

Magnetic parameters and chemical composition of *Nerium oleander* leaves: A study of pollution levels in Coimbra, central Portugal

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This study presents the magnetic parameters (magnetic susceptibility: χ_{LF} , isothermal remanent magnetization: IRM_{IT} , and S ratios: S_{300}) of *Nerium oleander*, *Platanus hispanica*, *Tilia, s.p.* and *Liquidamber styraciflua* leaves samples collected on the 4th July 2007 in the urban area of Coimbra. A Molspin pulse induction magnetizer was used to create magnetic fields at room temperature to a maximum of 1T and the IRM of the samples was measured with a Molspin spinner magnetometer. Chemical composition of 12 *Nerium oleander* leaves samples, corresponding to highest polluted areas, were also determined by High Resolution ICP/MS. The selection of samples was done considering the highest values of isothermal remanent magnetization (IRM_{IT}) obtained in the present study and in previous studies, which allowed the identification of the most polluted areas. The tree leaves were used as natural dust collectors and bioaccumulators. Magnetic parameters of ferromagnetic (s.l.) particles accumulated on leaves surfaces were obtained for 122 samples. The main goals of this study are: to identify the potenciality of the leaves of the different species as bioaccumulators of dust; to characterize the ferromagnetic dust; and to establish the relationship between IRM and the elemental content.

The S_{300} (IRM_{300}/IRM_{IT}) mean value obtained is 1.01 (N=122) indicating the presence of ferrimagnetic structures like magnetite probably produced by the traffic pollution. In this study the *Nerium oleander* leaves are the most efficient to collect dusts and *Liquidamber styraciflua* leaves presents the lower values of IRM. The IRM values are interpreted as a proxy of pollution levels. Significant statistical correlations were found between Cu, Fe, Mn, Pb, and Zn sum concentrations and IRM values ($R^2 = 0.98$).

Chondrite-normalized REE patterns obtained for *Nerium oleander* leaves samples show some overlap and positive Eu anomaly with Eu/Eu* ratio of 1.12-4.46. These patterns are not subparallel to the one of the upper crust suggesting an anthropic origin of the main components in leaves.

Leaves elements content (Cu, Fe, Mn, Pb, and REE) reflect both atmospheric dust contribution and uptake from soil.

New insights in the Early Ordovician magmatism from the Marão anticline, Northern Portugal

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The Marão anticline is located in the Central Iberian Zone (CIZ) of the Iberian Variscan Belt. The CIZ represents a segment of the northern Gondwana margin with a long Variscan geodynamic evolution. The occurrence of basic and felsic volcanic rocks in the basal units of the Early Ordovician below Armorican Quartzite Formation documents a pre-Variscan bimodal magmatic event, probably related to an extension episode on the northern Gondwana margin.

The felsic volcanoclastic rocks show a well defined foliation and are dominated by fine-grained quartz-rhyolitic metatuffs, sometimes microporphyritic, containing recrystallized white mica and sheared quartz crystals. The isolated quartz porphyroclasts are intensely corroded relicts and exhibit intergranular fracturing. The groundmass is devitrified and variably recrystallised. The presence of subhedral crystals of chlorite, biotite and tourmaline is interpreted as the result of Variscan metamorphic overprint. The felsic rocks are peraluminous and have rhyolitic to trachyandesitic composition. Their trace element patterns are characterized by a significant enrichment in the LIL elements and depletion in Y, Zr, Nb and REE. They show moderate REE fractionation, with more strongly fractionated LREE patterns and a negative Eu anomaly. The Sr isotopic signatures displayed by the felsic metatuffs are widely variable ($^{87}\text{Sr}/^{86}\text{Sr}_{470} = 0.6908$ to 0.7052 , suggesting disturbance of the Rb-Sr isotopic system, whilst their Nd values ($\epsilon\text{Nd}_{470} = -6.4$ to -4.1) are more uniform and point to the involvement of crustal materials in the petrogenesis of the rhyolitic parental magmas. ID-TIMS U-Pb ages of euhedral zircon crystals of magmatic origin give a precise age for the Ordovician magmatic event (470.1 - 474.6 Ma). The inherited zircons are dominated by Neoproterozoic (543.8 - 692.2 Ma) components. The U-Pb ages obtained in monazite crystals (331.8 - 333.7 Ma) are clearly younger and appear to date the Variscan metamorphic overprint, responsible for monazite resetting and disturbance of the Rb-Sr system.