Quantification of distinct phytolith pools in a perhydrated Andosol

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The global biogeochemical cycle of silicon (Si) is linked to the one of carbon through the weathering of silicate minerals that consumes atmospheric carbon dioxide, and the nutrition of photosynthetic diatoms in marine ecosystems. The global Si cycle is constrained by the terrestrial soil-to-plant cycle of Si. Aqueous Si is taken up by plants, and accumulates at transpiration sites as amorphous silica bodies called phytoliths. Phytolith particles return to soil with plant debris and contribute to the soil silica pool. They are 10^2 to 10^4 times more soluble than primary and secondary silicate minerals, and they readily dissolve at common pH values of soil solution. Thus they largely contribute to the Si biological cycling. Quantifying the phytolithic pool in soil is therefore primordial, but still subject to debate. It consists of a real challenge in soils rich in allophanic compounds (amorphous alumino-silicates). Here, we propose a new approach to quantify three phytolithic pools in a perhydrated Andosol under humid tropical conditions (Guadeloupe). Our approach is based on successive selective extractions. The pools differ in terms of Si bioavailability as measured through $CaCl_2$ kinetic extraction. We further show that our experimental approach may open new routes to understand the terrestrial biocycling of Si.