

## Impact of tailings on Environment: example of the weathering of schist constituting spoil tips in the North of France

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The subsoil exploitation has strong impacts on ecosystems especially through the generation of large amounts of waste which can lead to the release of potentially polluting elements into the surrounding environment. The North of France is particularly concerned because the region holds one of the largest coal mining area in the country. The inherited visible scars of this past extraction are the 339 inventoried spoil tips, mainly made of carboniferous schists and scoria. These schists come from carboniferous units located at a depth of 100 to 700 m, and were placed in contact with the atmosphere, hydrosphere and biosphere following the coal extraction. Consequently, they are subject to disintegration and weathering processes, as the first stage of element transfers. In this context, the fine characterization and the quantification of these weathering processes become essential.

For that, we performed a mineralogical and geochemical study of the schist and its alteration front, using optical microscopy, high-resolution electron microscopy (SEM, TEM on FIB sections), and X-ray diffraction (XRD). Schist samples from different spoil tips exhibit ochre alteration fronts composed by clay minerals (illite, kaolinite), jarosite and iron oxides. In fact, these fronts consist of two superimposed layers of  $\approx 10 \mu\text{m}$  thickness, one enriched in iron and made of oxides and clays, and one enriched in sulfur and iron, mixing of sometimes-well-crystallized jarosite, oxides, residual quartz and clays. Fractures crossing the schist are also filled with iron oxides, but without jarosite. This indicates that S and Fe can be easily transferred from the schist toward the environment, similarly to common acid mine drainage, but that varying conditions can influence the involved processes. Even if the formation of a jarosite-rich layer around the schist contributes to the development of an acidic neo-soil at the spoil tip surface, it can fix heavy metals and limit the element transfers.

**Mots-Clés** : tailings/spoil tips, schist weathering, sulfur, iron