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Investigating the relationship between soil sorption strength and anoxic microsites in the rhizosphere

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Rhizosphere soils are characterized by high inputs of labile carbon and active microbial communities, which are presumed to drive redox heterogeneity. Anoxic microsites (i.e., nonmajority soil volumes where oxygen demand outpaces oxygen supply within an otherwise oxic soil) are thought to form preferentially near root tips and partially determine the fate of carbon in the rhizosphere. Root exudates have been shown to drive anoxic microsites, but this has yet to be demonstrated across a variety of soils. Here we investigate how soil sorption strength regulates exudate-driven anoxic microsites. We deliver ^{13}C-labeled compounds via reverse microdialysis to simulate root exudation in soils of varying mineralogy and sorption strength. We monitor anoxic area over the course of three day/night cycles using planar optical oxygen sensors and interpret N_2O and Fe(II) as indicators of anaerobic activity. Solid-state ^{13}C mapping paired with $^{13}CO_2$ analysis allows us to determine how exudate extent controls anoxic microsite formation and the degree to which exudate carbon is stabilized in the rhizosphere. We expect to see greater anoxic microsite formation and anaerobic activity in soils of lower sorption strength. Our results will help improve our understanding of the mechanisms governing soil carbon fate in an ever-changing climate.