Natural estuarine particles and their uptake of nitrogen in estuaries

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Globally, total nitrogen (TN) loadings to estuaries are increasing due to changes in urbanisation etc. Organic N (ON) constitutes >50% of the TN input to estuaries, but its speciation, reactivity and fluxes are poorly quantified.

Water Samples were collected from the Tamar Estuary (SW England). Suspended particulate Material (SPM) was fractionated and the water and particles characterised. Incubations using ^{14}C-labelled amino acids (AA) as ON proxies examined SPM-water partitioning.

The particle concentrations used for incubation experiments were those measured in the estuary. The results under the two conditions employed (`live' and `dead' particles) were *considerably* different. Under dead conditions there was only negligible binding of the AA to the particles and most remained in the water. The results were similar regardless of the AA chemical structure. Under live conditions, uptake of the AAs onto particles was *rapid*, with 80-90 % removed from solution over 24 hours. This indicates that the AA uptake onto particles was controlled by bacteria, which used the AAs for cell growth. The results were unexpected as the research literature suggests that the compound chemistry controls its attachment to particles and we used a range of compounds to test this. The broad conclusion to be drawn was that bacterial uptake of AAs is much more rapid and quantitatively important than any other type of physico-chemical binding. Our findings contradict the idea that particle-associated ON is protected from bacterial degradation, and it appears that assumptions on the behaviour of ON in aquatic systems will need to be revised.

Volatile budget of the Kamchatka arc

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In this study I estimate the volatile output (C, N, He, Cl) from the Kamchatka volcanic arc using: (1) direct measurements of flow rates and chemical compositions of thermal waters and vapors from more than 100 groups of thermal springs and hydrothermal systems; (2) direct measurements and indirect estimations of the gas fluxes from Kamchatkan volcanoes and (3) volcano-plutonic Holocene productivity of magmas and the corresponding volatile flux. Plank and Langmiure (1998), Hilton *et al* (2002), Sadofsky and Bebout (2004) Jarrard (2002) are main sources for the accepted here input data for H_2O, CO_2, $N_{2,ex}$, S, Cl and He. The main results (fluxes in mole/year) are shown in the table below:

	IN	OUT	OUT/ IN	OUT global	Kam/ Globe
$Sx10^{-10}$	2.3	1.2	0.52	32	0.037
H_2Ox10^{-12}	2	1.4	0.7	80	0.018
CO_2x10^{-10}	7.8	2.3	0.29	230	0.010
$^4Hex10^{-4}$	4.5	45	10	2000	0.023
^3He	0.45	4.2	32	200	0.021
$N_{2,ex}\,x10^{-8}$	9.2	12	1.3	320	0.037
$Clx10^{-9}$	13	7	1.8	380	0.018

Kamchatkan fluxes relative to global fluxes are roughly proportional to the length of the Kamchatkan segment relative the global arc length (700 km vs ~40,000 km). "Arc-Magmatic" ratios $N_2/^3He$, $C/^3He$ and $Cl/^3He$ for Kamchatka in log-units are 8.7 ± 0.5, 9.8 ± 0.7 and 9.7 ± 0.6 respectively. It looks like the $Cl/^3He$ ratio is a stable indicator of the arc magmatism. Its uniform value among different manifestations including volcanic gases suggests an essentially magmatic source of Cl in thermal springs.

References

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