

tide-marks. As a rule, the coarse materials are thrown up about the upper limit of the beach. They seem to remain stationary there; but if watched and examined from time to time, they will be found to be continually shifted by high tides and storms, so that though the bank or bar of shingle retains its place, its component pebbles are being constantly moved. During gales coincident with high tides, coarse gravel may be piled up considerably above the ordinary limit of the waves in the form of what are termed *storm-beaches*.<sup>295</sup> Below the limit of coarse shingle upon the beach lies the zone of fine gravel, and then that of sand, the sediment, though liable to irregular distribution, yet tending to arrange itself according to coarseness and specific gravity, the rougher and heavier detritus lying at the upper, and the finer and lighter toward the lower edge of the shore. The nature of the littoral accumulations on any given part of a coast-line must depend either upon the character of the shore-rocks which at that locality are broken up by the waves, or upon the set of the shore-currents, and the kind of detritus they bear with them. Coasts exposed to heavy surf, especially where of a rocky character, are apt to present beaches of coarse shingle between their projecting promontories. Sheltered bays, on the other hand, where wave-action is comparatively feeble, afford a gathering ground for finer sediment, such as sand and mud. Estuaries and inlets, into which rivers enter, frequently show wide muddy flats at low water (p. 672). Deposits of comminuted shells, coral-sand, or calcareous organic remains thrown up on shore, may be cemented into compact rock by the solution and redeposit of carbonate of lime (p. 825). Where tidal

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<sup>295</sup> See Kinahan on Sea-beaches, Proc. Roy. Irish Acad. (2d ser.), iii. p. 101.