Oxidative weathering of black shale: A long-term humidity cell test

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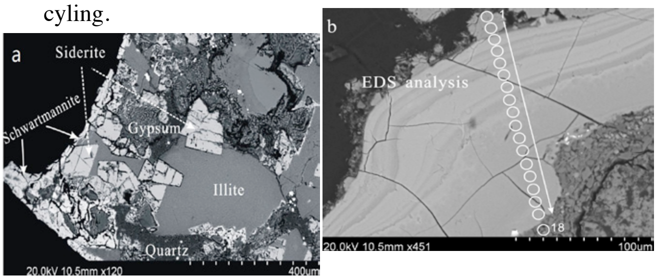
Weathering of black shale is of large envionmental interest, and is characterized by oxidation of sulfide minerals (mainly pyrite) and organic matter [1]. When oxidized large amount of trace elements could be liberated and subsequently transferred into the broader environment. Here we present a long-term humidity cell test of non-weathered black shale (NBS) and weathered black shale (WBS). The NBS and WBS was leached for 137 (66 leaching cycles) and 53 weeks (40 leaching cycles), respectively.

BET surface area of NBS increased by 26 %, which is mainly contributed by euhedral pits caused by the oxidation of pyrite embedded in the illite matrix (Fig. 1a). XRD analyses confirmed that the amount of pyrite decreased from ~4.3% to 2.8% during the experiment. As a result, large proportions (27% to 61%) of Co, Ni, Cd, Zn, Mn, U and Cu have been leached from NBS, whereas the proportions leached of As, Cr, Ba, Pb and V were lower than 2.3%. Major cations Fe and Al in NBS leachates showed significant correlation with S after cycle 32 at pH 5.5, implying that their behaviours were controlled by common sulphate minerals thereafter. The pore-rich grains of leached NBS, structured by a silicate matrix (illite and quartz) resistant to the oxidative weathering, were characterized by abundant precipitation of siderite and/or gypsum within pores and schwertmannite coating onto their surface (Fig. 1a). Three types of encrustations were identified in both leached NBS and WBS: schwertmannite with minor amount of Fe^{3+} phosphate (Fig. 1b), Fe^{3+} phosphate and apatite. These encrustations have strong affinity for trace elements occurred as negative charged aqueous species (e.g $H_2AsSO_4^-$), providing potential filters for natural trace element cyling.



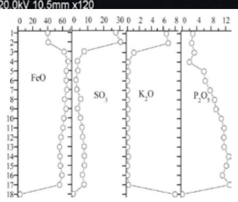


Figure 1 BSE image of Leached NBS grain (a) and encrustation profile with EDS analysis of major oxides wt % (b)

[1] Lavergren *et al*. (2009) *Appl Geochem* **24**, 59–369.

Assessing impact of aerosol intercontinental transport on regional air quality and climate: What satellites can help

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Mounting evidence for intercontinental transport of aerosols suggests that aerosols from a region could significantly affect climate and air quality in downwind regions and continents. Current assessment of these impacts for the most part has been based on global model simulations that show large variability. The aerosol intercontinental transport and its influence on air quality and climate involve many processes at local, regional, and intercontinental scales. There is a pressing need to establish modeling systems that bridge the wide range of scales. The modeling systems need to be evaluated and constrained by observations, including satellite measurements. Columnar loadings of dust and combustion aerosols can be derived from the MODIS and MISR measurements of total aerosol optical depth and particle size and shape information. Characteristic transport heights of dust and combustion aerosols can be determined from the CALIPSO lidar and AIRS measurements. CALIPSO lidar and OMI UV technique also have a unique capability of detecting aerosols above clouds, which could offer some insights into aerosol lofting processes and the importance of above-cloud transport pathway. In this presentation, I will discuss our efforts of integrating these satellite measurements and models to assess the significance of intercontinental transport of dust and combustion aerosols on regional air quality and climate.