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Direct evidence of CO_2 drawdown through enhanced weathering in soils

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The ability of engineered enhanced rock weathering to impact atmospheric CO_2 has been challenging to demonstrate due to the many processes occurring in soils and the short time span of current projects. Here we report the carbon balance in an Icelandic andosol receiving large quantities of basaltic dust over 3,300 years, providing opportunity to quantify the rates and long-term consequences of enhanced weathering. The added basaltic dust has dissolved continuously since its deposition. The alkalinity of the soil waters is more than 10-times higher than in equivalent basaltic dust-free soils. After accounting for oxidation and degassing when the soil waters are exposed to the atmosphere, the annual CO_2 drawdown is 0.62 tCO_2 ha^{-1} yr^{-1}. This study validates the addition of mafic minerals to soils to attenuate increasing atmospheric CO_2 by alkalinity export, however, induced changes in soil organic carbon storage could dominate the net CO_2 drawdown of enhanced weathering efforts.