Pilot-scale barrier system for removal of nitrate in mine drainage

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Undetonated ammonium nitrate is readily soluble in water and quickly enters into the mine water and process water at a mine site. In order to investigate the application of nitrate removal by denitrification in the cold climate of northern Sweden, a pilot-scale barrier system was constructed of sheet metal in autumn 2009 at the Malmberget iron ore mine. The barrier (9m x 2m x 1.5m) appears as an open basin with three inner dividing walls, and is filled with a reactive mixture consisting of crushed rock, sawdust, and sewage sludge. Water flows through the barrier at ca. 0.45 m^3/hour.

The chemical analyses of water flowing into and out of the barrier during 2010 indicate that the degree of nitrate removal generally lay in the range between 11 and 77% of influent nitrate concentrations. Stable isotope analyses of $\delta^{15}N$ and $\delta^{18}O$ in nitrate demonstrate an enrichment in ^{15}N and ^{18}O in nitrate as water flows through the barrier, supporting the conclusion that denitrification is responsible for nitrate removal. Ammonium concentrations in the barrier effluents are initially high, but these high levels are subsequently flushed from the barrier.

In order to increase the degree of nitrate removal by denitrification in the barrier, a reactive carbon source needs to be added to the influent waters; this will be tested during the 2011 field season.

Temporal variations in Galápagos plume-ridge interaction at the Cocos-Nazca spreading center

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The major goals of cruise SO208 with the German research vessel Sonne were to investigate 1) plume-ridge interaction through time at the Cocos-Nazca spreading center (CNS) north of the Galápagos Islands by sampling across axis profiles of the seafloor and 2) off axis volcanism at the East Pacific Rise (EPR) versus far field effects of the Galápagos hotspot documented in seamounts off the coast of N Costa Rica and Nicaragua. Overall the nature of material transfer from the plume to the ridge and its large scale distribution throughout the Eastern Pacific is beeing investigated by means of major and trace element and Sr-Nd-Pb (double spike) isotope data.

The seamounts on the EPR generated part of the Cocos plate appear to originate on one hand from a depleted MORB-like source consistent with their formation near the EPR axis, while other seamounts formed through lower degrees melting of an enriched OIB source either more distant from the EPR or by intraplate volcanism. Geochemical profiles across the Western and Eastern CNS indicate the participation of two different Galápagos plume components with a change in the amount this material entering the CNS with time. While at the western profile element ratios of more to less incompatible elements show an overall decrease of a plume component, Wolf-Darwin or Northern domain [1], with increasing age, the opposite is observed at the eastern profile. The Central domain component [1] increases with increasing age of the crust in this area. These observations indicate variable flux of specific Galápagos plume components to the CNS over the past 800 000 years. Sr-Nd-Pb isotope data to verify these observations are currently being generated and will be presented at the conference.

[1] Hoernle *et al*. (2000) *Geology* **28**, 435–438