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FRNs and SOC signatures to assess soil redistribution patterns in marine platforms and moraines of King George Island (Maritime Antarctica)

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In ice-free surfaces of King George Island (South Shetland Islands, Maritime Antarctica) the main formations along topographic chronosequences consist of weathered volcanic rock outcrops, marine platforms, deposits of glacial materials such as moraines, and present day beaches. In relation with recent glacier retreat processes of sediment redistribution in unstable paraglacial environments are highly active in the area. Together with soil particles the mobilization of associated soil organic carbon (SOC) can be further enhanced under conditions of climate change by melting snow and ice. In February 2015 we conducted a selective sampling of reference sites on marine platforms and moraines to be compared with surface sediments recently deposited in lakes on the platforms and in the proglacial environment of the Bellingshausen Ice Dome. During a 15 days field campaign funded by IAEA INT5153 project we collected soil and sediment profiles and lake surface sediments to assess if there were differences between old marine platforms and contemporary moraines in their FRNs and SOC signatures, as both proxies have been found to be effective tracers of recent glacier retreat in other polar environments. The reference samples on the platforms were characterized by relatively slightly higher contents of sand ($>$ 50%) than silt fraction and low clay contents ($<$ 5%) accompanied by SOC contents ranging between 1 and 3.5 % and FRNs values of 3.5 Bq kg^{-1}for ^{137}Cs and of 8 Bq kg^{-1}for ^{210}Pb$_{ex}$. In contrast, on moraines the dominant grain size was silt ($>$ 70 %), the SOC contents were below 0.5% and FRNs were much lower than in platforms soils with activities of ^{137}Cs below the detection limit and of ^{210}Pb$_{ex}$ less than 5 Bq kg^{-1}. The surface sediments accumulated in the proglacial lakes were enriched in sand ($>$ 80 %) while in the platform lake they were mainly silt ($>$ 70 %) and clay fractions reached up to 12 %. The sediments of the platform lake had high SOC contents (6.3 %) but the proglacial lakes had negligible values ($<$ 0.1%). FRNs were not detected at the proglacial Upper Lake where the source materials are moraine and fresh glacier materials. However, the low FRNs activities found at the Lower Lake are because its headwaters also comprise soils developed on marine platforms. Our results regarding contents of FRNs and SOC in the source areas and the sediments accumulated in the lakes, reflect a clear link on the provenance of sediments. The differences of grain size in lake sediments might suggest a relatively more energetic runoff in the proglacial lakes related to melting snow and ice directly from glacier in comparison with that on platforms. These results are consistent with a highly dynamic environment and in which soil and sediment particles are redistributed along the sediment cascade system in ice-free areas of Maritime Antarctica.