ORGANIC MATTER CHARACTERIZATION IN WHOLE AND DEMINERAIZED ANDOSOLS

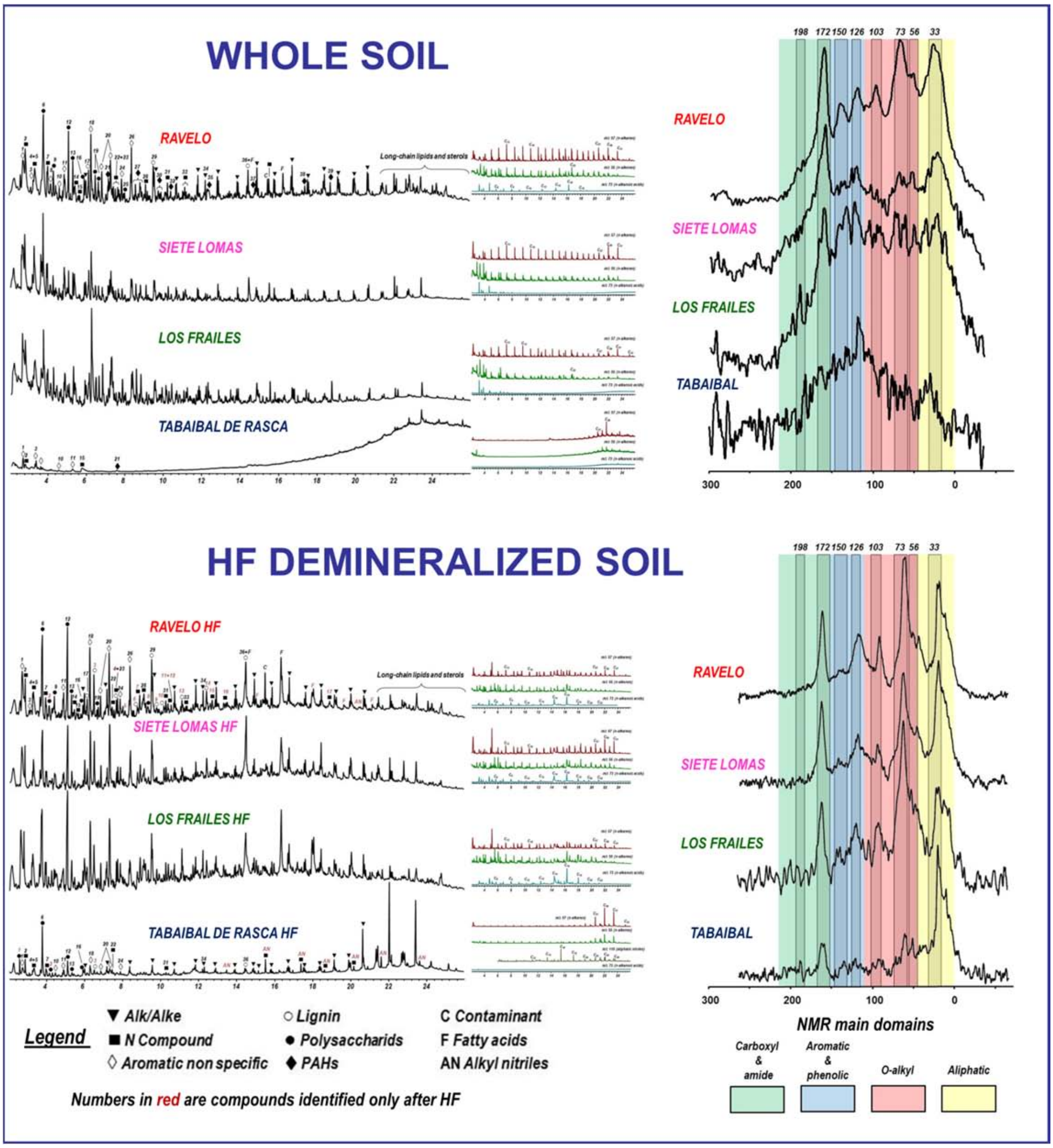
José A. GONZÁLEZ-PÉREZ[1*], Heike KNICKER, Cecilia M. ARMAS[2], Carmen D. ARBELO[2], Francisco J. GONÁLEZ-VILA[1] and Antonio RODRÍGUEZ-RODRÍGUEZ[2]

1. IRNAS-CSIC. Avda. Reina Mercedes, 10. Sevilla, E-41012 (Spain)
2. Univ.La Laguna, Avda. Astrofísico Fco. Sánchez s/n, La Laguna, Tenerife, E-38204 (Spain)
*) Corresponding author: *jag@irnase.csic.es*

Andosols are usually formed from volcanic substrates, with thick dark A horizons rich in organic carbon (5-20%), occurring mainly in the form of stabilized humic material. The peculiar properties of these variable-charge soils are due to the occurrence of poorly crystalline materials such as allophanes, imogolite and other Fe and Al oxyhydroxides. Such materials are prone to form organo-mineral structures with a high degree of stability. Consequently, Andosols store much more organic matter (OM) than other soils under similar conditions (Rodríguez-Rodríguez et al., 2002 and references therein).

This work complements previous results using analytical desorption/pyrolysis to elucidate soil organic matter structure in andosols. The samples studied were organic A horizons of three soils with andic properties and one non-andic soil (Sodic Cambisol) from the island of Tenerife (Canary Islands, Spain). A complete description of the soils including Py-GC/MS features of different organic fractions can be found in (González-Pérez et al., 2007). In order to further enlighten soil organic matter (SOM) molecular composition and its relation with the mineral matrix, the results from a comparative study is described here where whole soil and hydrofluoric acid (HF) demineralised samples were analysed by solid state NMR spectroscopy (CP-MAS ^{13}C-NMR) and analytical pyrolysis (Py-GC/MS) at 500º C.

The results obtained are summarized in the figure. This study demonstrates that the removal of minerals, including paramagnetic components, improves the resolution and sensitivity of the complementary analytical techniques solid-state ^{13}C NMR and Py-GC/MS. The results on specific compounds present in the soil organic matrix obtained by Py-GC/MS complement the structural information provided by ^{13}C NMR, and when used in combination, these techniques allow the elucidation of relevant structural features and processes in soils. Specifically, our findings support previous ones, suggesting the occurrence of high-performance organo-mineral sequestration mechanisms of aliphatic moieties (with main precursors from polysaccharides and plant lipids) in andosols (González-Pérez et al., 2007) and that HF treatment of soils is efficient in removing Al and Fe-oxides, freeing organics bound to the soil mineral phase (Knicker et al., 2005). Compound assemblages after pyrolysis and total ^{13}C NMR signal recovered of HF treated soils are richer and better resolved. The presence of easily identified compounds from diverse biological precursors in the soil pyrolysate after HF treatment may indicate an incorporation of microbial and plant metabolites into the stable C fractions. Likewise, the disappearance of compounds after HF treatment may be an indication that those are loose bonded to the mineral matrix.



REFERENCES:

González-Pérez et al. J. Anal. Appl. Pyrolysis 80:369–382 (2007)
Knicker et al. Soil Biol. Biochem. 37, 701–718 (2005)
Rodríguez Rodríguez et al., Land Degrad. Develop. 13, 515–523 (2002)