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AGING OF CHARCOAL IN FIRE-PRONE MINERAL SOILS OF SOUTHERN EUROPE

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Incorporated into the soil, charcoal produced during a vegetation fire is considered as highly recalcitrant and to increase the soil C sink. Recent laboratory experiments indicated that under optimal conditions, plant-derived pyrogenic organic matter (PyOM) can exhibit very short residence times < 100 years. To bring some light onto the fate and stability of PyOM, soil chronosequences with different recovery time after fire were analyzed for soil organic matter (SOM) composition and PyOM content. The respective alterations were related to SOM degradation rates determined in controlled laboratory respiration experiments. The first chronosequence (Histic Humaquept) (Doñana National Park, Southern Spain) was collected directly, 15 and 19 years after a severe fire and from unaffected comparable locations. The fire combusted the whole O layer (0–20 cm) and increased char content in the A horizon. Directly after fire, no PyOM was identified in deeper soil regions. After 19 years, the O layer recovered to 5 cm, but showed only minor PyOM contributions. In contrast, the mineral soil revealed PyOM contents of up to 18% of the total C at depths > 30 cm. This clearly evidences a downward translocation of PyOM within the soil profile. Fast translocation of PyOM was also observed for a Cambisol from Central Spain, where PyOM content in the A horizon, determined by a new approach of virtual fractionation of solid-state 13C NMR spectra, decreased from 30% to 24% within 1 and 24 years after fire mostly due to degradation, although erosion processes cannot be excluded.