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Dissolved Rhenium as a tracer of oxidation of petrogenic carbon in the Ganga (Hooghly) River catchment, India

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Oxidation of petrogenic organic carbon (OC_{petro}) counters CO_2 sink via organic carbon (C_{org}) burial and silicate weathering in the long-term carbon cycle. Since the time dissolved rhenium (Re_{diss}) in the rivers has been documented to be a robust tracer of OC_{petro} oxidation[1], studies have focused on estimating CO_2 flux via oxidative weathering of OC_{petro} from the catchments using $[Re/OC]_{petro}$ ratio[2]. We investigated the river water, suspended (SPM), and bed sediments of the largest river system of India, the Ganga (Hooghly), at its outflow before the mixing zone.

$[Re]_{diss}$ varies seasonally, with maximum concentrations during the dry periods compared to the wet periods. The comparison of Re/ΣCations* (* denotes corrected for cyclic contributions) ratios between river waters and major lithologies (silicates and carbonates) reveals that major lithologies are insignificant sources of Re_{diss}. $[Re]_{diss}$ depicts inverse correlation with ΣCations* and $[HCO_3^-]$. However, the relative decrease of $[Re]_{diss}$ with ΣCations* or $[HCO_3^-]$ is smaller in dry period than in wet period. These observations together indicate that supply of Re from major lithologies is lower in the wet periods. Re/Al ratios show a positive correlation with C_{org}/Al and an inverse correlation with $d^{13}C_{org}$ in bed sediment and SPM. These observations indicate that (i) Re is associated with organic phases and (ii) the OC_{petro}, presumably having a lower $d^{13}C_{org}$[2],[3],[4], is the major host of Re.

Calculations based on reported range of fractions of OC_{petro} being oxidized in the Ganga Basin[4] and $[OC/Re]_{petro}$[1] suggest that Re contributions from petrogenic organic matter alone can sustain the measured levels of $[Re]_{diss}$. The results of this study reinforce the idea that Re_{diss} can be used as a robust tracer for OC_{petro} oxidation.

References

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