Constant flow of AABW into the Indian Ocean over the past 140 ka? Conflict between $^{231}Pa/^{230}Th$ and sortable silt records

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Variation of past deep-ocean flow rate has been assessed for the North Atlantic using the sortable silt [1, 2] and $^{231}Pa/^{230}Th$ [3] proxies. Changes in Southern Ocean deep-water flow rate might be expected to be anti-phased to those in the north but this scenario has not been widely investigated. Two sortable silt records, however, indicate faster flow into the Pacific during glacials [4] and some changes of inflow into the Indian Ocean [5].

Here we present the first down-core record of $(^{231}Pa_{xs}/^{230}Th_{xs})^0$ from the southern Indian Ocean. The record spans the last 140 kyr and comprises 22 measurements of $(^{231}Pa_{xs}/^{230}Th_{xs})^0$ in a core with an existing sortable-silt record [5]. $(^{231}Pa_{xs}/^{230}Th_{xs})^0$ is nearly constant at ≈0.055. This is significantly lower than the production ratio (0.093) indicating that the proxy is sensitive to changes in circulation and/or productivity at this location. A simple particle scavenging model has shown that $(^{231}Pa_{xs}/^{230}Th_{xs})^0$ in sediments is likely to record conditions in the bottommost water mass [6] so this $(^{231}Pa_{xs}/^{230}Th_{xs})^0$ record suggests little change of AABW flow into the Indian Ocean during the last glacial-interglacial cycle. This is in contrast to the sortable silt proxy for bottom-water flow which shows variation during this interval [5]. The sortable silt variability might, instead, be attributed to a local geostrophic effect in Amirante Passage amplifying small changes in circulation, or to possible changes in sediment source during sea-level change.

An absence of changes in deep-water flow into the Indian Ocean does not preclude changes in intermediate flow, which could be assessed with $(^{231}Pa_{xs}/^{230}Th_{xs})^0$ records from shallower cores. Similarly, changes in the flow of AABW into the Pacific could result from deep water production around the coast of E. Antarctica (Adélie coast) rather than in the Weddell Sea, which could be confirmed with appropriate $(^{231}Pa_{xs}/^{230}Th_{xs})^0$ records from these basins.

References

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