

IODP Proposal Cover Sheet

Arabian Sea OMZ

819 - Apl 2

Title	Evolution of the oxygen minimum zone in the eastern Arabian Sea during Pleistocene-Holocene period.		
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Abstract

The eastern Arabian Sea hosts one of the most intense Oxygen Minimum Zones (OMZ) in the world. Changes in monsoon airflow and subsurface circulation drive OMZ variations in the region. Sediments from the region hosting evidence of past OMZ change have rarely been studied. Hence, retrieving high-quality/resolution sediment records from the western Indian continental margin enables crucial and unique research centered around understanding OMZ variability and its controls through time. We propose to drill a transect of three, triple APC-cored sites into the Quaternary hemipelagic sediments across the present day OMZ of the central-western margin of India. We will reconstruct the OMZ history during the Holocene – Pleistocene period, particularly focusing on specific time-slices such as super-interglacials and the mid-Pleistocene transition. Assessing the processes involved in relating monsoon variations and/or changes in intermediate and deepwater circulation in the eastern Arabian Sea to the OMZ history is an intrinsic part of this approach. Drilling the proposed sites will yield continuous high-resolution records of the last ~1.5 million years, allowing to address four crucial questions: (1) How was variability in OMZ intensity related to glacial-interglacial cyclicity and the onset of the 100 kyr world during the Mid-Pleistocene? , (2) What was the role of OMZ variability with regard to super-interglacials such as marine isotope stages 5, 11, and 21?, (3) How did the OMZ vary at a suborbital scale and how did it evolve over the last 1.5 Ma? (4) How did changes (and the timing thereof) in monsoon circulation and/or variations in intermediate-/ deep water circulation affect the OMZ strength through time?

This research has two important spin-offs regarding future climate change and its consequences for marine life. Regarding a future - warmer -world, assessing the controls of Earth's climate during super-interglacial times will aid in predicting man-made climate change due to global warming. Our approach also allows to relate variations in marine biota to alterations in OMZ strength by exploring the sensitivity of marine life to changes in oxygenation under natural conditions. These findings may prove instrumental for predictions of future OMZ changes and its consequences for marine life in the region. Finally, drilling these sites also reflects the importance of India as a new member of the IODP program, for the first time allowing access to unique sediment archives, which harbor crucial information of the coupled atmosphere-ocean dynamics through time in a key area of the Earth's climate system.

Scientific Objectives

The overarching aim of this drilling proposal is to assess variations in the strength of the OMZ through time and its importance for regional climate change and beyond. Our five specific objectives are:

A) Establish continuous time series at three sites reflecting OMZ variations over the last ~1.5 Ma using a strategic selection of proxy records.

B) Assess the controls of OMZ changes on orbital to suborbital time scales during the Holocene–Pleistocene period focusing on the pattern of OMZ variability during super-interglacials and along the mid-Pleistocene transition (MPT).

C) Specifically assess the combined effect of monsoon driven surface ocean change and variability at the intermediate/deep water level with regard to controlling OMZ intensity.

D) Place the OMZ variability in a regional framework and appraising its importance for climate change on a global scale.

E) Document the effect of changes in the strength of the OMZ for life at the seafloor, specifically during super-interglacial periods and assess potential implications for deep-sea life in a future warmer climate.

Non-standard measurements technology needed to achieve the proposed scientific objectives.

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Proposed Sites

Site Name	Position (Lat, Lon)	Water Depth (m)	Penetration (m)			Brief Site-specific Objectives
			Sed	Bsm	Total	
EAS-03A	14.61525, 72.451413	2049	100	0	100	(i) Construct high resolution records of paleo-monsoon variability orbital to suborbital time scales, for the last ~ 1.5 Ma with a focus on super-interglacial periods. (ii) Reconstruct history of intermediate/deep water circulation changes.
EAS-02A	14.77215, 72.681053	337	100	0	100	(i) Construct the Pleistocene OMZ variability record on orbital time scale (ii) Construct paleo-monsoon history and evaluate the linkage between OMZ intensity and monsoon circulation change.
EAS-01B	14.89805, 72.879923	770	250	0	250	(i) Construct the OMZ variability record on orbital to suborbital time scales, for the last ~ 1.5 Ma with a focus on super-interglacial periods. (ii) Construct high resolution records of

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