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Linking tephrochronology and soil characteristics in the Sila and Nebrodi Mountains, Italy

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Mediterranean soils are an important key to understanding past volcanic events and landscape evolution. The influence and timing of Quaternary volcanic events on soils, however, remains still poorly understood in southern Italy. We used a multi-method approach to explore the origin and age of volcanic deposits (soils) in Sicily and Calabria. By comparing the geochemical signature of the soils with the chemical fingerprint of magmatic effusive rocks in southern Italy, we tried to identify the source material. It seems that the investigated soils on the Nebrodi (Sicily) and Sila (Calabria) mountains were both influenced by volcanic deposits having a high-K calc-alkaline series volcanic background. The Aeolian islands (Lipari and Vulcano) are the most likely sources of origin. Due to weathering processes of the volcanic sediments and the partial mixing with the underlying non-volcanic parent material, a direct relation with the potential source areas was not always straightforward. Immobile elements and their corresponding ratios (e.g. the Nb/Y vs Zr/Ti plot) or trace elements (Co, Th) and rare earth elements gave better hints of the origin of the deposits. Radiocarbon dating of the stable soil organic fraction (H_2O_2 resistant) indicated a minimum age of 8 – 10 ka of the Nebrodi and Sila soils. The chemical proxy of alteration (CPA) and weathering index according to Parker (WIP) were tested as proxies for an age estimate of the volcanic deposits and duration of soil formation. The soils and, subsequently, landscape are characterized by multiple volcanic depositional phases for the last 30 – 50 ka in the Sila mountains and about 70 ka in the Nebrodi mountains. We show that a multi-method approach (numerical dating, relative dating using weathering indices and the forensic procedure) enabled the identification of potential source areas, gave tentative age estimates of the ash deposits, duration of soil formation and, therefore, improved our understanding of volcanic landscape evolution.