

EMISSION SOURCE APPORTIONMENT OF SOIL CONTAMINATION BY ORGANIC-GEOCHEMICAL AND MICROSCOPICAL METHODS (PTOLEMAIDA BASIN, NORTHERN GREECE)

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The Ptolemaida Basin in North Greece is affected by intense anthropogenic activities comprising in particular lignite mining, lignite combustion based power production, agriculture, traffic and industry. Especially, the two main cities, Ptolemaida and Kozani, are situated in the region of extensive lignite mining and combustion. Additionally, the area around the mining sites is used agriculturally. Unfortunately, the meteorological conditions in the basin favour a trapping of dust and emissions and, consequently, the contaminations are expected to affect the human health standards in this populated area.

The target of this study was not only to point out the level of contamination but, more important, to differentiate the numerous emission sources with organic-analytical and microscopical methods. Based on screening analysis of cultivated and uncultivated soils, fly ashes and lignite samples the organic-geochemical signature was revealed for different contaminations. Polycyclic aromatic compounds and pesticides dominated the organic pollution in soils as a result of agricultural and pyrolytic emissions representing intrinsic and extrinsic contaminations. In detail, the main groups of substances investigated included polycyclic aromatic hydrocarbons and its alkylated homologues, oxygen-, nitrogen- and sulphur-containing polycyclic aromatics, biogenic compounds comprising e.g. terpenoids and *n*-aldehydes as well as halogenated aromatics and pesticides. Specific marker compounds were used successfully to distinguish major sources of anthropogenic pollution, even though a more detailed identification of emission sources was not always effective. Especially, the differentiation of lignite derived contamination from those of fly ash or char coal on the base of PAH signature comparison was not successful. Also the spatial distribution of PAHs with respect to both quantity and pattern did not correlate well with the locations of emission sources or obviously affected areas. Extending this approach to S-, N- or O-containing PACs solely for the sulphur species a slight correlation of their spatial distribution and quantitative occurrence with fly ash derived pollution was observed. Hence, with respect to the major extrinsic pollution sources (lignite dust and fly ash) a differentiation based on chemical

parameters including typical pyrolytic indicators (e.g. pyrogenic PAH) was not achieved.

On the contrary, a significant contribution of fly ash and lignite derived material to the soil samples was pointed out by white light microscopy in incident mode as well as by REM. In addition, char coal residues (as a third fraction of pyrogenic organic material) were differentiated microscopically. Interestingly, a correlation of quantitative PAH data with microscopical information was not observed. Hence, the results obtained from both methods were complementary with respect to the information revealed for the different emission sources. Therefore, this combined application of microscopy and organic-geochemical analysis revealed a more precious view on the pollution and its sources in the soil environment.

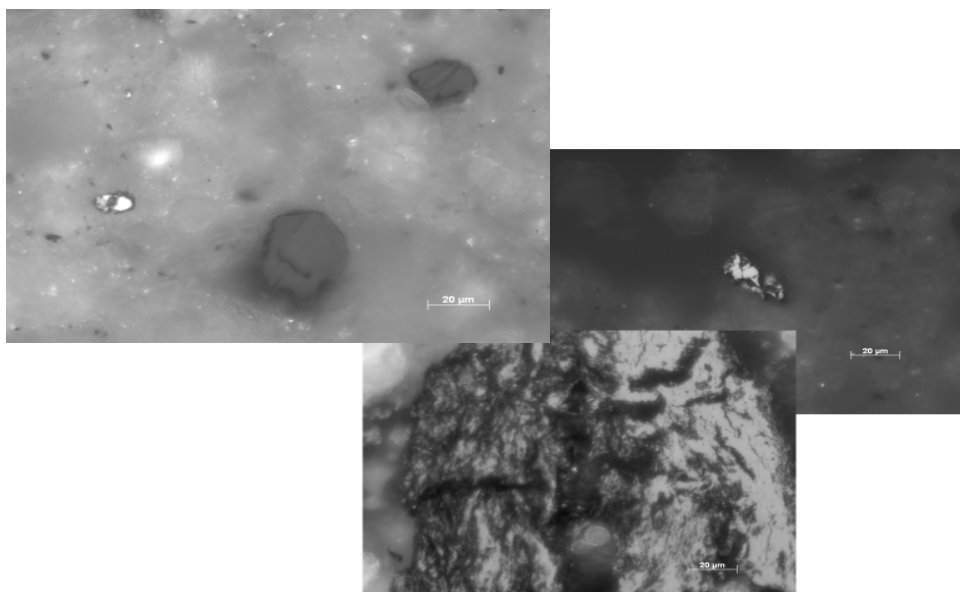
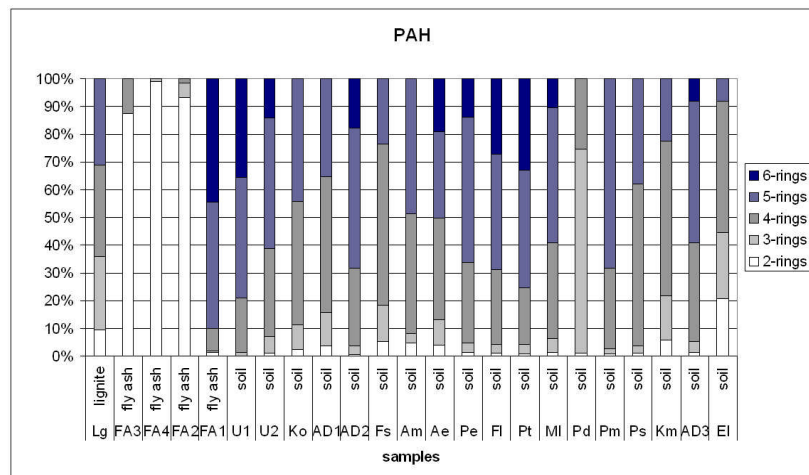


Figure 1. Relative composition of PAHs according to their ring numbers in soils, fly ash and lignite (A) and microscopical detection of lignite and fly ash particles in soil samples (B) from Ptolemaida Basin