^{234}Th determination

Immediately after sampling, the 20-liters of seawater were passed through a filter (Millipore membrane: diameter 142 mm, 0.45 µm pore size) to separate dissolved from particulate phases. Within two weeks after the collection, particulate ^{234}Th ($^{234}Th^{P}$) was directly measured on the filter with a low background-high efficiency γ detector (Schmidt and Reyss, 1996). ^{234}Th activities were measured from its 63.2 and 92.4-92.8 keV gamma rays, and decay corrected to the time of sample collection (Schmidt and Reyss, 2000). Because of the short half-life of ^{234}Th and to avoid significant ingrowth corrections, separation of dissolved ^{234}Th ($^{234}Th^{D}$) from its ^{238}U parent was carried out on board within 24 hours after seawater collection (Schmidt and Reyss, 2000). For analysis, ^{229}Th yield tracer and 150 mg Fe (as $FeCl_3$) were added to the dissolved sample after acidification to pH 2. After spike equilibration, $Fe(OH)_3$ was precipitated by addition of NH_4OH to pH 7. After recovery of the precipitate, the separation of ^{234}Th and ^{238}U was obtained by passage through an anion exchange column (Dowex 1x8, 100-200 mesh) that had been pre-conditioned with 8N HCl. In the laboratory ashore, purification of thorium was achieved by a second passage through an 8N HNO_3 column. After elution, Th was extracted with 1-(2-thenoyl)-3,3,3-trifluoracetone in toluene at pH 3 and then evaporated onto an aluminium foil. A first α-counting of this foil allowed the determination of ^{229}Th for chemical yield (between 20 to 60%); the following γ-counting allowed the measurement of ^{234}Th. As a result precision estimates are variable, reflecting the count rate of each sample (dependent on the chemical efficiency and the decay) and the detector used.

Schmidt, S., Reyss, J.-L., 1996. Radium as internal tracer of Mediterranean Outflow Water. Journal of Geophysical Research, 101: 3589-3596.

Schmidt, S., Reyss, J.-L., 2000. Improvement in radiochemical and γ-counting procedures for the determination of ^{234}Th in seawater. Radiochimica Acta 88, 459-463.