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## Seawater circulation analysis in the Southern and Indian Oceans by cross-sectional I-129 observation

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The Southern Ocean is suitable for detecting water masses containing anthropogenic  $^{129}\text{I}$  ( $T_{1/2}$ : 15.7 million years) tracer since  $^{129}\text{I}$  in the Southern Ocean is 3–6 orders of magnitude lower than that in the Northern Hemisphere. This study aimed to clarify seawater circulation in the Southern Ocean by vertical cross-sectional observations of dissolved  $^{129}\text{I}$  and water mass structure analysis from the Southern Ocean to the Indian Ocean, where few studies have been conducted. Seawater was sampled horizontally and vertically at six sites in the Southern and Indian Oceans (maximum depth: 5,230 m) during the JAMSTEC MR19-04 voyage (December 2019–February 2020) and horizontally at 15 sites from Australia to Showa Station in Antarctica during the National Institute of Polar Research SR21 voyage (November 2021–March 2022). After adding 1 mg of  $^{127}\text{I}$  carrier (Deepwater iodine,  $^{129}\text{I}/^{127}\text{I}$ :  $1 \times 10^{-14}$ ) per 500 ml of seawater, iodine was purified by solvent extraction, and silver iodide targets were prepared. The  $^{129}\text{I}/^{127}\text{I}$  ratio of the target was measured using an accelerator mass spectrometer at the University of Tsukuba and normalized using the S-Purdue reference material ( $^{129}\text{I}/^{127}\text{I}$ :  $8.378 \times 10^{-12}$ ). In the Antarctic Circumpolar Current (ACC) region of the Southern Ocean, anthropogenic  $^{129}\text{I}$  was rarely observed in the horizontal and vertical directions (maximum depth: 5,230 m) and was below the pre-nuclear activity level and Tsukuba AMS quantification limit. Anthropogenic  $^{129}\text{I}$  was observed in the surface layer from the northern area of the Southern Ocean to the Indian Ocean, and the relationship between the horizontal distribution of  $^{129}\text{I}$  and water temperature, salinity, and  $^{226}\text{Ra}$  provided information on the boundary between the Indian Ocean surface waters and the ACC. The vertical distribution of  $^{129}\text{I}$  in the Indian Ocean decreased with increasing depth from the surface. At the southernmost site in the South Ocean, two spike layers of  $^{129}\text{I}$  above pre-nuclear activity level were identified at 201 m and 1,670 m water depths, and an upper  $^{129}\text{I}$  spike was also observed in the isodensity layer at one site to the north.

### Student Submission

No

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