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Report on Activities in the Ambit of the Program FCT “Ciência 2007”

March 2008 – March 2012

Introduction

I began my contract on the first of March 2008. Since I arrived at IST/ITN I have communicated at all levels in Portuguese. My role is to coordinate research activity in the IST/ITN Luminescence Dating Laboratory, to optimize laboratory operation (equipment, protocols, procedures), and to develop new capabilities and research activity. My research focuses on luminescence dosimetry and related methods, particularly as applied to the analysis and dating of soils/sediments and cultural artefacts, and increasingly for the characterization of radioactivity and its effects in natural and man-made materials. I have a strong interest in the development of luminescence techniques and applications, and hence in basic understanding of the physical and chemical systems involved. I am developing analytical methodologies in environmental dosimetry and luminescence processes, and absolute chronologies for later prehistoric sites around Iberia, Quaternary coastal geomorphological processes in Portugal and Mozambique, and high-fired Post Mediaeval ceramics and historic tiles. These studies have produced theoretical developments and integrated approaches to experiment, analysis and interpretation, using different luminescence, geochemical and mineralogical methods (see projects, publications and presentations in Annex).

Optimization of laboratory outputs: equipment, methods, training, quality control

This dominated my work at first, and its maintenance and development continues to be the fundamental basis of my activities. The most significant aspect in the improvement and stabilization of analytical outputs was the training of technical staff and provision of guidelines and frameworks within which they could conduct their work. With care and close laboratory supervision this has developed from simple instruction into a controlled intellectual dialogue in which the knowledge and capabilities of all parties are improved. I have developed a series of files for data recording and analysis, and a matrix for dosimetry and age calculation that is able to cope with all materials, analyses, geometries and contexts commonly encountered in applied studies conducted by the GeoLuC group, based on the existing state of the art. This has permitted me to systematize my own analyses and those of technical staff, and to cross-check the quality of recording and results. One objective of my new project VADOSE is to evaluate and develop this further using new data and methods. My maintenance and update of existing hardware and software configurations of luminescence readers and gamma spectrometers, and installation of new equipment procured through service contracts and projects in which I am participant, has resulted in significant improvements to the operational capacity of the Luminescence Dating Laboratory. I now aim to develop new equipment in-house to augment capabilities beyond what commercially available equipment can provide, through a new project proposal COLURE.

Participation in projects and supervision of students

Since began my contract at IST/ITN I have participated in 3 research projects now completed (PTDC/HAH/74075/2006, PTDC/HAH/69506/2006, PTDC/HAH/71361/2006; total value €402k) and I am currently participating in 3 research and 1 strategic projects (PTDC/HIS-ARQ/101299/2008, PTDC/HIS-HEC/101756/2008, PTDC/CS-ANT/104333/2008, PEst-C/CTE/UI4035/2011; total value €866k). These projects address a variety of archaeological and cultural heritage questions including the transition to farming, megalithism, ancient funerary practices, rock art, historic trade and manufacture of porcelain and faience, and conservation strategies for glazed tiles. I have acted as co-supervisor of one completed Masters Dissertation project (18/20) in collaboration with the Instituto Politécnico de Tomar. I was instrumental in developing another successful PhD fellowship proposal to FCT (SFRH/BD/62396/2009), of which I am now co-supervisor, in collaboration with the Universidade de Aveiro through the GEOBIOTEC Research Team, of which I am an integrated member. These projects relate to the authentication of

museum collections and understanding archaeology and geochemistry of negative features in landscapes unsuitable for megalithic construction. In each case I have developed or supervised the development of approaches and methodologies to improve technical understanding and thereby contribute to novel applied research themes. This has resulted in a range of presentations and publications.

Development of new research activity

In addition to innovation within existing frameworks and the aforementioned PhD fellowship, my initiatives have so far brought two research projects to the GeoLuC group and IST/ITN. The FCT project VADOSE (PTDC/AAC-AMB/121375/2010) was approved with full funding (€198k) and began early this year. Geochemical and mineralogical analyses, based on neutron activation analysis, X-ray diffraction, field gamma spectrometry, and my recent introduction of high resolution gamma spectrometry of non-activated samples to the GeoLuC repertoire, are will be combined with luminescence analysis and radiation transport modelling to improve the evaluation of dose rates from NORMS in soils and sediments in collaboration with UPSR in IST/ITN, U. Aveiro, and SUERC in the UK. Some background work related to the project is already submitted for publication, and early related work on modelling and radionuclide measurement and geochemistry is resulting in upcoming conference presentations. A smaller project is developing international collaboration with a leading laboratory in the area of luminescence in Archaeometry and Materials Science (UNIMIB. italia128584682220330. Convénio Portugal (FCT) / Itália (CNR) 2011-2012). Building on published work related to projects in which I have participated (see Annex), different types of luminescence signal and dosimetric regime are being used to characterize radiation induced electronic processes and explore dosimetric responses (OSL, TTOSL, IRSL, TSL, RL, IL; regenerative, additive, predose). I aim to continue and expand this work through the project COLURE (Combining Luminescence techniques for Understanding Radiation Effects). This is in preparation for submission to FCT in 2012, in collaboration with partners in Portugal, Spain, Italy and the UK, and will significantly develop capabilities and synergies for luminescence analysis at IST/ITN. I aim to build upon these international collaborations to access EC project funding.

Dissemination of results

I have authored or co-authored 11 reports on these results, most written in Portuguese. I have personally made 7 oral presentations on this work at international conferences and meetings including conferences and European networks, and co-authored 6 oral presentations and 9 posters (plus 2, 2, and 2 respectively at national conferences and meetings, including in Portuguese: see titles in Annex). Other confirmed upcoming presentations (Roman numerals in Annex) relate to new gamma spectrometry results and an invited review paper. My work at IST/ITN has so far resulted in 6 papers in international peer reviewed journals (plus 2 under review and 1 shortly to be submitted: Roman numerals in Annex), and 3 in other publications. In the meanwhile I have continued to publish and present previous work under my current affiliation (1 journal article plus 1 to be submitted, 3 book sections, 2 oral presentations, 2 posters). The above mentioned publications and presentations have largely been devoted to establishing the technical depth and quality of the work now being conducted in the Luminescence Dating Laboratory of IST/ITN. This has already resulted in significant international recognition (below), but results with respect to the particular areas of application of each study are only now being prepared for publication. These represent a substantial body of geochronological data (circa 300 dating results in total) for later prehistoric sites around Iberia, Quaternary coastal geomorphological processes in Portugal and Mozambique, Post Mediaeval ceramics and historic tiles, and a variety of other site and material types. As they are published, they will establish the reputation of the IST/ITN Luminescence Dating Laboratory internationally within its client communities, just as GeoLuC is regarded in respect of geochemical archaeometric analyses.

International Recognition

I have contributed to the quality and profile of IST/ITN and the GeoLuC group through all the above activities, and have gained recognition of this from the international scientific community. I have acted on the organizing committees of two international conferences IX CIA and 2nd LAIS. For LAIS I am the principal host: I was awarded the organization of this conference in 2009 by the international standing committee, which is composed of senior members of the luminescence dating and archaeometry research community worldwide. In 2011 I made an invited presentation at CORALS II earth and planetary sciences conference, and have been re-invited to present at CORALS III. Since joining IST/ITN I have continued to conduct manuscript reviews for the international journals Radiation Measurements and Quaternary Geochronology, and since 2009 have conducted reviews for Mediterranean Archaeology and Archaeometry. Since 2009 I have been a full member of EURADOS, the European Radiation Dosimetry group, where I have made regular contributions to workgroup activities. Since 2011 I have been secretary of Working Group 10: Retrospective Dosimetry. Since 2010 I have provided expert reviews for project proposals to the National Research Foundation, South Africa, and l'Agence Nationale de la Recherche, France.

**Dr Christopher Ian Burbidge,
GeoLuC, IST/ITN.**

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ANNEX

PROJECTS/FUNDING

In Preparation/Submitted:

- 1 For submission to FCT, 2012. **Principal Investigator.** Combining Luminescence techniques for Understanding Radiation Effects - COLURE. Coordinator of Project: IST/ITN (Burbidge). Partners: U.A., GEOBIOTEC (Portugal), CIEMAT (Spain), UNIMIB (Italy), SUERC (U.K.).

Underway:

- 1 **Principal Investigator.** Spatial Variation of Dose Rate in Soils and Sediments - VADOSE. PTDC/AAC-AMB/121375/2010. €198k. Coordinator of Project: IST/ITN (C.I. Burbidge). Partners: U. Aveiro, GEOBIOTEC (Portugal), SUERC (U.K.).
- 2 **Project Coordinator and Investigator Responsible-Portugal.** Processos Luminescentes-Dosimetricos no Quartzo. italia128584682220330. Convénio Portugal (FCT) / Itália (CNR) 2011-2012. Investigator Responsible-Italy, Prof. M. Martini, CUDaM, UNIMIB.
- 3 Co-investigator. GEOBIOTEC. Projecto Estratégico - UI 4035 - 2011-2012. PEst-C/CTE/UI4035/2011. FCT / FEDER – COMPETE. €498k. Coordinator of Project: Fernando Rocha, U.A.
- 4 Co-investigator. Gestão da morte na Pré-História Recente: práticas funerárias no recinto dos Perdigueiros. PTDC/CS-ANT/104333/2008. FCT, €142k. Coordinator of Project: UC, Centro de Investigação em Antropologia (Ana M. Silva). Partners: NIA-ERA Arqueologia S.A. IST/ITN.
- 5 Co-investigator. Diagnóstico, descontaminação e conservação da herança cultural: neutrões e radiação ionizante em objectos de arte (RADIART). PTDC/HIS-HEC/101756/2008. FCT, €140k. Coordinator of Project: IST/ITN (M. Isabel Prudêncio). Partners: IMC.
- 6 Co-investigator. RUPSCIENCE - Analysis of the operational chains, archaeometry and chronology of Rock Art Paintings. An approach to materials technology of Portugal, Spain and Colombia's contexts. PTDC/HIS-ARQ/101299/2008. FCT, €84k. Coordinator of Project: IPT (Luiz Oosterbeek). Other partners: IST/ITN; UTAD; GIPRI, Bogota; IRP-UPV, Valencia; MAE/USP, São Paulo.

Completed:

- 1 Co-investigator. Halieutical resources industry in roman times: the Casa do Governador da Torre de Belém, the Tagus estuary and the Atlantic coast. PTDC/HAH/74075/2006. FCT, €96k. Coordinator of Project: FL/UL (Carlos Fabião). Other partners: ITN; Era Arqueologia SA.
- 2 Co-investigator. Dating, authenticity, materials, pigments. A laboratory study on Portuguese Faience and Chinese Porcelain produced for the Portuguese market (XVI to XVIII centuries). PTDC/HAH/69506/2006. FCT, €156k. Coordinator of Project: ITN (M. Isabel Dias). Partners: Cenimat/FCT/UNL; MNAA, IPCR.
- 3 Co-investigator. Transition landscapes: settlement, technology and chrono-stratigraphy of the transition to farming in central Portugal. PTDC/HAH/71361/2006. FCT, €150k. Coordinator of Project: IPT (Luiz Oosterbeek). Other partners: ITN; UTAD.
- 4 Travel grant to present at the 12th International Conference on Luminescence and Electron Spin Resonance Dating, Sept. 2008. Beijing, China. Calouste Gulbenkian Foundation: €1040.

Past applications:

- 1 Co-investigator, responsible for activities in ITN. A datação por luminescência na avaliação e previsão dos efeitos de fogos no meio ambiente e no património. Acções Integradas Luso-Espanholas 2012 (CRUP). Partners: U. Aveiro, Portugal; U. a Coruña, Spain.
- 2 Principal Investigator. Luminescence Analysis of Radiation Effects - LARE. PTDC/FIS/121383/2010. Coordinator of Project: ITN (Burbidge). Partners: U.A., GEOBIOTEC (Portugal), CIEMAT (Spain), UNIMIB (Italy), SUERC (U.K.).
- 3 Principal Investigator. Environmental Dosimetry of Soils and Sediments - DOSIMSS. PTDC/AAC-AMB/111718/2009. Coordinator of Project: ITN (C.I. Burbidge). Partners: Universidade de Aveiro, GEOBIOTEC.
- 4 Principal Investigator. Experimental evaluation of ionising radiation dosimetry in soils and sediments. PTDC/AAC-AMB/100920/2008. Coordinator of Project: ITN (C.I. Burbidge). Partners: Universidade de Aveiro, GEOBIOTEC.
- 5 Supervisor of the candidate. “Autenticação de cerâmicas e História de Arte. Composição e pré-tratamento na luminescência”. Fundação Calouste Gulbenkian, Programa de Estímulo à Investigação (Estímulo 17396). 2008.

TRAINING AND SUPERVISION

- 2010 – date **Co-supervisor**. FCT Doctoral Fellowship SFRH/BD/62396/2009 “Geoquímica, mineralogia e cronologia absoluta de materiais geo-arqueológicos circundantes à barragem do Alqueva. Contribuição para o conhecimento e valorização do património cultural”, A. L. Sebastião Rodrigues. Supervisor Prof. F. Rocha. Co-supervisors M. I. Dias (A. Valera). Partners: ITN, UA, NIA-ERA Arqueologia S.A.
- 2010 – date **Co-supervisor**. Doctoral project funded by the Estrada Foundation “Archeometry and Dating of Ceramics”, J. Mungur Medhi. Supervisor L. Oosterbeek, Polytechnic of Tomar. Co-supervisor M.I. Dias. Partners: ITN, IPT, UTAD.
- 2008 – date General supervision, training and coordination of visitors, students and technicians (post graduate to post doctoral level) in the ITN Luminescence laboratory and in the field.
- 2008 – 2009 **Co-supervisor**. Masters Dissertation Project (18/20) “Archaeometric contributions for heritage management: Geochemistry, Mineralogy & Dating of Ceramics from a Portuguese Pottery collection”, Master Erasmus Mundus em Quaternario e Prehistoria. J. Mungur Medhi, Polytechnic of Tomar, Mação. Supervisor J. Coroadó.

PROFESSIONAL ACTIVITIES AND MEMBERSHIPS

Organization and hosting of the second Luminescence in Archaeology International Symposium: L.A.I.S. 2012, Lisbon.

Organizing committee of IX Congresso Ibérico de Arqueometria, Lisboa, 26-28/10/2011.

Reviewer of articles submitted to Radiation Measurements, Journal of Mediterranean Archaeology and Archaeometry and Quaternary Geochronology.

Expert reports for project proposals to the National Research Foundation, South Africa, and l'Agence Nationale de la Recherche, France.

2010 – date Sociedad de Arqueometría Aplicada al Patrimonio Cultural

2009 – date GeoBioTec Research Team, Universidade de Aveiro. Integrated Member.
 2009 – date EURADOS full member. **Secretary Wg10, Retrospective dosimetry 2011-**
 2001 – date Quaternary Research Association

CONTINUING PROFESSIONAL DEVELOPMENT

- 2012 EURADOS Annual Meeting 2012. IAEA, Vienna International Centre (6-8/02/2012), including the Workshop "Dosimetry for secondary cancer risk estimation in radiotherapy".
- 2011 EURADOS Annual Meeting 2011. Czech Technical University, Prague (7-11/02/2011), including the 5th EURADOS Winter School "Radiation Protection for Medical Staff".
- 2010 EURADOS Annual Meeting 2010, Istituto Superiore di Sanita, Rome. (1-5/02/2010), including participation in WG10 "Retrospective Dosimetry" Meeting; 4th EURADOS Winter School "Radiological emergencies-Internal exposures"; Workshop on "Accelerator radiation protection and shielding".
- 2010 Workshop. "Towards a Portuguese participation in the ESS project", ITN. (29/01/10).
- 2009 Palestra. A Travessia do Tejo Chelas Barreiro – A Solução Estrutural de Estudo Prévio. Ordem dos Engenheiros, Lisboa. (15/05/09)
- 2009 Seminário. IV Jornadas de Arqueologia IberoAmericana, "Diversidade e Unidade do Comportamento Humano", Instituto Politécnico de Tomar, Mação. (05/03/09)
- 2008 Seminário. Parceira EFSA/Comunidade Científica-Interesses Comuns, Projectos Futuros. Autoridade de Segurança Alimentar e Económica, Universidade Técnica de Lisboa. (02/10/08)

PUBLICATIONS

Papers:

(International Peer Reviewed Journals)

- i **Burbidge, C.I.**, Trinade, M.J., Cardoso, G.J.O., Dias, M.I., Oosterbeek, L., Cruz, A., Scarre, C., Cura, P., Caron, L., Prudêncio, M.I., Gouveia, A., Franco, D., Marques, R. In Prep. Luminescence dating and associated analyses in transition landscapes of the Alto Ribatejo, Central Portugal. *Archaeometry*.
- ii **Burbidge, C.I.**, Sanderson, D.C.W and Housley, R.A. In Prep. Luminescence geochronologies of sand and silt sediment fractions from Palaeolithic sites North and East of the Black Sea'. *Archaeometry*.
- iii **Burbidge, C.I.**, Dose normalized dose response characteristics. Submitted. *Radiation Measurements*.
- iv **Burbidge, C.I.**, Cardoso, G.O., Sanderson, D.C.W., Dias, M.I. Submitted. Drained measurements for the constraint of time averaged water content. *Radiation Measurements*.
- 1 **Burbidge, C.I.**, 2012. Facets of Luminescence for Dating. *Spectroscopy Letters* 45, 118–126.
- 2 Prudêncio, M.I., Stanojev Pereira, M.A., Marques, J.G., Dias, M.I., Esteves, L., **Burbidge, C.I.**, Trindade, M.J., Albuquerque, M.B. 2012. Neutron tomography for the assessment of consolidant impregnation efficiency in Portuguese glazed tiles (16th and 18th centuries). *Journal of Archeological Science* 39, 964-969.
- 3 **Burbidge, C.I.**, Cabo Verde, S.I., Fernandes, A.C., Prudêncio, M.I., Botelho, M.L., Dias, M.I., Cardoso, G. 2011. Dosimetry in the multi kilo-Gray range using optically-stimulated luminescence (OSL) and thermally-transferred OSL from quartz, *Radiation Measurements* 46, 860-865.
- 4 **Burbidge, C.I.**, Rodrigues, A.L., Dias, M.I., Prudêncio, M.I., Cardoso, G.O. 2010. Optimisation of preparation and measurement protocols for luminescence dating of small

samples from a suite of porcelains and faiences. *Mediterranean Archaeology and Archaeometry* 10, 53-60. pub. 13 July 2011.

- 5 Sanjurjo Sánchez, J., Trindade, M., Blanco-Rotea, R., Benavides Garcia, R., Fernández Mosquera, D., **Burbidge, C.I.**, Prudêncio, M., Dias, M. 2010. Chemical and mineralogical characterization of historic mortars from the Santa Eulalia de Bóveda temple, NW Spain. *Journal of Archaeological Science* 37, 2346-2351.
- 6 **Burbidge, C.I.**, Dias, M.I., Prudêncio, M.I., Rebêlo, L.P., Cardoso, G.O., Brito, P. 2009. Internal α activity: localisation, compositional associations and effects on OSL signals in quartz approaching β saturation', *Radiation Measurements* 44, 494-500.
- 7 Kinnaird, T., Sanderson, D., **Burbidge, C.** and Peltenburg, E. 2008. OSL Dating of Neolithic Kissonerga-Mylouthkia, Cyprus, *Neo-lithics*, 2/07, 51-56.

(Other Journals and Proceedings)

- 1 Prudêncio, M.I., Dias, M.I., **Burbidge, C.I.**, Trindade, M.J. 2009. Técnicas nucleares e de luminescência na reconstituição da história da edificação de monumentos. *Pedra & Cal* 42, 4-6.
- 2 Sanjurjo Sánchez, J., Fernández Mosquera, D., Dias, M., **Burbidge, C.**, Prudêncio, M., 2010. Consideraciones metodológicas en la datación por luminescencia de materiales de construcción: el caso de los morteros. *VIII Congreso Ibérico de Arqueometría, Teruel, 2009*.

Books and Book Sections

- 1 Turner, V.E., Guttman, E.B.A., Simpson, I.A., **Burbidge, C.I.** 2010. Old Scatness: the Viking and Norse anthrosols, In Dockrill, S.J., Bond, J.M., Turner, V.E., Brown, L.D., Bashford, D.J., Cussans, J.E. and Nicholson, R.A. *Excavations at Old Scatness, Shetland Volume 1: The Pictish Village and Viking Settlement*. Lerwick: Shetland Heritage Publications.
- 2 **Burbidge, C.I.**, Richter, D., Sanderson, D.C.W., Housley, R.A. 2010. Luminescence analyses (OSL and TL) from Karabai I. In Chabai, V. (ed), *Karabai, Palaeolithic Sites of Crimea*.
- 3 Dias, M.I., **Burbidge, C.I.**, Prudêncio, M.I. 2009. The archaeometry of objects from the Bura-Asinda-Sika culture: Preliminary tests for luminescence dating of terracotta object Inv. 105-56 (ITN-Lum 467)', In: *African Soul: José Berardo African Art Collection*, Lisbon, The Berardo Collection, Lisbon City Council, Tinta da China, 36-37.
- 4 Housley, R.A., Sanderson, D.C.W., **Burbidge, C.I.**, Richter, D. and Higham, T.F.D. 2008. Luminescence analyses (OSL and TL) and AMS radiocarbon determinations from Kabazi V. In Chabai, V., Richter, J., and Urthmeier, T. (eds.), *Kabazi V: Interstratification of Micoquian & Levallios-Mousterian Camp Sites*, Palaeolithic Sites of Crimea Vol.3, Ch.3.

Reports:

- 1 **Burbidge, C.I.**, Dias, M.I., Prudêncio, M.I., Cardoso, G., Marques, R., Franco, D. 2011. *Datação por luminescência de amostras de sedimento e cerâmica, das escavações de ERA-Arqueologia S.A., campanha de 2009, do sítio do Palácio dos Lumiares (Andrades), Lisboa, Portugal*. Sacavém, Instituto Tecnológico e Nuclear. 8 p. Internal Report.
- 2 **Burbidge, C.I.**, Dias, M.I., Prudêncio, M.I., Cardoso, G., Marques, R., Franco, D. 2011. *Sumario dos resultados da datação por luminescência de duas amostras dos sedimentos da estação arqueológica do Alto da Fonte Nova, Península de Setúbal, Portugal*. Sacavém, Instituto Tecnológico e Nuclear. 4 p. Internal Report.
- 3 **Burbidge, C.I.**, Dias, M.I., Prudêncio, M.I., Cardoso, G., Marques, R., Franco, D. 2010. *Sumario dos resultados da datação por luminescência de duas amostras de sedimento do preenchimento da câmara de um menir proveniente das escavações da Câmara Municipal de Abrantes acerca de Medroa, Abrantes, Portugal*. Sacavém, Instituto Tecnológico e Nuclear. 4 p.
- 4 **Burbidge, C.I.**, Dias, M.I., Prudêncio, M.I., Cardoso, G., Franco, D., Marques, R. 2010.

- Datação por Luminescência de Sedimentos Costeiros de Bazaruto e Bilene, Moçambique: actualização de progresso até 23.04.10.* Sacavém, Instituto Tecnológico e Nuclear. 8 p.
- 5 **Burbidge, C.I.**, Dias, M.I., Prudêncio, M.I., Cardoso, G., Marques, R., Franco, D., García Gazólaz, J., Sesma Sesma, J. 2010. *Datação por luminscência de sedimentos do fosso circundante ao sítio de los Cascajos, das escavações da Sección de Arqueologia, Dirección Geral de Cultura, Navarra, Espanha.* Sacavém, Instituto Tecnológico e Nuclear. 111 p.
 - 6 Dias, M., **Burbidge, C.I.**, Prudêncio, M. 2010. *Testes por luminescência e difracção de raios-X de duas peças de terracota atribuídas à civilização Nok (Colecção Sr.Carlos Dias).* Sacavém, Instituto Tecnológico e Nuclear. 16 p.
 - 7 **Burbidge, C.I.**, Dias, M.I., Prudêncio, M.I., Cardoso, G. Marques, R., Franco, D. 2010. *Datação por luminescência da peça de terracota Bur-56J (ITN-LUM-467) atribuída à civilização Bura, pertencente à colecção Berardo. Breve estudo composicional.* Sacavém, Instituto Tecnológico e Nuclear. 56 p.
 - 8 **Burbidge, C.I.**, Dias, M.I., Prudêncio, M.I. 2009. *Datação por luminscência de sedimentos do fosso circundante ao sítio de Los Cascajos, das escavações da Sección de Arqueologia, Dirección Geral de Cultura, Navarra, Espanha. Relatório da amostragem (16-17 Setembro 2009) e estrutura dos dados.*, Sacavém, Instituto Tecnológico e Nuclear, 20 p.
 - 9 **Burbidge, C.I.**, Dias, M.I., Prudêncio, M.I., Cardoso, G. Marques, R., Franco, D., Ferraz, T. 2009. *Datação por Luminescência de Cerâmica e Argamassa de uma Canalização “Romana” das escavações de Arqueoiheria Estudos S.L. na Municipalidade de Turre, Almeria, Espanha.* Sacavém, Instituto Tecnológico e Nuclear. 49 p.
 - 10 Dias, M.I., **Burbidge, C.I.**, Prudêncio, M.I. 2009. *Testes preliminares para a datação por luminescência da peça de terracota Bur-56J (ITN-LUM-467) atribuída à civilização Bura, pertencente à colecção Berardo.* Sacavém, Instituto Tecnológico e Nuclear. 17 p.
 - 11 **Burbidge, C.I.**, 2008. *Resultados Sumários Luminescências: Mamoa do Leandro 2.* 3 p.

COMMUNICATIONS

Session Chair:

- 1 **Burbidge, C.I.** Datação. Congresso Ibérico de Arqueometria, CIA-IX, 26-28 Outubro de 2011, Lisboa, Portugal.

Oral, Invited:

(International Conferences)

- i **Burbidge, C.I.** Dosimetric luminescence from minerals. Conference on Raman and Luminescence Spectroscopy in the Earth Sciences (CORALS III). UZA (Universitäts-Zentrum Althanstraße), University of Vienna, Austria, 2013.
- 1 **Burbidge, C.I.** Facets of luminescence for dating. Conference on Micro-Raman Spectroscopy and Luminescence Studies in the Earth and Planetary Sciences (CORALS II), Museo Nacional de Ciencias Naturales, Madrid, May 18–20, 2011.

(Seminars)

- 1 **Burbidge, C.I.** (with Fabião C., Dias M.I., Filipe, I.) A indústria de recursos haliêuticos no período romano: a fábrica da Casa do Governador da Torre de Belém, o estuário do Tejo e fachada atlântica - Ensaios de Datação por Luminescência na Cetária 6. Colóquio ERA 8, 23rd January, 2010, Lisboa.
- 2 **Burbidge, C.I.** Datação por luminescência: métodos e aplicações. July 2008. Instituto Tecnológico e Nuclear, Sacavém. (Institute Seminar)

(Meetings/Workshops)

- 1 **Burbidge, C.I.**, Data Structure in Luminescence Retrospective Dosimetry. WG10 meetings, EURADOS Annual Meeting 2012. IAEA, Vienna International Centre (6-8/02/2012)
- 2 **Burbidge, C.I.** Datação e dosimetria retrospectiva por luminescência. Reunião Mensal do Grupo de Dosimetria e Radiobiologia, UPSR, ITN. 27/05/2011.
- 3 **Burbidge, C.I.**, Monteiro Gil, O., Alves, J., Cardoso, J., Santos, L. Proposal: Retrospective dosimetry of a gloved hand. EURADOS Annual Meeting 2011. Czech Technical University, Prague, 7-11/02/2011.

Oral, Presenter:

(International Conferences)

- 1 **Burbidge, C.I.**, Rodrigues, A.L., Dias, M.I., Prudêncio, M.I. e Cardoso, G. Técnicas para a datação por luminescência de amostras pequenas de cerâmicas cozidas a alta temperatura. IX Congresso Ibérico de Arqueometria, CIA-IX, 26-28 Outubro de 2011, Lisboa, Portugal.
- 2 **Burbidge, C.I.**, Cardoso, G., Sanderson, D.C.W., Dias, M.I. Constraint of time averaged water content using drained measurements. 13th International Conference on Luminescence and Electron Spin Resonance Dating 10-14 July 2011, Torun, Poland.
- 3 **Burbidge, C.I.**, Rodrigues, A.L., Dias, M.I., Prudêncio, M.I., Cardoso, G. Optimisation of preparation and measurement protocols for luminescence dating of small samples from a suite of porcelains and faiences. 1st L.A.I.S. Symposium. Delphi, Greece, 9 -12 September 2009.
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