

## Improvement in the understanding of mining legacy in the Pyrenees mountains using environmental archives

Adrien Claustres<sup>1,2,\*,@</sup>, Anne Probst<sup>1,2,@</sup>, François De Vleeschouwer<sup>1,2,@</sup>, Jeroen Sonke<sup>3,@</sup>, Florence Mazier<sup>4,@</sup>, Didier Galop<sup>4,@</sup>, Sandrine Baron<sup>5,@</sup>, Damien Rius<sup>4,@</sup>, Maxime Enrico<sup>3,@</sup>, Lars Heimbürger<sup>3,@</sup>, Gaël Le Roux<sup>1,2,\*,@</sup>

**1** : Université de Toulouse; INP, UPS; EcoLab (Laboratoire Ecologie Fonctionnelle et Environnement); ENSAT, Avenue de l'Agrobiopole, 31326 Castanet Tolosan, France

**2** : CNRS; EcoLab; 31326 Castanet Tolosan, France - **Website**

**3** : Géosciences Environnement Toulouse (GET) - **Website**

*CNRS : UMR5563, Observatoire Midi-Pyrénées, Université Paul Sabatier - Toulouse III, 14 avenue Edouard Belin 31400 Toulouse - France*

**4** : Géographie de l'environnement (GEODE) - **Website**

*CNRS : UMR5602, Université Toulouse le Mirail - Toulouse II, 5 Allée Antonio Machado 31058 TOULOUSE CEDEX 1 - France*

**5** : Travaux et Recherches Archéologiques sur les Cultures, les Espaces et les Sociétés (TRACES), *CNRS : UMR5608, Université Toulouse le Mirail - Toulouse II, MAISON DE LA RECHERCHE 5 Allée Antonio Machado 31058 TOULOUSE CEDEX 9 - France*

\* : Corresponding author

Pyrenees mountains have a long history of mining and metallurgical activities that could have impacted the natural biogeochemical cycles of trace metals (i.e. Pb, Hg, Ag...). Our aim is to investigate the impact of past and present human activities on metal soil contamination in the French Pyrenees. We want to decipher when, where and how the soils were contaminated by metals. We also focus our study on how the metals can accumulate specifically in mountainous ecosystems and how metal contamination can be related to other human-induced environmental changes in the past (i.e. deforestation, hydrological changes...).

For this purpose, environmental archives (peat, lakes...) have been sampled, freeze-dried, sliced and digested completely with a mixture of HNO<sub>3</sub> and HF acids. Then total trace metal content was analysed by ICP-MS. Core age-dating to reconstruct age-depth model was done with <sup>14</sup>C and <sup>210</sup>Pb. Statistical analysis, elements and elements ratios profiles were done to understand the origin of elements.

Our first results based on lake and peat records and focused on Pb contamination show a quite similar chronology during the last 5000 years along the entire Pyrenees range. Late Medieval mining activities seem to have largely contaminated Pyrenean soils (1 to 3 g m<sup>-2</sup> of Pb) and can in some area be larger than Pb contamination from the Industrial Revolution or the "leaded gasoline" era. A focus based on numerous environmental archives and proxies in a high-mountain catchment, close to Andorra, shows that chronological accumulation of metals in soils, peat and lakes are clearly related to other human impacts fingerprinted by paleoenvironmental data (pollen, charcoal). Our preliminary results show that an inventory of metals stored in mountainous soils since the beginning of metallurgy is necessary to understand possible release of these metals within the context of future environmental changes.