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Dissolution of particle-reactive radionuclides in deposit-feeder digestive fluids

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ABSTRACT: Naturally occurring radionuclides such as 23+Th, 7Be, and 210Pb are important tracers for quantifying sedimentmixing and sediment-accumulation rates. Profiles of these radionuclides in marine sediments are strongly influenced by particle displacement due to deposit feeding, Observations of rapid dissolution and high concentrations of dissolved metals in deposit-feeder digestive fluids suggest that particle-bound radionuclides could also undergo dissolution during depositfeeder gut passage. We investigated this possibility in laboratory experiments examining radionuclide dissolution into the digestive fluids of the lugworm, Arenicola marina. Experiments with artificially labeled particles indicated that significant fractions of 234Th, 7Be, and 219Pb dissolved from labeled algal detritus and clay particles at low particle concentrations. 'arcs was also dissolved from clays. However, if unlabeled sediment particles were added to reach sediment : fluid ratios similar to those in A. marina midguts, little net dissolution occurred, which implies resorption of dissolved radionuclides by the added solid phases. Partition coefficients of these radionuclides in mixtures of digestive fluid and the various solid phases imply that relatively more 234Th resorbs to the residual organic phase following digestion, compared to 219Pb and 7Be, which partition more strongly to the inorganic sediment phases. Despite little net dissolution, the phase change from algal detritus to either mineral surfaces (for 219Pb) or undigested organic matter (for 234Th) implies that 234Th would serve as a better tracer for organic-matter mixing in sediments compared to 214Pb, which would better trace bulk sediment mixing.

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