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Chemical features of organic carbon (OC) that foster OC burial in lake sediments

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Lakes were shown to be important players in the global carbon cycle. In spite of the small areal extent of lakes compared to the ocean, their sediments bury about half as much OC as marine sediments. The factors triggering the effective carbon sink in lake sediments are yet unclear. In this study, lakes with different trophic states, oxygen exposure times, and OC sources were compared to decipher which organic components become selectively preserved. Oxygen exposure time and terrigenous OC were found to trigger burial. An indicators for the diagenetic aging of the bulk OC, the Dauwe index, showed that reactive amino acids are removed fast during initial phases of decomposition, whereas non-protein amino acids selectively accumulate. Also, the proportion of D-Alanine, a biomarker for bacterial biomass, increased over time. By using Electrospray ionization Fourier transform ion cyclotron resonance mass spectrometry (FT-ICR MS) and taking advantage of its high resolving power to make precise formula assignments, it was also found that from autochthonous organic matter, unsaturated compounds undergo abiotic sulfurization and therefore accumulate along aging. Terrigenous organic matter did not form organic S-compound and stayed rather inert during early diagenesis. Results from this study showed that OC burial in lakes was mostly driven by a high share of terrigenous organic matter and its inertness to degradation, by selective accumulation of bacterial transformation products, bacterial biomass itself, and abiotic sulfurization.