

two-thirds of the ebb, though the surface-water is running out rapidly, the bottom-water is practically at rest: only during the remaining third of the ebb does the bottom-water flow outward and with sufficient velocity to scour the channel. But this lasts for so short a time that it hardly removes as much mud or sand as has been laid down during flood and the earlier part of ebb-tide. Hence the sediment is in a state of continual oscillation upward and downward in the estuary. At the lower end, some portion of it is continually being swept out to sea. At the upper end, fresh material of similar kind is being supplied by the river. But, between these two limits, the same sediment may be kept in suspension or may be alternately deposited and removed for many weeks or months before it finally escapes to sea and is spread out on the bottom. To this cause, doubtless, the remarkable turbidity of many estuaries is to be attributed.¹⁷⁴

Where a river, with a considerable velocity of current, enters the sea, its mouth is commonly obstructed by a bar of gravel, sand, or mud. The formation of this barrier results from the conflict between the river and the ocean. The muddy fresh water floats on the heavier salt water, its current is lessened, and it can no longer push along the mass of detritus at the bottom, which therefore accumulates and tends to form a bar. Moreover, as already mentioned (p. 646), though fresh water can for a long time retain fine mud in suspension, this sediment is rapidly thrown down when the fresh is mixed with saline water. Hence, apart from the necessary loss of transporting power by the checking of the current at the river-mouth, the mere mingling of

¹⁷⁴ See an interesting paper by Prof. Sollas, *Q. J. Geol. Soc.* xxxix., 1883, p. 611, and authorities there cited.