# Insights into the uranium speciation in the mill tailings of the COMINAK mine at Akouta, Niger

A. DEJEANT[1,2,*], L. GALOISY[1], G. CALAS[1], V. PHROMMAVANH[3] AND M. DESCOSTES[3]

[1] Institut de Minéralogie et de Physique des Milieux Condensés, Université Pierre et Marie Curie, Paris, France (dejeant@impmc.upmc.fr) (*presenting author),
[2] Université Paris-Diderot, Paris, France
[3] AREVA, BG Mines, R&D, Paris la Défense

The world's largest uranium underground mine, at Akouta (Niger), has been mined for more than 40 years. About 14 million tons of mill tailings were accumulated on site. The ore beneficiation process, based on an oxidative dissolution in sulfuric acid, reaches an extraction efficiency of up to 92-96% with some U remaining in the tailings. This study aims to assess the U mobility and trapping mechanisms in mill tailings for reprocessing/rehabilitating.

The Akouta U deposit (Guezouman) occurs in continental lower Carboniferous sandstone, containing quartz and feldspar with detritical clays and organic matter. Micro-phases of pitchblende are associated with coffinite and minor U-Ti and U-Mo oxides, with an average U concentration of 4000 ppm associated with trace metals (e.g. V, Zr, Mo).

U concentration measured along a vertical profile within the 30m high tailings pile shows that U is reconcentrated at three levels: at the base, at 14.5m and in the gypsum-rich surface crust, referred to as *gypcrete*. U speciation has been investigated by scanning electron microscopy (SEM) and synchrotron-based X-ray Absorption Spectroscopy (XAS). All tailings samples contain $U^{IV}$ and $U^{VI}$ with an increase in U-oxidation state at shallower depth in the pile. Fresh tailings collected right out of the mill, before storage, are the most reduced. The presence in fresh tailings of ore-inherited $U^{VI}$-phases, identified by SEM, is in agreement with XAS analyses, showing that they mainly contain non-uranyl species. Older stored tailings where U reconcentrates contain micron-sized secondary $U^{VI}$-phases (uranyl sulfates and phosphates). This illustrates the importance of post-storage U-transport and trapping. The post-disposal dissolution of residual pitchblende/coffinite is a source of mobile U. However, further precipitation of secondary U-phases and efficient U sorption on Fe oxides and clays limit the extent of U migration within the tailings.

# Mediterranean Sapropel S1: Synchronous basin-wide Preservation versus Productivity Signals

GERT J. DE LANGE*[1], C. SLOMP[1], C. CORSELLI[2], ELISABETTA ERBA[3], J. THOMSON[4] AND A. REITZ[5]

[1]Geosciences-Utrecht, NL; gdelange@geo.uu.nl
[2]University bicocca Milano, IT
[3]Universita degli Studi di Milano, IT
[4]Southampton, UK
[5] Geomar-Kiel, DE

Formation of the most-recent eastern Mediterranean S1 sapropel occurred from ~ 11 - 5 kyr 14C ago. The timing of deposition of all such distinct, organic-rich units (sapropels), is precession-related and associated with humid climate conditions. The last of such 'humid periods', simultaneous with a sustained circum-Mediterranean wet period including a vegetated Sahara. The end of this period coincides with a high manganese-oxide peak in all 30 studied cores and concurs with an abrupt re-ventilation event at 5.7 kyr for the deep-water.

We demonstrate that the most recent sapropel (S1) formed synchronously between 9.8 and 5.7 14C ky BP at all water depths greater than a few hundred metres. As a consequence of increased fresh water (monsoon) input, surface waters had a reduced salinity and concomitantly the deep (> 1.8 km) eastern Mediterranean Sea was devoid of oxygen during 4,000 years of S1 formation (De Lange ea., 2008). This has resulted in a differential basin-wide preservation of S1 determined by water depth, as a result of different ventilation/climate-related redox conditions above and below 1.8 km. Climate-induced stratification of the ocean may thus contribute to enhanced preservation of organic matter, i.e. formation of sapropels (and potentially black shales).

De Lange G.J., Thomson J., Reitz A., Slomp C.P., Principato M.S., Erba E., and Corselli C. (2008) Synchronous basin-wide formation and redox-controlled preservation of a Mediterranean sapropel. Nature Geo 1, 606-610.

www.minersoc.org
DOI: 10.1180/minmag.2013.077.5.4