# MEDFLUX: $^{210}$Po concentrations, fluxes, and particle settling velocities at the DYFAMED site, Northwestern Mediterranean

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## INTRODUCTION

As part of the MEDFLUX project, spatial and temporal profiles of the natural radionuclide $^{210}$Po were collected from March to May 2003 at the DYFAMED site (Ligurian Sea, Fig.1) to distinguish the physical and chemical characteristics of sinking material. This is the first time that this radionuclide has been examined in samples separated by sinking velocity. The relationship between polonium and organic carbon and protein was also explored to determine which type of compound is better traced by $^{210}$Po. To this end, a decomposition experiment was conducted to replicate the loss of organic matter and $^{210}$Po as particles sink through the surface ocean.

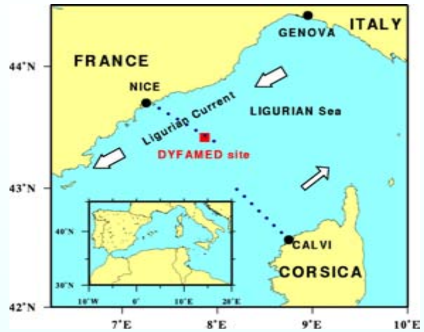


Figure 1. The DYFAMED site in the Ligurian Sea

## METHODS

Sediment Traps: IRS sediment traps were moored at the DYFAMED site for 56 days (*see Peterson et al.). The Settling Velocity traps were open every 24 h for differing lengths of time to trap material sinking at different rates. The Time Series traps were collecting sinking particles for five day periods over the course of two months.

Elutriator Samples: Material was collected over several days in a neutrally buoyant Net Trap with a 200$\mu$m mesh size (*see Peterson et al.). It was then slowly (8.3 ml/s) poured through the Elutriator. Due to a balance between settling velocity and upward pressure, particles get caught in the cylindrical vessels in accordance with their settling rate.

In Situ Pumps and Niskin Bottles: Particulate and Dissolved $^{210}$Po profiles were collected using Challenger pumps and Niskin Bottle rosettes from the surface to 2000m at the DYFAMED site.

Decomposition: Material caught in the Net Trap was also used in an 8 week decomposition incubation. The material was suspended in natural 1$\mu$m filtered seawater and sub- sampled for protein, carbon, mass, and radionuclide activity.

## RESULTS

Sediment Traps: $^{210}$Po **flux** from the surface to 200m is principally driven by mass flux, with more than 50% of the polonium sinking 200m/d or faster (Fig. 2). There was a period of high polonium flux between March 6 and 26. (Fig. 3). There is a strong relationship between organic carbon content and $^{210}$Po activity in the Time Series samples (Fig. 4).

Elutriator Samples: Particles sinking on the order of 20-50 m/d have the highest $^{210}$Po specific **activity**, but, as in the sediment traps, the flux of polonium is driven by the faster sinking particles (Fig. 5).

Bottles and Pumps: The vertical profiles of both $^{210}$Po and $^{234}$Th display an inverted pattern when compared to the POC profile (Fig. 6).

Decomposition: The loss of $^{210}$Po from natural particles mirrors the loss of both total carbon and nitrogen (Fig. 7). The loss of $^{234}$Th is offset from the loss of the other elements. Carbon concentrations were divided by ten to be on the same scale as $^{210}$Po, $^{234}$Th, and N.

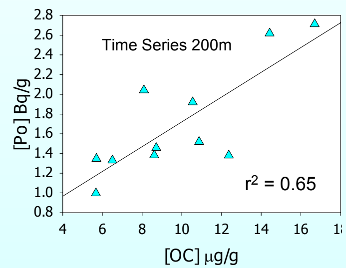


Fig. 4 Correlation between organic carbon concentration and $^{210}$Po activity in Time Series Sediment Trap samples.

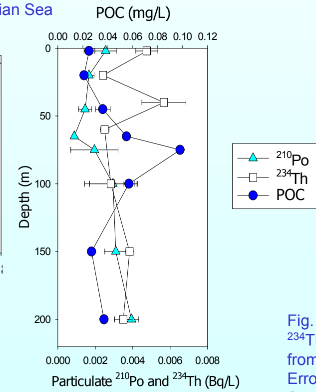


Fig. 6 Particulate $^{210}$Po, $^{234}$Th, and POC profiles from the *in situ* pumps. Error bars represent 1 SD from the mean.

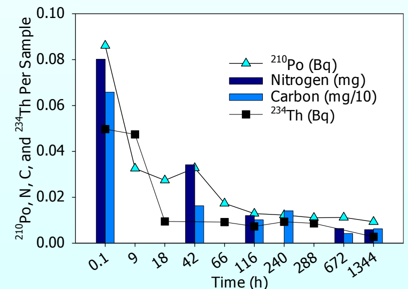


Fig. 7 Loss of Po,Th, C, and N during an 8-week incubation. Note: Carbon values have been divided by ten and time is not to scale.

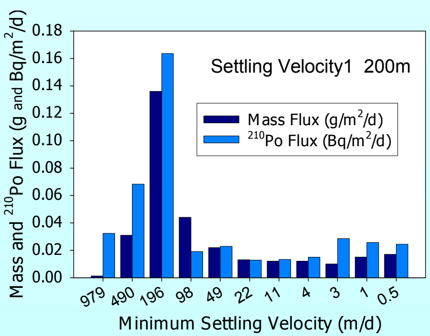


Fig. 2 Polonium flux (Bq/m$^2$/d) and Mass flux (g/m$^2$/d) in the Settling Velocity 1 sediment traps. The settling velocities are are not to scale and begin with the fastest settling particles.

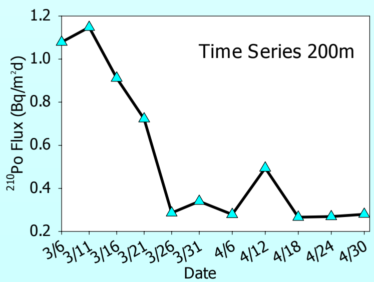


Fig. 3 Polonium flux (Bq/m$^2$/d) in the Time Series sediment traps at the same depth (200m).

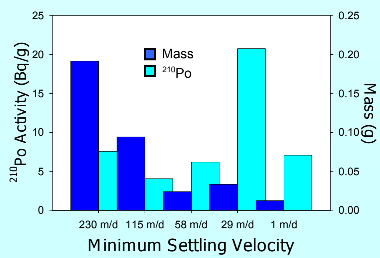


Fig. 5 Polonium activity and mass in elutriator fractions. Note: This is specific activity, not flux.

## CONCLUSIONS

- $^{210}$Po **flux** in the Ligurian Sea in spring is driven by particles sinking approximately 200m/d. Analyses of amino acids, lipids and pigments indicate that this **flux** is dominated by sinking diatoms.
- Polonium **activity** at 200m is more than twice as high in particles sinking approximately 30-50m/d than in particles with different settling velocities. Perhaps this is fresh, organic-rich matter.
- $^{210}$Po is lost from particles in conjunction with both organic carbon and nitrogen (protein) during decomposition, confirming the association of $^{210}$Po with labile organic matter.
- Principle Components Analysis (PCA) reveals that both $^{210}$Po and $^{234}$Th particulate activities trace total amino acids and fast sinking particles.
- Further information from the pumps and bottles is needed to interpret the depth profiles of $^{210}$Po, $^{234}$Th, and POC.

***FOR FURTHER INFORMATION ABOUT MEDFLUX**

Posters : Peterson et al., Xue et al., Liu et al., Wakeham et al., Cochran et al.

Talk: Lee et al. Thursday 1:45 in room 316B

Website: http://www.msrc.sunysb.edu/MedFlux

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