Sedimentation and mineralisation of organic carbon, nitrogen and phosphorus in a large humic lake, northern Sweden

Anders Jonsson and Mats Jansson

Umeå University

With 8 figures and 4 tables in the text

Abstract: Lake Örträsket is a large (7.3 km²) and deep (64 m) humic (DOC 10 mg·L⁻¹) lake in northern Sweden. Sediment trap data (gross sedimentation) and sediment core data (net sedimentation) has been used to calculate sedimentation and mineralisation of carbon, nitrogen, phosphorus, iron, aluminium and total particulate matter (TPM). Yearly gross sedimentation of nitrogen and organic carbon was higher than yearly net sedimentation caused by an annual sediment mineralisation of 54% and 32% of gross sedimentation, respectively. Annual gross sedimentation of phosphorus, iron, aluminium and TPM equaled annual net sedimentation and no significant sediment mineralisation of these elements was calculated. The annual retention (input-output) of organic carbon and nitrogen approximately equaled net sedimentation. Sediment mineralisation of nitrogen resulted in an accumulation of nitrate in the water column of the lake during periods of lake stratification. Approximately 2/3 of the nitrogen mineralised in and lost from the sediment was transported out of the lake (as nitrate) via the outlet during turnover in spring and autumn. Remaining 1/3 was assumed to be lost through sediment denitrification, equalling a denitrification rate of about 1 mgN·m⁻²·y⁻¹.

Introduction

Humic lakes in the northern boreal zone are characterised by a high input of allochthonous organic carbon. Humic material renders lake water slightly acidic, and tends to form complexes with metals, e.g., iron and aluminium (TIPPING 1986). Humic matter also affects nutrient availability by forming complexes with phosphorus and iron (De Haan & Boer 1986, Jones et al. 1988, Heikkilänen 1990). The colloidal properties of humic acids prevent such complexes from sedimentation. Nitrogen, that together with phosphorus go-