1. INTRODUCTION[1]

Shipboard Scientific Party[2]

INTRODUCTION

The ocean floor of the Western Pacific Ocean is covered by numerous scattered seamounts and atolls that cluster together to form larger complexes or are roughly organized along a preferential direction to form a chain. Most of the seamounts are guyots that have a flat top and are considered old, drowned atolls. The Marshall Islands constitute one of the chains departing from near the equator in a northwest direction (Fig. 1). Several authors explain such alignments, like the Hawaiian Chain, as having originated by the progression of a hotspot. Another alignment is illustrated by the Mid-Pacific Mountains, which exhibit a roughly east-west orientation. Other guyots or clusters of guyots may not show any apparent preferred orientation or they may be isolated features. This is the case of MIT Guyot and the poorly defined Japanese Seamounts located close to the Japan Trench.

Over wide areas of the Pacific Basin, drowned atolls now lie at depths between 1 and 2 km. Consideration of the normally rapid upward growth of reefs coupled with the relatively slow subsidence rates and sea-level changes led Schlager (1981) to propose that reef drowning is a paradox. Because many of the drowned reefs north of the Marshall Islands apparently drowned in mid-Cretaceous time (see Matthews et al., 1974; Winterer et al., in press), it was recently proposed that these Cretaceous reefs were drowned as a result of a global oceanic anoxic event in Aptian-Albian or Cenomanian-Turonian time (Schlanger and Jenkyns, 1976), or by a series of paleolatitudinal changes (Winterer et al., in press).

Periods of atoll emergence that result from a sea-level lowering faster than the regional subsidence cause the exposed limestones to undergo intensive diagenesis and karstification, as shown by drilling on Anewetak (Schlanger, 1963; Emery et al., 1954). Solution unconformities mark these periods of emergence. The timing of sea-level changes can be calibrated by analyzing the stratigraphic distribution of these solution unconformities, deciphering the diagenetic history of the previously emergent limestones, and tracking the stratigraphic section along a subsidence path (which will be refined by the drilling to clarify the thermal rejuvenation and subsidence history of these guyots).

From Darwin's early observations through Menard's (1964) concept of the Darwin Rise, and from Hamilton's (1956) work on the "Sunken Islands of the Mid-Pacific Mountains" to modern studies of uplift caused by thermal rejuvenescence related to mid-plate volcanism (Detrick and Crough, 1978; Crough, 1978), it has become obvious that the central Pacific Basin did not follow a straightforward Parsons-Sclater (Parsons and Sclater, 1977) type of subsidence path (see also McNutt and Menard, 1978). The abnormally fast subsidence of Anewetak and Pikinni since early Eocene time was used by Detrick and Crough (1978) to argue that the seafloor in the Marshalls region had undergone thermally induced uplift of as much as 1.6 km before Eocene time, but well after the formation of the underlying plate. McNutt and Fischer (1987) proposed that the Marshall Islands swell can be traced back to the South Pacific Superswell. If episodes of regional uplift and subsidence are related to the passage of the Marshall Islands over thermal anomalies, then the multiple volcanic episodes known to have occurred in the Marshalls region would argue for the fact that the region has undergone multiple episodes of thermal rejuvenation (Schlanger and Moberly, 1986). Further, the apparent intense and widespread volcanism seen in the Pacific during Cretaceous time was the cause of major uplift. This volcanism may have been a factor in causing the major Cretaceous global sea-level rise from ~110 to ~70 Ma (Schlanger et al., 1981).

Drilling Objectives

Drilling on Leg 144 had the following objectives:

1. To recover pelagic sediments for high-resolution stratigraphy and for reconstructing the paleoceanography in this sector of the Pacific;
2. To relate the acoustic stratigraphy of the pelagic cap to its depositional and diagenetic history and to correlate the seismic reflectors with those seen in other guyots;
3. To date the interface between the pelagic cap and the underlying platform, and to infer the age and cause of platform drowning;
4. To establish the stratigraphy, and to examine the faunas, floras, and growth of the carbonate platform and facies changes with time;
5. To reconstruct the migration routes of benthic organisms (rudists and benthic foraminifers) and their paleoceanographic implications;
6. To examine the diagenesis of the shallow-water limestones, and to compare the diagenesis of the older guyots with the younger guyots drilled in the Marshall Islands;
7. To investigate the nature and variability of the perimeter ridges on the Wodejebato and Takuyo-Daisan guyots;
8. To determine the age and causes of platform drowning and the possible emergence and subsidence history of the platform limestone relative to sea level;
9. To determine the genesis of the rough surface topographies of the MIT and Takuyo-Daisan guyots in relation to the hypothesis of emergence and karsting of the shallow-water limestone cap before the final drowning;
10. To establish the age and paleolatitude of the volcanic edifices and their subsequent paleolatitudinal changes;
11. To obtain geochemical data from the volcanic edifices for comparison with other sites and the DUPAL/SOPITA anomaly; and finally
12. To compare the geologic history of drilled guyots with that of other Western Pacific guyots drilled during Leg 143.

[1] Premoli Silva, I., Haggerty, J., Rack, F., et al., 1993. *Proc. ODP, Init. Repts.*, 144: College Station, TX (Ocean Drilling Program).
[2] Shipboard Scientific Party is as given in the list of participants preceding the contents.

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* Abbreviations for names of organizations and publication titles in ODP reference lists follow the style given in *Chemical Abstracts Service Source Index* (published by American Chemical Society).

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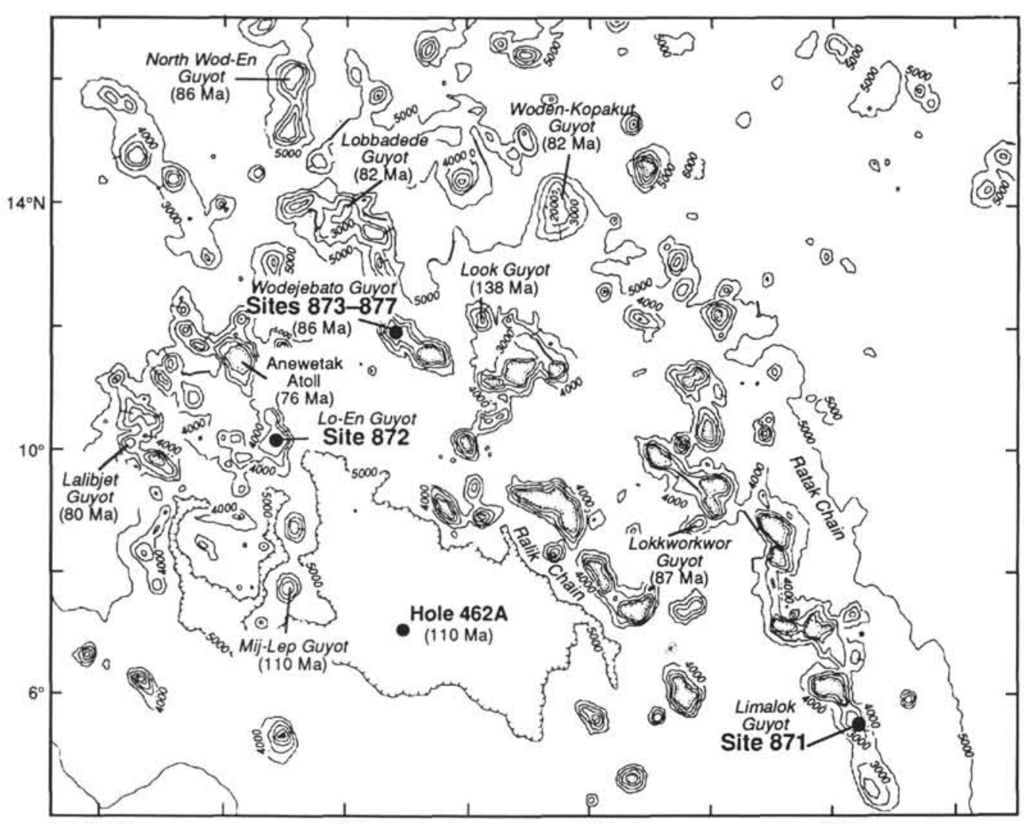

Figure 1. Bathymetry around the Marshall Islands. Contour interval is 1000 m, and the ages shown in parentheses are radiometric dates of basalts collected over a number of different surveys. Radiometric ages from Davis et al. (1989) and Pringle (1992). Figure revised from Hein et al. (1990). The locations of Ocean Drilling Program Site 871–877 are shown, as well as the location of Hole 462A, which was drilled during Deep Sea Drilling Project Leg 61.