Mineralogical controls on carbon reservoirs across a boreal forest climate transect

MACKENZIE PATRICK AND SUSAN ZIEGLER

Department of Earth Sciences, Memorial University of Newfoundland, St. John's, Newfoundland and Labrador, A1B 3X5

Boreal forests contain ~30% of global soil organic carbon (SOC) within a region that is predicted to undergo some of the greatest increases in temperature and precipitation over the next century, yet the controls on SOC reservoirs remain poorly understood. A considerable portion of SOC resides within the mineral soil, where mineralogy can play a significant role in its stabilization. The Newfoundland and Labrador Boreal Ecosystem Latitudinal Transect is a climate transect across boreal landscapes exhibiting increased temperature and precipitation similar to what is expected in the next century. The regions have common vegetation and soil type, but variable geological parent materials, allowing one to assess the impact of mineralogy and climate on C cycling in a natural system. In this contribution, the relationships between mineral soil characteristics and ecosystem parameters influenced by climate with SOC were assessed across this transect using an information theoretic approach. This method of model selection allows us to rank models by their ability to describe the response variable, an advantage here where multiple factors and their interactions potentially play a role. The strongest models, describing 81–83% of variance in SOC, included the poorly crystalline Al pool involved in podzolisation with either soil surface area or litterfall inputs. However, the Al pool was the stronger predictor variable, explaining 75% of the variance in SOC. The remainder variance of 17–38% may be described by dissolved organic carbon inputs, hydrology, or by temperature and precipitation, which were not included as they were captured in the regional effect. These results suggest that mineralogical mechanisms are more important for controlling SOC stocks in these mineral soils than forest inputs or climate effects. This may also be responsible for the observed maintenance of SOC stocks despite the increased fluxes into and out of these mineral soils across this climate transect.

Atlantic Geology, 2018, Volume 54
Geological Association of Canada – Newfoundland and Labrador Section Abstracts – 2018 Spring Technical Meeting
doi: 10.4138/atlgeol.2018.004