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Spectroscopic characterization of porewater and water-extractable organic matter along a peat bog profile

C Zaccone, V D'Orazio, and TM Miano

Dept. of Biology and Chemistry of Agro-Forestry and Environment, University of Bari, Bari, Italy (zaccone@agr.uniba.it)

The aim of the present study was to identify and compare chemical, physical and spectroscopic features of porewaters and corresponding water-extractable organic matter (WEOM) samples taken from a 105 cm ombrotrophic peat bog profile. The peat core was collected in 2005 from a Swiss bog and divided into 91 slices of 1 cm of thickness. Extracted porewater samples were filtered (0.45 μm), analyzed for pH and dissolved organic carbon (DOC) concentration and characterized by means of UV-Vis (E_4/E_6 ratio) and fluorescence spectroscopies. The same analyses were carried out also on the WEOM of peat.

Spectroscopic data underline that DOC_{we} presents a more aromatic character, a higher molecular weight, a higher degree of polycondensation and extent of conjugated fluorophore systems, and thus a more "humic" character with respect to porewater samples. Furthermore, E_4/E_6 values slightly increase with depth thus indicating that the organic matter of both porewaters and WEOM samples is characterized by a decreasing in aromaticity, molecular weights and degree of polycondensation throughout the profile.

Moreover, although DOC generally represents the most active and mobile form of the organic matter, the significant correlations between DOC_{pw} with both DOC_{we} (R^2 = 0.81, p <0.001) and peat dry density (R^2 = 0.67, p <0.001) seems to reflect a vertical stratification, with vertical movement of DOC rather limited. This finding on one hand is consistent with the well known correlation between hydraulic conductivity of peat and degree of humification, with the poorly decomposed surface peat layer (low density) much more conducive to fluid flow; on the other hand, may provide useful indications about translocation processes of organic and inorganic pollutants along peat profiles, especially considering that undisturbed bog cores are often used as a record of the impact of historical human activity.

The completely different properties characterizing the first ca. 20 cm of depth, probably due to the higher physiological activity of plants and microorganisms with respect to the deeper-anoxic horizons, strongly affect the physical, chemical and structural features of the organic matter occurring in this zone. These data are in agreement with DOC contents in both porewaters and WEOM samples, showing highest values in the living layer.