Geophysical Research Abstracts
Vol. 16, EGU2014-5295-1, 2014
EGU General Assembly 2014

The formation of technic soil in a revegetated uranium ore waste rock pile (Limousin, France)

Flora Boekhout (1), Martine Gérard (1,2), Aisha Kanzari (1), Georges Calas (1), and Michael Descostes (3)

(1) Institut de Minéralogie et de Physique des Matériaux et Cosmochimie, Université P&M Curie, Paris, France, (2) Institut de Recherche pour le Développement, Paris, France, (3) AREVA, BG Mines, R&D, Paris la Défense, France

Mining took place in France between 1945 and 2001 during which time ∼210 different sites were exploited and/or explored. A total of 76 Kt of uranium was produced, 52 Mt of ore was extracted, but also 200 Mt of waste rocks was produced, the majority of which, with uranium levels corresponding to the natural environment. So far, the processes of arenisation and technic soil formation in waste rock piles are not well understood but have important implications for understanding the environmental impact and long-term speciation of uranium. Understanding weathering processes in waste rock piles is essential to determine their environmental impact. The main objectives of this work are to assess 1) the micromorphological features and neo-formed U-bearing phases related to weathering and 2) the processes behind arenisation of the rock pile.

The site that was chosen is the Vieilles Sagnes waste rock pile in Fanay (Massif Central France) that represents more or less hydrothermally altered granitic rocks that have been exposed to weathering since the construction of the waste rock pile approximately 50 years ago. Two trenches were excavated to investigate the vertical differentiation of the rock pile. This site serves as a key location for studying weathering processes of waste rock piles, as it has not been reworked after initial construction and has therefore preserved information on the original mineralogy of the waste rock pile enabling us to access post emplacement weathering processes. The site is currently overgrown by moss, meter high ferns and small trees.

At present day the rock pile material can be described as hydrothermally altered rocks and rock fragments within a fine-grained silty clay matrix exposed to surface conditions and weathering. A sandy “paleo” technic soil underlies the waste rock pile and functions as a natural liner by adsorption of uranium on clay minerals. Post-mining weathering of rock-pile material is superimposed on pre-mining hydrothermal and possible supergene alteration. Clay minerals present are kaolinite, smectite and chlorite. The formation of these minerals is however ambiguous, and can form during both hydrothermal as weathering processes, calling for a detailed micromorphological study.

Micromorphological investigations on undisturbed samples by microscopic and ultramicroscopic techniques allow us to interpretate the processes behind the formation of technic soil in the matrix of the waste rock pile, as well as the rate and chronology of mineral formation and arenisation related to weathering (formation of protosoil and saprolitisation). By studying the formation of weathering aureaoles in between the different granitic blocks, we quantify the anthropogenic influence on weathering of this rock pile and their impacts on local ecosystem by comparing our site with natural occuring outcrops of granites currently subjected to weathering.

Electron microscope imaging and microgeochemical mapping permits us to make detailed micromorphological observations linking nanoscale processes to petrolographical macroscopic features and field observations. Different petrographic and electronic images of the mineral paragenesis in the micromass associated to their microgeochemical characteristics will be presented. Also, the impact of previous hydrothermal alteration will be highlighted.