Project acronym: SOCRATES

Project title: Soil Organic Carbon Research in the Arctic Tundra Ecosystems: a Pan-Arctic Exploration

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Discipline: Earth Sciences & Environment: Other - Environment

Station(s): Churchill Northern Studies Centre (Canada)

The aim of the project is to compare soil organic matter and microbial activity in different parts of the Arctic. At this stage, we plan to study the organic matter of Canadian tundra soils and compare this data with what we already have or plan to get in 2020 for tundra soils in the European Arctic (Russia, Finland, Sweden and Norway). We have chosen the soil of shrubs and graminoids ecosystems as the objects of our study not only because they are widespread in the tundra, but also because climate change is stimulated to rapid expansion of shrubs (especially Betula nana). The study will address two main goals. First, the influence of the shrub's expansion on changes in the composition of organic matter and the activity of soil microorganisms will be studied. Dwarf-shrubs form less annual litter with low nitrogen enrichment and also have less volume of fine roots than herbaceous plant. On the other hand, shrubs have more ectomycorrhizal mycelium. All of this could lead slow down the rate of soil organic matter mineralization and contribute to carbon sequestration in the future. The second research issue of the project is related to the role of mineral subsoil in the carbon cycle. It should be noted that our knowledge about the role of mineral subsoil in carbon cycle is limited. Studying mineral subsoil is important because they may be a significant component of carbon pools and fluxes. Above of all, it concerns the mechanisms of stabilization of organic matter in the interaction with the mineral part of the subsoil. We hypothesized that (1) the geographic location can have a great impact on carbon sequestration and these differences can be used to predict the impact of climate change on the carbon cycle; (2) the shrubification can contribute to a reduction in the rate of new low-molecular carbon turnover, which will help to reduce CO2 emissions from soil to the atmosphere during climate

warming; (3) subsoil has important role in the carbon cycle due to complex stabilization mechanism involving rocks and microorganisms; (4) microbiological activity in topsoil and subsoil have different temperature sensitivity and it can be used to predict the impact of climate change on the carbon cycle in the Arctic soils.