Succession of microbial photoautotrophs along a soil chronosequence in maritime Antarctica

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The Antarctic Peninsula has experienced extensive regional warming since the 1950's, which is reflected in accelerated rates of glacier retreat and ice shelf collapse in the region (Cook et al. 2005). As a glacier retreats, it exposes new terrestrial habitats for the colonization of pioneering organisms. The study of plant succession in glacier forefields is at the core of ecology (Matthews 1992), but very little is known regarding the primordial stages in which soil biomass and processes are dominated by microorganisms. Microbial phototrophs, such as cyanobacteria and green algae, are usually the first colonizers on exposed glacial deposits (Hodkinson et al. 2003; Kaštovská et al. 2005). Here we investigate the structure of soil microalgal communities along the Meseta chronosequence (Fildes Peninsula, King George Island, maritime Antarctica), consisting of twelve sites encompassing 6,200 years of deglaciation (Boy et al. 2016). A total of 333,776 16S rRNA gene sequences were obtained by 454 pyrosequencing, which were clustered into 195 OTUs at 97.5% similarity. OTUs were assigned to Cyanobacteria (131 OTUs), Chlorophyta (35 OTUs), Stramenopiles (12 OTUs), Streptophyta (7 OTUs) and Rhodophyta (1 OTU). Total, cyanobacterial and plastid richness followed a polynomial distribution along the chronosequence (R^2 = 0.72, p = 0.006). Community structure changed from a cyanobacteria- to a plastid-dominated state at about 4,500 years BP, which was mirrored by exponential shifts in cyanobacteria and plastid relative abundances (R^2 = 0.95, p < 0.001). Earlier communities (<4,500 years BP) were dominated by cyanobacterial OTUs related to *Nodularia*, *Phormidium*/*Phormidesmis*, *Pseudanabaena* and *Chamaesiphon*. Later communities (>4,500 years BP), on the other hand, were dominated by green algal OTUs related to *Prasiolopsis*, *Stichococcus* and *Elliptochloris*. These results show a consistent successional pattern of microbial photoautotrophs and emphasize the essential role of cyanobacteria as pioneers in recently deglaciated soils, where they contribute to the stabilization of the soil matrix and organic matter accumulation.

References

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