

The deep permafrost carbon pool of the Yedoma region in Siberia and Alaska

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Abstract

Estimates for circumpolar permafrost organic carbon (OC) storage suggest that this pool contains twice the amount of current atmospheric carbon. The Yedoma region sequestered substantial quantities of OC and is unique because its deep OC, which was incorporated into permafrost during ice age conditions. Rapid inclusion of labile organic matter into permafrost halted decomposition and resulted in a deep long-term sink. We show that the deep frozen OC in the Yedoma region consists of two distinct major sub-reservoirs: Yedoma deposits (late Pleistocene ice- and organic-rich silty sediments) and deposits formed in thaw-lake basins (generalized as thermokarst deposits). We quantified the OC pool based on field data and extrapolation using geospatial data sets to $83 + 61/-57$ Gt for Yedoma deposits and to $128 + 99/-96$ Gt for thermokarst deposits. The total Yedoma region $211 + 160/-153$ Gt is a substantial amount of thaw-vulnerable OC that must be accounted for in global models.