# Do explosive volcanic eruptions act as local carbon sinks?

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Relatively short-lived explosive eruptions emit $CO_2$ in the atmosphere and blanket the lanscape with tephra. As a result, soils may be buried and isolated from the surface. With time, new volcanic soils develop from the tephra deposits, leading to organic matter, and thus, C accumulation. In contrast, inputs of organic matter to the tephra-buried soil are suppressed and a net loss of organic C may result due to continuous degradation by soil microbes.

Here we test the hypothesis that the total amount of soil organic C accumulated above and sequestrated below a tephra deposit surpasses the combined amount of C released into the atmosphere by the same eruption that laid down the tephra and that lost in the buried soil through microbial degradation.

We determined the organic C content in soils below and above a ~930 $km^2$ tephra deposit corresponding to the 2270 yr BP eruption of Atacazo volcano, Ecuador. The amount of organic C lost through degradation in the tephra-buried soil since the eruption was estimated by comparing the organic C contents in the surface and buried soils. Using ArcGis©, we computed the corresponding C stocks by applying kriging techniques to our datapoints. The amount of volcanic C emitted by the 2270 yr BP eruption was inferred from the tephra deposit volume (~1.3 $km^3$ [1]), assuming that each $km^3$ of magma erupted releases ~10 Mt of $CO_2$ [2].

Our results indicate that ~41 Tg of organic C are currently stored in the surface and tephra-buried soils. This stock of C is ~3 times higher than the combined amount of volcanic C emitted into the atmosphere by the 2270 yr BP eruption of Atacazo and that removed from the buried soil by biological degradation. We argue that tephra-rich explosive eruptions in subtropical and tropical regions where soils development is rapid may act as local sinks of C.

[1] Burton et al. (2013) Rev Mineral Geochem, **75**, 323-354.
[2] Hidalgo et al. (2008) J Volcanol Geoth Res, **176**, 16-26.