



Soil organic carbon stocks in tropical soil systems under rainforests controlled by geochemistry

Are SOC stocks influenced by geochemical soil properties derived from different parent material?

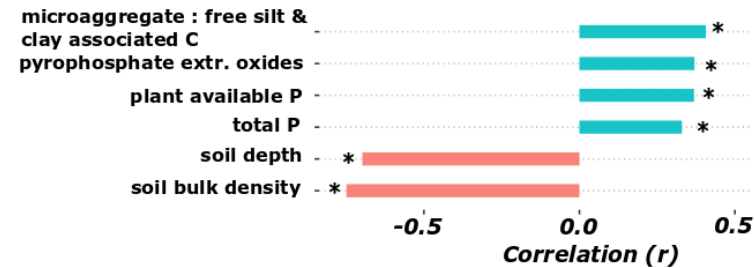
We are working in the eastern Congo Basin in areas with different soil parent material...

..but they don't dominate SOC stocks. There must be other interacting controls in addition to soil geochemical properties!

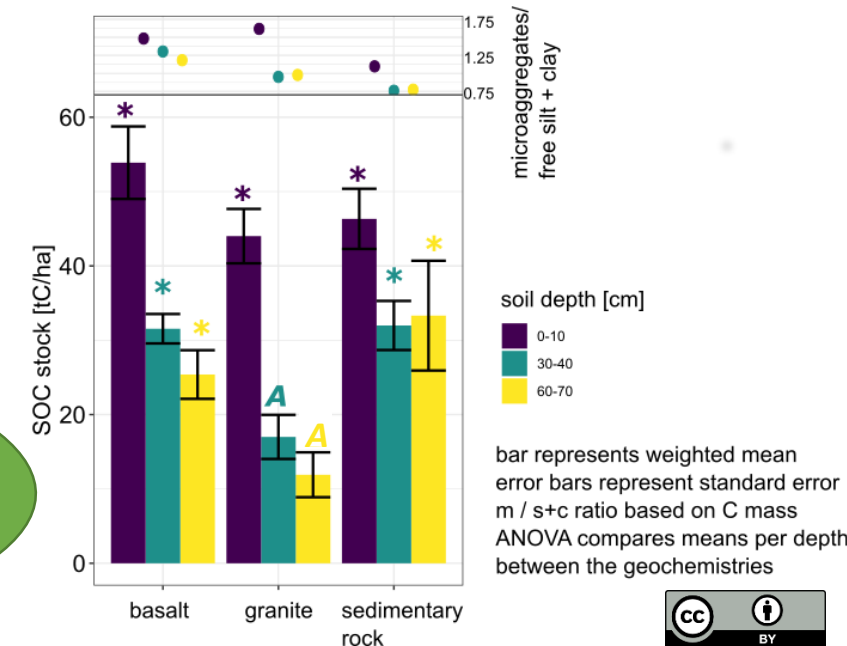
Soil profile (0-10 cm, 30-40 cm and 60-70cm)

Pearson correlation of entire dataset

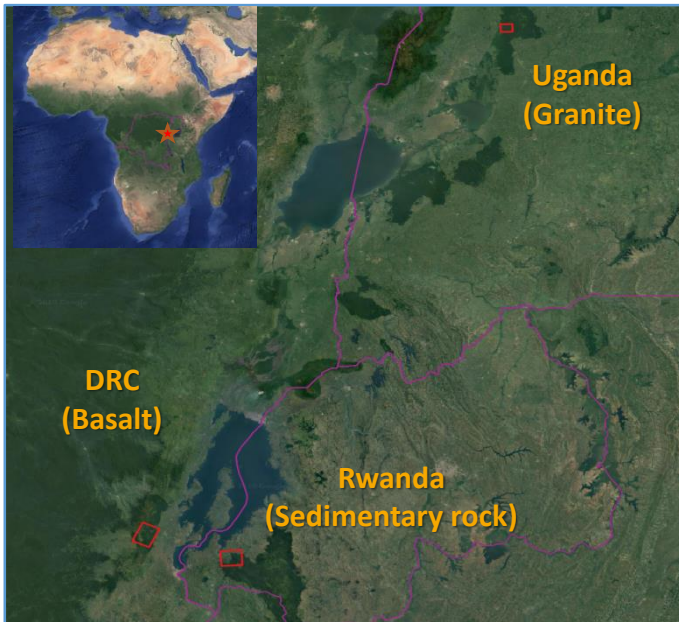
Correlation of soil parameters with SOC stock [tC/ha]



SOC stocks and C fractions along the geochemical gradient under forest



... and we found strong correlations between geochemical soil properties and SOC stocks ...

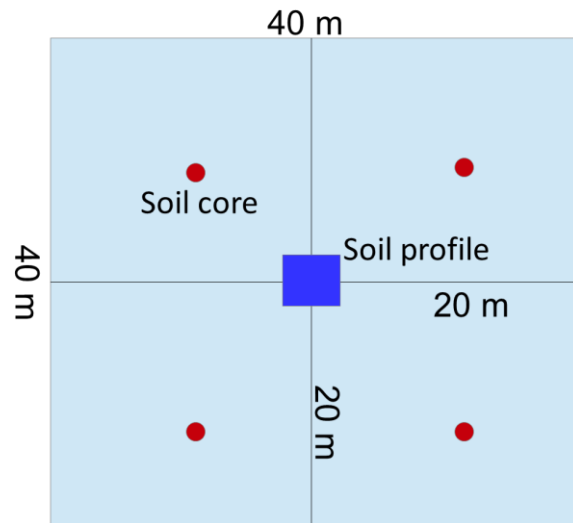


Are SOC stocks influenced by geochemical soil properties derived from different parent material?

Hypothesis: Soils derived from basaltic parent material with better fertility and C stabilization conditions will store more SOC than soils derived from granitic parent material

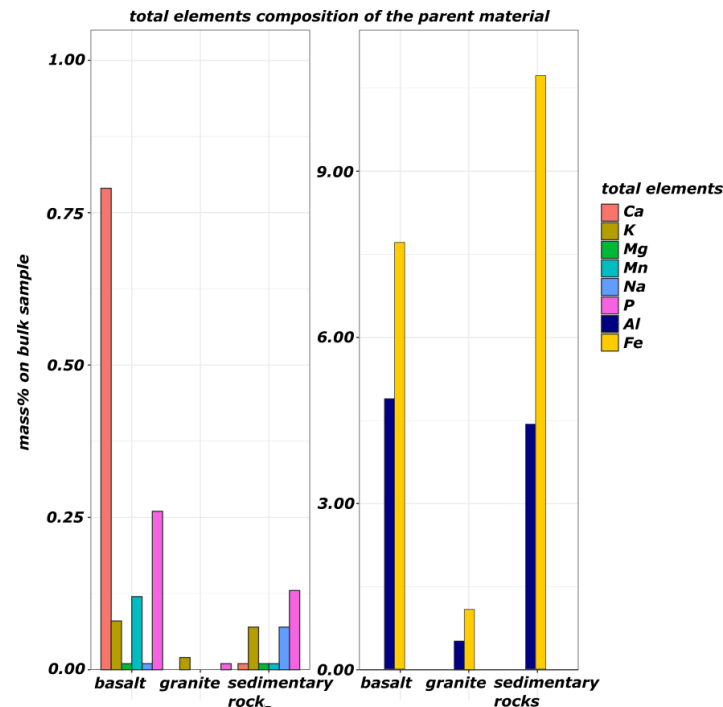
Methods

Soil sampling



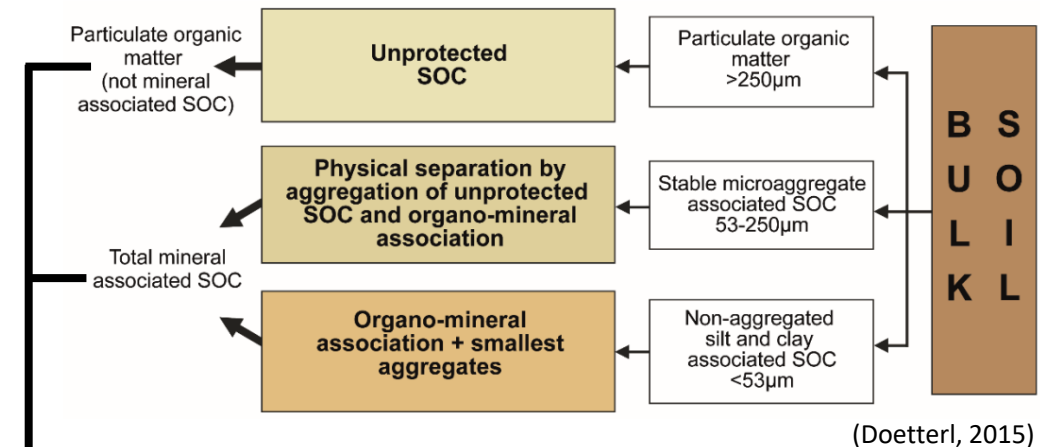
Soil sampling down to 1 m under rainforest at 36 plots in three different countries with different geochemistry. In each plot four soil cores were combined to one composite sample resulting in 560 composite samples in total.

Site characteristics



Each parent material shows a distinct different elemental composition.

Lab analysis

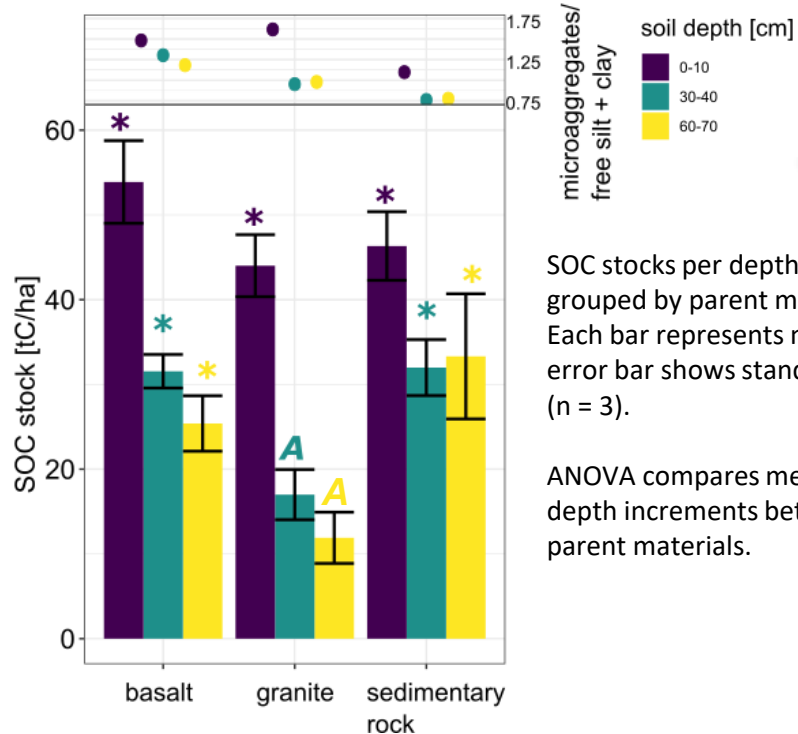


- Basic soil properties (texture, pH, eCEC, plant available P)
- Sequential pedogenic oxide extraction
- Total element analysis (ICP-OES & XRF)

Results

Statistical analysis

SOC stocks and C fractions on basalt, granite & sedimentary rock



SOC stocks per depth increment grouped by parent material. Each bar represents mean and error bar shows standard error (n = 3).

ANOVA compares mean per depth increments between parent materials.

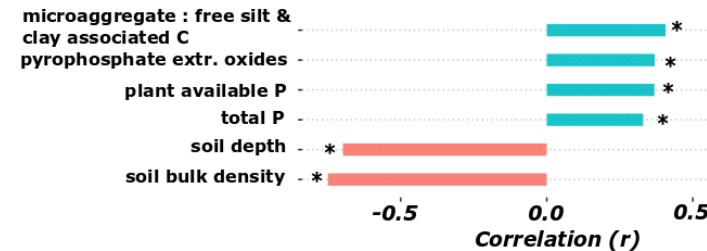
Major findings

- Soils derived from basalt and sedimentary rocks have similar SOC stocks
- Subsoils derived from granite store less SOC compared to other subsoils
- No significant difference on how SOC is distributed between coarse particulate organic matter, microaggregates and free silt and clay on different parent materials

Soil profile (0-10 cm, 30-40 cm and 60-70cm)

Pearson correlation of entire dataset

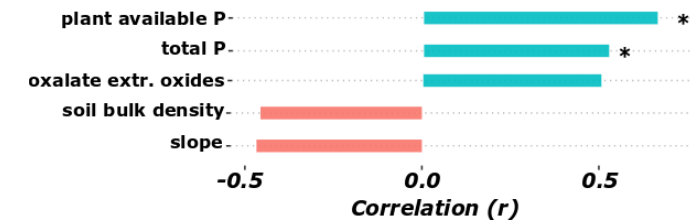
Correlation of soil parameters with SOC stock [tC/ha]



Topsoil (0-10 cm depth)

Pearson correlation of entire dataset

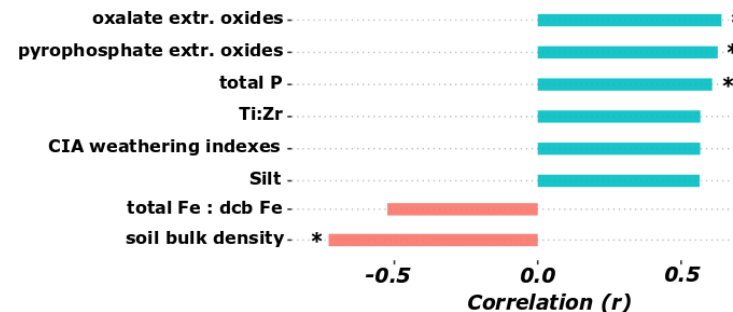
Correlation of soil parameters with SOC stock [tC/ha]



Midsoil (30-40 cm depth)

Pearson correlation of entire dataset

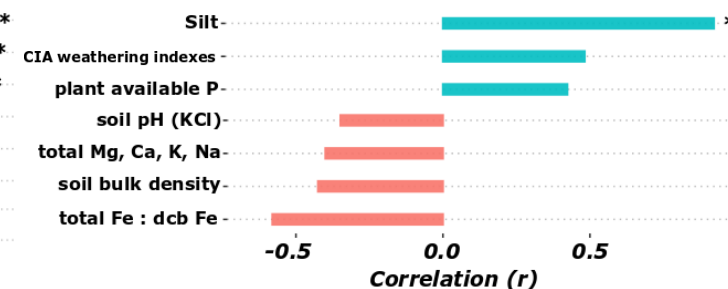
Correlation of soil parameters with SOC stock [tC/ha]



Subsoil (60-70 cm depth)

Pearson correlation of entire dataset

Correlation of soil parameters with SOC stock [tC/ha]



Pearson correlation between SOC stock and geochemical soil properties using data of all parent materials displayed for each depth increment (p-value = 0.05, significant correlations marked with *, n = 12-36).

Major findings

- Weak correlations of SOC stocks with geochemical soil properties in the topsoils but strong correlation in subsoils.

Conclusions & Outlook

What can we learn?

- Underlying geology leaves footprint in soil geochemistry despite long-lasting chemical weathering
 - Geochemical soil properties are correlating with SOC stocks but do not dominate them
- Soils derived from basalt has similar SOC stocks compared to soils derived from sedimentary rocks, even though the elemental composition of the sedimentary rocks are similar to granite

What's next?

- Building soil spectral library to increase dataset-power to decipher controls on SOC dynamics
 - Comparison of geochemical properties and SOC stocks between forest and morphodynamically active cropland sites
- What is the effect of erosion on SOC dynamics in the tropics?

Business Card



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