



Can soils be used as paleo-ecological records in spite of bioturbation?

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Volcanic ash soils typically have a high accumulation and preservation of organic matter. In some cases, such as in the northern Ecuadorian Andes, the accumulation of organic matter is such that the soil actually grows vertically, much like peat deposits do. Like peat deposits, such volcanic ash soils show high potential for use as paleo-ecological records, trapping proxies for past vegetation and or climate in the form of e.g. fossil pollen and biomarkers. A significant advantage over traditional paleo-ecological records such as peat deposits and lacustrine sediments is that one is not restricted to the chance occurrence of a peat bog or lake to obtain a record. However, unlike peat deposits and lacustrine sediments, soils are subject to bioturbation by soil fauna. The latter is a serious point of concern as bioturbation may obliterate the chronology that is essential for use in paleo-ecological reconstructions. Therefore, in a recent assessment of the usefulness of volcanic ash soils from the Ecuadorian Andes for paleo-ecological research, we specifically considered the effects of bioturbation on the chronology of the soil organic matter. We performed a semi-quantitative micro-morphological analysis of soil faunal pedofeatures and related it to the vertical distribution of SOM and radiocarbon dating. Our results show that bioturbation is responsible for the chrono-stratification of SOM in the studied volcanic ash soils under forest and páramo vegetation in Northern Ecuador. Chrono-stratification was possible because mixing occurred over short vertical distances, thus limiting contamination of radiocarbon ages. We conclude that the resolution of paleo-ecological records contained in the studied soils is at least 5 cm, certainly enabling the use of the studied soil profiles in paleo-ecological reconstructions.