1. INTRODUCTION[1]

Shipboard Scientific Party[2]

Leg 108 of the Ocean Drilling Program, which began on 21 February 1986 in Marseille, France, and ended on 17 April 1986 in Dakar, Senegal, drilled 12 sites in the eastern Equatorial Atlantic and along the northwest African continental margin. The geographic positions of these sites (Fig. 1) provide a transect spanning about 24° latitude designed (1) to determine the development and fluctuation(s) in the position and intensity of the Intertropical Convergence Zone (ITCZ) and the low-level wind flow for a better understanding of the history of aridity in Africa; (2) to define the history and response of surface circulation to tectonic and climatic changes during the Neogene; (3) to document the history of deep-water exchange between eastern and western Atlantic basins; (4) to document changes in global ice volume and low-latitude sea-surface temperature to determine the climatic linkages between the low and high latitudes; and (5) to develop an integrated high-resolution chronostratigraphy.

AFRICAN ARIDITY AND ATMOSPHERIC CIRCULATION

The eastern equatorial Atlantic is a critical boundary zone for surface oceanographic and atmospheric circulation that includes the Intertropical Convergence Zone (ITCZ) and the thermal equator. Leg 108 recovered a variety of windblown sediment components (lithogenic silt and clay minerals, freshwater diatoms, pollen, and opal phytoliths) that provide data essential for documenting the history of trade winds and ITCZ variations. Leg 108 sites (Fig. 1) span the latitudes of the summer (axis 15°–20°N) and winter dust plumes (axis 0°–10°), which deliver these components to the Atlantic Ocean. These windblown indicators document orbitally driven cycles of aridity and humidity in source areas located in North Africa (Pokras and Mix, 1985, 1987). In addition, they have the potential for increasing our understanding of the gradual desertification of Africa in the Pliocene and Pleistocene (Sarnthein et al., 1982).

SURFACE WATER CIRCULATION

Surface ocean circulation in the equatorial and eastern subtropical North Atlantic is dominated by the North and South Equatorial Currents, which flow from east to west and are fed by the eastern boundary currents (Canary and Benguela) along the western coast of Africa. This equatorial circulation may also respond to remote forcing from higher latitudes, particularly the relative strengths of the Arctic and Antarctic polar cells and the subpolar westerly circulation in each hemisphere (Flohn, 1978). Over geologic time scales, therefore, equatorial changes in surface circulation may be related in part to the amount of land and sea ice in each polar hemisphere.

Near-shore and equatorial upwelling cells are a characteristic feature of the eastern Atlantic Ocean. The biological productivity in these cells is controlled by climatic change, and it contributes to the carbon transfer from the sea surface and atmosphere to deep-ocean waters and sediments, with implications for the atmospheric CO_2 budget and climate. Several Leg 108 sites were positioned to monitor the variations of this chemical transfer and the diagenesis of sediments rich in organic carbon. In addition, upwelling causes cooling of the sea surface, reducing evaporation, and thus reducing the amount of moisture available for the monsoonal rains in Africa.

DEEP-WATER CIRCULATION

Antarctic Bottom Water (AABW) moves toward the equator in the western Atlantic and then flows into the eastern basins through low-latitude fracture zones (Mantalya and Reid, 1983). Subsequently, it flows around the eastern end of the Sierra Leone Rise in a northerly direction through a passage with a sill depth of 4570 m, the Kane Gap (Mienert, 1986; Sarnthein et al., 1982). The upper boundary of this mixed bottom water lies near 4000–4350 m water depth.

Differences in the bathymetric distribution of calcium carbonate dissolution and $\delta^{13}C$ (Curry and Lohman, 1983) suggest that there were dramatic variations in the exchange of deep water and oxygen between the western and eastern Atlantic from glacial to interglacial times. Subsequent studies indicate that these variations largely reflect changes in the proportion of AABW advected eastward through the fracture zones (Oppo and Fairbanks, 1987). Furthermore, a number of erosional reflectors, various echo characters, and differential growth rates of manganese nodules in the Kane Gap (Mienert, 1986) suggest that the exchange of bottom water between the northeastern and southeastern Atlantic was subject to substantial long-term changes, on which the short-term fluctuations during late Neogene times were superimposed. Results from Leg 108 coring help to date these events.

ICE VOLUME AND STRATIGRAPHY

The excellent preservation of calcareous sediments in the equatorial Atlantic provides an opportunity to use oxygen isotopes from foraminifers to monitor changes in global ice volume during the Tertiary. Of particular interest for Leg 108 is the clarification of whether the low-latitude signals (SST, African dust, coastal upwelling) are driven by polar ice volume or by other factors. In addition, Leg 108 investigated the tempo of tropical ocean variability prior and subsequent to the prominent changes in Northern Hemisphere ice-volume variability near 0.7 and 2.5 Ma.

Leg 108 sites also provide the means (geographic position, near-continuous stratigraphic records for the late Neogene, and high-quality cores) to develop a high-resolution Neogene biostratigraphy from the low-latitude Atlantic that is integrated with magnetostratigraphy and stable isotopes. The Leg 108 sites, when combined with sites previously cored during Deep Sea Drilling Project (DSDP) Leg 94 (Ruddiman, Kidd,

[1] Ruddiman, W., Sarnthein, M., et al., 1989. *Proc. ODP, Sci. Results*, 108: College Station, TX (Ocean Drilling Program).
[2] Shipboard Scientific Party is as given in the list of Participants preceding the contents.

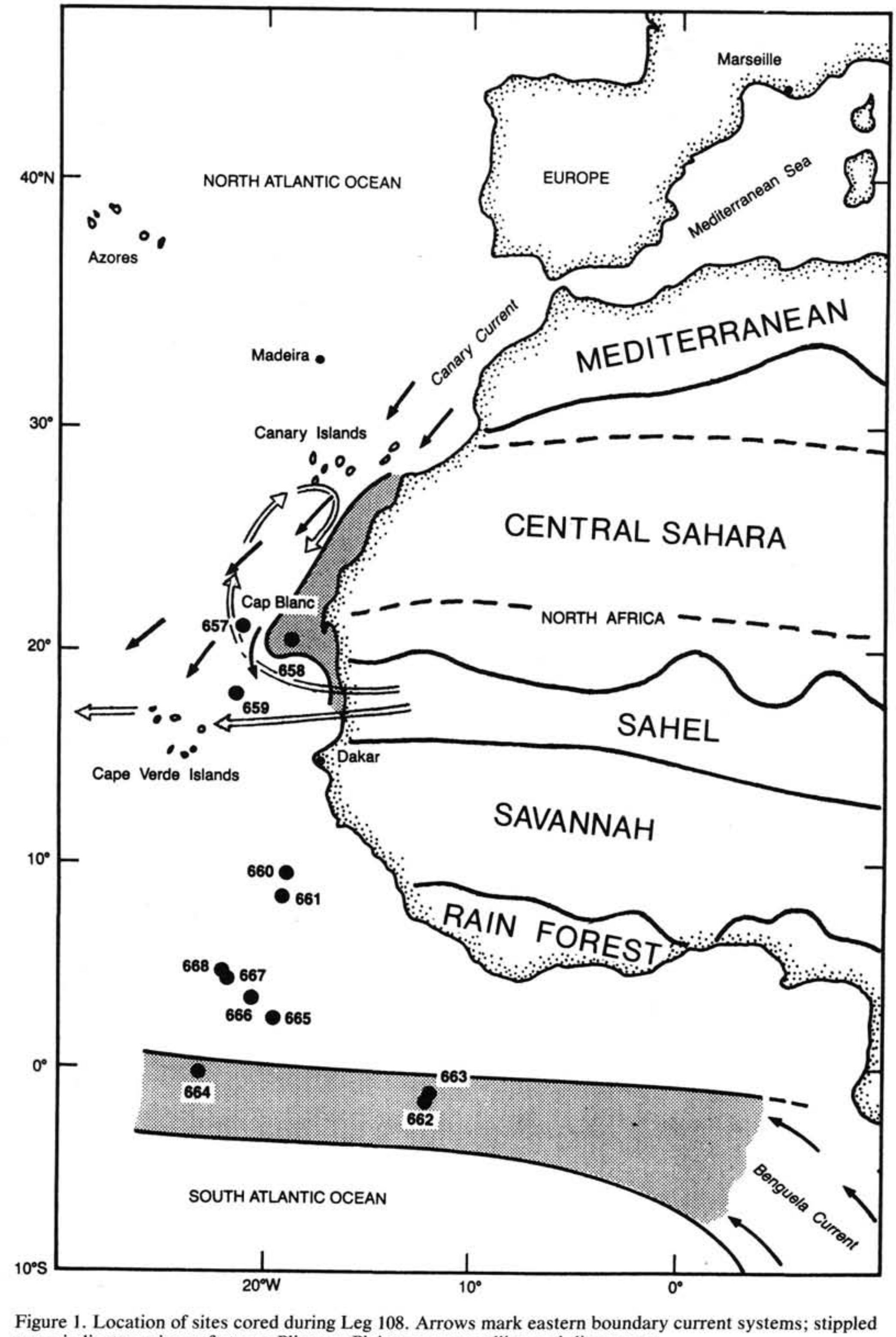

Figure 1. Location of sites cored during Leg 108. Arrows mark eastern boundary current systems; stippled areas indicate regions of strong Pliocene-Pleistocene upwelling and divergence.

Thomas, et al., 1987) in the middle- and high-latitude North Atlantic and Ocean Drilling Program (ODP) Leg 104 (Eldholm, Thiede, et al., 1987) in the Norwegian-Greenland seas, and ODP Leg 105 (Srivastava, Arthur, et al., 1987) in the Labrador Sea/Baffin Bay, allow development of a North Atlantic chronostratigraphy applicable across 70° latitude.

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