IODP Proposal Cover Sheet

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NW African Continental Margin Climate

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Title	Cenozoic climate, productivity, and sediment transport at the NW African continental margin
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Abstract

We propose an IODP expedition to investigate late Cenozoic climate, ocean productivity and mass sediment transport along the continental margin of NW Africa. We propose to drill a latitudinal transect of sites from Cap Bojador southeast of the Canary Islands to Sierra Leone Rise. One major objective, targeted at up to four primary sites, is to study North African hydroclimate and vegetation to reconstruct the timing and cause of Oligocene to Pliocene aridification and linkages to ocean circulation. A further main objective is to obtain long records of millennial- to orbital-scale climate change in the subtropics and related sediment transport regimes from sites with exceptionally high- to very high sediment accumulation rates. These archives will provide a counterpoint to those recently recovered from Southern Africa by IODP Exp. 361 and Continental Drilling Program coring of East African lakes and help build an in-depth understanding of natural climate variability under future-relevant conditions across Africa. Sediments from the proposed expedition will also provide records to study ocean productivity and ecosystem response to climate perturbations in the eastern boundary upwelling system off NW Africa and to investigate deposits from the Sahara and Mauritania submarine slides. These slides present an opportunity to constrain the processes leading to major slope failure in an area, to the northern end of the transect, where the influence of riverine sediment supply and large earthquakes is modest, and to test a potential influence of climatic as well as local environmental changes on landslide occurrence. Our drilling strategy is based on an extensive array of high quality multichannel seismic data combined with information from DSDP/ODP Legs 41 and 108. Drill cores from these two early legs provide helpful stratigraphic control and background information on past climate and ocean productivity. Our plans include three sites positioned close to three classic sites (366, 658 and 659) where drilling will recover the more complete sections that are needed, and a further seven sites where coring will provide unprecedented high-quality information on lithologic and climate variability during the late Neogene. Two sites aim in unraveling the landslide history along the margin. Our scientific objectives are closely aligned with those of the IODP 2013-2023 Science Plan and the proposed expedition will help meet the information priorities for human adaption to climate change in NW Africa identified by IPCC 2013 working group 2.

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Scientific Objectives

Objective 1 - NW African climate in a warmer world, with emphasis on wind systems, dust supply, precipitation and vegetation

- What is the variability of NW African climate within late Cenozoic warm intervals?
  What are the lessons from these records of natural climate variability for the Anthropocene?
- What is the relationship between NW African hydroclimate, global warming and Atlantic overturning ocean circulation?
- How is the origin and evolution of the Sahara - the world's largest hot desert - connected to global climatic and oceanic changes?

Objective 2 - High productivity ecosystem response to climates different from today

- What is the upwelling response to warmer-than-modern climate conditions?
- What is the role of dust in the fertilisation of marine bioproduction and the ballasting of particle fluxes?
- What are the consequences of future climate change for wind-driven high productivity marine ecosystems off NW Africa?

Objective 3 - Mass wasting response to climate change

- What preconditioning and trigger mechanisms cause the failure of low angle continental slopes in sediment-starved environments?
- How does climate change affect the timing and occurrence of giant submarine landslides?
- What is the future hazard potential associated with mega-slides off NW Africa?

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

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Proposed Sites (Total proposed sites: 12; pri: 8; alt: 4; N/S: 0)

Site Name	Position (Lat, Lon)	Water Depth (m)	Penetration (m)			Brief Site-specific Objectives
			Sed	Bsm	Total	
NWAFR-01A (Primary)	27.5374 -13.8459	1430	500	0	500	Cape Bojador high-resolution climate, Plio/Pleistocene millenial scale African hydroclimate, 0-3,5 Ma
NWAFR-02A (Primary)	24.2801 -17.1203	1640	600	0	600	Sahara slide upslope headwall, slide preconditioning factors, Late Miocene climate, Sahara summer dust input, 0 to 9-12 Ma
NWAFR-03A (Primary)	24.3876 -17.2680	2152	250	0	250	Sahara slide downslope, landslide frequency, dating seismic reflectors, 0 to 6-8 Ma
NWAFR-04A (Primary)	20.85154 -18.41739	2140	500	0	500	Cape Blanc high-resolution climate and productivity, Plio/Pleistocene millenial scale African hydroclimate, 0 to 3 Ma
NWAFR-05A (Primary)	15.4288 -17.8687	1970	500	0	500	South Senegal high-resolution climate, Plio/Pleistocene millenial scale African hydroclimate, 0-3,0 Ma
NWAFR-06A (Primary)	12.4293 -18.0054	3001	300	0	300	Casamanche high-resolution climate, Plio/Pleistocene millenial scale African hydroclimate, 0-4,0 Ma
NWAFR-07A (Primary)	18.0772 -21.0262	3069	400	0	400	Sahara dust summer plume, early Miocene African climate, 0-24 Ma
NWAFR-08A (Primary)	5.6783 -19.8517	2853	400	0	400	Sahara dust winter plume, Eocene/Oligocene African climate, 0-35 Ma
NWAFR-09A (Alternate)	20.2130 -18.4520	2500	500	0	500	Cape Blanc very high-resolution climate and productivity, Pleistocene millenial scale African hydroclimate, 0 to 1,5 Ma
NWAFR-10A (Alternate)	20.9380 -19.3900	3419	300	0	300	Cape Blanc high-resolution climate and productivity, Plio/Pleistocene millenial scale African hydroclimate, 0 to 4 Ma
NWAFR-11A (Alternate)	17.2138 -16.8563	690	320	0	320	Mauritania slide upslope headwall, slide preconditioning factors, Late Miocene climate, Sahara summer dust input, 0 to 9-12 Ma
NWAFR-12A (Alternate)	17.3169 -17.5387	2430	300	0	300	Mauretania slide downslope, landslide frequency, dating seismic reflectors, 0 to 3-4 Ma