

Temporal uranium records of oak tree rings (*Quercus petraea*) by (LA)-HR-ICP-MS from a former uranium mining site (Rophin, France)

Y. HASSAN LONI^{1*}, K. DAVID¹, S. LARRUE², G. MONTAVON¹, P. CHARDON³, B. GRAMBOW¹

¹ Laboratoire Subatech, Groupe Radiochimie, UMR 6457, IN2P3/CNRS/IMT Atlantique/Université de Nantes, 4 rue Alfred Kastler, BP20722, 44307 Nantes Cedex 3, France (* : yahaya.hassan-loni@subatech.in2p3.fr)

² GEOLAB, UMR 6042, CNRS/Université Clermont Auvergne, 4, rue Ledru, 63057 Clermont-Ferrand cedex, France

³ LPC, UMR 6533, IN2P3/CNRS/Université Blaise Pascal, 4, rue Ledru, 63057 Clermont-Ferrand cedex, France

The site of Rophin (Puy de Dôme, France) was used for uranium mining between 1949 and 1958. About 30 tons of uranium were extracted and 30,000 tons of wastes were stored on the ground afterwards. The aim of the study is to use oak tree rings as biomonitors of past and recent uranium contamination from mining activities in order to contribute to a better characterization of uranium transport.

Tree-ring samples were taken on six 150 years old oaks trees (*Quercus Petraea*) closely located upstream and downstream (with respect to the hydrologic system) of the site where uranium was mined and which is actually used for residue storing.

High Resolution Inductively Coupled Plasma Mass Spectrometry (HR-ICP-MS) was used to analyse the trace concentration of U within the tree-rings with both Laser Ablation (LA) and solution modes. Time resolved uranium signals were normalized to ¹³C internal standard signals and various materials were used for quantification. Two-dimensional (2D) mapping of uranium allowed to study U spatial distribution at 1mm² surface of tree rings. A strong heterogeneity was observed, with U concentration varying from 1 to 50 ppb This lead to average U concentrations with high uncertainties (40-60%). In addition, comparison with solution highlighted the limit of the LA technique. Thus, the solution mode was selected. Single annual ring was analysed for the year 1900 (i.e. before mining), 1940, 1952 and 1958 (during mining), 1990 (during the rehabilitation period) and nowadays (2010). According to the geochemical background, our findings showed an increase in concentration varying between 1 to 45 ppb for the trees located downstream of the mining site supporting U transport of the oak trees. Moreover, the results are consistent with the presence of a marked wet area located close to the trees.