Changes in soil microbial communities as a function of time in a marine terrace chronosequence, Santa Cruz, CA

Sarah Pistone

A series of five marine terraces located in Santa Cruz, CA were sampled and analyzed for microbial biomass carbon content. Each consecutive terrace was exposed by regional uplift with ages ranging from 65 ka to 225 ka. The region has a Mediterranean climate, with grasses being the dominant vegetation. Cores were augered down to depths of 3-4 m and samples were collected every 30 cm, with 15cm resolution for the first 60 cm. A freeze-drying method was used to analyze the microbial biomass carbon content of the soil samples (modified from Islam et al, 1997). When the soils were frozen, microbial cells ruptured, and released organic compounds. A potassium sulfate solution was added to the samples to extract total organic carbon (mg/kg dry soil), which was measured on a Shimadzu TOC analyzer. Control samples were not freeze dried, but were analyzed in the same way, using potassium sulfate to extract organic matter. The organic carbon content of the control samples were subtracted from the organic carbon content of the freeze-dried samples. The difference between the two values gave an estimate of microbial biomass carbon (MBC). MBC was found to be highest at the surface, and terraces three and five show a subsurface peak at a depth of about one meter. In terrace one the MBC content drops to negligible values by about 60 cm below the surface. In terrace three the MBC values reach detection limits by about 1.2 m depth, and in terrace five the MBC content drops below detection at about 2.8 m. It appears that the older terraces sustain their microbial communities to a greater depth. The older soils also show a significant increase in wt % clay (Pinney et al, 1998). The increased clay content stabilizes the soil moisture content, and decreases the seasonal fluctuations seen in younger soils (White et al, 2005). The water retained at depth in the older soils would support a greater abundance of micro-organisms, which helps to explain the slower decline in MBC in terraces three and five. Aluminum complexes with dissolved organics; microbial activity degrades organic matter, which in turn increases the aluminum concentration in soil pore water and may contribute to the precipitation of kaolinite/$Al(OH)_4$ (White et al, 2005). This process produces a positive feedback mechanism; the clay retains moisture to support micro-organisms that contribute to the formation and evolution argillic horizon.