

but they ought, he says, to be of rare occurrence, for in the case of atolls or of barrier or fringing reefs, the characteristic outline must usually be destroyed by denudation as soon as a reef begins to rise; since it is immediately exposed to the action of the breakers, and the large and conspicuous corals on the outer rim of the atoll or barrier are the first to be destroyed and to fall to the bottom of vertical and undermined cliffs. After slow and continued upheaval a wreck alone can remain of the original reef. If, therefore, says Mr. Darwin, "at some period as far in futurity as the secondary rocks are in the past, the bed of the Pacific with its atolls and barrier reefs should be converted into a continent, we may conceive that scarcely any or none of the existing reefs would be preserved, but only widely spread strata of calcareous matter derived from their wear and tear."*

When it is urged in support of the objection before stated (p. 767.) that the theory of atolls by subsidence implies the accumulation of calcareous formations 2000 or 3000 feet thick, it must be conceded that this estimate of the minimum density of the deposits is by no means exaggerated. On the contrary, when we consider that the space over which atolls are scattered in Polynesia and the Indian oceans, may be compared to the whole continent of Asia, we cannot but infer from analogy that the differences in level in so vast an area have amounted, antecedently to subsidence, to 5000 or even a greater number of feet. Whatever was the difference in height between the loftiest and lowest of the original mountains or mountainous islands on which the different atolls are based, that difference must represent the thickness of coral which has now reduced all of them to one level. Flinders, therefore, by no means exaggerated the volume of the limestone, which he conceived to have been the work of coral animals; he was merely mistaken as to the manner in which they were enabled to build reefs in an unfathomed ocean.

But is it reasonable to expect, after the waste caused by denudation, that calcareous masses gradually upheaved in an open sea, should retain such vast thicknesses? Or may not the limestones of the cretaceous and oolitic epochs, which attain in the Alps and Pyrenees a density of 3000 or 4000 feet, and are in great part made up of coralline and shelly matter, present us with a true geological counterpart of the recent coral reefs of equatorial seas?

Before we attach serious importance to arguments founded on negative evidence, and opposed to a theory which so admirably explains a great variety of complicated phenomena, we ought to remember that the upheaval to the height of 4000 feet of atolls in which the coralline limestone would be 4000 feet thick, implies first, a slow subsidence of 4000 feet, and secondly, an elevation of the same amount. Even if the reverse or ascending movement began the instant the downward one ceased, we must allow a great lapse of ages for the accomplishment of the whole operation. We must also assume that at the commencement of the period in

* Letter to Mr. Maclaren, Scotsman, 1843.