

## Dissolved trace metal speciation in an English lake with a seasonal anoxic hypolimnion: Esthwaite Water

E. P. Achterberg

University of Plymouth, Department of Environmental Sciences,  
Plymouth, PL4 8AA, UK

The chemical speciation of Cu, Ni, and Cr, and the dissolved and unfiltered concentrations of Mo, Ti, Co, Fe, Mn and Zn, were determined in the water column of a lake with a seasonally anoxic hypolimnion (Esthwaite Water, Cumbria, UK) during 3 surveys in the summer of 1991. Cathodic stripping voltammetry (CSV) with ligand competition was used for this speciation study. The metal

data, in conjunction with physical and nutrient data, were used to assess the biogeochemical processes controlling the distribution and speciation of the trace metals in the lake and their seasonal variation. Thermodynamic calculations were used to assess the dissolved trace metal speciation and the saturation state of metal-sulphide phases.

The development of anoxia in the lake had an

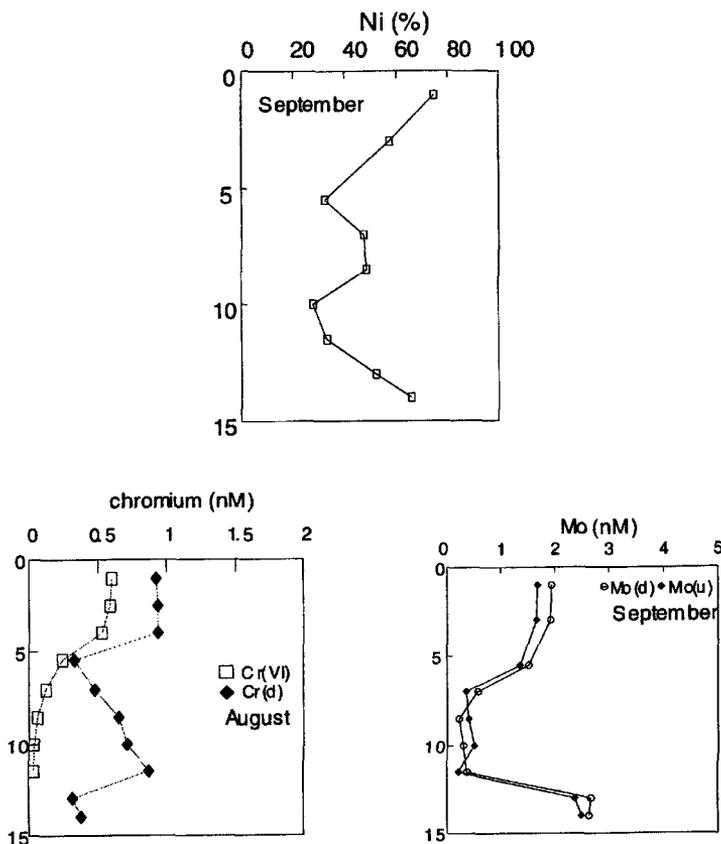


FIG. 1. Depth profiles of Ni fraction complexed by organic substances, dissolved Cr fractions, and dissolved and total Mo in Esthwaite Water during hypolimnetic summer anoxia.

important influence on the redox speciation of dissolved Cr, with Cr(III) forming the major Cr species under anoxic conditions. Co showed enhanced concentrations in the hypolimnion during anoxia, coinciding with enhanced Fe and Mn levels. Dissolved Cu, Ni and Zn concentrations in the hypolimnion decreased during anoxia, which could possibly be explained by particle scavenging (Fe sulphides) and a decline in hypolimnetic supply as the season develops. Regeneration processes of sunken organic detritus on the sediment-water interface were the most likely causes for enhanced hypolimnetic concentrations of Ni, Cu and Zn, during periods when the lake was completely oxic.

Substantial organic Ni and Cu complexation was observed in Esthwaite Water, which was attributed to the eutrophic character of the lake. Between 25–80% of the dissolved Ni in Esthwaite Water was strongly

complexed by natural ligands. The highest proportions of Ni complexation were observed in the epilimnion and hypolimnion, with a minimum in the thermocline. Strong Cu complexing ligands were observed in the lake, with dissolved ligand concentrations between 6.8–29.4 nM and conditional stability constants between  $10^{11.1}$  and  $10^{14.4}$ . More than 94% of the dissolved Cu in Esthwaite Water was complexed by the natural ligands.

### References

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