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“Mobilizing” organic carbon pool in the ocean

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Upon export to marginal seas, organic matter (OM) is subject to intensive remineralization. A small proportion can escape from the degradation, and deposit on the seafloor. Nevertheless, the sedimentary OM is still subject to remobilization and redistribution in the ocean, resulting in "transport time-associated aging" of the remobilized OM as a function of the lateral transport time (LTT). Many lines of evidence indicate that aging of OM (increasing LTT) due to lateral sediment redistribution is a widespread phenomenon on continental margins, suggesting that the OM lateral transport on the shelves may take place over centuries to millennia. The timescale depends on varying factors (e.g., lateral transport distance, specific hydrodynamic conditions), emerging as an important factor controlling on the preservation and degradation of corresponding sedimentary OM. Thus, given that the timescale is cumulative, there is a “mobilizing” pool of sedimentary OC that does not bury but still redistribute in the ocean.

This presentation seeks to test the hypothesis using radiocarbon analyses of total OC, thermally-resolved organic fractions, and specific compounds applied to different grain size fractions of sediments along a sediment dispersal pathway from the eastern Pacific continental margins. Our finding shows that 14C ages of total OC and vascular plant biomarker (plant leaf waxes) increase with increasing grain size sediments along the sediment dispersal pathway. The 14C ages of all corresponding grain size specific thermally-resolved organic fractions along the pathway increase, suggesting all organic constituents including both marine and terrestrial OC occurs aging during lateral transport. Our findings suggest that LTTs of sedimentary OM are continuous and cumulative. The sedimentary OM with a certain LTT corresponds an OC sub-pool, while the magnitude of the latter is related to the lateral transport timescale. Consequently, the whole pool of remobilized OC, a sum of time-continuous sub-pools, may mobilize in the ocean rather than burial on the shelf. The “mobilizing” OC pool will be discussed in the context of the lateral movement of OC with an implications for interpretations of sedimentary records of marine carbon cycle dynamics.