

# Environmental Analytical Chemistry

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The activities within the Environmental Analytical Chemistry Research Group involve the study of the Biogeochemical Cycles of Chemical Elements and Light Isotopes in the Environment. Our main skills are in the fields of *INSTRUMENTAL ANALYTICAL CHEMISTRY, ENVIRONMENTAL GEOCHEMISTRY, ISOTOPE HYDROLOGY AND ARCHAEOLOGICAL METALLURGY*.

In Instrumental Analytical Chemistry, fundamental work is focused in the implementation and/or optimisation of the used methodologies: Energy-Dispersive X-Ray Fluorescence Spectrometry; Mass-Spectrometry for Light Isotopes, Elemental Analysis coupled to the Mass Spectrometry and Tritium Dating. These methodologies are being utilised in studies involving the quantitative elemental and isotopic analysis of diverse materials, namely environmental (geological, hydrological and biological) archaeological and museological samples.

During the current year our main research work continued to be focused and reinforced in the above mentioned fields, either by the running projects or by some new approved proposals in collaboration with other research teams and other National and International Institutions.

Environmental Geochemical studies were mostly dedicated to Sedimentary Geochemistry in the framework of several research projects, particularly the project "Consequences of River Discharge Modifications on Coastal Zone and Continental Shelf (CRIDA)". This work aims at the evaluation of the consequences caused by the changes that occurred during the last centuries in the main Iberian river basins. Other studies involve the stratigraphic succession of the sedimentary record of Douro and Minho estuaries aiming the recognition and distinction of the environmental changes, which have occurred during the Late Quaternary. Recently studies were initiated in lagoons, estuaries and interdune depressions of the SW coast and related watersheds

The main overall objectives are:

- 1) to establish the evolutionary patterns of the studied environments since the Late Glacial; to define geochemical signatures for different marine and terrestrial contributions; to evaluate changes in sediment sources;
- 2) to characterise bottom sedimentation in the last centuries; to understand accumulation of heavy metals resulting from anthropic influence;
- 3) to map geochemical parameters and to identify sediment and contamination sources.

Geochemical studies integrate a multidisciplinary approach, including sedimentology, geochronology, dating, meteorology and paleoecology.

During 2004, the Elemental Analyser coupled to the mass spectrometer SIRA 10 has allowed the development of isotopic determinations in solid and liquid samples dedicated to the use of light isotope ( $\delta^{13}\text{C}$ ,  $\delta^{15}\text{N}$  and  $\delta^{18}\text{O}$ ) in organic matter as tracers of shelf sediments.

Isotope Hydrology has contributed to a better understanding of the dynamic evolution response of groundwater systems to Human influences and to the climatic evolution. The operation of the national network for isotopes in precipitation has provided important information for the management, protection and development of water resources. Hydrological investigations were largely enhanced by the approval to be financed by the FCT of three new research and one Coordinated Research Project by the IAEA to initiate a research study on the characterisation of the baseflow of Sado Hydrography basin.

Archaeometallurgy - The non-invasive characteristic of the EDXRF method has been driving for years some of our research to the study of archaeological metallic artefacts with museological and archaeological interest. In recent years, Archaeometallurgy has had a growing relevant interest in our research activities and during last year an interdisciplinary research project was approved to be financed by the FCT. This project aims to approach and characterise the technological and social conditions of Late Bronze Age metal production, circulation and consumption in Central Portugal.

Due to the specificity of the available equipment, analytical techniques and expertise within the group, technical services are provided to Universities and Public and Private Institutions.

Our proposal concerning the installation of a Mass-Spectrometer based elemental and isotopic analyser was finally approved within the "*Programa Nacional de Re-Equipamento Científico*". The installation of an ICP-MS (Inductively Coupled Plasma-Mass Spectrometry) will highly reinforce our analytical capabilities.

The training of young research students and the enhanced collaboration with other research groups and Institutions has also been improved. However, it is worth noting that in spite of our efforts in enlarging the group with graduated and post-doctoral students, the permanent staff is fairly small and in order to strengthen our research it is of a great urgency the contract of more researchers.

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## Research Team

### Researchers

- M.F. ARAÚJO, Auxiliary researcher, Group Leader
- P.M. CARREIRA, Auxiliary researcher
- D. BURDLOFF, Post-Doctoral FCT grant

### Technical Personnel

- P. VALÉRIO, graduate technician
- D. NUNES, graduate technician
- M. CORREIA, laboratory technician

### Students

- P.G. FERNANDES, PhD student FCT grant
- C. CORREDEIRA, PhD student FCT grant
- E. FIGUEIREDO, PRODEP grant
- A.I. DIAS, PRODEP grant
- A.R. MIRANDA, PRODEP grant
- M. TEIXEIRA, PRODEP grant
- I. SILVA, undergraduate student
- A. LOBATO, undergraduate student
- A. CRUCES, PhD student FCUL/ITN, FCT grant

### Funding (€)

Research Projects:	108.246,65
Services:	27.613,38
<b>Total:</b>	<b>135.860,03</b>

### Publications

Journals:	9 and 13 in press
Proceedings:	9 and 2 in press
Conf. Communications:	16
Theses: BSc	2