SUBMARINE GEOLOGY

by K. O. Emery

Little is known of certain phases of the topography of coral atolls and still less is known of the distribution and types of their sediments. It would be highly desirable to obtain soundings and samples from atolls of the Gilbert, Caroline, and other island groups for comparison with the northern Marshalls, which have become relatively well known as a result of recent studies. Among the more important problems that can be attacked with makeshift equipment are the following:

1. Steepness of outer slopes. In the northern Marshalls the edge of the leeward reefs is very steep, locally vertical, to depths of 100 to 200 feet. Most of the windward reef, however, is bordered by a slope of about 45° to a depth of 20 to 30 feet, beyond which a terrace may locally extend several hundred yards to depths of 40 to 50 feet. The greatest width is within broad lagoonward indentations of the reef. The terrace probably marks the position of an old reef level, the geographical distribution of which is unknown. Soundings can be made during times of low waves from aboard a skiff, using a light line marked in feet and weighted at the end with a 5-pound piece of scrap iron or a rock. For the steep leeward reef, distance out from the reef can best be determined by paying out another marked line that is attached to the reef, taking a sounding at each distance interval of 2 to 5 feet. For the seaward terrace, distance from the reef can best be estimated.

2. Lagoon terrace. In the northern Marshalls the seaward terrace has its counterpart in a lagoon terrace that is several hundred yards wide, particularly within seaward projections of the reef. Its depth is 50 to 60 feet. Sounding profiles across it can be obtained in the same manner as for the seaward terrace, but under easier wave conditions.

3. Coral masses. Scattered about the lagoons of the northern Marshalls are roughly conical coral knolls that range from less than 100 feet to more than a mile in diameter. They rise from any depth of the lagoon floor, and their tops may be at any depth, including sea level. At Canton and Johnston Islands, however, instead of conical coral knolls, there are elongate ridges that divide the lagoons into compartments. It would be of interest to know the geographical distribution of the two forms of coral growth of the lagoons, their composition, and details of their shapes. Such investigations may be conducted by simple sounding operations and by observation with a face mask or glass viewing box.

4. Lagoonal sediments. In the northern Marshalls the sediments of the lagoon are arranged in a series of concentric belts. In water deeper than 180 feet the sediments consist chiefly of small Foraminifera. In shallower depths, enough sunlight reaches the bottom to permit growth of a calcareous green alga, Halimeda. This plant grows faster than the small Foraminifera, so at depths less than 180 feet it is dominant, completely masking the Foraminifera. Within a mile or two of the shore or reef and at depths of less than about 100 feet the Halimeda itself is masked by detrital calcium carbonate mostly of fine sand size, carried by currents from shore

or from the reef. Along the shore the sandy beaches consist largely of Foraminifera again, but the types are different from those of the deep water. They have their origin in the sand mantle of the reef flat. Most of them are discoid or flattened forms and are 1 to 3 mm in diameter. Coral is concentrated in knolls and thickets at any depth, and is of various types. The fine sand is the most rapidly deposited of the sediments. The small maximum depth of small lagoons is probably a result of the rapid filling that takes place when the belt of fine sand reaches to or near the middle of the lagoon. Profiles of bottom samples across the lagoons of atolls in other areas of the Pacific would provide welcome new information. Such samples can be obtained with simple equipment. For example, a useful dredge can be made by attaching the bail of a stout bucket to a line with a 5 to 10 pound weight tied a foot or so above the bucket so that the lip of the bucket can cut into the sediment when dragged for a short distance across the bottom. A portion of the sample should be dried and placed in a cloth or paper bag labeled with the depth and position. The dredge can also be used to obtain samples from the upper part of the outer slope, thus providing more information on the differences between lagoonal and seaward sediments.

The great scarcity of information on submarine geology of atolls makes every new fact of great value in interpreting the composition and history of coral reefs.