Sulfur isotopes as indicators of microbial sulphate reduction in Cu-Zn mine tailings

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Introduction

An attempt was made in the present work to study microbial sulphate reduction by sulphate reducing bacteria (SRB) in Cu-Zn mine tailings with the help of isotopic composition of reduced solid-phase sulfides, and quantify the *in situ* rates of sulfate reduction in different time periods of the year.

Materials and Methods

Mine tailings were collected from an abandoned Cu-Zn mines at Calumet Island, Quebec, Canada over 12 months (summer, fall, winter and spring) in 2002-2003. Sulfate reduction rates (SRR) were determined using the ^{35}S radiotracer injection technique (Kostka et al., 2001). Mine tailings were extracted for acid volatile sulphide (AVS) and chromium reducible sulfides (CRS) and their isotopic compositions ($\delta^{34}S$) were determined with a continuous flow isotopic ratio mass spectrometer. Mineralogy, porewater sulphate concentrations, and solid phase sulphide concentrations were also determined.

Results and Discussion

We found that $\delta^{34}S$ of AVS and CRS fractions were typically low and negative at the oxic-anoxic interface and at depths where SRB were present and possibly active. These results were also in agreement with dissolved porewater sulphate and solid phase sulphide concentrations. The SRR values indicated that SRB populations were active throughout the year, even in the winter (temp.= -12°C) when the tailings were covered under a thick pile of snow.

Conclusion

The present study indicates that the isotopic composition of reduced inorganic sulfides in conjunction with sulfate reduction rates can be used as bioindicators to delineate microenvironments of sulfate reduction by SRB within mine tailings.

References

Kostka J.E., Gribsholt B., Petrie E., Dalton D., Skelton H. and Kristensen E., (2002), Limnol. Oceanogr. 47. 230-240.

Global dust transport over the oceans: The link to climate

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Dust plumes are the most prominent, persistent, and widespread aerosol features visible in satellite images over the oceans. To the extent that dust plays a role in ocean biogeochemistry, the impact could change substantially in response to climate change. Therefore it is important that we gain an understanding of the relationship between dust transport and climate so as to better understand the past variability of dust impacts on the oceans and to anticipate future changes. To this end I report on the long term record of dust measurements at ocean stations focusing mostly on the results from two stations – Barbados, West Indies (13°10’N, 59°30’W), and Midway (28º13’N, 177º22’W).

The Barbados record, which begins in 1965, shows large interannual variations in dust concentration that are highly correlated with rainfall deficits in North Africa (and also to the North Atlantic Oscillation and El Nino events). Based on long term rainfall records in Africa, it appears that dust transport out of Africa over the past 30 years was highly anomalous. Thus, we must interpret with caution the recent studies of the impact dust on the Atlantic and Indian Oceans.

The Midway record shows no major dust trends but there are periods of increased dustiness that appear to be linked to sporadic drought in Asia. The impact is limited to a few spectacular dust events rather than a persistent increase in dust transport. Nonetheless Asian dust outbreaks can impact huge areas, even North America and the western Atlantic.

The variability in dust transport since over the past decades demonstrates the extraordinary sensitivity of dust mobilization to changes in regional climate and highlights the need to understand how dust, in turn, might affect climate processes on larger scales.