

Lateral and vertical distribution of soil organic carbon in recently deglaciated areas of Elephant Point (Livingstone island, Maritime Antarctica)

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In Maritime Antarctica important environmental changes are affecting ice-free environments of the South Shetland Islands and the northern Antarctica Peninsula. In the Elephant Point Peninsula (Livingstone Island) a rapid glacier retreat during the last decades has exposed already around 20% of its 1.16 km² surface. Despite soil development is taken place in these new created lands little is known on the characteristics and properties of soils on different parent materials and landforms. One of the main soil properties is the organic carbon but the SOC pool dynamics in Antarctica environments is still poorly understood. This work aims to gain knowledge on the lateral and vertical variations of soil organic carbon (SOC) and organic carbon fractions in surface profiles that have been exposed succeeding the phases of glacier retreat. To this purpose a sampling scheme following the direction of the glacier retreat was established along a moraine extending from the western to the eastern coastlines and a sequence of Holocene marine terraces in Elephant Point.

To assess the lateral and vertical variations of SOC and SOC fractions a total of 10 sites were sampled until a depth of 12 cm then sectioned at 3 cm depth intervals. According to its chemical stability and turnover times, SOC can be divided into the active carbon fraction (ACF) composed of labile aliphatic and carboxyl groups with turnover rates of days to few years and a more stable refractory aromatic carbon fraction (SCF) with turnover rates from few years to centuries, highly resistant to microbial and chemical decomposition. The SOC content (%) was measured at 550 °C by the dry combustion method using a LECO, RC-612 multiphase carbon analyser. For the characterization of the active and stable carbon fractions the temperature of the furnace was stepped at 350 °C and 550 °C, respectively. Estimates of SOC and SOC fractions inventories (kg m⁻²) were done to assess their stocks on the different landforms. SOC and SOC fraction contents were only found in the soils of the marine terraces. The ACF fraction had the higher percentages that were up to 4-5 times the contents of the SCF. The presence of SOC is related to the vegetation cover of mosses and the existence of fauna. The lateral variation and the vertical distribution of SOC and SOC fractions allowed to derive information on the degree of soil development that has been reached on the main landforms of Elephant Point after deglaciation.