

Uranium accumulation in the plants of the old mine of Sevilha (Central Portugal)

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The old uranium (U) mine of Sevilha (Tábua, Central Portugal) is one of several small mines exploited by Portuguese Uranium Company. We decided to evaluate the U accumulation potential of the endemic species. Samples of soil, water and terrestrial and aquatic plants were collected in the vicinities of the study area. The plant survey did not follow a regular pattern to take into account the dispersion of the species and to sample all the units of the plant community. It was intended to obtain a global view of the response of the vegetation to the accumulation of U. This implied sample collection in the biogeochemical background and within the anomaly. As a result 82 different species were identified and sampled. These species belong to 32 families, five of which are aquatic. All samples were processed at the Chemistry Laboratory of the Earth Sciences Department of University of Coimbra. For determination of mass concentration of U in samples of natural water, soils and plants, it was used the 'Fluorat-02-2M' analyzer.

Current U soil contamination on the Sevilha mine ranges from 8 to 560 ppm. In the most abundant families of terrestrial plants, the results show that the Compositae and Ericaceae families have the highest concentrations. For the Compositae, an average of 4.91 ppm and a maximum of 13.12 ppm was found in *Helichrysum stoechas* and an average of 4.07 ppm and a maximum of 10.52 ppm was recorded in *Hypochaeris radicata*. In *Erica umbellata* an average of 1.70 ppm and a maximum of 7.50 ppm maximum were obtained. Even though the concentrations obtained in this later species are not high it is particularly interesting because it has a high bio-productivity. The water contamination in the vicinities of Sevilha mine results from the natural lixiviation of the wastes used to fill the open pit. Although the U concentrations in waters did not surpass 13 ppb (EPA limit: 30ppb). Four of the analysed aquatic species proved to be U accumulators. The measured average concentrations were: *Riccia fluitans* (29.19 ppm), *Lemna minor* (15.47 ppm), *Callitriche stagnallis* (9.97 ppm) and *Lythrum portula* (15.52 ppm). For these species, the observed maximum values were 50.59 ppm, 52.98 ppm, 55.53 ppm and 32.93 ppm, respectively.

Molecular quasi-chemical theory applied to liquid water

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We implement and test a molecular quasi-chemical theory of liquid water. The quasi-chemical perspective is that several physically transparent contributions are involved in a sensitive balance. Network-liquid contributions are precisely defined, and long-ranged interactions are characterized by a conditional distribution of binding energies. For simulated liquid water network-liquid contributions are small (even zero), and the free energy is dominated by long-ranged interactions. The binding-energy distributions for liquid water are observed to be unimodal, and a Gaussian model can be accurate. A broad distribution of interactions remains as the essential difficulty of the molecular theory liquid water.