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ADSORPTION CONTROLS ON THE COMPOSITION AND BIOLOGICAL REACTIVITY OF ORGANIC MATTER IN TERRESTRIAL AND AQUATIC ENVIRONMENTS

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The fate and transformation of organic matter (OM) in terrestrial and aquatic environments plays a major role in the global carbon budget. The transport of terrestrially derived organic carbon inputs to aquatic ecosystems exerts significant biogeochemical controls on dissolved organic matter (DOM) and leads to the change in their concentration and composition. One important example of such controls is the adsorption of DOM to mineral particles in soils, sediments and suspended in aquatic environments. The process of adsorption can selectively remove some DOM compounds and therefore potentially changes the biological availability and reactivity of DOM remaining in solution. The interplay between DOM adsorption and bioavailability greatly depends on the molecular structure and composition of DOM as well as properties of mineral surfaces. Deeper understanding of DOM-mineral interactions requires comprehensive information about adsorption across a range of DOM sources to different minerals and associated shifts in DOM composition due to adsorption. The main objective of this study is to use a matrix of DOM sources and mineral surfaces from both terrestrial and aquatic environments to determine adsorption characteristics and bioavailability of DOM remaining in solution. We used a combination of natural and end member sources. The DOM sources used included a humic lake, leaf litter, peat extract, black carbon and algae. Mineral surfaces included a podzol, an agricultural soil, sediment from a glacial stream, a commercially available clay and pure goethite. To this end, we exposed the five minerals with a range of adsorption characteristics to the five DOM sources and analysed changes to DOM composition using optical, mass spectrometry and 1H NMR spectroscopy. We also measured the fraction of organic carbon removed during incubations over 14 and 60 days to estimate bioavailability of the remaining DOM. This study allows us to develop a better mechanistic understanding of the importance of selective adsorption on controlling the biological reactivity and fate of DOM in terrestrial and aquatic environments.