Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.15596

The weathering of black shales and schists constituting spoil tips in the northern France: a conventional acidic mining drainage?

YENSINGA BAFOUNGA[1], EMILY LLORET[1], FRANCK BOURDELLE[2] AND PAULINE CLAISSE[1]

[1]Université de Lille - LGCgE

[2]CY Cergy Paris Université - GEC

Presenting Author: balikouzou.bafounga@univ-lille.fr

The subsoil of the northern France has been explored and exploited for more than 300 years for its coal reserves, generating a significant amount of mining waste (essentially Carboniferous black shales and black schists). This mining waste resulted in 339 spoil tips, of which 200 still exist. On the border between landfill site and UNESCO world heritage, these spoil tips are in supergene conditions, at the origin of their alteration and the release of chemical compounds, in the critical zone, particularly in soil and water. This alteration can lead to the oxidation of the pyrite contained in the shales, causing the release of sulphates and acidic waters potentially rich in metals. To identify and quantify the released elements, the fine characterisation of the alteration of shales is first required. To perform it, we have used a novative mineralogical and geochemical multitechnique approach (XRD, SEM, TEM on FIB sections, STXM-XANES) allowing the analysis of samples (including iron redox) at all scales, from the bulk rock to the nanophases. This study is focused on the alteration present like an ochre coating at the surface of shales and schists. This alteration surrounds the rock forming a front constituted of two micrometric layers. One of these layers is enriched in iron oxides and phyllosilicates having a preferential orientation suggesting a neoformation from dissolution and reprecipitation of rock compounds. And one, which is enriched in sulfates, oxides and jarosite. This alteration also fills the fractures through the rock, but only with iron oxides, more or less of sulfates, and without jarosite. This indicates that S and Fe can be transferred from the shale to the environment in a similar way to acid mine drainage, but changes in conditions may influence the processes involved, leading to several alteration layers with different compositions. The formation of jarosite in a part of the alteration front allows the biding of S and Fe. The external micrometric jarosite-rich layer of the alteration front can therefore potentially slow down the S-Fe transfers to the environment.