

## THE SLATE SHORES OF LUNDY

BY L. A. HARVEY

Slate differs from granite in that it is a sedimentary, as opposed to an igneous, rock. It was not formed as the result of the cooling of a continuous molten mass, but by the continuous sedimentation of fine particles of silt from their suspension in water. It was therefore laid down originally as a series of fine, horizontal laminae, which became hardened and compacted by the pressure exerted by the accumulating layers above. Later, earth movements of various kinds have caused these horizontal beds to tilt and crumple and fold, and they have also been baked and altered as a result of their near proximity to the hot magma from which the granite of the rest of the island has been formed. Cracks and fissures, which probably resulted from the pressure which thrust the granite magma upward, likewise became filled with molten material which cooled to form the basalt dykes which are so prominent in some of the cliffs, and which have been described by A. J. T. Dollar (*Geol. Mag.* 70, 1933). The result of these various operations is that the slate beds of Lundy for the most part are tilted, rising from south-west towards north-east. The slate being relatively soft weathers rapidly under the action of waves, wind and rain and, as is to be expected, blocks and flakes become detached along the bedding planes of the formation, so producing an effect of ridges and steps on both cliffs and shore. The pattern of this however varies according to the direction of exposure to the prevailing south-westerly weather. Of the three shores with which we are here concerned, one, Lametry Cove faces almost due south-west, and here the ribbing runs parallel with the shore, since the beds are rising from this same south-west. At the Gates, where the shore faces some degrees east of south, the ridges run directly down the shore, while on the north shore of Rat Island a similar pattern to that of the Gates obtains, but on a much more truncated scale. These differences in configuration have profound effects on the composition and distribution of both fauna and flora, and each shore therefore requires separate consideration.

Lametry Cove has not yet been fully examined, only three visits having been paid to it. Fully exposed to the south-west, this bay is being steadily cut back into the neck between the South Light and the main part of the island. From about half-tide level a shelving beach of coarse slaty sand and shingle slopes gently up to the base of the crumbling cliffs and screes. On the western, or northern, side exposure is not so drastic, and short reefs and isolated conical stacks project seawards. The eastern side, which receives the direct

pounding of the waves, has been eroded to a much greater extent, leaving a high ridge of rock running parallel with the shore and separated from it for most of its length by a wide gully. The whole of the centre of the bay below half-tide level is crossed by closely contiguous low reefs separated by narrow clefts, the tops of the reefs being exposed only at low-water. A somewhat bizarre element is contributed to the pattern by a basalt dyke, which weathers more slowly than the slate and therefore extends like a raised path right across the bay.

The zonation of weeds follows much the same pattern as on the granite at the margins of the cove. But in the centre the shingly beach above half tide presents few footholds for weeds, and those species which normally occur above this level are therefore excluded. The most striking feature of the shore is provided by the parallel reefs which have been described running across the bay, and therefore parallel with the shore. Only the innermost of these can be readily examined, for the clefts between them rapidly become too deep to work, although the *Laminarias* on the crests may be exposed at low water springs over a distance of several scores of yards seawards. These oarweeds are luxuriant, and include the three common species, *L. digitata*, *L. saccharina* and *L. cloustoni* together with *Saccorhiza bulbosa* and *Alaria esculenta*. *Himanthalia lorea* is also abundant and frequent clumps of *Halidrys siliquosa* occur. The seawards crests of most of the reefs, and often the bottom of the clefts, support a vigorous growth of *Corallina officinalis* and *Lithothamnion lichenoides*, the lappet-like growths of the latter being often bleached to pale pinks, yellows and greens, and having the appearance of those small bracket fungi which are so commonly to be seen on dead and fallen tree-stumps.

Closer inshore the oarweeds give way to the wracks, and *Fucus serratus* becomes the dominant weed. Very little *F. vesiculosus* or *F. spiralis* is present, except at the margins of the cove, for these would normally extend over the range occupied by shingle. Nor is *Ascophyllum nodosum* common, for the exposure is too great for this species to flourish. In the *F. serratus* zone the troughs between the reefs usually contain a deposit of sand on the bottom, and there may be stones and boulders present, mostly of slate, but a few basalt blocks are present derived from the dykes. Some heavily waterworn granite fragments are also present having been brought round by storms from the more westerly cliffs.

Although the cove as a whole is so exposed nevertheless a high degree of local shelter is provided by the transverse reef system, which breaks the force of the waves more and more as the tide falls.

There is little doubt that it is this which accounts for the richness of the flora and fauna. Encrusting and crevice-haunting animals are present in proportions and variety resembling those of the sheltered granite beaches of the east side. But absolute numbers are smaller, on account of the fact that loose stones are much more sparsely distributed, many of them also being deeply embedded in sand, to the exclusion of all but a few specialized species. A considerable amount of organic fragments tends to be trapped in the gullies and as a consequence detritus feeders such as amphipods and isopods are present in large numbers, while the Annelida are represented in greater numbers and variety than on most shores, the Polynoidae and *Phyllodoce lamelligera* being particularly prominent. Such scavengers tend also to seclude themselves in the dense cover offered by the holdfasts of the Laminarias and by densely tufted weeds such as *Corallina officinalis* and *C. rubens*. A comparative survey of the animal populations of these habitats is being made for all the important shores of the island, and while it is still too incomplete to yield exact information, it is apparent that samples from Lametry carry a comparatively rich and very varied fauna.

Turning now to the Gates, immediately south-east of Marisco Castle. Here the strike of the slate beds runs directly down the shore and the gullies between the reefs for the most part drain out with falling tide, leaving a dry, sandy bottom interrupted by occasional pools. The intervening ridges rise some six or eight feet above this bottom, the sides often being vertical, or nearly so, for the lower three or four feet. These miniature cliffs are clothed densely with small red weeds such as *Plumaria*, *Membranoptera* and *Chylocladia*, and overhung by curtains of trailing *Fucus* fronds from plants growing on the ledges and flat tops of the reefs. The increased shelter available here encourages *Ascophyllum nodosum*, particularly over the upper half of the shore, but flourishing plants occur on isolated boulders down to as far as low water neaps. The fine red weeds of the reef sides support a variety of sessile and sedentary animals. The little purse sponge, *Grantia compressa*, shows prominently, a dirty white against the sombre purples of the background. Nest-building amphipods, small tubicolous annelids and occasional colonies of small tunicates or individuals of *Lucernaria* and *Haliclystus* attach themselves to the fronds, while rissoid snails creep among them along with tiny juvenile Littorinas. Here too occurs the brilliant top-shell, *Calliostoma zizyphinum*, and more rarely the little keyhole limpet, *Diodora apertura*. The sand and gravel on the bottom encourage worms like *Arenicola ecaudata* and *Audouina tentaculata* and small Crustacea such as cumaceans,

harpacticid copepods and *Nebalia bipes*. Here, as at Lametry, there is plenty of organic detritus to support scavengers, and there being many loose slate slabs to provide shelter, a rich fauna of brittle stars, crabs, porcelain crabs, galatheids, amphipods, isopods and the like is to be found, and also occasionally *Psammechinus miliaris* and *Cucumaria saxicola*. Anemones such as *Actinia equina* and *Anemonia sulcata* are plentiful, while *Bunodactis verrucosa* is common under stones, and seems to exhibit a preference for those half embedded in sand. Hydroids are also quite numerous, particularly *Dynamena pumila* on the bases of the larger weeds and *Coryne muscoides* among the fine reds. Other less common species include *Plumularia setacea*, *Nemertesia antennaria*, *Myriothele cocksi* and *Obelia geniculata*. Of other sessile groups both Bryozoa and Tunicata are well represented, the same species occurring as are found on the sheltered granite shores, but usually in greater numbers and luxuriance.

The conditions on the northern shore of Rat Island are very different. Steep slate ribs drop rapidly to shallow water, with almost equally steep narrow valleys between. Very little water is held as the tide falls, and there are few movable stones. The surface of the shore is dominated by the fucoid weeds, where, at low-water, they are replaced by the Laminarias. In the sheltered conditions these coarse weeds grow to large size, to the exclusion of all but occasional patches of the finer species. Towards the eastern end the dips between the ridges become wider and deeper, and their sides more vertical. Fucus can rarely secure a hold on the polished straight sides, but nor can most other plants, and they are usually bare, except for small colonies of barnacles along the sides of cracks, and an occasional group of the coral, *Balanophyllia regia*. Perhaps the most interesting feature of the shore is the series of small caverns and arches carved out of the rock at the western end. Here the base of the island has been undercut and the overhanging walls are thickly covered with a limited but distinct community which includes fine red weeds like *Plumaria elegans* and species of *Polysiphonia* and *Ceramium*, the sponges, *Grantia compressa*, *Sycon coronatum*, *Leuconia nivea*, *Halichondria panicea* and *Hymeniacion sanguineum*, the anemone *Actinia equina* and, more particularly in the higher caverns, dense groups of *Sagartia anguicomma*. The worm, *Eulalia viridis*, is frequent, crawling over the damp weeds; barnacles include *Balanus perforatus* in some numbers, while the sea-squirts are represented by *Amaroucium punctum* and *Morchellium argus*. The commonest Bryozoa are various species of *Crisia*, while molluscs are represented by the dog-whelk, *Nucella lapillus*, *Gibbula umbilicalis*, limpets

and, very characteristically, the mussel, *Modiolus modiolus* and the sea-slug, *Goniodoris nodosa*. Apart from these, however, and a few species hidden in the weed fronds, few other animals appear able to survive, probably owing to the paucity of cover, and the relatively long exposure to air, for these formations all occur at levels above half-tide.

These three slate shores, differing sharply as they do among themselves, present very different conditions from those of the granite, the contrasts arising largely out of the geological structure of the two rocks. The granite a hard igneous rock, unlaminated and weathering into large rounded blocks presenting few crevices and with a continuous, rounded outline. The slate is softer, bedded and finely laminated, and weathers into jagged reefs, the direction of which in relation to shore and waves is determined by the tilt of the beds. The upper surface of the reefs is usually stepped into a series of platforms and vertical rises, with innumerable chinks and crannies between them. Where blocks are broken away the granite forms heavy, durable chunks which usually become firmly wedged together and ultimately bound by the holdfasts of the various weeds growing among them. The slate on the other hand gives large flat, brittle slabs, which within a few seasons break down into coarse gravel and sand. These blocks rarely become welded into a continuous mass, and may frequently be tossed over the shore during high seas. As a result there is usually far more local shelter available on the slate than on the granite, but it is less permanent. The fine grain of the slate, and its laminae, encourage the denser growth of small weeds, and communities of both animals and plants are therefore richer in numbers and species.

