Gillian Stewart, Marine Sciences Research Center, Stony Brook University, USA
gstewart@ic.sunysb.edu
J. Kirk Cochran, Marine Sciences Research Center, Stony Brook University, USA
kcochran@notes.cc.sunysb.edu
Pere Masqué, Institut de Ciència i Tecnologia Ambientals, Universitat Autònoma de Barcelona, Bellaterra, Spain, Pere.Masque@uab.es
Robert Armstrong, Marine Sciences Research Center, Stony Brook University, USA
rarmstrong@notes.cc.sunysb.edu
Juan-Carlos Miquel, IAEA Marine Environment Laboratory, Monaco,
J.C.Miquel@iaea.org
Alessia Rodriguez, Dipartimento per lo Studio del Territorio e delle sue Risorse, University of Genoa, Italy and IAEA, Monaco, A.M.Rodriguez@iaea.org
Scott Fowler, IAEA, Marine Environment Laboratory, Monaco, S.Fowler@iaea.org
Michael Peterson, University of Washington, USA, mlpmlp@u.washington.edu
Nicholas Fisher, Marine Sciences Research Center, Stony Brook University, USA
nfisher@notes.cc.sunysb.edu

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Title: ^{210}Po and ^{210}Pb concentrations, fluxes, particle settling velocities, and organic carbon at the DYFAMED Site, Northwestern Mediterranean

Abstract:

Novel settling-velocity sediment traps and an elutriator were employed along with traditional techniques to explore the characteristics of sinking and suspended material at the DYFAMED site. This is the first time that ^{210}Po, ^{210}Pb, and other characteristics have been examined in particulate samples separated by sinking velocity and may further elucidate the composition of particulate flux. Preliminary results suggest that ^{210}Po activities differ among particles sinking at different rates. These measurements will allow us to compare the efficiency of ^{210}Po and ^{234}Th as flux tracers, with an emphasis on the potential usefulness of ^{210}Po as a POC flux tracer.

Traditionally, sinking and suspended particles in the ocean have been separated by size fractions using filters and meshes (e.g. 1). Size alone, however, does not determine the rate at which particles sink. Equally important are the composition of the material and its density. In an attempt to establish some relationship between composition and sinking velocity, we collected particles at the DYFAMED site and separated them based solely on their settling rates. The samples were divided using an elutriator and a specially designed sediment trap into six sinking velocity ranges between <10 and >230m per day; each fraction was analyzed for total and organic carbon, ballast minerals, protein, lipids, pigments, and the radionuclides ^{210}Po, ^{210}Pb, and ^{234}Th.

Previously, the ratio of polonium to thorium has been used to decipher the organic and biogenic silica content of particles in the Southern Ocean (2). In the context of MEDFLUX, we are interested in the relationship between organic content, ballast content, and sinking flux. Potentially the amount of ballast, or dense mineral content, in a particle may determine not only the sinking rate, but also the extent to which organic matter is preserved as it is transported to depth (3,4). The preservation of organic carbon by ballast below the mixed layer may successfully sequester carbon for thousands of years, and thus warrants further investigation for the accurate modeling of the global carbon cycle and the biological pump.

Specifically, we are looking for a correlation between the $^{210}Po/^{210}Pb$ or the $^{210}Po/^{234}Th$ ratio and the organic content of sinking matter. We predict that the ratio of polonium to lead and/or thorium will reflect the ratio of organic matter to ballast as ^{210}Po is known to associate with labile cellular material (5) and ^{210}Pb and ^{234}Th are linked with more refractory organic material or inorganic substances such as sediment, atmospheric dust, and biogenic minerals (6,7).

Preliminary data suggest that the polonium activity differs in particles with differing sinking velocities (Fig 1). Over 52% of the total polonium flux was found within the fastest sinking particles but, when normalized to mass, the particles sinking between 29 and 58 m/day had the highest ^{210}Po activity. This result indicates that these particles contain either the highest organic content, highest protein content, or concentrate polonium for some other reason. The nature of these particles will be more fully known when the other analyses (total and organic carbon, Al, Ti, Si, etc.) are complete. Results of these investigations as well as the lead and thorium activities will be presented.

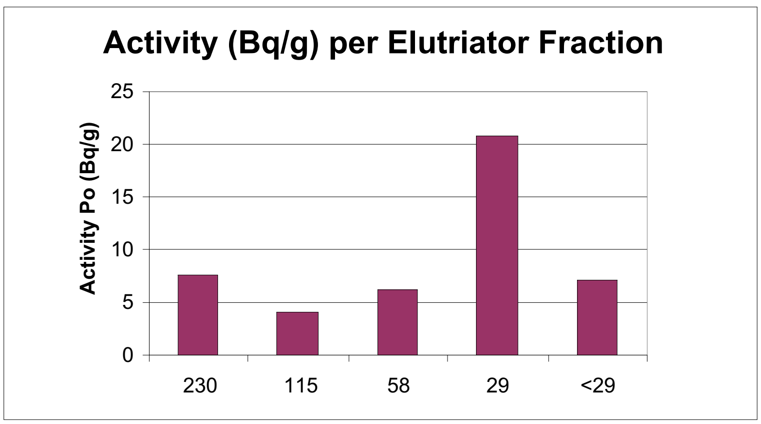

Figure 1. The preliminary ^{210}Po activity (Bq/g) in each of the elutriator fractions. The numbers below each column represent the minimum settling velocity in meters per day of particles in that fraction. The first column includes particles sinking faster than 230 m/day while the final column includes all particles that sink slower than 29 m/day.

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