THE EFFECT OF HEAT IN SOIL ORGANIC MATTER (SOM). EXPERIENCE FROM CONTROLLED BURNING EXPERIMENTS OF UNALTERED SOIL BLOCKS

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Wildfire is an important disturbance factor in many ecosystems, especially in the Mediterranean Basin (Keeley et al., 2012). Forest fires exert changes in soil organic matter (SOM) quality and quantity (González-Pérez et al., 2004) that in turn affect relevant and closely related characteristics like soil runoff and erosion response, due to changes on factors like wettability and aggregation (Certini et al., 2011; Mataix-Solera et al., 2011). The effects of heat in SOM are highly variable and dependent of many interrelated factors (Badía et al., 2011). Therefore SOM content may be affected from an almost total destruction to increases as a consequence of external inputs, mainly from forest necromass. Additionally to C losses or exogenous increases, pre-existing C forms in the soil may be transformed into recalcitrant pyrogenic material as black carbon (De la Rosa et al., 2012) contributing to the long term C and N sequestration in soils (Knicker, 2007; González-Pérez et al., 2008).

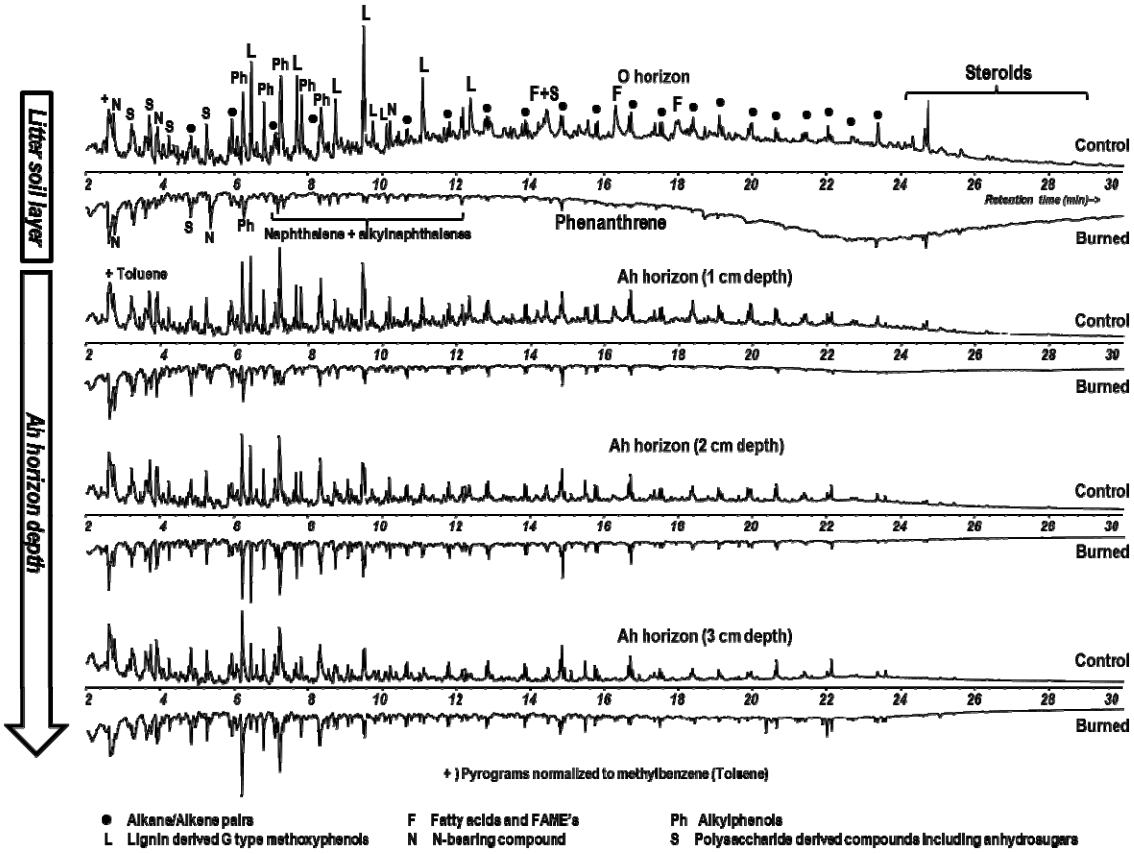
In this work the effect of fire to different soil properties and in particular to the quantitative and qualitative changes exerted to SOM are analysed in two different soil types; a gypseous soil (Hypergypsic Gypsisol) and a renzina (Rendzic Phaeozem). Undisturbed soil blocks sampled in the field were burned, under controlled conditions in the laboratory mimicking the conditions of a real wildfire.

With respect to C quantity, in general in the burned blocks a decrease in soil organic carbon (CO) was observed in the O horizon and down till the 1st cm in the mineral Ah horizon where a maximum temperature was 250 °C. No appreciable quantitative differences were observed in the inorganic C content (CI) at any depth.

With respect to C quality, soil organic matter alteration caused by fire was studied at a molecular level using direct analytical pyrolysis (Py-GC/MS). The technique was useful in assessing fire severity in terms of soil organic matter molecular structural shifts (Fig. 1). In the organic layer (O horizon) an almost complete disappearance of chromatographic peaks is apparent. In the mineral Ah horizon the effect of fire is still apparent (0-1 cm depth) affecting the chromatograms both qualitative and quantitative; a complete disappearance of some biogenic compounds, a reduction in the relative abundance of typical vegetation markers and a neat deviation of the natural distribution of the alkylic series i.e. shifts in carbon preference indexes (CPI) and increase in the relative abundance of low molecular weight homologues.

Among organic compounds, hydroaromatic structures (steroids) are found particularly resistant to heat, not only in the burned soils studied here, but also frequently observed by us to persists practically unaltered in other heavily charred matrices (biochars) obtained from a variety of substrates (LAR's, biomass, wood, etc.). The steroids are typical biomass markers with specific chemical structures informative

of origin i.e. vegetation, animals including humans, mosses or fungi. Several steroids and related compounds are well known physiologically active substances that play different roles in eukaryotic organisms. In the future it may be prudent to consider the potential effects of such substances when present in biochars, particularly when the intended use implies the release of large quantities into nature i.e. as amendments in



agriculture.

Figure 1. Total ion current chromatograms (TIC) of compounds released after pyrolysis (500 °C) of whole Hypergypsic Gypsisol (control vs. burned samples); axis x: retention time (min); axis y: relative abundance.

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