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Millennial scale thermocline ventilation changes in the Indian Ocean as implied from aragonite preservation in the Arabian Sea

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To better understand the underlying mechanism(s) of millennial scale variability in the strength of the oxygen minimum zone (OMZ) we studied a 50 kyr record (core MD042876) from the lower thermocline of the NE Arabian Sea (828 m depth). In this core aragonite is preserved during North Atlantic Heinrich events (HEs) and Dansgaard-Oeschger (DO) stadials while it is absent during DO interstadials and most of the Holocene. By showing the excellent correlation of aragonite and the Sr/Ca ratio, the presence of fine-grained aragonitic needles and the isotopic composition (d13C) of carbonates in the fine fraction we established that essentially all of aragonite originates as fine Sr-rich debris from shallow water (while pteropods are only trace contributors to bulk aragonite). The comparison with other records from the NE Arabian Sea yielded that bulk aragonite is not complicated by variable flux of aragonite but essentially a dissolution record depending on OMZ intensity variations as principal forcing mechanism. By strong correlation with documented changes in millennial scale ventilation of the entire Indian Ocean and presented modern oceanographic conditions we strengthen the theory that OMZ intensity variations are principally controlled by changes in the formation of Subantarctic Mode and Antarctic Intermediate Waters (SAMW-AAIW). Thus, during HEs and DO stadials the thermocline Arabian Sea experienced an invigorated influx of O2-rich SAMW-AAIW. Additionally, preserved aragonite needles in the deep Arabian Sea (core MD042873, 2200 m water depth) during HE1 document an enormous basin-wide aragonite flux due to combined effects of sea level rise and thermocline ventilation. On the other hand, OMZ conditions during

DO interstadials and the Holocene seem best explained by analogy to the present-day situation (supply of low O_2 combined with elevated O_2 demand).