

CHAPTER XXII.

REPRODUCTIVE EFFECTS OF TIDES AND CURRENTS.

Estuaries how formed — Silting up of estuaries does not compensate the loss of land on the borders of the ocean — Bed of the German Ocean — Composition and extent of its sand-banks — Strata deposited by currents in the English Channel — On the shores of the Mediterranean — At the mouths of the Amazon, Orinoco, and Mississippi — Wide area over which strata may be formed by this cause.

FROM the facts enumerated in the last chapter, it appears that on the borders of the ocean, currents and tides co-operating with the waves of the sea are most powerful instruments in the destruction and transportation of rocks; and as numerous tributaries discharge their alluvial burden into the channel of one great river, so we find that many rivers deliver their earthy contents to one marine current, to be borne by it to a distance, and deposited in some deep receptacle of the ocean. The current not only receives this tribute of sedimentary matter from streams draining the land, but acts also itself on the coast, as does a river on the cliffs which bound a valley.

In inland seas, where the tides are insensible, or on those parts of the borders of the ocean where they are feeble, it is scarcely possible to prevent a harbour at a river's mouth from silting up; for a bar of sand or mud is formed at points where the velocity of the turbid river is checked by the sea, or where the river and a marine current neutralize each other's force. For the current, as we have seen, may, like the river, hold in suspension a large quantity of sediment, or, co-operating with the waves, may cause the progressive motion of a shingle beach in one direction. I have already alluded to the erection of piers and groins at certain places on our southern coast, to arrest the course of the shingle and sand (see p. 306.). The immediate effect of these temporary obstacles is to cause a great accumulation of pebbles on one side of the barrier, after which the beach still moves on round the end of the pier at a greater distance from the land. This system, however, is often attended with a serious evil, for during storms the waves throw suddenly into the harbour the vast heap of pebbles which have collected for years behind the groin or pier, as happened in the late gale (Jan. 1839) at Dover.

The formation and keeping open of large estuaries are due to the *combined influence* of tidal currents and rivers; for when the tide rises, a large body of water suddenly enters the mouth of the river, where, becoming confined within narrower bounds, while its momentum is not destroyed, it is urged on, and, having to pass through a contracted channel, rises and runs with increased velocity, just as a stream when it reaches the arch of a bridge scarcely large enough to