

## HORIZONTAL AND VERTICAL TRANSPORT OF SOLUTES IN THE BIOTURBATED ZONE OF LONG ISLAND SOUND

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Animal-sediment interactions play an important role in the early diagenesis of marine sediments. In particular, irrigation of burrows by benthic fauna can dramatically increase solute exchange within the bioturbated zone. Quantitative models of solute transport in this zone usually emphasize net vertical exchange and assume laterally homogeneous, symmetrical distributions. In the present study, the conservative tracer  $\text{Br}^-$  was used to examine the symmetry of transport properties in the bioturbated zone of estuarine muds from both nearshore and central Long Island Sound, U.S.A.  $\text{Br}^-$  was introduced either directly into the overlying water, or as discrete vertical or horizontal intervals within otherwise undisturbed box cores containing natural populations of predominantly deposit-feeding benthos. Subsequent sampling and analyses of tracer distributions demonstrate enhanced vertical exchange in the upper  $\sim 7$  cm of sediment with evidence of lateral heterogeneity in transport properties. For tracer injection into the overlying water, lateral variability in mixing rates near the sediment-water interface results in horizontal variations of tracer concentration at depth, independent of deeper irrigation and transport. Introduction of  $\text{Br}^-$  directly into the sediment also demonstrates lateral variability in irrigation and transport at depths not resolved by the tracer input into the overlying water. If diffusion analogues, rather than nonlocal transport functions, are used to describe solute movement in the bioturbated zone, it is necessary to use a two dimensional transport model with spatially variable diffusion coefficients to describe  $\text{Br}^-$  distributions in detail.