Simultaneous pre-concentration of thorium and neodymium from seawater: Method development and application to the Kerguelen plateau

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Dissolved thorium (Th) and neodymium (Nd) are effective tracers of oceanic biogeochemical cycles and watermass mixing. Low concentrations of dissolved Th and Nd in seawater make their measurement a complex process, which requires pre-concentration and removal from the seawater matrix followed by further elemental purification, prior to detection using atomic spectroscopic methods. Here, we present a new method to simultaneously pre-concentrate Th and Nd using a chelating resin (NOBIAS) alongside modifications to existing separation techniques[1], with SF-ICP-MS detection. This method was applied to samples from the central Kerguelen plateau near to Heard and McDonald Islands, an area with strong natural iron fertilization and with a very dynamic hydrography.

Adsorption of trace elements by the NOBIAS resin is highly pH dependant[2]. We found the optimal pH to simultaneously pre-concentrate Th and Nd from 5-10 L of seawater was 4.5. At this pH the recovery of Th is > 75% and Nd > 90%. Our method showed good agreeementwith consensus values for GEOTRACES intercalibration materials (Th: BATS2000, SW2010-1; Nd:BATS2000, JNdi-1), with replicate measurements agreeing within 5%. Procedural blanks were less than 5 pg and 40 pg for Th and Nd respectively. Early results from the Kerguelen plateau indicate lower concentrations of ^{232}Th than published data[3].

The accuracy, precision, blank levels and convenience of our method make it a good addition to existing techniques to measure Th and Nd in seawater, offering advantages of reduced procesing time and sampling logistics.

[1] Anderson et al. (2012) Limnol. Oceanogr. Methods 10, 179-213. [2] Sohrin et al. (2008) Anal. Chem. 80(16), 6267-6273. [3] Venchiartutti et al. (2008) Deep-Sea Res. I. 55(10), 1343-1363.

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