MEDFLUX: RELATIONSHIPS AMONG BALLAST, PARTICULATE ORGANIC CARBON AND ^{234}TH ACTIVITIES AND FLUXES AT THE DYFAMED SITE, NORTHWESTERN MEDITERRANEAN

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Abstract

Standard approaches for measuring the distribution and flux of ^{234}Th (in situ pumps, sediment trap) have been applied at the DYFAMED site, NW Mediterranean and complemented by analysis of samples from traps that collect and separate particles into fractions according to sinking velocity, and particles collected in a "net trap" and separated into sinking velocity using an elutriator on board the ship. The results show that >70% of the sinking flux of ^{234}Th is carried by particles sinking at velocities greater than ~100 m d^{-1}. Measurements of particulate organic carbon and elements corresponding to mineral ballast in the sinking particles will help to better understand the relationships among these parameters.

Sinking fluxes of particulate organic carbon (POC) in the oceanic water column are frequently measured using the disequilibrium between the natural radionuclide ^{234}Th and its parent ^{238}U. Such estimates require measurement of both the extent of disequilibrium and the POC/^{234}Th ratio on the sinking particles. The latter is commonly estimated through measurement of the POC/^{234}Th ratio in a large (>50 to 70 μm) filterable fraction or in sediment trap material. The relationship between the POC/Th in the filterable and sinking particles remains uncertain, however. As part of the MedFlux program, we used *in situ* pumps to measure the patterns of Th/U disequilibrium in the water column at the French JGOFS time-series DYFAMED site in the northwestern Mediterranean. In addition, IRS swimmer-exclusion sediment traps were deployed at 200 m to collect both a regular time series of particle flux and a composite sample with individual cups programmed to collect particles separated according to sinking velocity. A large sample of particles sinking through 200 m was collected by means of a newly-designed net trap deployed for 3 days, and subsequently separated into sinking velocity fractions using an elutriator.

Several water column profiles of particulate and dissolved ^{234}Th were collected over a one-week period in May 2003 (Fig. 1). The data show a pronounced minimum in total ^{234}Th (particulate + dissolved) centered on the depth of the chlorophyll maximum. Fluxes of ^{234}Th at 200 m (calculated applying a steady state model to the ^{234}Th deficit) were 2000 – 3000 dpm m^{-2} d^{-1}. These fluxes were in the range of those observed in a time-series sediment trap deployed at 200 m during the previous 60 days, although they more closely corresponded to trap fluxes measured early in the period (Fig. 2).

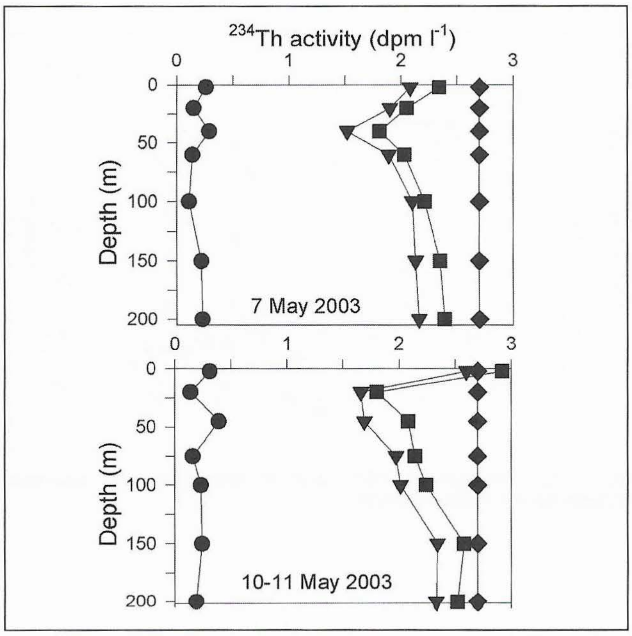

Fig. 1 Water column profiles of ^{234}Th (particulate:circles; dissolved:triangles and total:squares) and ^{238}U (diamonds).

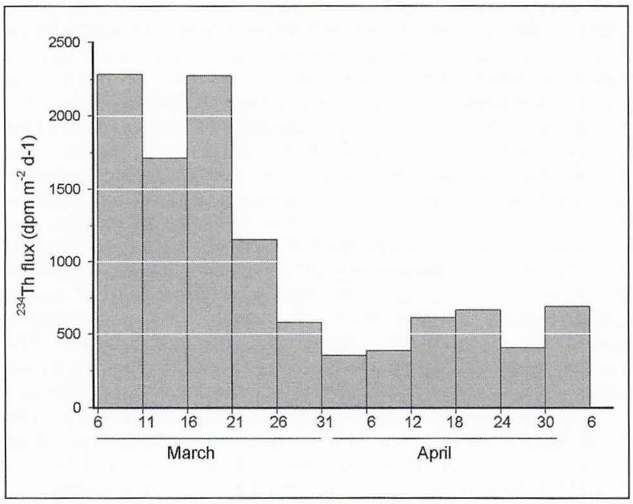

Fig. 2 Time series of ^{234}Th fluxes at 200 m.

Particles separated by sinking velocity using both the sediment trap and net trap/elutriator methods showed similar results. More than 50% of the ^{234}Th flux in the integrated sediment trap sample was carried in particles sinking faster than 196 m d^{-1} (Fig. 3). In the net trap sample collected May 6-8, more than 70% of the ^{234}Th collected was present on particles sinking at rates >100 m d^{-1}. The specific activity of ^{234}Th showed no clear relationship to sinking velocity. Future measurements of POC and ballast elements (Si, Ca, Al) will clarify the relationships between Th flux and particle composition.

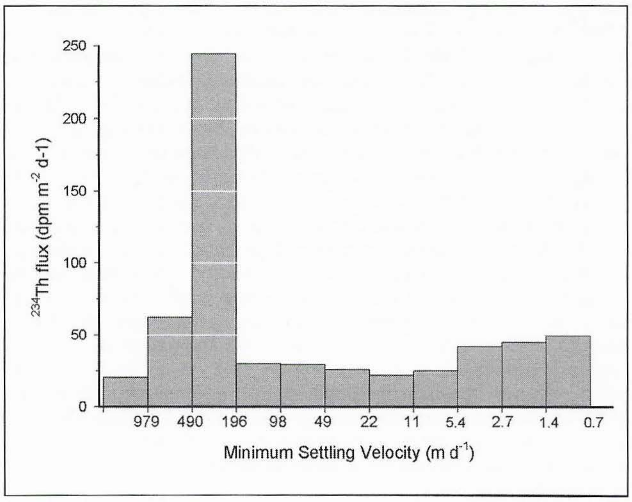

Fig. 3. Integrated ^{234}Th flux vs particle sinking velocity.