

MOLECULAR CHARACTERISATION OF A PEATY GLEY SOIL PROFILE USING TETRAMETHYLAMMONIUM HYDROXIDE THERMOCHEMOLYSIS

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Soil organic matter (SOM) is the largest store of terrestrial carbon made up of many different organic compounds. Investigating the turnover of such compounds will help us to better understand carbon dynamics and to determine whether the sink-source function of soils will change in response to climate change. In this presentation we use on-line tetramethylammonium hydroxide (TMAH) thermochemolysis, which is also known as thermally assisted hydrolysis and methylation (THM), coupled to GC/MS. The objectives are to study both degradation and humification processes for the biochemical constituents of SOM (primarily lignin and lipid).

A 50 cm depth profile of a peaty gley soil in Harwood Forest (Northumberland, UK) was investigated. The profile consisted of samples from the L layer (5-6 cm), H layer (10-11 and 18-19 cm), A layer (24-25, 30-31 and 38-39 cm) and B layer (48-50 cm). Total organic carbon (TOC) measurements revealed a high OC content, before a step drop between the 18-19 cm and 24-25 cm horizon (44% to 10%). The major TMAH thermochemolysis products from each of the layers included fatty acid methyl esters (FAMES) and lignin-derived methoxyphenols. Minor components included the triterpenoids and steroids. There were significant changes in the abundances of organic compounds down the profile but no major qualitative changes in compound types. Guaiacyl, syringyl and *p*-hydroxyphenyl (G, S and P) lignin derivatives were identified in all samples of which G6 was in general the most dominant. Syringyl monomers exhibit a general decrease in abundance down the profile indicating selective removal of S sub-units (Huang *et al.*, 1998). Decreasing abundance of lignin-derived compounds with increasing depth suggests further decay of the lignin biopolymer. *n*-Alkene/*n*-alkane doublets extending from C₁₀ to C₂₃ are present, which is a distribution that is characteristic of aliphatic biopolymers (Lichtfouse *et al.*, 1998). These homologous series were minor components in the TIC (total ion chromatogram) from all of the layers apart from the 18-19 cm horizon (bottom of H layer). A comparison of the *m/z* 55

and m/z 57 mass chromatograms highlights the changes in the contribution of these doublets with increasing burial depth (Fig. 1A). The C_{16} FAME was predominant in the first two layers but in the 18-19 cm layer there was a significant increase in longer chain FAMES in which there was a slight even over odd predominance (Fig. 1B).

Triterpenoid and steroid compounds were only identified in the thermochemolysis products from the upper three horizons (Fig. 1C). It is apparent that the 18-19 cm layer is an important transitional horizon and understanding the chemical changes through this layer may provide crucial information on carbon turnover.

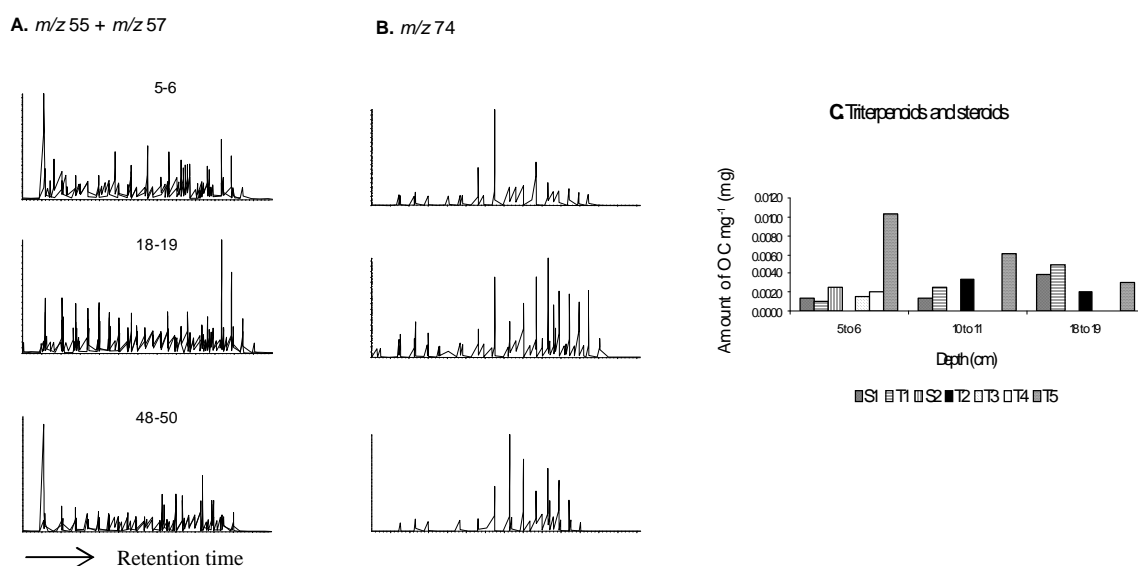


Figure 1. Thermochemolysis products from selected soil horizons (depth interval / cm): A. Combined mass chromatograms (m/z 55 + m/z 57) showing changes in n -alkene/ n -alkane distributions with depth; B. Mass chromatograms (m/z 74) showing changes in the FAMES with depth; C. Changes in the amounts of triterpenoids and steroids in the first three horizons.

REFERENCES

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