OF THE INTERNATIONAL UNION OF GEODESY AND GEOPHYSICS**

**HOLD AT PRAGUE, 22 JUNE – 2 JULY 2015**

**Coordinated by**

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## **1 – INTRODUCTION**

### **1.1 Overview**

During the 2011-2015 period, we can find results from the activity of Portuguese researchers in different scientific fields covered by IAGA five Divisions and three Inter-divisional Commissions.

In this report, and as detailed below, we highlight the contributions coming out from two laboratories supporting research in Paleomagnetism and in Rock Magnetism (Division I) in Lisbon and in Porto/Évora, from a governmental research institution, IPMA, and a new research unit in Coimbra, CITEUC, doing research related to different IAGA divisions.

## **2 – LABORATORY OF PALEOMAGNETISM AND ROCK MAGNETISM OF INSTITUTO DOM LUIZ (IDL), LISBON**

Palaeomagnetism and rock magnetism are applied in studies of volcanic processes, reconstruction of tectonic plate motions, fabrics development in different tectonic settings. The team is involved in a number of projects.

Some members have important roles in the community of Geomagnetism and Aeronomy. Pedro F. Silva is Deputy President of Division on Earth Magnetism & Rock Physics (EMRP) of European Geosciences Union (EGU) for the period 2015-2017. Eric Font is Guest Managing Editor for special issues of Palaeo 3 and Frontiers in Earth Science journals.

Among the realizations during this period, we outline the organization of the 14th Castle Workshop Paleo, Rock and Environmental magnetism sponsored by IAGA, that took place in Évora, Portugal, in August/September 2014 (photo below)



The team also participated actively on the Fogo Volcano (Cape-Verde) mission, providing scientific support to the Cape-Verde Civil Protection.



## 2.1 Research projects

- 2015-2016: "Paleomagnetism and U-PB geochronology of dyke and sill swarms of the west African Craton (Anti-Atlas inliers, Southern Morocco): Links to break-up of Precambrian supercontinents. Part II" (PI – Pedro F Silva). Bilateral Agreement Portugal-Morocco (FCT-CNRST). Funded by FCT (Portugal)
- 2013-2016: "ASTARTE", (7<sup>o</sup> Programa Quadro - União Europeia). PI: Maria Ana Baptista (ISEL/IPL).
- 2013-2015: REGENA - Holocene and Pleistocene recovery of geomagnetic secular variation in the North Atlantic (Azores and Cape-Verde archipelagos and Portugal mainland): Geomagnetic and volcanological implications (PI – Pedro F Silva). Funded by FCT (Portugal)
- 2013-2015: "GOLD" (PTDC/GEO-GEO/2446/2012) - Granites, Orogenesis, Long-term strain/stress, and Deposition of ore metals. PI: M. Francisco (Universidade de Évora).
- 2013-2014: "Paleomagnetism and U-PB geochronology of dyke and sill swarms of the west African Craton (Anti-Atlas inliers, Southern Morocco): Links to break-up of Precambrian supercontinents." (PI – Pedro F Silva). Bilateral Agreement Portugal-Morocco (FCT-CNRST). Funded by FCT (Portugal)
- 2012-2015: Origin of the Cretaceous-Tertiary and Triassic-Jurassic Mass Extinction: Bolide impact, volcanism or both? (PI: Eric Font), Funded by FCT (ref. PTDC/CTE-GIX/117298/2010, 120,000.00 €).

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- 2012-2013: PAULIF Program - Magnetic signature and age of Cretaceous dykes and sills of the Lusitanian and Algarve Basins, Portugal. (PI: Eric Font), Funded by FCT (Portugal) and CRUPS (France) (ref. TC-02\_12; ~5,000.00 €)
- 2011-2014: A new multidisciplinary method for the identification of Tsunami-induced deposits and their frequency in the geological record. (PI: Eric Font), Funded by FCT (ref. PTDC/CTE-GIX/110205/2009, 120,000.00 €)
- 2010-2013: "MEGAHAZARDS" (FCT/PDCTM). PI: F. O. Marques (Universidade de Lisboa).
- 2009-2012: "PESSOA". Calibration of the Apparent Polar Wander Path and Eulerian Poles of Iberia at the Jurassic-Cretaceous. (PI: Eric Font), Funded by FCT (~10,000.00 €)
- 2009-2013: AMSPROGRESS (PI – Pedro F Silva) - Multidisciplinary Study of AMS generation and relation to progressive strain: an experimental approach. Funded by FCT (Portugal)

## **2.2 Organization of Scientific Events and Meeting's sessions**

- 2015: Eric Font - Convener and chairperson of the session "Environmental Magnetism: advances and perspectives" - EGU 2015, Vienna.
- 2015: Eric Font - Co-convener and chairperson of the session "Volcanism, Impacts, Mass Extinctions and Global Environmental Changes", EGU 2015, Vienna.
- 2015: Pedro F Silva – Convener of the session A10 - Paleomagnetism and magnetic fabrics applied to tectonic and volcanic processes, da 26th IUGG - General Assembly 2015.
- 2014: Eric Font - Convener at the 14th Castle Meeting - New trends on Paleo, Rock and Environmental Magnetism, Évora, Portugal, 31st of August to 6th of September 2014.
- 2014: Eric Font - Co-convener and chairperson of the session "Volcanism, Impacts, Mass Extinctions and Global Environmental Changes", SSP1.2. - EGU 2014, Vienna.
- 2014: Eric Font - Member of the scientific committee and coordinator of the XIth congress of Geology of Portugal and 2nd congress of Portuguese Language.
- 2014 Pedro F Silva - Convener of one session at the XIII Castle Meeting - New trends on Paleo, Rock and Environmental Magnetism, Évora, Portugal, Agosto de 2014.
- 2014 Pedro F Silva – one of the organizers of the short course, "Theoretical concepts of magnetic susceptibility", Évora, Portugal, Agosto de 2014.
- 2014 Pedro F Silva, Marta Neres, Ana Lopes and Francisco Almeida - Main organizers of the International Conference: XIV Castle Meeting - New trends on Paleo, Rock and Environmental Magnetism, Évora, Portugal, Setembro de 2014. IAGA was one the main sponsors.
- 2012 Pedro F Silva - Convener of one session at the XIII Castle Meeting - New trends on Paleo, Rock and Environmental Magnetism, Slovakia, June of 2012.

## **2.3 Publications**

Neres, M., Silva, P.F., Ikenne, M., Martins, S., Hafid, A., Mata, J., Almeida, F., Youbi, N. First paleomagnetic results for the West African Craton at the Paleoproterozoic: implications for Nuna reconstruction. Accepted for publication at *Studia Geophysica et Geodaetica* under moderate revisions

Font, E., Fernandes, S., Neres, M., Carvalho, C., Martins, L., Madeira, J. and N. Youbi (in press). Paleomagnetism of the Central Atlantic Magmatic Province (CAMP) of the Algarve basin, Portugal: first insights. *Tectonophysics*. Special Issue on Iberian Geodynamics.

Fantasia, A., Adate, T., Spagenberg, J. and Font, E. (in press). Paleoenvironmental changes associated with Deccan Volcanism, examples from terrestrial deposits from Central India. Special Issue on "Impact, Volcanism, Global Changes and Mass Extinction", eds. Eric Font, Thierry Adate, Sverre Planke, Henrik Svensen and Wolfram Krushner. *Palaeogeography, Palaeoclimatology, Palaeoecology*.

Font, E., Ponte, J., Adate, T., Fantasia, A., Florindo, F., Abrajevitch, A. and J. Mirão (in press). Tracing acidification induced by Deccan Phase 2 volcanism. Special Issue on "Impact, Volcanism, Global Changes and Mass Extinction", eds. Eric Font, Thierry Adate, Sverre Planke, Henrik Svensen and Wolfram Krushner. *Palaeogeography, Palaeoclimatology, Palaeoecology*.

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## **2.4 Communications**

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Youbi, N., Marzoli, A., Bertran, H, Font, E., et al., 2011. Did the bolide impact(s), volcanism or both trigger the end of Triassic mass extinction? Second Arab Impact Cratering and Astrogeology Conference (AICAC II), Abstracts volume, 13-20 November 2011, Casablanca, Morocco.

Font, E., N. Youbi, S. Fernandes, H. El Hachimi, Z. Kratinova and Y. Hamim (2011). Magnetostratigraphy of the Central Atlantic Magmatic Province (CAMP) in Morocco, The 2nd International Joint MAPG & AAPG Conference & Exhibition, Marrakech.

Font, E., M.K. Bensalah, N. Youbi, A. Vieira, D. Lourenço and Y. Hamim (2011). Paleomagnetism and Rock Magnetism of the Jurassic-Cretaceous Basalts of the Aghzif-Naour and Aït Attab Sections, Morocco, The 2nd International Joint MAPG & AAPG Conference & Exhibition, Marrakech.

El Hachimi H., N. Youbi, J. Madeira, L. Martins, J. Mata, M Bensalah, A. Marzoli, H. Bertrand, G. Bellieni, E. Font et al. (2011). Physical Volcanology of the lava flows of the Central Atlantic Magmatic Province (CAMP) of Morocco, The 2nd International Joint MAPG & AAPG Conference & Exhibition, Marrakech.

Carretero, M.I., Pozo, M., F. Gómez-Toscano, Ruiz, F., M. Abad, M-L- González-Regalado, J. Rodríguez-Vidal, L.M. Cáceres, A. Toscano, M.A. Baptista, P.M.F. Silva and E. Font (2010) Primeras evidencias de contaminación histórica en el Parque Nacional de Doñana (SO de España). In proceeding of: *Studia Geologica Salmanticensia*, Ediciones Universidad de Salamanca.

Font E., Nascimento, C., Omira, R., Baptista, M.A. and P.M.F Silva (2010). Identification of tsunami-induced deposits using numerical modelling and rock magnetism. AGU Meeting Sao Francisco, poster session.

Font, E., Nédélec, A., Correia, J., Silva, P.M.F., 2010. Revisiting the KTB transition in Basque Country using detailed rock magnetism and chemostratigraphy: multiple impacts for mass extinction? 12th Castle Meeting, Pragues, 2010, oral session.

Font E., Ernesto, M., Ponte de Neto, C.F., 2010. Paleomagnetism and Rock Magnetism of the Itajaí Basin, Santa Catarina (Brazil), and the large-scale remagnetization of the Rio de la Plata craton. AGU Meeting Iguazu 2010, poster.

Font E., Nascimento, C., Omira, R., Baptista, M.A. and P.M.F Silva (2010). Magnetic evidences of Lisbon 1755 tsunami in re-worked litoral sediments. *Eos Trans. AGU* 91(26), Meet. Am. Suppl. Abstract GP14A-02. invited talk.

Pedro F. Silva, Bernard Henry, Fernando O. Marques, Pedro Madureira, Miranda, J.M., Lourenço, N., Madeira, J., Anthony Hildenbrand, João C Nunes, Zuzana Roxerová. Paleomagnetic study of Azores Archipelago: volcano-tectonic implications. AGU Fall Meeting, S. Francisco, USA, 2014.

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Silva, P.F., Almeida, F., Waerenborgh, J.C., Madureira, P., Henry, B., Neres, M., Petrovský, E. Thermomagnetic analyses of oceanic basalts - Testing a new approach to differentiate oxidation degree from the primitive composition of titanomagnetites. Castle Meeting, New trends on Paleo, Rock and Environmental Magnetism (Évora, Portugal), 2014.

Pedro F. Silva, Bernard Henry, Miranda, J.M., Lopes A., Fernando O. Marques, Pedro Madureira, Lourenço, N., Anthony Hildenbrand, Madeira, J., João C Nunes, Zuzana Roxerová. Paleomagnetic and geomagnetic study of Pico-Faial Ridge (Azores Archipelago). Castle Meeting, New trends on Paleo, Rock and Environmental Magnetism (Évora, Portugal), 2014

Moreira, M., Geoffroy, L., Pozzi, J.P. Magma flow pattern in dykes of the Azores revealed by the anisotropy of magnetic susceptibility. Castle Meeting, New trends on Paleo, Rock and Environmental Magnetism (Évora, Portugal), 2014.

Drago, T., Silva, P.F., Alonso, B., Vazquez, J.T. Lopez, N., Lopes, A., Roque, C., Neres, M. On the search of mass transport deposits on Southern Portuguese Margin - preliminary results. Castle Meeting, New trends on Paleo, Rock and Environmental Magnetism (Évora, Portugal), 2014

A. Lopes, P.F. Silva, H. Grison, C. Pires, T. Drago, P. Madureira. Environmental changes recorded in two sediment cores from North Atlantic Ocean. Castle Meeting, New trends on Paleo, Rock and Environmental Magnetism (Évora, Portugal), 2014.

Marques, A.F.A.; Hamelin, C.; Madureira, P; Rosa, C.J.P. Silva, P.; Relvas, J; Lourenço, N; Conceição, P.I.S.T.; Barriga, F.J.A.S.. Serreta Submarine Eruption 1998-2001, Azores: a new compositional end-member? EGU, Viena, Austria, 2014.

Silva PF, Almeida F, Madureira P, Henry B, Petrovský E (2013) Thermomagnetic analyses of oceanic basalts - Testing a new approach to differentiate oxidation degree from the primitive composition of titanomagnetites, 1.11-32p, International Association of Geomagnetism and Aeronomy Meeting, 1.11-25p, Merida, Mexico, 2013.

Silva PF, Baptista MA, Drago T, Oliveira A, Caetano M, Omira R, Duarte JF, Naughton F (2013). Identification of tsunami deposits using magnetic methods off-shore SW Iberia, International Association of Geomagnetism and Aeronomy Meeting, 1.11-25p, Merida, Mexico, 2013.

Marta Neres, Jean-Luc Bouchez, Pedro Terrinha, Eric Font, Mário Moreira, and Claire Carvallo. Modeling magmatic flow in a sill using AMS techniques. Geophysical Research Abstracts Vol. 15, EGU2013-11562-1, 2013. EGU General Assembly 2013

P.F. Silva; Marques F.O., Hirt A.M., Henry B., Madureira P., Kratinová Z.. Magma flow and cooling as inferred from distinct rock magnetic fabrics. 13th Castle Meeting on Paleo, Rock and Environmental Magnetism, June of 2012, Slovakia.

Z. Kratinová, Závada P., Machek M., Silva P.F, Marques FO., Henry B., Evolution of magnetic susceptibility and anisotropy in salt related to dyke emplacement. 13th Castle Meeting on Paleo, Rock and Environmental Magnetism, June of 2012, Slovakia.

B. Henry, A. Lamali, N. Merabet, S. Maouche, P.F. Silva, K. Graine–Tazerout, A. Mekkaoui, M. Ayache. Polyphased geodynamical evolution of the Ougarta (Algeria) magmatic complexes evidenced by paleomagnetic and AMS studies. 13th Castle Meeting on Paleo, Rock and Environmental Magnetism, June of 2012, Slovakia.

A. Lopes, Silva P.F., Conceição, P., Guerreiro, C., Magnetic characterization of sediments from Atlantic Ocean Seamounts (between 29°N and 38°N). Preliminary results. 13th Castle Meeting on Paleo, Rock and Environmental Magnetism, June of 2012, Slovakia.

Eduard Petrovsky; Hana Grison; Ales Kapicka; Pedro F. Silva; Eric Font. Characterization of magnetically enhanced buried soil layer in arid environment, AGU-Fall Meeting, S. Francisco, AGU.

Jorge Ponte, Eric Font, Cristina Veiga-Pires, Claude Hillaire-Marcel. The Holocene (5000-6000 yrs BP) Paleosecular variation record from a Portuguese speleothem, EGU 2015, Vienna (Austria).

M. Neres, J.L. Bouchez, P. Terrinha, E. Font, M. Moreira, R. Miranda, P. Launeau, C. Carvallo (2014). Magnetic fabric in a Cretaceous sill (Foz da Fonte, Portugal): magmatic flow model and implications for regional magmatism. Castle Meeting 2014: New Trends on Paleo, Rock and Environmental Magnetism, Évora, Portugal.

M. Neres, J.L. Bouchez, P. Terrinha, E. Font, M. Moreira, 2012. Conceptual model of flow in a sill using magnetic fabric data (Foz da Fonte, Portugal). LASI V: Physical geology of subvolcanic systems: Laccoliths, Sills, and Dykes, 2012, Porth Elizabeth, South Africa.

M. Neres, E. Font, J.M. Miranda, M. Moulin, J.L. Bouchez, P. Camps, P. Terrinha, J. Mirão, 2012. Reconciling Cretaceous paleomagnetic and marine magnetic data for Iberia. Castle Meeting 2012: Paleo, Rock and Environmental Magnetism, Zvolen, Slovakia. (Outstanding Student Presentation)

## **2.5 Young researchers training**

2014-2017: Jorge Ponte (IDL – Earth Systems) (Awaiting Viva). Thesis: Environmental magnetism and paleomagnetism of speleothems: a new tool for documenting high-frequency instabilities of the Earth's magnetic field and climate. Granted by FCT (ref. SFRH/BD/96241/2013), PhD thesis.

2015 – Ana Mateus. “Estudo micro-paleontológico e magnético de uma sondagem do Quaternário do Atlântico Norte (EMEPC - sondagem CO3, lat. 30.2N, long. 28.6W)”. Ongoing (DG/FCUL/UL, Co-supervisor: Pedro F Silva), master thesis.

2013- Marta Neres: Magnetic studies of the Late Cretaceous magmatism in Portugal: from Iberian plate kinematics to magnetic fabrics. December 2013 (IDL/UL – Université de Toulouse, France, Supervisor: Eric Font), PhD thesis.

2013 - Ana Lopes “Assessing climatic changes through environmental magnetic analyses of three sedimentary columns of the North Atlantic Ocean (between 29°N and 35°N). DEGGE/FCUL/UL (Supervisor: Pedro F Silva) , master thesis.

2013 - Jorge Ponte “Magnetic mineralogy of Cretaceous-Tertiary sections (Tethys, Iran and India): links with the Deccan Phase-2”. DEGGE/FCUL/UL (Supervisor: Eric Font) , master thesis.

2011-2012: Master Susana Fernandes (DEGGE-IDL). Master dissertation: Paleomagnetism and Magnetostratigraphy of the Central Atlantic Magmatic Province in South Portugal. (Supervisor: Eric Font) , master thesis.

2009-2010: Master Jorge Correia (DEGGE-IDL). Thesis: The KPB in Bidart and Hendaye: Climatic Changes and Mass Extinctions. (Supervisor: Eric Font) , master thesis.

## **2.6 Outreach**

Font, E. (2014). Aeolian akaganeite deposition and ocean acidification during the Deccan Phase-2. Invited talk at the Institut de Physique du Globe, Paris.

P. F. Silva, Das extinções en massa ao vulcanismo do Deccan. Conference “Geologia as Quarta”, Faculdade de Ciências e Tecnologia da Universidade Nova de Lisboa, March 2014.

P. F. Silva, Applications of Rock Magnetism to Geosciences. Invited talk at the Faculty of Science of the University of Porto, September 2013.

Font, E., Fabre, S., Nédélec, A., Adatte, T., Keller, G., Ellwood, B.B., Veiga-Pires, C.C., Ponte, J. and J. Mirão (2013). The Chlorine Perfume of the Deccan Traps. Volcanism, Impacts and Mass Extinctions, London 27-29 March, 2013.

Font, E. (2012) *Les extinctions en masse du Tr-J et du KT. Impact d'astéroïde, volcanisme, ou les deux: apports des études magnétiques*, Conférences of the Société Vaudoise des Sciences Naturelles, EPFL, Lausanne, Switzerland. <http://www3.unil.ch/wpmu/svsn/2012/11/agenda-uvss-decembre-2012/>

P. F. Silva, Paleomagnetism: from the History of the Earth to Tsunami. Invited talk at the Café Ocean (Faro, Algarve), sponsored by CIMA-University of Sciences of Algarve. <http://www.cima.ualg.pt/cimaualg/index.php?view=details&id=12%3ACAF%C3%89+OCEANO%3A+Paleo-link>, March 2012.

Font E. (2011) The snowball Earth Hypothesis. Invited talk, Conferences of the University of Huelva, Spain.

Font E., Nascimento, C., Omira, R., Baptista, M.A. and P.M.F Silva (2010). Magnetic evidences of Lisbon 1755 tsunami in re-worked littoral sediments. Eos Trans. AGU 91(26), Meet. Am., Iguaçú, Brazil. Suppl. Abstract GP14A-02.

P.F. Silva, The snowball Earth Hypothesis and the duration of the post-glacial period. Invited talk at the Physic Department of the ISEL Institute (Portugal), February 2010.

P.F. Silva - Palaeomagnetic study of a sub-aerial volcanic ridge (São Jorge Island, Azores) for the past 1.3 Myr: evidences for the Cobb Mountain Subchron, volcano flank instability and tectono-magmatic implications. Institute of Geophysics, Czech Republic, 2012.

### **3 – LABORATORY OF CHARACTERIZATION OF GEOLOGICAL MATERIALS OF INSTITUTE OF EARTH SCIENCES (ICT), PORTO/ÉVORA**

The Institute of Earth Sciences (ICT) is a recent research unit that merged the former 'Centro de Geofísica de Évora' (CGE) and 'Centro de Geologia da Universidade do Porto' (CGUP). Some of its team members have developed activity in rock magnetism with applications to structural geology, tectonics, paleogeographic reconstructions, environmental pollution and ore geology.

One of the team members, Helena Sant'Ovaia, is the present Director of the Geophysical Institute of University of Porto.

#### **3.1 Research projects**

2013-2016: "SUSMIN –Tools for sustainable gold mining in EU"; The SUSMIN-project identifies and evaluates environmental impacts and economical challenges of gold mining in EU.

2007-2013: "ECOAL- MGT Ecological Management of Coal Waste Piles"; Territorial Cooperation Programme. SUDOE Space (Southwest European Space)

2010-2013: PTDC/CTE-GIX/099447/2008 – “Petrophysic and gravimetric characterization of the late-Variscan Santa Eulália Plutonic Complex (Ossa Morena Zone): implications for

genesis, emplacement and mineralization” (PI: Helena Sant’Ovaia). Funded by FCT (Portugal), COMPETE/FEDER. Budget: 130 000 euros.

2011-2014: PTDC/CTE-GIX/112561/2009 - “PETROCHRON: Evolução crustal da Ibéria - Estudos Petrogenéticos, Estruturais e Geocronológicos nas Zonas Centro-Ibérica e de Ossa-Morena”. Funded by FCT (Portugal), COMPETE/FEDER. Budget: 92 000 euros.

### 3.2 Organization of Scientific Events and Meeting's sessions

2014: Organization and Scientific committee of “IX Congresso Nacional de Geologia e 2º Congresso de Geologia dos Países de Língua Portuguesa”, Porto, July 2014.

2013: Scientific committee of "Planear o futuro da sociedade de risco: desafios para a investigação na U.Porto", FCUP, Porto, May 2013.

### 3.3 Publications

SANT’OVAIA, H., NOGUEIRA, P., CARRILHO LOPES, J., GOMES, C., RIBEIRO, M.A., MARTINS, H.C.B, DÓRIA, A, CRUZ, C., LOPES, L., SARDINHA, R., ROCHA, A., NORONHA, F. 2014. Building up of a nested granite intrusion: magnetic fabric, gravity modelling and fluid inclusion planes studies in Santa Eulália Plutonic Complex (Ossa Morena Zone, Portugal). *Geological Magazine*, pp. 1–20. Cambridge University Press 2014. doi:10.1017/S0016756814000569.

MOURA, R., SANT’OVAIA, H., FERREIRA, R., SANTOS, C. , SIMÃO, B., FREITAS, J. M. S. , TEIXEIRA, L. 2014. Nuclear seismology: the case of the Porto (PTO) world-wide standard seismographic network WWSSN station. 14th SGEM GeoConference on Science and Technologies In Geology, Exploration and Mining, www.sgem.org, SGEM2014 Conference Proceedings, ISBN 978-619-7105-07-0 / ISSN 1314-2704, June 19-25, 2014, Vol. 1, 529-536 pp. DOI: 10.5593/SGEM2014/B11/S5.070.

MARTINS, H.C.B, RIBEIRO, M.A., SANT’OVAIA, H., ABREU, J., GARCIA DE MADINABEITIA, S. 2014. SHRIMP and LA-ICPMS U–Pb zircon geochronology of post-tectonic granitoid intrusions in NW of Central Iberian Zone. *Comunicações Geológicas*, Tomo 101, Fascículo Especial I: 147-150. Actas IX CNG e 2º CoGePLiP. Lisboa 2014. ([http://www.lneg.pt/download/9525/27\\_3065\\_ART\\_CG14\\_ESPECIAL\\_I.pdf](http://www.lneg.pt/download/9525/27_3065_ART_CG14_ESPECIAL_I.pdf))

CRUZ, C., DÓRIA, A., SANT’OVAIA, H. 2014. Caracterização dos paleofluidos aprisionados nos planos de inclusões fluidas dos granitos do Complexo Plutónico de santa Eulália. *Comunicações Geológicas*, Tomo 101, Fascículo Especial I: 71-74. Actas IX CNG e 2º CoGePLiP. Lisboa 2014. ([http://www.lneg.pt/download/9510/12\\_1828\\_ART\\_CG14\\_ESPECIAL\\_I.pdf](http://www.lneg.pt/download/9510/12_1828_ART_CG14_ESPECIAL_I.pdf))

RIBEIRO, M, A., SANT’OVAIA, H., MARTINS, H.C.B., DÓRIA, A., AREIAS, M., FERREIRA, J. 2014. Evolução tectono-metamórfica, migmatização e magmatismo sin-tectónico na região do Porto (NW Portugal). *Comunicações Geológicas*, Tomo 101, Fascículo Especial I: 297-300. Actas IX CNG e 2º CoGePLiP. Lisboa 2014. ([http://www.lneg.pt/download/9557/59\\_3111\\_ART\\_CG14\\_ESPECIAL\\_I.pdf](http://www.lneg.pt/download/9557/59_3111_ART_CG14_ESPECIAL_I.pdf))

SANT’OVAIA, H., RIBEIRO M.A., MARTINS H., FERRÃO F., GOMES C., NORONHA, F., 2014. Estruturas e fabric magnético no maciço granítico de Lavadores-Madalena. *Comunicações Geológicas*, Tomo 101, Fascículo Especial I: 313-318. Actas IX CNG e 2º CoGePLiP. Lisboa 2014. ([http://www.lneg.pt/download/9560/62\\_3092\\_ART\\_CG14\\_ESPECIAL\\_I.pdf](http://www.lneg.pt/download/9560/62_3092_ART_CG14_ESPECIAL_I.pdf))

SOBRINHO, E.S.C., RIBEIRO, J., NETO, C., SANT’OVAIA, H., ROCHA, F., FLORES, D., CARVALHO, C.E.G. 2014. Mineralogy and geochemistry of stream sediments from São Francisco stream (Amazonian River Basin – Brazil). *Comunicações Geológicas*, Tomo 101, Fascículo Especial I: 57-60. Actas IX CNG e 2º CoGePLiP. Lisboa 2014. ([http://www.lneg.pt/download/9507/9\\_3094\\_ART\\_CG14\\_ESPECIAL\\_I.pdf](http://www.lneg.pt/download/9507/9_3094_ART_CG14_ESPECIAL_I.pdf))

SOUSA, M., SANT’OVAIA, H., TASSINARI, C., NORONHA, F. 2014. Geocronologia U-Pb (SRIMP) e Sm-Nd do ortognaisse biotítico do Complexo Metamórfico da Foz do Douro (NW de Portugal). *Comunicações Geológicas*, Tomo 101, Fascículo Especial I: 225-228. Actas IX CNG e 2º CoGePLiP. Lisboa 2014. ([http://www.lneg.pt/download/9541/43\\_2994\\_ART\\_CG14\\_ESPECIAL\\_I.pdf](http://www.lneg.pt/download/9541/43_2994_ART_CG14_ESPECIAL_I.pdf))

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MOURA, R., SANT'OVAIA, H., SIMÃO, B., SANTOS, C., FREITAS, J.M., TEIXEIRA, L., FERREIRA, R. 2014. O IGUP e a sismologia nuclear em Portugal. *Comunicações Geológicas*, Tomo 101, Fascículo Especial I: 360-364. Actas IX CNG e 2º CoGePLiP. Lisboa 2014. ([http://www.lneg.pt/download/9569/71\\_3085\\_ART\\_CG14\\_ESPECIAL\\_I.pdf](http://www.lneg.pt/download/9569/71_3085_ART_CG14_ESPECIAL_I.pdf))

SANTOS, P. C., SANT'OVAIA, H., ESPINHA MARQUES, J. 2014. Estudo da suscetibilidade magnética em solos contaminados pela extração mineira de São Pedro da Cova. *Comunicações Geológicas*, Tomo 101, Fascículo Especial II: 1067-1071. Actas IX CNG e 2º CoGePLiP. Lisboa 2014. ([http://www.lneg.pt/download/9712/99\\_2974\\_ART\\_CG14\\_ESPECIAL\\_II.pdf](http://www.lneg.pt/download/9712/99_2974_ART_CG14_ESPECIAL_II.pdf)).

RIBEIRO, C., GUEDES, A., VALENTIM, B., SANT'OVAIA, H., RIBEIRO, H., NORONHA, F. 2014. Estudo da variação de propriedades de sedimentos com objetivos forenses. *Comunicações Geológicas*, Tomo 101, Fascículo Especial III: 1349-1353. Actas IX CNG e 2º CoGePLiP. Lisboa 2014. ([http://www.lneg.pt/download/9770/55\\_3033\\_ART\\_CG14\\_ESPECIAL\\_III.pdf](http://www.lneg.pt/download/9770/55_3033_ART_CG14_ESPECIAL_III.pdf))

CRUZ, C., RIBEIRO, M.A., SANT'OVAIA, H., MARTINS, H.C.B. 2014. Thermal effects of the Santa Eulália Plutonic Complex (southern Portugal) on the meta-igneous and metasedimentary host rocks. *Estudios Geológicos*. 70(2). doi: <http://dx.doi.org/10.3989/egeol.41730.320>.

RIBEIRO, J., SANT'OVAIA, H., GOMES, C., FLORES. 2014. Mineralogy and Magnetic Parameters of Materials Resulting from the Mining and Consumption of Coal from the Douro Coalfield, Northwest Portugal. In: G.B. Stratcher, E.V. Sokol and A. Prakash (Eds.), *Coal and Peat Fires: A Global Perspective*, 1st Edition. Volume 3: Case Studies – Coal Fires. Elsevier.

LOURENÇO, A.M., SEQUEIRA, E., SANT'OVAIA, H., GOMES, C.R. 2014. Magnetic, geochemical and pedological characterization of soils from different environments and geological backgrounds near Coimbra, Portugal. *Geoderma*, 213: 408-418.

GUEDES, A., MURRAY, R.C., RIBEIRO, H., SANT'OVAIA, H., VALENTIM, B., RODRIGUES, A., LEAL, S., NORONHA, F. 2013. The potential application of magnetic susceptibility as a technique for forensic soil examinations. Environmental and Criminal Forensics Meeting. Geological Society, London, Special Publication. doi 10.1144/SP384.7.

GUEDES, A., MURRAY, R.C., RIBEIRO, H., RODRIGUES, A., VALENTIM, B., SANT'OVAIA, H., NORONHA, F. 2013. Integration of different sediment characteristics to discriminate between sources of coastal sediments. Geological Society, London, Special Publication. doi 10.1144/SP384.1.

MARTINS, H.C.B., SANT'OVAIA, H., NORONHA, F. 2013. Late-Variscan emplacement and genesis of the Vieira do Minho composite pluton, Central Iberian Zone: constraints from U-Pb zircon geochronology, AMS data and Sr-Nd-O isotope geochemistry. *Lithos*, 162-163: 221-235.

SANT'OVAIA, H., MARTINS, H.C.B., NORONHA, F. 2013. Oxidized and reduced Portuguese Hercynian granites associated with W and Sn hydrothermal mineralizations. *Comunicações Geológicas*, 100(1): 33-39.

SANT'OVAIA, H., LACERDA, M.J., GOMES, C. 2012. Pollution by particles: an environmental magnetism study using biological collectors located in Braga, Porto, Valongo and Trancoso (Northern Portugal). *Atmospheric Environments* 61, 340-349.

MARTINS, H.C.B., SANT'OVAIA, H., ABREU, J., OLIVEIRA, M., NORONHA, F. 2011. Emplacement of the Lavadores granite (NW Portugal): U/Pb and AMS results. *Comptes Rendus Geoscience*, 343: 387-396.

GUEDES, A., RIBEIRO, H., VALENTIM, B., RODRIGUES, A., SANT'OVAIA, H., ABREU, I., NORONHA, F. 2011. Characterization of soils from the Algarve region (Portugal): A multidisciplinary approach for forensic applications. *Science and Justice*, 51: 77-82.

### **3.4 Communications**



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“Magnetic susceptibility studies in granites associated with gold deposits”, SUSMIN Kick-off Meeting, Porto, March 2014.

“Estruturas e fabric magnético no maciço granítico de Lavadores-Madalena”, Congresso Nacional de Geologia/2º Congresso Nacional dos Países de língua portuguesa, Porto, June, 2014.

“Exploração sustentável de recursos minerais – o caso dos feldspatos litinados da Mina do Castanho: atividade outdoor com alunos do 8º ano no âmbito das Metas Curriculares”, Porto, IX Congresso Nacional de Geologia/2º Congresso Nacional dos Países de língua portuguesa, June 2014.

### **3.5 Young researchers training**

- Gabriela Marques. “Estudo das Propriedades Magnéticas de Tecidos Humanos”. Mestrado em Ciências Forenses da Faculdade de Medicina da Universidade do Porto. December 2013. Job position: Technical of clinical analysis.

- Claudia Cruz. “Efeitos metamórficos e fluidos do Complexo Plutónico de Santa Eulália”. Mestrado em Geologia. DGAOT, FCUP. November 2013. Secondary grade teacher.

- Cristina Santos. “Estudo da Suscetibilidade Magnética nos Solos da Extração Mineira de São Pedro da Cova”. Mestrado em Ciências e Tecnologia do Ambiente. DGAOT, FCUP. November 2013. Job position unknown.

- Joana Machado. “ASM, IRM e Petrografia em granitos do Complexo Plutónico de Santa Eulália”. Mestrado em Geologia. DGAOT, FCUP. 2012. Job position unknown.

- Francisca Ferreira Fernandes Pereira Ferrão. “Caracterização petrofísica e petrográfica do granito da Madalena”. Mestrado em Geologia, DGAOT, FCUP. 2011. Job position unknown.

- Ana Isabel da Costa Vidal. “Estudo da suscetibilidade magnética em solos adjacentes a uma autoestrada”. Mestrado em Ciências e Tecnologia do Ambiente, Ramo de Riscos: Avaliação e Gestão Ambiental, DGAOT, FCUP. 2011. Job position : Environmental consultant.

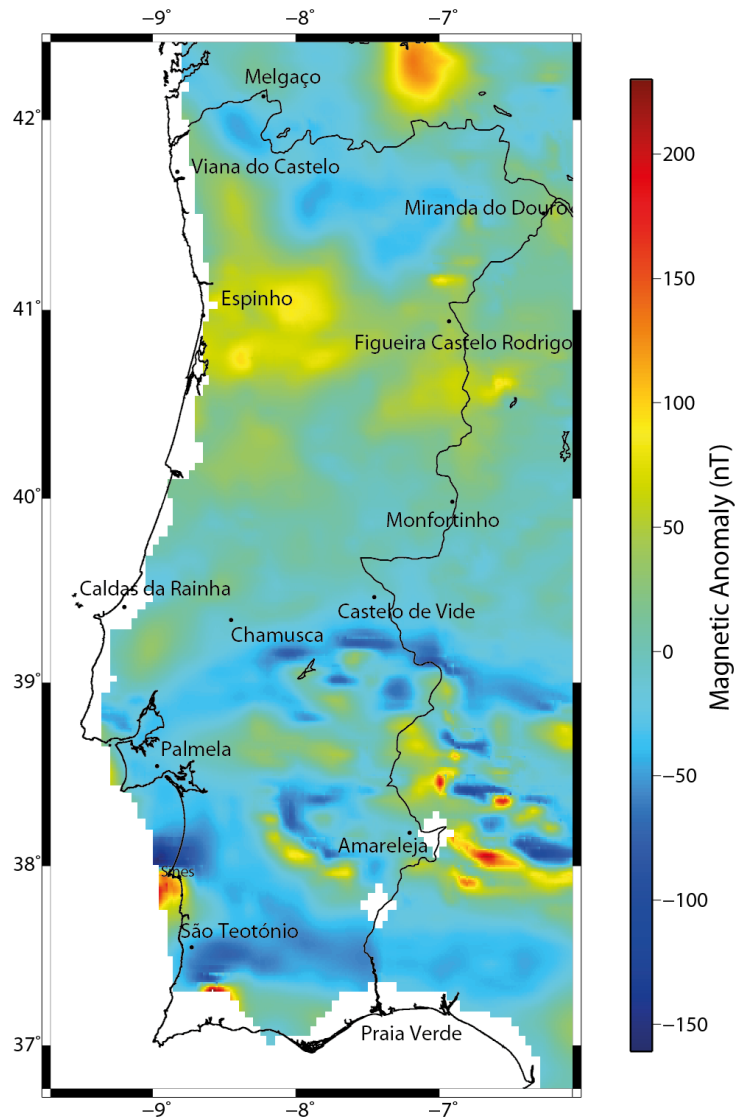
- Cláudia Susana Lopes Ferreira. “Formações de Conraria e Castelo Viegas, Grupo de Silves” por; Mestrado em Ciências da Terra, Departamento de Ciências da Terra, Fac. Ciências da Univ Coimbra. 2011. Job position : Secondary grade teacher.

## **4 – THE PORTUGUESE SEA AND ATMOSPHERE INSTITUTE (IPMA), LISBON**

The IPMA is a governmental research institute devoted to ocean and atmospheric science and technology. For the goal of this report, it is particularly relevant the fact that it is responsible for ensuring the functioning of the magnetic network of repeat stations, as well as develop and disseminate appropriate information. It is also relevant the application of palaeomagnetism in tectonics and palaeogeographic reconstructions related to the Mid-Atlantic Ridge. There exist strong collaborations with the Algarve University and IDL in different projects related with the geodynamics of the Azores Plateau, magnetic modeling of the Lucky Strike Segment and central north Mid-Atlantic Ridge.

The following magnetic anomaly chart was produced for the Portuguese mainland, as a result of repeat stations occupation:

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#### 4.1 Research projects

2010-2014: MAREKH (PTDC/MAR/108142/2008) (Mid-Atlantic Ridge Evolution in the last 20 Ma between Kurchatov and Hayes) (PI: Miguel Miranda), project, funded by the Portuguese Foundation for Science and Technology.

2008-2012: EU Research Infrastructures Project EMSO and member of the Steering Committee (some other partners: IFREMER, INGV, KDM...).

2010-15 "GMT5" (NSF). PI P. Wessel (University of Hawaii).

#### 4.2 Publications

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Miranda, J. M., Luis, J. F., Lourenço, N., Goslin, J. (2014). Distributed deformation close to the Azores Triple "Point". Marine Geology 355, 27-35. . <http://dx.doi.org/10.1016/j.margeo.2014.05.006>

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Neres M., Miranda J.M., Font E. (2013) Testing Iberian kinematics at Jurassic-Cretaceous times. *Tectonics*, 32(5), 1312-1319.

Gutscher MA, Dominguez S, Westbrook GK, Le Roy P, Rosas F, Duarte JC, Terrinha P, Miranda JM, Graindorge D, Gailler A, Sallares V, Bartolomei R (2012). The Gibraltar subduction: A decade of new geophysical data. *Tectonophysics*, Volumes 574–575, 29 October 2012, Pages 72–91.

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Hildenbrand, A., Marques, F. O., Costa, A. C. G., Sibrant, A. L. R., Silva, P. F., Henry, B., ... & Madureira, P. (2012). Reconstructing the architectural evolution of volcanic islands from combined K/Ar, morphologic, tectonic, and magnetic data: the Faial Island example (Azores). *Journal of Volcanology and Geothermal Research*, 241, 39-48.

#### **4.3 Communications**

J. M. Miranda, J. F. Luis, C. Reis, R. Omira, M. A. Baptista, 2014. Validation of NSWING, a multi-core finite difference code for tsunami propagation and run-up. , AGU Fall Meeting Abstracts, 1, 1736.

J. M. Miranda, J. F. Luis, M. A. Baptista, 2013. The 8 Ma Sudden Change In Spreading Velocity at the MID-ATLANTIC RIDGE, IAGA, Merida, Mexico.

Luis JF, Miranda JM, Lourenço N, Moulin M (2009). Improved Magnetic Compilation For The Central North Atlantic Based On New Data From The Portuguese Unclos Proposal And Cm4 Model. *Eos Trans. AGU*, 90(52), Fall Meet. Suppl., Abstract GP13C 0778.

Luis, J.F., Miranda JM, A Refined Age Grid For The Central North Atlantic. GP21A-1142 presented at 2012 Fall Meeting, AGU, San Francisco, Calif., 3-7 Dec.

Wessel, Paul, Smith, WH., Scharroo, R; Luis, JM., 2011. The Generic Mapping Tools (GMT) Version 5, AGU Fall Meeting Abstracts, 1, 05.

Miranda, J., Luis, J., Lourenço, N., Fernandes, R., Neves, C. (2011), Evolution Of The Segmentation Pattern Of The Mid-Atlantic Ridge Between 20n And 41n, In The Last 25 MA. EGU General Assembly 2011, Vienna, 3-8 Abril.

Miranda, JM, Luis, JF (2010). New Magnetic Study Of The Mid Atlantic Ridge Between Kurchatov And Hayes Fracture Zones, Abstract GP21A-0990 presented at 2010 Fall Meeting, AGU, San Francisco, Calif., 13-17 Dec.

Neves, M. L.; Miranda, J. M.; Luis, J. M. Models Of Segmentation Along The Terceira Rift: Implications For The Mar Evolution To The South Of Azores. American Geophysical Union, Fall Meeting 2011, abstract #T23D-2426.

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#### **5 – CENTRE FOR EARTH AND SPACE RESEARCH OF THE UNIVERSITY OF COIMBRA (CITEUC), COIMBRA**

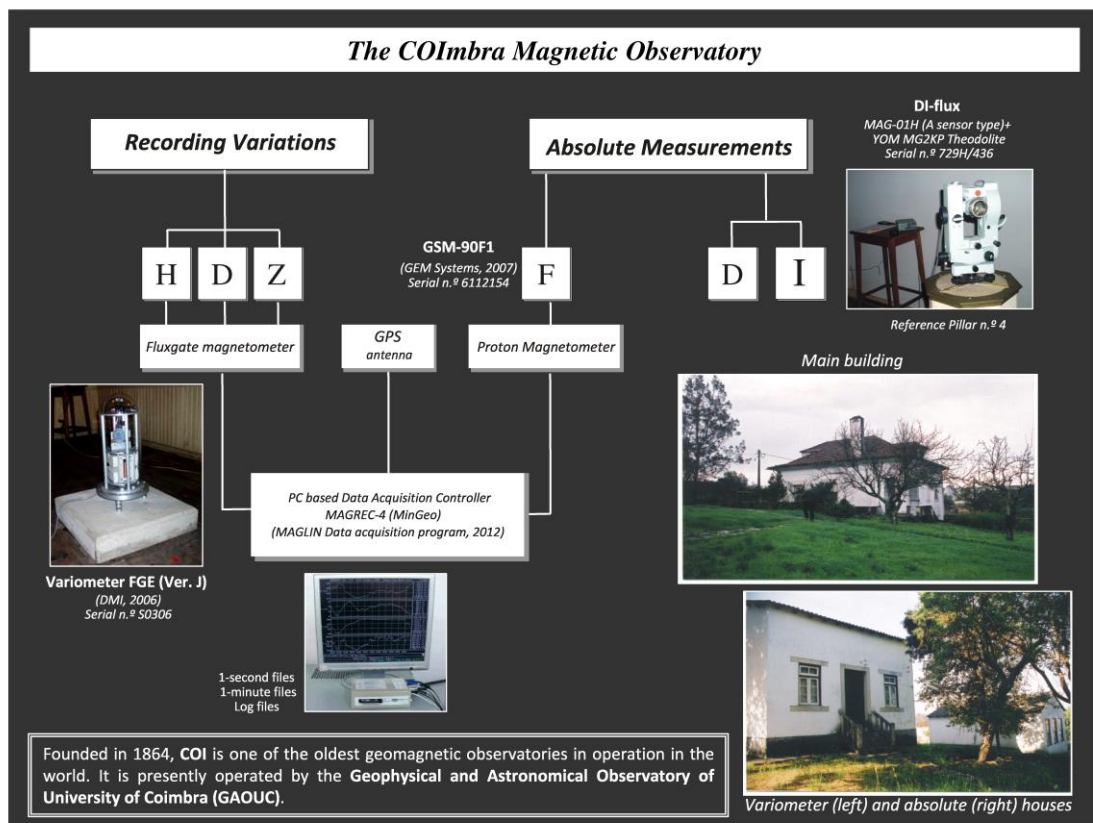
CITEUC is a recent research unit in Coimbra, that develops research activities in fields of Divisions I, II, IV and V of IAGA. Scientific research covers subjects from the dynamics of the Earth's and other planetary cores, geomagnetic and solar data series analysis, to identification of magnetospheric phenomena using ground and satellite observations.

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CITEUC is installing a laboratory to monitor and forecast space weather phenomena, called SPINLab, by integrating scientific knowledge and data in the fields of geophysics and astronomy with current daily observations of the Sun and the geomagnetic field. This will be made with the support of leading solar and space weather institutions in Ireland and UK and of the Portuguese governmental institution IPMA.

It is also a part of the international TRAGALDABAS project lead by Santiago de Compostela University, in Spain, in order to go deeper into the understanding of the cosmic rays arriving to the Earth surface and the interaction with the atmosphere and the geomagnetic field.

Finally, it is responsible for the maintenance and the exploitation of data from the only geomagnetic observatory in mainland territory, IAGA code COI (see figure below). In order to evaluate a possible dislocation of the observatory that is suffering from electromagnetic perturbation due to the trolleybus lines, a local survey at the Astronomical Observatory and subsequent data analysis were carried out. Nevertheless, the present equipment provides good quality, stable continuous time series of geomagnetic field components that can be used in different scientific research studies.



**5.1 Research projects**

2013 - present: participation in the collaboration TRAGALDABAS - TRAsGo for the AnaLysis of the nuclear matter Decay, the Atmosphere, the earth B-Field And the Solar activity (PI - Juan Garzon, Santiago de Compostela, Spain).

2012 - 2015: QG-APLIC (PI - Alexandra Pais) - Quasi-Geostrophic Approximation in Planetary Liquid Cores (PTDC/CTE-GIX/119967/2010). Funded by FCT (Portugal)

2009 – 2013: participation in AMSPROGRESS - Multidisciplinary Study of AMS generation and relation to progressive strain: an experimental approach (PI – Pedro F Silva, IDL). Funded by FCT (Portugal).

## **5.2 Collaborations with IT and Hi-Tech companies**

Application for a Feasibility Study - Solar Risk Service for Air Navigation, funded by ESA - PTTI; [http://ptti.ipn.pt/news\\_items/43](http://ptti.ipn.pt/news_items/43) (concluded).

## **5.3 Organization of Scientific Events and Meeting's sessions**

Coimbra Solar Physics Meeting - "Ground based Solar Observations in the Space Instrumentation Era", 5 - 9 October 2015, Coimbra, Portugal, CITEUC is host and co-organizer.

VIII Assembleia Luso-Espanhola de Geodesia e Geofísica, Évora, Portugal, 2014.(conference: A. Pais was member of the scientific committee).

EGU General Assembly, Vienna, 2013. (conference: A. Pais was co-convener for Session 'Earth's core structure and dynamics: observations, models, experiments', GD7.1/PS9.8).

VII Assembleia Luso-Espanhola de Geodesia e Geofísica, Donostia-San Sebastian, Spain, 2012. (conference: A. Pais was member of the scientific committee).

## **5.4 Publications**

A. Alvarez-Pol, Blanco, A., J. J. Blanco, J. Collazo, P. Fonte, J. A. Garzón, A. Gómez, G. Kornakov, T. Kurtukian, L. Lopes, M. Morales, A. Morozova, M. A. Pais, M. Palka, V. Pérez Muñuzuri, P. Rey, P. Ribeiro, M. Seco and J. Taboada (2015), 'TRAGALDABAS: A new high resolution detector for the regular study of cosmic rays', accepted for publication in Journal of Instrumentation

Morozova, A. L., and I.A. Mironova (2015). Aerosols over Continental Portugal (1978-1993): their sources and an impact on the regional climate. Atmos.Chem. Phys., accepted for publication.

Oliveira, J. S., B. Langlais, M. A. Pais, and H. Amit (2015), A modified Equivalent Source Dipole method to model partially distributed magnetic field measurements, with application to Mercury, J. Geophys. Res. Planets, 120, 1–20, doi:10.1002/2014JE004734.

Lourenço, A.M., Esteves, I., Rocha, A., Abrantes, I., Gomes, C. (2015). Relation between magnetic parameters and nematode abundance in agricultural soils of Portugal-a multidisciplinary study in the scope of environmental magnetism. Environmental Monitoring and Assessment, DOI 10.1007/s10661-015-4373-1.

Lourenço, A.M., Sequeira, E., Sant'Ovaia, H., Gomes, C.R., (2014). Magnetic, geochemical and pedological characterisation of soil profiles from different environments and geological backgrounds near Coimbra, Portugal. Geoderma, 213, 408-418.

Joana Ribeiro, Helena Sant'Ovaia, Celeste Gomes, Colin Ward e Deolinda Flores (2014). Mineralogy and Magnetic Parameters of Materials Resulting from the Mining and? Consumption of Coal from the Douro Coalfield, Northwest Portugal. In: Coal and Peat Fires: A Global Perspective. Volume 3: Case Studies – Coal Fires, Elsevier, 493-507 .

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Sant'Ovaia, H., Nogueira, P., Lopes, J. C., Gomes, C., Ribeiro, M. A., Martins, H. C. B., Dória, A., Cruz, C., Lopes, L., Sardinha, R., Rocha, A., Noronha, F. (2014). Building up of a nested granite intrusion: magnetic fabric, gravity modelling and fluid inclusion planes studies in Santa Eulália Plutonic Complex (Ossa Morena Zone, Portugal). *Geological Magazine*, page 1 of 20 c Cambridge University.

A. L. Morozova, P. Ribeiro, M. A. Pais, (2014) 'Correction of artificial jumps in the historical geomagnetic measurements of Combra Observatory, Portugal', *Annales Geophysicae*, Vol. 32, No. 1, pp. 19-40, doi:10.5194/angeo-32-19-2014. <http://www.ann-geophys.net/32/19/2014/angeo-32-19-2014.pdf>

R. Gafeira, C.C. Fonte, M. A. Pais, J. Fernandes, (2014) 'Temporal Evolution of Sunspot Areas and Estimation of Related Plasma Flows', *Solar Physics*, 1-12, doi:10.1007/s11207-013-0440-3. <http://link.springer.com/article/10.1007/s11207-013-0440-3>

M. A. Pais, A. L. Morozova, N. Schaeffer, (2014) 'Variability modes in core flows inverted from geomagnetic field models', *Geophysical Journal International* 200 (3): 402-420, doi:10.1093/gji/ggu403. <http://gji.oxfordjournals.org/content/200/1/402.short>

Blanco, A., J. J. Blanco, J. Collazo, P. Fonte, J. A. Garzón, A. Gómez, G. Kornakov, T. Kurtukian, A. López Agüera, J. M. López, L. López, M. Morales, A. Morozova, J. C. Mouriño, M. A. Pais, M. Palka, V. Pérez Muñuzuri, P. Ribeiro, I. Rodríguez Cabo, I. Sosa and J. Taboada (2014), 'TRAGALDABAS: a new RPC based detector for the regular study of cosmic rays', *JINS*, 9, C09027, doi:10.1088/1748-0221/9/09/C09027.

Ribeiro, P., Silva, P.F., Moita, P., Kratinová, Z., Marques, F.O. & Henry, B. (2013). Palaeomagnetism in the Sines massif (SW Iberia) revisited: Evidences for Late Cretaceous hydrothermal alteration and associated partial remagnetization. *Geophysical Journal International*, vol. 196: 171-196, doi:10.1093/gji/ggt261.

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Sant'Ovaia, H., Lacerda, M.J., Gomes, C. (2012). Particle pollution – An environmental magnetism study using biocollectors located in northern Portugal. *Atmospheric Environment*, V. 61, pp. 340-349. <http://www.sciencedirect.com/science/article/pii/S1352231012007455>

Morozova, A. L. and Valente, M. A. (2012): Homogenization of Portuguese long-term temperature data series: Lisbon, Coimbra and Porto, *Earth Syst. Sci. Data*, 4, 187-213, doi:10.5194/essd-4-187-2012, 2012.

Morozova, AL; Valente, MA (2012): Homogenization of Portuguese long-term temperature data series: Lisbon, Coimbra and Porto. doi:10.1594/PANGAEA.785377, Supplement to: Morozova, Anna L; Valente, Maria Antónia (2012): Homogenization of Portuguese long-term temperature data series: Lisbon, Coimbra and Porto. *Earth System Science Data Discussion*, 5, 521-584, doi:10.5194/essdd-5-521-2012, <http://doi.pangaea.de/10.1594/PANGAEA.785377>.

Ferreira, C., Gomes, C., Sant'Ovais, H. (2011), 'Anisotropy of magnetic susceptibility of Triassic Red Beds, Central Portugal.' *Goldschmidt Conference Abstracts 2011. Mineralogical Magazine*, 75 (3), 841-841.

Lourenço, A., Sant'Ovaia, H., Gomes, C. (2011), 'Magnetic parameters of soils developed on different geologic backgrounds, Central Portugal.' Conference Abstracts 2011. Mineralogical Magazine, 75 (3), 1358-1358.

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Schaeffer, N., and M. A. Pais (2011), On symmetry and anisotropy of Earth-core flows, Geophys. Res. Lett., 38, L10309, doi:10.1029/2011GL046888.

Paulo Ribeiro, M. Alexandra Pais (2015): Report on the Magnetic Measurements at the site of the Astronomical Observatory of University of Coimbra; 20 p. Relatório interno: OGAUC e CITEUC (Fac. Ciências e Tecnologia da Universidade de Coimbra), Coimbra, 2015.

Morozova, A. L., and I.A. Mironova. Aerosols over Continental Portugal (1978-1993): their sources and an impact on the regional climate (2014). Atmos.Chem. Phys. Disc., 14, 22, 31009-31038, 2014, doi: 10.5194/acpd-14-31009-2014.

M. A. Pais, A. L. Morozova, N. Schaeffer (2014), 'Variability modes in core flows inverted from geomagnetic field models', arXiv:physics.geo-ph/1406.4971, <http://arxiv.org/abs/1406.4971>, 2014.

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## **5.5 Communications**

A.L. Morozova (2015), 'Coimbra geomagnetic observatory: available data & their applications', 1st Collaboration Meeting, Univ. Santiago de Compostela: Facultad de Física., March, 30th. 2015

Anna Morozova, Juan Jose Blanco, Paulo Ribeiro (2015). Modes of temperature and pressure variability in the mid-latitude troposphere in relation to the geomagnetic and cosmic ray variations; Conference on Sun-Climate Connections, Kiel (Germany), 16-19 March 2015.

J. S. Oliveira, B. Langlais, M. A. Pais, H. Amit (2015), 'A new method to model partially distributed magnetic field measurements, with application to Mercury', EGU General Assembly, Vienna, April 2015 (invited talk).

H. Alvarez-Pol, A. Blanco, J.J. Blanco, J. Collazo, P. Fonte, J.A. Garzón, A. Gómez, G. Kornakov, T. Kurtukian, L. Lopes, M. Morales, A. Morozova, M.A. Pais, M. Palka, V. Pérez Muñuzuri, P. Rey, P. Ribeiro, M. Seco, J. Taboada (2014), TRAGALDABAS: a new high resolution detector for the regular study of cosmic rays. 24th. European Cosmic Ray Symposium, Kiel, Germany, September 2014.

Morozova, A., Juan José Blanco, Ribeiro, P., & Tragaldabas collaboration Team (2014). On cosmic rays flux variations in midlatitudes and their relations to geomagnetic and atmospheric conditions. 40th COSPAR Scientific Assembly, Abstract D1. 3-44-14., Vol. 40, p. 2179; held in 2-10 August 2014, Moscow, Russia.

Morozova, A., Ribeiro, P., and Tragaldabas collaboration Team (2014). Cosmic rays flux and geomagnetic field variations at midlatitudes, Geophysical Research Abstracts, Vol. 16, GU2014-7516 (EGU General Assembly, Vienna, 27 April – 02 May, 2014).

A. Blanco, J.J. Blanco, J. Collazo, P. Fonte, J.A. Garzon, A. Gomez, G. Kornakov, T. Kurtukian, A.L. Agüera, J.M. Lopez et al. (2014). TRAGALDABAS: a new RPC based detector for the regular study of cosmic rays. Conference Proceedings: 12th Workshop on Resistive Plate Chambers and Related Detectors (RPC2014), Beijing, China, 23-28 Feb 2014.



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M. A. Pais (2014), 'New quasi-geostrophic flow estimations for the Earth's core', ETH Zurich, Institutes Colloquium Geophysics, March 2014 (invited seminar).

M. A. Pais (2014), 'New quasi-geostrophic flow estimations for the Earth's core', EGU General Assembly, Vienna, April 2014 (invited talk).

J. Oliveira, B. Langlais, H. Amit, M. A. Pais (2014), 'Modeling the magnetic field of Mercury using the Time Dependent Equivalent Source Dipole method', EGU General Assembly, Vienna, April 2014 (oral).

J. S. Oliveira, B. Langlais, H. Amit, M. A. Pais (2014), 'Modeling the internal magnetic field of Mercury with the Time Dependent Equivalent Source Dipole method', European Planetary Science Congress, Cascais (Portugal), September 2014 (poster).

A. Pais on behalf of the Tragaldabas collaboration Team (2014), 'Tragaldabas: a new facility for the study of the Earth atmosphere and magnetic environment", 8th Portuguese-Spanish Assembly of Geodesy and Geophysics, Évora, Portugal, January 2014 (poster).

Morozova, A., Ribeiro, P., and Pais, M. Alexandra (2013). Homogenization of the historical records of geomagnetic field components and geomagnetic K-index of the Magnetic Observatory of Coimbra, Geophysical Research Abstracts, Vol. 15, EGU2013-8242. EGU General Assembly, Vienna, 07 – 12 April, 2013 (poster).

Anna Morozova, Tatiana Barlyaeva, and Dmitriy Ponyavin (2013), The role of climatic forcings in long-term variations of the Portuguese temperature: A comparison of different mathematical methods, Geophysical Research Abstracts, Vol. 15, EGU2013-7746. EGU General Assembly, 7-12 April, Vienna, Austria, 2013. [http://presentations.copernicus.org/EGU2013-7746\\_presentation.pptx](http://presentations.copernicus.org/EGU2013-7746_presentation.pptx) (poster)

Anna Morozova and Irina Mironova (2013), 'The role of aerosol forcing in the variations of Portuguese temperature parameters', Geophysical Research Abstracts, Vol. 15, EGU2013-7661. EGU General Assembly, 7-12 April, Vienna, Austria, 2013. [http://presentations.copernicus.org/EGU2013-7661\\_presentation.pptx](http://presentations.copernicus.org/EGU2013-7661_presentation.pptx) (poster)

H. Amit, M. A. Pais (2013), 'Differences between tangential geostrophy and columnar flow', Colloque 'Paléomagnétisme en France : Résultats récents et perspectives', IPGP Paris, France, March 2013 (poster).

J. S. Oliveira, B. Langlais, H. Amit, M. A. Pais (2013), 'Time Dependent Equivalent Source Dipole - a new method to model the internal magnetic field of Mercury', Colloque 'Paléomagnétisme en France : Résultats récents et perspectives', IPGP Paris, France, March 2013 (oral).

H. Amit, M. A. Pais (2013), 'Differences between tangential geostrophy and columnar flow', EGU General Assembly, Vienna, Austria, April 2013 (poster).

M. A. Pais, A. Morozova, N. Schaeffer (2013), 'Assessing the significance of QG-flow modes computed using Principal Component Analysis', EGU General Assembly, Vienna, Austria, April 2013 (poster).

J. S. Oliveira, B. Langlais, H. Amit, M. A. Pais (2013), 'Modeling the magnetic field of Mercury using the Time Dependent Equivalent Source Dipole method', AGU Fall meeting, San Francisco, California, December 2013 (poster).

A.L. Morozova and M.A. Valente (2012) "Homogenization of Portuguese long-term temperature data series: Lisbon, Coimbra and Porto", EGU2012-7989, EGU annual meeting, Vienna, Austria, 22-27 April 2012 (poster).



Morozova, A. L. and Pais, M. A. (2012), "Different forcings and their effect on temperature variations in Portugal: volcanic eruptions, anthropogenic aerosols, atmospheric circulation and solar activity", EGU annual meeting, Vienna, Austria, 22-27 April 2012 (poster).

Ribeiro, P., Pais, M.A. (2012). The Magnetic Observatory of Coimbra (COI): Operation and Data Quality Evaluation. 7.<sup>a</sup> Assembleia Luso-Espanhola de Geodesia e Geofísica, Livro de Resumos, SO3 (Geomagnetismo e Aeronomia), San Sebastian (Espanha), 23-28 Junho 2012 (oral).

Morozova, A.L., Ribeiro, P., Valente, M.A. and Pais M.A. (2012). On homogenization of Portuguese meteorological and geophysical data series, Proceedings of 7th Spanish-Portuguese Assembly of Geodesy and Geophysics (7AHPGG), 25-29/06/2012, San Sebastian, Spain, Ed. J. Zurutuza, pp. 293-296, 2012 (oral).

D. Saturnino, M. A. Pais, A. Morozova (2012), 'Identification of the Magnetic External Component by EOF Analysis of Annual and Monthly Observatories Data Series', 7th Portuguese-Spanish Assembly of Geodesy and Geophysics, Donostia-San Sebastian, Spain, June 2012 (oral).

M. A. Pais, N. Schaeffer (2012), 'Core flow inversion and the geodynamo', 13th Symposium of SEDI, Study of the Earth's Deep Interior, Leeds, UK, July 2012 (poster).

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J. S. Oliveira, B. Langlais, H. Amit, M. A.Pais (2012), 'Time Dependent Equivalent Source Dipole - a new method to model the internal magnetic field of Mercury', AGU Fall meeting, San Francisco, California, December 2012 (poster).

H. Amit, M. A. Pais (2012), 'Differences between tangential geostrophy and columnar flow', AGU Fall meeting, San Francisco, California, December 2012 (poster).

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Gafeira, R., C. Fonte, M. A. Pais, J. Fernandes (2012), "Growth and decay of ARs: Sunspot areas with Fuzzy Sets + SDO", 21st National Solar Physics Meeting, Stará Turá, Slovakia, June 2012.

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Ribeiro, P.; Martins, D.; Batlló, J.; Narciso, J.; Custódio, S.; Lopes, F.C.; Gomes, C.R. (2011). Jacinto de Sousa e a Criação do Observatório Meteorológico e Magnético da Universidade de Coimbra. Congresso Luso-Brasileiro de História das Ciências, Livro de Actas (ISBN: 978-989-26-0122-9): 1259-1273. Univ. Coimbra, 26-29 de Outubro de 2011.

A. Morozova, A. Pais (2011), "Solar and volcanic effect on Iberian climate: preliminary analysis, XXI Encontro Nacional de Astronomia e Astrofísica, Coimbra, 7-10 Setembro 2011 (oral).

Pais, A., A. Morozova (2011), "Circulation modes of the Earth's core flows", XXI Encontro Nacional de Astronomia e Astrofísica, Coimbra, 7-10 Setembro 2011 (oral).

Pais, M. A., N. Schaeffer, "Symmetry, Zonation and Scales in the Earth-core flow and their effect on the Length-of-Day variation predictions", Geophysical Research Abstracts, 13, 09472, EGU, Vienna, 2011.

Valente, MA, R. Trigo, P. Gomes, P. Nogueira, A. Simões, L. Cordeiro, J. Sigró, A. Morozova (2011), First General Assembly of the FP7 project ERA-CLIM ([www.era-clim.eu](http://www.era-clim.eu)), ERA-CLIM - European Re-Analysis of Global Climate Observations; WP1: Recovery, imaging, and digitisation of historical observations and metadata, Lisbon in 15-16 December 2011 (oral).

Valente, MA, R. Trigo, P. Gomes, P. Nogueira, A. Simões, L. Cordeiro, J. Sigró, A. Morozova (2011), 'Recovery of Portuguese atmospheric historical data for ERA-CLIM', 4th Workshop of ACRE - Atmospheric Circulation Reconstructions over the Earth ([www.met-acre.org](http://www.met-acre.org)), Utrecht, the Netherlands, 21-23 September 2011 (oral).

## **5.6 Young researchers training**

João Rosa Domingos, 'Contribution of geomagnetic data for monitoring and forecasting of space weather - application to the South Atlantic Anomaly', PhD thesis co-supervised by A. Pais, D. Jault and M. Manda, in progress.

Yvelice Soraya Castillo Rosales, 'The impact of solar activity on terrestrial ionosphere and magnetosphere using observational data of the Geophysical and Astronomical Observatory of the University of Coimbra (Portugal)', (Erasmus Mundus AMIDILA Scholarship); PhD thesis co-supervised by A. Pais and J. M. Fernandes, in progress.

Sara Carvalho, 'Mathematical models to predict solar activity', PhD thesis co-supervised by Teresa Barata, in progress

Tiago Marques, 'GNSS, Space Weather and Air Navigation', PhD thesis co-supervised by Teresa Barata, will started in September 2015.

Joana Sofia Rodrigues de Oliveira, 'The Magnetic Field of Mercury as Measured by the MESSENGER spacecraft', University of Nantes, April 2015; PhD thesis supervised by B. Langlais, H. Amit and A. Pais.

João Miguel Rosa Domingos, 'Dynamic Mode Decomposition Method - application to the Earth's liquid core', University of Coimbra, 2014; MSc thesis supervised by A. Pais.

Diana Filipa Lourenço Saturnino - 'Identification of the magnetic external component in annual and monthly means of magnetic observatory data series', University of Lisbon, 2012; MSc thesis supervised by Jorge M. Alberto de Miranda e A. Pais.

Joana Sofia Oliveira, "Modeling the Magnetic field of Mercury", University of Coimbra, 2011; MSc thesis co-supervised by A. Pais.

## **5.7 Outreach**

"Geomagnetic storms and Space Weather" – invited talk given within the Student Conference on Meteorology, Oceanography and Geophysics of Aveiro University (9-11 March 2015).

'A new method to model partially distributed magnetic field measurements, with application to Mercury', by Joana Oliveira, PhD student at University of Nantes; Observatório Astronómico, University of Coimbra, September 2014. (seminar)

"The Magnetic Observatory of the Geophysical Institute of the University of Coimbra: History and Future!" – seminars of CITEUC (University of Coimbra, 25 January, 2013).

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'Magnetic reversal frequency scaling in dynamos with thermochemical convection' by Hagay Amit, CNRS Researcher at LPGNantes, France; Observatório Astronómico, University of Coimbra, October 2013. (seminar)

'A new model for the (geo)magnetic power spectrum, with application to planetary dynamo radii of giant planets' by Benoit Langlais, CNRS Researcher at LPGNantes, France; Observatório Astronómico, University of Coimbra, October 2013. (seminar)

'Escoamentos à superfície do núcleo: consequências para a estrutura térmica do núcleo interno da Terra' by Luís Silva, Research Fellow in School of Earth and Environment, Universidade de Leeds, UK; Observatório Astronómico, University of Coimbra, August 2012. (seminar)