# Partitioning and mobility of trace elements in brine impacted fly ash residues

O.O. FATOBA[1*], L.F. PETRIK[1], R.O. AKINYEYE[1] AND W.M. GITARI[2]

[1]Environmnetal and Nano sciences Resaerch Group, Chemistry Department, University of the Western Cape, Private Bag X17, Bellville, 7535, South Africa. (*Correspondence: ofatoba@uwc.ac.za)

[2]Department of Ecology and Resourses Management, University of Venda, Thohoyandou, Limpopo, South Africa

Fly ash and brine are waste materials generated from the combustion of coal and wastewater treatment respectively. Apart from the major elements, these waste materials contain trace elements such as As, Zn, Cu, Pb, Mo and Cr. The need to safely dispose fly ash and brine, in order to avoid contaminating the surrounding soils and groundwater, has led to the co-disposal of fly ash and brine by some power utilities in South Africa. Chemical speciation reveals the availability and mobility of metals in solid materials in order to understand their chemical behaviour and fate [1]. To evaluate the availability and mobility of metals from solid materials such as fly ash, some extraction tests such as sequential chemical extraction have often been applied. This study aims at determining the partitioning of the trace elements and their mobility in the brine impacted fly ash residue. The brine impacted fly ash residue was exposed to sequential chemical extractions [2]. The filtrates from each of the sequential extraction steps were analysed for trace elements using ICP-MS. The results of the tests showed that trace elements were partitioned into different physicochemical forms in the residue. Apart from the bulk of the Co, Cu, Ni, Pb and Zn that are contained in the residual fraction, high concentrations of these elements in the carbonate fraction showed their existence as co-precipitates with carbonate minerals which are not easily mobile under natural environmental conditions except when the pH is very low.

[1] Kalembkiewicz et al., (2008) *Microchemical Journal* **90**, 37-43.
[2] Nurmesniemi et al., (2008) *Waste Management and Research* **26**, 389-399.

# Geochemical investigations of fjord surface sediments as basis for Holocence climate change studies in the Trondheimsfjord area

JOHAN C. FAUST[1*], JOCHEN KNIES[1], JACQUES GIRAUDEAU[2] AND GESA MILZER[2]

[1]Geological Survey of Norway, Trondheim, Norway, Johan.Faust@ngu.no (* presenting author), Jochen.Knies@ngu.no

[2]EPOC, University of Bordeaux - CNRS, Talence, France, j.giraudeau@epoc.u-bordeaux1.fr, g.milzer@epoc.u-bordeaux1.fr

High sedimentation rates in fjords provide excellent possibilities for high resolution sedimentary and geochemical records over the Holocene. To increase the understanding of these records the aim of this study is to investigate (a) recent factors controlling the inorganic/organic geochemistry of surface sediments, (b) to identify geochemical proxies for terrestrial input/river discharge and (C) compare these findings with Holocence records from three sediment cores.

In April 2011 sixty evenly distributed surface sediment samples were collected around the entire Trondheimsfjord, one of the largest fjords in Norway. All samples were analysed with regard to elemental composition, total organic carbon (TOC) and total nitrogen content (N), organic and inorganic carbon and nitrogen stable isotopes ($\delta^{13}C$, $\delta^{15}N$), bulk mineral composition and grain size distribution.

The TOC:N ratio of all samples varies between 8 and 16. However, excluding 7 samples collected in river deltas the ratio decreases to 8-10 corresponding to a high correlation between TOC and N ($r^2$=0.95) indicating a marine source. The fraction of $CaCO_3$ decreases gradually from 24% at the entrance to 1.4% at the inner fjord. The ratios of Fe/Al, Zr/Al and Sr/Ca show the opposite pattern. They are highest at river deltas and at the inner part of the fjord. Anthropogenic influences are identified by elevated heavy metal concentrations around Trondheim and heavy industries near the city of Orkdal in the south. The highest amount of total nitrogen (0.21%) and TOC (1.87%) are found at the fjord entrance in the Stjørnfjord. We assume that the TOC and N values are high in the Stjørnfjord due to a local upwelling. The Atlantic water entering the fjord is topographically steered towards the surface and induces an area of high primary production.

Our findings show that three main factors control the elemental distribution in Trondheimsfjord surface sediments: the inflow of ocean waters, the inflow of river waters and anthropogenic contributions. Therefore, we propose that Trondheimsfjord sediments provide an excellent geochemical record reflecting the intensity of river discharge and the impact of the North Atlantic Current on local climate and environmental changes since the last deglaciation. The application of these findings to Holocence sequences will provide insights into climate vulnerability of the Trondheimsfjord region.