COLLECTING GEOLOGICAL DATA

by Martin Russell

Many features of importance to the geologist will be seen by observers whose main interest may not be geology. Because geologists need more information on atoll composition, structure, and development, the non-geologist could make valuable contributions to the geological sciences if he would record observations about easily recognized features as he pursues his own particular scientific interest. Examples of the significant geological features of atolls have been described in one form or another. But, like words in a dictionary, though they may be known, they have little significance until they are fitted intelligently into a coherent story, by a writer in the case of words, by an intelligent observer and scientist in the case of geological features. If you would record what you see, you could, with little effort, do much to help the geologist.

A knowledge of certain basic features of an atoll is necessary in almost any field of atoll research. The chapter "Introduction to the Geography of Atolls" should make clear the names of these features, which become obvious to anyone after a few days on an atoll. Once understood, they should be freely used for orientation in making notes.

I. Reefs
   A. Seaward reefs
      1. Windward
      2. Leeward
   B. Lagoon reefs
   C. Coral knolls

II. Lagoon

III. Islands
   A. Seaward beach
   B. Lagoon beach
   C. Inland surface

A notebook and pencil should be carried at all times and if a large-scale base map is available it may be used to record the location of the features described. The following are the features to be seen that deserve a few lines of description in your notebook. One should not hesitate to report descriptions if similar features are observed in two or more locations. Some of the <u>names</u> of the features and the <u>characteristics</u> which should be noted are underlined.

REEFS. The growth, extent, and form of the reefs depend to a large degree on the winds and water currents passing over them. The observer should start out on a reef an hour or more before low tide, noting <u>width</u>, which ranges from a few tens of yards to a mile or more. Commonly there is a distinct <u>zonation</u>. On windward reefs there may be a reddish

tinged algal (or "Lithothamnion") ridge a foot or more higher than the reef flat, upon which the waves break; note the steepness of the outer slope and the surge channels running perpendicular to the reef front through which the sea rushes forward then back with each wave. Step carefully here for the reef may be very cavernous or honeycombed and a false step or slip would result in a nasty fall or an unexpected bath. Immediately shoreward of the reef front may be a pavement-like flat covered with mossy algae, close inspection of which may disclose multitudes of tiny sand-grain sized, cream-colored Foraminifera. The calcareous shells, or tests, of these animals are swept back over the reef to form a considerable portion of the beach sands and loose floor of the reef and lagoon. Note their concentration in different sandy deposits throughout the atoll. Between the reef front and the shore may be many different reef environments which should be noted: isolated coral growths separated by waist-deep, sandy bottomed water; shallow sandy areas; rough coral flats; and isolated channels or areas of deeper water. Note the different types of coral growth which commonly are restricted in distinct areas (delicately branching colonies, solid smooth heads, bluish palmate colonies, etc.)

On the leeward reefs, the picture may be much different, zonation may not be distinct, the reefs are commonly much narrower, and individual coral and algal forms may be more delicate and varied. Note the distribution and condition of reef blocks (negro heads) torn from the reef edge by tropic storms and cast upon the reef flat.

Anywhere on the reefs may occur sand or rock groins, platform-like structures which stand clearly above the level of the general reef flat. Any measurements of their height (above the general reef flat, in feet) and notes on their distribution, and orientation would be a valuable aid in determining the extent of geologic uplift and/or change in sea level.

Most atolls have distinct breaks or passes in the continuity of the reef ring. Distinguish whether these are clearly breaks with no reef growth or merely parts of the reef over which the water is deep enough for navigation.

On parts of the reef, commonly near islands, some currents form sand bars, and spits curving away from islands. Be sure to note, if possible, any difference in their size, shape, or location from those shown on any map you may have.

The reefs on the lagoon side may exhibit different forms around the atoll depending on the size and strength of waves generated within the lagoon. It is generally found that lagoon reefs on the windward side of the atoll (but leeward of their reef or island) are less developed than lagoon reefs on the opposite side where the waves generated by winds sweeping across the lagoon are sufficient to encourage extensive coral growth. Here again any zonation of reef type, observable features of the reef margins, slopes and character of sediments should be noted.

Should you be fortunate enough to fly over the atoll and its lagoon watch for coral knolls, which are masses of coral that grow to within a few feet or tens of feet of the surface of the water. Note their size, shape, relative numbers, and pattern of distribution if any. Note in what relation

to passes, islands, or abrupt change in direction of the reef ring these knolls occur.

ISLANDS. Beachrock, a common feature of the intertidal zone, generally dips (angle between a horizontal plane and the layered surface of the rock) toward the open water, a reasonably definite indication of the slope of the beach sands from which the beachrock was formed. It follows that should you record beachrock dipping toward the island instead of the open water, that there has been a shifting of the islands (by storms, currents, wind, etc.). In some places on the reef ring, the existence and even outlines of former islands can be inferred from lines of beachrock, now submerged, out on the open reef and between present islands. A feature generally found only on the seaward beaches of leeward islands is the boulder rampart.* Immediately above the intertidal zone there may extend a mass of water-worn and rounded boulders. A cross section of this mass perpendicular to the shore may show two, three, or four "steps" or ridges. These are formed during the infrequent but particularly severe storms.

Other island features of note include a) mangrove swamps containing brackish water; b) guano, a light gray, powdery material filling crevices or encrusting rocks; from action of bird droppings or calcareous rocks; c) layers of cemented phosphatic sandstone, commonly 4 to 10 inches thick, formed from action of bird droppings on calcareous rocks, but occurring only a few inches beneath the humus mat of Pisonia grandis forest; d) any unusual depressions; e) wind-formed sand dunes or irregular ridges; and f) the depth and thickness of any hard, cemented layer encouraged in excavations on islands. Because calcium carbonate (limestone) is the only material deposited by the reef-building organisms, the occurrence of any other rock material (hard, soft, or loose) is of especial interest (pumice, for example).

In describing the sands, rocks, gravel, and so forth, it is well to remember that four types of organisms are responsible for about 95% of the reef and island material on atolls. These are 1) hard or massive coralline algae (reef flats, reef front); 2) coral (colonies on reef flats, coral knolls); 3) segmented algae (the lagoon); and 4) Foraminifera (reef flat, lagoon).

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* This is termed a boulder ridge or a beach ridge by some workers. There are several other uses of the term "rampart", especially the application to a ridge lying on the reef flat, with water behind it, by those who have studied the Great Barrier Reef islands, Australia. -- Ed.