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## THE SULPHUR CONCENTRATION OF PEAT IN SUPHATE BEARING AREAS - CASE KRUUNUPYY, FINLAND

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### SUMMARY

Especially high sulphur concentrations are found in Kruunupyy municipality, where 722 assays of sulphur concentration of peat have been made. The mean sulphur concentration of peat was 0.45%. In Kruunupyy the sulphur concentrations are remarkable high; five of all samples have the sulphur concentration of over 10%, 8 over 5%, 54 over 1% and 134 over 0.5%. Three of ten highest concentrations of sulphur in peat in Finland analysed by GTK were found in Stormossen-Lanjärvmossen in the village of Kolam. The highest mean values (> 0.50%) per sampling point are represented as numerical values on the map (Fig.1). The highest mean sulphur concentration is found in the peat of Stormossen-Lanjärvmossen (6.38%). High mean sulphur concentrations per mire were also in the peats Högmossen 6.13%, Fräknesmossen 1.87% and Kalvhagakärret 1.52%. All these high values seem to relate to the strong black schist zones, within few kilometers radius, and also the vulkanites, which often exist in context with black schists. Also the sulphide soil affects a lot to the sulphur concentrations of peat.

**KEYWORDS:** Peat, sulphur, black schist, sulphide clay and silt, Kruunupyy

### INTRODUCTION

The sulphur concentration in sulphate bearing areas varies a lot. The highest regional sulphur concentrations were found in the areas near black schists, particularly in Northern Karelia and Ostrobothnia (Herranen, 2009). The high sulphur concentrations in Ostrobothnia, such as in the Kruunupyy (Fig. 1) and Kiiminki areas relate partly to the common sulphide clay and silt in the region and partly to the black schists in the vicinity.

### **Aim and methods**

The aim of this study, conducted between 2011 and 2012, was to determine the mean sulphur concentration of peat in a municipality in sulphate land area of Ostrobothnia. Kruunupyy was selected because of its especially high sulphur concentrations. In addition, the study examined the

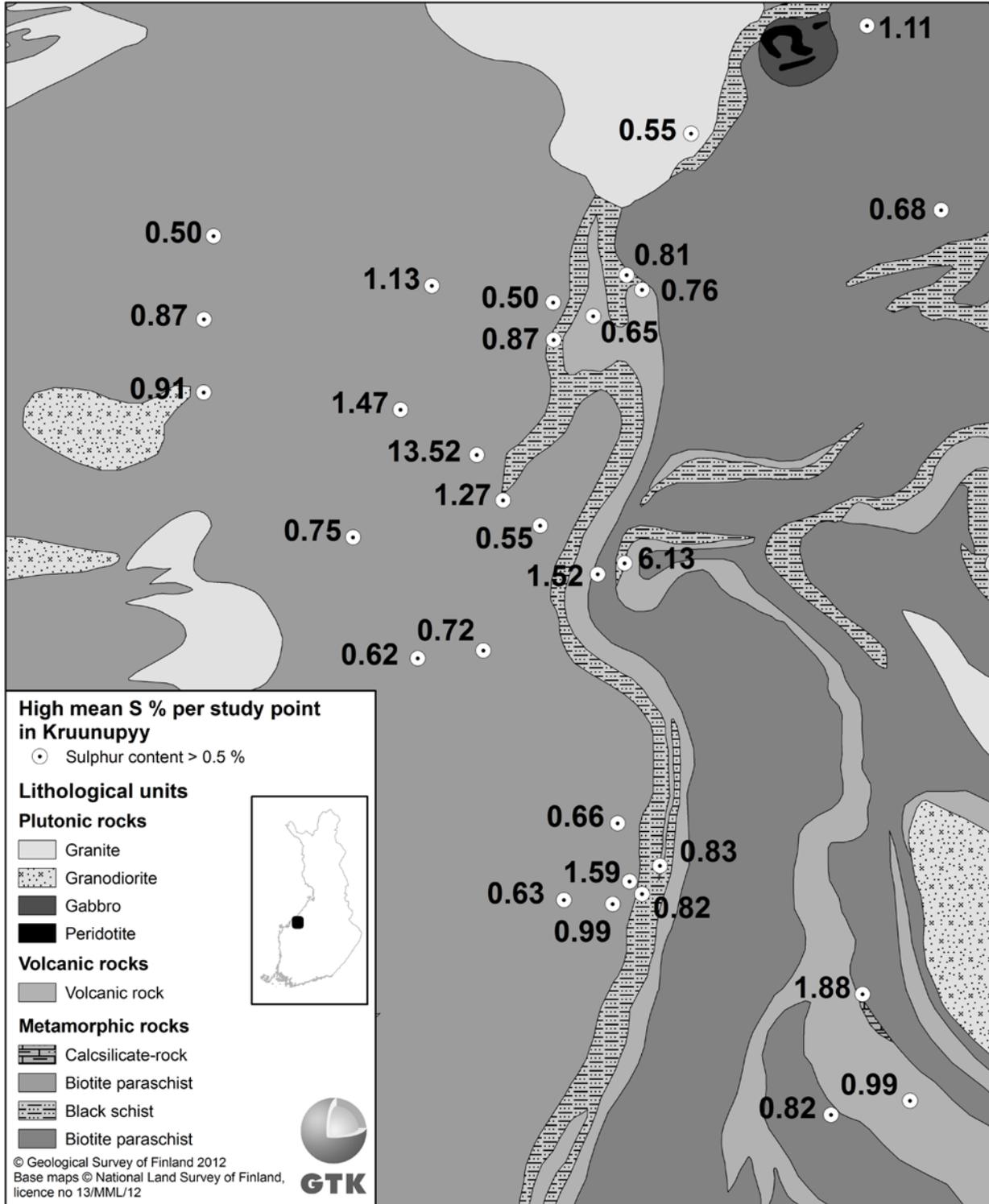


Fig. 1. The highest mean sulphur concentrations per sampling point in the municipality of Kruunupyy with respect to bedrock geology. Bedrock geology is from Bedrock of Finland (Geological Survey of Finland, www-document). The areas of black schists are situated according to Arkimaa *et al.*, 2000.

regional distribution of sulphur concentration, sulphur concentration per mire and in the various parts of the peat stratum. The influence of mire type, drainage, huminosity, subsoil, bedrock and peat type to the sulphur concentration of peat were also analysed.

Statistical analyses and graphic presentation are made with SPSS statistical programme (Milton & Arnold 1986).

### **The distribution of sulphur concentration**

80.7% of the sulphur samples taken from peat layed within a concentration interval of 0.04–0.48%. Ten percent of samples had the sulphur concentration 0.87% or higher and 5% the concentration 1.33 or higher. 72.5% percent of samples had the value 0.30% or lower (Fig. 2). The dispersion of sulphur concentration in peat was higher than in samples of the whole country.

### **The effect of subsoil to sulphur concentration**

The highest mean concentration of sulphur (1.34%) is found from peats accumulated on moraine. The remarkably high concentration of sulphur results mainly from the influence of black schists. Above the mean value of the bottom peat layer (0.75%) are also silt (1.04%), muddy silt (0.82%) and sulphite silt (0.79%). Sulphide silt has the clearly highest median (0.82%). The high values of peats accumulated on silty subsoil results partly from the influence of black schists and partly from the influence of sulphide bearing subsoil.

### **The effect of peat type to sulphur concentration**

The clearly highest mean concentration of sulphur is found in *Sphagnum-Carex* peat containing *Phragmites australis* (PRSC) (8.11%). That peat has also the clearly biggest standard deviation value (8.95). *Sphagnum-Carex* peat containing wood remains (LSC) had also high sulphur concentration (1.51%) and big standard deviation value (2.29). The corresponding values for *Carex-Sphagnum* peat containing wood remains (LCS) are 1.21% and 2.77. These peats had also the clearly highest individual sulphur concentrations: LCS (21.36%), PRSC (12.15%) and LSC (10.71%) PRSC had the highest median (6.65%) and also the clearly biggest interquartile range (IQR) (Fig. 3). All samples are included to calculation.

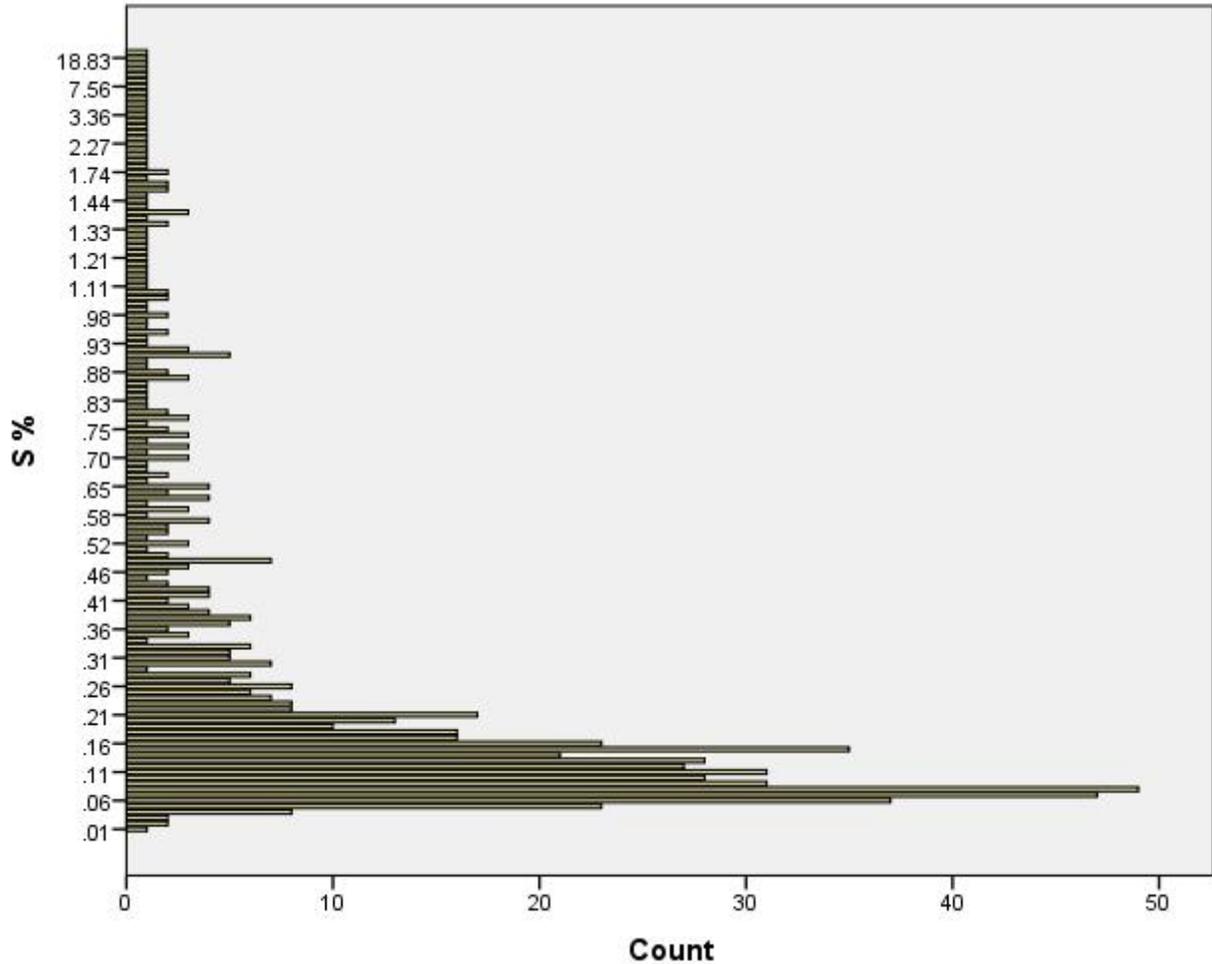


Fig. 2. The distribution of the sulphur concentration (N = 722).

### The effect of huminosity to sulphur concentration

The mean sulphur concentration of the main peat types in different decomposition degrees shows, that the lowest values relate to the weakly decomposed sphagnum-peats and the highest values to the highly decomposed Sphagnum-dominated peats as well as all Carex- and Bryales-dominated peats. The lowest mean sulphur concentrations were found in the weakly decomposed *Palustria-Acutifolia* (0.08%) and *Cuspidata* (0.09%) type *Sphagnum* peats. The highest mean sulphur concentration was found from *Sphagnum-Carex* peats (1.10%). *Carex*-peats (0.64%) and *Carex-Sphagnum* (0.53%) peats had also high mean values. The lowest mean concentrations of sulphur were found in peats with decomposition degrees H<sub>2-4</sub> (0.10–0.31%) and the highest mean values in peats with decomposition degrees H<sub>6-9</sub> (0.50–0.79%).

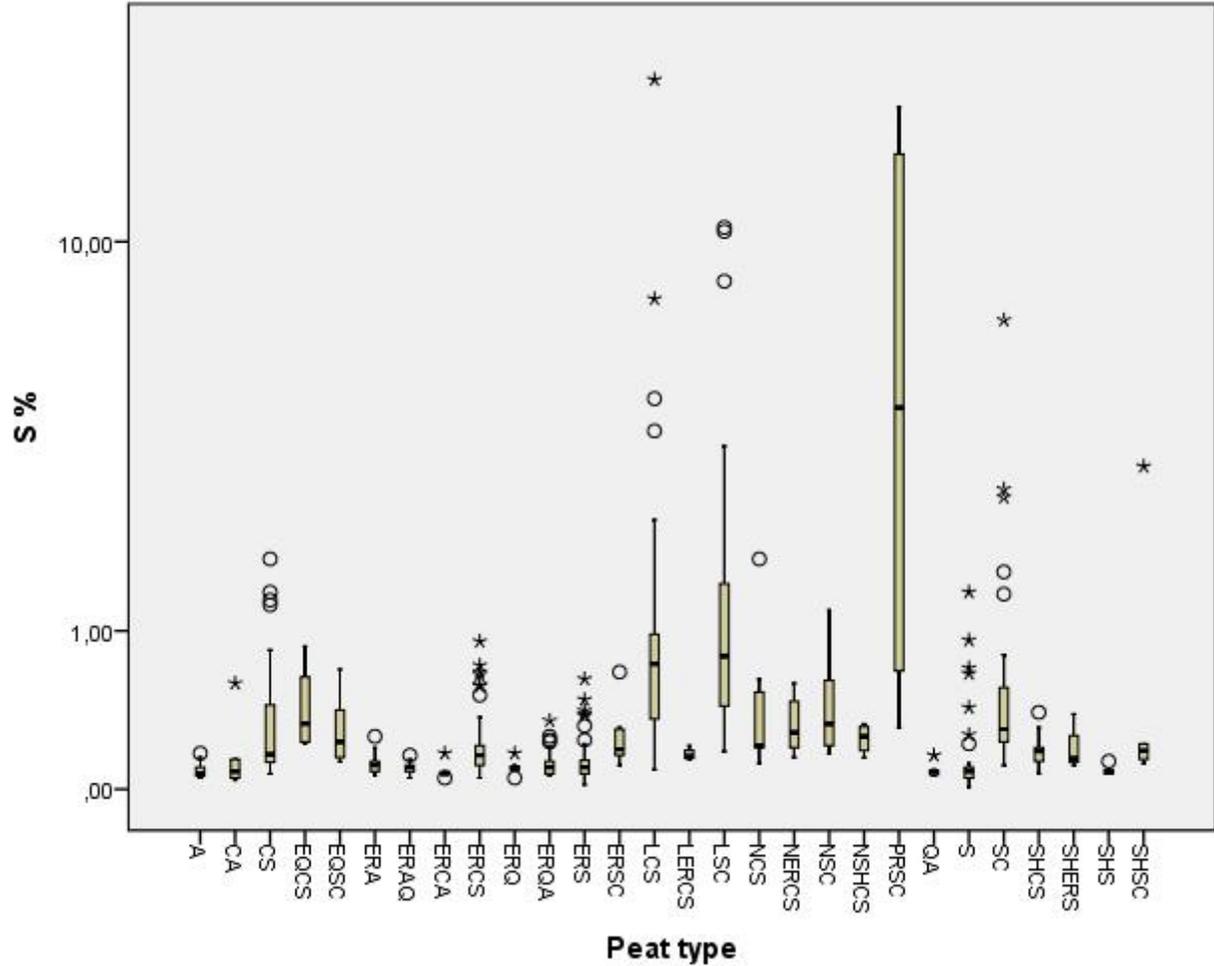


Fig. 3. The variation of sulphur concentration of peat types (N = 722). The uncommon peat types are excluded from boxplot figure.

**The correlation between sulphur and ash concentrations of peat**

The sulphur concentration had a clear positive correlation with ash concentration. The Pearson's correlation coefficient was 0.59. On average, if the sulphur concentration was about 10–20%, the ash concentration was about 20–30%. There is clear positive linear dependence between sulphur and ash concentrations ( $R^2 = 0.476$ ). The sulphur concentration had also a positive correlation with pH values. The Pearson's correlation coefficient was 0.40.

**The sulphur concentration of peat stratum**

The sulphur concentration was often higher in the middle and the bottom layers of the peat stratum and lower in the surface peat layer. The median was clearly highest in the bottom layer (0.37%). The sulphur concentration of the surface peat (0–140 cm under mire surface depending

of peat type and thickness of the whole peat stratum) was 0.17%, the intermediate layer 0.29% and the basal peat layer (50–170 cm above subsoil depending of peat type, ash content and thickness of the whole peat stratum) 0.95%. The standard deviation value was clearly highest in the bottom layer (2.33).

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