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Can we trace the biogeochemical cycling of phosphate in soils by its oxygen stable isotopes?

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The availability of phosphorus (P) to plants, severely limits their growth in many natural and managed ecosystems. Tracking the soil P transformations is hard since both immobilization and mineralization occur simultaneously. In this respect, stable isotopes techniques, which can evaluate the gross fluxes, show great promise. However, just a handful of studies aimed at determining the oxygen stable isotope composition of soil phosphate (delta18O(p)). We have developed improved techniques, which allowed for the first time to measure the delta18O(p) of available inorganic phosphate, in soils of Mediterranean and semi-arid ecosystems. In addition, we have applied a recently developed technique (Tamburini et al., submitted manuscript) for measuring the delta18O of total inorganic phosphate, in the same soils. Plots with rainfall manipulation experiments were used to further study the effect of varying rainfall on phosphate cycling, and the phosphate isotopes. Our results show both spatial and seasonal variations in delta18O(p), which suggest that the oxygen stable isotopes of soil phosphate can serve as a new tool for both studying the dynamics of soil phosphorous, and for estimating the turnover rates of the soil microbial pool.