Studies of metalotolerant vegetable species and their potential for biogeochemical prospecting and environmental restoration (Cavalo old mining area, Central Portugal)

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Biogeochemical prospecting and the environmental control in highly polluted areas presume the correct selection of the biogeochemical material for sampling and the interpretation of the analytical results that takes into account the physiological mechanisms of plant adaptation and, in particular, the pedogeochemical phenomena.

In this work, have been characterised the species present in the old mining area of Cavalo (Oleiros, Castelo Branco, Central Portugal); environment with important W, As and some Cu contamination.

The species were selected envisaging their use as bioindicators, meaning that they are able to detect the pollution present in soils for use in mineral exploration; and seeking their potential use in the restoration with metalotolerant species able to tolerate the geochemical stress imposed by these conditions. The analyzed species included: *Erica australis, Erica umbellata, Pterospartum tridentatum, Halimium ocymoides, Arbutus unedo, Cistus salvifolius, Hypochaeris radicata, Pinus pinaster, Anarrhinum bellidifolium, Conyza canadensis, Andryala integrifolia, Agrostis delicatula* and *Agrostis curtisii*.

The results of analysis show that the species best suited for biogeochemical indicating are by order of importance: *Erica australis, Arbutus unedo* (leaves), *Halimium ocymoides, Erica umbellata, Cistus salvifolius* and *Pterospartum tridentatum* for As; *Halimium ocymoides* for Cu; *Erica umbellata, Arbutus unedo* (leaves and stems), *Erica australis, Pterospartum tridentatum, Halimium ocymoides* e *Cistus salvifolius* for W.

On the possibility of using these species in revegetation of areas with this type of contamination, it appears that all species accumulate in their tissues the main elements causing contamination (As and W). On the other hand, these species only have medium physiological barriers, not implying a high intake of these elements in the ecosystem.

Uranium in aquatic plants from uranium contaminated water in Central Portugal

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The work presented here is a part of an on-going study on the uraniferous geochemical province of Central Portugal in which, the use of aquatic plants as indicators of uranium (U) contamination is being probed using aquatic plants emphasizing their potential use in the emerging phytotechnologies.

Several of the uraniferous deposits were exploited either by underground or surface mining methods. Many of the places were left in different stages of degradation.

The samples were collected in running and in standing waters (lentic and lotic) in the places where it was possible to observe aquatic species. In these sites, samples of the waters and of the vegetable species were taken. The plants collected represented the free floating and the rooted emergent plants. In the ponds, only free floating plants were found growing. The methodology adopted for the determination of the U content in the water and plants was fluorometry.

Even though we have observed very low concentration of U in the fresh waters of the studied sites we found a set of vegetable species with the ability to accumulate U in concentrations which are orders of magnitude higher than the surrounding environment. We have observed that *Callitriche stagnalis* (1948.41 mg/kg DW), *Lemna minor* (52.98 mg/kg DW) and *Fontinalis antipyretica* (234.79 mg/kg DW) accumulated significant amounts of uranium, whereas *Oenanthe crocata* excluded U. These results indicate substantial scope for proper radiophytoremediation and phytosociological investigation exploiting the native flora. These species show great potential for phytoremediation because they are endemic and easy to grow in their native conditions. *C. stagnalis* have high bioproductivity and yield good biomass.