

The best evidence of this has been afforded by Mr. Austen, who examined with very great care not merely the limestones of South Devon, but the rocks immediately associated with them. The limestones are stated by this author to occur, in nearly every instance, in the immediate vicinity of volcanic disturbances, and to be partly included in the slates and sandstones, and partly to rest upon them.

To the former belong the broad band extending from Staple Hill to Dean Prior, the minor bands in the neighbourhood of Thorpestone and Totness, and all those which occur beyond the Dart; also the limestones of Newton and Torbay. They are said to be less pure and more slaty than the overlying limestones, and to be frequently separated by seams of shale. Transverse sections of these bands show, that the strata in some cases become thinner as they descend, and the partings of the shale increase, as near Staverton in the valley of the Dart, and at Staple Hill; but that, in other instances, as between Newton and Totness, the strata, instead of fining off, end abruptly upon the slate, and are covered in the direction of the dip by similar slates. The strata are always inclined, but they invariably form a table land at the surface. This inclined position is conceived not to be due to dislocation, but to the beds having been deposited at the angle which they now present. The bands of limestone dip 40° , but are nowhere more than 150 feet thick, and they all contain the same description of organic remains.

In the structure of the Devonshire limestones, Mr. Austen considers that he has discovered evidences of an origin similar to that of modern coral reefs, which will explain their inclined position. At Ogwell Park the limestone forms a horizontal capping to the inclined strata, and at Bradley rests conformably against a ridge of slate, the basset edge of each bed rising to the level of the crest of the ridge. This structure agrees with that of the coral reefs in the Southern Ocean.

The stratified arrangement of the calcareous masses may be explained by the occasional deposition of sedimentary matter, which might, for a time, interrupt the labours of the *polypus*; and thus a series of beds would be produced, varying in thickness, according to the recurrence, at shorter or longer intervals, of interfering agents, each bed rising successively to the surface-level of the water.

If the deposition of sedimentary matter were great, then the *polypi* would be destroyed, and the reef would become encased in a mechanical accumulation. In further proof of the limestone of Devonshire having been coral reefs, Mr. Austen advances the great abundance of zoophytes found on the surface of the lower strata, embedded in the layers of sand which separate the beds; and, their absence in other parts, especially in the interior of the bands, is no objection to this view of the origin of the limestone, because, in recent reefs, all traces of organic structure are frequently obliterated.

If we refer back to the description quoted from De la Beche, or if we examine for ourselves the rocks *in situ*, we cannot but be struck with the resemblance in the conditions, to those which are constantly occurring in the Atoll of the Maldiva Islands, and the great coral reefs of the Eastern Archipelago. Masses of branching madrepores, then as now, were formed upon the coasts of a red sandstone sea; and alternations in the levels of land and water produced all the conditions of beds.

Mr. Charles Darwin, in his valuable

work on "The Structure and Distribution of Coral Reefs," has explained, with very great accuracy, all the conditions under which coral reefs are now forming in the Pacific Ocean. The conditions are precisely those which will explain all the phenomena of the limestones of Devonshire. Upon the theory that the land around which coral reefs have been formed has been gradually subsiding, and that during the subsidence there has been a constantly upward growth of the reef-constructing corals, this observer explains the progress of coral formation in some cases, and the destruction of the coral animals in others.

He has shown us at what depth the polypifers can exist, and how slight movements destroy them. Not only is the sea active in grinding up the coral rocks, and thus forming deposits, but "the number of the species *Holothuria*, and of the individuals which swarm on every part of these coral reefs, is extraordinarily great; and many ship-loads are annually freighted, as is well known, for China, with the trepan, which is a species of this genus. The amount of coral yearly consumed, and ground down into the finest sand, by these several creatures, and probably by many other kinds, must be immense. These facts are, however, of more importance in another point of view, as showing us that there are living checks to the growth of the coral reef, and that the almost universal law of 'consume and be consumed,' holds good even with the polypifers forming those massive bulwarks which are able to withstand the force of the open ocean."

By these means there was a formation of material which was eventually to receive a slaty structure; and if to this condition we add the by no means uncommon one of volcanic action pouring out its molten matter, to produce the all-involving trap rocks, the entire set of phenomena is complete.

Such then are the geographical, geological, and physical condition of the Devonshire limestone, we must now return to the economic value of these stones.

At the Marble Works of Mr. Woodley, at St. Mary Church, near Petit Tor, and Babbacombe may be inspected every variety of these limestones—worked into columns, vases, chimney-pieces, and a variety of other ornamental articles. These marbles are varied tints of grey, mingled with veins of white. Blocks composed almost entirely of fossil corals are frequently found. These are known as Madrepore Marbles. Red and yellow varieties are sometimes found near Babbacombe, but in smaller quantities. In addition to those, the following summary from the "Geological Survey of Devon and Cornwall," shows the variety which may be obtained.

"The marbles of Plymouth are not very dissimilar from those obtained at Petit Tor, with the exception of the black, a good variety of which is found at Cat Down. At Ipplepen, there is a reddish variety, which is extremely handsome; and near Totness, there are some of good appearance; indeed, throughout the limestone between Newton Bushell, Babbacombe, and Plymouth, marbles of very great varieties of colour may be obtained, though tints of grey chiefly prevail, and they deserve to be far more extensively employed than they have hitherto been: a greater demand would cause more varieties to be worked. A beautiful green marble is found in Kitley Park, and the rose-coloured dolomite in the vicinity of the same place, affords a very handsome, though hitherto neglected, material."

R. HUNT.