At Scinde Island the coast-line turns at right angles to the west for one and a quarter miles, where the waters of the Tutaekuri River finally discharge into the sea, after passing through the Ahuriri Lagoon. The sediment from this river tends to settle in the lagoon, which, whether limited by its naturally formed boulder-banks or by man-made embankments, is in reality a huge settling-basin for shingle and silt. In the last few miles of its course the fall of the Tutaekuri is very slight, and as it is continually depositing in its bed, and raising the level of that bed, it tends to silt up its own channel. Floods occur from time to time, and at these times, particularly when the outlet of the river is hindered by banked-up seas, or bars of silt and shingle, the river eventually breaks its banks in an endeavour to get away to the sea by the shortest route. This has happened often enough to justify the description of the breakaway of this river at Meanee, to the mouth of the Ngaruroro, or to the "washout" at Waitangi as a settled habit. This is simply a continuation of the natural processes that have formed the rich flats. At the present time the Tutaekuri River discharges ordinarily through the lagoon, and the Inner Harbour basin, and the entrance channel, into the bay, and, as already pointed out, its sediment, in so far as it reaches the sea, tends to be carried by tidal currents to the north-west, and therefore clear of the harbour-works. It is proposed by the Hawke's Bay Rivers Board, in order to cure the evils of the periodical floods of the Tutaekuri to the farming and residential localities in and near Napier, to divert the Tutaekuri River permanently to the sea at the mouth of the Ngaruroro. When this is done the silt and other material carried to the sea will be discharged south of the Breakwater Harbour, and will become contributory to the problem of littoral drift in relation to the harbour-entrance.

Natural Forces.—Ocean Currents.

There is a bare reference in the foregoing to the ocean currents running from south to north, and sweeping round the bay from Kidnappers past Napier. The presence of this current may be taken as proved; it was so treated by all the engineers whose reports are comprised in Commission's Exhibit No. 1, and was dealt with in detail and in a most interesting form by Mr. J. P. Maxwell, M.Inst.C.E., in his evidence before the Commission (see pages 353 and 354 of the notes of evidence).

Littoral Drift.

It may be taken as proved that the ocean currents at Napier flow generally from south to north, and to some extent assist in the northerly trend of the littoral drift. The main factor, however, is the set of the heaviest prevailing seas, impinging upon the coast-line at a suitable angle. Easterly seas which strike parallel to the coast exert little, if any, effect upon the northerly trend of the littoral drift. Seas due to north and north-east winds will during the time they prevail force the littoral drift southwards; these winds at Napier do not last for long periods or cause the heaviest seas. The trend of the coast, however, between the entrance to the Tukituki River and Tangoio Point, being south-east, north, and north-north-east, is open to the heavy seas and heavy ocean ground-swell experienced on this part of the coast. These seas impinge on the beach at a most favourable angle, and are the main cause of the predominating northerly littoral drift. That the shingle travels is undeniable. On the line of beach we have described its travel is northwards from Kidnappers to Whakaari. Phenomena that can be attributed to this cause can be actually seen. Such an observation is recorded in the memoranda prepared by Mr. F. E. Saunders, Engineer of the Napier Harbour Board, in September, 1882, to accompany the conditions of competitive harbour-designs which were invited in that year. Mr. Saunders says:—

The question of travelling shingle was tested in 1875 by running out a groyne 200 ft. long at the point marked "A" on drawing No. 2A. The time occupied in erecting this groyne was about six weeks, and during this period the shingle was trapped by the groyne, and the bar remained good; but a few days after the completion of the groyne the shingle passed round the end, and the bar was again subject to the usual changes.

The arrest of this drift by the breakwater built at the Bluff at Napier is another proof of the existence of the drift. There is the further fact that the shingle where it is deposited on the beach at the mouth of the Tukituki is of large components, and might well be described as consisting of boulders; as it travels north by a kind of tacking motion up and down the beach, it is reduced in size by attrition, until by the time it reaches Whakariri it is reduced almost to sand. Its gradual reduction in size can be traced as one walks up the beach and takes note of the shingle.

Sea and Wave Drift.

It seems to be commonly accepted that sea and wave drift cause an agitation of the sea-bottom near the coast, and that when this action is more or less regular by the existence of ocean currents and a prevalent set of the waves, it offers a difficulty when it is proposed to cut a channel in the sea, exposed to these forces. In such circumstances the accepted opinion seems to be that these forces will tend to fill up and finally obliterate the channel.

Tidal Currents in and out of Lagoons.

Another natural force that must be taken into account as a factor in the problem of Inner Harbour construction is the tidal current generated by the alternate filling-in and discharging, by tidal action, of the harbour basin of the Ahuriri Lagoon. On the ebb tide the water races out through the channel between the moles at a speed estimated at 5 to 6 knots per hour at least. The influence of this outflow as a well-defined stream can be seen and felt quite half a mile out from the moles. The force of this stream of water issuing from the Inner Harbour has a strong scouring effect—