

cony, the depth at which the sea breaks and is effective in the transport of sand along the bottom is said to vary from scarcely 3 metres in ordinary weather to 5 metres in stormy weather, and only exceeds 10 metres (32·8 feet) in great hurricanes. According to Commander Cialdi, the movement of waves may disturb fine sand on the bottom at a depth of 40 metres (131 feet) in the English Channel, 50 metres (164 feet) in the Mediterranean, and 200 metres (656 feet) in the ocean.²⁶⁰ Off the Florida coast the disturbing action of the waves is believed to cease below 100 fathoms.²⁶¹ As above remarked, the influence of currents has been detected at much greater depths.

(4) *Ice on the Sea*.—In this place may be most conveniently noticed the origin and movements of the ice which in circumpolar latitudes covers the sea. This ice is derived from two sources— α , the freezing of the sea itself, and β , the seaward prolongation of land-ice.²⁶²

α . Three chief types of sea-ice have been observed. (α) In the Arctic sounds and bays, the littoral waters freeze along the shores, and form a cake of ice which, upborne by the tide and adhering to the land, is thickened by successive additions below, as well as by snow above, until it forms a shelf of ice 120 to 130 feet broad, and 20 to 30 feet high. This shelf, known as the Ice-foot, serves as a platform on which the abundant débris, loosened by the severe

²⁶⁰ Quoted by Delesse, op. cit. p. 111.

²⁶¹ A. Agassiz, Amer. Acad. xii. 1882, p. 108.

²⁶² Consult on the whole of this subject K. Weyprecht's "Die Metamorphosen des Polareises," Vienna, 1879; Payer's "New Lands within the Arctic Circle," 1876, chap. i. The physics of sea-ice are discussed by O. Pettersson ("Vega-Expeditionens Vetenskapliga Iakttagelser," ii. p. 299, Stockholm, 1883), who concludes that instead of being contracted by cold, the volume of the frozen sea increases to an extraordinary degree, and that the rupture of the ice is thus due to expansion instead of contraction.