FEEDING SELECTIVITY AND PARTICLE PROCESSING RATES OF DEEP SEA MEGAFAUNAL DEPOSIT FEEDERS: A THORIUM-234 TRACER APPROACH

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By

Robert J. Miller

Thesis Committee:

Craig Smith, Chairperson
David Karl
Yuan-Hui Li

ABSTRACT

Deep-sea bioturbation rates often are tracer dependent, varying inversely with tracer half-life. This may be due to age-dependnt mixing (ADM), where deposit feeders selectively ingest newly settled, nutritionally rich particles and mix them into the sediments faster than older particles. Fresh material may be traceable using ^{234}Th, which is scavenged by particles in the water column and has a short half life (24 days). To test whether deposit feeders do select fresh, ^{234}Th-rich particles, I have compared excess (xs) ^{234}Th activities of the gut contents of deposit feeders from Santa Catalina Basin (SCB) (1200 m) and the Hawaiian Slope (~1800 m) to the activity of surface sediment, and, at SCB, with sediment trap material. I also measured concentrations of chlorophyll *a* in the guts of animals and surface sediment as another index of feeding selectivity. Chlorophyll *a* is considered to be an indicator of newly settled phytodetritus, which may be a major food resource for deep sea animals. $^{234}Th_{xs}$ activities in the guts of surface deposit feeders from SCB were 14-75-fold greater than those of surface sediments (0-5mm). *Pannychia moseleyi* and *Scotoplanes globosa*, two highly mobile surface deposit-feeding elasipod holothurians, were the most enriched in gut $^{234}Th_{xs}$ activity, indicating that these species were also the most selective feeders. *Chiridota* sp., a burrowing, surface deposit-feeding chiridotid holothurian, and *Bathybembix bairdii*, a surface deposit-feeding gastropod, were less enriched in gut $^{234}Th_{xs}$, perhaps reflecting lower mobility. A subsurface deposit-feeding molpadiid holothurian was not enriched in $^{234}Th_{xs}$ activity compared to surface sediments, but was greatly enriched compared to its

presumed feeding zone. Guts of Hawaiian Slope deposit feeders were less enriched in $^{234}Th_{xs}$, but were enriched in chlorophyll a, suggesting that the animals there are also selective, but that $^{234}Th_{xs}$ activity is not a good tracer of labile organic matter in this more energetic environment. I calculated that three dominant megafaunal surface deposit feeders consume a mean of 39% (s.e.=23%) of the daily vertical flux of $^{234}Th_{xs}$ in SCB. Megafauna in this environment may thus play an important role in the recyling and bioturbation of organic carbon and in the bathyal food web, as they chemically alter and redistribute organic matter horizontally and vertically.