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Uranium in surface soils: an easy-and-quick assay combining X-ray diffraction and fluorescence qualitative data

M.O. Figueiredo, T.P. Silva, M.J. Batista, J. Leote, M.L. Ferreira, and V. Limpo
INETI / LNEG, Dept. Economical Geol., Estrada da Portela, Apartado 7586, 2721-866 Alfragide, Portugal

Portugal has been a uranium-producer since the beginning of the last century. The uranium-rich area of Alto Alentejo, East-central Portugal, was identified more than fifty years ago [1]. Almost all the uranium-bearing mineralization occurs in schistose rocks of the contact metamorphic aureole produced by intrusion of the Hercynian monzonitic granite of Alto Alentejo into the pre-Ordovitian schist-greywacke complex forming deposits of vein and dissemination type.
The Nisa uranium-reservoir, situated at the sharp border of a large and arch shaped granite pluton, was identified in 1957 [2] but its exploitation was considered economically impracticable until recently. However, its existence and the accumulated detritus of these prospect efforts are a concern for local populations [3].
A study of the near-surface soils close to the Nisa reservoir was therefore undertaken to assess the uranium retention by adsorption on clay components under the form of uranyl ions, $[UO2]^{2+}$ [4-6] and its eventual release into the aquifer groundwater.
As an attempt to very quickly appraise the presence of uranium in as-collected near-surface sediment samples a combination of laboratory X-ray techniques was designed: X-ray diffraction (XRD) to identify the mineral phases and roughly estimate its relative proportion plus X-ray fluorescence spectrometry in wavelength dispersive mode (XRF-WDS) to ascertain the presence of uranium and tentatively evaluate its content by comparison with selected chemical components of the soil.
A description of the experimental methodology adopted for the implemented easy-and-quick uranium assay is presented. Obtained results compare quite well to the data of certified time-consuming analytical tests of uranium in those soil samples.

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