THE EVOLUTION OF ROMNEY MARSH.

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INTRODUCTION

THE evolutionary processes hereafter described apply not only to Romney Marsh but to all similarly reclaimed bays around the coast, and they are deeply interwoven with the archæology of the county. By them were created the commodious harbours associated with the Roman occupation and subsequently with the proud history of our Cinque Ports, which also by them have been rendered derelict. It is to them we owe the advent of the Teutonic Marshmen, who for all time have stamped their image upon the Men of Kent. To Romney Marsh we owe the ancient laws which govern the reclamation and drainage of all the Marsh lands of the country. And above all it is to these processes, so wonderfully adapted at every stage to their great purpose, that we owe the addition of many thousands of acres of land to the map of England. And the entire sequence of events has been developed since the advent of Neolithic man into the district. An attempt is here made to deal with this subject as affected by recent earth movements, the full evidence of which has lately become available.[1]

THE ORIGIN OF THE BAY.—The story of Romney Marsh is a geological paradox. At first sight it almost looks like a geological impossibility. Here of old was a land-locked bay. The earth crust of Western Europe, which for a long period had been in a condition of instability, was now slowly sinking. For thousands of years it continued to sink until around our coastal areas the sea had risen above the old 70 ft. contour line, and many hundreds of square miles of land had been wiped off the map.

[1] Gilbert, *Report, Int. Geog. Union*, 1928, pp. 112-3 ; 1930, pp. 93-101 ; *Quarterly Jour. Geol. Soc.*, Vol. 86, pp. 94-5.

And what then of the Bay? Naturally, one might imagine, it must be some 70 feet deeper. On the contrary, it had actually become dry land. To put it in another way, when the earth crust was 70 ft. higher than to-day the Marsh area was under the sea, and then after the earth crust had sunk some 70 ft. the sea in the bay had disappeared. It is with the mysteries of this paradox that we have to deal.

Romney Marsh is a product of the final stage in the creation of the English Channel. Across the Straits of Dover an extension of the great Wealden dome formed the latest bridge by which the successive races of Early Man found their way into England or were driven southwards by the asperities of a glacial climate (G, Fig. 1). During a depression of the earth crust this bridge was finally breached, and along the line of a submerged valley (F) which had traversed the dome and which had been carved by the Rother, the Brede and the Tillingham, with rivers from Northern France, the sea swept to and fro between the English Channel and the North Sea, and for the first time in the world's history, Great Britain became an island entity. The lateral erosion of the valley by the waves continued until the Channel had been extended with exceptional regularity to a depth of about 70 ft. and a width of about five miles (Gorge, Fig. 1). It is still a practically unaltered feature in the bed of the Straits of Dover, running from a line between Beachy Head and Etaples well up into the North Sea. A further pronounced depression seems to have initiated the final stage, during which the Wealden ridge on each side of the Gorge was gradually eaten back, yard by yard, and mile by mile, until at long last the Straits had widened to something like their present dimensions, our bay had come into being and the waves were washing against the foothills.

THE FOUNDATIONS OF THE MARSH.—Let us now try to visualize the scene at this stage of our history. First, then, we have in imagination to put back the clock some 10,000 years, to raise the earth crust bodily some 70 ft., and to remove the blanket of marine deposits which overlies the

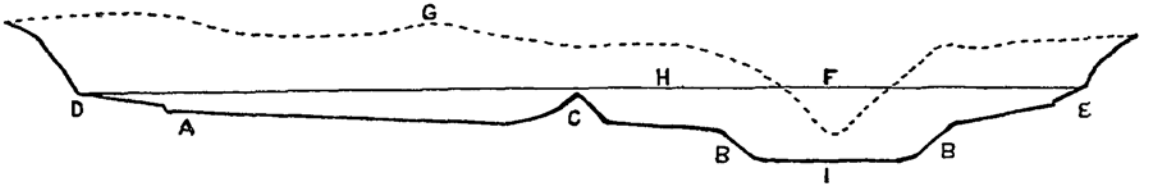

FIG. 1. SECTION ACROSS ENGLISH CHANNEL FROM HYTHE TO CAPE GRIZNEZ.

A Submerged Cliff at 10 fathoms.
B Submerged Cliff at 18 fathoms.
C Varne Elevation.
D Hythe shore.
E Cape Griznez shore.
F Valley across Isthmus.
G Ideal section of land prior to breach of Isthmus.
H Sea level.
I Gorge.

ancient floor of the bay. We have then exposed to view a high steep bare cliff, the back lands not as yet rounded off by denudation. This cliff swings round in an irregular semi-circle from a headland off Hythe and Folkestone,[1] and thence along the boundary hills of the Marsh to the western headland of Fairlight, stretching for several miles out into the sea.

The more resistant rocks of the coastline from Oxney to the island of Rye stand out in bold relief and dominate the central landscape. The contour of the bay is further broken by narrow V-shaped subsidiary bays into which the divided channels of the Rother deposit the ruins of the Wealden dome, and by similar bays opening out along the valleys of the Brede and Tillingham further westward. At high water an uninterrupted ocean view opens out as far as the eye can reach, and, as the tide recedes, we notice that herringbone systems of drainage have carved themselves out in the bed of the bay which bring in the flood tide, and carry off the ebbing waters, while the rivers trace their way across the eroded floor of the Wealden beds. Ever and anon from the cliffs mighty landslides come hurtling down on to the shore, to be sucked into the sea by the undertow of the waves, and yielding up perchance a selection of fossil bones from the giant reptiles of the Wealden period.[2] Looking landward, the vast primeval forest of Anderida spreads in every direction over hill and dale, in the dark shade of which the Royal oak, destined to become the sacred tree of Druidical worship, reigns supreme. It is an impressive Neolithic spectacle.

THE DEPRESSION.—We now approach the initial stage in the solution of our paradox. It was toward the close of the final period of Paleolithic man in England. A re-adjustment

[1] We know that after the widening of the English Channel a headland of the Green Sand and Wealden beds still existed off Hythe and Folkestone because its now denuded foundations are visible at exceptionally low tides.

[2] Valuable collections of these fossils are on view in the British Museum and the Museum of the Geological Survey, and restorations of some of the animals themselves decorate the grounds of the Crystal Palace.

of the earth crust was bringing about a widespread depression covering not only the area of the bay but a great part of Britain, Flanders, and Northern and Western France as well. Its movement was almost inconceivably slow—so slow in fact that deposits of shingle and sand from the up-channel drift, spreading in sheets across the bed of the bay, were able to keep pace with the depression. This process seems to have continued with little or no intermission over a period of several thousands of years, until the depression had been sufficient to permit of the deposit of some 70 ft. of detritus over the bed of the bay, when it came to a definite halt.

Borings at Ruckinge in search of coal, and at Holme Stone for water, have revealed the following details of these recent marine beds. A further boring of 70 ft. at Appledore by Mr. James Elliott still finished in marine sand.

Ruckinge near the foothills		Holme Stone	
Turf and mould ..	½ ft.	Shingle	15 ft.
Clay with shells ..	4 ft.	Boulders	4 ft.
Loamy sand ..	1½ ft.	Brown sand ..	13 ft.
Fine grey clayey sand	3 ft.	Clay	4 ft.
Sand and mud with bands of peat ..	2 ft.	Black and grey sand	20 ft.
Soft light blue clay, grey sand and sandy clay ..	5½ ft.	Pebbles	1 ft.
Grey sand with a few shells	30 ft.		
Soft light blue clay with bands of peat	9 ft.		
Brown sand with pebbles	9 ft.		
	64½ ft.		57 ft.
Wealden beds below	64½ ft.	Continuation doubtful.	

As the result of this prolonged depression, vital changes had taken place in the topography of the bay. The headland off Hythe and Folkestone, exposed alike to the up-channel and down-channel storms, had been progressively cut back, until in the final stages of the depression it had practically disappeared. By a similar process several miles of Fairlight headland had been eaten away. The cliffs at the base of the bay had also been cut back, and lowered and rounded off by subaerial denudation, while the scour of the encroaching sea, successively attacking the river valleys at a higher horizon, had broadened them out into pretentious bays. In short we had suffered the fate of every other part of the midland and southern British coastline, and the old land up to at least the 70 ft. contour was now beneath the sea, but with this profound distinction, that while, as a rule, the lost territories had been permanently wiped off the map, the waves in the bay (and in many other bays similarly situated) had been laying the foundation for a great restitution.

Early Man.—The era of this depression will ever be memorable in our history in that it witnessed the advent of Neolithic man. For long ages, in a condition little removed from that of the animals around them, successive races of primeval man had roamed the countryside, dependent from day to day upon the precarious moods of fortune. And then, at long last, with the advent of the Neolithic race, came the first glimmerings in the dawn of agricultural development. They had come to realize that the seeds and herbs and the fruits of the field were amenable to culture, and that certain untamed animals, the slaughtering of which had hitherto ministered to their needs, might be brought under domestication. And now, for the first time, straggling groups of this later race with domesticated sheep and cattle found their way into England.

It was an epoch of supreme and lasting importance, for these animals of the wild, by the process of evolution, were destined to become progenitors of the manifold British breeds of the present day, from the blood of which (with the

exception of the Merino sheep) most of the high class flocks and herds throughout the world were to be derived.[1] And the men of this race from their rude abodes on the higher land around the Marsh once looked down upon our tidal bay, and, maybe, fished in its waters. Their polished and pigmy flint implements and other relics have been found in great abundance upon the adjacent hills of Kent and Sussex.

THE FOREST UPLIFT.—The Neolithic depression, being but the culmination of a series of earth movements which at comparatively short intervals had been in operation for hundreds of thousands of years, it is hardly surprising that

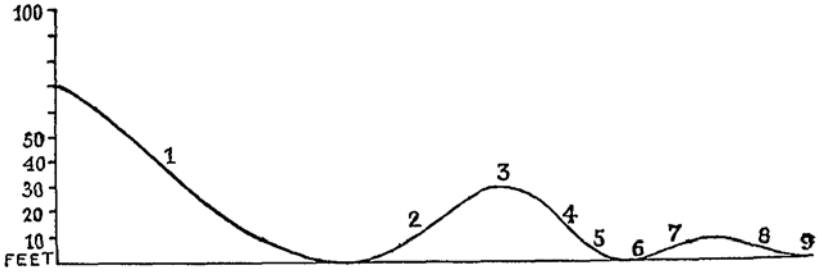

FIG. 2. GRAPH OF EARTH MOVEMENTS.

1 Neolithic depression.
2 Forest uplift.
3 Forest growth.
4 Forest depression.
5 Peat bed.
5 and 6 Deposit of alluvium, marsh beaches and Hythe promontory.
7 Post Forest uplift—initiation of Dungeness.
8 Post Forest depression and destruction of Old Winchelsea.
9 Last stages of Dungeness.

this latest depression, rather than coming to an abrupt close, should die out in a diminuendo of minor oscillations. It is with the first and most important of these oscillations that we have now to deal (Fig. 2).

[1] As a typical example of the success of other breeds in other markets of the world, the Romney Marsh sheep has always held the dominating position in New Zealand, in the extensive pastures of Patagonia, the Falkland Islands and elsewhere. And our export trade in rams, to maintain the standard type, is a permanent and lucrative feature in the sheep farming industry.

Scattered over the Marsh in every direction numberless "moor logs" lay entombed beneath the alluvium. At the Brack, near Woodruffs, in the parish of Fairfield, in a recent extensive drainage operation, relics of a submerged forest of large oak trees in a growing position were disclosed. They were resting upon a thin sheet of river silt which overlay the offshore sands of the early bay. The trees were quite black and as hard as ebony, and so firmly rooted that it was only with the utmost difficulty that they were dislodged. The forest was buried beneath 8 ft. of black leafy mould from its decayed foliage and undergrowth, and this in turn was covered by 18 in. of peat and some 5 ft. of Marsh alluvium (Fig. 3).

A splendid exposure of this submerged forest is also to be seen along the shore between Cliff End and the Pett Level. It extends beyond the boundary of the lowest tides and occupies many acres of the foreshore. The wood is largely of oak and hazel, and the abundance of rooted stumps shows that much of it grew upon the spot. An unworn flint of Neolithic (or later) age has been found in this deposit.[1] Cropping out along the southern shore of Dungeness, and also extending beyond low water mark, is a deposit containing branches and roots of trees which has been described as "peaty mud."[2] It has been greatly denuded by wave action and its remains are now largely hidden beneath recent accumulations of sand. This deposit clearly belongs to the submerged forest period.

Now the trees of these forest and peat beds manifestly could not have spread out over the off shore sands unless and until the bay had been raised above high tide level, and the fact that they now extend beyond the low tide limit seems to postulate a minimum land uplift of some 25 to 30 ft.

During the gradual process of this uplift a mantle of salt-loving vegetation would naturally come into being, the decay of which, supplemented by a deposit of river silt, would create a congenial soil for the subsequent spread of the

[1] *Proc. Geol. Assn.*, Vol. 32, p. 220.

[2] Geol. Survey Map of 1864.

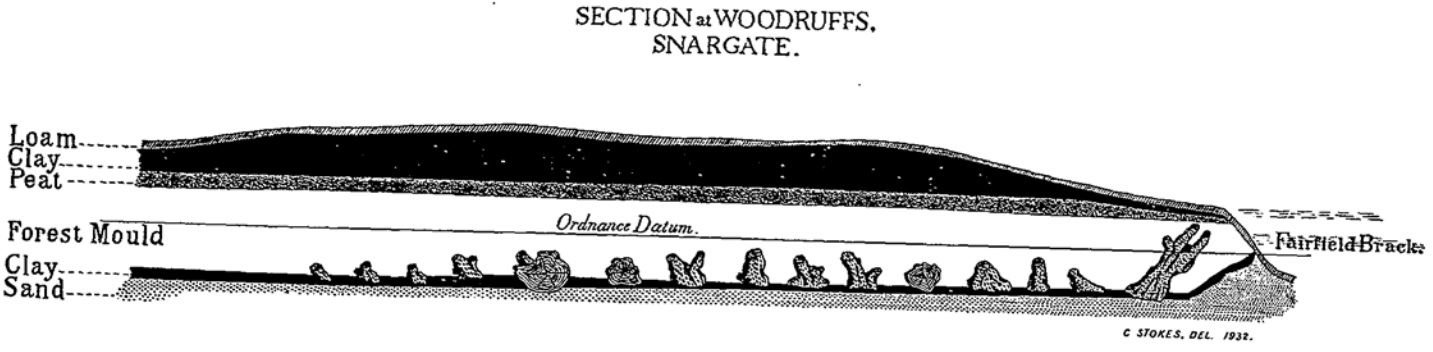

FIG. 3. SECTION OF THE FAIRFIELD SUBMERGED FOREST.

forest, as in the case of the Fairfield section and the " peaty mud " of the West Bay. Hence, too, the wide distribution of the " Moor logs " in the subsoil of the Marsh.

APPLEDORE DOWLES.—The forest trees which are found in great numbers in the peat over the Appledore Dowles, have been claimed by Lewin and other writers[1] to have drifted from the hills by the Rother, and it is asserted that " there is something in the Marsh mould uncongenial to the oak," and that except at West Hythe Oaks not a single specimen is to be found in the Marsh. As to the first point, it is inconceivable that in such numbers the trees could have found their way into the river, or that such large specimens could have been transported by such a shallow stream and have been so widely distributed.[2]

The uncongeniality or otherwise of the " Marsh mould " has no bearing upon the question, as the forest bed flourished long before the " Marsh mould " came into existence. But is not the statement a libel upon the " Marsh mould " ?[3]

One can hardly leave this branch of our subject without referring to the submerged forests around our coasts which extend far out into deep water, and which might suggest that our uplift had been greatly underestimated. The author ventures to claim that these deep water beds, of Neolithic age, are older than the land oscillation, and that the forests from which they were derived were already growing upon the land sloping down towards the coast at the time of their original submergence. They might thus date from the earliest or from any later stage of the depression. The nearer they grew to the shore level, the earlier would be their submergence and the further their ultimate extension into deep water. Any deposit of Neolithic marine beds with which they were associated would therefore rest

[1] Lewin : *Invasion of Britain by Julius Cæsar*, p. 64.

[2] In the making of the R.M. Canal Captain O'Brien found the trees in equal abundance and also of large size more than a mile E. from the Dowles.

[3] In an inquisition held in 1379 one Robert de Burton was found to have felled and sold 75 large oaks, worth £20 from land at Brookland (*Riddles of Rye*, L. A. Vidler, p. 17).

upon the submerged forests, and not, as in our case, underlie them.

To sum up this important chapter: the uprise had brought about a great transformation; the erstwhile bay had become dry land, and one might vainly imagine that our problem had already been solved. But this was not yet Romney Marsh. The mantle of alluvium which was to create the rich pastures of our low-lying coastal valleys had yet to be deposited; but the foundations had been well and truly laid for their ultimate addition to the map of England.

THE MARSH ALLUVIUM.—By far the most important result of the uplift was that during the long pause at its close a more or less substantial shore beach had been thrown up at the seaward boundary of the uplifted area. Its position was determined by the slope in the bed of the bay, which steepened as the headlands were approached. This new shore ran parallel with the Fairlight headland and swung out across the shallow water in the centre of the bay to seaward of the submerged forest and "peaty mud" and thence off the present shore at Romney and Hythe (see map).[1] The last stage of the forest period was succeeded by a depression which proved a supreme factor in the evolution of the Marsh. The sinking of the land brought about a tidal invasion through the river mouths and the weaker sections of the subsiding beach. Thus a lagoon was formed behind the shore line, which crept landward with the depression, until finally at high tide the entire area of the bay became re-flooded. The process, however, had been so gradual that rich deposits of marine and river silt had again kept pace with the depression, with the result that practically the whole of Romney Marsh and the higher parts of Walland Marsh had been clothed with salt-loving plants and the land was ripening for reclamation.

It would appear, however, that after being driven back an appreciable distance a section of the shore beach in the

[1] The original beach was subsequently driven in, and the towns of Lydd and Romney and the Romney Warren now represent its reconstructed relics.

West Bay had been broken through or submerged, and the sea thereafter continued to scour the back lands of Walland Marsh as far as the Appledore Dowles, depositing its silt only over the land covered by the more quiet water at the outward spread of the flood tide. It was probably during this period that the steep cliffs of Rye and Peasmarsh were carved back.

Breaches also occurred in the eastern shoreline, though these proved of an entirely beneficent character. In the process of repairing the Dymchurch Wall, the late James Elliott records that he came upon a succession of shingle bars running under the Wall and out into the Marsh more or less at right angles with the shore.[1] The more westerly bars are of no great length and lie embedded beneath the upper alluvium. Off Dymchurch during a hot summer their course can still be traced by the colour of the burnt herbage. Further east the bars gradually increase in altitude and in length (at first underlaid and intersected by alluvium) until we come to the broad belt of shingle which runs close up to the foothills at West Hythe.

It seems clear that the original beaches along this eastern section became progressively submerged, and in places swept away. Fortunately, however, ample supplies of shingle were drifting along the coast, and, with the extension of the newer beaches and the deepening of the depression, the lateral bars were thrown out into the salt marshes.

The shorter and deeper bars were formed during the earlier stage of the depression and subsequently buried beneath the alluvium, and the longer surface bars manifestly belong to its later stages, when even the back lands had again sunk below high tide level.

The net result was that, apart from the shingle zone, the vast alluvial area of Romney Marsh east of the Rhee Wall had come into being efficiently protected from future wave attack alike in the south and east.

THE HYTHE PROMONTORY.—These West Hythe shingle ridges are in close succession and have the same continuity

[1] *Account of the Dymchurch Wall*, p. 6.

and uniformity of structure as those of Dungeness. They were clearly thrown up by the waves from the open sea in the east. It follows that the Hythe headland must previously have been eaten away right up to the foothills.[1] A reference to the map (Fig. 4) will show that they are all cut off at the shoreline, and, traced seawards, take the form of a cuspate promontory,[2] the western flanks of which ran appreciably to seaward of the present Dymchurch Wall. It is important to bear in mind that these shingle formations extended over the entire stage of the Forest depression, before a pebble of Dungeness had been deposited. Its arrested development and the process of its destruction are dealt with in due sequence (see pp. 268-9).

THE HYTHE HAVEN.—During the deposit of the shingle ridges which culminated in the Hythe series, the sea from the east which had thrown them up had access to the back lands by means of a broad channel along the foothills. This subsequently became the western branch of the Hythe Haven, the eastern section of which was shut in from the sea by a belt of shingle between Hythe and Folkestone (Fig. 4). A whole library of controversial literature has gathered around this subject. For example, was the Haven the site of Cæsar's landing ? Did a critical battle take place upon the islands ? Did the Haven give access to a Roman fort at Lympne ? Was it the *Portus Lemanis* of Ptolemy, or was there no port at all ? Did the river Limen run along the foothills and empty into the Haven or elsewhere, or was it blocked at Appledore by the erection of the Rhee Wall ? These and a host of other questions have for centuries been the subject of dispute among archæologists, and still remain unsettled. We can only leave them in their hands.

Reverting for a moment to the alluvial period, the following points may be of interest. The forest land, being

[1] A substantial shore beach can still be traced along the foothills between Hythe and Sandgate.

[2] It seems probable that the latest ridges of the promontory (since cut off at the shore) and which were laid down at the very close of the depression, were slightly higher than those which preceded them.

but the uplift of the early sea bed, was naturally sloped seawards. At the close of the lagoon stage the slope was largely reversed. This was due to the longer period of submergence of the lower coastal lands during the depression, coupled with the fact that the coarser detritus of shingle and sand was first precipitated, and bulked more largely than the finer material deposited from the still waters at the landward spread of the tides.

The result was a rapid and relatively deep deposit of coarser material over the coastal areas and a more gradual accumulation of finer and stiffer alluvium further inland. The back areas, being the last to be submerged, naturally received a restricted supply of alluvium. It was, indeed, found to be entirely absent in the Ruckinge boring.

In addition to the marine silt, the forest itself contributed not a little to the building up of the Marsh. In this connection Mr. W. E. Ellis writes to me that in his building operations "a bit inland, and especially on the higher ground around Brenzett and Brookland" he has found beneath the alluvium "layers of vegetable matter (containing branches of trees and logs of wood) from a few inches to 10 feet and more in thickness", obviously derived from a local section of the forest. "They rest upon quicksands which work up like a lot of gruel."

The suspended material in the water of the English Channel averages some fifty-two parts of sand, twenty-four parts of calcareous solids and twenty-four parts of organic matter.[1] To these constituents, supplemented by rich organic material from the rivers,[2] the wonderful fertility of the Marsh is largely due. The richest pastures are naturally those of the fattening lands, in which profile plays an important part. Even in adjoining fields the drainage from the higher to the lower land will bring about chemical reactions in the soil which lead to deterioration.[3]

[1] *Journal S.E. Agricultural College, Wye*, No. 30.

[2] This river silt contains from 20 to 30 per cent. of organic matter.

[3] *Ibid.*, p. 144.

The best fattening pastures are those of higher profile, in which the initial fertility is associated with good subsoil drainage. " Their temperature then rises quickly in spring and the rate of nitrate production is high " (p. 161). The richest " fattening fields " in the Marsh are said to be one of 17 acres at Snave Corner, regularly carrying and fattening eleven to twelve sheep per acre, and a field at Burmarsh carrying up to twelve sheep per acre. In several other localities up to ten sheep per acre are fattened. The wide areas known as " breeding land ", as distinguished from " fattening land ", carry but two to six sheep per acre. In the case of arable land profile deterioration is minimized by cultivation and the general soil analysis is of primary importance.

The surface irregularities were produced in a variety of ways. In an instructive paper on the Salt Marshes in course of formation along the Norfolk coast, Mr. J. A. Steers[1] describes a shore beach eight miles in length which in recent times has been thrown out obliquely from the old shore line at Weybourne and up to the present has extended to Blakeney Point. It encloses a series of salt marshes about four miles in width, also intersected by lateral bars of shingle. He shows how these marshes " cut up by an intricate series of minor creeks draining into major ones, become carpeted by a rich mantle of vegetation which captures the silt and blown sand and causes some parts of the floor to be raised higher than the others."[2]

In the wider area of Romney Marsh, with the Rother also spreading out in distributive channels, these irregular conditions would naturally be intensified.

Apart from the work of man, the topography of Romney Marsh proper presents much the same surface features as those prevailing at the close of the Lagoon period, and it seems probable that the natural drainage levels of to-day are

[1] *Proc. Geol. Assn.*, Vol. 40, pp. 341-56.

[2] Mr. Steers attributes the formation of the beaches which intersect Romney Marsh to similar processes, a conclusion which, apart from the depression, can be readily accepted.

but an inheritance of the arterial channels which formerly brought in and carried off the tidal waters of the lagoon.

THE FINAL OSCILLATION.—We have now to record what we would fain hope may prove the final stage of these subsidiary oscillations (7, 8, Fig. 2). It was a relatively feeble effort, but it extended over an immense area and was associated with phenomena of the highest importance. The original movement commenced with the latest era of Paleolithic man; the forest uplift is dated by the advent of the Neolithic race; the final pulsation pre-dated the Bronze Age; and the resulting depression extended over the Roman and Saxon periods.

In the Thames Valley the uplift is evidenced by the renewed growth of large forest trees over the previously submerged area and by its occupation first during the Bronze Age and later as a Roman settlement, after which the land was again depressed below sea level.[1] At Dixon's Corner, near Sandwich Bay, Mr. G. C. Solley has unearthed a considerable quantity of Roman pottery several feet below high tide level.[2]

In the coastal regions of Flanders and northern and eastern France abundant evidences of man's occupation during the Neolithic, the Bronze and the Roman periods have been revealed at successive horizons in the marine deposits, while at St. Omer and Dunkirk houses and factories have been built upon marine deposits which overlie the ancient Roman settlements.[2]

In the Arun Valley of Sussex a Roman ford across the river is now submerged,[2] even at low tide, by 3 ft. of swiftly flowing water, indicating a similar final earth movement.

In our district the formation of Dungeness was initiated, the shore defences strengthened and the water-logged marsh consolidated, prior to the depression which preceded the Roman era and the advent of the Teutonic settlers with their "extensive flocks".

[1] Spurrell, *Proc. Geol. Assn.*, Vol. 11, p. 214.

[2] *Report*, Int. Geog. Congress, 1928, p. 112.

The final stage was associated with tragic happenings. The ancient writers, Twine, Lambarde, Camden, Somner and many others, speak of the ravages of exceptionally furious storms between the eleventh and fourteenth centuries. In 1097 the island now occupied by the Goodwin Sands was utterly destroyed; in 1250 at old Winchelsea, an island in the West Bay, "besides the hurt that was done in bridges, mills, breaks and banks, there were 300 houses and some churches drowned"; in the reign of Edward I[1] Camden records that "the sea . . . made pitiful waste of people, of cattle, and houses in every place, as having quite drowned Bromhill, a pretty town well frequented, and made the Rother forsake his own channel and stopped his mouth [at Romney] to pass into the sea by Rhie." And the same storm swept away the ruins of the island of Winchelsea.

At this time there was no protecting shore beach at Littlestone, the lowlands from Belgar to the Warren were one vast estuary, ships anchored along the fringe of the town, and with the sea at its doors, nothing but a few feet in altitude stood between Romney and a similar catastrophe. As it was, a coating of several feet of shingle and sand was thrown in over the greater part of the town. This enveloped the churchyard and blocked the western entrance of the church of St. Nicholas, access to which had thereafter to be effected by a number of descending steps. The pillars of the nave for about 4 ft. up still show a dark discolouration, marking the line of the muddy waters. Not only so, but a new shore beach was thrown up which can be traced dipping towards the fields along the seaward side of the town.

Now in the first place it requires a considerable stretch of the imagination to picture a succession of such exceptional storms over a period of more than three centuries, and ravaging an area north, south and east of the English Channel, and well up into the North Sea. And when we find such indisputable evidence of a post-Roman depression over such a vast area we seem forced to the conclusion that these tragic happenings were due to its progressive weakening of

[1] Somner, p. 58.

shore defences, never too substantial, and that the storms were but a final and contributory agency in the destruction.

The earth movement itself was probably a gradual one initiated much earlier than the thirteenth century.

THE RECLAMATION OF WALLAND MARSH AND GULDEFORD LEVEL.—Reverting for a moment to the Forest depression: we have seen that as the result of a breach in the forest shore of the West Bay the alluvium had not been laid down over the back lands of Walland Marsh. Aided, however, by the new uplift, accumulations of shingle and sand had progressively contracted the breach and broken the scouring force of the waves. Thenceforward the tidal and river silt were freely deposited over the erstwhile submerged area.

The Rhee Wall, which cut off the Dowles from the rest of the lowlands, arrested the new deposits, which between Appledore and Snargate are to-day no less than 8 ft. higher than the land to the east. This permitted of the "Inning" and subsequent reclamation of the lands bounding the Wall to the west; and thereafter, by progressive stages, the entire area to its boundary in the West Bay was added to the alluvial marsh lands, the final shutting out of the sea by the reclamation of Guldeford Level being accomplished in A.D. 1562.

THE PARADOX.—We will now venture to sum up the foregoing evidence. In the Evolution of the Marsh we have three definite periods of depression, with two intervening upheavals, and the phenomena associated with each movement have their indispensable place in the final result.

But for the deposit of marine beds during the early depression the Marsh area would have remained a bay, and a deep one at that. Had the depression been other than a gradual one, it would have outpaced the growth of the marine deposits, with a similar result. The new shore beach created by the forest uplift alone rendered possible the creation of the lagoon and the deposit of the Romney Marsh and Hythe shingle ridges and of the alluvium during the

renewed depression, while the alluvium in its turn not only raised the surface of the marsh but was accountable for its wondrous fertility. The ensuing uprise consolidated the new deposit and paved the way for its reclamation, strengthened the shore beaches, and probably initiated the formation of Dungeness.

The final depression alone had a malign influence. By it we lost our Haven, and with it our ancient glory as a Cinque Port. We lost Old Winchelsea and the " pleasant watering-place " of Broomhill, and are now on the way to losing our Pett Level.

Yet the credit balance has been a munificent one, and it now rests with man to conserve the blessings which the gods have provided.

And so the impossible had happened and our paradox had been solved. While large areas of the coastal lands of England had been irretrievably lost, nearly a hundred square miles of erstwhile submerged bay had been transformed into dry land. Meanwhile the same beneficent " impossibility " had repeated itself in the case of the reclaimed bays of the Cinque Ports and of endless similar bays around the coasts of England and France, and it had all been rendered possible by the oscillations of the Forest and post-Forest periods.

THE MYSTERY OF DUNGENESS.—Dungeness is one of the most remarkable shingle promontories in the world. It is of such a distinctive character that British sailors have attached its name to similar formations in such distant localities as the Paget Sound and the southern shore of Patagonia. Striking out as it does for several miles into the sea, athwart the course of the up-channel storms which elsewhere are carving back the Channel coastline, its evolutionary processes and their relationship to those of the Romney Marsh, have been the subject of world-wide controversy, which as yet has reached no satisfactory conclusion.[1]

[1] E. M. Ward : *English Coastal Evolution*, p. 206.

The Ness has been variously attributed to longshore currents and to tidal eddies (neither of which exists in sufficient force to drift the coarse material); to the meeting of opposing North Sea and Channel tides (the location of which is subject to continuous variation); to the shingle being arrested by the estuary of the Rother (which did not deflect a single ridge of the Ness overflow) and so on.

William Topley[1] makes the frank admission that "the cause of the original formation of Romney Marsh is entirely unknown." On the other hand in a comprehensive paper[2] which has met with very general acceptance,[3] Dr. F. P. Gulliver writes:—"It is almost certain that this valuable agricultural tract [of Romney Marsh] could never have been deposited . . . if it had not been for the outlying barren tract consisting of shingle and gravel called Dungeness Point." He then proceeds to suggest the processes by which this was accomplished. "In an attempt to close the bay" a straight shingle bar passing through the Midrips, was formed between the headlands of Fairlight and Hythe. "Owing to eddies" this line became deflected into cuspate form, progressively extending seawards, as indicated in Fig. 5. In other words, the beaches 1, 2, 3, 4 approaching each other from the two promontories were the foundations upon which Romney Marsh was built.

This theory was avowedly based upon methods found to apply to similar forelands in other parts of the world. It is here suggested that in no respect is it applicable either to the closing of the bay or to the formation of Dungeness. His numbered ridges, for example, could not have been deposited for many hundreds of years after it was possible for them to have influenced the early development of Romney Marsh. This can readily be proved. The physical feature which determined the Marsh evolution was not a bar across the centre of the bay but an ordinary shore beach at

[1] *Mem. Geol. Survey*, 1885: "Geol. of the Weald," p. 304.

[2] *Geog. Jour.*, Vol. 9, pp. 536-545.

[3] *Mem. Geol. Survey of Hastings and Dungeness*, 1928, E. H. Chater (Changes in the Coastline near Rye), Inst. Civ. Eng., 1930, etc.

the boundary of the uplifted forest area. It did not run out from the two headlands, but followed a contour line parallel with them, to seaward of the submerged forest and the peaty mud of the West Bay, and of Gullivers beaches (see map).

Now the peaty mud underlies the Dungeness beaches from Holmestone for a considerable distance eastward.[1] It therefore follows that none of the shingle over this area

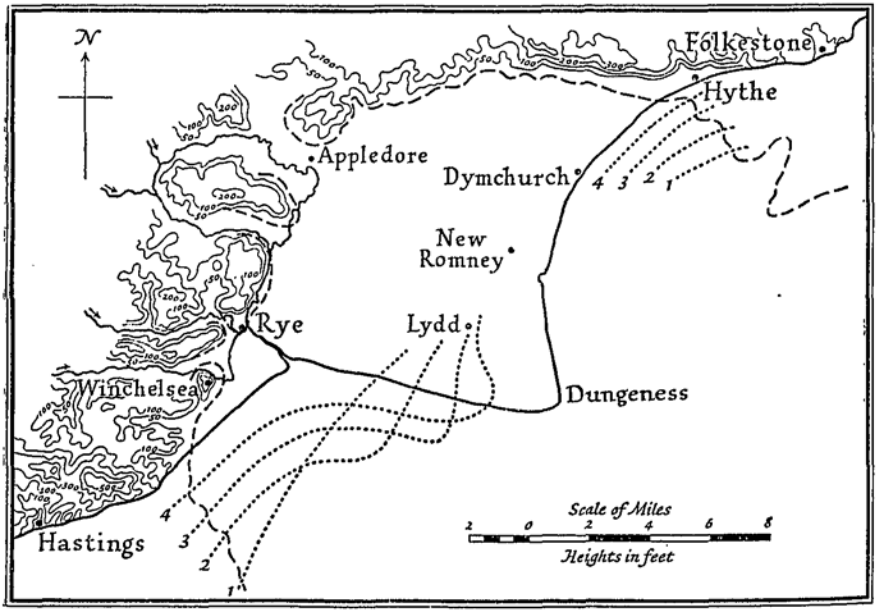

FIG. 5.

By permission of the Royal Geographical Society.

could have been deposited until the peaty mud had been formed, and the early Forest beach had been driven in, during the depression as far West as the Midrips.

Over the whole of this period and onwards throughout this depression, the shingle from the west was being drifted up channel, the Coastal and Hythe beaches had been laid

[1] In the Geological Survey Map of 1864 their denuded relics were mapped by Drew as far eastward as Abnor Pit, a distance of about three miles.

down, the major part of the Marsh had come into being,[1] and its future developments were foreshadowed. But of Dungeness which was alleged to have been responsible for the creation of " this valuable tract " there was not a trace. It will be seen from the map that every ridge of Dungeness dies out, within its own borders, and if even the initial beaches at Holmestone had existed, there could then and thenceforth have been no leeward escape of shingle to build up the stable shore defences and the broad expanse of Hythe beaches which created and protected the Marsh. To build up the Ness every pebble became arrested. Such a transformation could only have been effected by one of those profound readjustments of the beaches so characteristic of the West Bay, due possibly to the second or post Forest, uplift.

The seaward extension of the Ness seems clearly due to the fact that the shoreline has developed at such an angle to the dominant wind waves as to arrest the shingle at a greater rate than it can be driven round to leeward by the less aggressive waves of the East bay, and the terminal readjustment of the shore line must have been in somewhat the form of an arresting elbow (see Map). In this way the first promontory was created, and the Holmestone beaches are its leeward overflow just as the beaches of the East Bay are the overflow of the present point. These fundamental characteristics were perpetuated in all the later stages of its growth. In the process of extension the nose of the promontory, probably diverted by the up-channel wind waves, gradually swung round more and more to the north-east until at Abnor Pit the complete curve can be traced upon the map (see lines a, b, c, d).

By a further readjustment of the shore line, the later stages of the Ness were, however, completely, robbed of supplies, which were diverted to form the broad expanse of shingle between Camber Castle (built in the sixteenth century upon the coastline) and Rye Harbour. And thenceforth the promontory was only extended from the product of its own

[1] See The Marsh Alluvium, pp. 256-257.

wastage, supplemented probably to some extent by shingle swept across the mouth of the Bay by the storm waves. This alone is accountable for the severe erosion which ever since has been eating away the southern shoreline of the Bay. The addition of the Rye and Winchelsea shingle would have added greatly to the volume and impressiveness of the promontory.

Gathering up the threads of this vexed question, no person studying the evidence of our recent earth movements can doubt that the Forest beach across the mouth of the uplifted bay furnishes the key to the evolutionary processes of the Marsh, or that the shingle of the Marsh and the Hythe beaches was derived from the up-channel drift. Everything then falls into line, and Dungeness takes its place in the closing, and not in the opening chapter of our history.

We have only to take Gulliver's Dungeness beaches as our starting point to realize that the Romney Marsh and Hythe shingle would have been arrested in the West Bay —a more imposing promontory would have resulted, but there would have been no Romney Marsh, and the Rother would now have been flowing into the bay at Appledore.

Denge Marsh.—The eastern section of this rich alluvial area is definitely the product of the Ness. Until its reclamation, the sea ever had free access from the north and east, and its richness is entirely due to the marine silt by which an extensive salt marsh was created. The last stage of its reclamation was effected by the erection of an earth bank at its junction with the New Romney Level on the southern side of the Hoy.

The Destruction of the Hythe Promontory.—This promontory was dependent alike for its creation and its subsequent maintenance upon adequate supplies of shingle from the west. As soon as these supplies were finally arrested at Dungeness its destruction by the up-channel

storm waves was but a matter of time.[1] It had, however, accomplished a great purpose. But for its existence, the leeward cliffs of Sandgate and Folkestone and the shore of the Hythe Haven would have been at the mercy of the self-same storm waves, and it is extremely doubtful whether the alluvial area of Romney Marsh would have come into being.

Its western flanks were fortunately preserved more or less intact, and for many hundreds of years continued to protect the Marsh from invasion. Indeed, it was not until the beginning of the nineteenth century that the shingle had so far been eaten away as to demand the protection of a metalled wall.[2]

But it also proved of equal importance as a creative agency. Let me explain. The drift of shingle is chiefly governed by the direction for the time being of the wind waves. Our prevailing and most powerful winds are up-channel and therefore on balance the shingle drifts eastward. But a section of coast may become so protected from the dominant winds, and be left so exposed to the down-channel winds, that the balance of drift force may swing round, and the shingle will travel back in the reverse direction. This is exactly what resulted from the growth of Dungeness. The old shoreline from Romney eastward became progressively sheltered, the western flanks of the Hythe promontory became protected from the up-channel storms,[3] the wastage from denudation of shingle was correspondingly arrested, and this is why the western flanks escaped destruction with

[1] From Cole's map of the seventeenth century and other evidence it would appear that the Hythe shore has been carved back about a quarter of a mile in 250 years. Even at this rate it must originally have extended well over two miles to seaward.

[2] James Elliott: *Account of Dymchurch Wall*, p. 9.

[3] So effective did this protection ultimately become that, even during the wildest up-channel storms, the East Bay became a safe anchorage for shipping. Before steam came into general adoption it was no uncommon occurrence during a gale from the West to see literally hundreds of sailing ships safely riding at anchor in the bay. These vessels, but for the protection of Dungeness, would have been driven back into the Downs. Within a few hours of the cessation of the storm they had all resumed their voyage down-channel. To watch this vast array of shipping simultaneously spreading out its gigantic sails was indeed an impressive spectacle.

the rest of the promontory. Not only so, but by the erosion of the Hythe promontory, these flanks became fully exposed to the down-channel storms, the balance of wave force was gradually reversed, and the shingle began to drift back westwards, and this proved the birth of the

New Littlestone Shoreline. The reverse drift, however, did not follow the ancient shoreline along the Warren, but struck obliquely out to sea, and continued to extend until at the Hoy it was over a mile and a half seaward of Romney.

During this extension the source of its supplies became gradually exhausted, and thenceforth it was only extended from the products of its own wastage.

In A.D. 1617 the new beach ran some distance off the present coast (see line of Cole's map), and in the memory of the writer the entire shoreline as far south as the Lifeboat House (and somewhat beyond it) has been eaten away by the down-channel wind waves to a depth of at least thirty yards, the bulk of it going to the extension of the new shore beach. The final junction with the base of Dungeness at Great Stone Point was effected by the erection of an embankment across the mouth of the bay. This, however, was but an anticipation of the processes of Nature, as the two points were persistently extending from opposite directions and would ultimately have joined forces.

The Reclaimed Land.—As in the case of Romney Marsh, an extensive salt marsh was formed behind and in advance of the new shoreline. It was of triangular form and embraced the Littlestone Golf Links and the rich agricultural land between Romney and the sea. This was reclaimed in successive stages by the erection of a network of earthen walls.

The Sand Dunes.—The reclaimed area is intersected by a series of sand dunes. I have followed every stage in the formation of these dunes. At the extreme point of the beach for the time being, a low incurved ridge of fine shingle

and blown sand would spread out into the salt marsh, and upon this ridge rushes would soon commence to grow. Some little distance eastward an older ridge, with a similar landward incurve, might be observed, but in this case the nucleus of a dune of blown sand had been accumulated by the rushes. Between the two, alluvium was being deposited at every tide. Still farther on the long ridge of a mature sand dune, clothed with turf, had been accumulated in the same way, and similar dunes with intervening deposits of alluvium had been created at frequent intervals along the entire coast.

Some of these dunes are on a small scale, while others extend for a considerable distance inland, a difference which was probably due to the variation in the halting periods of extension. It is quite clear, then, that the whole of the new shoreline was created by processes similar to those of the immediate past, and as a result of the dominating force of the down-channel wind waves.

Complexities.—In this short stretch of shoreline from Greatstone to Hythe (less than nine miles), we have a range of complexities, which, taken in conjunction with the vagaries of its early development, must surely be unique.

Taking it from West to East, the first section is in the stage of accumulation, the second of tentative equilibrium, the third of depletion, and the fourth and fifth have disappeared in opposite directions. The first is the Hoy shore, the second a short section adjoining, the third the entire beach to the junction with the fourth (the flanks of the promontory off the Dymchurch Wall), and the fifth the promontory itself.

Then we have the contradictory behaviour of the shingle. The Hythe promontory was built up with shingle from the West. It was distributed partly to the east and partly to the West. At Greatstone the up-channel drift meets the Littlestone drift, from the opposite direction. And the whole of these complexities have been brought about by the growth of Dungeness and the operation of opposing wind waves.

At Greatstone the drifts meet at an angle in the shoreline, where the wind waves which bring along the Dungeness shingle are onshore in the Littlestone section, and therefore have no drift power either way. And the same applies in reverse order to the waves which drift the Littlestone shingle to Greatstone. This has nothing to do with the currents, which are the same in each case.

It is here suggested that in the controversy on the cause of shingle drift, neither the wind wave nor the current school of thought is either entirely right or entirely wrong. But both are definitely wrong in the crying sin of generalisation. That shingle is transported and rounded off by current action is beyond controversy; the river gravels alone are sufficient to prove this. It is all a matter of drift force. Around our coasts the drift force of the current is by no means equal to that of the wind waves, and whenever the two under normal conditions are in opposition, as on the east and west shores of the Portland promontory, the shores of the Marsh, and many other localities, it is the wind waves that prevail.

Lack of space precludes any detailed reference to the extensive literature of this subject. This, with many other interesting problems, such as the origin of the Rhee Wall, the Roman and pre-Roman settlement at Sandtun, the various courses of the Rother, the shingle complexities of Dungeness, the cause and effect of earth movements, and so on, must be reserved for a future communication.

In conclusion, my warmest thanks are due to Mr. Charles Stokes for his valuable map of the Marsh, past and present, and for having placed his great knowledge of the district so freely at my disposal.

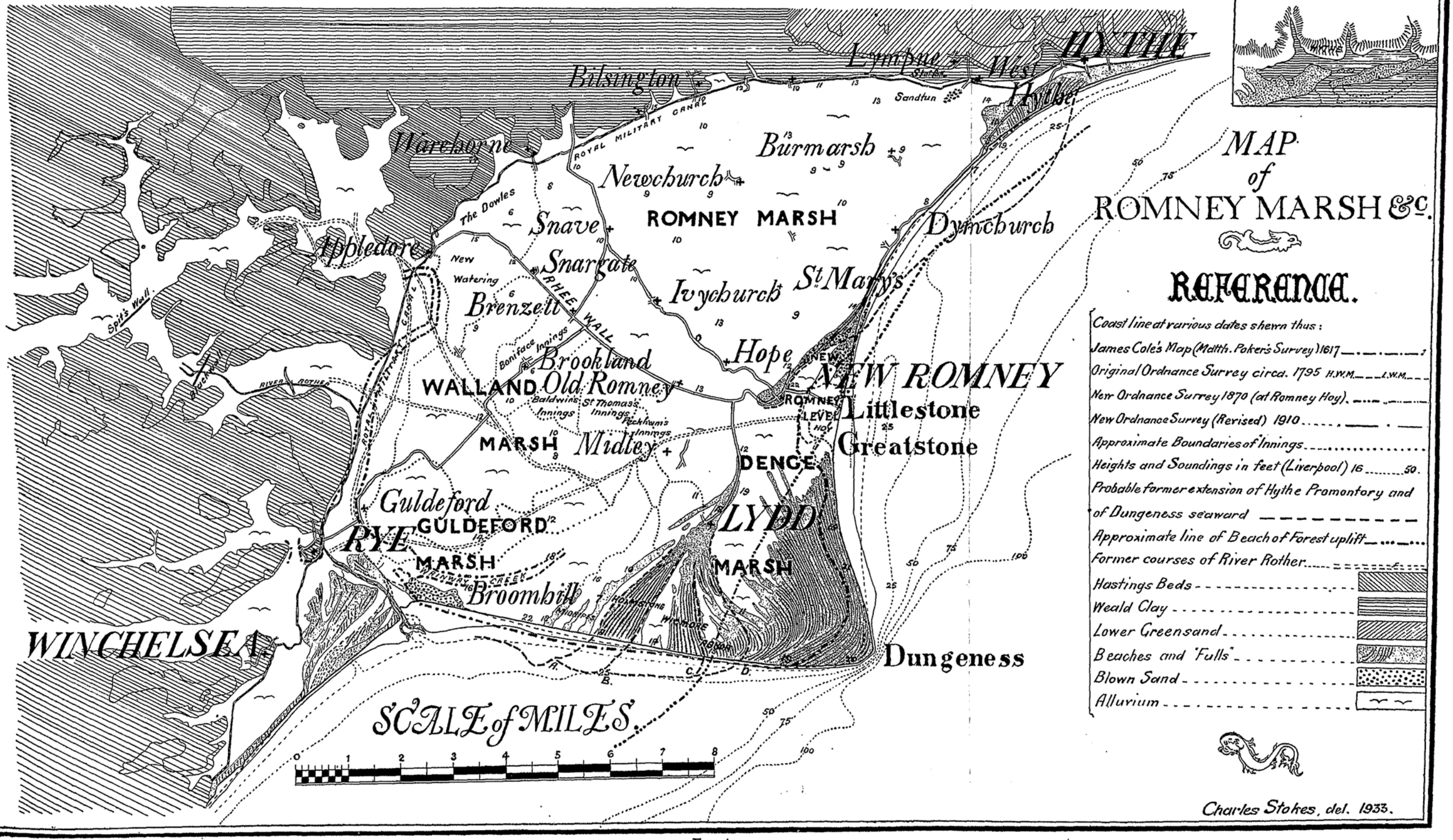
HYTHE HAVEN.
MAP of ROMNEY MARSH &c.
REFERENCE.
Coast line at various dates shewn thus:
James Cole's Map (Maitth. Poker's Survey) 1617
Original Ordnance Surrey circa. 1795 H.W.M. L.W.M.
New Ordnance Surrey 1870 (at Romney Hoy).
New Ordnance Surrey (Revised) 1910
Approximate Boundaries of Innings
Heights and Soundings in feet (Liverpool) 16 50.
Probable former extension of Hythe Promontory and of Dungeness seaward
Approximate line of Beach of Forest uplift
Former courses of River Rother
Hastings Beds
Weald Clay
Lower Greensand
Beaches and 'Fulls'
Blown Sand
Alluvium
Charles Stokes, del. 1933.
HYTHE
West Hythe
Lympne
Bilsington
Warehorne
Appledore
Newchurch
Burmarsh
ROMNEY MARSH
Dymchurch
Snave
Snargate
Brenzett
Ivychurch
St Mary's
Hope
NEW ROMNEY
Littlestone
Greatstone
Dungeness
WALLAND MARSH
Old Romney
Brookland
Midley
DENGE MARSH
LYDD MARSH
GULDEFORD MARSH
Guldeford
RYE
Broomhill
WINCHELSEA
ROYAL MILITARY CANAL
RHEE WALL
The Dowles
New Watering
Spit's Wall
Boniface Ingings
Baldwin's Innings
St Thomas' Innings
Peckhams Innings
ROMNEY LEVEL
SCALE of MILES.
0 1 2 3 4 5 6 7 8

Fig. 4