Geochemical investigations of fjord sediments reveal Zr, Ni and Ca as NAO proxies in central Norway

JOHAN C. FAUST[1,2*], JOCHEN KNIES[1], KARL FABIAN[1], ALBA N. RODRIGUEZ[3], MICHAEL BLASCHEK[4], GESA MILZER[5] AND JACQUES GIRAUDEAU[5]

[1]Geological Survey of Norway, 7491 Trondheim, Norway, (*correspondence: Johan.Faust@ngu.no)
[2]University of Tromsø, Department of Geology, 9011 Tromsø, Norway
[3]Plymouth University, Plymouth, UK
[4]VU Amsterdam, Climate Change and Landscape Dynamics, Amsterdam, Netherlands
[5]EPOC, University of Bordeaux - CNRS, Talence, France,

Sediments accumulating in fjords offer an excellent opportunity for studying land-ocean interactions and can provide high-resolution records of local responses to short-term variability in the Earth's climate. In order to increase the understanding of these records we previously investigated the inorganic/organic geochemistry of sixty surface sediment samples from the Trondheimsfjord in central Norway. By comparing our results with analyses of terrigenous sediments and bedrocks from the Trondheimsfjord drainage area we identified Zr/Al, Ni/Al and $CaCO_3$ as potential proxies for terrestrial input/river discharge.

Instrumental data reveal that the climate in central Norway is mainly driven by the North Atlantic current and the North Atlantic Oscillation (NAO). The aim of this study is to evaluate the applicability of Zr, Ni and Ca as proxies for changes in temperature, precipitation and NAO by comparing geochemical records with instrumental and modelling data of the last sixty years and apply these findings to Holocene sequences. For this purpose we analysed two multicores and three gravity cores from the Trondheimsfjord for their elemental composition, total organic carbon (C_{org}), nitrogen (N_{org}) and organic carbon stable isotopes ($\delta^{13}C_{org}$), grain size distribution and biomarkers. First results show that the instrumental and geochemical records coincide, confirming that Trondheimsfjord sediments provide an excellent geochemical record reflecting the intensity of river discharge and the impact of the NAO. Moreover, we found a continuous climate/weathering signal for at least the last 3000 years. Ongoing statistical verification of the connection between instrumental and sediment records will help to provide a high resolution record of Holocene climate variability in the Trondheimsfjord region.

Distribution of heavy metals and arsenic in soils of an abandoned lead mine (Central Portugal)

PAULO J.C. FAVAS[1,4*], JOÃO PRATAS[2,4], ROHAN D'SOUZA[3], MAYANK VARUN[3] AND MANOJ S. PAUL[3]

[1]Department of Geology, University of Trás-os-Montes e Alto Douro, 5001-801 Vila Real, Portugal; * (correspondence: pjcf@utad.pt)
[2]Department of Earth Sciences, University of Coimbra, 3001-401 Coimbra, Portugal
[3]Department of Botany, St. John's College, Agra 282 002, India
[4]IMAR-CMA Marine and Environmental Research Centre, University of Coimbra

The present study aims to assess contamination and distribution of heavy metals in soil around an abandoned Pb mine in Central Portugal (Barbadalhos mine also known as the Zorro mine). This mine was exploited for Pb by underground mining from 1887 till the 1940s. The mineralogy consists mainly of argentiferous galena and sphalerite (and chalcopyrite and arsenopyrite in small amounts). Samples were collected from two line transects. Line transect 1 is perpendicular to the mineralized veins. Line transect 2 is in nearby nonmineralized zone. Soil samples were collected at 20 m intervals along the line transects. Atomic absorption spectrophotometry was used after acid digestion to determine Fe, Mn, Cu, Zn, Pb, Ni, Co, Cr and Ag concentrations in the soils. To determine As content, a hydride generation system (HGS) linked to an atomic absorption device was used. Metal concentrations in soil ranged from (in mg/kg): 98-9330 (Pb), 110–517 (Zn), 7.1-50 (Co), 69-123 (Cr), 31-193 (Cu), 33400-98500 (Fe), 7.7-51 (Ni), 0.95-13 (Ag), 2.8-208 (As), and 71-2220 (Mn) along LT1; and 24-93 (Pb), 30-162 (Zn), 3.7-34 (Co), 61-196 (Cr), 21-46 (Cu), 24100-59400 (Fe), 17-87 (Ni), 0.71-1.9 (Ag), 4.3-12 (As), and 44-1800 (Mn) along LT2. Mean Pb and As concentrations were nearly 9 and 2 times the threshold for industrial soils suggested by Canadian Environmental Quality Guidelines. One way ANOVA indicated a statistically significant difference in mean content of Pb, Zn, Cu (P<0.001) and Ag, As, Co, Fe and Mn (P<0.05) in soil samples from the two transects. Similar distribution of Cr and Ni along the two transects indicates a non-localized distribution of the metals not limited to the mineralized veins of the region. This was confirmed by one way ANOVA where no significant difference (P<0.05) was observed in mean Cr and Ni content of the soil samples.

www.minersoc.org
DOI:10.1180/minmag.2013.077.5.6