

Organic micro-pollutant profiles from urban, industrial, and rural soils and sediments from South Africa

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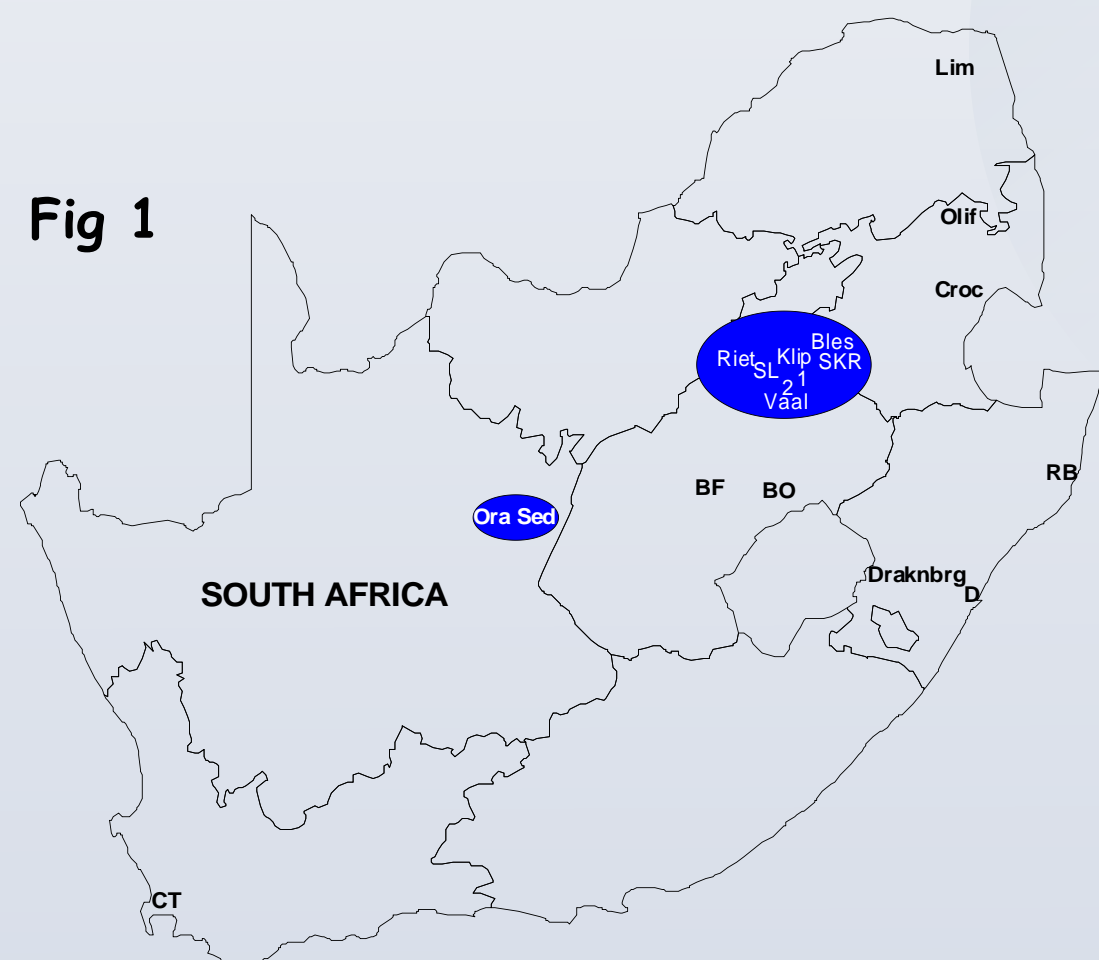
INTRODUCTION

- Despite having the largest economy in Africa, very little is known about organic pollutants in soils and sediments from urban, rural, and industrial areas of South Africa (SA).
- Here, we present the results of the first studies to investigate levels and distribution of organochlorine pesticides, PCBs, PAHs and dioxin-like chemicals from industrialised, and rural areas.
- Industries include petro-chemicals, ferrous and non-ferrous metal production, paper and pulp, coking, mining, and coal-fired power plants.
- Urban areas are characterised by both high and low-density residences. Open burning is still practiced in many of the high-density urban areas.
- Rural activities include crop farming, rangelands, mining, and transport.

COLLECTION & ANALYSES

- Soil samples were mainly collected in the industrialised Gauteng region of South Africa, while sediments were collected in the same region and elsewhere in SA (Fig 1). Consult map for localities in graphs.
- Areas marked in blue have their graphs in the central column.
- Sediment and soil samples were collected, dried, and shipped to accredited NILU laboratories in Norway. Not all samples were analyzed for the same compounds.
- Extraction and analyses was done according to standard procedures and quality control. HRGC/HRMS was employed.

Fig 1



RESULTS

- HCB was prominent in industrial soils (Ind1, Fig2), as well as residential sediments (RB1, Fig3). DDTs predominated in other sites, especially Lim 4, where DDT is still used for malaria control.
- PCB concentrations ranged between 120-60 000 ng/kg dw in soils and sediments with highest concentrations from industrial (Ind2, Fig4; RB1, Fig5) and associated residential areas (Inf2, Fig4; S/L9, Fig 5).
- PAHs ranged between 44-39 000 ng/g dw and the concentration of carcinogenic PAHs ranged between 19-19 000 ng/g dw.
- MCCPs dominated the chlorinated paraffin profiles (Fig6).
- PBDEs were present in sediments at low concentrations, but higher at RB1/2, D14, and S/L9 (Fig7). Very low levels from background sites (Drknberg1/2) but also low levels at residential sites (S/L1-8; Fig7).
- PAHs were found at high levels in industrial soils (Ind1/2, Fig8), and industry-associated sediments (S/L8, CT7, Fig8). The high levels at Croc1b (Fig9) is associated with a large paper mill.
- Pyrogenic processes were the most likely sources, with some petrogenic contributions from harbours (CT and D, Fig10), but not RB (another harbour). Most sites had combinations of sources.
- Carcinogenic PAHs at low-income residential sites and from some of the sediments were sufficient to potentially cause health effects such as cancer considering direct contact with soil (data not shown).
- A grid-collection scheme was applied for soils at Sasolburg and Vanderbijlpark (S on Fig1), and analysed for dioxins and furans. This area houses large petrochemical and other industries, as well as formal (Sasolburg/Vaalpark) and informal residential areas (Zamdela).
- Fig11 shows that the Vaalpark and Zamdela residential areas had higher soil-TEQ than the industrial area located between them.

DISCUSSION & CONCLUSIONS

- These country-wide investigations show a variety of sources in different areas, not dissimilar from other regions.
- The sources, processes and threats that govern the lesser concentrations in sediment and higher concentrations in soils need further investigation as it may affect human exposure.
- Threats to human health and biota from terrestrial and aquatic food webs under developing-country conditions needs further investigation before conclusive statements about the need for mitigating interventions can be made.
- However, PAHs may likely be the issue with the greatest concern.
- These studies have contributed towards a much better understanding of organic chemical pollutants in sediments and soils from the largest economy in Africa, and have identified hot-spots for investigation.

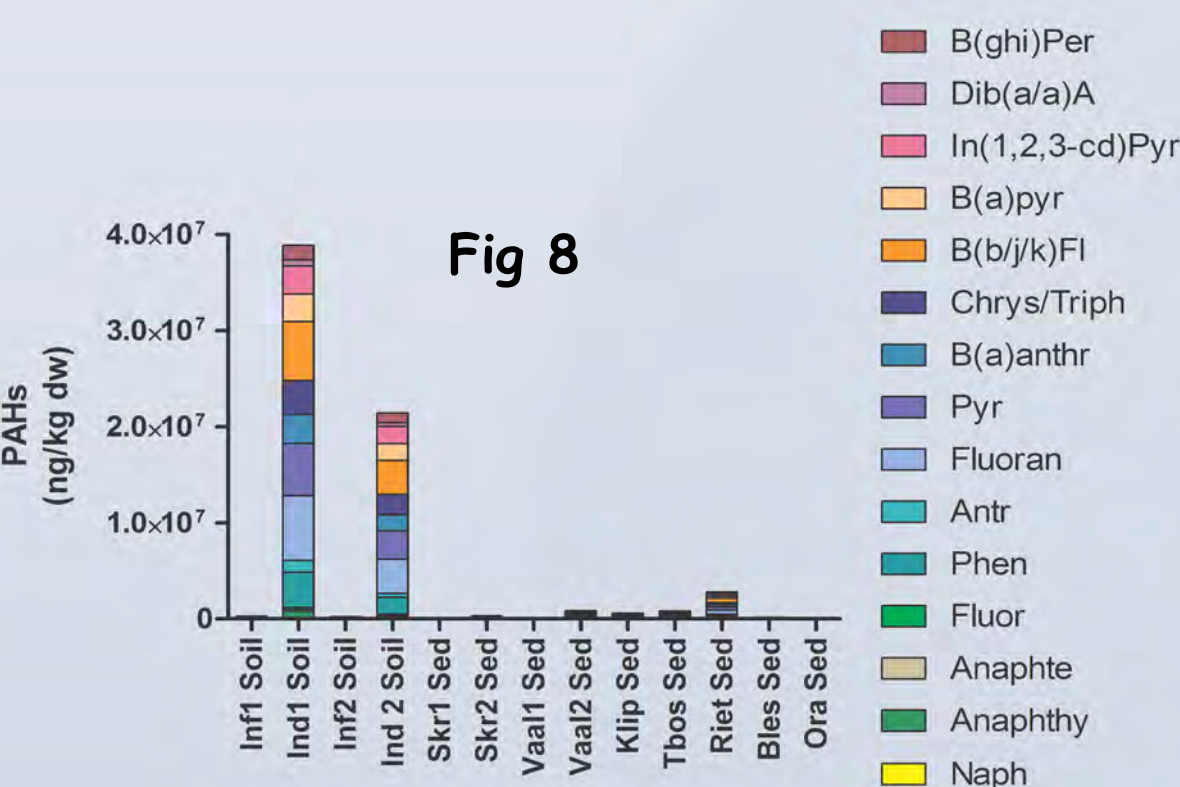
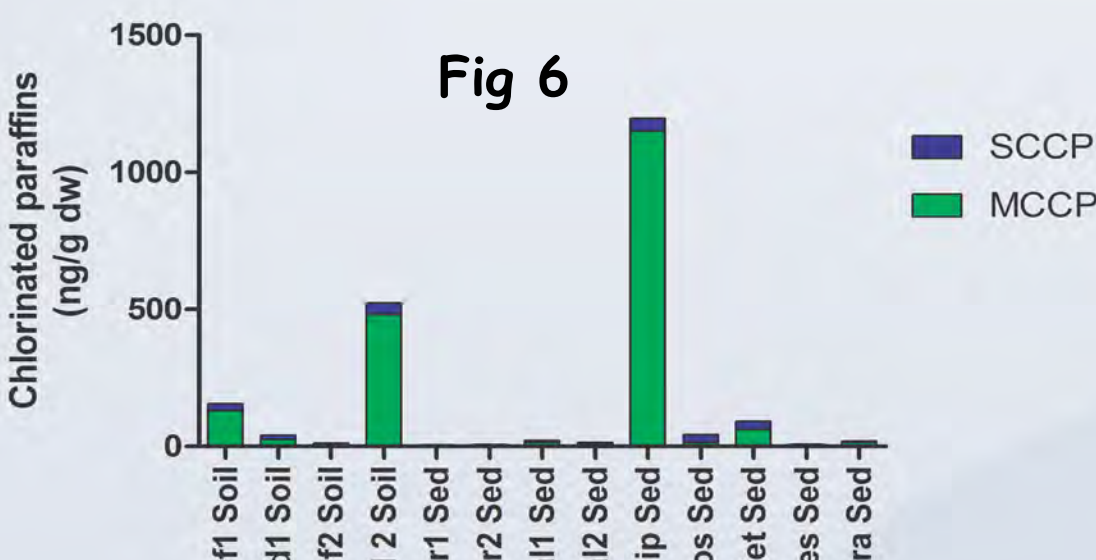
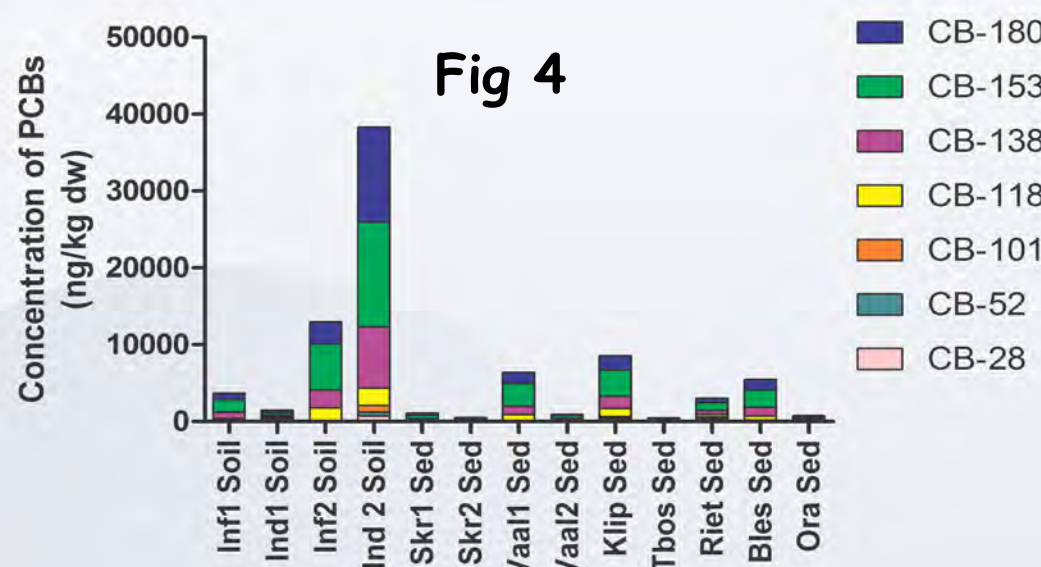
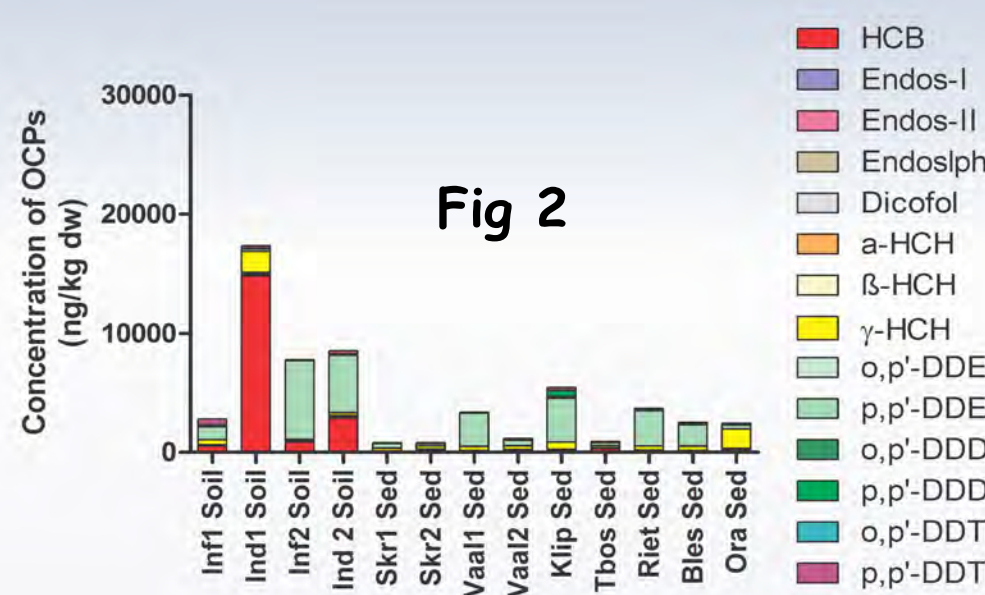
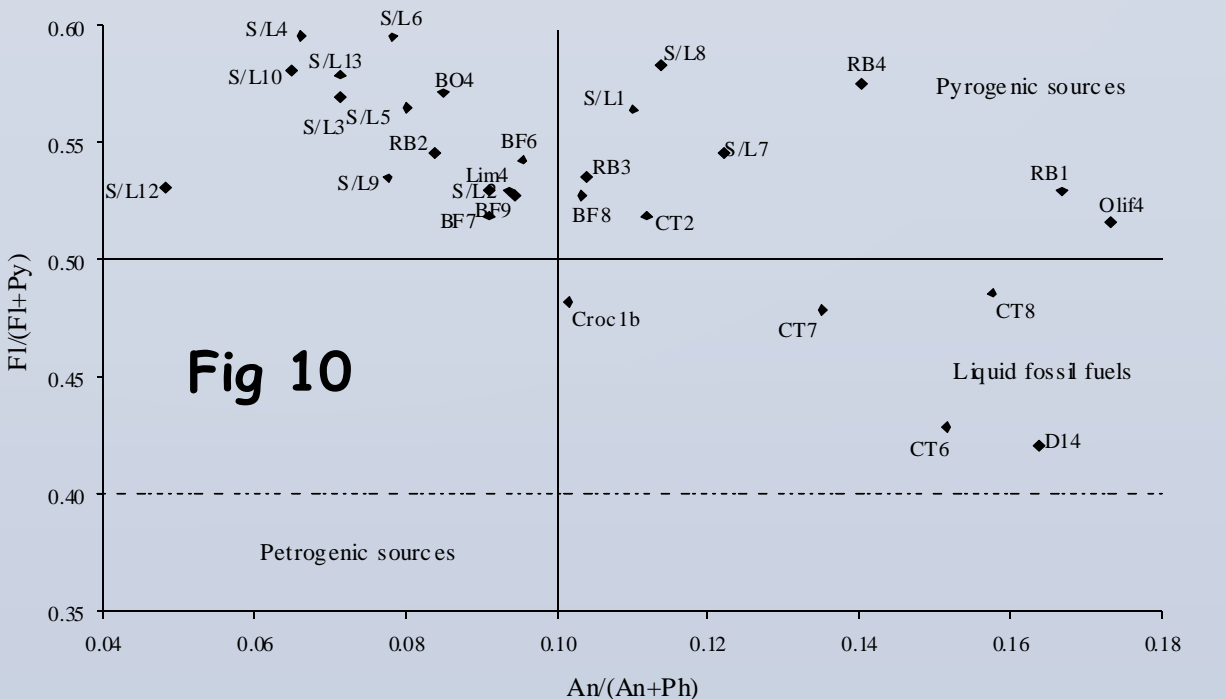
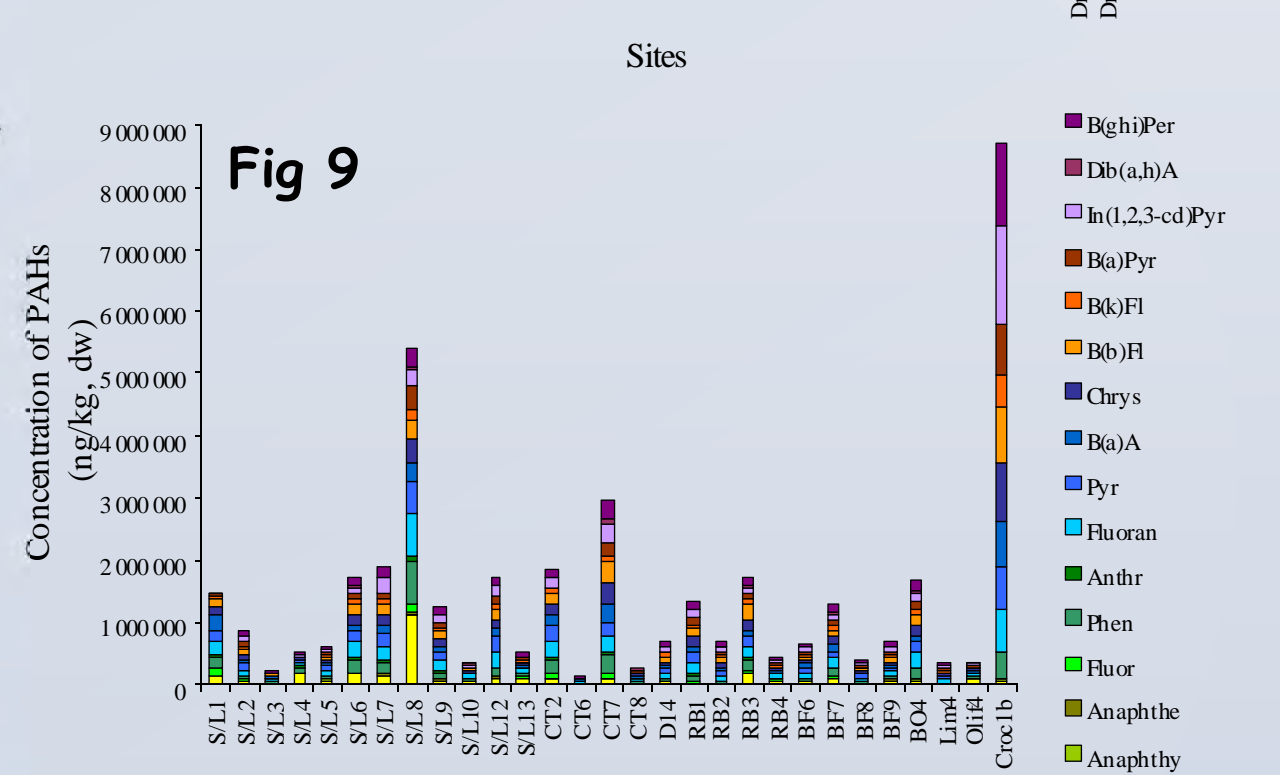
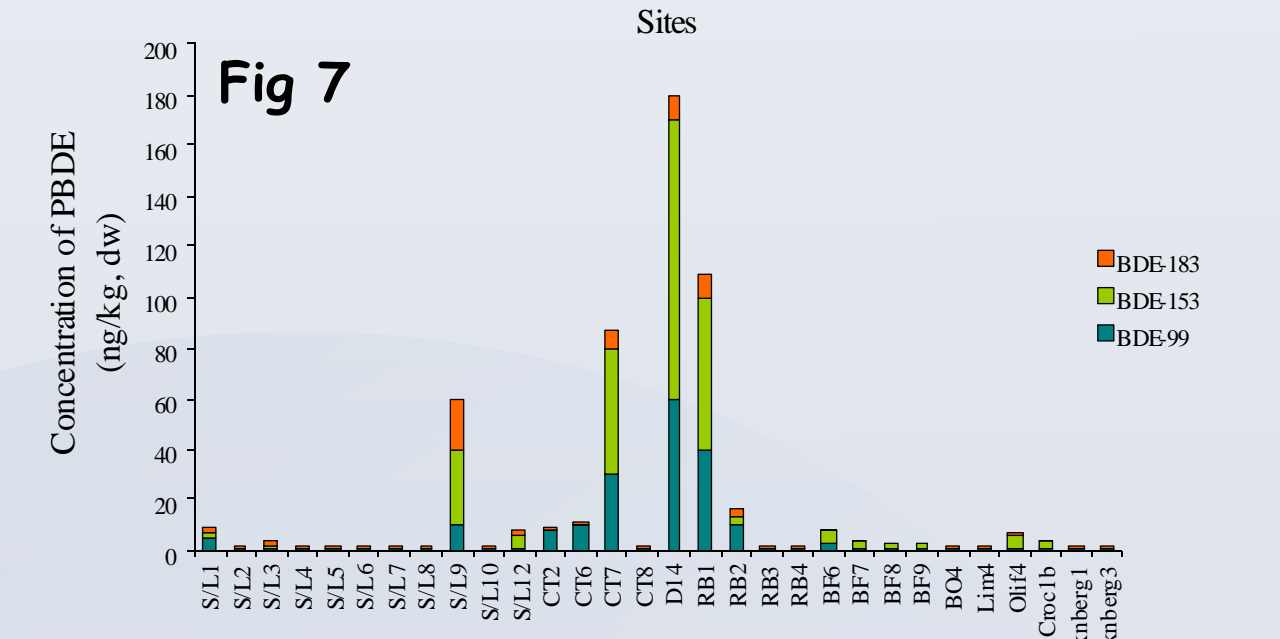
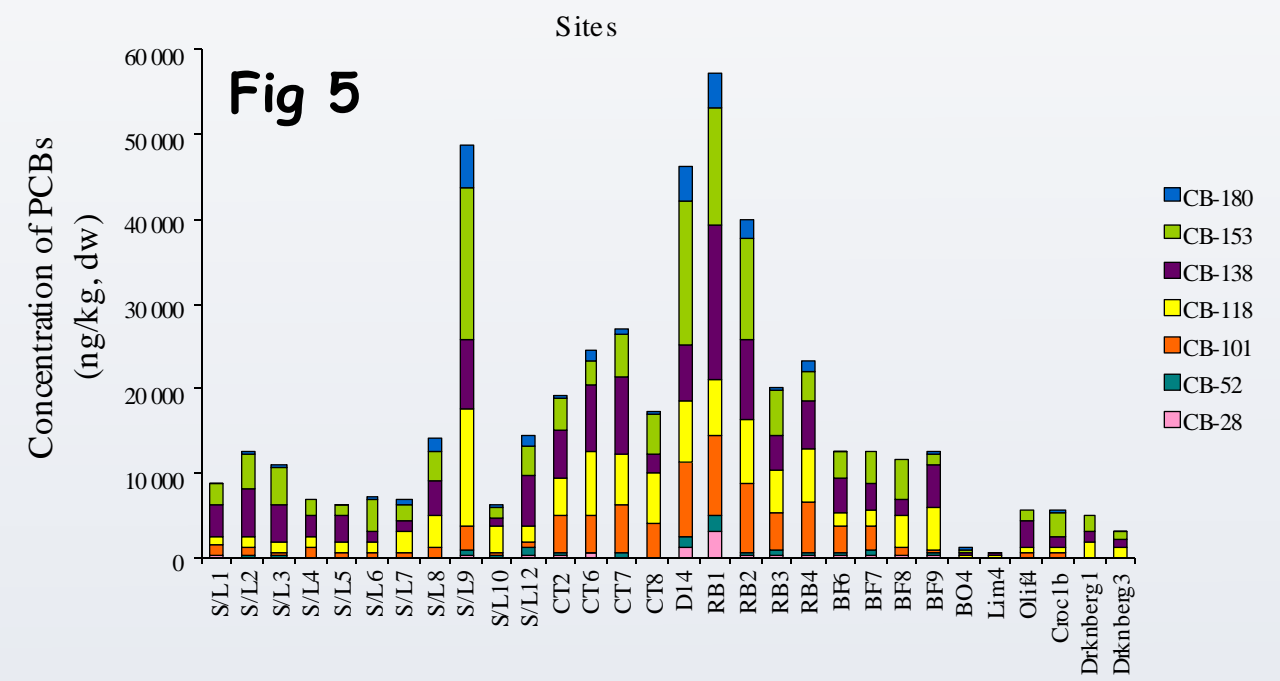
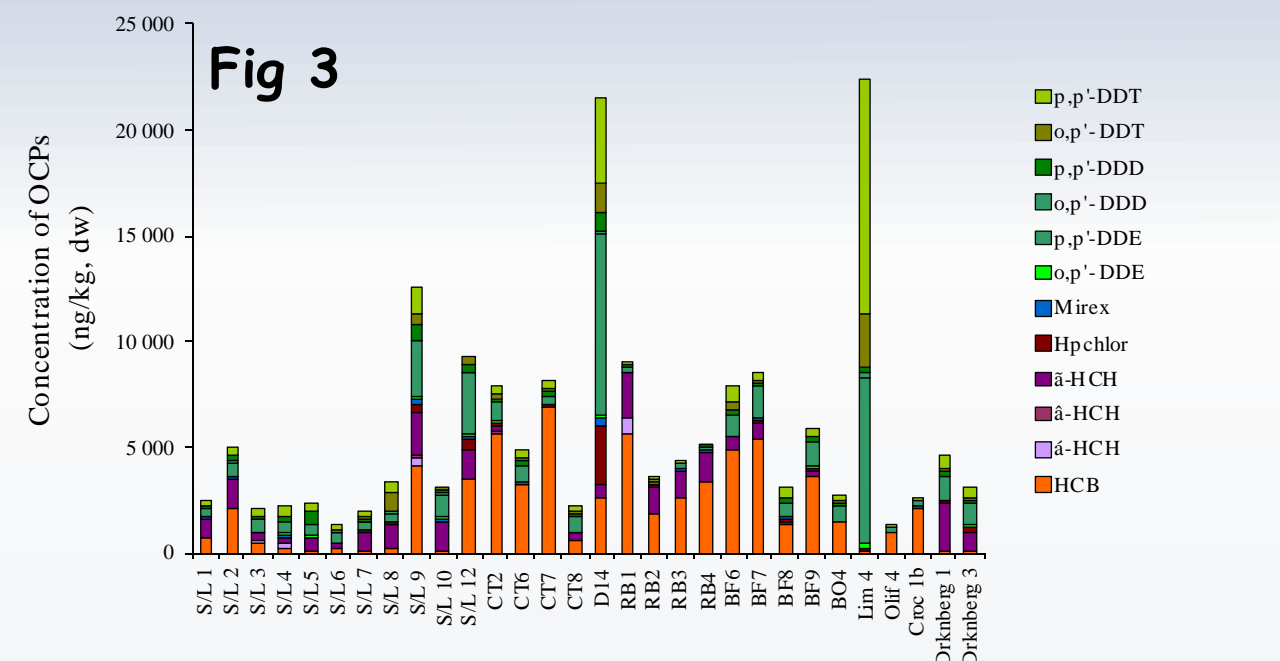
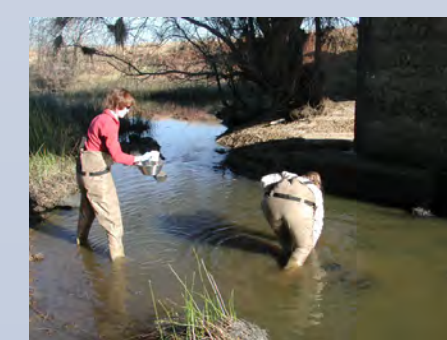
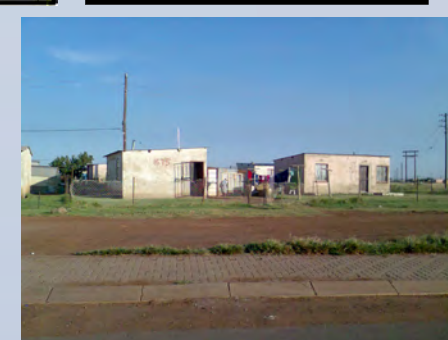
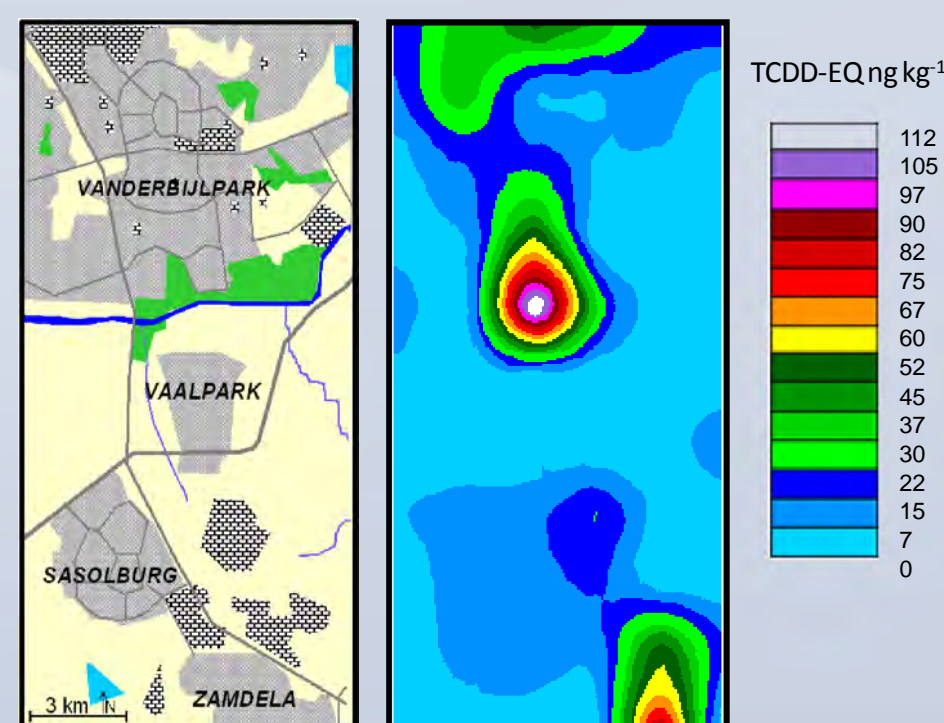


Fig 11



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