

## Scavenging of radionuclides and elements in a neutrally buoyant Mid-Atlantic Ridge hydrothermal plume

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We have examined Ra and Th isotope distributions within a neutrally buoyant plume overlying the TAG hydrothermal vent field (26°N, 45°W, Mid-Atlantic Ridge) using data from the recent US GEOTRACES Atlantic transect (2011). Particulate <sup>228</sup>Th ( $t_{1/2}$  = 1.91 y) and <sup>234</sup>Th ( $t_{1/2}$  = 24.1 d) activities agree well with previous measurements at the TAG site [1]. High particulate Th activities within the plume indicate scavenging of dissolved Th from the surrounding ambient seawater. The residence times of dissolved and particulate <sup>228</sup>Th and <sup>234</sup>Th were calculated, and the <sup>234</sup>Th/<sup>228</sup>Th ratio was used along with a simple model to estimate the rate of dilution of the neutrally buoyant plume.

The four naturally occurring Ra isotopes (<sup>223</sup>Ra,  $t_{1/2}$  = 11.4 d; <sup>224</sup>Ra,  $t_{1/2}$  = 3.66 d; <sup>226</sup>Ra,  $t_{1/2}$  = 1600 y; <sup>228</sup>Ra,  $t_{1/2}$  = 5.75 y) were used to estimate the age of the plume, giving an approximation of transit time from the site of eruption to the sampling location. A similar approach based on particulate <sup>234</sup>Th/<sup>228</sup>Th produced results in good agreement with the Ra method.

Finally, the flux of dissolved Th to the particulate phase was related to particulate element concentrations to calculate the rate of element uptake on to plume particles. This calculation was done for various elements and isotopes, including Fe, P, Nd, and <sup>227</sup>Ac, which appears to have a previously unnoted hydrothermal source.

Samples from an East Pacific Rise hydrothermal plume were collected on the 2013 US GEOTRACES Pacific transect and will allow for a preliminary comparison of <sup>228</sup>Th and <sup>234</sup>Th between hydrothermal sites in each ocean basin.

[1] German *et al* (1991) *Earth Planet. Sci. Lett.* **105**, 170-181