Abstract

Soil organic matter (SOM) is highly important for soil quality and the global carbon cycle. SOM content is influenced by a complex interplay of many different factors such as time, climate, parent material, vegetation, and others. The effect of time is often studied using the chronosequence approach using a set of study sites differing in age but comparable in other soil-forming factors. The effect of other factors can be studied by comparing two or more chronosequences. An important assumption of these approaches is that the SOM quantification methods produce comparable results both among sites of each sequence and among different sequences. In this thesis, I explored the key factors in SOM accumulation and dealt with SOM quantification methods. I studied SOM accumulation in two model situations – in post-mining sites after open-cast coal and oil shale mining and in landslides in the Western Carpathians.

The results of this thesis are summarized in one book chapter accepted for publication and four papers, out of which three have been published and one is prepared for publication in an international journal with impact factor.

The key factor affecting the rate of SOM accumulation after a major disturbance is time. The accumulation rates found in the first 40 to 100 years in both post-mining sites and landslides are relatively high due to the low or zero initial SOM content of the newly exposed surfaces and high plant production. In the long term, the C storage attains a steady state and on the millennial time-scale, gradual loss of phosphorus controls the dynamics of carbon and nitrogen. Other important factors controlling SOM accumulation include climate and vegetation which interact together and affect the SOM inputs and outputs.

Based on a methodological comparison, several methods that overcome the bias caused by fossil carbon of dominantly aliphatic character were identified as suitable for use in studies of SOM accumulation in post-mining sites.

This thesis provides further insight into the factors and mechanisms controlling SOM accumulation and provides a solution to a major methodological issue connected with the study of SOM accumulation in post-mining sites.