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Mercury Distribution in Litter and Soils at 8 Czech Forest Sites

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INTRODUCTION

The Czech Republic has long ore mining and processing history, which together with high atmospheric emissions during the communist era led to the environmental Hg pollution. Distribution of Hg within the Czech forest soils corresponds to the occurence of local emission sources (**see Fig.1**).

Eight sampling sites in the western part of the Czech Republic were selected for this study. Five rural sites belong to the GEOMON network (LP, LYS, LIZ, NAC and PLB) and remaining three sites were chosen for their unique position with respect to Hg emmision/deposition history. Site CSS is located within the area of Black Triangle, site NER in vicinity of chlor-alkali plant and site PRI within the contaminated hotspot in the central Czech Republic originating from historical mining and ore processing (**see Fig.1**).

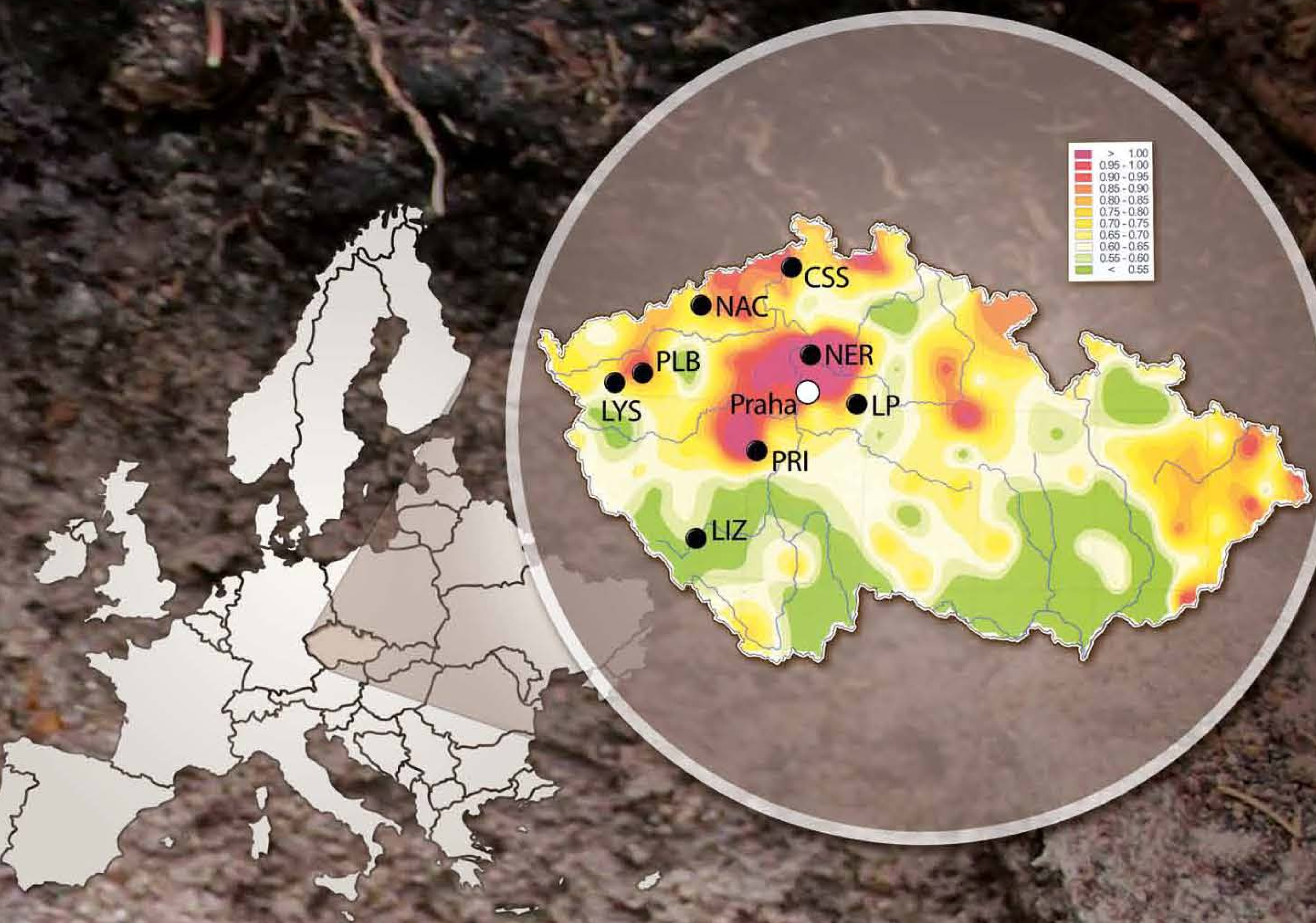
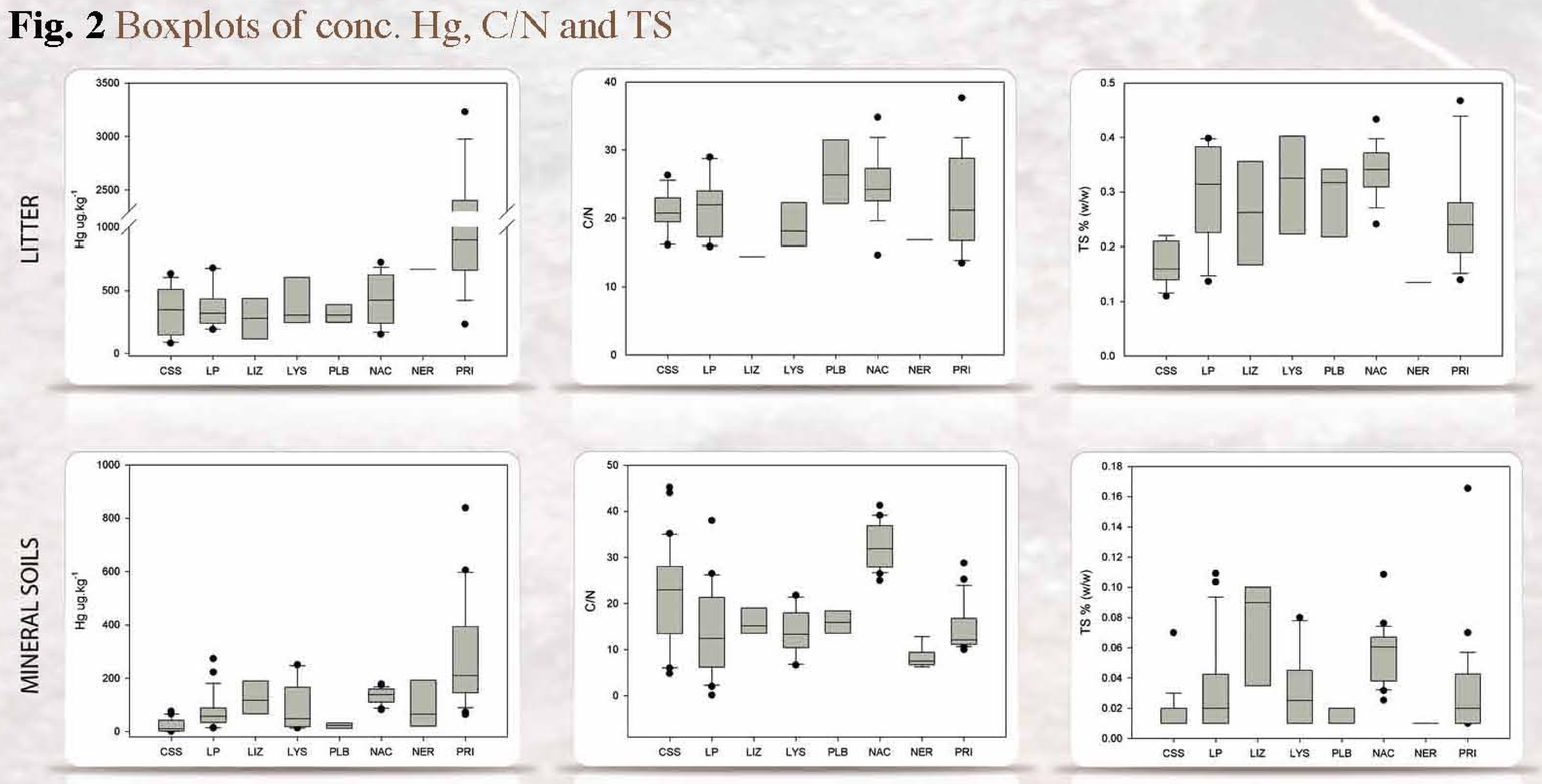


Fig. 1 Location of sampling sites in the map of Hg distribution in forest floor humus in the CR (Suchara, Sucharová 2000)

Fig. 2 Boxplots of conc. Hg, C/N and TS



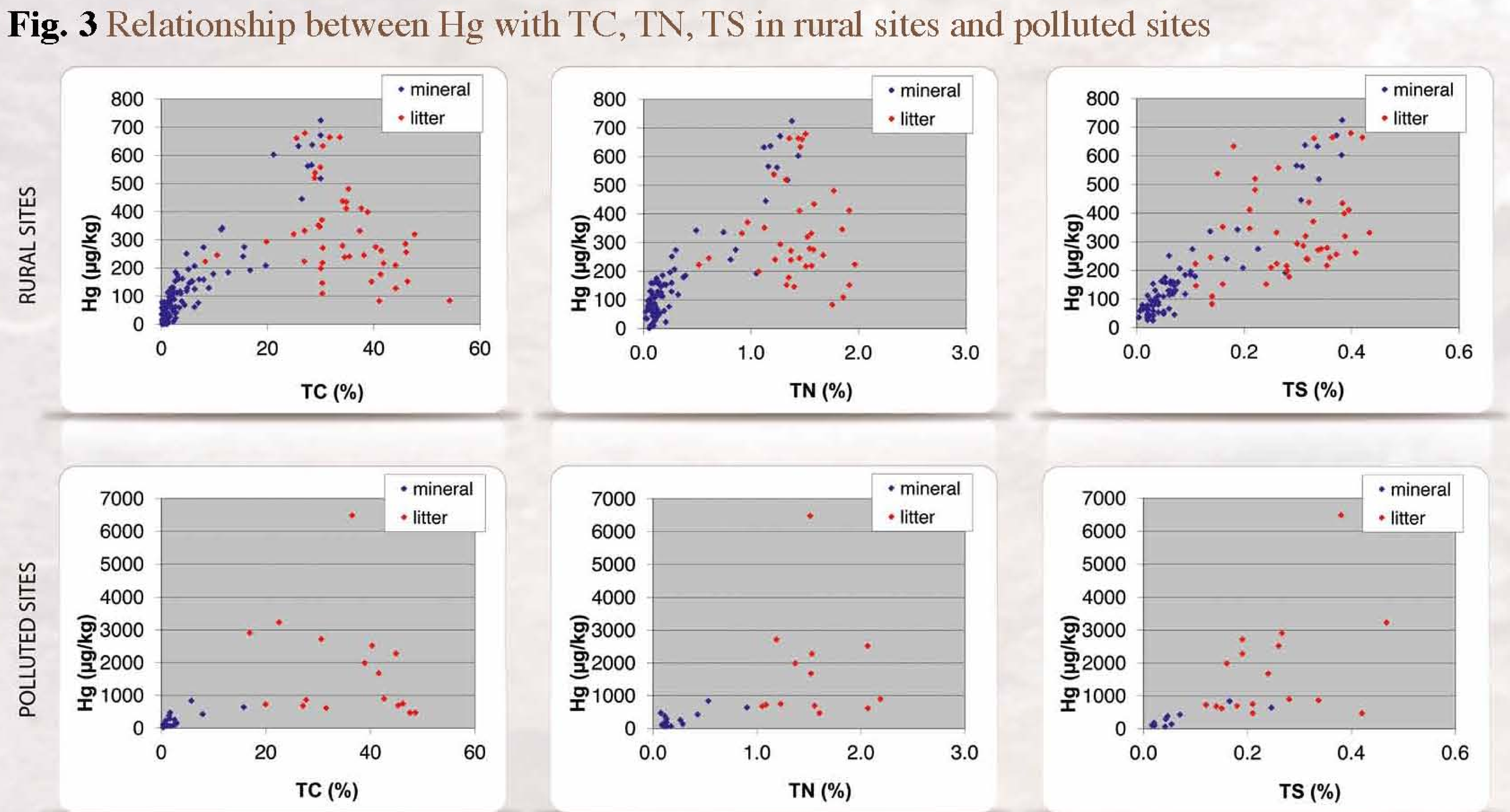
- the concentrations of Hg in litter horizons were greater than in mineral soils at all sites
- the highest concentrations of Hg in litter and soils were found at historically polluted site PRI
- concentrations of TS in litter and mineral soils were relatively uniform at all sites
- C/N ratios were higher in litter horizons than in mineral soils with exception of sites NAC and CSS located

METHODS

- Concentrations of Hg in soils samples were measured by CV-AAS.
- Analysis of TN was done by modified Kjeldahl method.
- Analysis of TC was done by sulfochromic oxidation.
- Analysis of TS was done by catalytic oxidation with ultrared detection.
- pH, CEC, oxalate extractable concentrations of Al, Fe and Mn were determined using standard procedures.

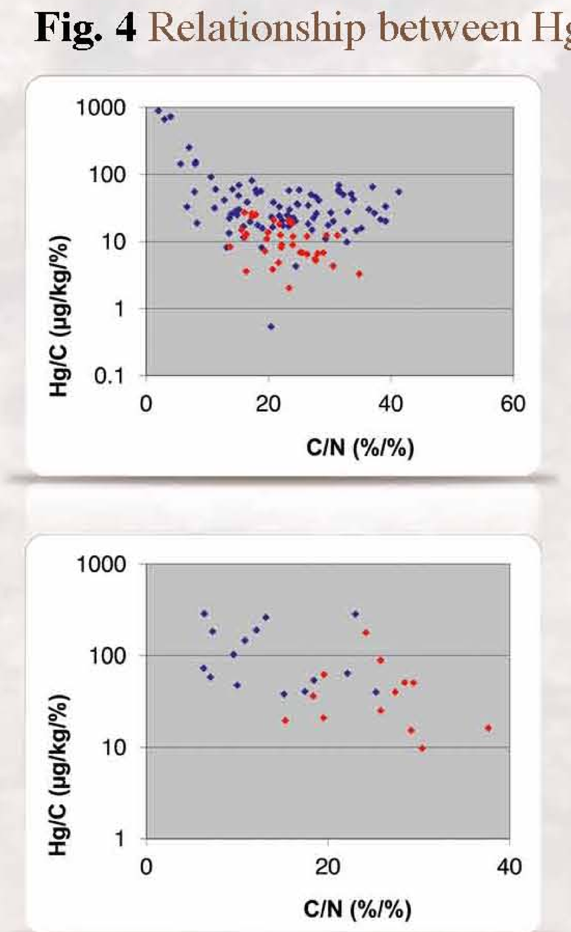
RESULTS

Fig. 3 Relationship between Hg with TC, TN, TS in rural sites and polluted sites



- close relationships between Hg and C (N) across sites are widely known
- content of soil organic matter (C, N) is critical for Hg concentration in mineral soil
- negative statistical relationship was found between Hg concentration and C, N content in litter
- the statistically most significant relationship of Hg concentrations in mineral soils was found with TS
- this probably results from either preferential bonding of Hg to S functional groups in litter or in similar deposition patterns

Fig. 4 Relationship between Hg/C and C/N in rural sites and polluted sites



- relationship of soil Hg and litter Hg to organic carbon should reflect the historic legacy (Obrist et al. 2009)
- C/N ratios indicate the degree of decomposition; high values = fresh organic matter, low values = older, decomposed fraction
- Obrist et al. (2009) suggested high Hg/C ratios in mineral soils originate from historical deposition of Hg onto ambient organic matter
- the changed C/N ratio of mineral soils (Oulehle et al. 2008) at heavily acidified sites (NAC) disturbs exponential relationship of C/N and Hg/C
- the data from Czech soils indicate that the highest Hg/C ratios in mineral soils did not occur on sites with the highest historical deposition
- the data from Czech soils indicate that increased Hg/C ratios may be a result of association of Hg with other soil fraction (Fe-hydroxides) than SOM in the deep mineral soils

Table 1 Statistical relationships of Hg concentrations with TC, TN and TS (ns = not significant, * = significance p<0.01, ** = significance p<0.001)

	polluted mineral Hg	polluted organic Hg	rural mineral Hg	rural organic Hg
TC	0.48*	-0.21ns	0.67**	-0.29ns
TS	0.61**	0.42ns	0.78**	0.28ns
TN	0.52*	-0.01ns	0.70**	-0.02ns

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