Solute exchange across the sediment water interface in an acidic pit lake

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Solute exchange across the sediment-water interface affects the water quality in mining pit lakes. Fluxes are supposed to be affected by advective groundwater flow. However, benthic solute fluxes in such lakes have mostly been determined by sediment core incubations in the laboratory or by calculation from pore water profiles.

In the present study direct solute flux measurements were carried out *in situ* in acidic Mining Lake 111 in the Lausitz lignite mining area, Germany. Three sites were chosen to represent A) groundwater inflow conditions B) the lake profundal and C) a reference littoral site. A volume of lake water and the sediment below were enclosed using an opaque benthic flux chamber. Oxygen decrease in the chamber was directly measured using an optode, whereas parameters such as total inorganic carbon (TIC) and dissolved Fe^{2+} were analyzed in a series of water samples withdrawn from the chamber.

Sites B and C showed oxygen consumption rates between 5 and 15 mmol m^{-2} d^{-1} while oxygen loss from the chamber at site A equaled rates between 19 and 35 mmol m^{-2} d^{-1}. TIC fluxes from the sediment varied closely around 5 mmol $m^{-2}d^{-1}$ at sites B and C, but reached up to 100 mmol $m^{-2}d^{-1}$ at site A. Further a distinct increase of ferrous iron in the chamber was detected only at site A, i.e. in the groundwater inflow area.

Our results reveal significant differences in benthic solute fluxes depending on groundwater inflow and setting in the lake. The groundwater inflow area is characterized by high oxygen consumption and high inflow of TIC and dissolved iron. To our knowledge these are the first measurements of this kind, providing valuable practical experience for the use of benthic flux chambers in pit lake research.

FTIR water observation in minerals from diamond inclusions and matrix of diamondiferous eclogite

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The series of recent observations have recovered that nominally anhydrous minerals (NAM) in the Earth's mantle may contain significant amount of water. There are some evidences that water plays an important role in diamond formation. Here we present the first data on water content in clinopyroxenes (Cpx) in the matrix and diamond inclusions (DI) from diamondiferous eclogite xenolith from Udachnaya kimberlite pipe (Yakutia, Russia, description in [1]). The water content has been estimated from unpolarized FTIR spectra of slices of the rock and polished plates of diamonds with DI. Spectra from individual DI have been obtained by subtraction to diamond absorption in the point near inclusions. The thickness of rock slices was measured by micrometer and thickness of inclusions was determined by up and bottom focusing under microscope with reference to refractive index.

The strong band at 3450 cm^{-1} and two weaker bands at 3620 and 3740 cm^{-1} are observed in FTIR spectra of Cpx from the matrix of eclogite. Most Cpx inclusions in diamonds show single absorption band at 3450 cm^{-1} and only one inclusion has additional band with the maximum at 3600 cm^{-1} (may be attributed to OH band in chlorite [2]). Water content in Cpx has been estimated by using calibrations from [3]. Water concentrations are 60-90 ppm in Cpx from the matrix and 80-150 ppm in Cpx from diamond inclusions. Neither Grt DI nor Grt from the matrix do not show any water absorption in their FTIR spectra.

Specific results of this study are: (i) the major phase containing water in the eclogite is Cpx; (ii) water content in the matrix and DI from eclogite is not significantly different. It may testify that water content in eclogite did not change during period between diamond formation and ascent of xenolith to the surface by kimberlite magma.

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References

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