A meta-analysis of paleolimnological records reveals the sensitivity of lacustrine carbon burial rates to carbon sources and preservation conditions during the Anthropocene

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Inland waters are sites of active carbon (C) processing and transport along the land to ocean aquatic continuum (LOAC) that need to be accounted for closing the global C budget[1,2]. However, monitoring data are lacking and do not extend back as far as few decades, limiting our comprehension of the LOAC C cycle for the last centuries. Lake sediments provide a key archive for assessing C transport and transformation that occurs in lake catchments. Here, the analysis of large numbers of samples was performed on 420 lakes sediment records of the world to assess C burial rates and sources during the last 300 years. C and N (organic and mineral forms) on discrete samples were analyzed using a Variomax elemental analyzer to assess total C sequestration by lakes, C sources, and long-term changes in the contribution of allochtonous vs autochtonous sources to C transfers in lake-watersheds. Continuous sediment records were generated using core scanners (i.e. micro-XRF) and computed tomography to provide near-annual trends on terrigenous elements, here used as proxies of allochtonous sources (e.g. Al, Ti, K, Fe), and Mn:Fe ratio to infer past oxygen conditions[3]. Our results suggest that establishing a morphology-relevant lake typology that better characterises the types and distribution of oxygen conditions and terrigenous supplies across our sites is therefore the first step in providing a more robust evidence base for explaining the spatial-temporal variation in lake C burial rates.

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