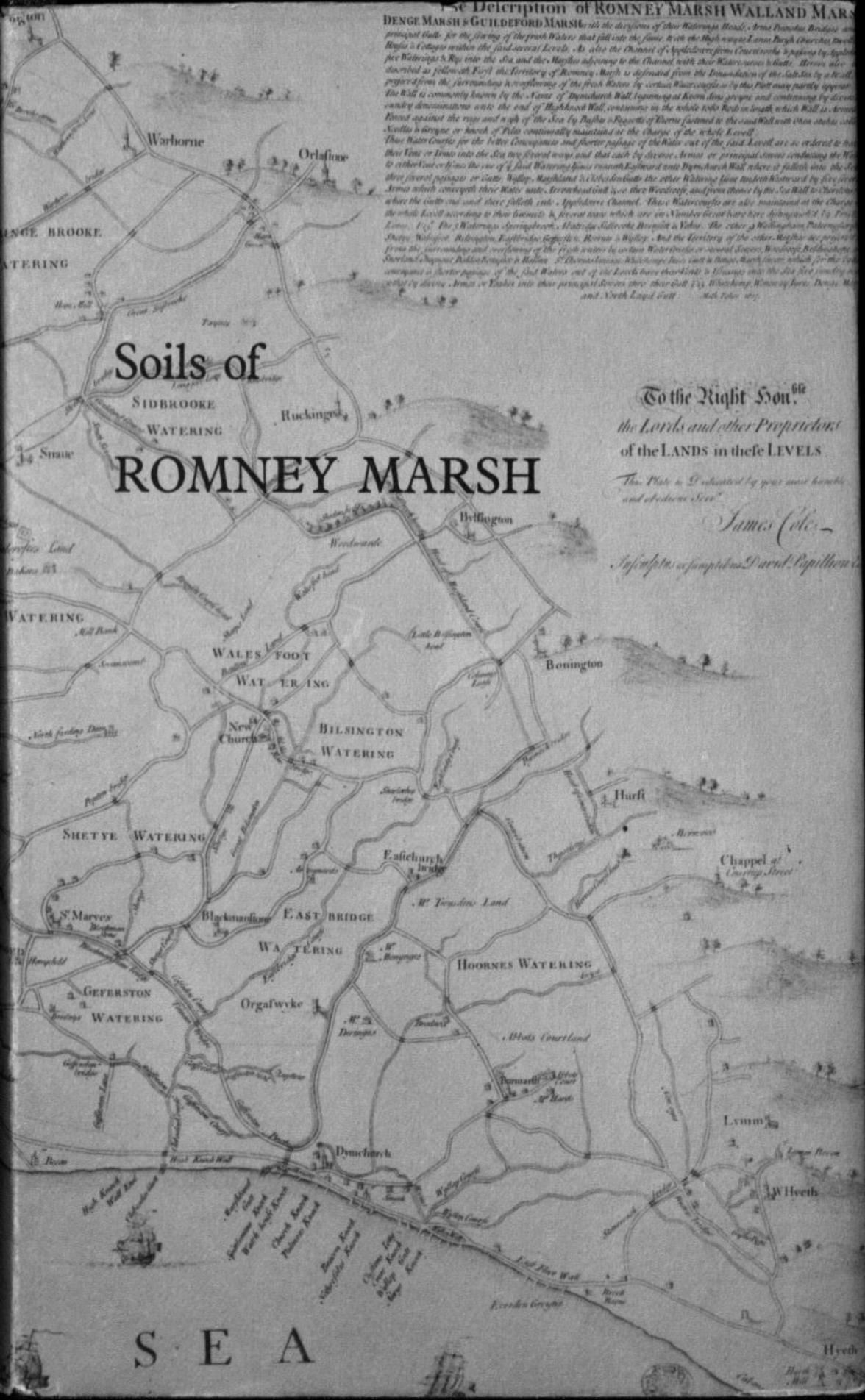


Description of ROMNEY MARSH WALLLAND MARSHES
DENGEL MARSH & GUILDFORD MARSH is the divisions of these Waterways, Roads, Arise, Ponds, Bridges and principal Works for the serving of the fresh Waters that fall into the same, from the High way of Lamb Marsh (Churches, Ditch, Dykes & Cottages within the said several Levels. As also the Channel of Applodesse from Courtmoor & passing by Applodesse, Rye into the Sea and the Marshes adjoining to the Channel with their Waterways & Dykes. Hereon also is described as follows First the Territory of Romney Marsh is delineated from the Foundation of the Salt Sea by a Wall, projected from the Riverward to the opening of the fresh Water by certain Watercourses as by the Part may partly appear. The Wall is commonly known by the Name of Dyngarth Wall, commencing at Keen Sea Arise and continuing by direct course & directions unto the end of Highland Wall, continuing in the whole 1000 Yards in length which Wall is a strong Bond against the rage and a gale of the Sea by Ruffs & Pigeons of Earth fastened to the said Wall with strong cables with Voles & Springs or hooks of Iron continually maintained at the Charge of the whole Level. These Water Courses for the better Conveyance and better passage of the Water out of the said Level are so ordered that they flow or flow into the Sea by several ways and that each by diverse Arms or principal Courses containing the Water to either East or West the way of a fresh Waterway flows through Eastward into Dyngarth Wall where it falleth into the Sea three several passages or ways. Wally, Highland & Dyngarth the other Waterways flow towards Westward by five several Arms which conceive their Water unto, Terenhead cut, the three Woodcut, and from those by the Sea Wall to Christchurch where the cutts are and there falleth into Applodesse Channel. These Watercourses are also maintained at the Charge of the whole Level according to their bounds & recent laws which are on Vinty's Great Survey here following of 1717. The Waterways are, Hattin, Saltwater, Breynt & Vole. The other of Widdington, Paterbury, Dunge, Widdington, Biddington, Eastbridge, Beptham, Horne & Wally. And the Territory of the other Marshes are projected from the Riverward and conveyance of the fresh Water by several Watercourses & several Ditches, Woodcut, Biddington, Dunge, Beptham, Biddington, Biddington & Biddington. The several Waterways & Ditches, cutts & other Works, from which the fresh Water conceives a better passage of the fresh Water out of the Level have their Heads & Springs into the Sea first contrary to the order of divers, Arise or Dykes into their principal Rivers thro' the cutts & Woodcut, Widdington, Beptham, Dunge, Wally, and North Lloyd cutt. Oct. 1717.



Soils of ROMNEY MARSH

To the Right Hon.^{ble}
 the Lords and other Proprietors
 of the LANDS in these LEVELS.
 This Plate is Dedicated by your most humble
 and obedient Servant
James Cole
 Surveyor of the Marshes, Dykes, and Waterways.

SEA

The Soil Survey of Great Britain makes maps showing the distribution of soils, and memoirs and bulletins describing their properties, both from the scientist's and agriculturist's viewpoint.

This survey covers the 100 square miles of reclaimed marshland and beaches between Rye in Sussex and Hythe in Kent, known as Romney Marsh, a traditional sheep-farming area but nowadays with a large arable acreage.

After an introductory chapter, a detailed account is given of the formation and reclamation of the Marsh, fundamental to the development of the soils and their pattern. Chapters on soil formation and classification, the soils of the Marsh, and their relationships to the Land Types, follow. Finally agriculture and some of its problems are considered.

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Photograph by Aerofilm Ltd.

The north-east corner of Romney Marsh proper looking east to Hythe. The Royal Military Canal is at the foot of the old sea cliff.

AGRICULTURAL RESEARCH COUNCIL

SOIL SURVEY OF GREAT BRITAIN

ENGLAND AND WALES

BULLETIN NO. 4

SOILS OF
ROMNEY MARSH

R. D. GREEN

HARPENDEN

1968

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SOIL SURVEY OF GREAT BRITAIN

ENGLAND AND WALES

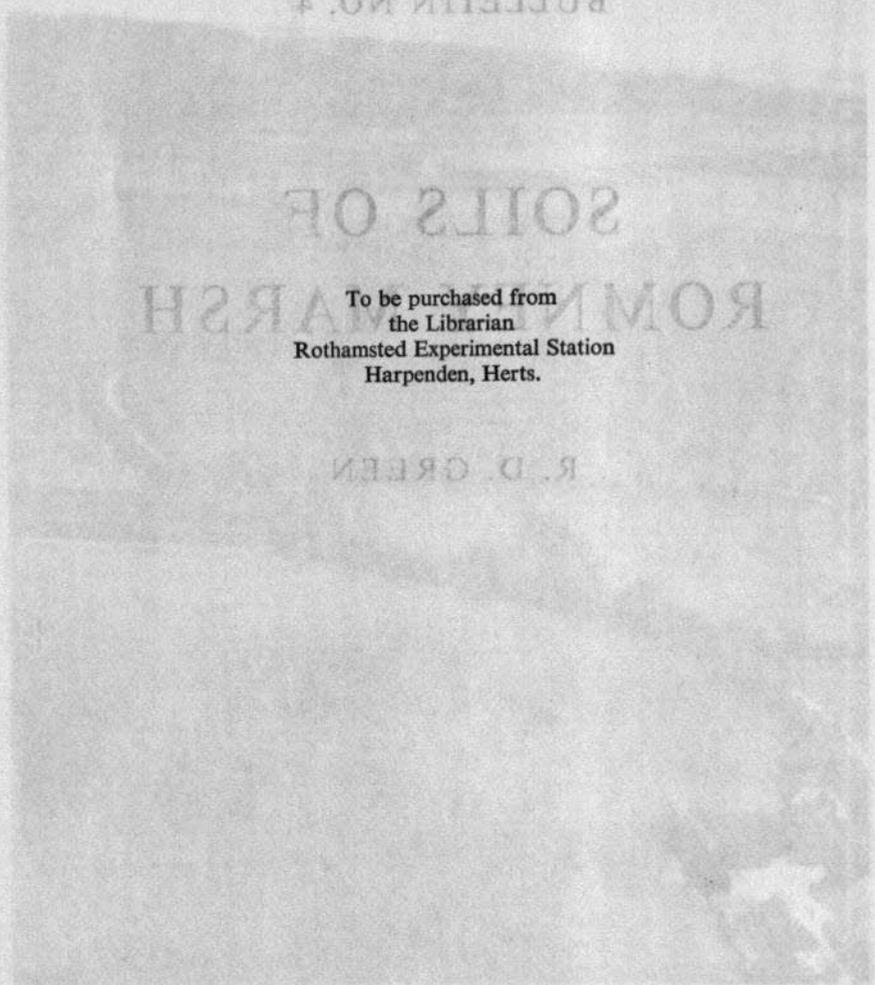
BULLETIN NO. 4

SOILS OF

ROMNEY MARSH

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R. D. GREEN



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HARPENDEN

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PREFACE

This Bulletin describes the soils and agriculture of most of the reclaimed marshlands collectively known as Romney Marsh. The first major soil studies were carried out by Hall and Russell (1911, 1912) in the course of attempts to elucidate the differing qualities of adjacent fattening and breeding pastures. Later work by Brade-Birks (1932), Furneaux, and Cole and Dubey (1932) related pasture performance and fertility to the soil profile, and nine soil series were described, mainly on a textural basis.

The present survey was initiated under the late Dr. A. Muir in 1954 following a request from the Ministry of Agriculture for soil maps to assist N.A.A.S. soil chemists at Wye in their investigations into micro-nutrient deficiencies in arable crops. This request closely followed the Agricultural Land Commission's recommendation in 1949 that ley farming was the proper system to ensure full and efficient use of the land for agriculture.

The Bulletin describes the formation and reclamation of the area, both being closely concerned with the development of the soils and their patterns of distribution. Much of this information is of general interest, particularly to those concerned with the history of the Marsh, and the bulletin includes discussion of many controversies and long-standing problems.

The area was mapped by R. D. Green for the Soil Survey of England and Wales, with J. M. Hodgson participating in the closing stages of the work: B. W. Avery took part in the preliminary investigation. Mr. G. P. Askew of the Department of Physical Sciences, Wye College, participated in the work on a part-time basis between 1954 and 1959, during which he mapped appreciable areas and described characteristic soils in several parts of the Marsh. Five of his profile descriptions are included in this Bulletin and a number of others were joint work. The Bulletin was written by R. D. Green, the maps and diagrams prepared by E. M. Thomson, and most of the analytical data provided by C. L. Bascomb. Officers of the N.A.A.S. were always helpful, and thanks are due in particular to Dr. T. H. Rose, Soil Scientist, Wye, for analytical data shown in Table 17, and Mr. R. A. Smith, District Agricultural Adviser, Romney Marsh, for help with the section on agriculture. Mr. B. W. Avery gave helpful advice in the preparation of the Bulletin, and Messrs. G. P. Askew and V. Rendell are thanked for constructive comments on the final text. Thanks are also due to Messrs. F. N. Midmer and G. W. Robinson, Area Engineers of the Kent River Authority, for assistance with Fig. 3. The engraving of Poker's map is reproduced by courtesy of the Trustees of the British Museum.

The soil map could have been made only with the co-operation of farmers and land-owners, for which the Survey is grateful.

Copies of the 1 : 25,000 coloured maps are obtainable from Ordnance Survey agents. Fair copies of the field sheets are kept at the headquarters of the Soil Survey, where they can be inspected by appointment.

10th May 1968
Rothamsted Experimental Station
Harpenden, Herts.

K. E. CLARE
*Head of the Soil Survey of
England and Wales*

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K. E. CURZ
Head of the Soil Survey of
England and Wales
10th May 1968
Rothamsted Experimental Station, Harpenden, Herts.

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In pocket
Soil map : 1/25,000

Introduction

LOCATION AND PHYSIOGRAPHY

The location of the area described in this Bulletin is shown in Fig. 1, and comprises the 100 sq. miles of the tract of reclaimed coastal lowlands and islands known as Romney Marsh. N. H. Farham in the *Geography Legend* writes: "The world according to the best geographers is divided into Europe, Asia, Africa, America and Romney Marsh." The last named and "6th" quarter of the globe is mainly in Kent but partly in East Sussex and is bounded on the south and east by the English Channel and on the north and west by old sea cliffs due to the Wealden Mass (Froese and Fig. 2). This ancient coastline divides Down Hylton on the east past Appledram and Rye to meet the present coast again east of the marsh-west, its art being broken only by river valleys, as near Stone where the old turn inland to follow the main valleys of the Rother on either side of the former Isle of Oxney.

Romney Marsh is a collective name for several marshes, the two largest being Romney Marsh proper and Walland Marsh. The former comprises the northern part of the area and adjoins Walland Marsh along the New Sea

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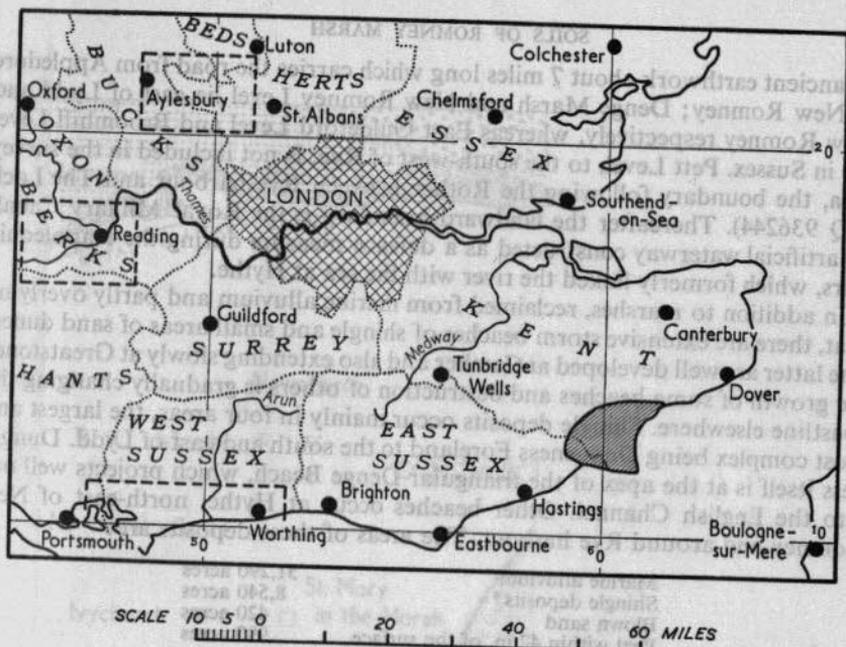


Fig. 1. Location of the Survey Area

CHAPTER I

Introduction

LOCATION AND PHYSIOGRAPHY

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Romney Marsh is a collective name for several marshes, the two largest being Romney Marsh proper and Walland Marsh. The former occupies the northern part of the area and adjoins Walland Marsh along the Rhee Wall,

an ancient earthwork about 7 miles long which carries the road from Appledore to New Romney; Denge Marsh and New Romney Level lie east of Lydd and New Romney respectively, whereas East Guldeford Level and Broomhill Level are in Sussex. Pett Level, to the south-west of Rye, is not included in the survey area, the boundary following the Rother between Rye harbour and The Lock (TQ 936244). Thereafter the landward boundary is the Royal Military Canal, an artificial waterway constructed as a defence measure during the Napoleonic wars, which formerly linked the river with the sea at Hythe.

In addition to marshes, reclaimed from marine alluvium and partly overlying peat, there are extensive storm beaches of shingle and small areas of sand dunes. The latter are well developed at Camber and also extending slowly at Greatstone; the growth of some beaches and destruction of others is gradually changing the coastline elsewhere. Shingle deposits occur mainly in four areas, the largest and most complex being Dungeness Foreland to the south and east of Lydd. Dungeness itself is at the apex of the triangular Denge Beach, which projects well out into the English Channel. Other beaches occur at Hythe, north-east of New Romney and around Rye harbour. The areas of these deposits are:

Marine alluvium	51,290 acres
Shingle deposits *	8,540 acres
Blown sand	420 acres
Peat within 42 in. of the surface	990 acres

The higher dunes at Camber locally attain elevations of over 40 ft O.D., but most of the land lies between 2 and 22 ft O.D. in characteristic patterns of microrelief with natural bank or ridge systems up to 8 ft above the adjacent ground. The marine alluvium lies at or below the high water level of spring tides,† e.g. at about 2 ft O.D. in parts of Appledore Dowels. Such land needs effective sea defences, and the coast alternately comprises artificial sea walls as at Dymchurch and Camber (*Plate Ia*) and sand dunes or storm beaches which afford natural protection. The protective shingle in sequences of ridges representing successive shorelines is over 20 ft above O.D. in some places.

The principal towns all occur on or near the coast, Dymchurch (pop. 1,739) and the small municipal boroughs of Lydd (3,560) and New Romney (3,330) being the most important. Hythe (10,590) and Rye (4,370) are close by and partly on the uplands, both having long historical associations with the Marsh. Excepting Dymchurch, all these towns are Cinque Ports or corporate members of that confederacy. Many small villages, mostly with elegant and disproportionately large churches, are scattered across the marshland, the largest being Burmarsh, Newchurch (*Plate Ib*), Ivychurch, Old Romney, Brenzett, Snargate (*Plate IVb*) and Brookland. Many other villages, such as Appledore, are on the uplands overlooking the Marsh and are intimately linked with it historically.

DEVELOPMENT

The Marsh rests on a platform of Hastings Beds and Weald Clay in which rivers excavated a broad valley during the Pleistocene period when sea-level was much lower. Deep bore holes show that these rocks are under 40–100 ft of sediments

* This figure includes 2,840 acres of pebbly soils developed on thick beach deposits. The area of beach shown on 1:25,000 O.S. maps totals 5,430 acres.

† High water for equinoctial tides 12.7 ft O.D. Mean high water for spring tides 10.5 ft O.D. Mean high water for neap tides 7.5 ft O.D. (Lewis and Balchin 1940).

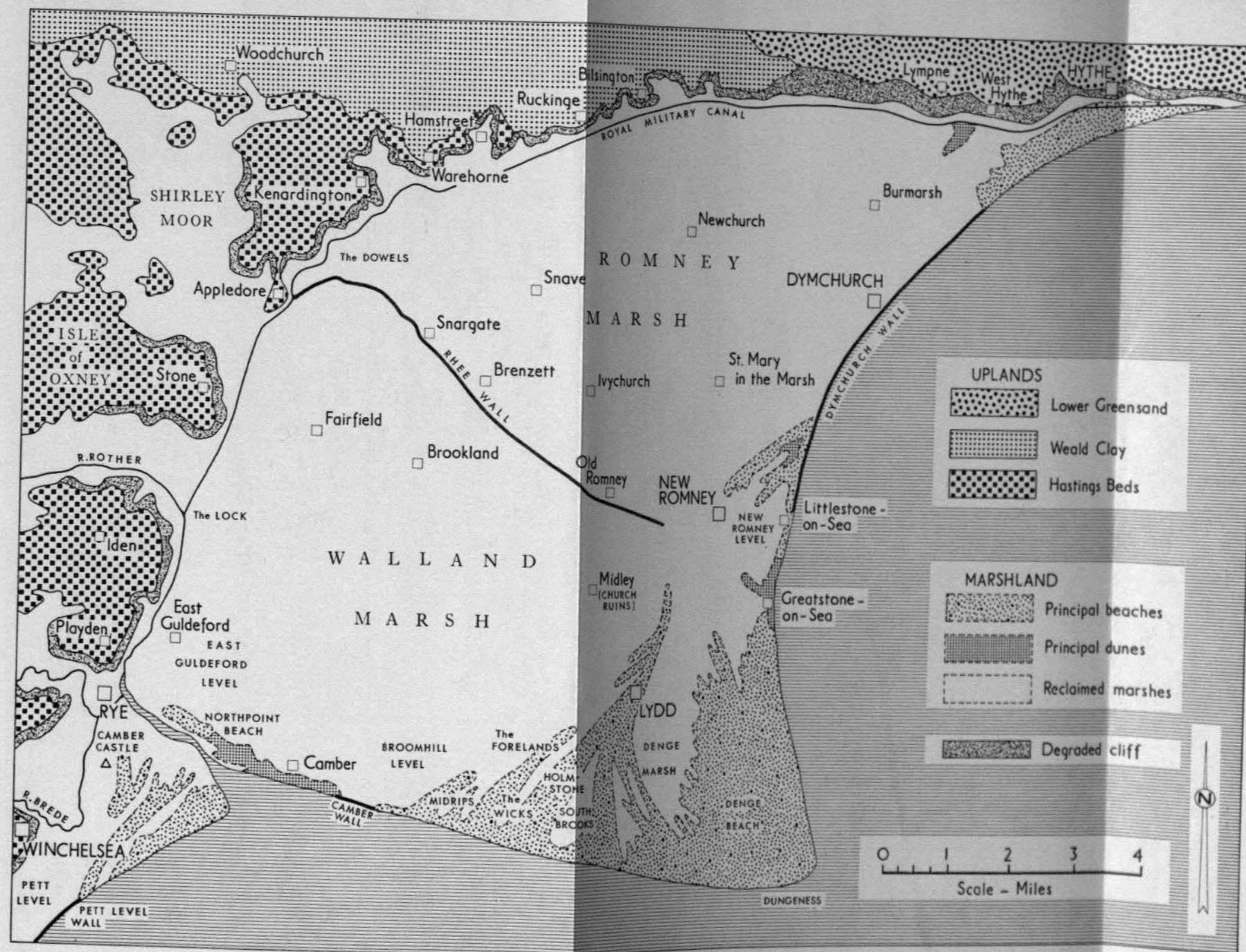


Fig. 2. Romney Marsh and Adjacent Lands

safeguard the land from drying out later, but are removed completely in very wet seasons to pass all possible water to sea as quickly as tidal conditions and other factors permit.

Land drainage is closely linked with sea defence in reclaimed marshlands, and is administered by the Kent River Authority and several Internal Drainage Boards, *i.e.* Walland Marsh, Denge and South Brooks, Romney Marsh Level, and New Romney Level. A system of mutual obligation and co-operation between owners and tenants, necessary because lands lying in the heart of the marsh can

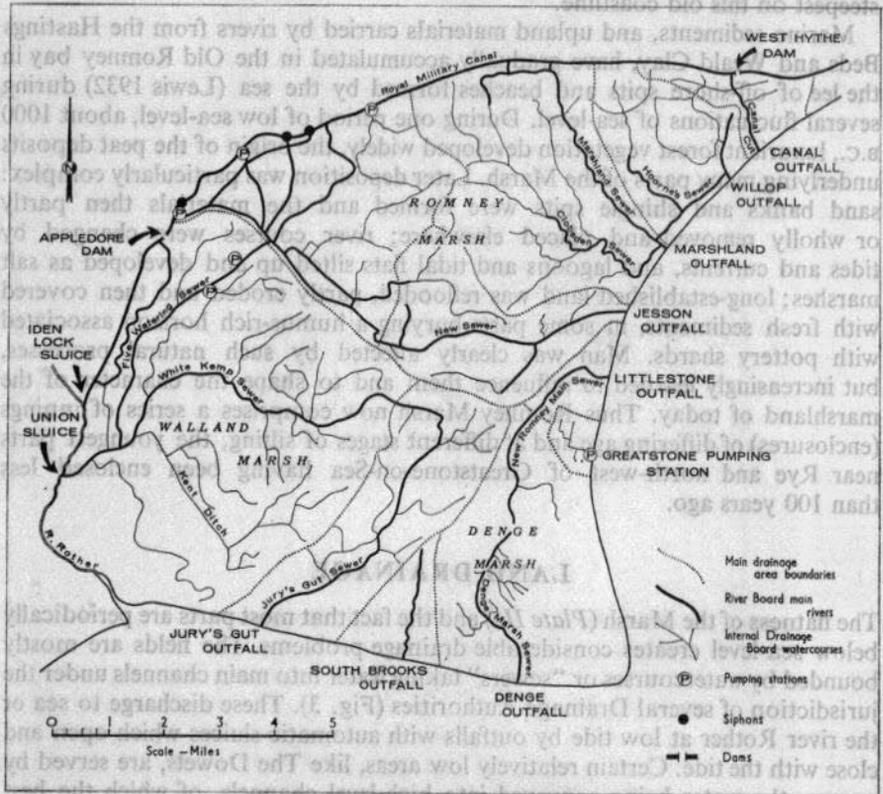


Fig. 3. Drainage of the Marsh

suffer through neglect of a wall or waterway several miles away, was initiated in the 12th century, and by 1250 was administered by 24 sworn men or Jurats "elected by the commonalty, to enforce the contribution of land holders within the Marsh towards the maintenance of sea walls and water courses for the common benefit and safety" (Teichman Derville 1936). Later development of this organization was complex and accompanied by much litigation, but by the close of the Middle Ages there existed a famous body of Land Drainage and Sea Defence Law called the "Laws and Constitutions of Romney Marsh", of which Lambard (1576) wrote, "they are now become a paterne and exemplar to all the like places of the whole realme whereby to be governed", or in the words of Dugdale (1662), "they have been long ago made the rule and standard whereunto all the other marshes and fens in this nation were to conform".

CLIMATE

The Marsh has a nearly uniform climate, with low rainfall, windiness, long hours of sunshine and moderate temperature.

Temperature

Monthly averages of maximum and minimum daily temperatures for Dungeness are given in Table 1. Due to the moderating effect of the sea, the annual temperature range between January and July (20.3° F) is two or three degrees less than most inland parts of Kent and Sussex, where average January and July figures are slightly lower and higher, respectively. The date of the first and last frosts at Dungeness are 15th November and 1st April.

TABLE 1
Average Daily Temperatures (°F) at Dungeness
(Period 1921-50)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Max.	45.1	44.9	47.9	51.8	57.9	63.2	67.5	67.8	65.1	58.4	50.1	45.6	55.4
Min.	37.6	36.6	37.5	41.0	46.1	51.1	55.7	55.8	52.5	47.3	41.3	38.0	45.1
Mean	41.3	40.7	42.7	46.4	52.0	57.1	61.6	61.8	58.8	52.9	45.7	41.8	50.3

Sunshine and Fog

The sunniest part of mainland Britain is along the south coast, where some places have an average of just over 5 hours of bright sunshine per day, e.g. Worthing 5.03 hours. Records for Lympne (Table 2) indicate the general sunniness of the Marsh, particularly as this station is on the adjacent uplands and is sometimes screened by cloud when areas nearer the coast are sunny. Coastal fog occurs at times throughout the year, particularly near Dungeness, but seldom from April to August.

TABLE 2
Average of Bright Sunshine at Lympne
(Daily means in hours for the period 1921-50)

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
1.9	2.9	4.6	5.8	7.3	7.9	7.3	6.8	5.4	3.8	2.3	1.8	4.8

Rainfall

Mean monthly and yearly rainfall figures at Hythe and Dungeness are given in Table 3. The annual average is between 25 and 27.5 in. over most of the area (Fig. 4), rising to about 28 in. near Hythe and west of a line through Appledore

and Rye harbour. On average June is the driest month and October and November the wettest. The wettest four consecutive months are October to January, and in the five months from February to June the rainfall is less than one third of the annual average.

TABLE 3
Average Monthly Rainfall (in.)
(Period 1916-50)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Hythe	2.83	1.97	1.69	2.01	1.85	1.48	2.19	2.21	2.28	3.17	3.54	2.93	28.15
Dungeness	2.44	1.66	1.51	1.77	1.64	1.31	2.00	2.02	2.02	3.06	3.05	2.57	25.05
Days of precipitation at Dungeness	17	13	12	10	11	9	12	11	12	14	15	16	152

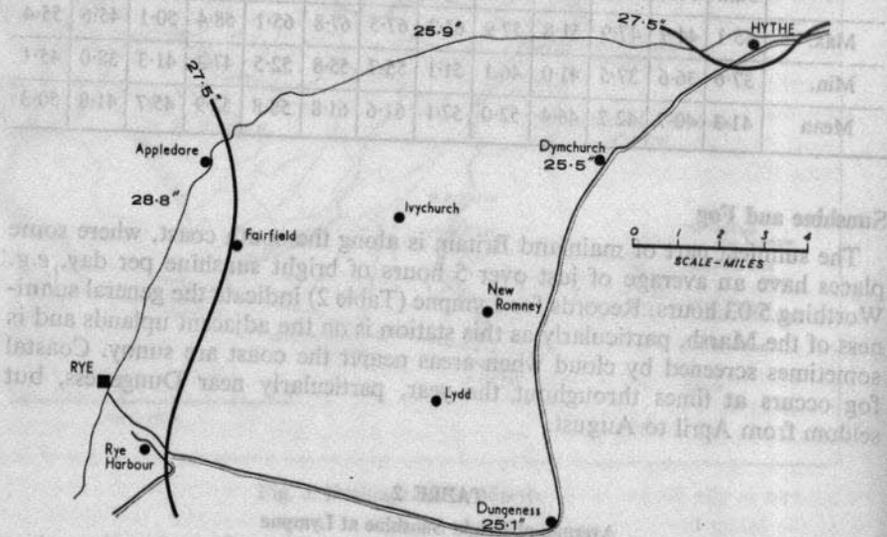


Fig. 4. Rainfall (reproduced by permission of the Director General, Meteorological Office)

Wind

Calm days are rare (Table 4) and winds, dominantly from the south-west, are an important climatic factor. Trees and well-grown hedges are uncommon in the Marsh, and profitable fruit or glasshouse production is ruled out by exposure; horticulture is best restricted to low-growing crops. The effect of prolonged wind on tree growth is seen in the shape of holly trees on Holmstone.



Plate 1a. Modern sea wall near Camber.



Photograph by G. P. Askew

Plate 1b. Newchurch Church. Only the upper part of the tower is vertical, as uneven subsidence of the clayey substratum occurred before the building was finished. Newchurch soils are typical of this locality.



Plate 11a. Marsh fields on Newchurch soils bordering the old sea cliffs north of Burmarsh. The sewer coincides with part of an original creek system.

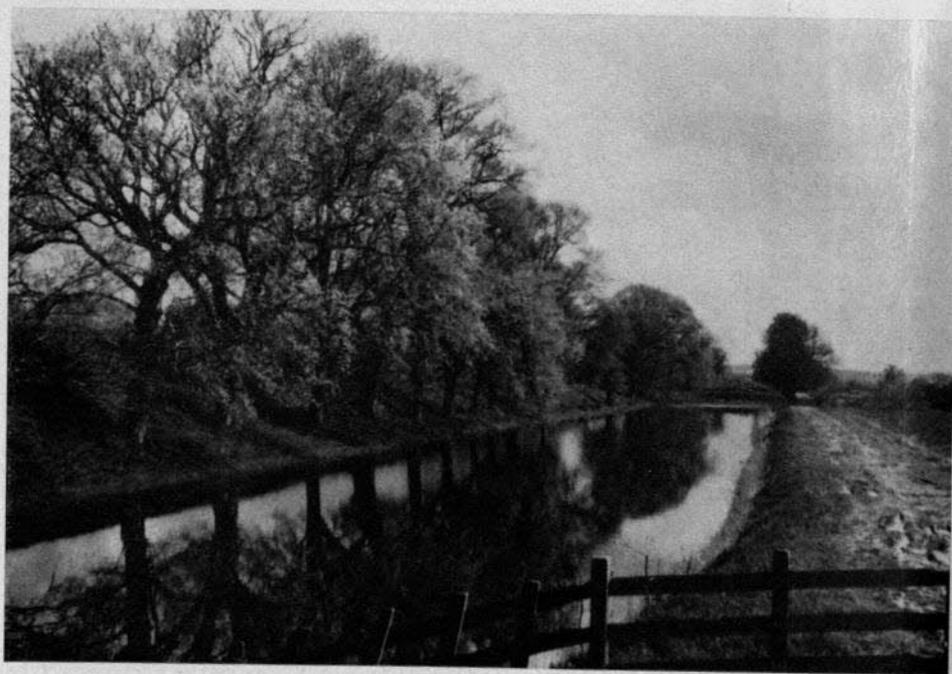


Plate 11b. The Royal Military Canal below Ruckinge. This was a defence work dating from Napoleonic times, but is now an integral part of the Marsh drainage.

TABLE 4
Wind Direction at Dungeness and Number of Days of Strong Wind
(Period 1916-50)

Month	Percentage of Observations									No. of Days of Strong Wind or Gale
	Wind from									
	N	NE	E	SE	S	SW	W	NW	Calm	
Jan.	10	9	9	5	10	24	20	12	1	2
Feb.	9	10	11	7	12	23	17	10	1	2
Mar.	12	15	10	4	9	26	14	9	1	2
Apr.	13	22	9	3	5	23	15	8	2	1
May	10	25	12	3	7	25	11	5	2	0.3
June	9	21	10	3	6	30	14	6	1	0.4
July	9	15	8	3	6	33	16	8	2	0.5
Aug.	8	12	6	3	7	34	19	9	2	0.8
Sept.	13	16	10	5	6	21	15	12	2	1
Oct.	12	10	11	7	12	21	14	12	1	3
Nov.	12	8	9	7	10	21	19	13	1	4
Dec.	9	7	7	6	13	27	19	11	1	3
Mean	10	14	9	5	9	26	16	10	1	21

The highest and most mature parts may be partly covered by the tide, and ultimately would be scarcely influenced at all, but such a late stage of development is commonly forestalled by erosion. This is effected by lowering up earthen embankments from a permanent ditch and damming the creek. Creek distributaries are either filled artificially or provide field boundaries, wet fences for stock, and drainage channels.

In a wide estuary, salt-marsh development continues for a long period, and successive parcels may be reclaimed as silt up proceeds. Ultimately many separate miles of marshland may be enclosed and, as occurs to the west and south-west of Walsand Marsh, successive images commonly show a similar pattern of

INTRODUCTION
TABLE I
Wind Direction at Dungeness and Number of Days of Strong Wind
(1947-1950)

CHAPTER II

Depositional History and Soil Parent Materials

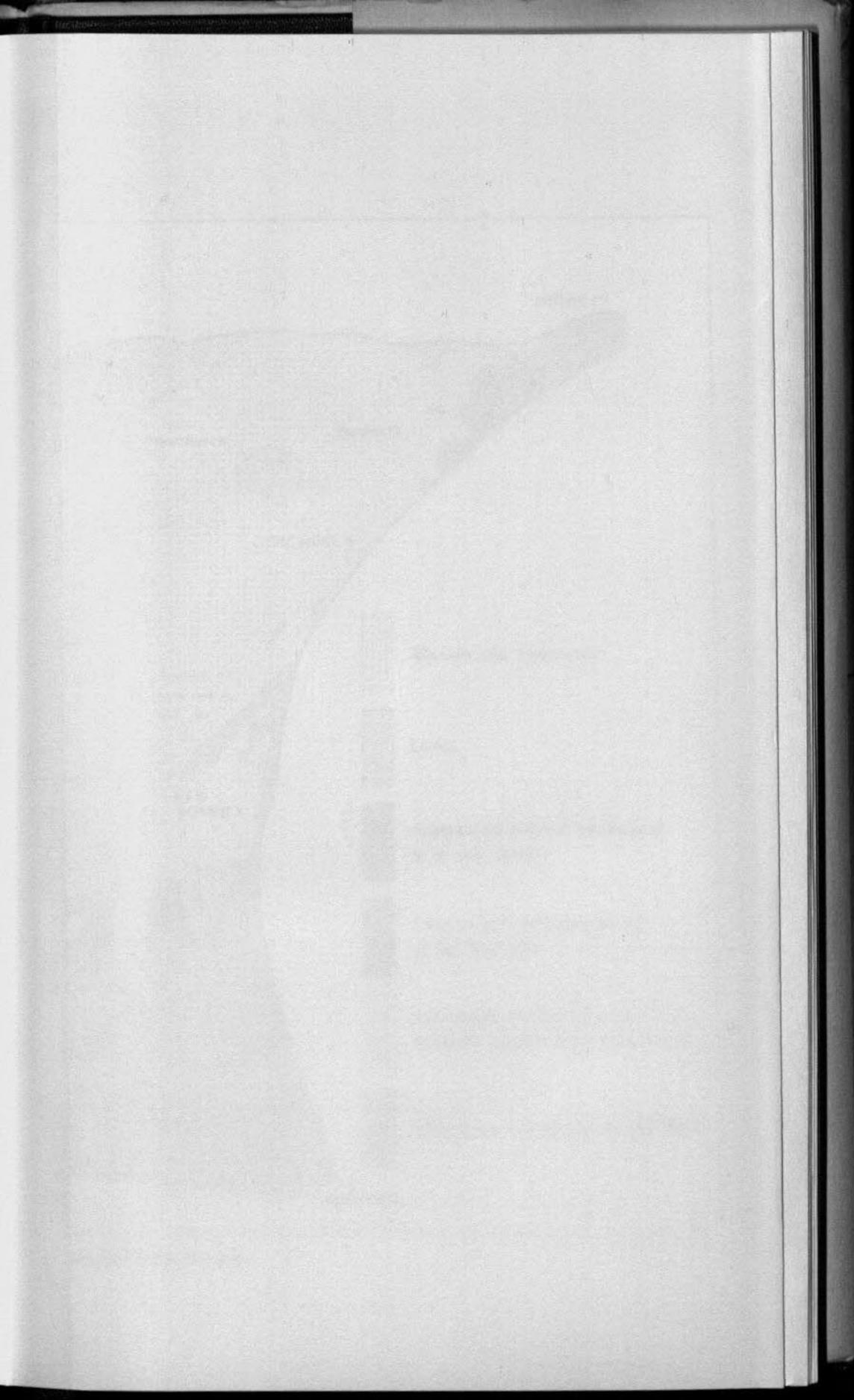
SALT MARSH DEVELOPMENT

Salt marshes develop whenever fine mineral particles carried in suspension by rivers, or the sea, accumulate in coastal areas. This "silt", which may include grains of every size from clay to coarse sand and may vary considerably in mineral constitution, settles out as the water flow is checked along the margins of a bay or estuary, or in waters sheltered by off-shore shingle or sand bars.

Salt marshes originate from intertidal sand or mud flats over which silt-laden waters flow fairly uniformly at first, with sedimentation occurring mainly during the period of relative stagnation around the turn of the tide. Pioneer plants bind the deposits and, by checking the flow of water, increase sedimentation. Algae, especially seaweeds, are followed by other pioneer plants, such as marsh samphire (*Salicornia* spp.) and then by larger and more efficient silt trappers, such as annual seablite (*Suaeda maritima*) and sea aster (*Aster tripolium*). The pioneer plant communities are patchy at first as low vegetated hummocks develop, but as sediments accumulate, the plant cover spreads, thickens and becomes more varied. Meanwhile depressions, beginning as wide shallow channels, develop into creeks, which ultimately form dendritic systems crossing relatively elevated and, excepting salt pans, completely vegetated salt marsh. When creeks overflow, the silt-laden waters are appreciably checked, partly by the bordering vegetation, and coarse textured material is deposited to form low banks or levees while finer particles are carried farther and settle under relatively quiet conditions. In profile, textures range upwards from sand to clay, since progressively finer sediments accumulate as the age and height of the marsh increases. Variations on this simple pattern are common, partly through disturbance by wave action and burrowing animals (Evans 1965), and abrupt changes in texture may also follow alterations in creek or river courses. Developing salt marshes differ in maturity from one part to another, and different plant communities can occur in distinct zones approximately parallel to the primary source of sediment (Tansley 1939).

The highest and most mature parts may be barely covered by the tide, and ultimately would be scarcely influenced at all, but such a late stage of development is commonly forestalled by enclosure. This is effected by throwing up earthen embankments from a perimeter ditch and damming the creeks. Creek distributaries are either filled artificially or provide field boundaries, wet fences for stock, and drainage channels.

In a wide estuary, salt-marsh development continues for a long period, and successive parcels may be reclaimed as silting up proceeds. Ultimately many square miles of marshland may be enclosed and, as occurs to the west and south-west of Walland Marsh, successive innings commonly show a similar pattern of



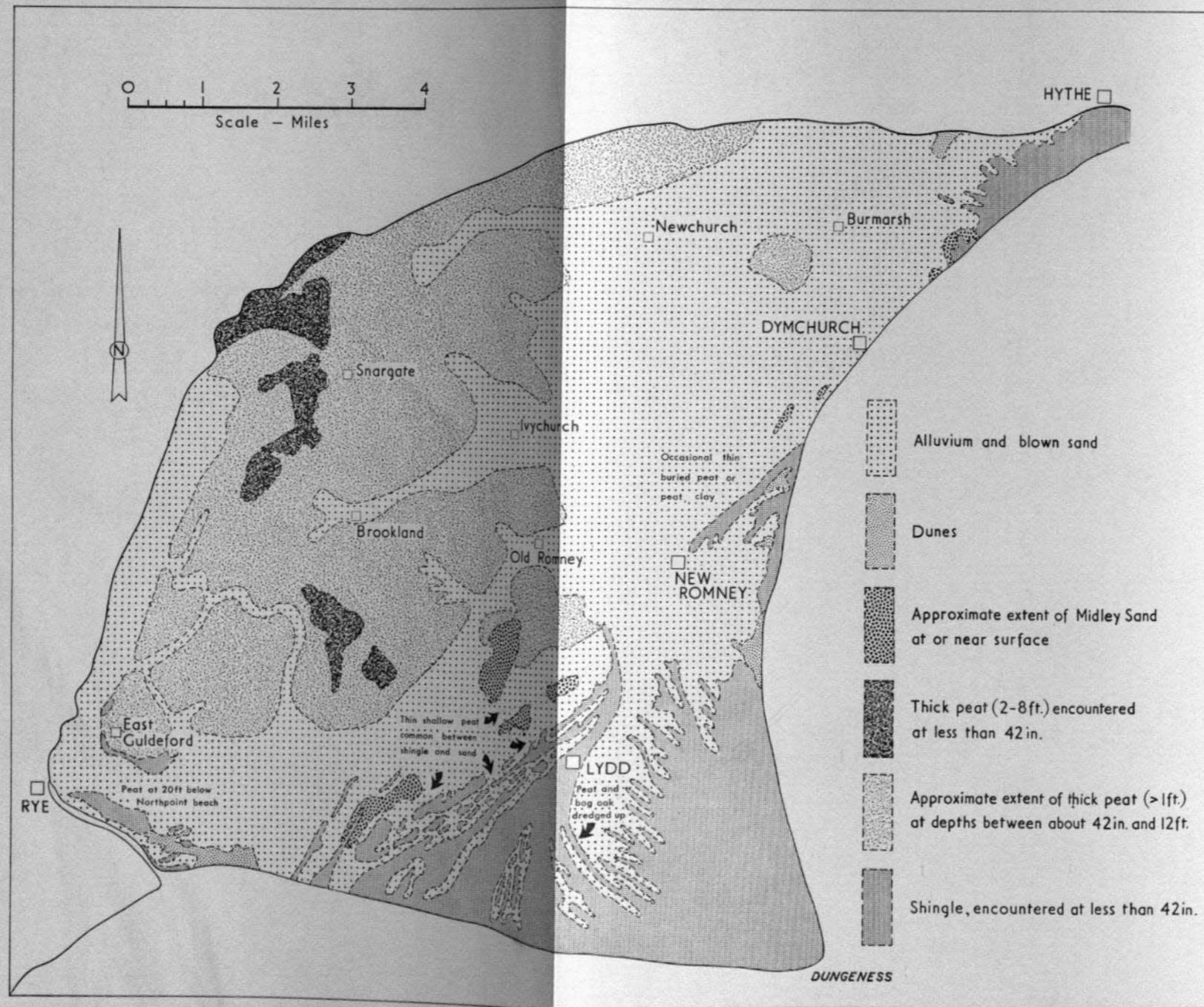
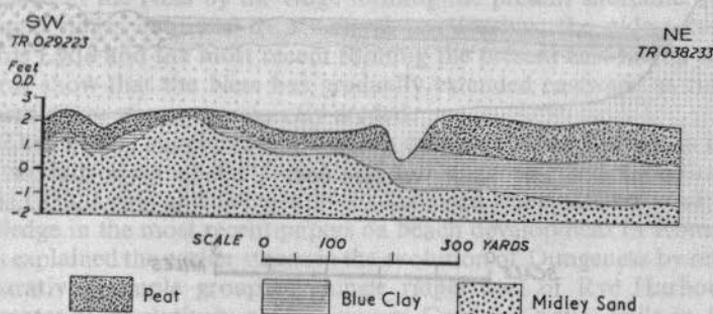


Fig. 6. Deposits and Soil Parent Materials

development and the same depositional sequences. Where off-shore features are present, salt marshes develop simultaneously in their lee and outwards from the coast, gradually filling in the estuary. This may have occurred in Romney Marsh proper between the old sea cliffs and protective off-shore shingle which formerly existed seaward of the Dymchurch Wall (Elliott 1847).

THE DEPOSITS

The top few feet of the deposits are soil parent materials and include all texture grades from sand to clay, as well as peat and shingle. The mineral deposits differ widely in age, and it is convenient to consider the shingle as a whole and the finer textured sediments and peat in stratigraphic order. The peat underlies mineral deposits of variable texture, and normally overlies blue silty clay to silt loam resting on sands. Deep borings and ditch sections have shown that this



5. Sketch-section showing variations in height and thickness of substrata near Midley

sedimentary sequence is characteristic of many parts of the Marsh. It was most clearly observed near Midley in 1957 when the Jury's Gut Sewer was widened. Here, the pre-peat sands form an irregularly rising floor against which the overlying clayey deposits and peat gradually wedge out (Fig. 5). Close by, where the sands are at a higher elevation clayey and finer-sandy post-peat deposits also wedge out, leaving several very sandy banks, *e.g.* at Birdskitchen (TR 043223) and south-west of the ruins of Midley Church (TR 031232). The term Midley Sand is here used for the old sandy stratum (Green and Askew 1958b) and Blue Clay for the finer textured material normally occurring between it and the peat, the sequence being:

Young alluvium
Peat
Blue Clay
Midley Sand

The complete sequence does not occur everywhere, but has been observed in widely scattered localities, *e.g.* near Bell Corner (TR 034240), at Baynham (TR 005243), Bonnington (TR 055338), College Farm (TR 073339), Bridge Farm (TR 046335), Appledore (TQ 981299) and Fairfield (TQ 968263). At the first five places the Midley Sand has a very high content of medium sand, and the boundary to Blue Clay was well defined at 10 ft (-3 ft O.D.), 14 ft (-9 ft O.D.), 15 ft (-6 ft O.D.), 10.5 ft (-1.5 ft O.D.) and 14 ft (-4 ft O.D.), respectively.

Fig. 6 shows the distribution, and Fig. 7 schematically illustrates the vertical arrangement of the various deposits.

Shingle

The shingle is chemically inert, being very largely composed of flint pebbles. It cannot readily be placed in the sedimentary sequence because it has accumulated and been reworked in Romney Bay over a long period, with the formation of beaches of widely differing ages. The very considerable deposits, often more than 50 ft thick* and with upwards of 8,000 acres exposed at the surface, bear witness to their importance in the formation of Romney Marsh. The deposits are

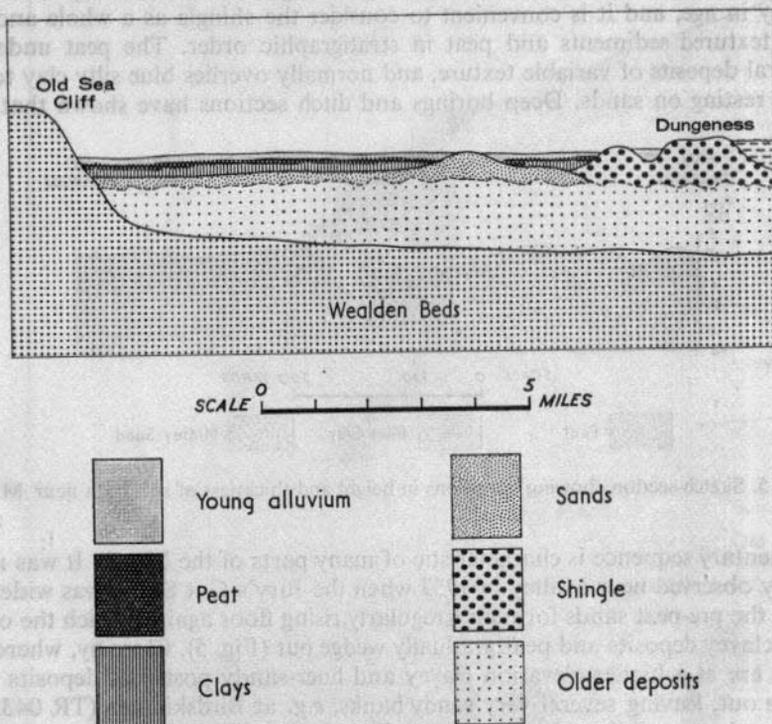


Fig. 7. Sketch-section from the uplands to Dungeness

in four main areas, the promontory of Dungeness to the south and east of Lydd being the largest shingle structure in Britain (*Plate IIIa*). Other beaches occur south-west of Hythe, north-east of New Romney and around Rye harbour (Fig. 6). About 98 per cent. of the pebbles are of flint, some of the others being derived from west-country rocks (White 1928). The Sussex Chalk, as in the cliffs at Beachy Head, provided most of the flint directly or indirectly, pebbles being carried along the coast by drifting. This process is due to wave action, since, on balance, movement of beach material is eastward in the English

* In 10 exploratory boreholes near the site of Dungeness nuclear power station the thickness of shingle, with or without inclusions of sand, varied between 35 and 52 ft and in some instances "sand with gravel" continued for a further 40 ft.

Channel, because wave approach is dominantly from the south-west under the influence of the prevailing south-westerlies (Drew 1864). The effect is clearly apparent along the foreshore in many parts, particularly at Pett Level, where shingle is usually piled high on the western side of the groynes.

The extensive inland beaches of Romney Marsh are corrugated with successive ridges, or fulls, thrown up during storms (*Plate IIIb*). There are between 60 and 100 or more to the mile on Dungeness Foreland* (Lewis and Balchin 1940), and since each is an abandoned shoreline, their arrangement affords evidence of the pattern of growth and change of the promontory. Several beaches comprise the Dungeness Foreland, those west of Denge Beach alternating with hollows infilled with thick clay alluvium and having ridges which all meet the southern shore approximately at right angles. These ridges were clearly once prolonged to the south-west and have been truncated by marine erosion. The ridge directions vary widely in Denge Beach, however, and meet the southern shore at progressively smaller angles until nearly parallel to it, the pattern being completed at the Ness by the ridge forming the present shoreline. Northwards the same ridges continue to a natural termination, the oldest curving back towards Lydd and the most recent forming the present east-facing shore. These patterns show that the Ness has gradually extended eastward as ridges on the southern shore were progressively eroded.

Gulliver (1897) suggested a migrating cusped foreland which is the basis of most modern ideas on the formation of Dungeness, and Lewis and Balchin (Lewis 1932, Lewis and Balchin 1940) discussed this and later contributions to knowledge in the most recent papers on beach development in Romney Marsh. Lewis explained the earlier stages in the evolution of Dungeness by reference to a comparatively simple group of shingle ridges west of Rye Harbour (Fig. 8). This material is relatively recent because Camber Castle, built in 1538-39 on or close to the shoreline, is now over a mile away on the innermost arm of a fan-like pattern of shingle beaches alternating with alluvium-filled hollows. The pattern centres on a point south of Winchelsea. Lewis suggests that early developments at Dungeness followed a similar pattern, point A in Fig. 8, representing a former headland about a mile seaward of Fairlight, and lines 1, 2 and 3 the earliest ridges. Lewis relates section BC of shoreline 3 to shingle deposits west of The Midrips which are about 8 ft lower than Denge Beach or the present shingle foreshore, and deposited when the sea-level was relatively low. He thought that sea-level then fell further, producing the low shingle recurves below the Dymchurch Wall (Elliott 1847) and allowing the forest and peat bed to develop as shingle ridges extended towards Hythe. When the sea-level rose later the shingle was driven landwards and gradually built up so that when movement ceased the shore followed line 4 through Lydd and New Romney, forming a narrow barrier between the sea and a large lagoon with a main outlet between Hythe and New Romney. This shingle ridge was eventually breached in two places, one break occurring near the present site of New Romney, which became the outfall of the river Rother, and the other north-east of Fairlight Head, which accommodated the rivers Tillingham and Brede. Lewis considers this an important stage in the evolution of the Foreland, as shingle was then isolated between the two estuaries and the ridge, starved of new material, became eroded and re-oriented by storm waves, new ridges being formed parallel to the wave fronts.

* Some of the ridges are represented on the soil map by overprinted dashed lines.

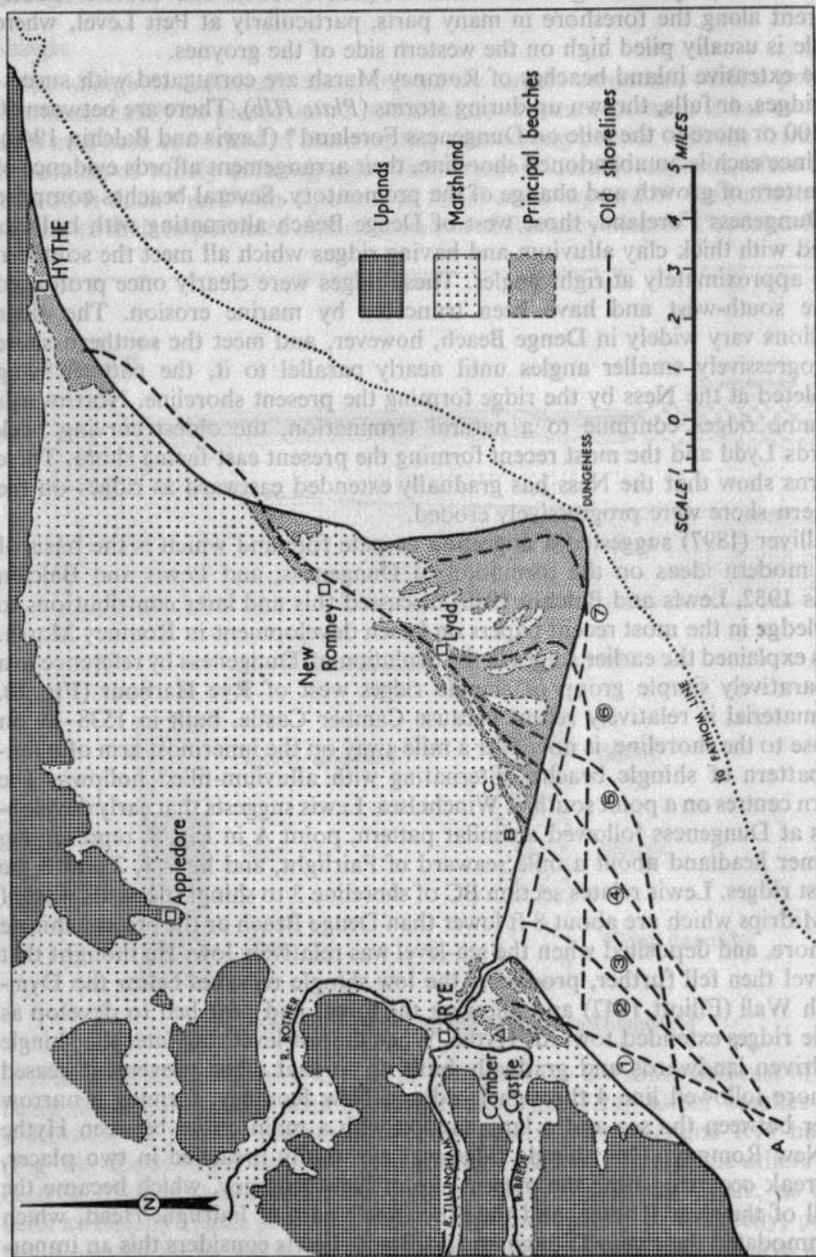


Fig. 8. Sketch-map of the Evolution of Dungeness (after Lewis 1932)

...stage in the evolution of the formation as shingle was first isolated between the two estuaries and the ridge, staved of new material, became eroded and re-oriented by storm waves, new ridges being formed parallel to the wave front. ...

* Some of the ridges are represented on the map by dashed-dotted lines.

The shoreline, with its western end no longer attached to Fairlight, tended to swing round to face the dominant southerly to south-westerly waves (line 5). As the bend sharpened (line 6) the northern shore became a lee-shore, so that the rate of shingle drift along this part lessened and large supplies of shingle accumulated at the bend. The Ness then moved seaward, south-west waves building shingle ridges overlapping the point and north-east waves forming them parallel to the eastern shore. The lines of the two shores and the sharpness of the point are due to the proximity of the French coast, preventing the occurrence of large waves from the south-east which would flatten the Ness.

Many inland beaches have a very irregular landward margin, due to varying extensions of contiguous fulls during development. The best example is the north-west boundary of Denge Beach, where prolonged fulls, either singly or in small groups, interdigitate with alluvium deposited subsequently. Other examples occur north-east of New Romney, where shingle moved irregularly in a south-westerly direction, and near Dymchurch Redoubt, where the terminal ridges run north-west. The relatively blunt or rounded aspect of many near Hythe suggests that they were reworked before alluvium was deposited; possibly evidence of an early channel between the shingle deposits and the hills.

Another series of beach ridges showing evidence of secondary reworking occupies a zone through Scotney Court (TR 016199) and Lydd Rectory (TR 041214). They form elongated "islands" aligned with Holmstone to the east and occur in a more or less parallel series from south-west to north-east, the summit elevations mostly being lower than more recently formed ridges farther east. The islands are crests of banks buried by alluvium, below which they commonly shelf quite steeply. The orientation of recurves suggests that the original fulls developed from the south-west and that the islands are possibly parts of an extensive beach, or beaches, which originally included the remnants adjacent to The Midrips.

Midley Sand

This material is coarse textured compared to most younger sandy deposits; the content of medium grade sand is high, clay and silt are scarce and calcium carbonate is absent except at considerable depth. The particle-size distribution of a sample collected at about 3 ft is:

	<i>Per cent.</i>
Clay (<2 μ)	1
Silt (2-50 μ)	1
Very fine sand (50-100 μ)	1
Fine sand (100-200 μ)	20
Coarser sands (200 μ -2 mm)	81

It is exposed at the surface or thinly covered in several localities and commonly forms conspicuous banks, particularly north-west of Lydd and north-east of Broomhill near a settlement appropriately called Sandyland. These banks run approximately south-west to north-east (Fig. 6), and there may once have been an extensive feature, perhaps a sand spit or a system of sand banks or dunes, which suffered dissection and reworking during partial burial beneath the Blue Clay and younger deposits.

Blue Clay

This material, which overlies old beach deposits west and north-west of Lydd and Midley Sand elsewhere, commonly has a high 2–50 μ silt content, a typical sample having the following particle-size distribution:

	Per cent.
Clay (<2 μ)	38
Silt (2–20 μ)	27
(20–50 μ)	21
Sand (>50 μ)	14

In texture, colour and consistency it is similar to the Buttery Clay of the Fenlands, to which it is may be stratigraphically related, since both contain shells of *Scrobicularia* and are overlain by peat.

The Blue Clay is a soil parent material in alluvium-filled hollows between shingle banks to the west and south-west of Lydd, mostly occurring at depths below about 15 in. Its presence is indicated by thin peat or peaty clay at the surface and by woody roots in the upper part of the clay (p. 23). Similar deposit sequences occur locally north of Dymchurch (TR 101304), where thin peaty clay overlies stiff and deeply decalcified clay, but the organic-rich layer has not been correlated with the main peat bed, and the underlying clay may be relatively recent.

Peat

The occurrence at various depths of an organic layer with remains of trees and miscellaneous marsh plants has long been known in the Marsh. The peat is black in its upper part and brown at lower levels, where it is permanently waterlogged. Large very hard trunks of oak, birch and other trees, called "moor log" and "bog oak", occur in it. It has been suggested that the trees were washed into the area by rivers in flood (Elliott 1852), but the presence of stumps at or near the peat floor (Drew 1864, Gilbert 1933) shows that they grew *in situ* during a period of relatively low sea-level. Rooted stumps may still be seen at low tide on the foreshore at Pett Level.* Wood samples taken from the peat by J. G. O. Smart in two localities and dated by radio carbon assay proved to be about 3,000 years old† (Callow *et al.* 1964). Rivers presumably crossed the developing peat, and the first sediments were perhaps deposited on it from flood waters when the sea-level rose relative to the land. The date of submergence of the forest bed is uncertain, but a similar bed in analogous parts of Holland was drowned about 300 B.C. (Bennema and van der Meer 1952).

The original extent and thickness of the peat has been changed by erosion, by compaction beneath mineral deposits of variable thickness, by differential shrinkage due to uneven drying out and partly to wastage by oxidation. Differential shrinkage has appreciably influenced the pattern of soil drainage, the mineral deposits overlying the peat having subsided to low, relatively wet positions in many places. Fig. 6 summarizes the known occurrences of peat and shows where it is within 42 in. of the surface and is therefore important as a soil parent

* There are three thin peat layers along some parts of this foreshore but only one in the area surveyed.

† These samples, probably birch, were dated 1070 B.C. \pm 94 years and 1390 B.C. \pm 92 years.

material. The thickest peat occurs where its floor is relatively low, about 6 ft in The Dowels east of Appledore, and near Fairfield Church, where Blue Clay occurs at about 5 ft below O.D. The bed thins out east of these places, particularly along the north side of Romney Marsh proper, and wedges out completely over elevated Midley Sand and old shingle deposits north-west to south-west of Lydd.

Post-peat Deposits

These deposits range in texture from clay to sand and are commonly 6 ft or more thick. Deposition extended over more than 2,000 years, with the formation of sedimentary patterns of contrasting age and complexity in different parts of the Marsh, each with a wide range of textures. Further differences developed, following reclamation, due to uneven subsidence after the drying out and shrinkage of thick peat below.

Since time is an important factor in soil development, post-peat deposits of similar textures but differing age would be expected to have soils differing in some characteristics. It is therefore useful to consider the history of sedimentation and enclosure.

THE POST-PEAT PERIOD

The initial extent and arrangement of the shingle deposits is uncertain. Lewis and Balchin (1940) assumed that banks around Scotney Court, west of Lydd, and between New Romney and St. Mary's Bay were parts of "the shore formed when the sea level rose to near the present and drowned the 25 ft submerged forest". Those north-west to west-south-west of Lydd, however, all have a lower summit elevation and are older than the peat (Green and Askew 1958b, p. 22), a thin extension of which forms part of thick deposits partially covering the shingle (p. 23). They must therefore be the remnants of an extensive beach, eroded and protected by others farther east long before the forest period (Fig. 9). Smart (1966b) regarded shingle banks south of Birdskitchen and another of similar height immediately north-west of New Romney as parts of recurves into an estuary of the Rother, forming, with other truncated recurves north-east of Dymchurch, remnants of a shore older than the peat (Fig. 9). At the end of the forest period shingle was driven landward and built up as sea-level rose (p. 11). That these higher beaches are younger than the peat is indicated by the presence of hard peaty mud below the shingle at mean water level along the shore near Holmstone and farther east (Drew 1864) and by the occasional dredging up of peat and bog oak in ballast workings south of Lydd and at Northpoint Beach, near Rye harbour. Later shingle deposition, erosion and redeposition has already been described. Lewis and Balchin (1940) found evidence in the younger beaches of post-Roman fluctuations in sea-level. The differing heights of ridge crests along transects parallel to the southern shore were attributed to changes in sea-level, and by dating ridges from historical evidence they deduced a rise of a foot a century from the 15th century to the present day; the levels are approximately the same today as in the 13th century, they were a foot or so lower in the 8th century and 5 or 6 ft lower in Roman times. The 8th century dating is questioned (p. 43), but one high ridge of a group dated A.D. 1300 marks a distinct change in ridge alignment which must be related to one of the violent storms of that period. Many older ridges south-west and north of its

cusps are truncated (Fig. 9) and the Ness then sharpened because shingle accumulated preferentially at the bend.

Changes in sea-level also accord with distinct phases of deposition in the reclaimed marshland, seen both in vertical sections and in different areas. Abrupt texture changes in vertical section, *e.g.* from sand to clay, are often found in salt marshes (p. 8) and, combined with evidence of soil development, indicate burial of an established land surface and the start of a new phase of deposition. Buried soils appear as a humus-rich or leached zone in the soil profile, and in some parts of the Marsh pottery shards and other artefacts indicate a human settlement invaded by the sea. Often sediments of different ages are in different places; younger sediments wedge out against older, more elevated deposits, such as a shingle spit, or are halted by a sea wall from wider encroachment across an older landscape. There is then an abrupt contrast in levels and/or sedimentary patterns.

Such phenomena may also arise from changes in the pattern of deposition or erosion, *e.g.* the gradual weakening of protective shingle beaches, or the breaching of a sea wall. After drainage, marshland commonly settles as the deposits dry out. This effect can be very considerable, particularly if thick peat substrata are present, as in parts of the Marsh. Evidence of disturbance and the presence of distinctive deposits indicate that "established" land was periodically flooded by the sea, or the rivers, during the post-peat period. Some parts of natural or artificial sea defences are especially vulnerable, particularly to storms at high tide, and although some breaches were evidently local and readily repaired before much disturbance was caused, others were of greater magnitude or duration and involved complete or prolonged loss of land.

Before land was enclosed, saltings adjacent to the uplands, or fringing off-shore beaches and sandy islands, *e.g.* at Midley, were probably used for grazing, but with the construction of sea defences permanent settlement and agriculture became possible. Thus natural processes were arrested or deflected, as skill increased in the construction of sea defences, particularly as the protection afforded by naturally formed but ever-changing coastal banks and beaches was supplemented or replaced by artificial walling. Mastery was never complete, however, control sometimes merely delaying or magnifying an inevitable change, and the sea periodically modified or reshaped the enclosed land, at times with considerable loss of life and property (see below). When the sea thus reclaimed an area, renewing deposition and salt-marsh development, the land enclosed later was often far more suitable for agriculture and settlement than the original.

The development of Romney Marsh during the post-peat period has thus been very complex; deposition of the finer materials under conditions determined by the ever-changing configuration of the off-shore beaches and the varying protection they provided from the full force of the sea, relative fluctuations in sea-level, changes in river courses (pp. 33 and 41), inking and draining—all these playing a part.

SETTLEMENT AND RECLAMATION

Old sea walls identified with reasonable certainty are shown on the soil map by unbroken red lines; many others were probably destroyed or excavated during the long and complex post-peat period, and it is uncertain whether those built first still exist or which of those evident now are oldest. The few walls in

Romney Marsh proper were unknown to 19th century students, and Roman discoveries near Dymchurch supported the earlier belief (Dugdale 1662) that Romney Marsh proper was enclosed as a whole by the Romans (Elliott 1847, Lewin 1862, Holmes 1907). This was questioned later on place name evidence by Ward (1940), and there is now sedimentary and other evidence that the Rhee Wall is much younger and is not primarily an innings wall (p. 38). There is no record of Roman enclosure, and it would have been unnecessary if settlement followed a fall in sea-level which left beaches* and tracts of marshland high and dry.

Excepting certain beaches, e.g. at Lydd, and some areas of relatively elevated Midley Sand, the Roman surface was ultimately overwhelmed and buried beneath fresh deposits. The Dymchurch pottery shards, bones and other Roman artefacts were found at about 2 ft below the surface (Smith 1850), and relics of similar age were unearthed at similar depths during the present work (p. 27).

Place name (Ward 1940) and charter evidence indicates occupation of the marshlands in Saxon times (pp. 28 and 43) but no of reclamation.† Nennius, a 9th century writer, gives a colourful account of the state of the Marsh at this time in his *Catalogue of British Wonders*: "The Fourth marvel is the Lommon (Limen) Marsh, for in it are 340 islands with men living on them. It is girt by 340 rocks and in every rock is an eagle's nest, and 340 rivers flow into it; and there goes out of it into the sea but one river, which is called the Lemm (Limen)."

Mention of walls in Romney Marsh appears first in grants of land, many near Appledore, made at the beginning of the 12th century and carrying covenants about maintenance, e.g. "that the tenants engage to maintain the walls and sewers against the salt and fresh water, and as often as there shall be need, to repair and strengthen them according to the law of the marsh" (Teichman Derville 1936). By 1250 such obligations were administered by the "XXIV sworn men or Jurats". A large number of walls must have existed by this time, although many were probably to protect land long settled and farmed, or to reclaim it following flooding, rather than to enclose primary saltings (p. 29). Several records of this period note the "great" and the "little" walls of Appledore, which were especially important and vulnerable; and that the principal sea defence work was not, as now, the coast of Romney Marsh proper, the Dymchurch Wall. The powers and duties of the Jurats were frequently referred to, and sometimes disputed, in the latter part of the 13th century, particularly in relation to havoc caused by a series of violent storms which occurred about this time. The most disastrous occurred in 1287 resulting in "the banks and ditches upon the sea coast and parts adjacent . . . being in divers places broken, through the violence of the sea" (Dugdale 1662). Several records refer to the south-west side of the Marsh, where at least two settlements were swept away, one being Old Winchelsea, which it is thought occupied an old shingle beach (cp. Lydd) somewhere seaward of Rye harbour (Elliott 1862, p. cxix).

One particular embankment in Walland Marsh appears to be readily related

* At Lydd, beaches were occupied by the Romans (Jones 1953), and a similar protective beach is thought to have existed on the sea side of the Dymchurch Wall until the 13th century. This is assumed from the many shingle banks at right angles to the present coast found under and inland of the Wall when it was strengthened and realigned in the mid-19th century. Elliott (1847) also recorded Roman age material on its sea side.

† Widely published innings maps by J. Elliott (1862, 1874) show that Denge Marsh was reclaimed about A.D. 774, but there is some doubt about this (p. 43).

to such events and to the probably higher sea-level about this time. Beginning at Appledore, this wall zigzags for about 15 miles to the coast at Broomhill, running through Appledore station, Fairfield and Little Cheyne Court, turning north-east then towards Midley House and back again south-west of Midley towards Broomhill (Fig. 14). It is a significant division, land to the west being higher and having thicker and clearly younger post-peat deposits. It is shown, in part, on Elliott's map,* and probably existed by about the end of the 13th century (p. 32). The history of reclamation and sea defence in this part of Walland Marsh is very complex, the zigzag character of the wall indicating that only relatively successful parts of a straighter defence line now remain, *e.g.* that linking Appledore and Fairfield. There is certainly evidence that the wall was locally breached in several places (pp. 116-17), and other breaks may have been less readily repaired. Another barrier constructed or extended in the same period was the Rhee Wall, a pair of closely parallel walls channelling part of the Rother (diverted to Rye about this time by the violence of the storms) back to its old outfall at New Romney (p. 40). Between Appledore and Appledore station it is the boundary between very contrasting landscapes, though this could be explained by the breaching and loss of an older wall between Fairfield and Appledore.

Lower walls are common in Walland Marsh between those discussed above, *i.e.* around Brookland and south-west of Old Romney. Elliott (1862) regarded many of these as the boundaries of the first innings in Walland Marsh, attributing them to 12th and 13th century ecclesiastics, *e.g.* St Thomas's Innings, but it seems likely that they were built partly to protect settled land and partly to re-enclose areas which had been flooded (p. 29).

Land west and south of New Romney, part of which must correspond to the silted outfall of an old river Rother, was also clearly disturbed during the same stormy period and was evidently reclaimed shortly afterwards (p. 42). Excepting the Dymchurch Wall, which replaced a natural defensive shingle structure to seaward, the walls west of New Romney were probably the last built in Romney Marsh proper. The northern part of this marsh was evidently traversed by a river or large creek until about the end of the 9th century, and it possibly included a large estuary or inlet at an earlier time, but there is meagre evidence of walls, and the area was settled by the 11th century (p. 36).

Walland Marsh, west of the zigzagging wall described above, comprises a series of innings showing that it was progressively reclaimed towards the south-west (p. 30). Similarly, on land east of a line between New Romney and Lydd reclamation was being directed towards Greatstone and Littlestone. This phase of enclosure probably gained momentum after the 14th century, its beginning being uncertain, but it was clearly incomplete in 1617 (p. 31), and reclamation continued towards Rye and to a lesser extent towards Greatstone and Littlestone until about 1900. The settlement pattern and landscape character contrast with those of the adjoining land, which has a closer network of roads and tracks, many very sinuous, and more old buildings and trees. The presence of smaller fields in the latter, some showing evidence of former subdivision, suggest a centre from which new reclamations were effected. Breaching of walls by the sea is evident in several places, in some instances because there is a pattern of erosion and/or a new mantle of deposits in the older land. More marked,

* Elliott's map in Lewin (1862) is reproduced in Steers (1964).

however, is a characteristic irregularity in the line of a wall, an arc-like section facing seaward. Such reconstruction avoided filling a deep scour hole and presumably ensured a stronger repair (pp. 103-116).

REGIONAL DIFFERENCES AND LAND TYPES

Romney Marsh can be conveniently subdivided and described according to differences in landscape character, the most obvious contrast being between the marshland areas and the beaches. For reasons given above, however, the character of the marshland also varies from place to place, due to man's influence and/or sedimentary conditions at different times during a long and complex development. Accordingly, different *Land Types* have been recognized (Fig. 10), some with pre-peat or early post-peat deposits at or near the surface and commonly a land form determined by the variable distribution or differential erosion of underlying peat. In others, relatively young post-peat deposits are thick, and peat is either absent or exerts little influence. The boundaries between land types partly conform to beach margins or old sea walls, as, for example, the important walling between Appledore and Broomhill referred to in the previous section, but arbitrary criteria are also used, e.g. the occurrence of Midley Sand at less than 42 in. Elsewhere boundaries are determined by the presence or absence of calcium carbonate in the surface layers of the thick alluvial deposits (p. 59), this difference being most marked across sea walls separating land types of widely different ages. The younger marshland, with thicker post-peat alluvium forming higher land, is calcareous throughout, whereas the adjacent land is mostly non-calcareous in the surface, and in some parts contains no detectable native lime. Sedimentary and historical evidence indicate that the youngest alluvium is the most calcareous, and lack of lime is due to pedological decalcification (p. 50). Accordingly, the reclaimed areas are conveniently divided into Decalcified (Old) Marshland and Calcareous (New) Marshland (Fig. 10), although lands of transitional or intermediate character occur near some boundaries. The age range of soil parent materials is appreciable in both, with some overlapping, but in general the Decalcified (Old) Marshland has pre-peat or early post-peat deposits at or near the surface and/or a land form closely determined by former patterns of erosion in underlying peat. In the Calcareous (New) Marshland young post-peat deposits are mostly thick, and older undisturbed materials (including buried Old Marshland) are either absent or below 4 ft. There is peat below about 6 ft in some parts, but it has influenced relief less than in the Decalcified (Old) Marshland.

Unreclaimed lands, and areas still influenced by the sea, are considered separately as Saltings.

INLAND BEACHES AND ASSOCIATED BLOWN SAND

The beaches* are mostly of shingle, but thick sands and pebbly sands of similar summit elevation are locally important; they are associated with the shingle and partly overlie it.

The beaches of the Dungeness promontory and others south-east of Rye and

* The finger-like shingle ridges and "islands" (p. 13) are parts of the beaches, but form characteristic land types with interdigitating alluvium and are considered later (pp. 24 and 42).

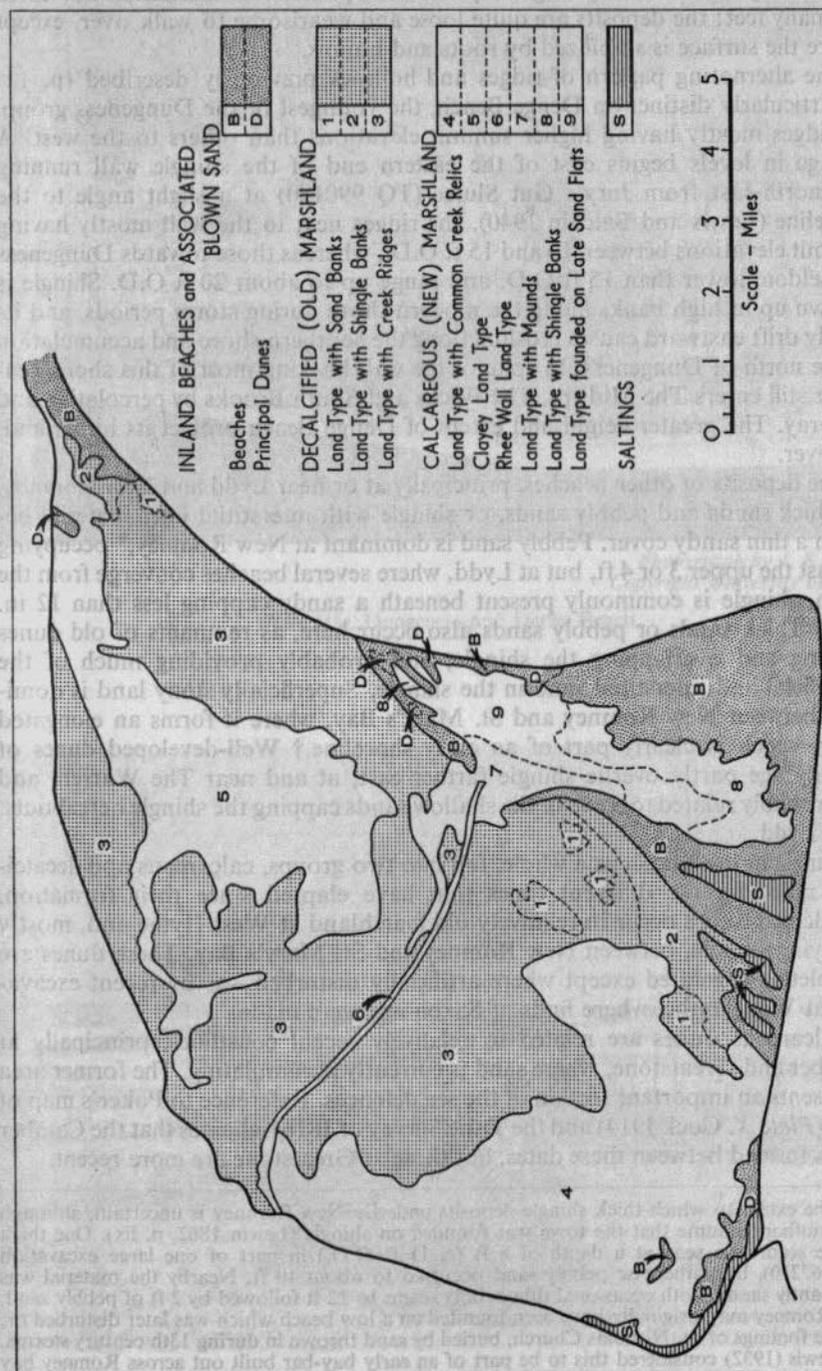


Fig. 10. Land Types

at West Hythe are mostly singularly free of superficial or interstitial fine earth for many feet; the deposits are quite loose and wearisome to walk over, except where the surface is stabilized by roots and humus.

The alternating pattern of ridges and hollows previously described (p. 11) is particularly distinct on Denge Beach, the youngest of the Dungeness group, its ridges mostly having higher summit elevations than others to the west. A change in levels begins east of the eastern end of the shingle wall running east-north-east from Jury's Gut Sluice (TQ 990180) at a slight angle to the shoreline (Lewis and Balchin 1940), the ridges next to the wall mostly having summit elevations between 10 and 15 ft O.D., whereas those towards Dungeness are seldom lower than 15 ft O.D. and range up to about 20 ft O.D. Shingle is thrown up in high banks along the modern shore during storm periods, and its steady drift eastward causes erosion along the southern shore and accumulation at the north of Dungeness. In spite of the wall backing most of this shore, sea-water still enters The Midrips, The Wicks and South Brooks by percolation and as spray. The greater height and extent of Denge Beach protect its hinterland, however.

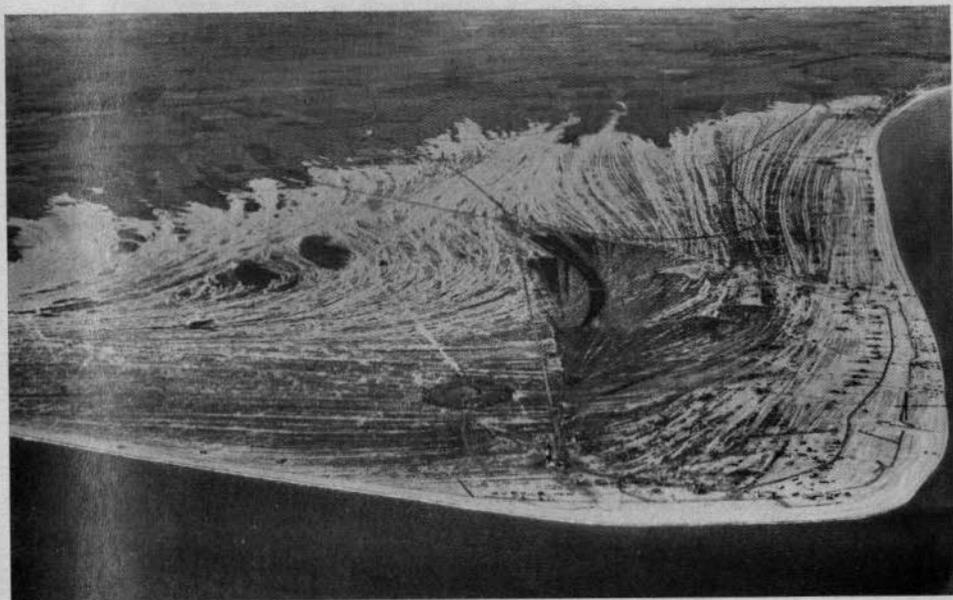
The deposits of other beaches, principally at or near Lydd and New Romney, are thick sands and pebbly sands, or shingle with interstitial finer material beneath a thin sandy cover. Pebbly sand is dominant at New Romney,* occupying at least the upper 3 or 4 ft, but at Lydd, where several beaches converge from the south, shingle is commonly present beneath a sandy capping less than 12 in. thick. Thick sands or pebbly sands also occur here, as remnants of old dunes fringing and overlapping the shingle, and probably providing much of the superficial and interstitial sand in the shingle. Superficially stony land is dominant between New Romney and St. Mary's Bay, where it forms an elongated beach which is clearly part of an early shoreline.† Well-developed dunes of varying age partly overlie shingle farther east, at and near The Warren, and are probably related to some of the shallow sands capping the shingle hereabouts, as at Lydd.

Dunes, in the Marsh as a whole, fall into two groups, calcareous and decalcified, reflecting the different times that have elapsed since their formation. Decalcified dunes occur in relatively old marshland at West Hythe and, mostly overlying shingle, between New Romney and St. Mary's Bay. These dunes are completely vegetated except where artificially disturbed—as by recent excavation at West Hythe, where finds of Saxon age were made.

Calcareous dunes are related to relatively recent coastlines, principally at Camber and Greatstone, where sand is currently accumulating. The former area represents an important section of the sea defences. Reference to Poker's map of 1617 (*Plate X*, Cock 1914) and the Tithe Survey of 1816 indicates that the Camber dunes formed between these dates, but those at Greatstone are more recent.

* The extent to which thick shingle deposits underlie New Romney is uncertain, although some authors assume that the town was founded on shingle (Lewin 1862, p. lix). One thick shingle seam was seen at a depth of 8 ft (c. 11 ft O.D.) in part of one large excavation (TR 067250), but otherwise pebbly sand occurred to about 10 ft. Nearby the material was dominantly sandy, with occasional thin pebbly seams to 12 ft followed by 2 ft of pebbly sand. New Romney may originally have been founded on a low beach which was later disturbed or, like the footings of St. Nicholas Church, buried by sand thrown in during 13th century storms.

† Lewis (1932) considered this to be part of an early bay-bar built out across Romney bay from the south-west and later breached between New Romney and Lydd. This breach may account for the recurves at the south-west end near New Romney, although later shingle in The Warren, with similarly orientated recurves, clearly drifted from the north-east.



*Photograph by J. K. St. Joseph.
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Plate IIIa. Dungeness and Denge Beach.



Plate IIIb. Denge Beach showing full-and-low microrelief and vegetation stripes on soils of the Dungeness series.



Plate IVa. Court-at-Wick, Brenzett. The farmhouse is sited on a trunk creek ridge in the Old Marshland.



Plate IVb. Meandering sewers separating small fields on Snargate and Finn soils near Snargate. The church is on a minor creek ridge.

DECALCIFIED (OLD) MARSHLAND

The Decalcified Marshland occupies most of the central part of the Marsh and also includes lands backing the Dymchurch Wall, bordering the Royal Military Canal from Appledore to below Aldington, and extending nearly to the coast south-west of Lydd (Fig. 10). It includes the villages of Snargate, Brookland, Brenzett, Burmarsh and Old Romney, and is bisected by the Rhee Wall, the boundary between Romney and Walland Marshes. Physiographic and geological differences are greatest where pre-peat shingle, Midley Sand or peat are at or close to the surface. Elsewhere these materials are absent or deeply buried beneath later deposits of varied texture.

Land Type with Sand Banks

Midley Sand forms distinct banks and very old surfaces in several places,* e.g. near Midley Church (TR 031232)† and Birdskitchen (TR 043223). The banks shelve gently away beneath younger deposits of relatively old post-peat age that range from fine and very fine sand to clay and in many places include thin peat and reworked Midley Sand. This land form is characteristic of several localities north-west of Lydd and north-east of Broomhill; arbitrary boundaries delineate land where Midley Sand is within 42 in. of the surface or where younger deposits include appreciable amounts of reworked Midley Sand.

Contrasting relief is due partly to differing summit heights and partly to shrinkage of peat deposits in surrounding areas. Where these have been thick subsidence will have been greater and the banks will stand out, e.g. the Midley Church bank.

Land Type with Shingle Banks

A system of pebbly banks with summits ranging between 8 and 12 ft O.D. and interjacent "lows" containing thick alluvium gives a different landscape in the Decalcified Marshland west and south-west of Lydd and north-west of the beach near Hythe (Fig. 10). Augering and examination of sections along the Jury's Gut Sewer near Scotney Court (TR 016199) showed that shingle underlies many lows thereabouts and that a succession of deposits, ranging from clay to sand and including thin peat, progressively filled deep hollows between originally high shingle banks. The variation in level of the thin peat suggests that the present varied relief of the landscape has resulted partly from differential shrinkage or compaction, the land between the shingle "islands" having subsided appreciably (p. 103).

Radiocarbon dating of samples of thin peat and underlying relic roots included in the thick clayey infill between the shingle banks near Scotney Court (TR 023202) indicates that such spits were formed and disturbed at least 2,000 years ago and probably much earlier. At one site, with shingle occurring at about 7 ft, a 2 in. thick peat layer at 48 in. overlays 30 in. of bluish grey silty clay loam with numerous woody roots *in situ*. The latter, $2,740 \pm 400$ years old (Callow *et al.* 1966), are evidently similar in age to wood collected by Smart

* 10 ft of sand has been proved in several places for two banks, deeper augering being prevented by running sand. In some outer parts of one bank thin peat or peaty clay was found several feet below the surface due to local reworking.

† The name Midley (Saxon "Middle island") is said to indicate an old island between New Romney and Lydd (Holloway 1849), but was possibly first given to the larger, central island of a group.

from the thick peat bed in Appledore Dowels which was about 3,000 years old (p. 14). These dates, combined with stratigraphical evidence, suggest that the clay-with-roots deposit is Blue Clay but with a surface relatively high (4-6 ft O.D.) compared to The Dowels (-4-6 ft O.D.), where it underlies thick peat. The correlations, however, indicate the antiquity of both the underlying shingle and the associated beach banks. This land was presumably protected in some way when sea-level rose after the peat formed, and since Holmstone beach partly forms its eastern boundary, this also may be older than the peat.

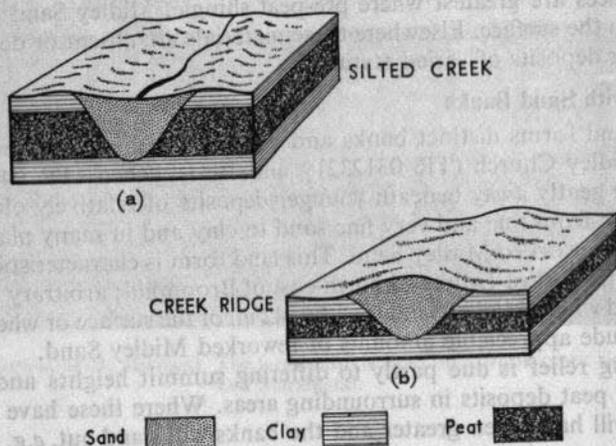


Fig. 11. Block diagrams of creek ridge development

Land Type with Creek Ridges

Many other ridges are associated with a thick peat substratum elsewhere in the Decalcified Marshland, the most common being of sand and the most conspicuous being bordered by thin clay over thick peat. Such contrasts, whether in texture or the nature of the deposits, are characteristic. The ridges are nearly symmetrical in cross-section and form complex dendritic systems rooted in broad "trunk" ridges several hundred yards wide (Fig. 14). Heights differ from place to place and with the size of the system, but the lowest "feeder" ridges occur at about 3 ft O.D. and the highest "trunk" ridges at 9-11 ft O.D. The altitudinal difference between ridge crests and the adjacent low ground varies, but rarely exceeds 5 ft.

Similar landscapes in Holland have been studied by Dutch workers, initially by Vlam (1943), who found that a peat substratum, commonly below clay, was always associated with the low areas but not with the adjacent wide ridges, where sand extended downwards to or below the base of the peat (Fig. 11b). In other words, a peat substratum existed everywhere except beneath wide, sandy ridges, and these are thought to correspond to a system of creeks cut into thick and extensive peat deposits, and that clay, silt and sand were deposited over this landscape until the peat was buried and the creeks silted up. The sediments were carried in suspension by tidal waters, with sandy material settling first in the creeks while the finer clay and silt particles were carried out over the uneroded peat and settled there under relatively quiet conditions (Fig. 11a).

According to Vlam, the existing relief results from differential shrinkage of the peat, particularly after artificial drainage following enclosure. In former creeks, where the peat layer was eroded, there was little subsidence, and the sandy sediments thus emerged as ridges. In Holland these are termed creek ridges (*Kreekrugs*), and the low lying, irregularly shaped areas between are called pools (*Poels*). Creek ridge development by this process is termed *inversion*.

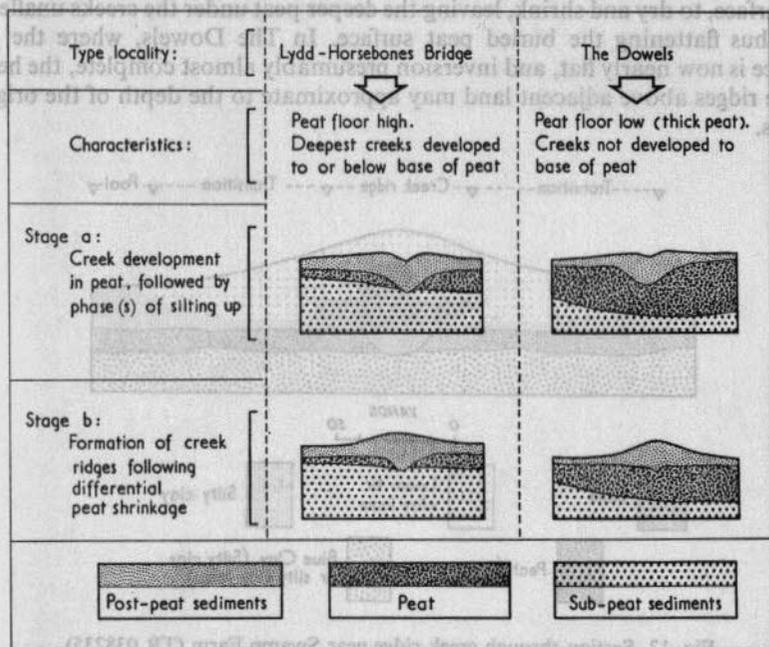


Fig. 12. Schematic illustration of creek ridge development in different localities

In Romney Marsh, sections and deep augering confirmed the existence of similar sequences of deposits in relation to relief (Green and Avery 1955, p. 12), and the Dutch nomenclature is therefore followed here. There are regional differences, however, partly due to the variation in thickness and elevation of the peat and partly because the creeks were not all formed at the same time or under the same circumstances. There is evidence that peat shrinkage occurred between successive phases of creek formation and that man achieved variable success in preventing flooding. Such factors have regulated the amount of sediment deposited and the degree to which the deposits of one phase were disturbed or buried by those of the next.

The effect of peat thickness and elevation on creek ridge formation can be illustrated in The Dowels and in the Lydd-Horsebones Bridge area (Fig. 12). The low creek ridges in the latter are probably due to erosion through thin peat, as the existing peat is mostly less than 2 ft thick and rests on a relatively high floor (around 1 ft O.D.), and sections along the Jury's Gut Sewer showed that the base level of erosion was such that some creeks were cut several feet below the base of the peat into Midley Sand. On the other hand, the relatively narrow well-defined ridges in The Dowels evolved from deep creeks eroded in very thick

peat, which is still continuous below both ridges and pools (Figs. 34 and 36). The deposit above the peat in the pools is thin and very clayey, as would be expected for higher ground seldom flooded by the sea, and Blue Clay is encountered now at -6 ft O.D. under 6 ft of peat.

The ubiquitous peat in The Dowels emphasizes that creek ridge development is basically due to differential shrinkage in relation to filled-in creeks. Falling water-table levels have allowed the peat between the creeks, which is nearer to the surface, to dry and shrink, leaving the deeper peat under the creeks unaffected and thus flattening the buried peat surface. In The Dowels, where the peat surface is now nearly flat, and inversion presumably almost complete, the height of the ridges above adjacent land may approximate to the depth of the original creeks.

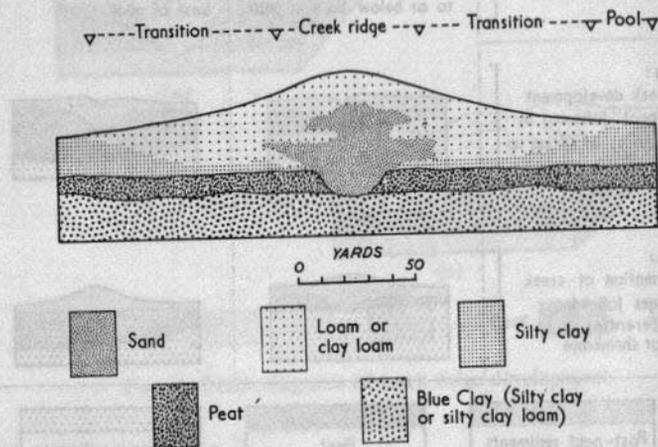


Fig. 13. Section through creek ridge near Swamp Farm (TR 038235)

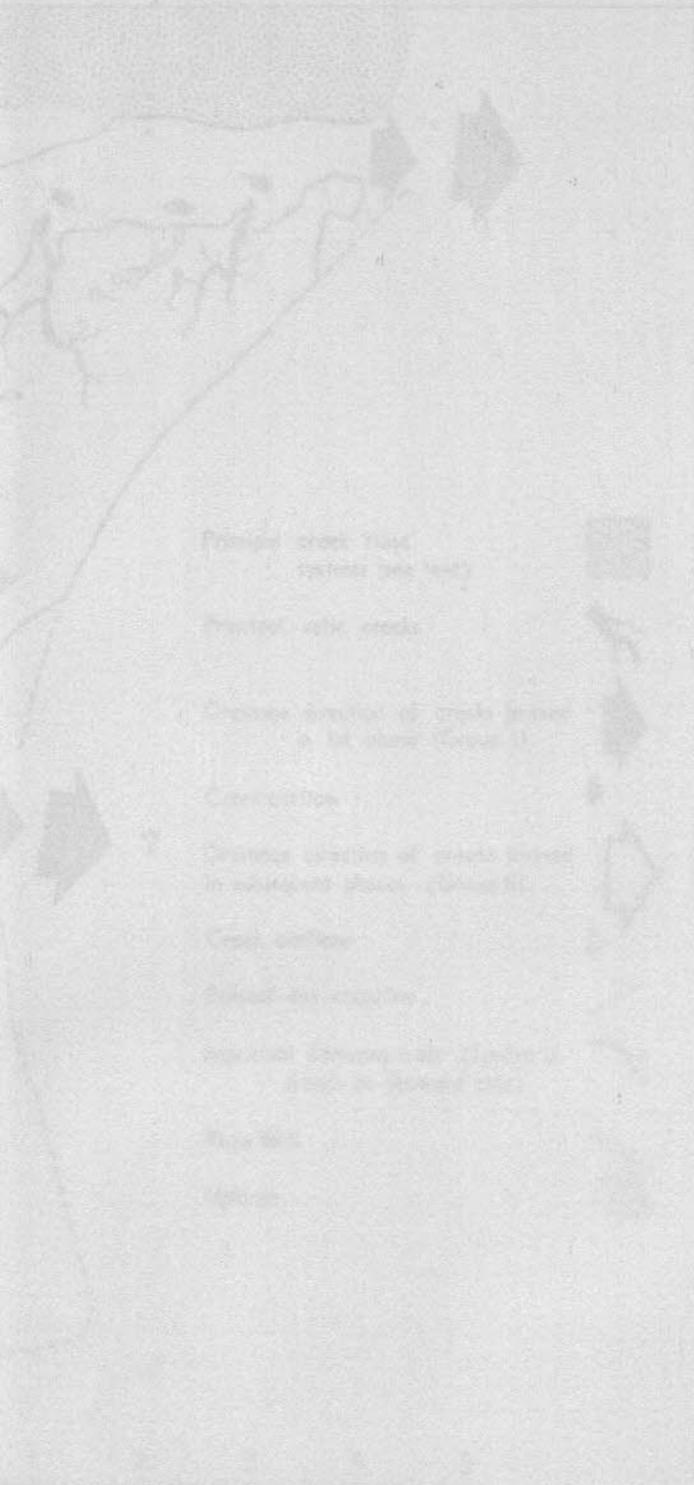
Elsewhere partly filled creeks were dammed while silting was still in progress, or have been only partially inverted, giving levee-like creek ridges bordering low, often swampy tracts (p. 115). The latter are termed *creek relics*, because after reclamation the original creeks were partially filled by sediments from the drainage water. In some parts the bordering ridges gradually converge upstream to form a single creek ridge (pp. 113 and 116).

Some creek ridges are clayey rather than sandy (p. 107); others are very low, and were perhaps mainly formed by the differential shrinkage of clay and sand following drainage (p. 113).

In this land type, between Snave and Brenzett and south-west of Old Romney, the flanks of wider ridges slope gently and are dominantly loamy, though a layer of clay commonly overlies the peat (Fig. 13). These *transitional zones*, between a creek ridge and adjacent pools, presumably developed from silted creek margins where little or no peat was eroded but where deposits became progressively thinner and finer textured towards the pools. Accordingly, the wider creek ridges are seldom conspicuous (*Plate IVa*), for while they may be 5 ft above the pools, the difference is scarcely noticeable due to a wide transition zone.

In many places sedimentary conditions were quiet when the peat was first

1. The first part of the map shows the general outline of the region, including the coast and the main rivers. The second part shows a more detailed view of the central part of the region, with the main cities and roads. The third part shows a detailed view of the southern part of the region, with the main cities and roads.



- Frontier zone
- Protected zone
- Districts
- Roads
- Rivers

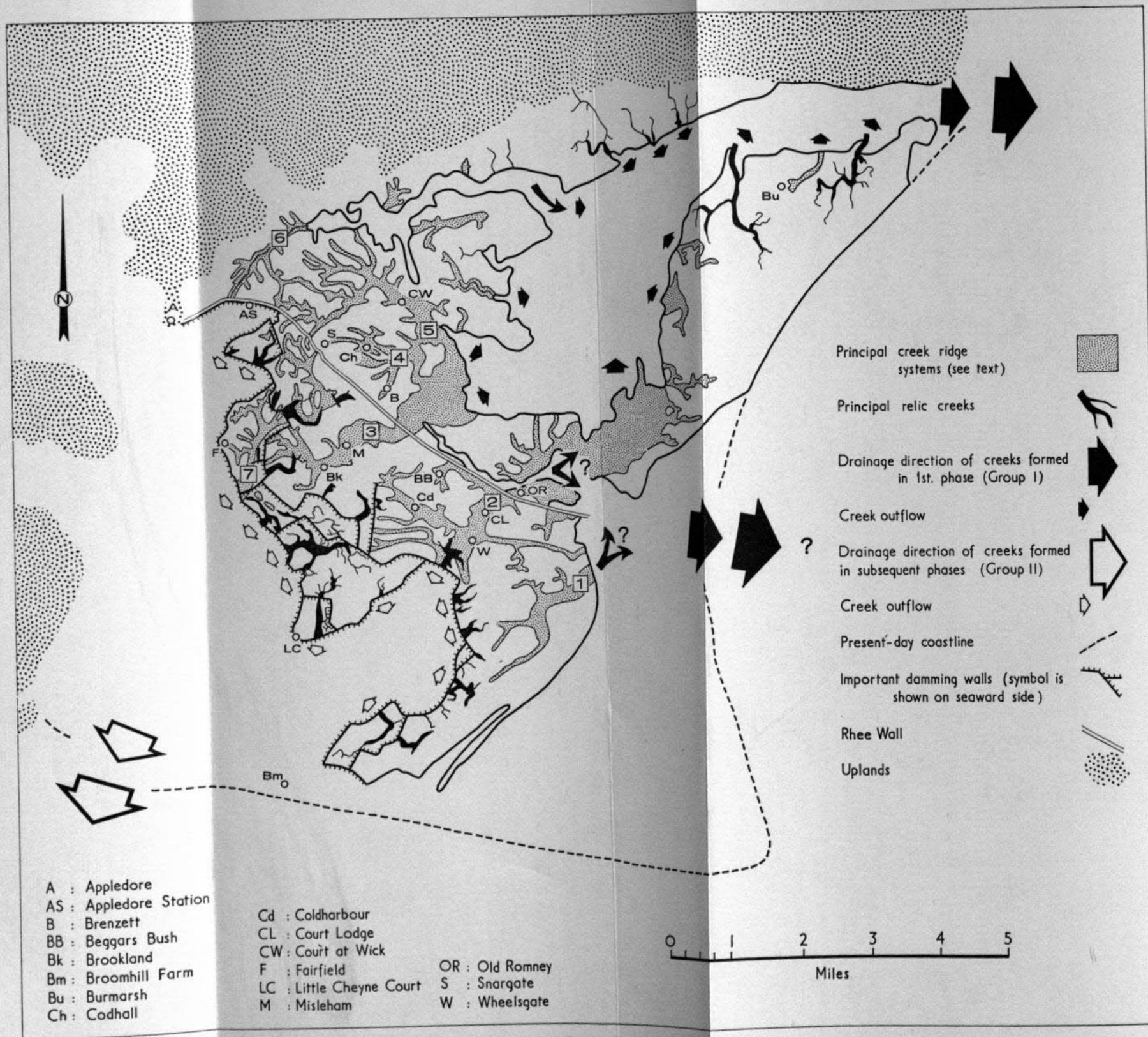


Fig. 14. Original Creeks and Drainage in the Decalcified (Old) Marshland

buried and later changed abruptly, giving strata of sandy loam on clay with abrupt boundaries. They occur in close vertical sequence below transition zones, particularly near eroded edges of the peat (Figs. 13 and 39), and also below many creek ridges with a peat floor (Figs. 18 and 34). Possibly a shingle shoreline initially protected the area from severe flooding while the sea-level was rising but was ultimately breached (Lewis 1932, Gilbert 1933); two distinct transgressive phases may have been involved, however. There was certainly a vigorous transgression phase in the early post-peat period and widespread erosion of creeks in a peat and/or clay-over-peat landscape.

Peat erosion led to the sporadic occurrence of buried, sedimentary peat, either as organic material finely interleaved with mineral material (at about 6 ft in creek ridge sands near Baynham TR 005242) or as more or less rounded hunks (peat pebbles). The latter could be formed only from relatively compact material, and their occurrence indicates erosion from peat which had undergone some drying and shrinkage. Several were observed near Horsebones Farm (TR 027219) in old creek ridge sands.

The pattern of creek relics and ridges shows that creeks in this land type developed at different times, and that renewed flooding disturbed older sediments. Different depositional phases are often seen in vertical section, with the later ones overlying a dark humus-rich zone (p. 115), e.g. bordering creek ridge No. 3 to the north, south and west of Brookland in Fig. 14. Some creeks were clearly oriented towards an outlet south of Hythe and/or between New Romney and Lydd (Group I), whereas others (now low-lying creek relics) drained south-west (Fig. 14). The latter (Group II) all end abruptly against sea walls, some clearly originating through breaching, e.g. near Midley House (TR 017236) and Flats Houses (TR 974247). Others were probably dammed during progressive land enclosure following extensive flooding (see below), but in either case their seaward continuations silted up and were commonly obscured before the next parcel was enclosed. At least two phases of creek development are indicated, particularly near Brookland, where tributary endings of low-lying creek relics oriented to the south-west (Group II) interdigitate with and partly intersect the relatively elevated and fully silted creek ridge No. 3 (in Group I), on which the village is centred. In addition, the dark marker horizon widely present at depth around Brookland has not been encountered in this ridge, and its sandy soils have less calcium carbonate than those of similar texture on neighbouring ridges oriented south-west. These characteristics show that creek ridge No. 3, and presumably others of similar type and orientation, developed first. Their formation and the settlement of the land concerned may be dated from an excavation near Jesson Farm in St. Mary-in-the-Marsh (TR 082276), which revealed 1st century B.C. or early 1st century A.D. pottery* associated with an old surface buried by 3 ft of loamy deposits (Green and Askew 1960). A similar disturbed horizon, commonly corresponding to the surface of the relatively finer textured deposits, occurs widely hereabouts, particularly towards the coast. At one site (TR 079276) this was interrupted and its edge clearly overlain by loams and sands of a minor creek ridge (p. 113 and Fig. 40), showing that infilling of Group I creeks and perhaps their formation had not occurred by early Roman times. The C^{14} content of shells buried in the sands

* The material was kindly identified by J. W. Brailsford of the British Museum as part of a Belgic or Romano-Belgic cooking or store jar.

of creek ridge No. 2, south-west of Old Romney (Smart 1964), indicates that infilling was well advanced by late Roman times.* It is likely that early creek formation and infilling in Romney Marsh were similar to those in the island of Walcheren, Holland, where two early transgression phases are recognized. There, Roman settlement on the clayey banks of early tidal channels in a peat landscape was followed by a vigorous transgression towards the end of the 3rd century when new channels developed which were subsequently infilled (Edelman 1950, p. 95).

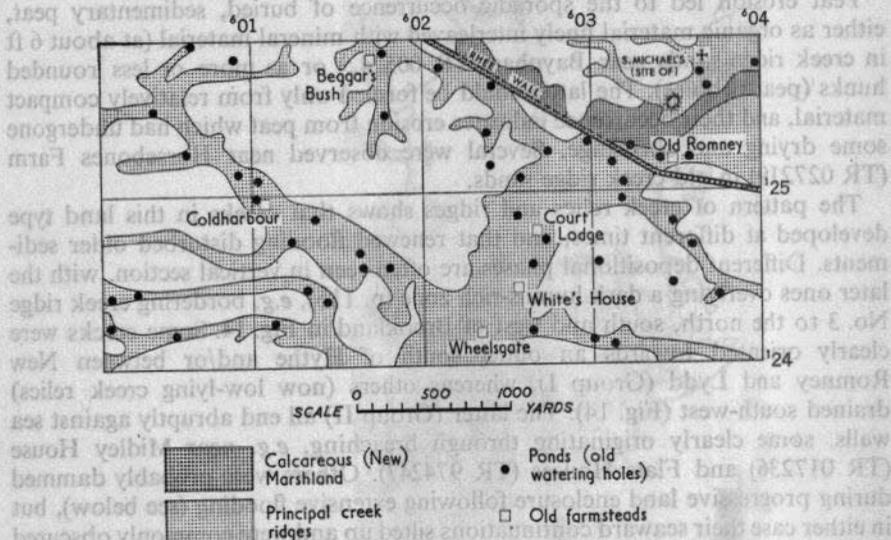


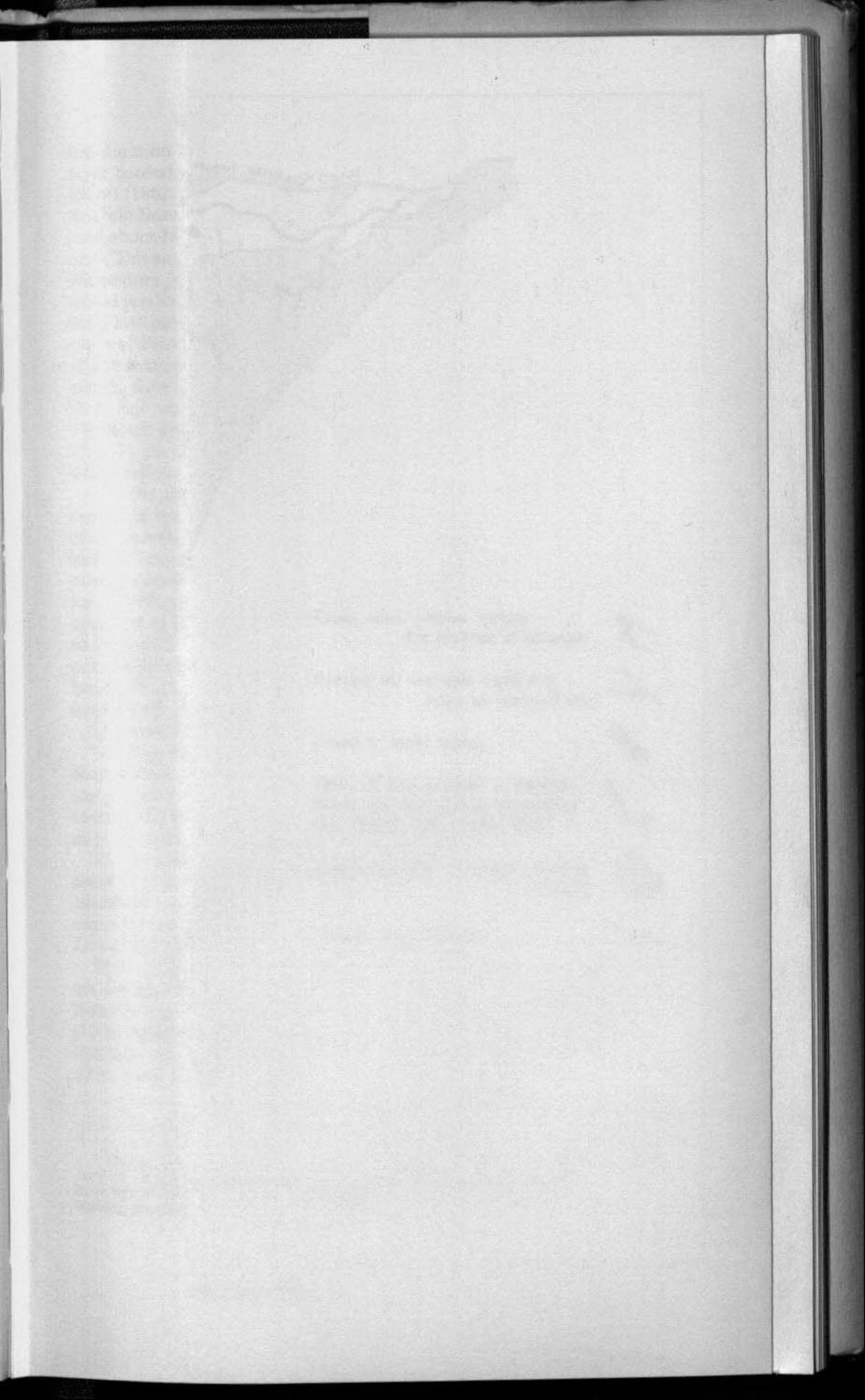
Fig. 15. Distribution of old buildings and watering holes in the Decalcified (Old) Marshland near Old Romney

These early creek infillings were settled by the 9th century, since an old farmhouse called Misleham on creek ridge No. 3 (TQ 995264), has been identified by Wallenberg (1931) as the Mistanham mentioned in a charter of A.D. 832. The correlation between creek ridges and old buildings, e.g. farmhouses such as Codhall and Coldharbour, and the churches at Snargate (*Plate IVb*), Brenzett, Brookland † and Old Romney (Fig. 15), indicates that such sites were high and dry long ago, and many creek infillings had probably emerged as ridges by Saxon times. Saxon settlement of land in Romney Marsh proper is also associated with other creek ridges in Group I. Thus, land near Sellinge Farm (TR 086293) has changed little since A.D. 700 (Ward 1936), and parts of Burmarsh are referred to in charters of A.D. 850 and A.D. 946 (Ward 1933a). Holloway (1849) believed that Orgerswick (Ogarswick TR 084306 and Orgarswick Farm TR 090309) existed in A.D. 791.

There is little direct evidence for either the formation of the Group II creeks or

* These shells, collected near Wheelsgate (TR 025237), were dated A.D. 400 ± 120 years.

† Brookland Church appears to be built near the margin of a creek ridge, its south side on a transition zone where continuing peat shrinkage probably brought about subsidence which has damaged that side of the building.



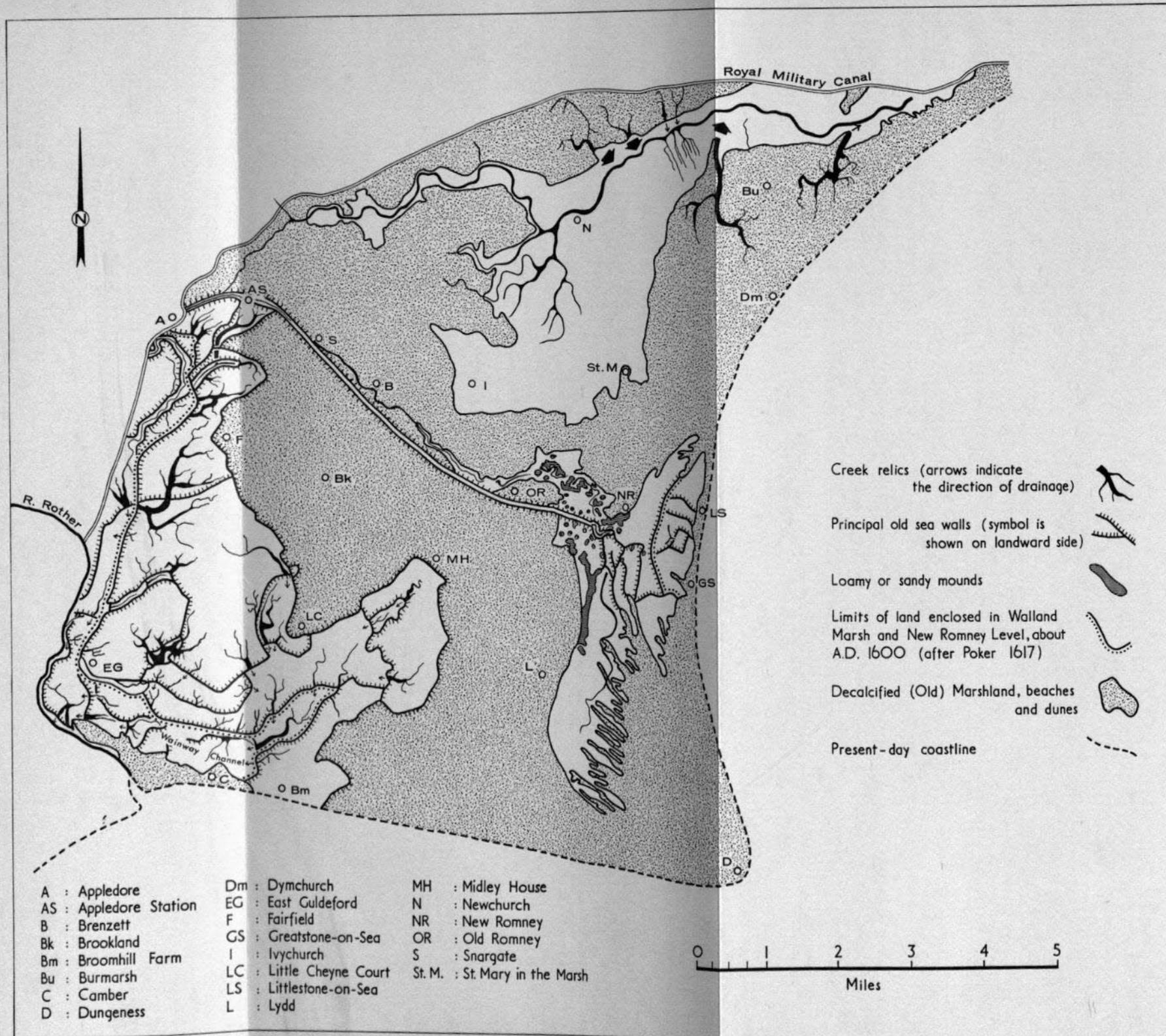


Fig. 16. Original Drainage, Walls and Mounds of the Calcareous (New) Marshland

the duration of the phase of deposition which has buried the dark, organic layer bordering creek ridge No. 3 to the north, south and west of Brookland. Elliott (1862) quotes the earliest reference to inning in the Marsh, concerning Baldwin Scadaway to whom "Wilbert, a prior, gave about A.D. 1150, as much land about Mistelham in the Marsh, as he could inne at his own cost against the sea". This suggests that Misleham, sited on creek ridge No. 3 and existing in the 9th century, was bordered by flooded land early in the 12th century. Inversion would render the original pools progressively more vulnerable to flooding, and these may have been widely suitable for enclosure or re-enclosure about the 12th century. Teichman Derville (1936) refers to a record of 1292 in which the tenants of Fairfield and Brookland were called upon to maintain the sea defence of their marsh, wording which suggests that the wall referred to was no farther east than that which separates this land from the Calcareous (New) Marshland. The latter wall was obviously breached west of Brookland and elsewhere (pp. 116-17), probably during or shortly after the stormy 13th century, records of which follow:

"On the first day of October, 1250, the moon upon her change, appearing exceeding red and swelled, began to show tokens of the great tempest of wind that followed, which was so huge and mighty both by land and sea, that the like had not been known, by men then alive. The sea, forced contrary to his natural course, flowed twice without ebbing, yielding such a roaring, that the same was heard (with great wonder) a far distance from the shore. Moreover, the same sea appeared in the dark of the night to burn as it had been on fire, and the waves to strive and fight together after a marvellous sort, so that the mariners could not devise how to save their ships where they lay at anchor. At Winchelsey, besides other hurt that was done in bridges, mills and banks, there were 300 houses and some churches drowned with the high rising of the water."

This evidently paved the way for more widespread inundation:

"And in the year 1286, on the nones of February, the sea in the Marsh of Romney rose or swelled so high that it broke all the walls and drowned all the grounds; so that from the great wall of Appledore as far as Winchelsey,* towards the south and west, all the land lay under water, lost" (Holloway 1849, p. 68, quoting Holinshed).

This drastic flooding is thought to have initiated the development of the Land Type with Common Creek Relics (p. 32). Some innings in the Decalcified Marshland include land like the younger marshland, e.g. the Indraft Innings east of Water House (p. 117), suggesting comparatively late flooding and that Group II creeks developed at different times.

West of the Rhee Wall between Snargate and Old Romney certain features are linked with or have names corresponding to 12th and 13th century Archbishops, e.g. St. Thomas's Innings, Peckham's Wall, Baldwin's Sewer. Elliott (1862) mapped and dated four innings on this basis, but it is unlikely that all this land was newly won from the sea or first settled during the period, 1162-1270, when these Archbishops held office.

* This is Old Winchelsea, which possibly stood on an ancient shingle spit seaward of Rye harbour (Elliott 1847, Lewin 1862). A beach, similar to that on which Lydd stands, may once have formed part of an extensive sea defence line to the south-west of Romney Marsh, which, wasting progressively through easterly drift, was ultimately overwhelmed.

CALCAREOUS (NEW) MARSHLAND

There are three largely independent areas of New Marshland, each having common boundaries with the beaches and the Old Marshland. The central part of Romney Marsh proper and the north and west sides of Walland Marsh are distinct land types, but the third region, covering most of Denge Marsh and New Romney Level, with a connecting tongue of land narrowing towards Old Romney, Brenzett and Snargate, comprises three land types (Fig. 10). The long narrow tract of the Rhee Wall system is similar and links two regions, but is highly artificial and needs separate consideration. The character and clarity of boundaries with the Old Marshland differ appreciably and are described after an account of each of the six land types recognized.

Land Type with Common Creek Relics

This marshland, stretching south-west of Appledore, Fairfield, Little Cheyne Court and Newland across to Rye, comprises a number of innings (Fig. 16), each having a characteristic land form related to well-preserved relics of the original natural drainage system. Relics of trunk creeks or old river courses, up to 100 yds wide, and often with low swampy areas, are typically fringed by high, sandy to loamy levee-like ridges of similar or greater width, grading in turn to finer textured pools 2-4 ft lower. Good examples occur near Willow Farm (TQ 950250) and north of Beachfield (TQ 952215), where the relic trunk creeks, at about 3-5 ft O.D., are bordered by levees which rise locally to 9-10 ft O.D. There are also levees along ramifying distributaries, becoming progressively smaller and of finer texture until finally the channels continue across the pools as narrow, meandering depressions (Fig. 17).

The abrupt termination of creek relics against old sea walls indicates the damming of creeks by man before silting had ceased. The repetitive land form is due to systematic enclosure, although a few creek systems may have developed after wall breaching. Silting naturally continued to seaward after each enclosure, in some instances obliterating the original trunk creeks, *e.g.* north of Willow Farm (TQ 958240), but the course of such features is usually still evident from the distribution of the sandiest deposits and/or by a narrow channel, a relic distributary of the creek system which served the succeeding enclosure, as near Chittenden's Cottage in the Wainway Creek (TQ 974194). The various features mentioned reveal the original overall natural drainage of this land type and also outline the course of progressive enclosure (Fig. 16).

These relic creeks and the associated levee systems generally developed in the manner described (p. 8); some wide creeks silted up almost completely with sandy materials, *e.g.* the Wainway Creek, and low creek ridges occur locally, particularly between New Cheyne Court (TQ 979237), New Building (TQ 963246) and Great Cheyne Court (TQ 968228). They are the finer ramifications of several interfingering systems. Along the centre of some ridges there is a narrow shallow depression a foot or two higher than the adjacent pools, a relic of the final creek. Thick peat about 6 ft below the pools and about twice as deep under the loamy ridge crest (at TQ 963239) indicates a filled-in creek in peat and ridge development by inversion; other pools with peat at similar depths (Fig. 6) have probably subsided similarly. The post-peat deposits in this area were probably laid down in two phases (Smart 1966a), the last burying an Old



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Plate V. Oblique view near Lydd looking north-east towards the coast at Littlestone and Greatstone. The farm in the foreground is on Beach Bank soils and the shingle ridge continues north-east to the Lydd-New Romney road.



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Plate VI. Romney Marsh proper north of Burmarsh with Lower Wall Road crossing east-west. (Scale approx. 1 : 10,000)



Reproduced by permission of the Kent County Council from a photograph by Hunting Surveys Ltd.
Plate VII. The Rother valley and adjacent uplands south-west of Newenden (TQ 83273). The meandering course of the embanked river is very similar to that of Lower Wall Road. (Scale approx. 1 : 10,000)



Reproduced by permission of the Kent County Council from a photograph by Hunting Surveys Ltd.

Plate VIII. Walland Marsh east of Camber. The pattern of walls and scour holes at Sandy land pits (south-east of centre) is the result of recurrent wall breaching. Part of the silted Wainway Channel occurs to the north-west. A narrow shingle ridge with shallow droughty Beach Bank soils runs diagonally from north-east to south-west.

Marshland surface already partially compacted, and the correspondence of a loamy creek ridge with a channel in the peat suggests that creek systems often coincided.

Following enclosure, many creeks, particularly the trunks, were adapted to serve land drainage (*Plates IIa and VIII*). Drainage water, gravitating to them, carried sediments from adjacent parts to form the deposits of their wide flat floors (Fig. 17). The texture of the infilling varies, often corresponding to that of the dominant deposit in the innings concerned, e.g. relic creek beds in the

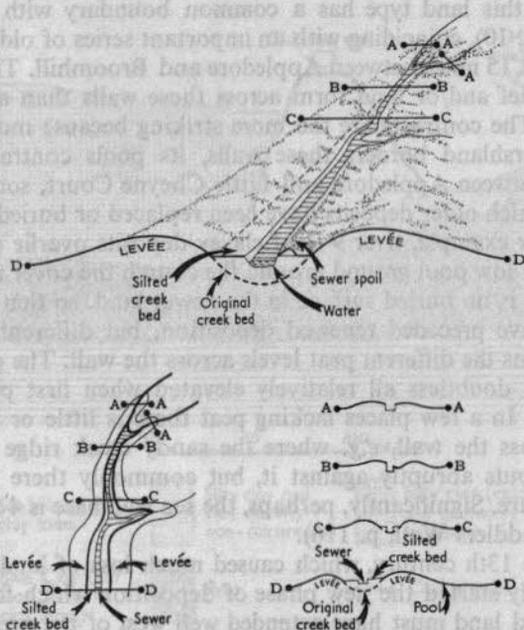


Fig. 17. Sketch-section of a relic creek and associated features

Wainway Creek are mostly loamy or sandy, whereas those immediately north of the Wainway Wall are finer. Nearly all trunk creeks contain a main sewer, but drainage is sometimes in the opposite direction to that of the original creek, e.g. the Guldeford Sewer, which takes water north to the Union Channel along the low trunk creek north of Beachfield (TQ 952215).

Some channels mark former river courses or tributary creeks, particularly between Appledore and Rye, where the Highknock Channel, from the Royal Military Canal (at TQ 952285) to the Kent Ditch, follows an old course of the Rother when it flowed north of the Isle of Oxney. According to Homan (1938), the river meandered on southward in the 13th century, joining the rivers Tillingham and Brede at the harbour of Old Winchelsea between Camber and Broomhill (Fig. 9), but later it flowed to Rye in or close to its present course, e.g. a channel system between Rye and East Guldeford defines a relatively late meander. These areas, together with the Wainway Channel, are the youngest in Walland Marsh, and are shown as a wide estuary on Poker's map of 1617 (*Plate X*). At that time the eastern shoreline at East Guldeford was clearly the

shingle ridge between Salts Farm (TQ 935214) and Beachfield (TQ 948208), its eastern end forming the northern shore of the Wainway Channel. The estuary narrowed towards Appledore, and reclaimed land on its eastern bank was defined by a wall bordering the Five Watering Sewer as far as Becket's Bridge (TQ 960271) and thereafter by the zigzagging wall carrying the road to Appledore. These very young lands lie comparatively high, with levels often between 10 and 12 ft O.D., possibly due to a higher sea-level and/or mature silting. The greater height of the pools relative to those of older innings is perhaps also due to lack of differential subsidence.

To the east, this land type has a common boundary with the Decalcified Marshland (Fig. 10), coinciding with an important series of old sea walls which zigzag for about 15 miles between Appledore and Broomhill. There are sharper contrasts in relief and/or land form across these walls than across any other in the Marsh. The contrasts are the more striking because most of the lowest Decalcified Marshland borders these walls, its pools contrasting with land 3-8 ft higher between Appledore and Little Cheyne Court, some indication of the extent to which older deposits have been replaced or buried by recent ones. At Fairfield, for example, over 9 ft of clayey deposits overlie peat west of the wall, whereas in low pool ground around the church the cover is only 2 ft thick (Fig. 18). There is no buried surface in the newer land, so that erosion or peat digging may have preceded renewed deposition, but differential compression probably explains the different peat levels across the wall. The older marshland hereabouts was doubtless all relatively elevated when first protected by sea walls (p. 116).* In a few places lacking peat there is little or no difference in land levels across the wall, e.g. where the sandy creek ridge at Dean Court (TQ 970255) abuts abruptly against it, but commonly there is then a sharp contrast in texture. Significantly, perhaps, the sea wall here is 4 ft higher than at Fairfield (cp. Saddlers Wall, p. 116).

Floods of the 13th century, which caused much loss of land near Old Winchelsea, probably started the new phase of deposition which formed this land type. Established land must have extended well west of the present Decalcified Marshland, although it is not certain whether it was enclosed or how it was protected. There may have been a natural sea defence far to the south-west which was breached when Old Winchelsea was swept away. Discussing records of frequent breaches of the great wall of Appledore and the need for repair, Teichman Derville (1936) suggests that it was the western boundary of the Marsh in the 13th century. The important wall referred to in the last paragraph was obviously breached in places (pp. 116-17) and is probably part or a continuation of the original great wall. Its zigzag course, particularly between Fairfield and Appledore, suggests unsuccessful endeavours to create or maintain a straighter defence line, and parts of an original wall may have been totally swept away or buried. Thus it is interesting that parts of the western side of the small Indraft Innings east of Water House (TQ 972285) are similar to the adjoining Calcareous Marshland, suggesting that flooding, possibly from a breach in the west beyond its borders, was arrested before the character of the whole tract was completely altered (p. 117). As shown in Fig. 18, deposits overlying peat are often 6 ft

* Although situated on a very minor creek ridge, Fairfield Church is only at about 5 ft O.D., and in spite of much improved drainage by pumping, the ground is still commonly flooded in very wet seasons. It is unlikely that this land was so low when the church was founded.

thicker west of the wall. This amount of additional fine silt indicates as much as several hundred years* of deposition before enclosure of the new land.

Excepting the Wainway Channel and a wide tract bordering the Rother referred to earlier, all this land was evidently enclosed by A.D. 1600 (Elliott 1862, Holloway 1849).

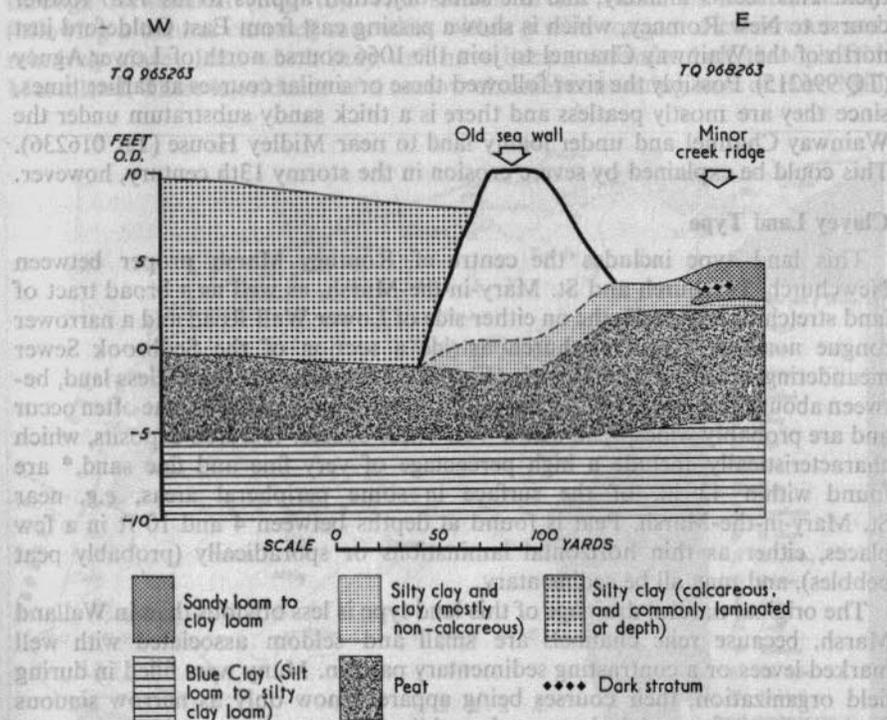


Fig. 18. Land levels and deposit thicknesses at Fairfield

Elliott's belief that the river Rother flowed through the south-west part of Walland Marsh in the 11th century (Elliott 1862, 1874) was evidently founded on at least one of the relic trunk creeks (at TQ 981236) in this marshland.† He states (1862): "There is at the present day a succession of 'fleets', cut off from each other by a series of embankments for innings, but sufficiently continuous and connected to show that at one time they formed the bed of the then river from Appledore to Fairfield and Midley, and thence to the haven at Romney. These 'fleets' . . . lie west of the Great Wall shutting in Peckham's, St. Thomas's, Baldwin's and Boniface's Innings." According to evidence discussed above,

* Amounts of accretion in 45 months at Scott Head, Norfolk, averaged just over 3 cm on young low marshes and less than 1 cm on high old marshes (Steers 1964). For the North Kent Marshes, believed to be undergoing subsidence, Evans (1954) deduced that between A.D. 1000 and 1950 between 8 and 10 ft of silt had been deposited, giving a rate of 10.1-12.4 in. per century.

† The widely reproduced map of 1862 shows a generalized channel between Appledore and New Romney, but that of 1874 is more detailed, portraying river courses in 1066, 1287 and after 1636.

however, the present landscape was not initiated until the 13th century, and as an appreciable interval would be necessary before enclosure began, the creeks may be quite unrelated to earlier watercourses. If they coincided, Elliott's belief that they marked the course of the Rother to New Romney in 1066 probably also requires that the trunk creeks (Numbers 1 or 2 in Fig. 14) remained open then. This seems unlikely, and the same objection applies to his 1287 Rother course to New Romney, which is shown passing east from East Guldeford just north of the Wainway Channel to join the 1066 course north of Lower Agney (TQ 996215). Possibly the river followed these or similar courses at earlier times, since they are mostly peatless and there is a thick sandy substratum under the Wainway Channel and under loamy land to near Midley House (TR 016236). This could be explained by severe erosion in the stormy 13th century, however.

Clayey Land Type

This land type includes the centre of Romney Marsh proper between Newchurch, Ivychurch and St. Mary-in-the-Marsh, as well as a broad tract of land stretching east to Hythe on either side of Lower Wall Road and a narrower tongue north-west of Newchurch astride a section of the Sedbrook Sewer meandering nearly to The Dowels (Fig. 10). This relatively featureless land, between about 7 and 10 ft O.D., is clayey, but silty to fine sandy laminae often occur and are probably widespread below 4 ft. These coarser textured deposits, which characteristically include a high percentage of very fine and fine sand,* are found within 42 in. of the surface in some peripheral areas, e.g. near St. Mary-in-the-Marsh. Peat is found at depths between 4 and 10 ft in a few places, either as thin horizontal laminations or sporadically (probably peat pebbles), and may all be sedimentary.

The original natural drainage of this land type is less obvious than in Walland Marsh, because relic channels are small and seldom associated with well marked levees or a contrasting sedimentary pattern. Many were filled in during field organization, their courses being apparent now only as narrow sinuous depressions, or on aerial photographs, while others are preserved as sewers, or their banks used as tracks and roads. Locally a few are associated with loamy or sandy deposits; several patches parallel to Lower Wall Road may once have fringed the south side of a wide channel. The complex of narrow meandering courses, with mainly clayey superficial deposits, indicates advanced silting under relatively quiet conditions, possibly in a former sea inlet or estuary.

Some channels, inferred from meandering sewers and/or roads (Fig. 16), are particularly interesting, as, for example, that between Sherlock's Bridge (TR 071329) and Botolph's Bridge (TR 121335). Between these points Lower Wall Road is associated with a low narrow ridge with a remarkably sinuous form, the relationship of road to ridge changing from one part to another.† It is uncertain whether this feature is a creek ridge because no peat has been found under the adjacent ground and there is little texture contrast in the sediments to at least 4 ft, but its form clearly suggests a natural origin and there can be little doubt of a former association with a watercourse. From the name of the associated road, Lower Wall, and the fact that at one time it coincided with parts of the

* Where such materials occur below the water table in the Marsh they are termed "running sands", because it is difficult to maintain the sides of a deep hole or trench.

† On the soil map the ridge more or less corresponds with the moderately well drained phase of the Newchurch-Walland complex.

boundaries of seven parishes (Fig. 19), it is likely that this was an important feature in the landscape; probably the road conforms closely to the final channel, and in part follows a bordering wall.

Another important channel coincides with the Sedbrook Sewer south of Ruckinge and is linked to Lower Wall Road by a course following the road through Newchurch (Fig. 16). This section of the Sedbrook Sewer, clearly following a natural channel, meanders within a wide tongue of calcareous and relatively clayey land which may well have been a meander belt through Old Marshland. There is evidence of a narrow channel continuing west of Ham Mill



Fig. 19. Parish Boundaries on the Tithe Survey Map of 1816

Green (TR 002316), partly associated with more loamy deposits, which has a meandering form very similar to Lower Wall Road. This continues right across to The Dowels, conforming there to a section of the Blackman's arm of the Springbrook Sewer as far as the Rhee Wall. Here, the relic channel is increasingly associated with a well developed creek ridge, and for this and other reasons is included in the Decalcified Marshland (pp. 107-109).

The linked channel and associated creek ridges described could be relics of the river Limen's course between the Rhee Wall and West Hythe (Green and Askew 1959, p. 25). The location of such a river, presumably part of the Rother, has been debated by many earlier writers and its existence questioned (Holmes 1907, Steers 1964). Neither Elliott (1852), a drainage engineer, nor Topley (1875), a geologist, found any clear topographical evidence of a river course across the northern part of Romney Marsh proper. Elliott (1862, p. cviii) regarded the various meandering channels as relic sea creeks, and gave levelling

data confirming that The Dowels is lower than land farther east. He over-emphasized the difference, however, ignoring the relatively high creek ridge associated with Blackman's arm of the Speringbrook Sewer. When allowance is made for land subsidence due to peat shrinkage in The Dowels, of which Elliott was unaware, there is little difficulty on this point. Saxon charter evidence discussed in Holmes (1907) and extended by Ward (1931b, 1933a and b) reputedly refers to the river Limen passing south of Kit's Bridge (TR 017325) and Warehorne (A.D. 724 and 820, respectively), north of Burmarsh (A.D. 850) and south of the small patch of sand dunes south-east of Stutfall Castle (A.D. 833), which agrees with the channel relics shown in Fig. 16. A Saxon chronicle quoted by Lambard (1576) provides further evidence, referring to an incursion by the Danes in A.D. 893, who, with 250 vessels, "sailed into the mouth of the river Limen, in Kent, which floweth from the great wood that is called Andred; thence they towed up their boats four miles into that wood from the mouth of the river. . . ." Taking a point north-west of Newchurch as the mouth of the river, the course thereon fits the distance given to the great wood, although, following Somner (1693), many writers believed the fleet entered an arm of the sea between Lydd and New Romney towards which the Limen was directed along the Rhee channel. Holloway (1849) doubted this, however, and, although perplexed by the even greater distance from West Hythe to Appledore, or Kenardington, clearly felt such a course to be a strong possibility. It is considered that the various features described above support the charter evidence of the existence of an artificially influenced, well-silted river course directed towards the east, and this perhaps receives additional support from the existing walled section of the Rother west of Newenden Bridge which has a meandering course very similar to that of Lower Wall Road (cp. *Plates VI and VII*).

Historical records of this creek or river course across the north of Romney Marsh indicate the end of the 9th century as the earliest time for the complete enclosure of this land type and also indicate that little or no inversion had then occurred in The Dowels. Enclosure was presumably well advanced or complete shortly after this, however, as Newchurch, Eastbridge and Iychurch all appear in Domesday Book (Wallenberg 1931), but it may have required little effort if the beach north-east of Dymchurch was then extending towards Hythe. Final exclusion of the sea by or before the 11th century, however, means that other areas of the Calcareous Marshland, and possibly all that of Walland Marsh, were enclosed later (p. 32). Differences in age are less evident in Romney Marsh proper than in Walland Marsh with its sea walls and associated topographic differences.*

The boundary drawn between this land type and the Decalcified Marshland is not everywhere a definite shoreline (p. 114), but there is good evidence of their different ages, *i.e.* land with abruptly terminating, sandy to loamy, levees or creek ridges surrounds dominantly fine textured land with few distinct features apart from the narrow creek bed deposits. They also differ in calcium carbonate content. There is historical corroboration of the relative youth of this land compared with adjacent parts of Romney Marsh proper. Ward (1936) deduces from a Saxon charter that land near Sellinge Farm (TR 086293) has changed

* A distinct change in level, noticeable in the road south of Oak Farm, does occur north of Newchurch, where the New Marshland is appreciably lower for about half a mile, mostly east of the point mentioned.

little since A.D. 700, thus distinguishing it from parts farther north and north-west through which he believed the river Limen flowed until much later. He also considered that the river formed the northern boundary of Burmarsh in A.D. 850 (Ward 1933a). Holloway (1849) refers to evidence that the Manor of Ogerswick (p. 28) was acquired by Christ Church, Canterbury, in A.D. 791, and considers the name *wic* signifies a place on the seashore or the bank of a river. Also on an old map of the Marsh in 1623 (Meryon 1845) the Rhee Wall is marked and Romney Marsh proper includes a large area, narrowing towards Hythe, labelled "Estuary in 894". Finally, the parish boundaries of Newchurch in the Tithe Survey of 1816 almost entirely enclose New Marshland as here defined (cp. Figs. 16 and 19).

The sandy and loamy creek ridges and levees of the adjacent land type appear to be truncated and disturbed remnants of a drainage system directed to an old estuary or arm of the sea (Fig. 14) which formed a nucleus for the later development of the Clayey Land Type.

Rhee Wall Land Type

This land type comprises a relatively high and narrow tract enclosed by two more or less parallel earthen walls, known as the Rhee Wall, which between them carry the main road for 7 miles between Appledore and New Romney.

Between Snargate and New Romney it is about 50 yds wide and, apart from slight directional changes at Old Romney and Hammond's Corner (TR 052246), is nearly straight. It widens north-west of Snargate and curves westward towards Appledore, both walls having irregularities suggesting they enclosed a meandering channel. The whole system was clearly designed to channel water, and the straight section is completely artificial. All authorities agree that formerly it canalized the Rother, or part of it, to New Romney.

The Rhee channel finally silted up higher than the land on either side, but although it has been partly levelled and disturbed, there is evidence of a land form corresponding to the Land Type with Common Creek Relics. A relic channel, now dry and commonly occupied by a fence or hedge, is still clearly evident between Appledore and Snargate, meandering widely within the confined limits and with distinct levees of clay loam texture. Loam deposits also occur towards New Romney, corresponding more to the adjacent New Marshland of Denge Marsh and New Romney Level, but deposits are otherwise clayey throughout.

Between the Royal Military Canal and a point just beyond Appledore station the Rhee Wall was once a part of a significant sea defence system, although this may have been accidental (p. 32). Less significant depositional contrasts occur across the Wall between Snargate and Brenzett and near Vine Cottage, Old Romney (p. 42).

The importance of part of the Rhee Wall as a boundary and its remarkably straight course presumably fostered the idea that it was built by the Romans to enclose Romney Marsh proper when a naturally defensive shingle ridge stretched from New Romney nearly to Hythe (Elliott 1847). Supporting evidence was seen in the writings of Tacitus, wherein a British chief complained that the Romans wore out and consumed their bodies and hands in clearing the woods and banking the fens (Dugdale 1662), and the idea gained common acceptance after Roman relics were found at Dymchurch. Elliott (1852) furthered the belief by correlating relatively low land near Appledore with the Roman mouth

of the Limen, and in explanation of the Rhee channel, supposed that "in erecting this wall it became necessary to provide some exit for the water from the hills as well as the drainage of the land enclosed". The low land in question is evidently The Dowels, but Elliott was unfortunately unaware of the phenomenon of peat shrinkage and that these parts were relatively elevated until much later than Roman times. Ward suggested that the Limen flowed to Lympe until at least A.D. 850, and, seeing no indication of a course through the Rhee Wall, assumed that it must be much younger.* He also argued (1940) that all Romney Marsh was old, settled country and good agricultural land during Saxon times, and that the very oldest place names, those ending in *-ham*, are scattered impartially on either side of the wall.

Excepting the section between Appledore and Snargate, the Rhee Wall is not the depositional boundary between Romney Marsh proper and Walland Marsh that would be expected if it had been constructed in Roman times, since it passes across both Old and New Marshland between Old and New Romney. Further, at Old Romney it crosses a trunk creek ridge, and radiocarbon dating of shells in the sands here rules out Roman construction, because the creek was still silting in very late Roman times (Smart 1964).

Elliott (1862, 1874) assumed the Rhee Wall formed a baseline for a series of innings in Walland Marsh between A.D. 1162 and 1270, but no obvious walls abut against it in the positions he indicated. One alleged wall (a track south of Finn Farm) is aligned with a short wall in Romney Marsh proper which joins another, possibly older than the Rhee Wall, at Owen's Bridge (TR 015267), but this cross wall is not necessarily connected with enclosures to the west. A wall remnant near Coldharbour Bridge (TR 018245) appears to be part of another wall of Elliott's "St. Thomas's Innings", but the name Millbank Lane is the only remaining evidence that this extended to the Rhee Wall at Old Romney as he suggests, and this does not necessarily mean that it was a wall.

The existence of most of the Rhee Wall system at the end of the 13th century follows from a Patent Roll of 1257. This records the diversion of the river of Newenden (the Rother) from its ancient course to the detriment of the Port of Rumenale (normally assumed to be New Romney not Old Romney†) and continues with details of a plan for saving the port by making "a certain new course . . . according to the ancient course . . .". Many other writers, e.g. Holloway (1849), have also assumed this record concerned the Rhee Wall system; there is no other known plan for a watercourse linking the places mentioned, Appledore, Snargate and Romney, and between the latter places the wall is artificial. Evidence that the ancient course conformed to the Rhee Wall between Appledore and Old Romney in 1257 and that the new course planned was later constructed from there to New Romney is considered in the next section.

A record of 1337 (Holloway 1849) speaks of "an ancient trench leading from an arm of the sea called Appledore towards the town of Romney . . . which was

* Elliott's claim that Roman relics occur extensively east of the Rhee Wall (Elliott 1862) does not appear well documented and, excepting finds near Dymchurch and Stutfall Castle (the latter on the hill slopes below Lympe), authentic *in situ* identification appears rare. Miscellaneous shards collected north of Gribble House (TR 018314) proved to be medieval (priv. comm. J. W. Brailsford).

† The record speaks of the town of Rumenale and the Port of Rumenale, the former possibly referring to Old Romney and the latter to New Romney.

newly obstructed by sands" and "that there was a certain other trench . . . lately made by the force of the sea, by which boats and ships might pass as they had wont to do by the other, before it was filled up". The width cited for the old trench (66 yds by the 20 ft perch—see Teichman Derville 1936, p. 8) is of the right order for the Rhee Wall, but the length (2.7 miles) can only be a section of it, probably near Appledore (Elliott 1862).

The first actual reference to "Rhee" appears in a record of 1384 which speaks of the "Wall of the Re" as a boundary (Robertson 1880), and thereafter there are several records of "digging in the Ree", until finally, in 1562, "the lande betwene the walles" was granted to New Romney.

Land Type with Mounds

This mainly loamy land, to the west and south of New Romney (Fig. 16), includes an arc of low mounds from The Poplars (TR 045257) in the west nearly to Jack's Court (TR 052217) in the south. Rising locally to about 14 ft O.D., these form some of the highest marshland, higher than either the adjacent Land Type with Creek Ridges or the shingle ridge along the Lydd to New Romney road. West of New Romney the mounds commonly have a steep side resulting from undercutting by former meanders, the dry relics of which still remain, some coinciding with parish boundaries (cp. Fig. 19 and the soil map). Deposits of clay loam texture are common between the mounds, and similar calcareous loams occur in flat land south-west of The Poplars towards and past Old Romney Church. This part also includes remnants of meandering natural channels and one, now part of the New Sewer, continues on through Brenzett to Snargate, where, with a narrow zone of calcareous deposit alongside, it meets the Rhee Wall where this changes from a straight and artificial feature to a meandering one (Fig. 20 and see below).

The form and grain of this land is different from that of the adjacent Old Marshland, and deposits of varied calcium carbonate content are closely juxtaposed. A shingle spit separates them along part of the Lydd to New Romney road, and in other places the boundary follows old sea walls, as along the road between New Romney and The Homestead (TR 055256). Just west of Old Romney the boundaries are the Rhee Wall system on one side and a wall along or near the north bank of the meandering New Sewer on the other. The latter wall is a substantial feature to a point near Owen's Bridge (TR 015267), but the boundary then follows the Sewer on through Brenzett to Snargate. Possibly the wall was lower here (see below), or was excavated later, but the evidence is confused by the presence of a road or track which was probably important before the Rhee Wall was constructed or usable as a more direct route between Snargate and Old Romney.

From the features described it appears that this land type coincided with a natural watercourse through older lands, the arc of banks near New Romney being formed in a sea inlet or estuary and later partially eroded by undercutting. The following quotation from Camden (1586) records that the 13th century storms were important in this locality, and the mounds were probably formed then. Speaking of New Romney, he says: "It is seated on a high hill of gravel and sand, and on the west side had a pretty large haven, that was guarded against most winds before the sea withdrew itself. But in the reign of Edward I, A.D. 1287, when the sea, driven forward by the violence of the winds, overflowed this tract, and for a great way together destroyed men, cattle, and houses, threw

down Promhill, a little populous village, and removed the Rother (which formerly emptied itself into the sea here) out of its channel, stopping up its mouth, and opening for it a nearer passage into the sea by Rhie; then it began by little and

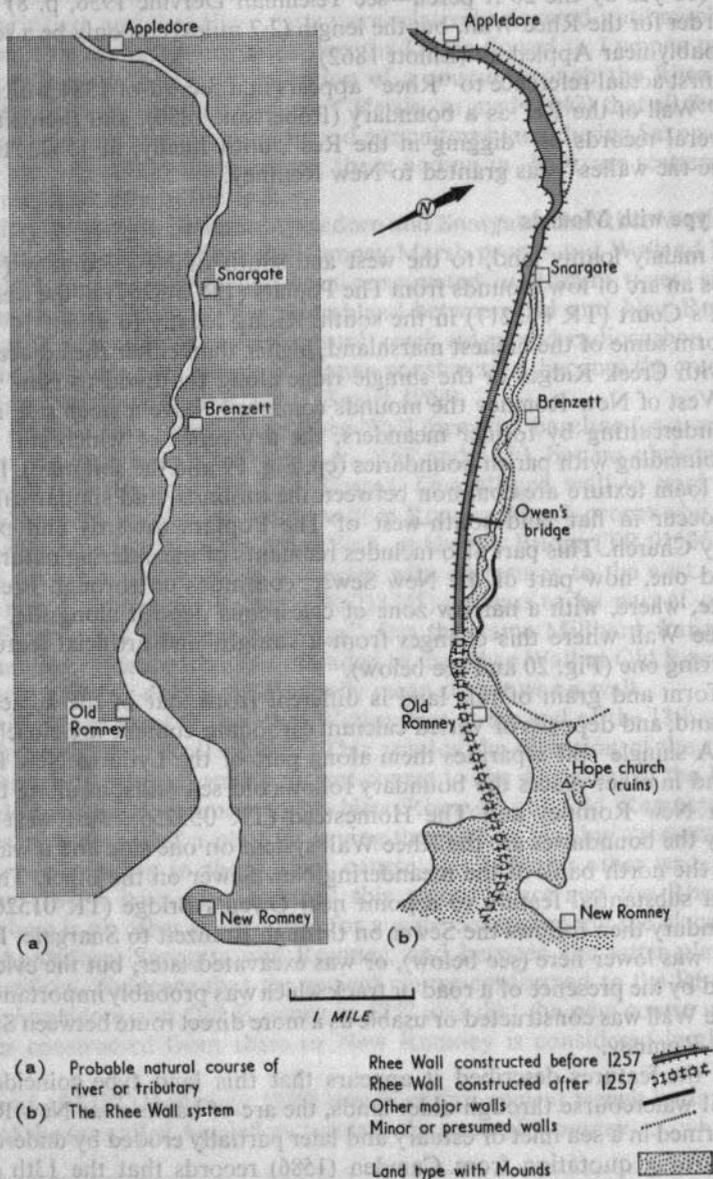


Fig. 20. Natural and artificial watercourses between Appledore and New Romney

little to forsake this town, which has decayed by degrees ever since, and has lost much of its populousness and dignity."

It is also likely that bordering lands were much disturbed at this time, as, for example, near the ruins of Hope Church, which is nearly surrounded by very

uneven land. Trunk Creek Ridge No. 1 is also truncated, suggesting that some of it was eroded and the remainder "sealed off" by the shingle spit now carrying the Lydd to New Romney road.

There is also evidence that this land is relevant to the problem of the much discussed Rother course to New Romney (Green and Askew 1958a, p. 30). Ward (1940) affirms the existence of such a river in A.D. 830, as does Holloway, following Somner, in the latter part of the same century "for we find that a considerable (perhaps the larger) branch of the Limen now flowed in this direction, as it is now first recognised by the name of Rumeneia, that is, the Roman water, from its passing by Roman island, the literal name of Romney". Speaking of the name Romney in the context of the 11th century, Holloway also says, "The inhabitants have a tradition that the old and new town were once connected, and this, I think, was most probably the case, for they both stand on the banks of the Limen, and as the mouth of this river, by deposits of the land and sea, was continually being transferred nearer and nearer to the English Channel, it became necessary that the buildings should follow it, so that the port might be as near to the mouth as possible." Two centuries later the Patent Roll of 1257 records the diversion of a river from Romney, and this led to discussion of its course up to and after that date, although earlier writers appear to have found no evidence of a course in Romney Marsh proper. The question is complicated by the Rhee Wall system because it is generally agreed that this once canalized the river between the salient points. Elliott (1847, 1852, 1862) supposed this to be so in Roman times, but not after the 8th century, when he believed the river followed an oblique, natural course to New Romney from points in Walland Marsh well to the west (p. 34). However, Holloway quoted the Patent Roll as evidence that the river flowed down the Rhee Wall until about 1250, when its main course was altered during one of the storms, and he refers to the Rhee (or River Wall) on the Walland Marsh side and the Marsh Wall on the other. There is clear evidence that the Rhee Wall system remained a functional watercourse after the formation of the mounds near New Romney, as a connected, meandering channel with bordering walls can be discerned at least as far as an artificially steepened mound half a mile south-west of New Romney Church. This extension skirts several mounds, its walling evidently being built during the final silting up and enclosure of the Land Type with Mounds, and it may be the new course referred to in the Patent Roll. From Holloway's interpretation of the landmarks and place names, however, this new course ran "from Old Romney to New Romney and thence out to sea", and if so it must be part of the Rhee Wall system (assuming that this new course was constructed as planned).* Accordingly, the corresponding reach of the old course, known to be close to the planned line of the new one, may reasonably be inferred within the Land Type with Mounds. Its estuary-like form seaward of Old Romney and the various meandering relic channels accord with a river, presumably a Rother tributary, flowing naturally from Snargate to New Romney and, considering

* Elliott (1862) identified the same place names with quite different parts of the Marsh, *i.e.* Aghnepend near Lower Agney (TQ 996215) near the centre of Walland Marsh and two other places being east of Lydd, which "would give a course south-west to north-east from Aghnepend to Romney, and would pass obliquely into the haven of Romney". No obvious channels, either natural or artificial, follow such a line, however, and the nearest relevant features appear to be Trunk Creek Ridges Nos. 1 and 2 (Fig. 14). Either could have carried the river to New Romney when they were open creeks, but they were evidently silting up by late Roman times and inverted and widely settled by the 13th century (pp. 28-29).

the natural aspect of the Rhee Wall system upstream of Snargate, between Appledore and New Romney (Fig. 20). On Holloway's place name evidence the river was evidently artificially channelled to Old Romney by the Rhee Wall before 1257, possibly because land subsidence due to peat shrinkage resulted in flooding near Appledore and Snargate (although most of this movement has probably occurred since). The Patent Roll supports this with its reference to the construction of a sluice gate at Appledore so that "salt water . . . with the recent water of the river may come together by the ancient course into the new course", suggesting that the latter would be served by at least part of an older channel downstream of Appledore. Other evidence is apparent at Old Romney, where the southern boundary of the Land Type with Mounds by Vine Cottage (TR 026255) is a section of the Rhee Wall, suggesting that the latter existed before the sea was shut out from the old haven referred to by Camden. The short substantial cross wall at Owen's Bridge is also about the limit of high walls (Fig. 20), as though it was built and other defences strengthened and heightened to this point to guard against flooding. A low and evidently undisturbed wall in The Dowels close by and parallel to the Rhee Wall (Fig. 20 and p. 108) may also be significant, being possibly part of an earlier river wall (Green and Askew 1958b, p. 25). The importance of the Land Type with Mounds in the 13th century is corroborated by evidence relating to administrative boundaries, particularly those of the so-called Liberties which were circumscribed areas within which certain rights and privileges were granted of old to resident freemen (Teichman Derville 1936). A connection between the Cinque Port Liberty of New Romney and a watercourse to New Romney, or attempts to maintain one, is clearly evident because this Liberty included all the Rhee Wall system (see 6 in. O.S. maps dated 1877). Between New Romney and Appledore the tract comprised little else, but one significant exception occurred just north-west of Old Romney where the Liberty extended to the wall, on the northern bank of the New Sewer, which sharply separates the calcareous Land Type with Mounds from the decalcified Land Type with Creek Ridges. Although modified with changing circumstances, the Liberty boundaries originate from the 13th century (see Teichman Derville), so that this coincidence with land type boundaries suggests the existence near Old Romney of a distinctive landscape feature of importance to New Romney, like the bank or bordering wall of an old river course or estuary. The same line marks the old boundary between New Romney and Old Romney parishes (cp. Figs. 10 and 19), the former also adjoining the one time parish of Hope along the line of the meandering channel relic south of Hope Church, thus showing the importance to New Romney of the old watercourse.

Land Type with Shingle Banks

This land type, consisting of finger-like banks of shingle separated by lows with thick alluvium, lies along the north-west margin of Denge Beach, with a similar smaller area south-west of the shingle and blown sand of The Warren (Fig. 10). The narrow tracts of alluvium, partly overlying a shingle floor and with textures from sand to silty clay, infilled hollows between originally high shingle banks. South of Lydd Airport, loams occur between the extremities of the shingle fingers and the alluvium becomes progressively finer textured until the lows die out against Denge Beach. Clays commonly overlie sands elsewhere, and in one elongated low in New Romney Level this capping becomes progressively thinner towards its ending.

Land Type founded on Late Sand Flats

Excepting miscellaneous areas of blown sand and shingle, this land type occupies the remaining parts of Denge Marsh and New Romney Level (Fig. 10) and is flat apart from a few relic creeks, miscellaneous sea walls and two associated and partly artificial mounds half a mile south of New Romney. Although founded on sand flats, the texture of the superficial deposit ranges from sandy loam to silty clay, and the thickness from less than 12 in. to more than 4 ft, depending partly on the stage at enclosure and on the shelter afforded by the fringing beaches. The sands, often with a high proportion of medium grade grains (200–500 μ diam.), are best seen in a recently enclosed embayment west of Littlestone and Greatstone (see below), where the capping of finer sediments is mostly less than 15 in. thick. Silty clay overlies the sands south of the road between New Romney and the coast but grades to sandy loams farther north and near the Greatstone dunes. Small relic creeks, many quite deep, occur but there are no conspicuous levees and little textural differentiation associated with them.

Similar vertical deposit sequences occur in older land to the west, but the cover of silty clay to sandy loam is thicker (p. 120). Areas marked with an overprint on the soil map have relatively coarse sands at less than 42 in. Parts of the Denge Marsh Sewer coincide with relic creeks but no large systems occur like those in the Land Type with Common Creek Relics.

All the innings walls were probably built after the 13th century storms, but dates are uncertain except for the youngest near Littlestone and Greatstone. According to Elliott's maps, the land east of Lydd was inned about A.D. 774, the evidence being a Saxon charter which refers to Lydd and Denge Marsh and gives the boundaries of the land granted by King Offa to Archbishop Janibert. Ward (1931a) located this land in Denge Marsh,* but much depends on interpretation, as Holloway (1849), translating the same charter, referred to the sea being both north and east of Lydd. The charter reference to Denge Marsh does not necessarily imply that such land was reclaimed in A.D. 774, and furthermore, the placing of the name differs on different maps, the Tithe map of 1816 showing that it then included land both east and west of Lydd (Fig. 19). Elliott gave the same reclamation date to both, but although the land to the west, *i.e.* part of the Land Type with Creek Ridges was probably settled in A.D. 774, that to the east seems far younger. Possibly old land east of Lydd was flooded in the 13th century and reclaimed later, but no evidence for an old buried surface has been found.

Farther north reclamation progressed eastward as land silted up, this being indicated by the north to south orientation of many walls and the way they meet or overlap similarly oriented and progressively older shingle fingers of Denge Beach. The younger land to the east of some walls is slightly higher than that to the west. According to Poker's map, the two small, irregular mounds about half a mile south of New Romney were well within reclaimed land in 1617; their marking as "salt coates" presumably indicates their use for salt winning. Land east of New Romney station silted up very slowly, Poker's map clearly showing an embayment hereabouts. A similar area, called Romney Sands,

* An old track between the beach near Lydd railway station and a shingle ridge in Denge beach may follow the line of a former wall.

still existed in 1816 (Tithe map), when shingle drift from the north and south had formed clear points at Greatstone and Littlestone respectively. These provided a more sheltered environment, allowing finer textured deposits to accumulate, and by 1893 only a small embayment remained enclosed.

SALTINGS

Two categories of Saltings are recognized, the calcareous type being unreclaimed periodically flooded lands adjacent to the Rother (*Plate IXa*), and the decalcified type comprising several old marshes south-west of Lydd associated with complex systems of partially buried shingle ridges. The latter, known as The Midrips, The Wicks and South Brooks, are occasionally flooded by the sea during storm periods, possibly because of progressive erosion along the southern shoreline of Dungeness.

CHAPTER III

Soil Formation, Mapping and Classification

SOIL FORMATION

The formation and evolution of soils depends on the stabilization of the ground beneath a cover of vegetation and involves three groups of processes; addition, decay and incorporation of organic matter; physical and chemical alteration of the parent mineral material, and redistribution or removal of soluble or dispersed constituents by soil water.

Under aerobic conditions part of the dead organic material on or below the ground surface decays rapidly, and the nitrogen and mineral nutrients released can be assimilated by plants and soil organisms. Another part is less readily mineralized, its decomposition yielding humus, which, becoming more or less incorporated with mineral particles, assists the development of soil structure and increases the capacity to retain nutrients. The amount and type of humus and its distribution depends on the vegetation, soil aeration, moisture content, acidity, temperature and nutrient supply which regulate the composition and activity of the soil population using and supplying organic matter. The amount may fluctuate seasonally, widely so at the soil surface, but in mature soils under natural or semi-natural conditions the amount and location of amorphous humus is relatively constant.

The mineral particles of the soil disintegrate and decompose relatively slowly during weathering. Except in the initial stages of soil formation on hard rocks, where physical breakdown predominates, the chief weathering agent is rain-water charged with oxygen and carbon dioxide. This water reacts with mineral particles as it percolates through the soil; thus, calcite (calcium carbonate) gradually dissolves, mica and other minerals become hydrated, ferrous and sulphide ions are oxidized and primary silicate minerals such as feldspars hydrolysed. By such processes nutrient elements are released in forms available to plants. The rate and type of reaction varies with the size and constitution of the particles of the parent material, and with climate; the rate of weathering increasing with rising temperature and the quantity of water passing through the material.

Percolating water is also responsible for leaching, whereby weathering products and other materials are taken up in solution and moved downwards through the soil. Where rainfall exceeds loss by evaporation and transpiration by plants, as in south-east England, calcium, magnesium, potassium and sodium are readily removed in ground-water and eventually discharged into streams and rivers. Calcium can also be reprecipitated at lower levels in the soil as white efflorescences or hard nodules of carbonate. Unless losses due to leaching are balanced by weathering of less soluble minerals, the soil becomes acid. Under certain conditions clay particles may also be moved downwards in suspension, as well as small amounts of organic matter and compounds of iron and aluminium, all of which may be redeposited in the subsurface.

Plants and soil fauna strongly influence weathering and leaching under both aerobic and anaerobic conditions. Organic acids and other compounds derived from living roots and organic residues react with the inorganic fraction of the soil, the products being partly used for nourishment of new generations of plants and animals, so that under natural conditions mineral substances are continually in circulation. Soil animals, particularly earthworms and ants, assist soil aeration and mix plant material with mineral matter.

Restricted drainage, due to a regional water-table or impermeable layers in the soils or parent material, affects the intensity of weathering by hindering or preventing the removal of decomposition products. Waterlogging also affects plant roots and soil micro-organisms by restricting the supply of oxygen. Under such anaerobic conditions ferric compounds are reduced and mobilized as ferrous complexes, either by microbial action or by direct reaction with soluble products of plant decomposition (Bloomfield 1951). This process, known as gleying, can give soil a grey or bluish colour, either directly due to the presence of ferrous complexes or because such compounds are relatively soluble and their removal in seepage water or by other means leaves the soil locally impoverished in iron. Waterlogging is intermittent in many soils, and oxidation of reduced iron compounds can occur as air returns into the soil. Under these circumstances the brown or red ferric compounds, typical throughout freely drained soils, are formed locally, so imparting a mottled or streaked appearance to the layers concerned. Dark specks or hard concretions of secondary manganese dioxide may also form in the same way. Air can re-enter the soil by fissures and along old root channels or animal burrows, which under some conditions become lined with iron oxides; hard rusty "pipes" formed in old root channels are common in soils with a fluctuating ground-water table.

As soils develop, through the interaction of physical and biological processes, mineral particles aggregate into crumb-like units and/or fissuring yields others of blocky or prismatic shape; the shape, size and arrangement of such peds giving the soil its structure (U.S.D.A. 1951) or pedality (Brewer and Sleeman 1960). This is influenced by the nature of the soil parent material, particularly its clay content, base status and by seasonal wetting, drying and freezing. Thus, clay-rich soils readily fissure as they dry out due to volume changes in clay minerals. The ramifications of roots and the physical pressures exerted during their growth also promote aggregation, particularly when humus and other products of biological origin are present to aid adhesion, e.g. fungal gums and mucilage. Many burrowing animals cast aggregates of intimately mixed organic and mineral materials. Soils with high calcium commonly have a well developed structure with strong aggregates, because very stable clay-humus complexes are formed, whereas aggregation in acid soils is relatively weak unless the peds are stabilized by iron and aluminium compounds.

The continual interaction of these processes produce *soil horizons*, layers roughly parallel to the ground surface, which differ from each other in such features as colour, texture, structure, type and amount of organic matter, degree of root development or faunal activity. Horizons which are readily recognized in the field are also distinguished by less evident characteristics, such as acidity, aeration, nutrient status, moisture content at field capacity and hydraulic conductivity. The whole system of horizons lying within the zone penetrated by plant roots constitutes the *soil profile*, and the material in which they have developed is termed the *parent material*. The relatively unaltered material below

is often directly related to the parent material, but can be different in origin, so that the soil horizons are imposed on a vertical succession of different materials, giving a so-called composite profile.

SOIL SURVEY METHODS

To describe and map soils a classification is needed. This is usually established from information assembled during a preliminary reconnaissance to examine soils in pits, auger borings and recently exposed sections in relation to differences in land form, vegetation and geology. Attention is primarily directed to relatively permanent features of the profile, such as texture and subsoil characters and not to ephemeral features, like the differences in nutrient status, pH and structure of the surface soil, which are often affected by farming practices. Many soil profiles are examined and compared, as well as the more or less unaltered geological material, and from this the taxonomic and principal mapping units are established.

The basic classification unit used in this Bulletin is the *soil series*, defined as a group of soils with similar profiles derived from similar parent material under similar conditions. Soil series are taxonomic units, each named after the locality where it was first described or is well represented. Most series are also mapping units, but in areas where two or more are so closely associated that their separation is impracticable the mapping unit is a *soil complex*, named according to its major constituent series. Taxonomic units lower in order than the series also serve as mapping units, in particular the *soil type* and *soil phase*. Soil type is a subdivision based on surface texture (e.g. Greatstone silty clay loam, Greatstone sandy loam). Soil phases are based on such features as average slope or degree of erosion (e.g. steep phase, eroded phase), but here are applied to drainage differences (Romney series, moderately well drained; Romney series, imperfectly drained), and to differences in calcium carbonate status (Snargate series, deeply decalcified; Snargate series, slightly decalcified).

Systematic surveying is started when the main mapping units have been established, the boundaries between them being determined by auger examination of soil profiles, mostly to 42 in. in the present survey. Soil boundaries are commonly associated with changes in slope or semi-natural vegetation and, having determined the relationships between land form and soil during reconnaissance, the surveyor selects lines of traverse and augering intervals appropriate to his established legend. Where such aids to boundary location are lacking, as in parts of Romney Marsh, the map is compiled from a regularly spaced pattern of auger borings, but under all circumstances the site of each augering and profile pit is recorded on a 6 in. to 1 mile O.S. map. Appropriate symbols are used to indicate soil series, and other important characteristics of soil and site, and the boundaries between the main mapping units are plotted. When field work is complete, clean drafts of the map are reduced to a smaller scale for publication, in this instance to the 1 : 25,000 (2½ in. to 1 mile) scale.

To characterize soil series, types and phases, pits are dug at representative sites and the profile and site details described in standard terms. Depth, thickness and clarity, as well as colour, texture, stoniness, consistence, porosity and structure are recorded for each horizon in turn, together with the kind and distribution of organic matter, calcium carbonate, secondary mineral deposits, soil

fauna and roots. The underlying material is also examined, and the drainage of the soil deduced from profile and site characteristics.

The methods and terms used in these descriptions are summarized in Appendix II. Colours are described according to the Munsell Soil Color Charts, and

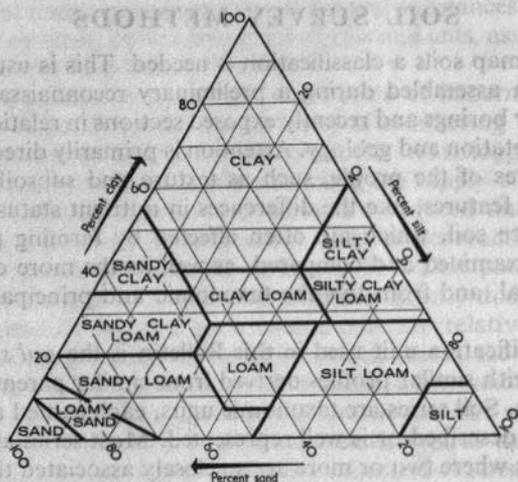


Fig. 21a. Soil Texture Diagram

textural class names are based on the estimated proportions of sand (particle sizes between 2.0 and 0.05 mm), silt (0.05–0.002 mm) and clay (<0.002 mm) in the inorganic fraction of the soil. Twelve textural classes are recognized and defined graphically (Fig. 21a) in terms of the three particle size grades. The

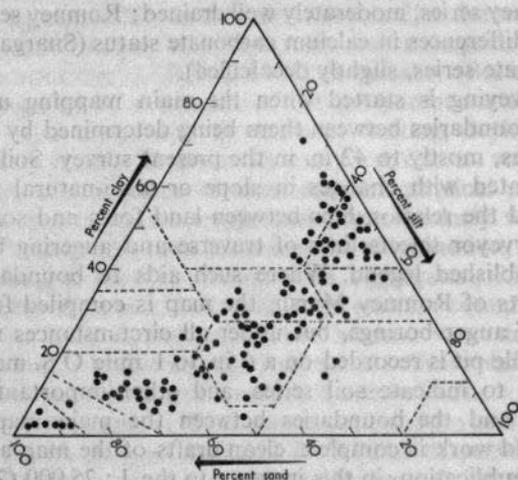


Fig. 21b. Distribution of textures of horizons from representative soils in soil texture classes

class names are qualified to indicate the predominant size grade within the class (e.g. fine sandy loam, medium sand), and the kind, size and quantity of stones (e.g. pebbly loam, very gravelly sand), or the presence of more than about 13 per cent. of organic matter (e.g. humose loam, peaty clay).

To confirm and supplement field observations and to assist in the characterization of mapping units, samples are taken from each horizon of representative profiles for analysis. In this survey determinations of particle-size distribution (mechanical analysis), pH and calcium carbonate were made on all samples. Determinations of carbon and nitrogen, soluble cations, exchangeable cations, base exchange capacity and available potassium and phosphorus were also made on samples from selected profiles (Appendix I).

Horizon Nomenclature

In order to facilitate discussion and comparison of soils it is convenient to designate profile horizons by a letter notation, the same symbol being applied to analogous horizons in profiles of similar type. The notation adopted here is:

Surface horizons

- O Partially decomposed, mineral-free, organic material.
 A Mineral horizon with intimate humus throughout (subdivided A1, A2, etc.).
 Ap Ploughed layer of cultivated soils.

Subsurface horizons

- Ea Bleached or pale coloured horizon in podzolized soils.
 B Altered horizon distinguished by differences in structure and/or colour resulting from alteration *in situ*. Humus, if present, is mainly on aggregate faces and in macropores or occurs as occasional infillings from the overlying horizon.
 Bfe Reddish brown horizon of maximum iron deposition in podzolized soils.
 Bh Dark horizon of maximum humus deposition in podzolized soils.
 C Horizon little altered, except by gleying, and either like or unlike material in which overlying horizons have developed (subdivided C1, C2, etc.).
 Bca } etc. As above, but containing appreciable amounts of redeposited (secondary)
 Cca } calcium carbonate.
 Ag } Mottled (gleyed) horizons subject to waterlogging; where gleying is only
 Bg } etc. weakly expressed the suffix (g) is used.
 Cg }
 A/C } etc. Horizons of transitional or intermediate character.
 A/B }

SOIL DEVELOPMENT IN ROMNEY MARSH

The properties of the soil at any particular place depend partly on the physical and mineralogical constitution of the parent materials; partly on past and present environmental factors, including climate, vegetation and hydrologic conditions, which regulate the nature and intensity of the soil-forming processes; and partly on the length of time these processes have operated.

The shingle deposits are mainly of inert flint pebbles. The finer mineral particles come from sedimentary rocks of the Weald, and have a varied mineralogy. Quartz and micaceous minerals are dominant in the sands and silts, and montmorillonite and mica in the clays, but calcite (calcium carbonate) is found in widely different particle sizes and other weatherable minerals, such as glauconite, also occur. Calcite, the commonest weatherable mineral, is partly derived from the Chalk, but various Mollusca clearly constitute an important source as fragments and whole shells of *Cardium*, *Scrobicularia* and *Planorbis* spp. are common.

The principal soil differences in the unconsolidated marsh deposits are

determined partly by geology and physiography, which respectively govern soil texture and drainage, and partly by time. Though few of the soils are more than 2,000 years old, there is a wide variation in age, the youngest parts of the Marsh having been reclaimed less than 100 years ago. Parent materials have been chiefly transformed by leaching of soluble salts and native calcium carbonate, by oxidation, reduction and translocation of iron-bearing minerals and by progressive penetration of organic matter and development of structure. Soil development can be assessed by comparing soils of similar texture and environment but of different age.

The various processes referred to are conveniently considered in turn:

Leaching

Amounts of water soluble salts are naturally very high in relatively mature saltings near Rye (profile K48a p. 122), and significantly saline soils occur locally in a few places near the coast subject to salt spray (p. 44) and in certain poorly drained sites, particularly those with peat at shallow depth (p. 111). Salt contents are low elsewhere, indicating rapid leaching where soil and site drainage was reasonably satisfactory. Small differences do occur, however, and appear to be partly correlated with age of reclamation, soils in younger New Marshland commonly having higher contents.

Decalcification

Soils in 19th century enclosures, such as those bordering the Rother, between East Guldeford and Rye are all very calcareous, the calcium carbonate content often exceeding 15 per cent. throughout, and the nearby saltings have similar, but slightly higher, contents. Adjoining older parts of the New Marshland to the east, reclaimed between 1450 and 1700, have, however, on average, only 2-6 per cent. in the surface horizon. No native lime occurs to depths of at least 18 in. in parts of the Old Marshland, such as the sandy creek ridge through Brookland, whereas younger deposits nearby, between Brookland and Snargate, with soils of similar texture and drainage are also leached, but less deeply. This is a recurring if not always simple pattern, in which time is more significant than texture or drainage and the gradual downward leaching of native calcium carbonate is an important soil-forming process.

It cannot be assumed that all Marsh deposits were uniformly calcareous initially, but there is evidence from the unleached layers that all contained some carbonate. Most decalcified soils have a well defined "leaching front", as an undulating boundary between non-calcareous and calcareous horizons revealed by applying dilute acid to a vertical face. Secondary deposits of calcium carbonate are common in lower horizons at about 18-24 in., one reprecipitated form being small but relatively hard nodules. In some soils they occur in the non-calcareous matrix above the leaching front, since they are less easily dissolved than the more finely divided primary calcium carbonate. Nodules have not been observed in saltings soils near Rye, where recurrent flooding and poor structure restrict percolation, or in adjacent 19th century enclosures, but they occur in older calcareous soils.

Development of Soil Structure

Unconsolidated parent materials of loam to clay texture with reserves of calcium carbonate favour the development of well structured soils if they are

not permanently wet or saline for too long. These conditions apply to most of Romney Marsh, where structure development has also been favoured by the prevalence of grassland continually manured by stock. Both factors encourage high biological activity and an extensive root network, whereby, particularly in the surface horizons, primary soil particles aggregate to crumbs (p. 46).

Low water-table levels in summer allow extensive subsurface shrinkage and fissuring, giving moderate or strong prismatic and blocky peds, in well drained fine textured soils, to depths of 3-4 ft, *e.g.* profiles K37, K19 and K111 (pp. 66, 82 and 79). The effect of time in structure development is seen by comparing old grassland soils of similar texture and drainage in different innings. Thus, fine textured saltings soils near Rye (*e.g.* profile K48a p. 122) have a weak coarsely prismatic structure to depths of only 24-30 in. Imperfectly drained soils in adjacent 19th century enclosures (*e.g.* profile K47 p. 69) have a more developed structure, particularly in the upper 2 ft, but the peds are mostly prisms or large angular blocks apparently formed by the fissuring of coarse prisms. Such angular peds occur in similarly drained soils of still older innings (*e.g.* profile K53 p. 66), but their smaller size, or occurrence at deeper levels, suggests further structure development, emphasized by the much smaller peds in the overlying horizons, where blocks are subangular.

Clayey parent materials normally show better developed structures at deeper levels than loams and sandy loams of similar age, though soils developed on the latter also show more advanced aggregation and/or deeper structure development with increasing age, as may be noted by comparing profiles K105, K52, K16 and K28 (pp. 75, 74, 75 and 92).

The inhibiting effect of poor soil drainage on structure development is exemplified by profiles K54 (p. 124) and K51 (p. 123), both on creek bed deposits. They are as old as profiles K53 and K52, but have only weak or very weak structure in the surface horizons and are structureless at 11 in. and 8 in. respectively.

Poor drainage and saline ground-water give soils a coarse prismatic structure, sometimes strongly developed, below the A horizon, as in profiles K24 (p. 71) and K106 (p. 86).

Development of Brown Colours

Many soils in Romney Marsh have one or more uniformly brown subsurface horizons indicating well aerated conditions, and studies of morphology, moisture content and water-table levels show that the colour occurs at different depths and intensities in soils of similar texture and drainage. In general, older soils have darker brown colours to a greater depth, although there is no evidence that the older deposits were browner originally.

When land has been reclaimed and recurrent flooding prevented soil development is closely governed by water-table levels. These fluctuate seasonally and may be altered fundamentally from time to time as land drainage is improved. Of the three zones important to soil development, the first, below the lowest level of the water-table, is a zone of permanent reduction. Above this is a zone seasonally subject to aeration and water saturation and hence to periodic oxidizing and reducing conditions. Finally, a third zone, waterlogged for short periods after heavy rain but never appreciably anaerobic, may extend to the surface, though in wetter sites it is naturally thin or absent. These zones are clearest in porous, loamy or sandy materials but their thickness or depth varies

from year to year, depending on the weather, and boundaries are rarely sharply defined. Clayey soils can have one or more impermeable layers which restrict percolation of rain-water and/or the seasonal change of water-table levels.

Over most of Romney Marsh the water-table level in late summer or autumn is between 4 and 8 ft below the surface, but there is considerable seasonal variation, and it often rises in winter to about 2 ft, even in the highest and driest sandy creek ridge soils. In most places the water level is then considerably higher, and in a few flooding is common. These changes of water-table levels and of waterlogging determine the duration and intensity of gleying and oxidation processes, and hence soil properties. The permanently saturated lowest zone commonly has dark grey to bluish black colours, fading to pale grey or brownish grey when disturbed and exposed to the air, presumably as ferrous sulphides are oxidized (Bloomfield 1951). However, such materials are commonly too deep now to be considered part of the soil. The overlying seasonally saturated zone, up to about 6 ft thick, has variegated or mottled colours, often with distinct rusty deposits lining old root channels at lower levels; in structured soils peds contain distinct ochreous segregations, and, at some levels, commonly have distinct grey or bluish grey faces. Brown colours may also be present in the upper levels, where oxidation is presumably relatively intense and/or of longer duration, but these are distinct only in the older soils. The upper, more or less continuously aerobic zone, seldom much more than 2 ft thick, normally has humus incorporated at the surface, and in some instances there are humus coated ped faces below which tend to mask the mineral colour. Otherwise rather pale brown colours (e.g. 10 YR 5/3) are typical, and mostly of shallow extent in the youngest soils, but darker (10 YR 4/4) and/or evident to deeper levels in progressively older soils. This correlation of colour with age may be seen by comparing, for example, profiles K52 (p. 74) and K43 (p. 91) (or K91 p. 92) for moderately well drained soils of loam or sandy loam texture, profiles K105 (p. 75), K16 (p. 75) and K28 (p. 92) for imperfectly drained soils of like texture, and profiles K37 (p. 66) and K111 (p. 79) for moderately well drained soils of fine texture, the soils in each group being in order of age. The brown colours are probably produced by oxidation of iron-organic complexes and/or weathering of iron-bearing minerals in the parent material, whereby hydrated iron oxides are gradually formed or released. The mixing of material by soil animals, particularly earthworms, also contributes, after reclamation or whenever improved soil drainage permits their deeper penetration.

Exceptions occur, for example, west of Barnfleet (TQ 988224), where many soils show little development of brown B horizons and resemble immature soils of much younger innings. This area, being low lying and isolated, has long been poorly drained, but is now served by a pumping installation, so that the present drainage is as good as that of areas with more mature soils. Such adjustments in the water-table régime alter the thickness or depth of the three soil zones described earlier and can increase the depth or seasonal duration of oxidation. The thin pale B horizon of these soils shows that brown colours develop slowly. Thus age is not the only important factor in oxidative weathering, and soils of similar age, texture and drainage do not necessarily have the same brown colours.

Organic Matter Distribution

The content and distribution of soil organic matter varies appreciably, and from comparative studies of soils of similar texture and drainage under old

grassland in progressively older innings it appears that some differences are correlated with age. Moderately well drained loamy soils in the youngest innings, for example, have relatively shallow A horizons, commonly less than 6 in. thick, with a clear, if irregular, boundary to the underlying soil. Soils of similar texture in older innings mostly have thicker A horizons, with merging lower boundaries and humus on ped faces in the upper part of the B horizons (e.g. K52 p. 74). The thickest A horizons and most diffuse boundaries occur in still older, decalcified soils, however, some extending to 15 in. or more (e.g. K43 p. 91), and these soils also commonly have distinct humus coatings on ped faces

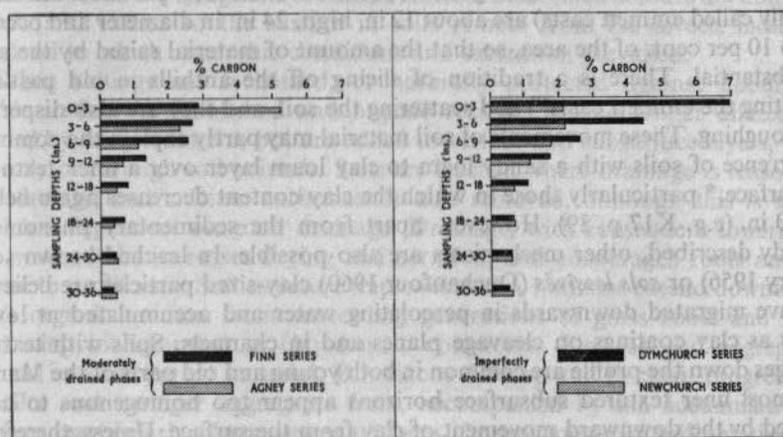


Fig. 22. Distribution of carbon with depth in soils of differing age

to an appreciable depth in the B horizon. Similar features are also apparent in imperfectly drained soils of differing age (e.g. K105 p. 75, and K28 p. 92) and in finer textured soils (e.g. K13 p. 72, and K17 p. 89, or K37 p. 66, and K111 p. 79). In addition, the A horizon colours of soils with similar drainage commonly differ according to age and can be brownest in the older, decalcified soils.

These studies in innings of different age indicate that A horizons gradually thicken with time and small amounts of humus accumulate at lower levels. Thus soils in the Decalcified (Old) Marshland often have more humus in their subsurface horizons than soils of corresponding texture and drainage in the Calcareous (New) Marshland, particularly those in the youngest innings (Fig. 22). This humus may play an important part in the development of B horizons, particularly in stabilizing their structure.

When vegetation and environmental factors are constant after reclamation, equilibrium between the addition and decomposition of organic matter may be attained. The organic cycle is also influenced by soil properties, however, and changes in pH and base saturation after decalcification may modify the distribution and content of humus by affecting its stability. Thus the thicker A horizons of decalcified soils and the greater depth to which dark colours occur on ped faces in the B horizons may be partly due to downward movement of humus.

Texture Differentiation

Because of variations in sedimentation, marsh soils often show texture changes with depth, many having composite profiles developed in two or more contrasting deposits in vertical succession (Figs. 32, 34, 36, 39 and 40). Similar differences may be produced during soil development, in particular through the activities of the mound ant (*Lasius flavus*). This species is widespread in the Marsh, and tunnels to depths of 3 or 4 ft, using the excavated material to construct mounds or nests of various sizes at the surface (Green and Askew 1965). The nests are a mixture of materials from different depths and can be finer or coarser in texture than the original topsoil. In some old pastures the nests (locally called emmett casts) are about 12 in. high, 24 in. in diameter and occupy up to 10 per cent. of the area, so that the amount of material raised by the ants is substantial. There is a tradition of slicing off the anthills in old pastures ("cutting the emmett casts") and scattering the soil, and they are also dispersed by ploughing. These movements of soil material may partly explain the common occurrence of soils with a sandy loam to clay loam layer over a finer textured subsurface,* particularly those in which the clay content decreases again below 18–30 in. (e.g. K17 p. 89). However, apart from the sedimentary phenomena already described, other mechanisms are also possible. In leached brown soils (Avery 1956) or *sols lessivés* (Duchaufour 1960) clay-sized particles are believed to have migrated downwards in percolating water and accumulated at lower levels as clay coatings on cleavage planes and in channels. Soils with texture changes down the profile are common in both young and old parts of the Marsh, but most finer textured subsurface horizons appear too homogenous to have formed by the downward movement of clay from the surface. Unless, therefore, these leaching processes were more active in the early post-reclamation period, as, for example, following the leaching of salts, it is probable that such profiles were formed in other ways.

Podzolization

In some strongly acid freely permeable soils in Britain soluble organic compounds are formed which react with ferric and aluminium oxides derived by the breakdown of clay minerals. The downward leaching of these readily mobile metal-organic complexes leads to the development of a bleached subsurface layer depleted of iron and aluminium, the Ea horizon, which is succeeded by dark, often ochreous layers in which humus and/or iron and aluminium compounds have been redeposited, the Bh and/or Bfe horizons.

Such soils are comparatively rare in Romney Marsh, being restricted to old, very coarse textured parent materials like the Midley Sand.

These and other processes concerned with soil formation naturally operate simultaneously. When plants first colonize the developing tidal flats (p. 8) soil formation is limited by the recurrent accession of fresh sediment, but plant growth keeps pace with this and the organic matter thereby incorporated, and the voids left following the death and decay of roots evidently assume significance later (Green and Askew 1965). The saltings are less frequently flooded as

* Humus influences the feel of soil material, making the A horizons of most fine textured soils seem less clayey, but only differences in the mechanical composition of mineral soil are considered here.

they mature, and organic residues eventually accumulate in a surface layer while stresses due to alternate wetting and drying act with plant roots to develop structure. This improves aeration, reduced iron compounds are oxidized and dark grey or bluish colours disappear; meanwhile salts and native calcium carbonate are partially leached by rain. Immature soils at this stage occur in primary saltings in Romney Marsh (profile K48a p. 122), although small in area and comparatively uniform. Parts now reclaimed presumably once showed local soil differences related to microrelief, similar to those in saltings at Scott Head, Norfolk, where soils on slight levees adjacent to creeks have a better developed structure and are browner to a depth of about 9 in. compared to adjacent but lower-lying soils of similar texture. Blue-black colours are dominant below and extend to the surface in soils remote from the levees, indicating the level to which anaerobic conditions and saturation prevailed.

When saltings are reclaimed, or naturally protected against flooding, a stable surface is established and organic residues are no longer diluted and buried by fresh sediment, but are added to surface and subsurface layers, either directly or through soil animals. Salts are leached where drainage is reasonably satisfactory, and calcium carbonate is also removed, although this is slower and less dependent on good drainage. Drainage, with consequent lowering of the water-table, increases drying and aeration, and encourages roots and soil fauna to proliferate. Soil structure improves and A horizons extend downwards, with organic residues from succeeding generations of grass roots and fauna becoming incorporated as clay-humus complexes. Fissures and aggregation extend into the parent material, B horizons develop and thicken, progressively smaller and stronger aggregates form, accompanied by the accumulation of humus, particularly along aggregate faces. Improvement in soil aeration and permeability presumably leads to the development of brown colours, which, together with soil structure, are diagnostic of B horizons, while leaching eventually removes all the native calcium carbonate from the surface soil, which then becomes acid.

Thus, immature ACg soils with shallow calcareous A horizons over pale coloured or greyish parent material change slowly to deep ABCg or ABgCg soils with deeper A horizons over brownish structured subsoils; they are also more or less decalcified and slightly or even strongly acid, at least in the surface.

SOIL CLASSIFICATION

The soils are classified (Table 5) using relatively simple criteria, principally:

- (1) Variations in the texture profile, or lithology, to a depth of 42 in.
- (2) Differences in intensity and depth of grey and/or ochreous mottling due to gleying.
- (3) The content and distribution of native calcium carbonate.

Texture

Texture is important in the classification, because the full range from sand to clay is present (Fig. 21b), and it influences structure, consistence, porosity and moisture retention, which, in turn, affect drainage, ease of working and plant growth, and hence management and fertility. In shallow soils the underlying relatively unaltered materials are often important rooting media for plants, and

TABLE 5
Texture and Drainage of Soil Series

Drainage	Subsurface Texture	Dominant Texture of B Horizon or between 12 and 30 in.					
		Coarse		Medium		Fine	
		Stony	Loamy sand or Sand	Loam or Sandy loam	Clay loam	Clay loam over Silty clay	Silty clay or Clay
Excessive or well drained	Similar to that between 12 and 30 in.	Beach Bank ¹	Lydd ² Midley ^{2,3}				
Imperfectly drained	Similar to that between 12 and 30 in.		Greatstone ⁴				
Imperfectly or moderately well drained	Similar or finer texture below about 30 in.			Snargate ²	Finn ²	Brenzett ² Walland ⁴	Dymchurch ² Newchurch ⁴
	Loam to sand below about 30 in. to at least 42 in.			Romney ⁴	Agney ⁴	Ivychurch ² Guldeford ⁴	
Poorly or very poorly drained	Thick peat occurs between 24 and 42 in.						Dowels ² Fairfield ⁴
	Thick peat occurs at less than 24 in.						Appledore ²

¹ Beach Bank soils are locally calcareous.

² Decalcified soils.

³ Midley soils are developed on loamy medium sand or sand.

⁴ Calcareous soils.

TABLE 6
Relationship of Drainage and Mottling Classes to Soil Series

Drainage Class	Mottling Classes*	Soil Series
Excessive	<i>d</i>	Beach Bank Dungeness
Well	<i>d</i>	Lydd Midley
Moderately well and imperfect	<i>b, c and a</i>	Newchurch Dymchurch Walland Brenzett Guldeford Ivychurch
	<i>c, d and a, b</i>	Agney Finn Romney Snargate
Imperfect	<i>a, b</i>	Greatstone
Poor	<i>a</i>	Dowels Fairfield
Very poor	<i>a</i>	Appledore

* Mottling

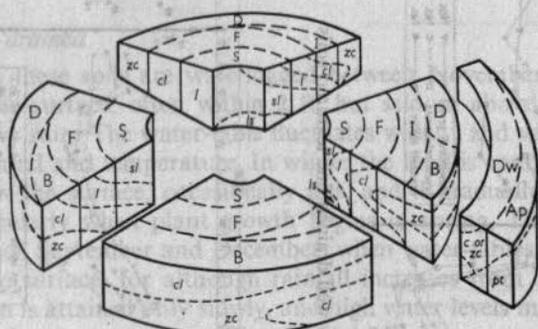
(a) above 12 in.

(b) between 12 and 15 in.

(c) between 15 and 24 in.

(d) below 24 in.

affect natural and artificial drainage; therefore, account is taken of texture to an arbitrary depth of 42 in. irrespective of any horizon development. In most soils texture varies with depth; sometimes sharply, for example, from clay to sand or vice versa, but normally loamy deposits of different thicknesses merge into materials of finer or coarser texture. Elevation and texture are often related, the highest land being stony or sandy. A thick layer of peat occurs at less than 42 in. in many of the lowest parts of the Marsh (Fig. 6), mostly below clay soils. In fact, several soil series include horizons of widely differing texture or mineral content (Fig. 23). The 18 series established are grouped into three texture classes, fine, medium and coarse, according to the dominant texture of the B horizon.



S : Snargate
 F : Finn
 I : Ivychurch
 D : Dymchurch
 B : Brenzett
 Dw: Dowels
 Ap: Appledore

ls : Loamy sand
 sl : Sandy loam
 l : Loom
 cl : Clay loam
 zc : Silty clay
 c : Clay
 pt : Peat

Fig. 23. Block diagram illustrating the relationships of soil series

Soil Drainage

Drainage refers to the frequency and duration of periods when the soil profile is wholly or partly saturated with water. In flat land this is governed by the balance of rainfall and evaporation, by the rapidity and extent of removal of water by downward percolation and by the proximity of subterranean zones of permanent saturation. Drainage is assessed in the field by observations of soil moisture at different periods of the year and of profile morphology, particularly the presence and intensity of ochreous and/or grey colours due to gleying. Interpretation of such colour patterns in terms of gleying intensity or soil drainage is often difficult, however, since profile morphology is here a complex function of age and past and present drainage.

The soils have been assigned to mottling classes on the basis of the depth at which common to many distinct ochreous (7.5 YR 5/6-5/8 or redder) and/or greyish mottles occurred;* and to drainage classes from observations on the

* Temporary compaction by machinery or stock (poaching) can give localized mottling in the surface soil, but this gives no indication of the frequency and duration of saturated conditions in the profile as a whole, and is disregarded.

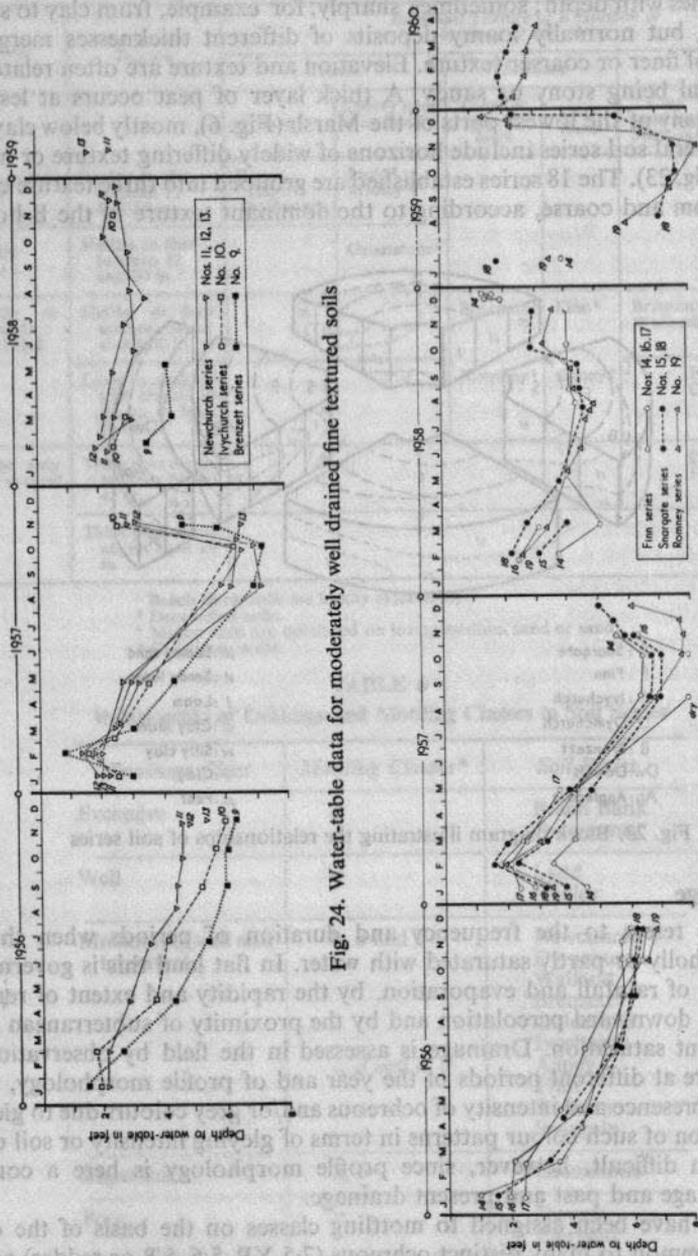


Fig. 24. Water-table data for moderately well drained fine textured soils

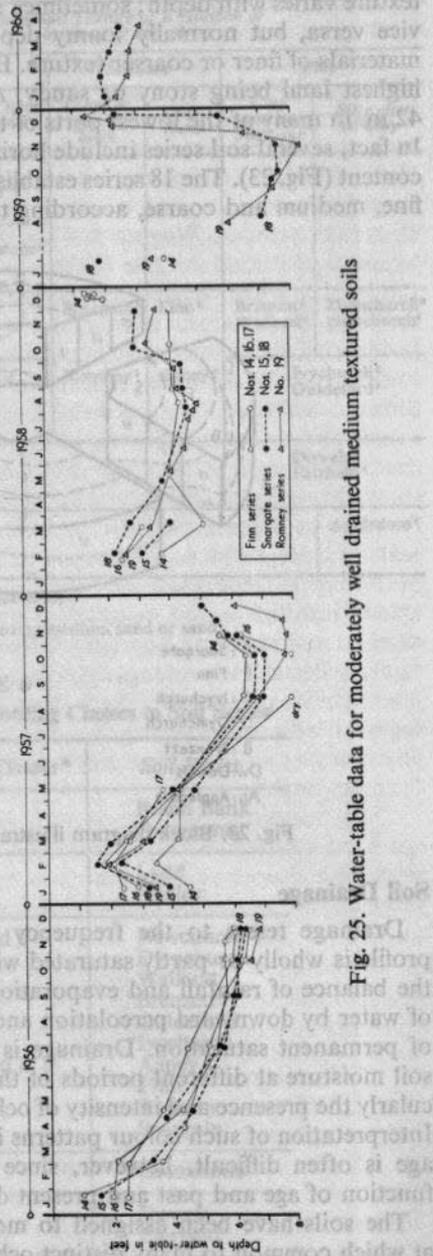


Fig. 25. Water-table data for moderately well drained medium textured soils

frequency and duration of periods during which profiles are wholly or partly saturated.

The following drainage classes are recognized:

Well drained and excessively drained

The soil is seldom saturated within about 30 in. of the surface except immediately after heavy rain. Soils in this class have water-table levels 5-8 ft below the surface in summer and autumn in normal years, rising in winter often to between 2 and 4 ft below the surface. They are mostly high lying and coarse textured, many being very stony. Very porous soils with a high organic matter content in the A horizon are regarded as excessively drained.

Moderately well drained

In most years these soils are waterlogged between November and April to within 3 ft of the surface, often within 2 ft, but seldom above 15 in., except briefly after heavy rain. The water-table fluctuates widely, and varies from year to year with rainfall and temperature. In winter the level is commonly between 2 and 3 ft below the surface, occasionally less, and it gradually declines after February, particularly when plant growth begins in spring. The lowest point is reached between September and December, when water-tables are commonly 5-8 ft below the surface, for although rainfall increases from September onwards, saturation is attained only slowly, and high water levels may not develop until mid-December in some years (Figs. 24 and 25).

Imperfectly drained

In most years these soils are waterlogged between November and April to within 2 ft of the surface and often to or within 15 in., particularly until February. Water-table levels fluctuate widely (Figs. 26 and 27), being higher in winter than in the last class and for a longer time, and summer and autumn levels may also be 1-2 ft higher.

Poorly and very poorly drained

Part of the soil within about 24 in. of the surface is saturated for at least half the year. The water-table level rarely falls below about 4 ft, is mostly within 3 ft and often at or near the surface in winter (Fig. 27). Very poorly drained soils have a thin, nearly black Ag horizon, commonly with a peaty mat.

Calcium Carbonate

The presence or absence of readily detectable native calcium carbonate in the surface horizons* is the basis of division into Calcareous and Decalcified soils. The former are calcareous throughout, with from about 1 to 15 per cent. or more in the surface horizons, but include some composite profiles in the Old Land where an older, partly non-calcareous, soil occurs below later calcareous deposits.

Soils in the Decalcified group range from those that are entirely calcareous except for their surface horizon to profiles that are completely non-calcareous to depths greater than 42 in. Calcium carbonate occurs at different levels in

* 0.5 per cent. or more calcium carbonate is readily detected in a soil sample by adding dilute acid.

The following drainage classes are recognized:
 saturated.
 frequency and duration of periods during which profiles are wholly or partly

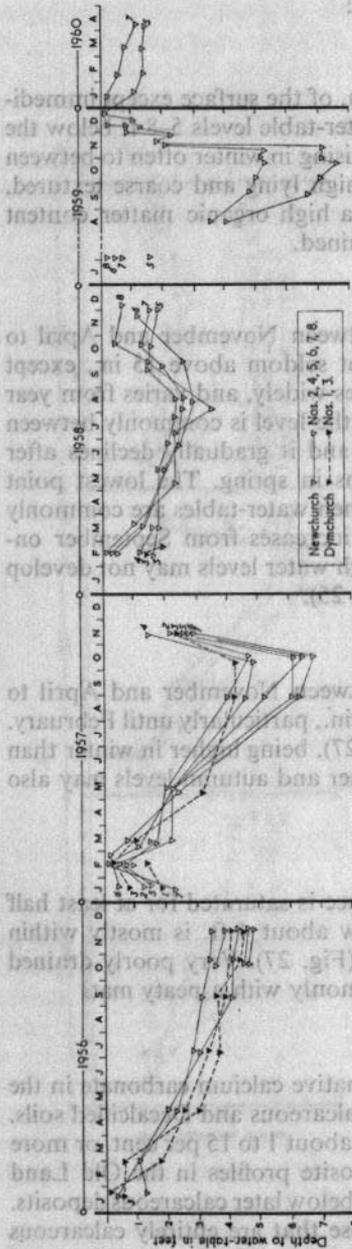


Fig. 26. Water-table data for imperfectly drained fine textured soils

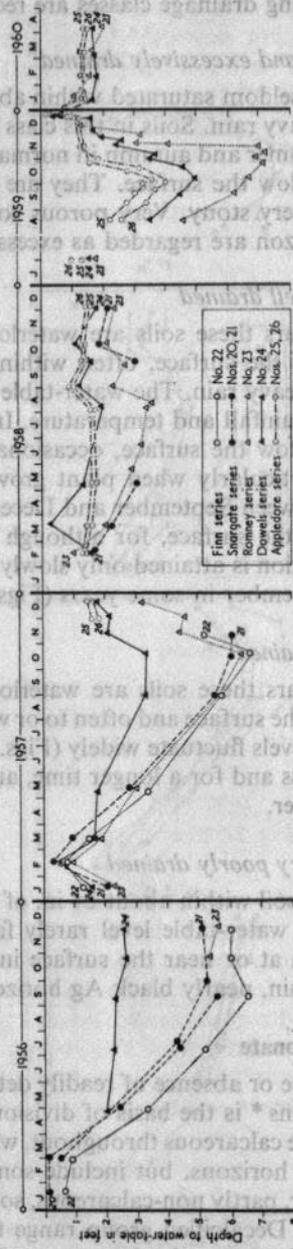


Fig. 27. Water-table data for imperfectly drained medium textured and poorly drained fine textured soils

* 0.2 per cent. or more calcium carbonate is readily detected in a soil sample by adding dilute acid.

all soils of this group except those of the non-calcareous Appledore, Midley and Dungeness series. Two soil phases are recognized within most, those of the deeply decalcified phase being non-calcareous to 18 in. or more, and those of the slightly decalcified phase to shallower depths. In some soils there is a second non-calcareous zone below the calcareous horizons, often more humose, and probably an older buried topsoil.

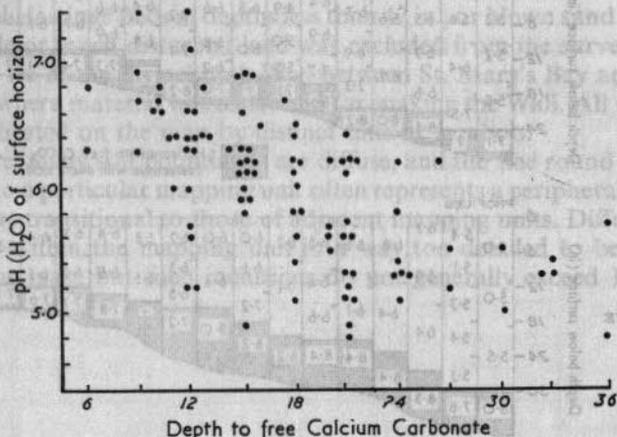


Fig. 29. Soil reaction in Fins and Sarnate profiles

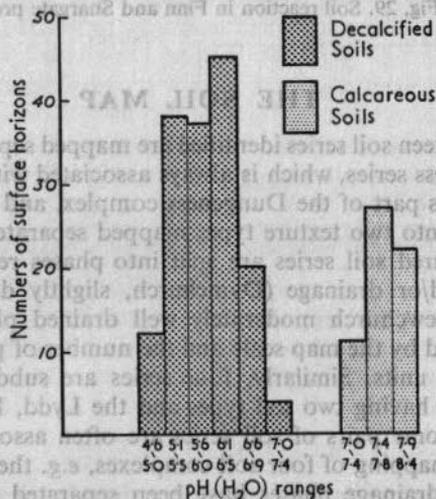


Fig. 28. Soil reaction of surface horizons of undisturbed soils

The surface horizons of undisturbed, unlimed soils in the Decalcified group are acid, the pH generally being lowest in the deeply decalcified phases (Fig. 28). Non-calcareous subsurface horizons are also commonly acid (Fig. 29).

Calcareous subsoil can be turned up by the plough in some fields, particularly where slightly decalcified phases are mapped separately. Decalcified soils are also subject to natural disturbance, particularly by ants and even on soils

decalcified to below 30 in. their mounds include much soil from deep calcareous substrata (Green and Askew 1965). Moles are also common in Romney Marsh, and their burrowing is sufficiently deep to throw up calcareous material in some slightly Decalcified soils. There may thus be big differences in soil reaction from one part of a field to another (pp. 131-2).

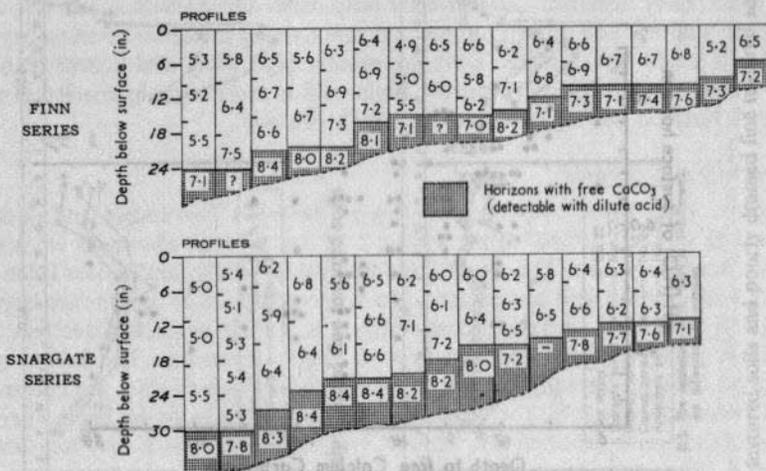


Fig. 29. Soil reaction in Finn and Snargate profiles

THE SOIL MAP

Sixteen of the eighteen soil series identified are mapped separately, the exceptions being the Dungeness series, which is always associated with unvegetated shingle deposits and forms part of the Dungeness complex, and the Greatstone series, which is divided into two texture types mapped separately. Eleven of the fine and medium textured soil series are split into phases reflecting the degree of decalcification and/or drainage (Dymchurch, slightly decalcified, imperfectly drained phase; Newchurch moderately well drained phase), and, subject to limitations imposed by the map scale and the number of points examined, these serve as mapping units. Similarly, four series are subdivided texturally, the Beach Bank series having two soil types and the Lydd, Romney and Snargate series one each. Some pairs of soil series are often associated geographically, necessitating the mapping of four soil complexes, e.g. the Newchurch-Walland complex, though drainage phases have been separated whenever possible. A deeper, fine textured variant of the Beach Bank series is an additional mapping unit.

Other mapping units, grouped as Miscellaneous Land Types, are Saltings, Dunes and Creek Bed complex, the first two with subdivisions mapped separately. These soils are distinct, though some creek beds are influenced by brackish water and contain saline soils like those of the Saltings.

The mapping units are shown in the legend and on the map by combined colours and symbols. Each soil series has a different symbol, and soil complexes are represented by combining those of the constituent series sometimes over

the same colour; subscripts are added to the symbols to distinguish soil types and variants. Drainage phases have the same tint and symbol as the parent series, and differ in the presence and type of a grey hatchure overprint. Moderately well drained phases have a clear tint, but a cross-ruling overprint, giving tonal darkening, is added for imperfectly drained phases. A single-ruling overprint, giving an intermediate tonal effect, is used where the soil series include both drainage phases.

Coloured overprints show either unusual substrata, such as Midley Sand, shingle and Hastings Beds at depths less than 42 in., or blown sand in the surface. Inaccessible or much disturbed land was excluded from the survey, particularly that in the lee of the Dymchurch Wall between St. Mary's Bay and Dymchurch Redoubt, where material was excavated for making the Wall. All such disturbed land is indicated on the map by distinct tints or symbols.

In nature, many soil boundaries are diffuse, and the line round an area corresponding to a particular mapping unit often represents a peripheral zone in which the soils are transitional to those of adjacent mapping units. Different soils may also occur within the mapping unit in a way too detailed to be shown at the scale of the map, but such inclusions do not generally exceed 15 per cent. of the area.

Soil Series	Parent Series	Drainage Phase	Substratum
NEWCHURCH SERIES			
NEWCHURCH (1)	NEWCHURCH (1)	Well drained	Normal
NEWCHURCH (2)	NEWCHURCH (2)	Well drained	Normal
NEWCHURCH (3)	NEWCHURCH (3)	Well drained	Normal
NEWCHURCH (4)	NEWCHURCH (4)	Well drained	Normal
NEWCHURCH (5)	NEWCHURCH (5)	Well drained	Normal
NEWCHURCH (6)	NEWCHURCH (6)	Well drained	Normal
NEWCHURCH (7)	NEWCHURCH (7)	Well drained	Normal
NEWCHURCH (8)	NEWCHURCH (8)	Well drained	Normal
NEWCHURCH (9)	NEWCHURCH (9)	Well drained	Normal
NEWCHURCH (10)	NEWCHURCH (10)	Well drained	Normal
NEWCHURCH (11)	NEWCHURCH (11)	Well drained	Normal
NEWCHURCH (12)	NEWCHURCH (12)	Well drained	Normal
NEWCHURCH (13)	NEWCHURCH (13)	Well drained	Normal
NEWCHURCH (14)	NEWCHURCH (14)	Well drained	Normal
NEWCHURCH (15)	NEWCHURCH (15)	Well drained	Normal
NEWCHURCH (16)	NEWCHURCH (16)	Well drained	Normal
NEWCHURCH (17)	NEWCHURCH (17)	Well drained	Normal
NEWCHURCH (18)	NEWCHURCH (18)	Well drained	Normal
NEWCHURCH (19)	NEWCHURCH (19)	Well drained	Normal
NEWCHURCH (20)	NEWCHURCH (20)	Well drained	Normal
NEWCHURCH (21)	NEWCHURCH (21)	Well drained	Normal
NEWCHURCH (22)	NEWCHURCH (22)	Well drained	Normal
NEWCHURCH (23)	NEWCHURCH (23)	Well drained	Normal
NEWCHURCH (24)	NEWCHURCH (24)	Well drained	Normal
NEWCHURCH (25)	NEWCHURCH (25)	Well drained	Normal
NEWCHURCH (26)	NEWCHURCH (26)	Well drained	Normal
NEWCHURCH (27)	NEWCHURCH (27)	Well drained	Normal
NEWCHURCH (28)	NEWCHURCH (28)	Well drained	Normal
NEWCHURCH (29)	NEWCHURCH (29)	Well drained	Normal
NEWCHURCH (30)	NEWCHURCH (30)	Well drained	Normal
NEWCHURCH (31)	NEWCHURCH (31)	Well drained	Normal
NEWCHURCH (32)	NEWCHURCH (32)	Well drained	Normal
NEWCHURCH (33)	NEWCHURCH (33)	Well drained	Normal
NEWCHURCH (34)	NEWCHURCH (34)	Well drained	Normal
NEWCHURCH (35)	NEWCHURCH (35)	Well drained	Normal
NEWCHURCH (36)	NEWCHURCH (36)	Well drained	Normal
NEWCHURCH (37)	NEWCHURCH (37)	Well drained	Normal
NEWCHURCH (38)	NEWCHURCH (38)	Well drained	Normal
NEWCHURCH (39)	NEWCHURCH (39)	Well drained	Normal
NEWCHURCH (40)	NEWCHURCH (40)	Well drained	Normal
NEWCHURCH (41)	NEWCHURCH (41)	Well drained	Normal
NEWCHURCH (42)	NEWCHURCH (42)	Well drained	Normal
NEWCHURCH (43)	NEWCHURCH (43)	Well drained	Normal
NEWCHURCH (44)	NEWCHURCH (44)	Well drained	Normal
NEWCHURCH (45)	NEWCHURCH (45)	Well drained	Normal
NEWCHURCH (46)	NEWCHURCH (46)	Well drained	Normal
NEWCHURCH (47)	NEWCHURCH (47)	Well drained	Normal
NEWCHURCH (48)	NEWCHURCH (48)	Well drained	Normal
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NEWCHURCH (51)	NEWCHURCH (51)	Well drained	Normal
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NEWCHURCH (54)	NEWCHURCH (54)	Well drained	Normal
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NEWCHURCH (56)	NEWCHURCH (56)	Well drained	Normal
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NEWCHURCH (59)	NEWCHURCH (59)	Well drained	Normal
NEWCHURCH (60)	NEWCHURCH (60)	Well drained	Normal
NEWCHURCH (61)	NEWCHURCH (61)	Well drained	Normal
NEWCHURCH (62)	NEWCHURCH (62)	Well drained	Normal
NEWCHURCH (63)	NEWCHURCH (63)	Well drained	Normal
NEWCHURCH (64)	NEWCHURCH (64)	Well drained	Normal
NEWCHURCH (65)	NEWCHURCH (65)	Well drained	Normal
NEWCHURCH (66)	NEWCHURCH (66)	Well drained	Normal
NEWCHURCH (67)	NEWCHURCH (67)	Well drained	Normal
NEWCHURCH (68)	NEWCHURCH (68)	Well drained	Normal
NEWCHURCH (69)	NEWCHURCH (69)	Well drained	Normal
NEWCHURCH (70)	NEWCHURCH (70)	Well drained	Normal
NEWCHURCH (71)	NEWCHURCH (71)	Well drained	Normal
NEWCHURCH (72)	NEWCHURCH (72)	Well drained	Normal
NEWCHURCH (73)	NEWCHURCH (73)	Well drained	Normal
NEWCHURCH (74)	NEWCHURCH (74)	Well drained	Normal
NEWCHURCH (75)	NEWCHURCH (75)	Well drained	Normal
NEWCHURCH (76)	NEWCHURCH (76)	Well drained	Normal
NEWCHURCH (77)	NEWCHURCH (77)	Well drained	Normal
NEWCHURCH (78)	NEWCHURCH (78)	Well drained	Normal
NEWCHURCH (79)	NEWCHURCH (79)	Well drained	Normal
NEWCHURCH (80)	NEWCHURCH (80)	Well drained	Normal
NEWCHURCH (81)	NEWCHURCH (81)	Well drained	Normal
NEWCHURCH (82)	NEWCHURCH (82)	Well drained	Normal
NEWCHURCH (83)	NEWCHURCH (83)	Well drained	Normal
NEWCHURCH (84)	NEWCHURCH (84)	Well drained	Normal
NEWCHURCH (85)	NEWCHURCH (85)	Well drained	Normal
NEWCHURCH (86)	NEWCHURCH (86)	Well drained	Normal
NEWCHURCH (87)	NEWCHURCH (87)	Well drained	Normal
NEWCHURCH (88)	NEWCHURCH (88)	Well drained	Normal
NEWCHURCH (89)	NEWCHURCH (89)	Well drained	Normal
NEWCHURCH (90)	NEWCHURCH (90)	Well drained	Normal
NEWCHURCH (91)	NEWCHURCH (91)	Well drained	Normal
NEWCHURCH (92)	NEWCHURCH (92)	Well drained	Normal
NEWCHURCH (93)	NEWCHURCH (93)	Well drained	Normal
NEWCHURCH (94)	NEWCHURCH (94)	Well drained	Normal
NEWCHURCH (95)	NEWCHURCH (95)	Well drained	Normal
NEWCHURCH (96)	NEWCHURCH (96)	Well drained	Normal
NEWCHURCH (97)	NEWCHURCH (97)	Well drained	Normal
NEWCHURCH (98)	NEWCHURCH (98)	Well drained	Normal
NEWCHURCH (99)	NEWCHURCH (99)	Well drained	Normal
NEWCHURCH (100)	NEWCHURCH (100)	Well drained	Normal

CHAPTER IV

The Soil Series

CALCAREOUS SOILS ON MARINE ALLUVIUM

The seven series in this group all have calcium carbonate in the surface and, with the exception of some Fairfield soils, the amount increases below the A horizon. The series can be arranged according to clay content and depth to peat as follows:

	<i>Dominant Texture of B Horizon or between 12 and 30 in.</i>				
	<i>Silty clay or Clay</i>	<i>Clay loam* over Silty clay or Clay</i>	<i>Clay* loam</i>	<i>Sandy loam or Loam</i>	<i>Loamy sand or Sand</i>
Texture below 30 in. similar or finer than that of B horizon	Newchurch	Walland	Agney	Romney	Greatstone
Loam to sand occurs between 24 and 42 in.	Guldeford				
Thick peat between 24 and 42 in.	Fairfield				

* Silty clay loam and sandy clay loam also occur, but silt and sand contents are mostly very close to those of clay loam.

Texture varies with relief, higher sites being sandier. Soil drainage ranges from moderate to very poor, and is also related to relief, the wettest soils being those of the low-lying Fairfield series.

NEWCHURCH SERIES

Types: silty clay, clay loam, silty clay loam

Phases: moderately well drained, imperfectly drained

Texture Profile

The characteristic texture of the Newchurch series is silty clay, but the surface soil, down to 12 in., may be clay loam or silty clay loam. Laminated silty clay or clay horizons with very thin, horizontal bands of fine sandy or sandy silty materials are also included, provided the texture of a large, well rubbed sample is only slightly coarser than the diagnostic texture to a depth of about 24 in. The texture may be less clayey below, particularly where sandy laminae

are thicker and/or more frequent, but profiles with dominantly sandy or loamy textures are included with the Guldeford series.

Profile Morphology

In typical profiles of the moderately well drained phase under old grass the calcareous A horizon, commonly about 9 in. thick, is a dark greyish brown silty clay with a well developed structure of friable, fine subangular blocks which may be aggregated when dry to a compound structure of medium blocks or prisms. It merges to a brown (e.g. 10 YR 4/3 to 5/3) B1 horizon of calcareous or highly calcareous silty clay with a moderate to strong structure of medium prisms more or less compounded with finer prisms and medium to fine subangular blocks, the peds mostly having brown (10 YR 5/3) to dark greyish brown (10 YR 4/2) faces. Internal ochreous mottling, present in many profiles below about 12 in., is typically distinct and common by about 15 in., and small ferri-manganiferous concretions can also be present. The B2 horizon, commonly beginning at a depth of 18 in., has a coarser, but still well developed structure, and is more distinctly mottled. Pale greyish colours occur, but brown or pale brown (10 YR 6/3) remains prominent internally and/or on ped faces. Thin, horizontal bands of colourless sandy or sandy silty materials present in many profiles accentuate any greyness in such horizons, and often recur more frequently with depth. The rubbed texture in the B3 or B/C horizon below about 30 in. may be clay loam or silty clay loam and coarse, rather weak prisms, commonly present, part readily along horizontal planes. As the Newchurch soils have common boundaries with Guldeford soils (loam to sand substratum) and Fairfield soils (peat substratum), substrata may differ below 42 in., and in some places their occurrence can be predicted (Fig. 6).

At equal depths B horizons of soils of the imperfectly drained phase (*Plate XII*) are greyer and more distinctly mottled than those of the moderately well drained phase; ochreous and/or greyish mottling occurs at less than 12 in. and soil structure is typically coarser and/or less strongly developed. The dominant A horizon colours resemble those in the moderately well drained phase, but are slightly darker or greyer in the wettest soils, with distinct ochreous mottling or rusty staining.

The B1g horizon, between about 9 and 18 in., is greyish brown (e.g. 10 YR 4/2 to 5/2) with ochreous colours prominent inside moderately developed medium to fine prisms and/or coarse blocks, the latter sometimes rather angular. Structure is weaker or coarser in the succeeding B2g horizon below 18 in., where light brownish grey (10 YR 6/2) and pale grey areas contrast with mainly ochreous matrix colours.

In relatively young New Marshland, for instance, between Rye and East Guldeford, soils of the Newchurch series tend to be greyer (e.g. 10 YR 4/1) and more coarsely structured than those described above, partly because of their relative immaturity. Even under old grass, A horizons can have a medium and coarse angular blocky structure and are underlain by a B1g horizon with moderately developed coarse prisms and angular blocks. These characteristics are also found in Guldeford soils in similar sites (profile K47 p. 69). The B1g horizon between about 9 and 16 in. in some Newchurch soils is greyer and more prominently mottled than the succeeding horizon, where structure is weaker and coarser, suggesting that water stagnates above the B2g horizon in winter, causing relatively intense gleying. In summer the soils commonly dry

out and crack deeply, and ground-water levels 6-7 ft below the surface have been recorded between August and October.

Representative profile descriptions

PROFILE NO.: K37, Newchurch series, moderately well drained phase (analyses, pp. 140 and 148).

Location: Honeychild Manor Farm, St. Mary-in-the-Marsh (grid ref. TR 054277).

Relief: slightly elevated area in field with slight micro-relief.

Elevation: c. 9 ft O.D.

Land use: permanent pasture.

Horizons:

in.

- 0-9
A Very dark greyish brown (10 YR 3/2) friable calcareous silty clay with a compound structure of moderate medium prisms and strong fine and medium subangular blocks; common fine pores, occasional very large (1-2 cm) pores; abundant fine fibrous roots; ants and earthworms active; narrow boundary.
- 9-21
B1 Yellowish brown (10 YR 5/4 grading to 10 YR 5/8 with depth) firm highly calcareous silty clay with a moderately strong fine and medium prismatic structure; ped face colours pale with depth from dark greyish brown (10 YR 4/2) to brown (10 YR 5/3), the latter also occurring internally; abundant fine and medium pores, several very large (1-2 cm) pores; fine fibrous roots very common; ants and earthworms active; many small black ferri-manganiferous concretions; merging boundary.
- 21-36
B2g Mottled brown (10 YR 5/3) and strong brown (7.5 YR 5/8) firm highly calcareous silty clay with a moderate medium and coarse prismatic structure; ped faces brown (10 YR 5/3) in upper part, becoming paler and greyer with depth; many very thin horizontal laminae of colourless fine sand, giving an effect of greyish banding; abundant fine and some medium pores; many wide (1-2 cm) interconnecting channels give significant macroporosity; fine roots common; a few black ferri-manganiferous concretions; merging boundary.
- 36+
Bg/Cg Coarsely mottled light brownish grey (2.5 Y 6/2) and strong brown (7.5 YR 5/6) plastic and sticky highly calcareous silty clay with a very weakly developed very coarse prismatic structure, the prisms being interrupted by many very thin bands of fine sand; fine and medium pores common; wide channels continue, a few to 5 ft, some occupied by large earthworms (*Lumbricus terrestris*).

PROFILE NO.: K53, Newchurch series, imperfectly drained phase (analysis, p. 140).

Location: near Sisley Land, East Guldeford (grid ref. TQ 975201).

Relief: flat, some levees and relic creeks in locality.

Land use: permanent pasture.

Horizons:

in.

- 0-8
A Dark brown (10 YR 4/3 and 4/2) calcareous silty clay with a moderate compound structure of medium prisms breaking readily to firm fine and medium subangular blocks; dark greyish brown (10 YR 4/2) ped faces; fine roots very common; sharp boundary.
- 8-19
B1g Yellowish brown (10 YR 5/4) firm highly calcareous silty clay with a moderate medium and coarse angular blocky structure; greyish brown (10 YR 5/2) ped faces and common distinct yellowish red (5 YR 5/6) mottles internally; a few fine pores; fine roots common; some dark grey earthworm burrows; merging boundary.

- Horizons:**
- in.*
 - 19-31 Strong brown (7.5 YR 5/6) wet slightly sticky and plastic silty clay with a moderate fine prismatic and fine angular blocky structure; occasional laminations; ped faces mainly light brownish grey (2.5 Y 6/2); many earthworm burrows and irregular cavities; few roots.
 - B2g
 - 31-45 Below water level; pale brown (10 YR 6/3) laminated silty clay with much strong brown (7.5 YR 5/8) mottling. Fine sandy laminae are dominant below 45 in. and bluish grey medium sand occurs at 72 in.
 - Cg

WALLAND SERIES

Types: clay loam, silt loam, loam

Phases: moderately well drained, imperfectly drained

Texture Profile

Typical soils have loamy A horizons and the clay content increases with depth, with silty clay below 18 in. There is a range of texture profiles, however, with silty clay (or laminated clays as in the Newchurch series) above or below this depth, the thickness of overlying clay loam, silty clay or loam being between 12 and 24 in. Many soils have composite profiles, the upper horizons having formed in a coarser textured deposit (profile K14 below).

Profile Morphology

Moderately well drained and imperfectly drained phases occur and, while soil structure, colours, consistence and thicknesses of horizons are similar to those of the Newchurch series, in typical profiles the A and B1 horizons are rather more friable and finely structured, particularly in soils with loamy A horizons in which fine and medium crumb structure is common.

Representative profile descriptions

PROFILE NO.: K14, Walland series, moderately well drained phase (analysis, p. 140).

Location: Little Scotney, Old Romney (grid ref. TR 008212).

Relief: flat area in field with relic creeks and associated levee-like creek ridges.

Elevation: c. 10 ft O.D.

Land use: old pasture.

Horizons:

- in.*
- 0-4 Dark brown (10 YR 3/3) very friable slightly calcareous loam with moderate fine to medium crumb structure; abundant fine roots; narrow boundary.
- A1
- 4-12 Dark greyish brown and yellowish brown (10 YR 4/2 and 5/4) friable calcareous loam to clay loam with moderate medium to fine subangular blocks loosely aggregated (by abundant fine fibrous roots) into coarse prisms; earthworms active; merging boundary.
- A2
- 12-18 Brown (10 YR 4/3 to 5/3) calcareous clay loam with a moderate, medium prismatic structure, the peds with faint yellowish brown (10 YR 5/6) mottling internally; some ped faces are brown (10 YR 5/3), but otherwise pale yellow and yellowish red (5 Y 8/3 and 5 YR 4/6); sandier material occurs locally in pockets and along ped faces; fine roots common; merging boundary.
- IIB1
- 18-30 Pale brown (10 YR 6/3) firm finely laminated very calcareous silty clay

Horizons:*in.*

- IIB2g** with distinct coarse strong brown (7.5 YR 5/6) mottling; moderately strong coarse and very coarse prismatic structure, the ped faces mainly light brownish grey (10 YR 6/2); fine fibrous roots fairly common; earthworms active.
- 30+** More frequently laminated silty clay; yellowish brown (10 YR 5/4) clayey material with thin light grey (10 YR 7/2) sandy bands affecting the texture of a rubbed sample below 42 in.
- IICg**

PROFILE NO.: K55, Walland series, imperfectly drained phase (analysis, p. 140).

Location: Salts Farm, East Guldeford (grid ref. TQ 945219).

Relief: flat area in field with relic creeks and associated levee-like creek ridges.

Elevation: c. 8 ft O.D.

Land use: old pasture.

Horizons:*in.*

- 0-9** Very dark greyish brown (10 YR 3/2) calcareous silty clay loam with a moderate compound structure, medium prisms falling to finer prisms and medium to fine subangular blocks; fine fibrous roots common, some associated with rusty mottling; sharp boundary.
- A(g)**
- 9-21** Strong brown (7.5 YR 5/8) very calcareous silty clay loam with a moderate medium prismatic and coarse to medium subangular blocky structure; ped faces greyish brown (10 YR 5/2 grading to 2.5 Y 6/2) and similar colours lining very common fine pores (1 mm diam.) and root channels inside the peds; fine fibrous roots are common; several earthworm burrows occur; merging boundary.
- Bg**
- 21-33** Strong brown and yellowish red (7.5 YR 5/6 and 5 YR 5/8) very calcareous silty clay with a weak coarse prismatic and medium to fine subangular blocky structure, also slightly laminated; ped faces grey (5 Y 6/1 to 7/1) and light brownish grey (10 YR 6/2) and similar colours lining very common fine pores (<1 mm diam.) and rare root channels inside the peds; plastic and slightly sticky.
- Bg/Cg**
- 33-44** Light grey (2.5 Y 7/2) and yellowish red (5 YR 5/8) very laminated very calcareous silty clay.
- Cg**
- 44-126** Laminated bluish grey and rusty mottled loam to 66 in. above dark bluish clay loam over peat at 90 in. (peat at least 36 in. thick). Water seeped into pit to 33 in. (7th May 1957).

GULDEFORD SERIES

Types: silty clay, silty clay loam, clay loam, loam

Phases: moderately well drained, imperfectly drained

Texture Profile

Clayey soils similar to the Newchurch series, with coarser textured horizons between 24 and 42 in., are distinguished as the Guldeford series. Soils with a substratum of loam texture (whether laminated or not) are included, but substrata are normally sandier. The coarsest textured materials present are loamy medium sands or sands (Midley Sand in a few localities) and when at 42 in. or less they are shown on the map by overprints. Clay, or a clay-over-peat sequence, can occur at greater depths, usually below 5 ft, but the sandy sub-

strata are normally thick and extend to at least 8 ft in some parts. Profiles grading to those of the Walland or Agney series are of clay loam, or loam and clay loam textures, to about 15 in., but must have at least 9 in. of silty clay or clay in the B horizon before the texture becomes coarser below.

Profile Morphology

Moderately well drained and imperfectly drained phases have been mapped. Where the sandy or loamy layers are little altered the soils are similar to those of the Newchurch (or Walland) series.* But where soil structure has developed, the peds are naturally coarser or less distinct than in horizons at equivalent depths in the finer textured soils, and the soils are less sticky and plastic. The original sedimentary laminations are often seen, but may be somewhat disturbed by earthworms.

Profile K47, described below, was sited in relatively young New Marshland between Rye and East Guldeford, where Guldeford soils tend to be greyest and relatively coarsely structured.

Representative profile descriptions

PROFILE NO.: K41, Guldeford series, moderately well drained phase (analysis, p. 140).

Location: Haffenden Farm, St. Mary-in-the-Marsh (grid ref. TR 063281).

Relief: flat.

Elevation: c. 9 ft O.D.

Land use: ryegrass-white clover ley after recent arable.

Horizons:

in.

- | | |
|-------|---|
| 0-10 | Dark greyish brown (10 YR 4/2) firm slightly calcareous silty clay with a moderate medium and coarse blocky structure; common fibrous roots largely in fissures; earthworms and millipedes present; narrow boundary. |
| 10-21 | Brown and yellowish brown (10 YR 5/3 and 5/6) firm calcareous silty clay with fine grey (5 Y 6/1) mottling apparent below 15 in.; moderate medium prismatic structure, ped faces brown (10 YR 5/3); ferri-manganiferous and secondary calcium carbonate concretions below 18 in.; fine pores common; a few fibrous roots; merging boundary. |
| 21-28 | Finely mottled yellowish brown (10 YR 5.5/4), strong brown (7.5 YR 5/6) and grey (5 Y 6/1) very calcareous loam becoming sandier with depth; very weak prismatic structure; many fine pores and a few earthworm burrows; a few fibrous roots; merging boundary. |
| 28-44 | Similarly mottled light brownish grey (2.5 Y 6/2) wet structureless very calcareous sandy loam grading to loamy sand below about 36 in.; a few fine pores and fibrous roots. |
| 44+ | (Auger boring); loamy sand continues to at least 76 in. |

PROFILE NO.: K47, Guldeford series, imperfectly drained phase (analysis, p. 140).

Location: East Guldeford (grid ref. TQ 933212).

Relief: flat.

Elevation: c. 10 ft O.D.

Land use: old pasture.

* The inherent permeability of the sandy horizons or substrata is assumed to be high compared to the clayey substrata of the Newchurch (or Walland) series, although the latter have remarkably high hydraulic conductivities under certain circumstances (p. 138). However, the sandy substratum is considered sufficiently significant to justify the separation.

Horizons:

	<i>in.</i>	
0-9	A	Dark greyish brown (10 YR 4/2-4/1) very calcareous very firm silty clay with a few rusty mottles; moderate medium and coarse angular blocky structure, the ped faces grey to dark grey (10 YR 5/1-4/1); fine roots common; narrow boundary.
9-16	B1g	Dark grey to greyish brown (10 YR 4/1-4/2) very calcareous firm silty clay loam with rusty staining along root channels and common grey (5 Y 6/1) mottling in pores; moderate compound structure of coarse prisms and coarse angular blocks; fine roots common; some earthworm activity; narrow boundary.
16-21	B2g or B2g/Cg	Greyish brown (10 YR 5/2) and yellowish brown (10 YR 5/4) very calcareous firm silty clay with grey and ochreous colours associated with some fine pores; weak coarse prismatic structure, ped faces mostly greyish brown (10 YR 5/2); fine pores common; roots rare; small shells occur; merging boundary.
21-35	Cg	Yellowish brown (10 YR 5/4) very calcareous ochreous mottled silty clay with very thin light brownish grey (2.5 Y 6/2) sandy silty laminae (rubbed texture silty clay loam); common fine pores; roots rare; merging boundary.
35-45	IIC1g	Laminated light brownish grey (2.5 Y 6/2) and yellowish brown (10 YR 5/4) wet sandy loam (rubbed texture) with grey and ochreous mottling, the latter particularly associated with common fine pores.
45+	IIC2g	Grey (5 Y 6/1) rusty mottled sand with a few brown (10 YR 5/3) silty clay laminae (rubbed texture loamy sand); sandy material below 70 in. is bluish black.

FAIRFIELD SERIES

Types: silty clay, silty clay loam, clay loam

Fine textured, mainly calcareous, soils over thick acid peat between about 24 and 42 in. are grouped as the Fairfield series, the average thickness of mineral soil being 33 in. Many of the soils have composite profiles, surface horizons in particular being developed in a highly calcareous clay loam layer up to 15 in. thick which has buried a decalcified horizon of finer texture, apparently an older soil. Silty clay loam, silty clay and clay are dominant elsewhere, or below the cover, clay particularly in a non-calcareous or slightly calcareous layer 3-18 in. thick immediately over the peat. Possibly the earliest deposits on the peat had little calcium carbonate, or lost it quickly in the acid environment, but in some profiles this clay is sharply separated from a calcareous horizon of coarser texture above, and may be a separate parent material of older soils. A comparable sequence forms the substrata of profile K28 (p. 92).

The thickness of mineral soil in the Fairfield series is related to elevation, depth to peat being least in the lowest wettest sites. Soil drainage varies accordingly, mostly being poor, but grading to very poor where peat occurs at about 24 in.

Typical profiles have a dark, prominently mottled, calcareous Ag horizon, the silty clays having a moderate prismatic to blocky structure. Below about 9 in. there is a calcareous coarsely prismatic Bg horizon of silty clay with grey and ochreous colours inside peds followed by a very sticky, plastic, grey and ochreous clay which is very coarsely structured, contains little or no calcium carbonate and is humose just above the peat.

Profile K24, described below, is on a low and very poorly drained site. It is unusual in carrying salt loving plants such as glasswort (*Salicornia* spp.), but all Fairfield soils probably contain some salt, since the ground water is commonly brackish (p. 111). This profile has the calcareous cover which occurs in many Fairfield soils in the Indraft and Fairfield areas, but the layer of slightly calcareous clay is unusually thick. The profile shows the coarsely structured subsurface horizons typical of the series.

Representative profile description

PROFILE NO.: K24, Fairfield series (analysis, p. 141).

Location: 150 yds south-east of Fairfield Brack (grid ref. TQ 970267).

Relief: low (pool) zone to wide creek ridge.

Elevation: c. 3 ft O.D.

Land use: old pasture.

Horizons:

- in.
- 1-0 Dark greyish brown (2.5 Y 4/2) peaty mat with very abundant fine fibrous roots (living); narrow boundary.
- O
- 0-2½ Grey to greyish brown (2.5 Y 5/1) wet calcareous clay loam with a weak fine subangular blocky structure; plastic, slightly sticky; abundant fine fibrous roots, with dark brown staining along many root channels; gastropod shells (snails) common; sharp uneven boundary.
- A1g
- 2½-6 Greyish brown (2.5 Y 5/2) and light grey (10 YR 7/2) wet very calcareous nearly structureless clay loam with common prominent yellowish red (5 YR 4/6) mottles; very weak medium prismatic and fine subangular blocky structure; slightly plastic and sticky, but somewhat gritty; abundant fine fibrous roots; gastropod shells and fragments very common; merging uneven boundary.
- A2g
- 6-23 Grey (5 Y 5/1, but becoming more bluish grey with depth) very sticky plastic clay with a weak coarse prismatic structure; many large prominent strong brown (7.5 YR 5/6) mottles occur inside the peds, which below about 15 in. contrast sharply with bluish grey colours on structure faces and within fine pores and root channels; fine fibrous roots are common; occasional shells and shell fragments occur, the horizon being variably calcareous; merging boundary.
- IIBg
- 23-44+ Black non-calcareous peat with many wood fragments and some live roots in upper part.
- III

AGNEY SERIES

Types: loam, clay loam

Phases: moderately well drained, imperfectly drained

Texture Profile

Clay loam is the characteristic texture of these soils between about 9 and 27 in., below which coarser textured horizons commonly grade to thick sand. Clayey substrata also occur, however, and loam or clay loam may pass abruptly to silty clay, clay or a clay-over-peat sequence (cp. profile K94 of the Finn series). This change occurs at about 27 in. in profiles grading to those of the Walland series, but peat seldom occurs at less than 5 ft. The characteristic clay loam merges to loam below about 21 in. in profiles grading to those of the Romney series, and includes a rather finer textured horizon, up to 9 in. of silty

clay, by about 15 in. in profiles grading to those of the Guldeford series. The soils often have distinct sedimentary laminations (e.g. K13).

Profile Morphology

In typical profiles of the moderately well drained phase the dark greyish brown unmottled A horizons are between 6 and 10 in. thick and of calcareous friable loam and/or clay loam texture. Under old grass, structure is moderately developed fine to medium crumb immediately below the surface over fine to medium subangular blocks, commonly aggregated to prisms.

The B horizons, also calcareous and of clay loam texture, are brown, the oldest soils tending to be darker and with greyish brown ped faces. Structure differs with age and clay content, but in typical profiles is moderately developed and compound in the upper part, with fine to medium subangular blocks aggregated to medium to coarse prisms. Structure development weakens towards the C horizon, which is often encountered by about 24 in., and has sedimentary laminations, sometimes disturbed by earthworms, the burrows being clearly marked by greyish brown linings. Distinct ochreous and/or greyish mottling occurs in the C horizon, or in the B horizon below about 15 in., and abundant fine pores are usually present, particularly at lower levels.

B horizons of the imperfectly drained phase are paler or greyer than those of moderately well drained soils of corresponding age and common to many distinct ochreous and grey mottles are seen at less than 15 in. Soil structure is also less deeply or less well developed than in moderately well drained soils of the same texture. The dominant A horizon colours are similar in both phases, but grade to or include darker colours (e.g. 10 YR 2/2), and distinct ochreous or rusty staining occurs in the wettest soils.

Representative profile descriptions

PROFILE NO.: K13, Agney series, moderately well drained phase (analyses, pp. 141 and 148).

Location: 400 yds south-east of Little Scotney (grid ref. TR 007212).

Relief: slightly elevated site in field with minor relic creeks.

Elevation: c. 11 ft O.D.

Land use: old pasture.

Horizons:

in.

- | | |
|-------|--|
| 0-4 | Very dark greyish brown (10 YR 3/2) very friable very calcareous clay loam with moderate to strong, fine to medium crumb structure; abundant fine roots; narrow boundary. |
| A | |
| 4-10 | Dark greyish brown and yellowish brown (10 YR 4/2 and 5/4) calcareous loam with a compound structure of weak very coarse prisms falling readily to medium subangular blocks; greyish brown humose ped faces; fine roots abundant; earthworms active; narrow boundary. |
| A/B | |
| 10-18 | Brown (10 YR 4/3-5/3) very friable very calcareous clay loam with moderate fine to medium subangular blocky structure with some yellowish brown to brownish yellow (10 YR 5/4-6/6) loamy material occurring locally in pockets or along structure faces; fine roots very common; earthworms active; narrow boundary. |
| B | |
| 18-40 | Laminated very calcareous clay loam comprising alternate bands of pale brown (10 YR 6/3) silty clay and light grey to pale brown (2.5 Y 7/2-10 YR 6/3) sandy material, the latter with prominent ochreous mottling; fine pores abundant; occasional greyish brown earthworm burrows; fine roots common. |
| Cg | |

Horizons:
in.
 40+ Wet strongly laminated very calcareous sandy loam, dominantly light grey (5 Y 7/2) fine sandy material with yellowish brown (10 YR 5/4) clayey banding; some vertical ochreous streaking partly associated with abundant fine pores; dark grey fine sand at 72 in.

PROFILE NO.: K10, Agney series, moderately well drained phase (analysis, p. 141).

Location: 600 yds south-west of Peartree Farm, Bilsington (grid ref. TR 038324).

Relief: slightly elevated ridge adjacent to narrow creek relic.

Elevation: c. 9 ft O.D.

Land use: old pasture.

Horizons:
in.
 0-6 Very dark greyish brown (10 YR 3/2) slightly calcareous silty clay loam with a strong medium to fine subangular blocky structure; firm when moist, hard when dry; abundant fine roots; merging boundary.
 A
 6-14 Brown (10 YR 4/3) to yellowish brown (10 YR 5/4) calcareous silty clay loam with a moderate medium to fine subangular blocky structure; firm when moist, hard when dry; dark greyish brown (10 YR 4/2) ped faces; fine roots common; merging boundary.
 B1
 14-26 Brown to pale brown (10 YR 5/3-6/3) firm very calcareous silty clay loam with many faint paler and stronger brown fine mottles; weak compound medium prismatic and medium to fine subangular blocky structure; greyish brown ped faces; fine roots common; earthworms active; fine pores very common; some small rounded concretions of secondary calcium carbonate present; merging boundary.
 B2(gca)
 26-45 Weakly laminated wet very calcareous fine sandy clay loam comprising alternate bands of pale brown (10 YR 6/3) silty clay and greyish fine sandy material; many distinct greyish and ochreous mottles; numerous rounded concretions of secondary calcium carbonate; fine roots few to common.
 Cgca
 45+ Grey to light brownish grey laminated fine sandy loam with prominent ochreous mottling.

ROMNEY SERIES

Types: loam, sandy loam

Phases: moderately well drained, imperfectly drained

Texture Profile

The characteristic textures of these profiles are loams and/or fine to very fine sandy loams to a depth of at least 27 in., the sand content increasing progressively with depth below about 18 in. Lower horizons, or substrata, are at least as coarse as loamy fine sand, and such material may extend down to 8 ft or more (e.g. profile K52). This is not an essential characteristic of the series, however, for otherwise similar soils have fine textured substrata at varying depths below 27 in. Profile K52, in which there is a substantial increase in clay between about 28 and 35 in., is an example, and clay, or a clay-over-peat sequence, occurs in some soils (cp. profile K91 of the Snargate series), although peat is rarely present at less than 5 ft.

Profile Morphology

The dark unmottled A horizons of the moderately well drained phase are between 6 and 10 in. thick and comprise friable or very friable loams or sandy

loams. Under old grass the structure is weakly or moderately developed, with fine to medium crumbs and subangular blocks which may be aggregated to fine or medium prisms. The B horizons, also calcareous and of loam or fine sandy loam texture, range in colour from light yellowish brown to brown, the oldest soils tending to be darker and to have greyish brown ped faces, at least in the upper part of the horizon. Structure differs to some extent with age and clay content, but peds are larger and more weakly developed than in the corresponding A horizon. Well developed B horizons are about 9 in. thick, but in some young soils the A horizon merges into a very pale brown, weakly structured B/C horizon. Distinct ochreous and/or greyish mottling due to gleying occurs in the C horizon or in the B horizon below about 15 in. There is a merging boundary to the C horizon which includes sedimentary laminations, but these may have been disturbed by earthworms, the greyish brown lined burrows being often conspicuous.

The B horizons of the imperfectly drained phase are paler or greyer than those of the moderately well drained phase of the same age and common to many distinct mottles are seen at less than 15 in. Soil structure is also less deeply or less well developed than in moderately well drained soils of equivalent texture. The dominant A horizon colours are similar in both phases, but grade to or include darker colours in the imperfectly drained phase, and distinct ochreous or rusty staining may occur in the wettest soils. In some young soils the A horizon merges into a very pale brown, more or less structureless Bg/Cg or Ag/Cg horizon in which traces of original sedimentary lamination may still be seen. A transitional horizon of this kind occurs between 7 and 14 in. in profile K105.

Representative profile descriptions

PROFILE NO.: K52, Romney series, moderately well drained phase (analysis, p. 141).

Location: Wainway Creek (grid ref. TQ 978197).

Relief: elevated site (natural bank or levee) bordering relic creek.

Elevation: c. 10 ft O.D.

Land use: old pasture.

Horizons:

- | | |
|-------|---|
| in. | |
| 0-7 | Dark yellowish brown (10 YR 3/4) friable loam with moderate compound structure of fine prisms falling readily to fine subangular blocks and crumbs; abundant fine roots; earthworms active; narrow boundary. |
| A | |
| 7-16 | Light yellowish brown (10 YR 6/4) to yellowish brown (10 YR 5/4) and very dark greyish brown (10 YR 3/2) to dark greyish brown (10 YR 4/2) friable loam, the greyish brown colours particularly on ped faces; moderate medium subangular blocky structure; numerous roots; earthworms and mound ants active; some marine shells; narrow irregular boundary. |
| 16-28 | Light yellowish brown (2.5 Y 6/4) and light grey (2.5 Y 7/2) loamy sand more or less laminated with yellowish brown (10 YR 5/8) silty clay (rubbed texture, sandy loam); numerous fine roots and abundant fine pores; numerous earthworms and burrows with dark greyish brown humose coatings; merging boundary. |
| B/C | |
| 28-35 | As above, but slightly paler in colour and with more frequent and more conspicuous silty clay laminae (rubbed texture, loam). |
| C1(g) | |
| 35-43 | Wet pale brown (10 YR 6/3) and grey (5 Y 6/1) fine sand, finely laminated with light yellowish brown (10 YR 6/4) silty clay (rubbed texture, loamy sand); numerous fine pores; a few earthworms active. |
| C2g | |

Horizons:

in.

43-72 Wet structureless pale brown (10 YR 6/3) and grey (5 Y 6/1) loamy sand with prominent ochreous mottling; no roots; abundant fine 1-2 mm diam. pores; marine shells occur.

C3g

72-120+ Blue-grey fine sand.

C4g

PROFILE NO.: K105, Romney series, imperfectly drained phase (analyses, pp. 141 and 148).

Location: East Guldeford (grid ref. TQ 936203).

Relief: elevated site (natural bank or levee) bordering relic creek.

Elevation: c. 8 ft O.D.

Land use: old pasture.

Horizons:

in.

0-4 Very dark brown (10 YR 2/2) friable fine sandy loam with moderate fine and very fine crumb structure; abundant fine roots; narrow boundary.

A1

4-7 Very dark brown (10 YR 2/2) friable fine sandy loam with weak fine crumb structure; common fine roots; sharp irregular boundary (tongues to 11 in.).

A2

7-14 Pale brown (10 YR 6/3 and 7/3) almost structureless fine sandy loam with common rather faint yellowish brown and strong brown mottling; few roots; sharp boundary.

B/Cg

14-28 Light brownish grey (10 YR 6/2) and light grey (10 YR 7/2) fine sand with frequent pale brown silty clay laminae (rubbed texture, fine sandy loam); prominent yellowish red to strong brown mottling; a few roots in occasional fine pores; shells of *Cardium* sp. occur.

C1g

28-35+ Light grey (5 Y 6/1) similarly mottled and laminated material; roots rare.

C2g

PROFILE NO.: K16, Romney series, imperfectly drained phase (analysis, p. 141).

Location: Belgar Farm, Lydd (grid ref. TR 063227).

Relief: level area between two beach banks.

Elevation: c. 10 ft O.D.

Land use: arable; site in clear drill 4 ft wide between roots and spring wheat.

Horizons:

in.

0-12 Dark greyish brown (10 YR 4/2 and 3/2) friable loam, some inclusions of subsurface material; weak compound subangular blocky structure, medium to coarse aggregates falling locally to fine subangular blocks and crumbs; few roots; earthworms active; sharp undulating boundary.

12-20

Light yellowish brown (10 YR 6/4) friable loam with brown (10 YR 5/3) and greyish brown infillings and common faint pale grey and ochreous mottlings; weak fine subangular blocky structure; few roots; earthworms active; narrow boundary.

Bg

20-28 Pale brown (10 YR 6/3) very friable nearly structureless loam with common faint yellowish brown and ochreous mottling; occasional manganiferous concretions; earthworms are active and occasional burrows and old root channels have greyish brown humose coatings; roots rare; some marine shells; narrow boundary.

C1g

28-36 Light brownish grey (10 YR 6/2) wet finely porous structureless sandy

C2g

loam with mottling as above; marine shell fragments.

36+

Grey (10 YR 6/1-6/2) mottled loamy sand.

C3g

GREATSTONE SERIES

Types: silty clay, clay loam, sandy loam

Calcareous soils formed in, or over thick, rather coarse sands or loamy sands at depths between 6 and about 15 in. are grouped as the Greatstone series.* The texture at the surface ranges from silty clay to sandy loam, different soil types being recognized accordingly. In many of the finer textured soils there is an abrupt boundary to the underlying sands and loamy sands, but the latter may include thin bands of clayey materials (sedimentary laminations).

Lack of distinct browning and the common occurrence of undisturbed sedimentary laminations above 12 in. in typical profiles suggest that the soils are immature (AC or weak ABC soils).

When nearly dry the subsurface horizons are often very hard or even indurated, and this characteristic, which occurs in some instances to a depth of 21 in., may be of pedological origin. Most of the soils have distinct ochreous or rusty mottling to or near the surface, but their drainage mostly appears to be imperfect. The recent construction of a new outfall at Greatstone, however, should improve the drainage of most of the land concerned.

Representative profile descriptions

PROFILE NO.: K61, Greatstone series (analysis, p. 141).

Location: Littlestone-on-Sea (grid ref. TR 074244).

Relief: level area, but with relics of eastward draining creeks.

Elevation: c. 11 ft O.D.

Land use: old (rough) pasture.

Horizons:

- | | |
|------------|--|
| <i>in.</i> | |
| 0-10 | Dark greyish brown (10 YR 4/2) very calcareous silty clay with much distinct strong brown (7.5 YR 5/8) mottling below about 7 in.; moderately strong coarse and medium prismatic structure, falling partly to very hard medium subangular blocks; ped faces mostly very dark greyish brown (10 YR 3/2); occasional very fine laminations below 5 in.; earthworm burrows are present; fine roots abundant in the surface, decreasing to common; merging boundary. |
| A1g | |
| 10-14 | Dark greyish brown (10 YR 4/2) firm to hard very calcareous loam and sandy clay loam with many distinct fine yellowish red (5 YR 5/8) mottles; weak fine and medium subangular blocky structure and fine sedimentary laminations; ped faces mainly dark greyish brown, but locally paler and greyer (10 YR 5/2-5/1); few 2-3 mm pores; fine fibrous roots common; many earthworm burrows; shells common; sharp boundary. |
| A2g | |
| 14-21 | Multi-speckled very hard calcareous loamy sand; overall colour light yellowish brown (10 YR 5.5/4), but consists of very pale brown (10 YR 7/4), dark brown (7.5 YR 4/4) and clear grains with much prominent yellowish red (5 YR 5/6) mottling, particularly associated with common fine pores; a few fine fibrous roots; occasional earthworm burrows; merging boundary. |
| IIBg/Cg | |
| 21-36 | Multi-speckled rather loose calcareous medium sand; overall colours are |

* A small reclaimed area east of Rye harbour (TQ 949187) has been mapped as Greatstone series, but evidently still suffers periodic inundation by the sea and may better be regarded as Saltings.

- Horizons:**
 in.
 IICg pale brown (10 YR 6/3) and light brownish grey (10 YR 6/2), but consists dominantly of strong brown (7.5 YR 5/6), clear and black grains; structureless but clayey laminations occur in three bands about 1 in. thick between 23 and 32 in.; a few rust-lined pores; fine fibrous roots very rare; occasional earthworm burrows; some shells present.
 36+ Similar, but wet, material passing to saturated dark grey medium sand at 54 in.; no roots.

PROFILE NO.: K62, Greatstone series (analysis, p. 141).

Location: Greatstone-on-Sea (grid ref. TR 077235).

Relief: level.

Elevation: c. 11 ft O.D.

Land use: rough 4-5 year ley.

- Horizons:**
 in.
 0-7 Light brownish grey (10 YR 6/2) hard very calcareous sandy loam with strong brown (7.5 YR 5/8) mottling along root channels; structureless except for occasional weak sedimentary laminations and local very weak fine crumbs; common fine pores (old root channels); fine fibrous roots common; sharp boundary.
 A(g)
 7-9 Light brownish grey (10 YR 6/2) and very pale brown (10 YR 7/3) very hard very calcareous sandy loam speckled with clear sand grains and with much reddish yellow (7.5 YR 6/8) mottling; structureless except for occasional weak sedimentary laminations; weakly cemented; a few fine pores and fine fibrous roots; narrow boundary.
 Bg/Cg
 9-14 Very pale brown (10 YR 8/3) very calcareous loamy sand with frequent light brownish grey (10 YR 6/2) finer textured laminae (rubbed texture, loam) and many reddish yellow (7.5 YR 6/8) mottles; weakly cemented, very hard to break vertically but slightly hard horizontally; few fine pores (old root holes); few fine fibrous roots; narrow boundary.
 Clg
 14-21 Coarsely mottled brownish yellow (10 YR 6/6), very pale brown (10 YR 8/3) and brown (7.5 YR 5/4) loose calcareous loamy sand speckled with clear sand grains; structureless; a few fine fibrous roots in very occasional earthworm burrows; many fragmented shells present; merging boundary.
 IIC2g
 21+ Pale brown (10 YR 6/3) loose calcareous sand with prominent reddish yellow (7.5 YR 6/8) mottling associated with old vertical root channels; abundant fragmented shells; passes to bluish grey medium sand at 48 in.
 IIC3g

DECALCIFIED SOILS ON MARINE ALLUVIUM

The eight series in this group, all more or less decalcified (p. 59), may be arranged according to clay content and depth to peat as illustrated in the table on the next page.

In general texture is correlated with relief, the higher sites mostly being sandier. Drainage, which ranges from good to very poor, is commonly related to relief and texture, the higher and coarser textured Midley soils being the better drained. Fine textured soils with a peat substratum at less than 42 in., the Dowels and Appledore series, are on the lowest and wettest sites.

	<i>Dominant Texture of B Horizon or between 12 and 30 in.</i>				
	<i>Silty clay or Clay</i>	<i>Clay loam* over Silty clay or Clay</i>	<i>Clay* loam</i>	<i>Loam or Sandy loam</i>	<i>Loamy sand or Sand</i>
Texture below 30 in. similar or finer than that of B horizon	Dymchurch	Brenzett	Finn	Snargate	Midley
Loam to sand between 24 and 42 in.	Ivychurch				
Thick peat between 24 and 42 in.	Dowels				
Thick peat above 24 in.	Appledore				

* Silty clay loam and sandy clay loam also occur, but silt and sand contents are very close to those of clay loam.

DYMCHURCH SERIES

Types: silty clay, clay loam, silty clay loam

Phases: moderately well drained, imperfectly drained, decalcified, slightly decalcified

Texture Profile

This series is texturally akin to the Newchurch series, typically silty clay, though the surface soil down to 12 in. may be clay loam or silty clay loam. Laminations are less conspicuous than in Newchurch soils, however, or occur only below about 30 in. Profiles with dominantly sandy or loamy textures at such levels are included with the Ivychurch series.

Profile Morphology

In typical profiles of the moderately well drained phase under old grass, A horizons, non-calcareous and mostly dark greyish brown (10 YR 3/2), are friable silty clays with a well-developed fine to very fine subangular blocky structure or, when dry, a compound structure with coarser blocks and prisms. Such horizons have no distinct mottling and may be less than 6 in. thick, but if so there is a comparatively thick A/B horizon of firm silty clay with dark brown (10 YR 3/3-4/2) ped faces and slightly brighter colours (10 YR 4/3-4/4) inside the peds. These A/B horizons may or may not be calcareous and are up to 12 in. thick with a moderate structure of fine to coarse prisms partly breaking to fine subangular blocks; faint or distinct ochreous mottling and ferri-manganiferous concretions can occur below 12 in., but conspicuous grey colours are absent. A more distinctly mottled B1g horizon of firm silty clay, with a moderate to strong medium prismatic structure, occurs below about 15 in. with mainly brown colours (10 YR 4/3-5/4) internally and dark greyish brown ped faces. Pale

mottling, where present, tends to be greyish brown (2.5 Y 5/2), with greyer colours only in wetter soils transitional to the imperfectly drained phase. Ochreous and grey mottling is more prominent inside peds between about 24 and 30 in., and is the main characteristic of the B2g horizon at these depths. The very firm silty clay has a similar structure to the B1 horizon, although in some profiles medium or coarse prisms fall readily to medium or coarse blocks, along planes of weakness possibly due to relic laminations. In spite of mottling and ferri-manganiferous deposits, typical B2g horizons are quite brown, particularly as brown to pale brown (10 YR 6/3) colours inside peds are commonly accompanied by dark greyish brown to brown colours on ped faces and along fissures. A coarser weaker structure can occur below 36 in., but brown colours diminish, and substrata are dominantly grey with ochreous mottling.

The A, or combined A and A/B, horizons of the imperfectly drained phase tend to be thinner than in the moderately well drained soils, and at a given depth the B horizons are greyer, more distinctly mottled and have a less strongly developed structure or one which is nearly a grade coarser. Distinct ochreous and/or greyish mottling is seen above 12 in., and rusty staining can also occur in the A horizons of the wettest soils, mostly associated with roots or old root channels. Both surfaces and interiors of peds in the A/Bg and Bg horizons are as dark as those of the moderately well drained phase, but grade to greyish browns of lower chroma (e.g. 10 YR 5/2) or yellower hue (e.g. 2.5 Y 4/2-5/2), particularly with depth. Ochreous and grey colours, the latter commonly rather dark, are dominant in the B2g horizon or below about 18 in.

B horizons in Dymchurch soils are browner and/or darker than in Newchurch soils of equivalent drainage phase at the same depth. The upper part of the B horizon in moderately well drained Dymchurch soils is brown (e.g. 10 YR 4/3) inside peds, and similar or rather greyer colours (e.g. 10 YR 4/2) occur on ped faces and are characteristic of such sites to appreciable depths (e.g. profile K111). In moderately well drained Newchurch soils, however, colours at corresponding depths grade to or include paler or greyer browns (e.g. 10 YR 5/3), and dark brown or greyish brown colours occur on ped faces only in the upper part of the B horizon (profile K37).

Grey colours also differ between the two series, particularly in the imperfectly drained phases, being dark (e.g. 5 Y 5/1) and/or bluish in Dymchurch soils, but pale (having higher values) in Newchurch soils (e.g. 2.5 Y 6/2, 5 Y 6/1). In addition, greyish brown (2.5 Y 4/2-5/2) colours are relatively common in Dymchurch soils.

Representative profile descriptions

PROFILE NO.: K111, Dymchurch series, moderately well drained, deeply decalcified phase (analyses, pp. 142 and 147).

Location: Great Lath Farm, Burmarsh (grid ref. TR 107322).

Relief: level.

Elevation: c. 8 ft O.D.

Land use: permanent pasture.

Horizons:

in.

- 0-6 Very dark brown (10 YR 2/2) friable clay loam with a moderately strong compound structure of fine prisms which fall readily to fine and very fine subangular blocks and some fine granules; fine roots common; non-calcareous; narrow boundary.
- A

- Horizons:**
- in.*
- 6-15 Dark brown (10 YR 3/3) and dark yellowish brown (10 YR 4/4) firm silty clay with a moderately developed fine and medium prismatic and subangular blocky structure; dark brown (10 YR 3/3) ped faces; fine pores and roots very common; non-calcareous; narrow boundary.
- A/B
- 15-24 Brown (10 YR 4/3) very firm silty clay with many distinct dark brown (7.5 YR 4/4) mottles; moderately strong medium prismatic structure, the ped faces brown to dark greyish brown (10 YR 4/3-4/2); fine pores and roots common; some ferri-manganiferous stains and concretions; mostly non-calcareous; narrow boundary.
- B1g
- 24-36 Brown (10 YR 5/3, locally 4/3) very firm calcareous silty clay with much distinct diffuse mottling, the grey colours ranging from greyish brown (2.5 Y 5/2) to olive-grey (5 Y 5/2) and ochreous colours from dark brown (7.5 YR 4/4) to yellowish red (5 YR 4/6); moderately developed medium and coarse prismatic and subangular blocky structure, the ped faces dark greyish brown (10 YR 4/2); fine pores very common; a few fine roots; some ferri-manganiferous stains and concretions; some local secondary carbonate concretions.
- B2gca

PROFILE NO.: K108, Dymchurch series, imperfectly drained, deeply decalcified phase (analysis, p. 142).

Location: Manor Farm, Brenzett (grid ref. TR 017294).

Relief: nearly level site in pool zone.

Elevation: c. 6 ft O.D.

Land use: permanent pasture.

Horizons:

- in.*
- 0-5 Very dark brown (10 YR 2/2) friable silty clay to silty clay loam with much yellowish red (5 YR 4/6) staining associated with roots; moderately strong compound structure of fine and medium prisms and fine and very fine subangular blocks; abundant fine roots; non-calcareous; narrow boundary.
- A1(g)
- 5-12 Very dark greyish brown (10 YR 3/2) and dark yellowish brown (10 YR 4/4) rather firm silty clay with a few distinct ochreous and greyish mottles; moderately strong compound structure of coarse to medium prisms falling readily to fine prisms and medium and fine subangular blocks; ped faces very dark greyish brown (10 YR 3/2); fine roots abundant; non-calcareous; merging boundary.
- A2g
- 12-19 Dark greyish brown (2.5 Y 4/2) and brown (10 YR 4/3) firm silty clay to clay with common distinct ochreous mottles; moderate structure of well-fissured coarse and medium prisms; dark greyish brown (10 YR to 2.5 Y 4/2) ped faces and fine pores; non-calcareous; some black ferri-manganiferous specks; merging boundary.
- B1g
- 19-27 Brown (10 YR 4/3) firm calcareous silty clay with distinct grey (10 Y 6/1) and ochreous mottles dominant; moderate medium and coarse prismatic structure; dark greyish brown (2.5 Y 4/2) ped faces and linings to pores; common fine roots; fine pores; occasional irregular burrows around 1 cm diam.; small concretions of calcium carbonate below about 22 in.; black ferri-manganiferous specks common; narrow boundary.
- B2gca
- 27-36 Grey (5 Y 5/1) very firm highly calcareous silty clay with distinct ochreous mottling ranging from strong brown (7.5 YR 5/6 to 5/8) to yellowish red (5 YR 5/6 to 5/8); occasional widely spaced vertical fissures; a few fine pores; irregular faunal burrows die out by about 33 in.; roots rare; some concretions of calcium carbonate; some black ferri-manganiferous specks.
- B3g/Cg

PROFILE NO.: K25, Dymchurch series, imperfectly drained, slightly decalcified phase (analysis, p. 142).

Location: College Farm, Aldington (grid ref. TR 073339).

Relief: nearly level.

Elevation: c. 9 ft O.D.

Land use: old pasture.

Horizons:

- in.
- 0-10 Ag Dark brown (10 YR 3/3) firm non-calcareous silty clay with a moderate to strong compound structure of coarse prisms and fine subangular blocks; distinct yellowish red (5 YR 5/6) mottling is common internally, and some rusty staining is associated with roots and root channels; fine roots very common; mound ants and earthworms present; merging boundary.
- 10-18 B1g Dark yellowish brown (10 YR 4/4) extremely firm calcareous silty clay with many distinct greyish and ochreous mottles; moderate to strong coarse prismatic structure; fine roots are very common, particularly along ped faces; occasional fine pores; some small black ferri-manganiferous concretions; merging boundary.
- 18-31 B2ga Yellowish brown (10 YR 5/4) extremely firm calcareous silty clay with distinct grey (5 Y 5/1) colours associated with root channels and occasional fine pores; moderate to strong coarse prismatic structure, the ped faces grey (5 Y 5/1); few roots; concretions of secondary calcium carbonate at 22-25 in.; merging boundary.
- 31-50 Cg Grey and ochreous plastic partly laminated silty clay; no roots. Silty clay continues to 72 in., becoming peaty at 68 in., and is succeeded by 12 in. of greenish silt loam. The latter overlies peat at 84 in., merging with organic silty clay loam below 102 in. and greyish blue sand (Midley Sand?) occurs at 127 in.

BRENZETT SERIES

Types: clay loam, silty clay loam, loam

Phases: moderately well drained, imperfectly drained, slightly decalcified, deeply decalcified

Texture Profile

This series comprises soils with a similar range of texture profiles to the Walland series (p. 67), and many also appear to have composite profiles.

Profile Morphology

Typical profiles of both drainage phases differ from those of the Dymchurch series in having rather more friable and finely structured A and B1 horizons, particularly in soils with loamy A horizons, where a fine and medium crumb structure is common in the surface.

Soil structure, colours, consistence and the thicknesses of horizons are analogous to those of the Dymchurch series.

Representative profile descriptions

PROFILE NO.: K19, Brenzett series, moderately well drained phase (analysis, p. 142).
Location: 150 yds east of Hangman's Toll Bridge, Snave (grid ref. TR 013291).

Relief: flat.

Elevation: c. 8 ft O.D.

Land use: old pasture.

Horizons:

- in.
- 0-4 Very dark greyish brown (10 YR 3/2) friable silty clay loam to clay loam with a moderate fine subangular blocky and crumb structure; non-calcareous; abundant fine fibrous roots; merging boundary.
- A
- 4-16 Very dark greyish brown (10 YR 3/2) and dark yellowish brown (10 YR 4/4) firm clay loam with a compound structure of moderate coarse to medium prisms partly falling to fine subangular blocks; ped faces very dark greyish brown (10 YR 3/2); non-calcareous; abundant fine fibrous roots decreasing with depth; earthworm burrows frequent; merging boundary.
- A/B
- 16-26 Dark greyish brown (10 YR 4.5/2) and dark yellowish brown (10 YR 4.5/4) firm calcareous clay with a few faint strong brown (7.5 YR 5/6) mottles; strong coarse and medium prismatic structure, the ped faces dark greyish brown; fine pores and fine fibrous roots common; frequent earthworm burrows with dark brown castings and linings; merging boundary.
- B1
- 26-40 Brown (10 YR 5/3) and pale brown (10 YR 6/3) firm very calcareous clay with many distinct yellowish red (5 YR 5/6-5/8) and grey mottles and many small secondary calcium carbonate and ferri-manganiferous concretions; strong medium prismatic and angular blocky structure; fine pores common; fine fibrous roots few to common; several earthworm burrows with dark brown linings.
- B2gca
- 40+ Pale brown silty clay with prominent ochreous and grey mottling, the latter becoming dominant below 50 in. as the texture becomes clay loam.

PROFILE NO.: K45, Brenzett series, imperfectly drained, slightly decalcified phase (analysis, p. 142).

Location: near Old Romney (grid ref. TR 032248).

Relief: low pool to east of trunk creek ridge.

Elevation: c. 7 ft O.D.

Land use: permanent pasture.

Horizons:

- in.
- 0-5 Very dark greyish brown (10 YR 3/2) friable humose silty clay loam with a moderately strong compound structure of fine prisms, subangular blocks and fine crumbs; abundant fine roots; some soil material slightly calcareous; probably due to incorporation of deeper material by ants; mound ants and eggs occur; narrow boundary.
- A1
- 5-11 Dark greyish brown (10 YR 4/2) firm silty clay loam with many olive-brown (2.5 Y 4/4) mottles inside the peds; moderate compound structure of medium prisms comprising coarse and medium subangular blocks and some fine crumbs; fine roots common; mound ants (and local slightly calcareous soil) still present; narrow boundary.
- A2(g)
- 11-17 Greyish brown (10 YR 5/2) to dark greyish brown (10 YR 4/2) firm clay loam with many faint fine yellowish brown (10 YR 5/6) and grey (5 Y 5/1) mottles mainly within peds; non-calcareous; moderate medium prismatic structure with some subangular blocks; some fine pores; occasional roots; earthworms fairly abundant and many burrows; many small ferri-manganiferous concretions; narrow boundary.
- IIBg

Horizons:

- in.*
- 17-38 IIC1g Brown (10 YR 5/3) and greyish brown (10 YR 5/2) laminated silty clay with many light grey (2.5 Y 7/2) and strong brown (7.5 YR 5/8) mottles; weak coarse prismatic and blocky structure, most pedis having thin horizontal fine sandy silty bands; few fine roots; fine pores abundant; many interconnecting large holes (c. 1 cm diam.) and cavities; narrow boundary.
- 38-48 IIC2g Bluish grey plastic and slightly sticky calcareous clay with many coarse yellowish red (5 YR 5/6) mottles; some large holes continue from horizon above.
- 48-51 IIICg Bluish grey plastic and slightly sticky clay with many coarse yellowish red (5 YR 5/6) mottles; non-calcareous.
- 51-59 Peat.
- 59-68+ Grey silty clay loam.

IVYCHURCH SERIES

Types: silty clay, silty clay loam, clay loam, loam

Phases: moderately well drained, imperfectly drained, slightly decalcified, deeply decalcified

Texture Profile

Clayey soils similar to the Dymchurch series, with coarser textured horizons between 24 and 42 in. are distinguished as the Ivychurch series. Soils with a substratum of loam texture (whether laminated or not) are included, but sandier substrata are more usual, and loamy medium sand or sand occurs in some places. The latter is mostly Midley Sand, and its occurrence above 42 in. is shown on the soil map by overprints as variants of the series. This old deposit is often sharply separated from the clay or silty clay above, sometimes by an inch or so of peat. Elsewhere silty clay, or a clay-over-peat sequence, are found below the sandy substrata (e.g. profile K96), but the latter are often thick and extend to at least 8 ft in some places (e.g. profile K92).

Profiles grading to Brenzett or Finn series have surface horizons of clay loam, or loam and clay loam to about 15 in., but there must be at least 9 in. of silty clay or clay in the B horizon before loamy to sandy horizons are encountered.

Profile Morphology

Ivychurch soils with sandy or loamy substrata little altered, except by gleying, are similar to those of the Dymchurch (or Brenzett) series. When affected by soil development structures are coarser or less well developed compared to horizons at equivalent depths in finer textured soils, and they are not sticky or plastic unless laminated.

Representative profile descriptions

PROFILE NO.: K92, Ivychurch series, moderately well drained, deeply decalcified phase (analyses, pp. 143 and 147).

Location: Honeywood Farm, Newchurch (grid ref. TR 057328).

Relief: flat.

Elevation: c. 10 ft O.D.

Land use: old pasture.

Horizons:

in.

- 0-6
A Dark greyish brown (10 YR 4/2) hard finely fissured loam with a compound structure of moderate coarse prisms falling to strong fine subangular blocks; non-calcareous; common fine and few medium pores; abundant fine fibrous roots; burrowing activity by earthworms and/or ants, the holes mainly 0.5 cm and 1 cm diam.; merging boundary.
- 6-11
A/B Brown (10 YR 4/3) very hard clay with a few faint strong brown mottles in lower part; moderate compound structure of very coarse prisms falling to medium prisms, coarse to medium blocks and some fine to medium subangular blocks; dark greyish brown (10 YR 3.5/2) ped faces; non-calcareous; common fine and few medium pores; fine fibrous roots very common, particularly along fissures and faunal burrows, the latter mostly between the peds; merging boundary.
- 11-18
B1(g) Yellowish brown (10 YR 5/4) extremely hard clay with greyish brown (10 YR 5/2) and strong brown (7.5 YR 5/8) mottling, increasing with depth; compound structure of moderately strong very coarse and coarse prisms falling to medium prisms and coarse and very coarse blocks; ped faces and pores dominantly dark greyish brown (10 YR 4/2); common fine and few medium pores; non-calcareous; a few ferri-manganiferous concretions; fine fibrous roots common, particularly along fissures and a few faunal burrows, the latter mostly between the peds.
- 18-32
B2g Yellowish brown (10 YR 5/4) very hard clay with greyish brown (2.5 Y 5/2) and strong brown (7.5 YR 5/8) mottling; compound structure of moderately strong very coarse and coarse prisms falling to coarse and very coarse blocks; ped faces and pores dominantly dark greyish brown (10 YR hue dominant); common fine pores; non-calcareous; many ferri-manganiferous concretions; fine fibrous roots common, mostly along ped faces and within pores; few faunal burrows as above; merging boundary.
- 32-37
B3g Light yellowish brown (10 YR 6/4) and brown (10 YR 5/3) slightly plastic silt loam with yellowish red (5 YR 5/8), strong brown (7.5 YR 5/8) and greyish brown (10 YR 5/2) mottling; moderate medium and coarse prismatic structure weakening with depth and weakly laminated; ped faces dark greyish brown (10 YR 4/2); non-calcareous; many ferri-manganiferous concretions; common fine and medium pores and a few faunal burrows.
- 37-42
C1g Pale brown (10 YR 6/3) sandy material with thin brown (10 YR 5/3) horizontal clayey laminae (rubbed texture, sandy loam); many prominent strong brown (7.5 YR 5/8) mottles partly associated with the laminations; non-calcareous; occasional ferri-manganiferous concretions; common fine pores and frequent faunal burrows with dark greyish brown (10 YR 4/2) linings; a few fine fibrous roots; a few large earthworms; merging boundary.
- 42-50
C2g Greyish brown (10 YR 5/2) and brown (10 YR 5/3) slightly laminated sandy loam with strong brown (7.5 YR 5/8) mottling, the latter partly associated with fine and medium pores; non-calcareous; common medium and few fine pores; occasional faunal burrows with a few fine fibrous roots; several large earthworms; narrow boundary.
- 50-96+
C3g Calcareous medium sand, becoming grey at 63 in. and greenish grey at 84 in.

PROFILE NO.: K96, Ivychurch series, imperfectly drained, slightly decalcified phase (analysis, p. 143).

Location: Pear Tree Farm (grid ref. TR 042328).

Relief: flat, near centre of slight creek ridge.

Elevation: c. 9 ft O.D.

Land use: old pasture.

Horizons:

- in.
- 0-9
A Very dark greyish brown (10 YR 3/2) clay loam with prominent strong brown (7.5 YR 5/8) mottling associated with dead roots in 0-3 in.; compound structure of moderate very coarse prisms falling to moderately strong fine, very fine (and some medium) subangular blocks; consistency extremely hard to hard with increasing ped size; finely fissured; non-calcareous; a few fine and medium pores; abundant fine fibrous roots; occasional faunal burrows; merging boundary.
- 9-14
B1g Dark brown (10 YR 4/3) and dark greyish brown (2.5 Y 4/2) silty clay with distinct common strong brown (7.5 YR 5/8) mottling; compound structure of moderate very coarse prisms falling to coarse and medium prisms, medium blocks and some weak medium and fine subangular blocks; dark greyish brown (10 YR 3.5/2) ped faces, extremely hard to very hard; non-calcareous; common fine pores and a few medium pores; common fine fibrous roots; occasional faunal burrows; merging boundary (but sharp change in calcium carbonate content).
- 14-24
B2gca Yellowish brown (10 YR 5/4) calcareous silty clay with many distinct strong brown (7.5 YR 5/6) and light brownish grey (2.5 Y 6/2) mottles, the latter mostly associated with pores; compound structure of moderate very coarse prisms falling to coarse and medium prisms with frequent horizontal planes of weakness which give coarse angular blocky peds; dark greyish brown (10 YR 4/2) ped faces; abundant secondary concretions of calcium carbonate, particularly in slightly sandier material below 23 in.; a few scattered ferri-manganiferous concretions; extremely hard to very hard; common fine few medium pores; a few fine fibrous roots, particularly along ped faces and a few faunal burrows, the latter mostly between the peds; narrow boundary.
- 24-28
B3gca Pale brown (10 YR 6/3) and very pale brown (10 YR 7/4) calcareous sandy loam with fine brownish yellow (10 YR 6/8) mottling; very weak very coarse prismatic structure, the ped faces mostly brown (10 YR 5/3); many calcium carbonate concretions [0.2-1.5 cm in diam.]; abundant fine and a few medium pores; few fine fibrous roots; occasional faunal burrows, partly lined with very dark greyish brown (10 YR 3/2) material; merging boundary.
- 28-39
B4g/Cg Pale brown (10 YR 6/3) and light grey (2.5 Y 7/2) calcareous sandy loam with a few faint light yellowish brown (10 YR 6/4) mottles; structureless except for occasional thin clayey laminations of sedimentary origin; common fine pores; a few fine fibrous roots; a few faunal burrows, partly infilled with very dark greyish brown (10 YR 3/2) material; merging boundary.
- 39-48
B5g/Cg Brown (10 YR 5/3) calcareous clay loam (grading to silty clay below) with light olive-grey (5 Y 6/2) and yellowish red (5 YR 4/8) mottling; weak coarse prismatic structure, the ped faces greyish brown (2.5 Y 5/2); plastic and sticky; common fine pores; fine fibrous roots rare; a few earthworms and burrows occur.
- 48-152+ Bluish grey calcareous silty clay encountered at 72 in. and non-calcareous peat at 90 in. Below 126 in. the latter grades through brown peaty mud to calcareous bluish grey silty clay loam at 138 in. which passes to calcareous bluish grey loamy sand (152 in. +).

DOWELS SERIES

Types: silty clay, silty clay loam, clay loam

Phases: slightly decalcified, deeply decalcified

Slightly or deeply decalcified, fine textured soils over thick, acid peat at depths between 24 and 42 in. are grouped as the Dowels series, the average thickness of mineral soil being about 33 in. Silty clay and clay are the dominant textures, the latter often as a distinct, very slightly calcareous or non-calcareous layer 3-18 in. thick immediately over the peat (cp. Fairfield series). Silty clay loam also occurs, however, mostly in a layer less than 12 in. thick at the surface and/or at deeper levels between calcareous clays and non-calcareous clay-over-peat.

The thickness of mineral soil is related to elevation (cp. Fairfield series), the peat being nearest to the surface in the lowest wettest sites. Soil drainage varies accordingly, being mainly poor, but grading to very poor. The soils are mostly non-calcareous to depths between 9 and 15 in. and decalcified rarely deeper than 24 in.

A typical profile, such as K106, has an Ag horizon of dark grey prominently mottled silty clay with a moderate prismatic to blocky structure. This passes at about 9 in. to a Bg horizon about 12 in. thick, comprising very firm mainly grey and ochreous silty clay with a coarse prismatic structure. Below this, a very sticky and plastic coarsely fissured grey and ochreous clay contains little or no calcium carbonate and becomes appreciably humose just above the peat.

A variant of the Dowels series occurs in an innings just east of Barnfleet (TQ 995222), where a thin sandy wash covers an older surface (p. 117). The texture of the non-calcareous surface soil to depths between about 6 and 15 in. varies from loamy sand to loam, and similar materials commonly occur on ped faces in underlying, mostly calcareous, clayey horizons. Peat occurs at depths between 30 and 42 in., and the clay immediately above often has little or no calcium carbonate. The content of soluble salts is appreciable. Other Dowels soils are similarly affected, as the ground water associated with peat is commonly brackish.

Representative profile description

PROFILE NO.: K106, Dowels series (analyses, pp. 143 and 147).

Location: The Dowels (grid ref. TQ 981306).

Relief: pool zone bordering lower slopes of creek ridge.

Elevation: c. 4 ft O.D.

Land use: old pasture.

Horizons:

in.

- 0-9 Very dark grey (10 YR 3/1) rather humose silty clay with many grey (10 YR 5/1) and yellowish red (5 YR 5/6) mottles inside the peds; moderate medium and fine prisms are well fissured (incipient development of medium to fine angular blocks, particularly near the surface); non-calcareous except for specks of applied lime; fine fibrous roots are common (many dead) and there is associated rusty staining to about 4 in. depth; merging boundary.

Horizons:

- in.*
- 9-21 Grey (5 YR 6/1 and 5 GY 6/1) calcareous silty clay with many prominent yellowish red (5 YR 5/6) to strong brown (7.5 YR 5/6) mottles inside the peds and greyish brown (10 YR 5/2 to 4/2) colours locally along root channels and on ped faces; moderate to strong very firm coarse prismatic structure; many ferri-manganiferous concretions (<1 mm diam.); very abundant fine pores; fine roots common, particularly along ped faces; narrow boundary.
- Bg 21-26 Grey (10 BG 6/1-5/1) and yellowish red (5 YR 5/6) plastic and sticky nearly structureless clay; non-calcareous; fine fibrous roots are rare, old root channels grey coated; narrow boundary.
- Bg/Cg 26-31 Very dark grey and yellowish red (5 YR 5/8-4/6) organic clay; nearly structureless; a few dead roots apparent along occasional fissures; non-calcareous.
- Cg 31-36+ Black peat (wood and reed leaves evident).
- IICg

APPLEDORE SERIES

Poorly or very poorly drained, non-calcareous clay soils over thick mainly acid peat between about 12 and 24 in. are grouped as the Appledore series, the average thickness of mineral soil being 18 in. They occupy sites lower than those of the Dowels series, and the thickness of mineral soil is again closely related to relief, the peat being nearest to the surface in the lowest wettest sites.

A typical profile has an Ag horizon about 6 in. thick of very dark grey (e.g. 10 YR 3/1) humose clay with weak blocky structure and abundant rusty staining. There is often a thin peaty mat at the surface. The Bg horizon is of non-calcareous coarsely prismatic clay, the insides of peds being ochreous and grey (or bluish grey) in the upper part but with very dark colours near the junction with the peat. Roots, especially numerous along ped faces, also penetrate through them. The horizon next to the peat in the profile described below was very porous and relatively well structured due to the activities of mound ants.

Many Appledore soils, typically the finest textured and wettest pool soils in the Land Type with Creek Ridges, are probably akin to those of the Dowels series, an originally calcareous clayey deposit having been decalcified both next to the underlying peat and downwards from the surface. Some profiles may be composite, the clay nearest the peat being a separate deposit.

Representative profile description

PROFILE NO.: K107, Appledore series (analyses, pp. 143 and 147).

Location: The Dowels (grid ref. TQ 981305).

Relief: low (pool) zone bordering creek ridge.

Elevation: c. 2 ft O.D.

Land use: old pasture.

Horizons:

- in.*
- 0-2 Very dark brown (10 YR 2/2) humose clay with a moderate to weak sub-angular blocky structure; non-calcareous except for added lime; narrow boundary.
- Ag

G

Horizons:

- in.*
- 2-7 Ag/Bg Very dark grey (10 YR 3/1) firm non-calcareous clay with prominent light grey (5 Y 6/1) and yellowish red (5 YR 4/6) mottling, the latter associated with dead roots; weak very fine and fine rather angular blocky structure; fine fibrous (live) roots common; occasional small earthworm; narrow boundary.
- 7-13 Bg Grey (10 YR 6/1) non-calcareous clay with many prominent yellowish red (5 YR 4/8) to strong brown (7.5 YR 5-6) mottles inside the peds; ped faces (locally more humose) are partly very dark grey (10 YR 3/1); moderate medium and coarse prismatic structure; fine fibrous roots less common than above; holes and fine pores with grey (10 YR 6/1) linings; narrow boundary.
- 13-18 Bg/Cg Grey (10 YR 5/1-6/1) and black non-calcareous peaty clay with many prominent dark red (2.5 YR 3/6) mottles; moderate fine prismatic and fine to very fine subangular blocky structure; many irregular interconnected macropores (0.2-1 cm) and spaces due to mound ants; fine fibrous roots are common, many rusty coloured.
- 18-36+ IICg Black peat (wood and reed leaves evident) becoming dark reddish brown towards the base.

FINN SERIES

Types: loam, clay loam

Phases: moderately well drained, imperfectly drained, slightly decalcified, deeply decalcified

Texture Profile

This series comprises a similar range of texture profiles to the Agney series (p. 71), with clay loam the characteristic texture between about 9 and 27 in. Clay content commonly increases to 15 in., and profiles grading to Ivychurch series have a horizon of silty clay up to 9 in. thick at about this depth. Deeper horizons are commonly of loam texture, and either grade to a thick sandy substratum (e.g. profile K17) or pass, often abruptly, to silty clay, clay or a clay-over-peat sequence (e.g. profile K94). Thick peat occurs below about 4 ft in some profiles.

At the boundary to the Brenzett series clay loam passes directly to silty clay at about 27 in., whereas in profiles grading to Snargate series clay loam merges to loam or sandy loam below about 21 in.

Profile Morphology

The dark unmottled A horizons of the moderately well drained phase are friable loams or clay loams. They can be up to 15 in. thick, and are usually thicker than A horizons of similarly drained Agney soils, and at least partly non-calcareous when undisturbed. Under old grass structure is at least moderately developed, fine to medium crumbs being common just below the surface over fine to medium subangular blocks commonly aggregated to prisms. B1 horizons, mostly of clay loam texture and commonly also decalcified, have a well developed medium prismatic and/or coarse and medium subangular blocky structure, the peds having dark greyish brown faces and yellowish brown to dark yellowish brown (10 YR 5/4-4/4) colours internally. Such horizons are often about 9 in. thick, but similar dark colours can be seen on ped faces to about 3 ft, and internal "browning" is common to the same depth, the brown

colours paling progressively downwards. Ochreous and greyish mottling increases similarly in amount and contrast, and there is usually a Bg horizon between 15 and 24 in. Structure below the B1 horizon becomes progressively weaker and coarser with depth, but can be seen to about 48 in. in soils with more than 20 per cent. clay.

B horizons of the imperfectly drained phase are paler or greyer than those of the moderately well drained phase and common to many distinct mottles are seen at less than 15 in. Soil structure is also less deeply or less well developed compared to moderately well drained soils of the same texture. The dominant A horizon colours are similar in the two phases, but distinct ochreous or rusty staining occurs in the wettest soils.

Representative profile descriptions

PROFILE NO.: K17, Finn series, moderately well drained, slightly decalcified phase (analyses, pp. 143 and 148).

Location: Snave Corner Field, Snave (grid ref. TR 014293).

Relief: creek ridge.

Elevation: c. 9 ft O.D.

Land use: old pasture.

Horizons:

in.

- 0-6 A1 Very dark greyish brown (10 YR 3/2-2/2) non-calcareous friable sandy clay loam with a strong fine subangular blocky and crumb structure; abundant fine roots; ants and earthworms present; merging boundary.
- 6-14 A2 Very dark greyish brown (10 YR 3/2) very slightly calcareous friable clay loam; compound structure of moderate fine to medium subangular blocks weakly aggregated into medium prisms; fine roots very common; merging boundary.
- 14-23 B(g) Yellowish brown (10 YR 5/4) firm calcareous clay loam with greyish brown infillings; moderate compound structure, mainly of coarse subangular blocks and prisms; dark greyish brown (10 YR 4/2) humose ped faces and a few faint very fine ochreous mottles internally; earthworms active, their burrows and old root channels having greyish brown coatings; fine roots very common; occasional manganiferous concretion; narrow boundary.
- 23-30 B(g)ca Light yellowish brown (10 YR 6/4) plastic very porous highly calcareous clay loam with common faint light greyish and ochreous mottling; very weak structure as above, fading with depth; greyish brown humose infillings and linings to earthworm burrows and abundant fine pores; roots common; many powdery secondary deposits of calcium carbonate; merging boundary.
- 30-37 Bg/Cg Light yellowish brown (10 YR 6/4) and pale brown (10 YR 6/3) slightly plastic nearly structureless highly calcareous fine sandy loam with many distinct greyish and ochreous mottles; few fine roots, but fine pores are very common; secondary deposits of calcium carbonate are less common; narrow boundary.
- 37-47 Cg Light brownish grey (10 YR 6/2) to pale brown (10 YR 6/3) structureless highly calcareous fine loamy sand with many distinct greyish and ochreous mottles and occasional rusty streaks; roots rare.
- 47-96+ (Auger data); dark bluish grey loamy sand grading to wet sand at 80 in.

PROFILE NO.: K94, Finn series, imperfectly drained, deeply decalcified phase (analysis, p. 143).

Location: about $\frac{1}{3}$ mile ENE of Snargate Church (grid ref. TQ 996288).

Relief: side slope of creek ridge.

Elevation: c. 7 ft O.D.

Land use: old pasture.

Horizons:

- in.
- 0-7 A1g Very dark greyish brown (10 YR 3/2) non-calcareous friable sandy loam with many prominent yellowish red (5 YR 5/6) mottles partly associated with roots and old root channels; compound structure of moderate medium and fine prisms and subangular blocks; abundant fine roots; mound ants active; merging boundary.
- 7-13 A2g Dark greyish brown (10 YR 4/2) non-calcareous loam with many distinct strong brown (7.5 YR 5/8) to yellowish red (5 YR 5/8) mottles; compound structure of moderate coarse and very coarse prisms falling to weak fine prisms and subangular blocks, very hard when dry; dark greyish brown (10 YR 4/2) humose coatings on ped faces; earthworm burrows and abundant very fine pores; fine roots abundant; mound ants and earthworms active; merging boundary.
- 13-21 B1g Greyish brown (10 YR 5/2) clay loam with many distinct strong brown (7.5 YR 5/6) and grey (10 YR 6/1) mottles; strong coarse to medium prismatic structure, the ped faces grey (10 YR 5/1) and greyish brown (10 YR 5/2); abundant pores (<2 mm diam.); frequent dark greyish brown coated earthworm burrows; common fine roots; many fine manganiferous concretions; mostly non-calcareous; merging boundary.
- 21-29 B2g Light brownish grey (2.5 Y 6/2) very firm clay loam with many prominent fine yellowish red (5 YR 5/6) to strong brown (7.5 YR 5/6), pale yellow and light grey mottles; moderate to strong coarse prismatic structure, the peds very hard when dry; ped faces greyish brown (10 YR 5/2); fine roots common, particularly along ped faces; sharp boundary to calcareous soil at 22 in.; merging boundary.
- 29-41 C1g Pale yellow (2.5 Y 7/4) and light grey (5 Y 7/1) calcareous loam with many distinct but diffuse brownish yellow (10 YR 6/6) mottles; structureless; abundant fine (c. 1 mm diam.) pores; a few very fine roots, some dead; a few dark greyish brown coated earthworm burrows; sharp boundary.
- 41-45 IIC2g Grey and ochreous calcareous silty clay loam; structureless; very few roots but abundant fine pores.
- 45-63 IIC3g Darker grey calcareous silty clay with more prominent ochreous mottling; fine roots very rare; fine grey coated pores still abundant, some bordered by a yellowish red (5 YR 4/8) zone.
- 63-65 Darker grey non-calcareous clay.
- 65-116 Peat.
- 116-180 Bluish grey silty clay loam.
- 180-186+ Sand (Midley Sand?).

SNARGATE SERIES

Types: loam, sandy loam

Phases: moderately well drained, imperfectly drained, slightly decalcified, deeply decalcified

Texture Profile

This series comprises a similar range of texture profiles to the Romney series (p. 73), with loam and/or fine to very fine sandy loam to a depth of at least 27 in. below which the proportion of sand often increases to depths of 8 ft or more (e.g. profile K43). In many profiles the highest clay content occurs at

about 18 in., particularly in soils grading to the Finn series, and there are others grading to Brenzett soils in which loams overlie clay, or a clay-over-peat sequence, at depths below 27 in. (e.g. profile K91), although peat is rarely present at less than 5 ft.

Profile Morphology

The dark unmottled A horizons of the moderately well drained phase are friable or very friable loams or sandy loams and are at least partly non-calcareous when undisturbed. They can be up to 15 in. thick, and on average are thicker than A horizons in the similar drainage phase of the Romney series. Structure in the loam soils is at least moderately developed under old grass, being fine to medium crumb or subangular blocky, but sandy loams under similar circumstances often have a weaker structure with finer peds. The B1 horizon, commonly decalcified, has a weak or moderate medium prismatic structure, usually compound, with smaller prisms and some fine to very fine subangular blocks and crumbs. Ped faces are dark greyish brown and darker than the interiors which are commonly brown to yellowish brown. Such horizons are about 9 in. thick and overlie a paler brown Bg horizon with a weaker structure and/or larger peds or a pale or greyish Cg horizon (*Plate XII*). The latter, structureless or with sedimentary laminations, can occur below 24 in., with "browning" to at least 30 in., and profiles with a high clay content at these levels show structured horizons (e.g. K91).

B horizons of the imperfectly drained phase are typically paler or greyer than those of the moderately well drained phase, and common to many distinct mottles are seen at less than 15 in. Soil structure is also less deeply or less well developed compared to moderately well drained soils of equivalent texture. The A horizon colours are similar in the two phases, but distinct ochreous or rusty staining occurs in the wettest soils.

At a given depth B horizons of Snargate soils are browner and/or darker than those of typical Romney soils of equivalent drainage, particularly below 12–15 in. In moderately well drained Snargate soils the insides of peds are brown or yellowish brown (e.g. 10 YR 4/3, 4/4 or 5/4) to 18–24 in. and ped faces are dark greyish brown (e.g. 10 YR 4/2), whereas in corresponding Romney soils colours below 6–15 in. grade to or include paler browns (10 YR 6/3) inside the peds and brown or greyish brown (10 YR 5/3 or 5/2) on ped faces.

As with fine textured soils, associated grey colours are characteristically paler in calcareous than in decalcified soils (p. 79).

Representative profile descriptions

PROFILE NO.: K43, Snargate series, moderately well drained, deeply decalcified phase (analyses, pp. 143, 147 and 148).

Location: Coldharbour, Old Romney (grid ref. TR 017246).

Relief: near the centre of a major creek ridge.

Elevation: c. 10 ft O.D.

Land use: old pasture.

Horizons:

in.

- 0–5 Dark brown (10 YR 3/3) very friable non-calcareous fine sandy loam with a moderate fine and medium crumb structure; abundant fine roots; mound ants active; merging boundary.
- A1

- Horizons:**
- in.
 - 5-15 Very dark greyish brown (10 YR 3/2 and 4/2) very friable non-calcareous fine sandy loam with weak compound structure of medium prisms falling to weak fine prisms and crumbs; fine roots common; earthworm burrows are common and lined with very dark greyish brown humose coatings; merging boundary.
 - A2
 - 15-26 Brown and yellowish brown (10 YR 4/3 and 5/5) very friable non-calcareous sandy loam; weak medium prismatic and crumb structure; dark greyish brown (10 YR 4/2) humose ped faces; earthworm burrows are common and lined as above; fine roots common; sharp irregular boundary.
 - B
 - 26-42 Light grey and light brownish grey (10 YR 7/1, 2.5 Y 7/2 and 6/2) calcareous loamy sand with common distinct ochreous mottling; common fine ferri-manganiferous concretions; fine roots rare; a few greyish brown coated earthworm burrows.
 - Cg
 - 42+ Fine sand which continues to at least 12 ft; dark grey (permanent water-table level) at about 9 ft.

PROFILE NO.: K91, Snargate series, moderately well drained, deeply decalcified phase (analysis, p. 144).

Location: about $\frac{1}{2}$ mile west of Dymchurch (grid ref. TR 095295).

Relief: very low ridge (creek ridge?).

Elevation: c. 10 ft O.D.

Land use: old pasture.

Horizons:

- in.
- 0-11 Dark greyish brown (10 YR 4/2) finely fissured loam with strong compound structure of coarse prisms falling readily to medium fine and very fine sub-angular blocks; hard when dry; non-calcareous; common fine pores; abundant fine roots; earthworms active; merging boundary.
- A
- 11-23 Yellowish brown (10 YR 5/4) loam; compound structure of moderate coarse and very coarse prisms composed of weak medium prisms; very hard when dry; dark brown to dark yellowish brown (10 YR 4/3 to 4/4) humose ped faces; non-calcareous; few fine ferri-manganiferous concretions; common fine pores and common fine roots; many earthworm burrows; merging boundary.
- B1
- 23-34 Yellowish brown (10 YR 5/4), strong brown (7.5 YR 5/8), yellowish red (5 YR 5/8) and grey (10 YR 5/1) mottled calcareous loam with moderate medium and coarse prismatic structure; a few fine ferri-manganiferous concretions; common fine pores; common fine roots; abundant earthworm burrows; sharp boundary.
- B2g
- 34-40 Light brownish grey to grey (10 YR 6/2 to 6/1) calcareous silty clay; moderate coarse prismatic structure, the peds distinctly mottled internally with strong brown; few fine pores; fine roots rare; occasional earthworm burrows with brown (10 YR 5/3) linings.
- IIB3g
- 40-78 (Auger boring); laminated grey and ochreous mottled calcareous clay loam and loam; merging boundary.
- Cg
- 78+ Dark grey calcareous fine sandy loam passing at 12 ft to medium (Midley?) sand (144-169 in.+).

PROFILE NO.: K28, Snargate series, imperfectly drained, slightly decalcified phase (analyses, pp. 144 and 148).

Location: Fairfield Court, Fairfield (grid ref. TQ 977271).

Relief: creek ridge.

Elevation: 7 ft O.D.

Land use: old pasture.

Horizons:

- in.*
- 0-5 A1(g) Very dark greyish brown (10 YR 3/2) very friable non-calcareous loam with abundant rusty mottling associated with roots; moderate medium prismatic and fine crumb structure; fine roots common, some a rusty colour; narrow boundary.
- 5-12 A2(g) Dark greyish brown (10 YR 4/1-5) friable non-calcareous loam with common distinct ochreous mottling; very weak compound structure of medium prisms and fine crumbs; some dark greyish brown (2.5 Y 4/2) humose ped faces; common fine pores; few roots; some earthworms; merging boundary.
- 12-21 Bg Dark yellowish brown (10 YR 4/4) and greyish brown (10 YR 4.5/1-5) friable calcareous loam; moderate compound structure of medium prisms and weak fine crumbs; greyish brown humose ped faces; common fine pores; few roots; many earthworm burrows lined or infilled with greyish brown material; merging boundary.
- 21-36 Bg/Cg Light greyish brown (2.5 Y 6/2) almost structureless calcareous loam with abundant yellowish brown (10 YR 5/4) and ochreous mottling; abundant fine pores; roots rare; a few earthworms; sharp boundary.
- 36-41 IICg Dark grey (10 YR 4/1) plastic and sticky slightly calcareous clay loam with many pale grey and ochreous mottles; very weak very coarse prismatic structure; few fine pores; roots rare; narrow boundary.
- 41-49 Grey (5 Y 5/1) slightly plastic and sticky structureless loam with olive-yellow and ochreous mottling; few fine pores; roots very rare.
- 49-57 Structureless non-porous calcareous grey silty clay with ochreous mottling; very sticky and plastic; no roots.
- 57-119 Peat.
- 119-155+ Pale blue silt loam.

MIDLEY SERIES

Very sandy non-calcareous soils developed on Midley Sand, and similar coarse textured deposits derived largely from it, are grouped as the Midley series. Excepting a few places where superficial contamination with younger finer sandy materials has occurred, the soils have more than 50 per cent. of medium grade sand (200-500 μ) and often very little clay or silt. Most are well drained, and high above the water-table, but a few on lower sites have some rusty mottling below 18 in. where they are saturated in winter. The permanently saturated zone, often below 6 ft, is dark grey. All the soils are very permeable and have a low moisture retaining capacity, so that growth of grass and crops is poor during dry spells in summer and autumn.

Most soils are very acid, and evidence of podzolization is common, particularly on the Midley Church bank, where podzols are well developed. A profile (K44) from this site has an A horizon 10 in. thick consisting of dark greyish brown to dark brown, structureless sand. There are many bleached sand grains, and the pale Ea horizon below passes abruptly to a hard, dark reddish brown Bfe1 horizon about 1 in. thick between 24 and 28 in. Below this, a faintly mottled Bfe2 horizon merges below 34 in. to brownish yellow sand (*Plate XII*).

A few Midley soils have a darker subsurface horizon, possibly a Bh horizon formed by the downward movement and accumulation of humus, while others are little podzolized, but have many clear sand grains in the A and upper B

horizons. Thus profile K98 has several subsurface horizons which are hard or extremely hard when dry (even cemented), and the soil between 20 and 30 in. can be dug only with a pick.

Representative profile descriptions

PROFILE NO.: K44, Midley series (analyses, pp. 144 and 147).

Location: 400 yds south-west of Midley Church (grid ref. TR 029229).

Relief: wide sandy bank.

Elevation: c. 12 ft O.D.

Land use: old pasture.

Horizons:

- | <i>in.</i> | |
|------------------|---|
| 0-3
A1 | Very dark greyish brown (10 YR 3/2-4/2) structureless sand speckled with clear grains; abundant fine fibrous roots, partly dead; narrow irregular boundary. |
| 3-10
A2 | Dark brown (7.5 YR 3/2) medium sand speckled with clear grains; structureless and rather loose; many fine fibrous roots; sharp boundary. |
| 10-24/28
Ea | Pale brown (10 YR 6/3, paler when dry) medium sand with abundant clear grains; structureless and loose; many fine fibrous roots; old rabbit burrows; sharp irregular boundary, partly tonguing down through the Bfe1 horizon to about 32 in. |
| About 26
Bfe1 | Dark reddish brown (5 YR 3/4) weakly cemented medium sand, the horizon undulating, partly discontinuous and varying from 0.5 to 1.5 in. thick. This weak iron pan is the limit of root penetration except where the overlying horizon tongues down through it; narrow boundary. |
| 26/28-34
Bfe2 | Strong brown (7.5 YR 5/6) medium sand with faint brownish yellow (10 YR 6/8) to yellowish brown (10 YR 5/8) mottling; structureless and loose; no roots or soil fauna; merging boundary. |
| 34+
C | Brownish yellow (10 YR 6/8) to yellowish brown (10 YR 5/8) medium sand; structureless and loose; water seeping into pit at 48 in. |

PROFILE NO.: K98, Midley series (analysis, p. 144).

Location: 800 yds south of Hawthorne Corner, Old Romney (grid ref. TR 024224).

Relief: flat.

Elevation: c. 10 ft O.D.

Land use: ley.

Horizons:

- | <i>in.</i> | |
|-------------|---|
| 0-2
A1 | Dark greyish brown (10 YR 4/2) loamy sand speckled with colourless grains; weak fine and medium subangular blocky structure with some fine and very fine granules; slightly hard, crushing to loose; non-calcareous; a few fine pores; abundant fine fibrous roots; narrow boundary. |
| 2-7
A2 | Dark greyish brown (10 YR 4/2) sandy loam speckled with colourless sand grains; hard and structureless; non-calcareous; a few fine pores; abundant fine fibrous roots; occasional earthworm burrows; merging boundary. |
| 7-12
A3 | Dark greyish brown and brown (10 YR 4/2 and 4/3) sandy loam speckled with colourless sand grains; structureless and very hard to extremely hard (pan-like); non-calcareous; very common fine and medium pores; very common fine fibrous roots; a few earthworm burrows; merging boundary. |
| 12-20
B1 | Dark brown and dark greyish brown (10 YR 4/3 and 4/2) sandy loam; structureless and very hard to extremely hard (pan-like); non-calcareous; common fine and medium pores; common fine fibrous roots; occasional earthworm burrows, partly with dark greyish brown (10 YR 4/2) infillings; merging boundary. |

Horizons:

in.

- 20-30 Brown (10 YR 5/3) sandy loam faintly mottled with pale brown (10 YR 6/3) and with a few faint brown (7.5 YR 5/4) mottles in lower part; structureless and extremely hard (pan-like); non-calcareous; a few fine and medium pores; few fine fibrous roots; occasional earthworm burrows, partly with dark greyish brown (10 YR 4/2) linings and infillings; merging boundary.
- 30-37 Light yellowish to very pale brown (10 YR 6.5/4) medium sand speckled with black, yellow and colourless sand grains and with common large diffuse brownish yellow (10 YR 6/6) mottles; structureless and slightly hard, crushing easily to loose; non-calcareous; fine fibrous roots rare; very occasional earthworm burrows with pale brown (10 YR 6/3) infillings; merging boundary.
- 37+ Very pale brownish yellow (10 YR 7/5) medium sand speckled with black and colourless sand grains and with a few very pale brown (10 YR 8/4) areas; structureless and loose; non-calcareous.

SOILS ON OLD BEACH DEPOSITS**LYDD SERIES**

The Lydd soils are developed on thick pebbly sands and sand banks of low summit elevation, either over shingle or close to it. Locally the deposits overlie finer textured materials, loams to clays, mostly below 30 in. The fine earth is usually loamy fine sand or sand, but coarser (medium grade) sands and loamy sands occur in some parts and sandy loams with a sand content greater than 70 per cent. are also included. The soils are well drained and deeply decalcified, some being completely non-calcareous and quite acid.

Typical profiles, such as K109 below, show a thick A horizon of very dark brown to greyish brown loamy sand with weak crumb structure in the surface, passing below 15 in. to a brown, nearly structureless B horizon of loamy sand. The brown colour pales with depth and merges to a yellowish brown C horizon of loose sand.

Representative profile description

PROFILE NO.: K109, Lydd series (analysis, p. 144).

Location: Forty Acre Farm, Lydd (grid ref. TR 054220).

Relief: sandy bank adjoining and overlying old shingle ridge.

Elevation: c. 15 ft O.D.

Land use: old pasture.

Horizons:

in.

- 0-5 Very dark brown (10 YR 2/2) very friable fine sand with weak coarse and medium crumb structure; abundant clear sand grains; abundant fine roots; narrow boundary.
- 5-15 Dark greyish brown (10 YR 4/2) slightly hard nearly structureless fine sand; abundant clear sand grains; common fine roots; occasional small flint pebbles; merging boundary.
- 15-21 Brown (10 YR 4/3) rather loose fine sand with some clear sand grains; common fine fibrous roots; many small pebbles; occasional earthworm burrows; narrow undulating boundary.

Horizons:

in.

- (21-31) Yellowish brown (10 YR 5/4) loose fine sand; but with pale brown, orange and black sand grains; roots rare; occasional earthworm burrows; merging uneven boundary.
- B2
- 31-36 Light yellowish brown (10 YR 6/5) loose fine sand; roots very rare.

C

BEACH BANK SERIES

Types: silty clay, clay loam, loam, sandy loam, loamy sand
Variant: deeper fine textured

This soil series (*Plate XII*) is associated with old, inland pebble banks and beaches containing appreciable interstitial mineral material of less than 2 mm diam. The dominantly stony strata can extend to depths of 10 ft or more and include intercalations of finer materials, mostly sands. The top 15 in. of surface soil can be almost stoneless, its texture ranging from silty clay to loamy sand; soils with less than 20 per cent. clay (sandy loam to loamy sand) are grouped as the coarse textured type and those with more than 20 per cent. clay (loam to silty clay) as the fine textured type. These types are mapped separately where one or other is dominant over extensive areas. Most soils are well drained and excessively drained in that they contain little water to sustain normal plants during dry periods. Consequently, "scorching" is common in summer (*Plates V and VIII*) and the soils commonly have highly organic A horizons because humus is slow to mineralize. Reaction is acid in the surface, and many soils support only acidophilic species, but lower horizons can be calcareous and alkaline, particularly where the fine earth is clayey.

Calcareous and/or wetter stony soils occur locally, and a deeper variant is mapped south-west of Lydd, where fine textured soils have stony layers below 18 in., mostly between 24 and 30 in. These occupy lower sites, can be moderately or imperfectly drained and often have a thin layer of dark grey clay immediately over the shingle floor. This clay mostly underlies mottled loam and/or clay loam, and its greyness is believed to be partly due to its former associations with peat or an old buried surface (pp. 103-4).

Representative profile descriptions

PROFILE NO.: K110, Beach Bank series, fine textured type (analysis, p. 145).

Location: The Forelands, Lydd (grid ref. TR 018194).

Relief: north-west side of wide beach ridge (beach bank).

Elevation: c. 12 ft O.D.

Land use: old (rough) pasture.

Horizons:

in.

- 0-3 Very dark brown (10 YR 2/2, 10 YR 2/1 moist) extremely stony humose silt loam with a moderate very fine and fine crumb structure; soft; abundant fine fibrous roots; non-calcareous; narrow boundary.
- A1
- 3-6 Dark reddish brown (5 YR 3/2-3/3, 5 YR 2/2 moist) very stony humose silt loam with a moderate medium platy structure; hard; fine fibrous roots are very common; non-calcareous; narrow boundary.
- A2
- 6-16 Loose small flint pebbles with some dark reddish grey (5 YR 4/2-5/2, 5 YR 2/2 moist) organic silty clay loam; fine roots common.

PROFILE NO.: K112, Beach Bank series, fine textured type (analysis, p. 145).

Location: Northlade, Lydd (grid ref. TR 067222).

Relief: east side of old beach ridge (beach bank).

Elevation: c. 15 ft O.D.

Land use: old (rough) pasture.

Horizons:

- in.
- 0-5 Very dark brown to dark brown (10 YR 2/2-3/3) very stony humose loam with moderate very fine to medium subangular blocky structure; ped faces are mainly black (10 YR 2/1), and the soil adjacent to the small, mainly flint, pebbles is similar; fine roots are abundant; mostly calcareous, but locally decalcified in surface 0-2 in.; narrow boundary.
- A1
- 5-11 Rounded and subangular flint gravel with some interstitial dark brown (10 YR 3/3) loam; few roots; calcareous; merging boundary.
- A2
- 11-19 Small pebbles with brown (7.5 YR 4/4) interstitial silt loam; cohesive; fine roots rare.
- B1
- 19-30+ Wet, rounded and subangular flint gravel and small pebbles with brown (10 YR 5/3) interstitial loam; very cohesive; roots very rare.
- B2

PROFILE NO.: K113, Beach Bank series, coarse textured type (analysis, p. 145).

Location: Northlade, Lydd (grid ref. TR 067222).

Relief: east side of old beach ridge (beach bank).

Elevation: c. 14 ft O.D.

Land use: old (rough) pasture.

Horizons:

- in.
- 0-10 Dark brown (10 YR 3/3) stony fine sand with common clear sand grains; weak fine and very fine subangular blocky structure; loose to very friable; very abundant fine roots; non-calcareous; narrow boundary.
- A
- 10-24 Small flint pebbles with some brown (10 YR 4/3) loam; few fine roots; occasional shell fragments; merging boundary.
- B
- 24+ Wet; rounded and subangular flint gravel and small pebbles with brown (10 YR 5/3) interstitial silty clay loam; very cohesive; roots rare; calcareous (includes shell fragments).
- B/C

PROFILE NO.: K115, Beach Bank series, deeper fine textured variant (analysis, p. 145).

Location: Scotney Court, Lydd (grid ref. TR 011195).

Relief: slight depression in wide beach ridge (beach bank).

Elevation: c. 9 ft O.D.

Land use: grass ley.

Horizons:

- in.
- 0-4 Dark brown (10 YR 3/3 and 7.5 YR 3/2) friable gravelly silt loam with local rusty staining, partly along roots; moderately developed medium prismatic and fine and medium blocky structure; fine roots very common; non-calcareous; narrow boundary.
- A1(g)
- 4-12 Dark brown (7.5 YR 3/2) friable gravelly silt loam with a few brown (7.5 YR 4/4) and greyish mottles; moderate fine and medium blocky structure; fine roots common; non-calcareous; narrow boundary.
- A2(g)
- 12-17 Dark brown to brown (7.5 YR 4/3) friable gravelly silty clay loam diffusely mottled with dark reddish brown (5 YR 3/4) and greyish colours; distinct grey (10 Y 4/1) and rusty colours locally, increasing as clay content increases with depth; moderately developed fine prismatic and medium and fine subangular blocky structure; few fine roots; non-calcareous; narrow boundary.
- Bg

- Horizons:**
- in.*
- 17-20 Mainly dark grey (N 4/1) extremely gravelly silty clay loam; few fine roots; IIAg non-calcareous; sharp boundary.
- 20-25 Pale grey (10 Y 5/1 to 6/1) and dark reddish brown (5 YR 3/4) to yellowish red (5 YR 4/6) almost stoneless silty clay loam; moderately strong fine and medium prismatic structure; ped faces brown (10 YR 4/3) with greenish grey (5 GY 5/1); plastic and slightly sticky; few fine roots; non-calcareous; sharp boundary.
- 25-30 Rounded flint gravel and small pebbles with interstitial black (10 YR 2/1) silty clay (peaty) and occasional fragments of red brick or pottery; roots rare; narrow boundary.
- 30-36 Small pebbles with interstitial dark grey (10 Y 5/1) silty clay, locally mottled with rusty colours; no roots.

DUNGENESS SERIES

The Dungeness series, widely associated with inland pebble beaches, comprises skeletal stony soils with little or no interstitial mineral material. The soils have developed through the gradual accumulation of plant litter and humus and the presence of extremely abundant roots in the surface which bind the shingle to depths up to 9 in. Below this the shingle becomes looser, as fine roots and organic residues decrease and vertical sides in a hole or section cannot be maintained. Small and large roots occur locally to considerable depths and deep excavations, e.g. near well established holly trees, have shown that they penetrate plentifully to below 5 ft. Some herbs, e.g. viper's bugloss (*Echium vulgare*), also have deep roots able to reach moist shingle near the ground water-table. The soils are very acid, and the grass often scorches during dry periods.

Representative profile description

PROFILE NO.: K63, Dungeness series.

Location: Denge Beach, near Dungeness (grid ref. TR 087169).

Relief: flat, but ridge and hollow topography evident locally.

Elevation: 18 ft O.D.

Vegetation: acid heath; sweet vernal grass (*Anthoxanthum odoratum*), white stonecrop (*Sedum anglicum*) and miscellaneous herbs.

Horizons:

- in.*
- 0-4 Very dark greyish brown gravelly organic layer with abundant mainly fine roots.
- A Rather loose gravel and small stones (pebbles) with abundant fine roots and some fine organic material.
- A/C
- 12+ Loose gravel and small stones (pebbles); fine roots decrease with depth, but a few medium roots continue below 24 in.
- C

CHAPTER V

The Soils and Soil Associations of the Land Types

Each land type (see Chapter II) has one or more repeating soil patterns, called soil associations (Table 7), which are described below. Those of the Old Marshland are shown in Fig. 30 and those of the New Marshland in Fig. 10. An account of the Old Beaches, Saltings and Creek Bed complex follows with descriptions of typical soils.

TABLE 7
The Soil Associations and Soil Series of Land Types

	<i>Land Type</i>	<i>Soil Association</i>	<i>Soil Series</i>
Decalcified (Old) Marshland	Sand Banks	S ₁ S ₂ S ₃	Midley, Ivychurch Midley, Snargate Midley, Snargate, Finn, Romney, Agney
	Shingle Banks	B	Beach Bank, Snargate, Finn, Brenzett, Dymchurch
	Creek Ridges	C ₁ C ₂ C ₃ C ₄ C ₅ C ₆ C ₇	Snargate, Finn, Brenzett, Dymchurch Snargate, Finn, Dowels, Appledore Brenzett, Dymchurch, Dowels, Appledore Slightly decalcified Snargate, Finn, Dymchurch, Dowels Slightly decalcified Snargate, Finn, Ivychurch, Brenzett, Dymchurch Finn, Snargate, Ivychurch, Brenzett, Dymchurch Slightly decalcified Snargate, Finn (dominant), Romney, Agney, Newchurch, Walland, Dowels, Fairfield (locally important)
	Common Creek Relics		Romney, Agney, Guldeford, Walland, Newchurch
	Clayey		Newchurch, Walland, Guldeford
	Rhee Wall		Newchurch, Walland, Agney, Romney
	Mounds		Romney, Agney
Calcareous (New) Marshland	Shingle Banks		Beach Bank, Romney, Agney, Newchurch, Guldeford, Greatstone
	Late Sand Flats		Romney, Agney, Greatstone, Guldeford, Newchurch, Walland
Miscellaneous	Old Beaches		Dungeness, Beach Bank, Lydd
	Salting		Unnamed
	Creek Bed complex		Unnamed

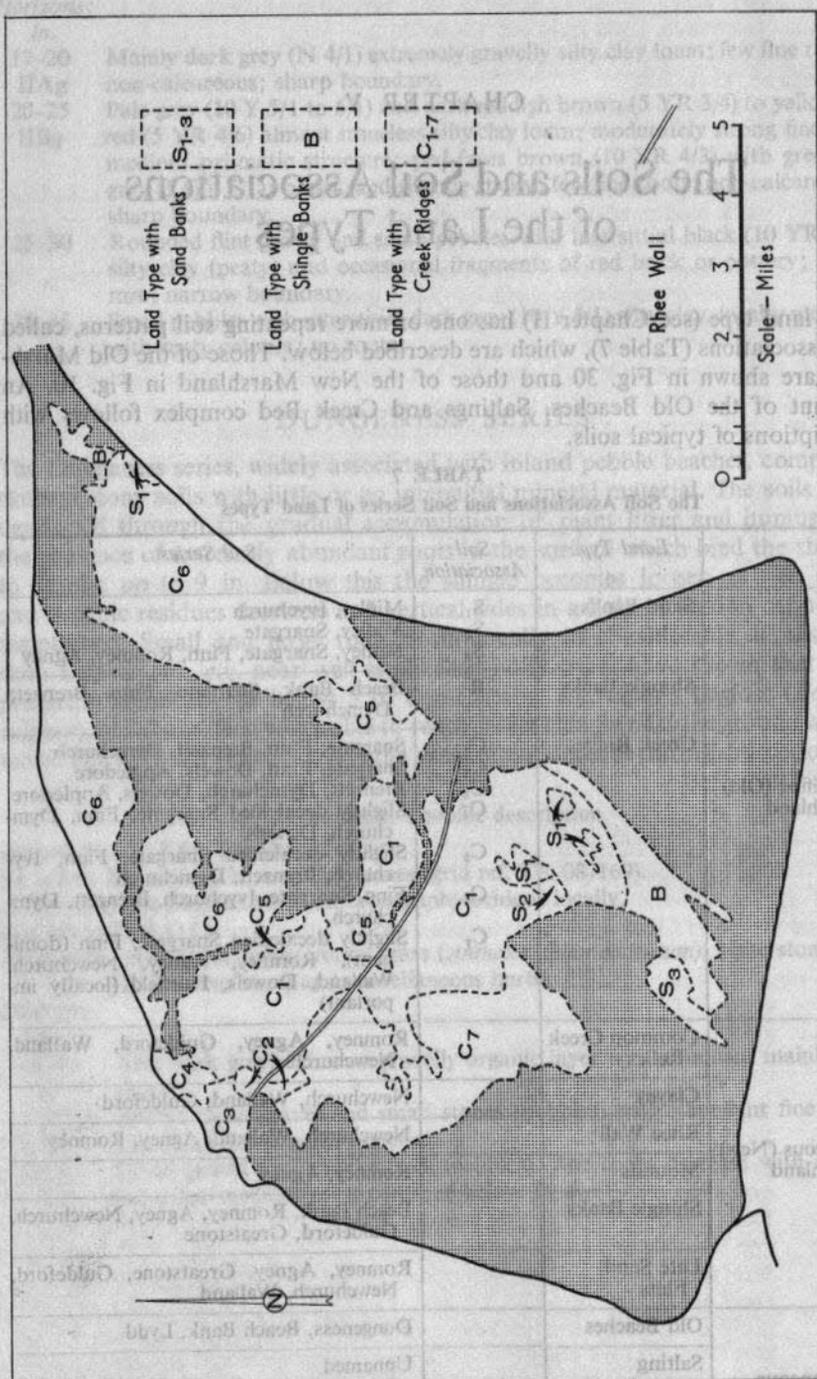


Fig. 30. Land Types of the Decalified (Old) Marshland. The shaded area is of the Calcareous (New) Marshland and beaches

DECALCIFIED (OLD) MARSHLAND

Land Type with Sand Banks (S)

Midley soils occupy the banks, but the associated soil series, mostly Ivychurch, Snargate and Finn, differ from one locality to another and are regarded as variants because their sandy substrata have coarser grade sands and less clay than usual. In other respects, *i.e.* texture, leaching of native calcium carbonate and gleying the variants conform to typical soils of the same series.

S1

In three places north-west of Lydd and another south-west of Dymchurch Redoubt (Fig. 30) lower land is mainly occupied by Ivychurch soils. Upper horizons are developed in Old Marshland pool clay, thin silty clay deposits of similar age and origin as those in Dymchurch and Brenzett soils in the Land Type with Creek Ridges near by. North-west of Lydd many Ivychurch soils have composite profiles in which a thin relic peaty zone, an inch or so of non-calcareous orange and grey mottled clay and a thin rather loamy layer occur between the Midley Sand and the pool clay, the latter being seldom less than 24 in. thick. At some places, as near Birdskitchen (TR 043223), A horizons are sandy clay loams with a high medium sand content, suggesting that Midley Sand was washed or blown on to clay and mixed with it, or even carried in by man to ameliorate the heavy soil.

Both Midley and Ivychurch soils occur together in many fields, where they give striking differences in the herbage. In one field at Birdskitchen, Yorkshire fog (*Holcus lanatus*) and bent grass (*Agrostis tenuis*) are the dominant grasses on the very acid, seasonally dry Midley soils, while perennial ryegrass (*Lolium perenne*) with wild white clover is dominant on the less acid, moisture-retaining Ivychurch soils. The soil boundary is sometimes marked by grazing sheep, who closely nibble the ryegrass but leave the Yorkshire fog and bent grass to flower. Also, the herbage on the Midley soils may be flattened because sheep rest on higher and drier areas, and move between them and the Ivychurch soils, which carry better herbage.

Midley soils mapped south-west of Dymchurch Redoubt in the lee of the sea wall may not be developed on Midley Sand *in situ*, but these coarse, deeply decalcified sandy soils are very similar. Shingle is sometimes present at differing depths, some appearing only as thin layers within the sand rather than as buried banks, but such soils have usually been mapped as Beach Bank series.

The drainage of the Ivychurch variant is imperfect, even where upper silty clay horizons are well structured. The defective drainage is probably due to high water-table levels in winter and/or slow water movement into the Midley Sand below. There is an abrupt texture change, and the clay, or peaty clay, at the junction is commonly very tenacious and relatively structureless. Ivychurch soils are mostly decalcified to between 12 and 24 in., and the sand substratum is non-calcareous to at least 42 in.

S2

South-west of the old sea wall at Midley (TR 027226), parent materials are all sandy, ranging from Midley Sand to younger fine and very fine sandy loams and loamy sands, the latter probably related to the creek systems to the south-

west. Some Midley soils are superficially contaminated with the finer sands and/or include a thin seam of grey clay below about 24 in., suggesting that the Midley Sand hereabouts has suffered disturbance. A similar thin seam of clay overlies Midley Sand in some Snargate variants, but all other soils are very permeable, so plant growth in summer depends on rainfall and the ability of roots to reach moist layers near the water-table. Snargate variants are usually more deeply leached of native calcium carbonate than typical soils of this series in the same innings, and some are completely non-calcareous.

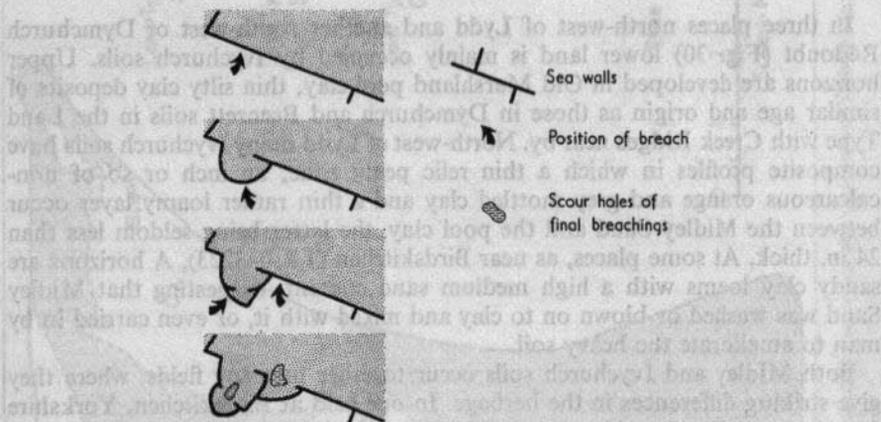


Fig. 31. Breaching sequence in wall at Sandyland pits (TQ 989191), see Plate VIII

S3

Reworking and erosion of Midley Sand is also seen to the south-west in Broomhill parish, particularly in an innings adjacent to the farmstead aptly named Sandyland (TQ 991196). Midley soils occupy a series of banks, running south-west to north-east, bordered by Snargate and Finn variants, the latter partly fringing relic creeks with wetter, coarse textured soils. Past disturbance of the old sea wall near Wainway Gate (TR 000202) suggests that some creeks formed through dyke breaching early in the development of the Calcareous (New) Marshland to the north. If the main creek (now called Oakhill Fleet) originated in this way, then its formation must have been accompanied by disturbance of extensive Midley Sand deposits.

Next to the old sea wall near Sandyland, Midley soils are atypical in having shingle below 18 in., part of a long and probably very old bank now truncated at the coast near Broomhill Farm (TQ 982182).

Snargate and Finn variants are appreciably interfingering, large areas being mapped as a soil complex, and soils of both series can have surface horizons of loam to loamy sand texture, probably by additions of reworked Midley Sand. All these soils, except in a few low-lying areas, are moderately drained and all are non-calcareous to at least 12 in., the Snargate soils with least native calcium carbonate and, with the Midley soils, probably having a high lime requirement for optimum plant growth. Calcareous soils, many incorporating reworked Midley Sand, occur in parts of this innings, for instance imperfectly drained

Romney soils border the northern side of Pig's Creek, which also has poorly drained or very poorly drained loamy to very sandy soils.

Snargate variants and associated Midley soils also occur outside this innings, on a tongue of land south-west of Sandyland pits (TQ 989191). Dyke breaches must have recurred here (*Plate VIII* and Fig. 31), and soils on reworked Midley Sand occur on both sides of the Wall.

Land Type with Shingle Banks (B)

On the limb of Old Marshland west and south-west of Lydd there is a scattered occurrence of stony Beach Bank soils (*Plate XII*), mostly occupying high sites between 9 and 12 ft O.D. The texture of the fine earth varies widely, with fine textured types generally occurring adjacent to fine textured stoneless soils. They are completely vegetated, but droughty and commonly carry acidophile plants, particularly where the A horizon is highly organic (e.g. K110). The deeper, fine textured Beach Bank variant is mapped locally, however, on low banks or local hollows with a thicker, and less stony, loamy to clayey capping. These are less droughty, and some are moderately or imperfectly drained. Many Beach Bank soils of this land type have a thin layer of dark non-calcareous clay which is probably a buried soil. It usually occurs directly over the shingle and beneath a loam to clay loam surface and/or occupies the voids of the first mainly pebbly horizon; in some soils it is somewhat peaty, and in one place, K115 (p. 97), includes fragments of brick or pottery.

The soils between, principally of the Snargate, Finn, Brenzett and Dymchurch series, are often more than 3 ft lower than the Beach Bank summits and locally, as to the west of Lydd, are indistinguishable from soils in the Land Type with Creek Ridges farther north. Composite profiles with thin layers of dark non-calcareous clay, sometimes sandwiching a thin peat layer, are a feature in this land type. In Dymchurch and Brenzett soils this sequence commonly occurs as a zone less than 9 in. thick at depths below 15 in. The lower horizons are developed in Blue Clay (p. 24). In Snargate and Finn soils, however, the dark clay underlies the loam and/or clay loam horizons, mostly below 36 in. These soils are common between Widney Fleet (TR 009194) and the Kent Pen Wall by Wallhouse Farm (TQ 994190).

The development of this land type was evidently complex, because there is evidence of two buried horizons in some soils, thin peat being sedimentary in some parts and *in situ* elsewhere. The dark clay is believed to be a reliable marker horizon, however, particularly to the south-west, where the browner, superficial loams and clay loams of the Brenzett series may be related to thicker deposits of similar texture in Snargate and Finn soils and to silty clays forming the upper horizons of composite Dymchurch soils. The superficial loams and clay loams common in Beach Bank soils are probably also related, the dark underlying clay being continuous throughout (Fig. 32). This correlation suggests that the present varied relief of the landscape has resulted partly from differential shrinkage or compaction, the finer textured land between the shingle "islands" having subsided appreciably.

The dark non-calcareous clay commonly gives rise to alternating non-calcareous and calcareous horizons in the soils, particularly those of the Dymchurch and Brenzett series. Where the dark clay occurs at 15-18 in. and the material above is completely leached, the soil is deeply decalcified, with calcium carbonate only beneath the dark clay. Irrespective of this feature, the fine textured soils east of

Burnthouse and Upper Wick Walls tend to be more deeply decalcified than those to the west, possibly because of differing times of enclosure.

Slightly decalcified Dymchurch soils in the long strip of alluvium enclosed by Lower and Upper Wick Walls lack the buried peaty horizon. Their drainage is imperfect to poor, and they are interlaced by closely spaced artificial channels or diggings. The latter are often in a herringbone pattern with existing sewers, but are mostly shallow, probably through recent silting and superficial peat development.

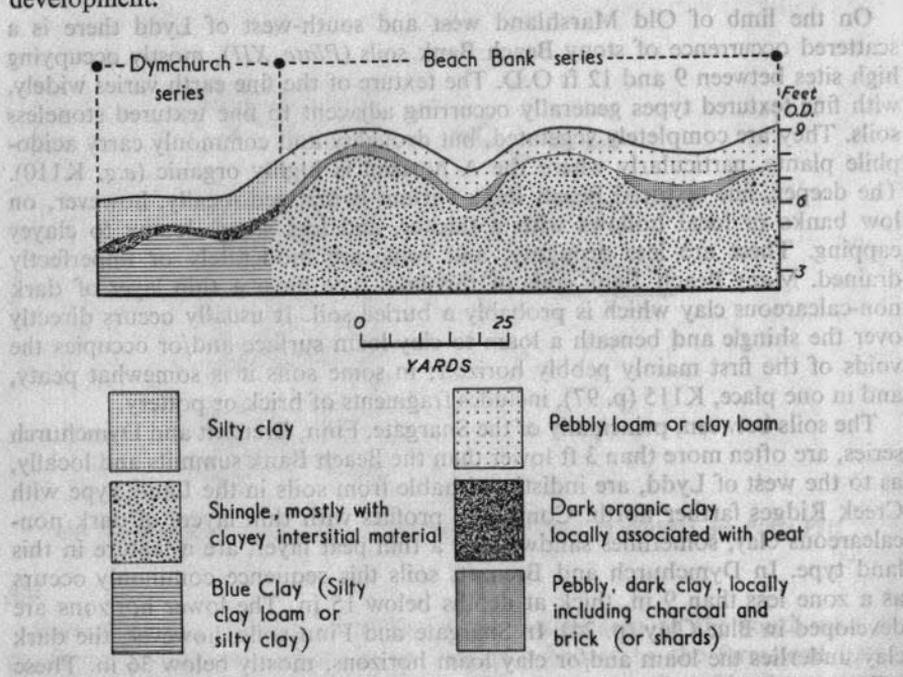


Fig. 32. Section through shingle ridge south-west of Scotney Court, Lydd (TR 011193)

Beach Bank soils interfinger similarly with lower-lying Dymchurch or Brenzett soils between Dymchurch Redoubt and Hythe (Fig. 30). Some deeply decalcified Dymchurch soils have a thin non-calcareous layer below 24 in., particularly in low places where drainage is imperfect to poor but, in contrast to the Lydd area, there are no dark colours suggesting earlier peat development or deposition.

Land Type with Creek Ridges (C)

This land type varies both in the nature and degree of development of the creek ridges and pools and in the soils. Accordingly, it has been divided into seven associations (Fig. 30).

C1

This land, straddling the Rhee Wall between Lydd and The Dowels and including the villages of Snargate, Brenzett and Old Romney as well as parts of Brookland, is typical creek-ridge-pool country and the nucleus of the existing Old Marshland with Creek Ridges. Five major ridges occur, each with a system

of distributaries, the absence of substantial relic beds indicating that the original creeks were silted up before reclamation.* Small relic channels may have persisted until infilled artificially; the line of one is preserved at Snargate in a road meandering along a creek ridge between Cuckold's Corner (TQ 994294) and Wick Bridge (TR 003303). This was possibly associated with relatively late developments, such as the formation of the Clayey Land Type to which the meander leads (near Ham Mill Green).

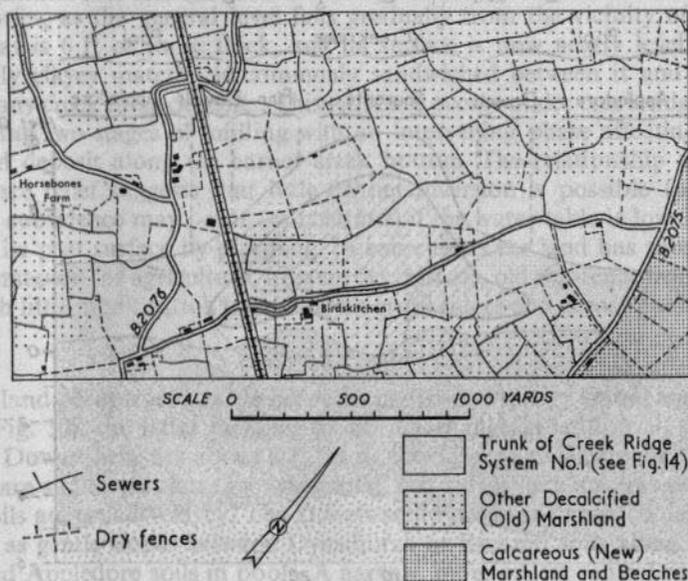


Fig. 33. Wet and dry fencing in the Decalcified (Old) Marshland near Lydd

Summit elevations of the major creek ridges are between 8 and 10 ft O.D., with a change in level through the transitional zones to the finer textured pools, which, towards Baynham and Snargate, include land at 4-5 ft O.D. In general, inversion is slight near Lydd, presumably because the peat was relatively thin, so that the pools suffered little subsidence. The trunks of the sandy ridges form flat easily drained terrain up to a quarter of a mile wide, in which wet fences (sewers) are rather uncommon (Fig. 33).

Moderately well drained Snargate soils are dominant on the major creek ridges; the fine sandy loam type is extensive and mapped separately on parts of three of them, Nos. 1, 2 and 3 through Brookland, Court Lodge (TR 027247) and Prospect Cottage (TR 047229) respectively. These areas have progressively sandier substrata to depths of at least 8 ft, and no peat except as occasional pebbles or as thin horizontal sedimentary bands.† The finer textured Finn soils

* There is a system of channels at the south-west end of trunk Creek Ridge No. 2 through Court Lodge (TR 027247) and Old Romney, but evidence of repair to the sea wall near Midley House (TR 016236) suggests that a dyke breach occurred there, the sea evidently transgressing and scouring reclaimed land.

† Midley Sand occurs within 5 ft of the surface in parts near Dering Pen (TR 026212), and buried podzolized soils were observed in several localities where peat wedged out against former low banks of this deposit (Green and Askew 1958b).

(normally the loam type) occur towards the margins of these creek ridges, but are commoner farther north towards Snargate and Snave. Here, it is unlikely that even the principal creeks cut down to the base of the peat, as this, or a clay-over-peat sequence, is often a substratum at depths between 4 and 7 ft. These creek ridge soils, particularly the Snargate series, are deeply leached and are often very acid. The churches and older farmsteads are mostly sited on them, for in addition to the smaller risk of flooding or catastrophic transgression by the sea (p. 28 and Fig. 15), puddling and poaching are less troublesome.

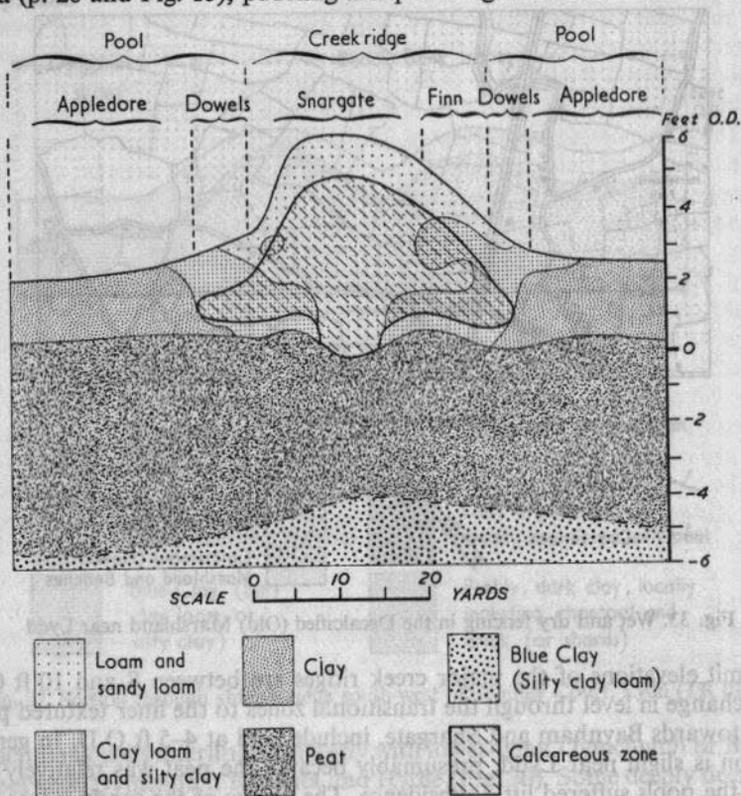


Fig. 34. Section through sandy creek ridge in The Dowels (TQ 980299)

The transition zones and associated minor creek ridges are lower than the major ridges, have a clay-over-peat substratum between 4 and 6 ft and carry imperfectly drained Snargate and Finn soils. Both drainage phases of these series can occur in a catenary sequence, however, particularly where the micro-relief of land bordering a major creek ridge is determined by a complex pattern of minor ridges.

The Dymchurch and Brenzett soils occur on the finer textured pool deposits, and peat occurs above 42 in. in a few of the lower sites, particularly north of Baynham (TR 003245) and south of Midley, giving Dowels soils. Microrelief is common in areas mapped as Brenzett-Dymchurch complex, with imperfectly drained Dymchurch soils on lower and the moderately well drained Brenzett soils on higher sites. Brenzett soils usually merge into the Snargate and Finn soils typical of minor creek ridges and transition zones.

C2

Two small areas north-west of Snargate and separated by the Rhee Wall with its enclosed strip of New Marshland (Fig. 30) differ from the lands just described, being lower and having pools at about 2–3 ft O.D. with Dowels and/or Appledore soils. Adjacent Snargate and Finn soils, typically imperfectly drained, occupy small but well marked creek ridges with summit elevations near 6 ft O.D. Thus this land is all lower than typical creek ridge country (C1), but there are no sharp boundaries, as the general level falls gradually from the vicinity of Snargate. The peat is 6 ft or more thick, and its surface is now nearly level (Fig. 34); relatively clayey material is commonly sandwiched between it and the sandy and loamy creek ridge deposits. This sequence occurs under creek ridge margins, suggesting two stages of infilling with an intervening phase affecting the finer textured deposit along the earlier creek bottom. The relationship of the peat to surface relief suggests that little further inversion is possible (p. 26), but general subsidence may occur (or continue) if the water-table is lowered further below the peat surface by pumping. In some fields the land has subsided since it was first used for agriculture, because depressions, old wet-fence field divisions, run with little modification up and down creek ridges and across pools (Fig. 35).

C3

This land occupies the angle between the Royal Military Canal and the Rhee Wall (Fig. 30), the latter marking an abrupt change in land level, since much of The Dowels here lies about 8 ft below the adjoining Calcareous Marshland. Levels are similar to those just described, but ridges here are less obvious and their soils are usually clayey. The Dowels series occupies many low feeder ridges as well as gentle slopes between Dymchurch or Brenzett soils along ridge summits and Appledore soils in pools. A narrow, more or less central zone of Finn soils runs along some of the highest ridges, particularly alongside the Blackman's Arm of the Springbrook Sewer on the trunk ridge which crosses The Dowels from south-west to north-east.

In Appledore and Dowels soils the depth to peat is less in lower-lying land, suggesting that the peat surface is nearly flat. Deep augering combined with levelling along a transect crossing a creek ridge (at TQ 981305) has confirmed this, although a slight dip occurred under the ridge crest, which is probably the only remaining part of the original creek carved in the peat. Peat levels and thicknesses here are very similar to those of the sandy creek ridge in area C2 (Figs. 34 and 36), so that peat, about 6 ft thick, must be widespread in The Dowels. Its floor approaches the surface in several places near the Royal Military Canal, and Dymchurch variants are mapped where thin clayey alluvium and peat remnants overlie lobes of upland rocks (Tunbridge Wells Sands) extending just south of the canal. These marsh deposits, many feet higher than the lowest parts of The Dowels, confirm subsidence elsewhere due to compaction and peat shrinkage and indicate the earlier height of this part of the marsh.

The depositional history is imperfectly understood, but the association of Finn soils with relic channels and/or their occurrence along the crest of otherwise clayey ridges suggests that silting up occurred in two stages, the deposition of clay being succeeded by that of more loamy sediments with an intervening phase of clay and peat erosion along older creek bottoms (p. 27 and cp. Figs. 13 and 36). The Appledore and Dowels soils differ in their calcium carbonate

content, the former being non-calcareous and the latter calcareous in subsurface horizons except next to the peat. Fig. 36 shows this and the tendency for the central zone of calcareous clay to thicken with increasing height and thickness of clay. Leaching is thought to account for the absence of calcium carbonate in upper horizons, but the origin of the non-calcareous zone immediately above the peat, which is seldom thicker than 6 in., is not so well understood. This is greyer



Fig. 35. Old field divisions in The Dowels

than the overlying horizons and mottled with bright yellowish red (5 YR 5/6) colours. It usually has a high clay content and is very sticky and plastic. Such material commonly occurs immediately over *in situ* peat, particularly in the Old Marshland, and was either non-calcareous when deposited or rapidly decalcified, aided by close proximity to acid peat. Appledore soils, in which the thickness of clay is less, include similar material next to the peat, and the thinnest clays may never have been calcareous even in the surface.

Much exchangeable magnesium and sodium are found in Dowels and Appledore soils hereabouts, probably coming from the ground-water which is often brackish in peat. The typical coarse prismatic structure of subsurface horizons may also be attributable to this.

Being lower, Appledore soils have poorer drainage than even Dowels soils, and commonly have a thin peaty surface layer, but very poorly drained variants of the Dowels series have also been noted in a narrow zone parallel to the Rhee Wall. These soils, with slightly decalcified upper horizons, are separated from Appledore and more typical Dowels soils by a very low embankment extending from the Royal Military Canal to just east of Appledore station. This bank runs over minor ridges, as though it existed before inversion, and its crest

is many feet below that of the Rhee Wall, suggesting that it was an early defence of this part of Romney Marsh, probably following an old river course (Green and Askew 1958b, p. 25). Peat occurs at depths between 18 and 30 in. in this narrow tract, and it sometimes contains calcareous clay but the characteristic zone of non-calcareous clay is commonly present immediately above it.

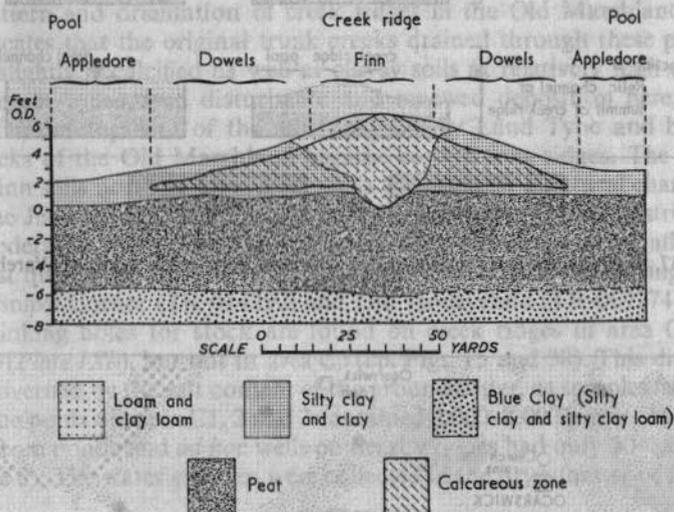


Fig. 36. Section through clayey creek ridge in The Dowels (TQ 981304)

C4

A small tract of land bordering the Royal Military Canal north-east of The Dowels has a simple creek-ridge-pool pattern, with Finn and Snargate soils on the ridges and Dymchurch and Dowels soils in the pools. The Dymchurch soils are continuous with those on creek ridges in The Dowels, and at similar levels, whereas the less common Dowels soils are in lower parts of the pools at about 5 ft O.D.

The main creek ridge, a continuation of the more clayey ridge in The Dowels, is joined by two branches from Horsemarsh across the Royal Military Canal, which probably once carried the stream rising in Faggs Wood on the adjacent uplands. Relic meandering channels can still be seen on some ridges, particularly the east-west one thought to correspond to part of an old river course across the north of Romney Marsh proper (p. 35). This channel, which is shown on the soil map, varies considerably in height because it now meanders from one side of the ridge to the other, suggesting that inversion has occurred, and that the final silted bed only occasionally coincides with the deepest part of the original creek traversing the peat landscape (Fig. 37).

C5

Three areas near the borders of the Decalcified Marshland are transitional to the adjoining Calcareous Marshland. The largest is between New Romney and St. Mary-in-the-Marsh, another is around Brenzett Place (TR 013273) and the third and smallest lies south of Snave Church (Fig. 30). All three have a

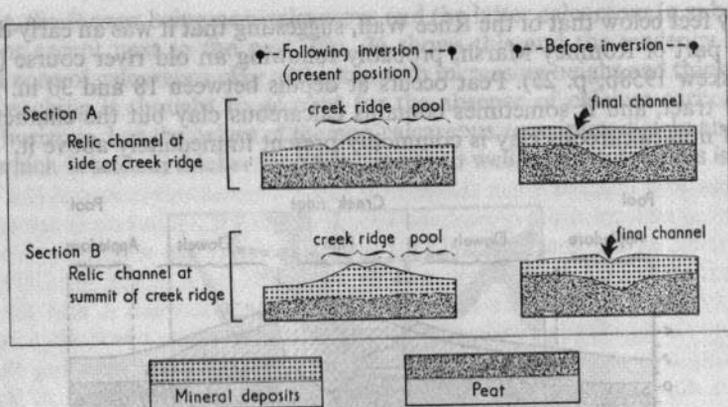


Fig. 37. Sketch-sections of a creek ridge with final relic creek south of Warehorne (TQ 982312)

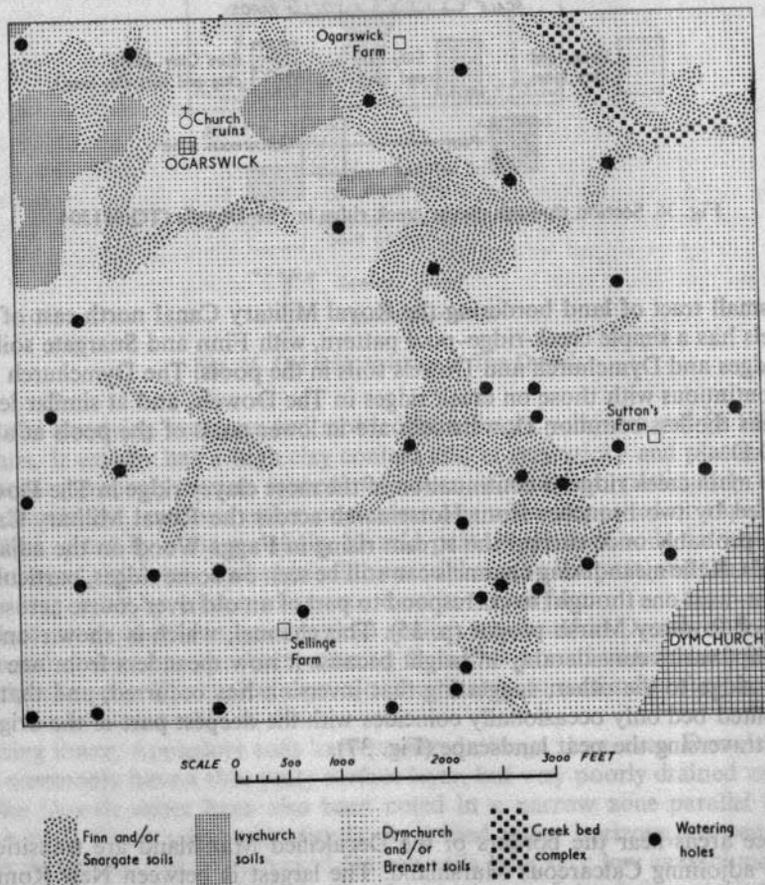


Fig. 38. Distribution of old buildings and watering holes near Dymchurch

succession of slightly decalcified fine and medium textured soils at similar heights (within the range 8–10 ft O.D.) well displayed east of Brenzett Place, where Finn, Ivychurch and Dymchurch soils occur successively towards Ivychurch. Peat is generally absent, and a thick sandy substratum (beginning within 42 in. in many areas of Snargate, Finn and Ivychurch soils) has been proved at several points and, to judge from the experience of farmers, is widely present.

The pattern and orientation of creek ridges in the Old Marshland near by (C1), indicates that the original trunk creeks drained through these parts (Fig. 14), and slightly decalcified as well as clayey soils at relatively high elevations suggest recent widespread disturbance and renewed deposition here, possibly early in the development of the adjoining Clayey Land Type and before the silted creeks of the Old Marshland became conspicuous ridges. The extensive area of Finn soils north of New Romney is traversed by a natural channel (now part of the Jefferstone Sewer), a relic of the creek system in this district.

The moderately well drained soils, particularly of the Finn series, afford some of the best quality land in the Marsh, two of the very best old fattening pastures being at Snave Corner (TR 014292) and Old Honeychild (TR 069274).

Old drinking holes for stock are found on creek ridges in area C1 of this land type (*Plate IXb*), but not in area C5 (cp. Figs. 15 and 38). This distribution may be governed by the salt content of the ground-water, as samples from *ad hoc* wells in the pools of areas C1, 2 and 3 contained 2,000–8,000 p.p.m. Na, whereas samples from ponds and *ad hoc* wells on nearby ridges had only 30–1,200 p.p.m. Na (Table 8). The water samples were collected in the dry summer of 1959 when

TABLE 8
Salt Content of Ground Water
(p.p.m. Na)

Area	Map Ref.	Well on Creek Ridges	Old Watering Hole on Creek Ridge	Well in Pool Area	Ditch crossing Pool Area
Baynham	TR 005242	1125	118	7600	4300
Coldharbour	TR 015246	29	100		
The Dowels	TQ 981304	450		4200	4300
The Dowels	TQ 980293	1188		2350	2000

water-tables were low. The higher values are in excess of those generally considered satisfactory in drinking water for stock.

Water from miscellaneous ponds, sewers and *ad hoc* wells in various parts of C4 and C5 had low salt contents, 30–1,000 p.p.m. Na, irrespective of relief or soils. These differences may be due to the peat stratum being close to the surface in the pools of C1, 2 and 3, but very thin or absent in C4 and 5. Furthermore, ground-water from the peatless ridge at Coldharbour contained very little salt compared to one at Baynham with thin peat at about 7 ft, or others in The Dowels with thick peat.

The ponds are very old features and Old Marsh graziers probably discovered that drinking water was better under the well developed ridges in C1. Few ponds occur in or near The Dowels (C2, 3 and 4), where peat underlies every part and the salt content of ground-water from creek ridges (equivalent to the Baynham well in one case) may have been small only since drainage has been improved by pumping.

C6

The Decalcified Marshland to the north and east of Romney Marsh proper (Fig. 30) differs from the typical creek-ridge-pool land of C1, in that ridges are either paired, as levees to ramifying relic creeks, or are relatively low and narrow. Levels are mainly between 7 and 10 ft O.D., and since the pools are relatively high, there is less topographical variation. They carry Dymchurch soils, particularly to the north, where the silty clay type occurs widely. Fine textured deposits are more important generally, with Dymchurch and Brenzett soils dominant and Finn soils commoner than Snargate soils on the ridges. Ivychurch soils are also common, either on low creek ridges or alongside the Finn or Snargate soils (Fig. 39).

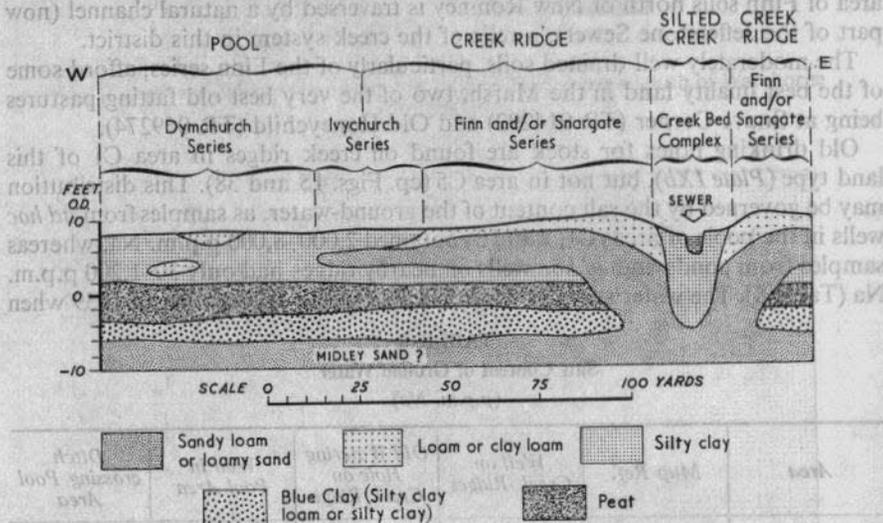


Fig. 39. Section through creek ridge south of Bonnington (TR 055339)

There is an extensive peat substratum, 1-5 ft thick, between Ogarswick (TR 084307) and Forty Acre Farm (TR 091397) and to the north and west of Newchurch (Fig. 6). Fig. 39, based on data obtained by augering and levelling along a transect at right angles to a creek relic south of Bonnington (TR 055339), shows that the stratigraphy is similar to that of C1 to C4 (cp. Fig. 39 with Figs. 13, 34 and 36) and the depositional history probably similar.*

A noteworthy contrast is the clayey infill of the final creek at Bonnington and the maintenance of a shallow creek, probably first developed in a peat or clay-over-peat landscape. The infilling is perhaps contemporaneous with deposits of similar texture in the New Marshland to the south, and may originate at least in part from the Weald Clay of the adjacent uplands, as it occurs in one of several creeks related to former courses of upland streams.

Other prominent creek relics in this land type (all mapped as Creek Bed complex because of variations in soil texture and drainage) are also bordered by

* Finn soils bordering another creek bed system near Forty Acre Farm (TR 088317) overlie a clay-peat-clay deposit sequence below 5 ft; sandy loam 3-5 ft, silty clay 5-10 ft, peat 10-12 ft, silty clay 12-15 ft.

Finn and/or Snargate soils on levee-like ridges grading to Dymchurch and/or Brenzett soils in low-lying pools. The pools may be only slightly lower, however, as near Burmarsh, where the fine textured soils are moderately well drained. It is probably significant that there is no peat substratum here, to which inversion is normally related. Peat shrinkage is associated with another creek bed east of Snav which funnels into the Clayey Land Type near Lodgeland (TR 035295); the wider end is occupied by a sewer meandering between levee-like ridges of Finn and Snargate soils which converge towards Snav and continue as a simple creek ridge. Similarly, east and west of the relic creek bed at Bonnington (Fig. 39) imperfectly drained Ivychurch soils, of the silty clay type, occupy the ultimate creek ridges. These soils also have the clay-peat-clay-sand deposit sequences found below 4 ft under Finn soils on associated levee-like ridges. Farther south, however, on an axis through Honeywood Farm (TR 057328) and Oak Farm (TR 048326) a slightly higher peatless area with a thick sandy substratum occurs which may correspond to an original trunk creek.* The soils hereabouts, principally Finn, Ivychurch and Brenzett series, are commonly better drained than farther north.

In some places Finn and Snargate soils are imperfectly related to a system of relic creeks, indicating more than one phase of development. Thus, west of St. Mary's Bay and Dymchurch these soils are often on very low creek ridges which probably formed by differential shrinkage of clay and sand on drying out. Surveying hereabouts depended largely on regularly spaced augerings, and the Finn and Snargate soil boundaries are therefore generalized. A particularly interesting area occurs near Jesson Farm (TR 087227), where habitation on an older surface is proved by widespread multicoloured pottery debris and charcoal at depths between 15 and 36 in., mostly associated with a grey clayey layer. Many shards † and a skeleton (probably that of a young horse) were found below 3 ft in a Brenzett soil described at one pool site (TR 082276), and similar miscellaneous debris were found below 30 in. in Finn and Snargate soils on a loamy creek ridge near by. Here (TR 079276) there were signs of disturbance in the surface of a buried clayey deposit which appeared to be part of an old creek bank (Fig. 40). The section indicated that an old creek had been infilled with loamy deposits and were similar to that near Swamp Farm (Fig. 13). Again no relic bed coincided with the buried channel, and traces of carbonaceous material, including peat, were also found at about 60 in. at the base of the orange and grey mottled clay similar to that over peat elsewhere. Possibly Roman occupation included the clayey banks of pre-Roman creeks that were later buried (p. 28), as in parts of Holland (Edelman 1950, p. 95), but the creeks may also have eroded through an old habitation surface. In one deeply decalcified Snargate soil (TR 082277) the disturbed horizon was associated with the surface of a thick stratum of rather coarse sand at about 30 in., perhaps an older creek deposit or an old sandy bank. ‡ Fig. 41 shows the pattern of relic creeks which, as mentioned earlier, are often imperfectly related to the low creek ridges and

* Near Honeywood Farm (TR 054328) this sand has been proved to a depth of at least 13 ft (— 3 ft O.D. approx.). In some places hereabouts it is medium grade (cp. the Midley Sand at Midley).

† These fragments have been dated to the late 1st century B.C. or early 1st century A.D. (see footnote p. 27).

‡ A sandy substratum with medium grade sand (cp. Midley Sand at Midley) occurs at several points over half a mile on a line parallel to the Romney, Hythe and Dymchurch railway approx. 500 yds north-west of Jesson Farm (TR 087277).

other areas of Finn and Snargate soils. It is difficult to reconstruct such systems because some creeks are now only meandering depressions which flood infrequently and others, deepened for land drainage, are only sinuous sewers. The main trunk of one creek system, however, conformed to a substantial section of the Clobden Sewer (see also Poker's map of 1617). This watercourse has no levee-like ridges and the adjacent land is clayey, but, as shown in the figure, the tributaries partly coincide with the Finn and Snargate soils and so, in turn,

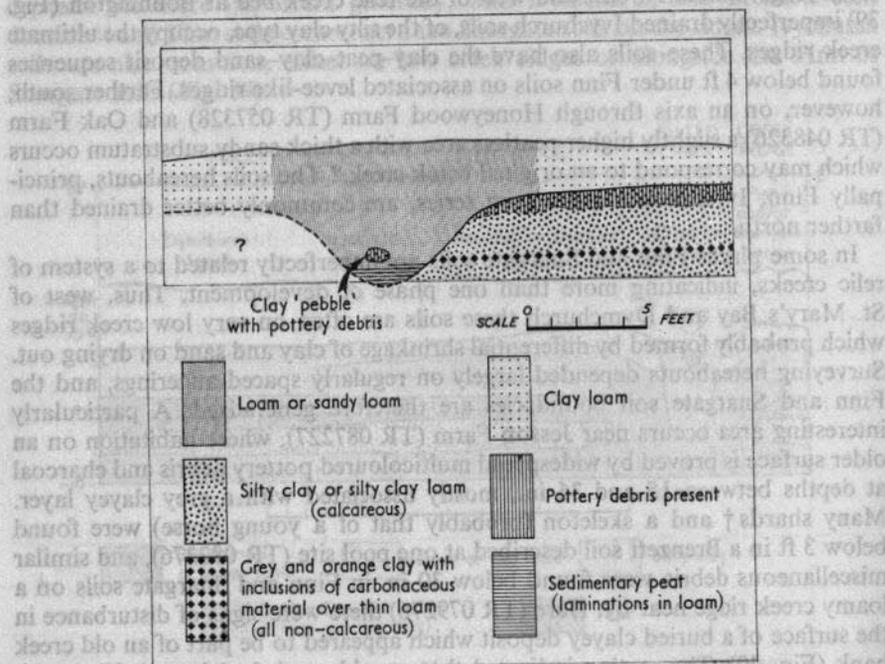


Fig. 40. Sketch-section of minor creek ridge near St. Mary's Bay (TR 079276)

with the low loamy ridges. Others, however, are bordered by Brenzett soils, and the overall pattern suggests that a relatively late transgression imposed this system on the landscape and partly redistributed the loamy to sandy deposits filling the earlier creeks. Flooding evidently occurred from the east, perhaps just prior to the building of the Dymchurch Wall, which replaced a naturally defensive shingle bank farther seaward that had been gradually weakened by erosion and eventually removed completely (Elliott 1847).

Slightly decalcified soils are widespread in areas bordering the Clayey Land Type, suggesting that the superficial deposits are younger and/or were extensively disturbed during the formation and silting up of the newer land. Thus, the slightly decalcified Dymchurch soils between the Sedbrook Sewer and Wey Street may coincide with a "wash zone" fringing the old river course to the north now represented by a tongue of calcareous clayey land including the Sedbrook Sewer, the latter conforming to the final meandering channel.

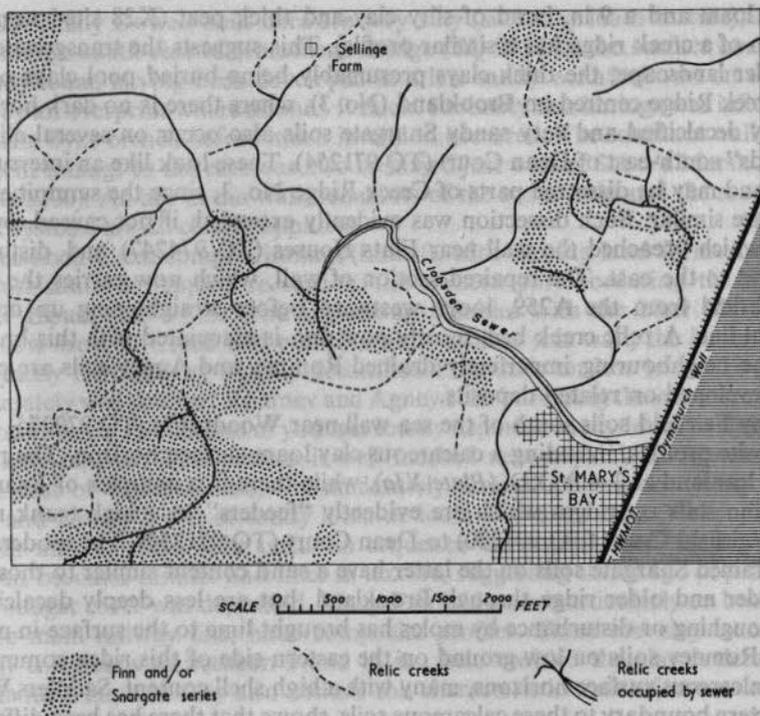


Fig. 41. Pattern of creek relics near St. Mary's Bay

C7

The creek ridges (Fig. 30) are commonly of the levee type and border the relics of south-west draining creeks, the latter mapped as Creek Bed complex because of differences in soil texture and drainage and because a low swampy area commonly borders an associated sewer. Dowels and Fairfield soils are common in pools to the north and south and are associated with Newchurch and Walland soils in one locality east of Water House (TQ 972285). Microrelief is well marked, with medium textured soils occupying the higher land. Elsewhere slightly decalcified Snargate and Finn soils are dominant, the moderately drained phases corresponding either to higher major creek ridges, e.g. north-east of Dean Court (TQ 971254), or levee-like ridges bordering the larger creek relics. The corresponding imperfectly drained phases are mostly on lower land in between, and may be regarded as transition zones. They are believed to conform to buried pools, because a dark, rather organic band, either of eroded peat or a former soil relic, occurs widely at about 3 ft and appears to mark the surface of a former landscape. It lies below many ridges and is relatively clayey, with less calcium carbonate than deposits above. In a transition zone south of Brookland (TQ 991257) it is at the top of a nearly 3 ft thick layer of silty clay over thick peat and is overlain by 3 ft of mottled loam and clay loam, *i.e.* an imperfectly drained Finn soil. It is at a similar depth below less mottled sandy loam, a moderately well drained Snargate soil, on the neighbouring levee-like creek ridge (TQ 992256), but is here underlain by more than 3 ft of loam or very fine

sandy loam and a 9 in. band of silty clay and thick peat (K28 sited near the margin of a creek ridge has a similar profile). This suggests the transgression of an older landscape, the thick clays presumably being buried pool clays of the old Creek Ridge centred on Brookland (No. 3), where there is no dark horizon. Deeply decalcified and very sandy Snargate soils also occur on several aligned "islands" south-east of Dean Court (TQ 971254). These look like an interrupted ridge and may be dissected parts of Creek Ridge No. 3, since the summit elevations are similar. Such dissection was evidently extended, if not caused, by the flood which breached the wall near Flats Houses (TQ 974247) and disturbed the land to the east. The repaired section of wall, which now carries the road to Fairfield from the A259, loops westward before straightening up on the original line. A relic creek bed, mostly now dry, is associated with this breach, and the neighbouring imperfectly drained Romney and Agney soils are probably developed on related deposits.

Many Fairfield soils south of the sea wall near Woodruff's (TQ 970275) have composite profiles, including a calcareous clay loam surface horizon. The pools are on low land at 3-4 ft O.D. (*Plate XIa*), while there is a complex of Snargate and Finn soils on ridges which are evidently "feeders" to a high trunk ridge from Fairfield Court (TQ 977270) to Dean Court (TQ 971254). The moderately well drained Snargate soils on the latter have a sand content similar to those on the wider and older ridge through Brookland, but are less deeply decalcified, and ploughing or disturbance by moles has brought lime to the surface in many fields. Romney soils on low ground on the eastern side of this ridge commonly have calcareous surface horizons, many with a high shell content. Saddlers Wall, the eastern boundary to these calcareous soils, shows that there has been differential subsidence here since reclamation. The wall is high (at TQ 976265) where it crosses moderately drained Snargate soils on a creek ridge (those to the west are intergrades with Romney soils), probably because adjoining lengths of the wall subsided.

Very low, mainly swampy creek beds occur in enclosures between Hook House (TQ 985248), Old Cheyne Court (TQ 997236) and Little Cheyne Court (TQ 983219), and, with the pools occupied by Dowels or Fairfield soils, include much of the lowest land in the Marsh. Innings walls of widely different ages occur here, the oldest being very low and breached by the main creeks. Slightly decalcified Snargate and Finn soils occupy higher land bordering Dowels soils, and Romney and Agney soils are similarly associated with the Fairfield soils. These medium textured soils are partly on levee-like ridges and transition zones, but in some parts, particularly near the Woolpack Fleet (TQ 988237), they merge to form a single ridge as the relic distributary they flank narrows and becomes shallower "upstream". There is thus a point at which the creek bed forms part of a creek ridge, but it may not be fixed and has presumably moved "downstream" as a result of differential subsidences. The extensive and higher areas of moderately well drained Snargate and Finn soils farther east, as around Old Cheyne Court (TQ 997236), may be analogous because other distributaries of the same creeks die away similarly there, presumably among deposits infilling a large creek. The low walls crossing thinly covered, clayey pools around the Beaconsfield and Woolpack Fleets and narrowness or absence of loamy levees suggest that the land was only just below sea level when the creeks developed. The peat was probably still very high then and remained so to a late stage, since the creeks hereabout developed later than others in this land type, *i.e.* 1-5 in

Fig. 14. Many Dowels soils here are very silty (silty clay loam texture), and in one innings south-east of Horsehead Bridge (TQ 991230) the surface horizon is a sandy loam, having been developed in a late sandy wash* shown on the soil map by an overprint where about 1 ft thick. Probably this innings was influenced by a late dyke breach before much inversion occurred. The southern wall of the adjacent innings to the east was also breached just west of Scott's Marsh House (TR 005230). An arc in the wall, remnants of the scour hole and the associated creek systems are all clearly apparent.

A distinctive and complex innings (Indraft) with varying land forms and soils lies just south of Appledore station, the western part bordering the wall by Water House (TQ 972285) having strong affinities with the New Marshland. Two low areas of Creek Bed complex abut against this wall, the larger clayey and partly bordered by slightly decalcified Finn soils on low levee-like ridges. Moderately well drained Romney and Agney soils bordering the other are higher and on differing thicknesses of younger loamy deposits, sandy loam to clay loam, over clay-on-peat. This pattern is well marked near a patch of Romney soils north-east of Water House, the moderately drained phases occupying higher land and having 3-4 ft of sandy loam or loam above the clay. Walland, Newchurch and Fairfield soils occur in sequence downslope, and the superficial deposit becomes thinner and finer in texture, suggesting shrinkage of peat since the younger cover was deposited. Many Fairfield soils, particularly on both sides of the main railway line, have composite profiles. These are clay loams and highly calcareous to between 9 and 15 in., below which the clay is decalcified for about 3 in., and they also include the characteristic zone of non-calcareous clay over the peat.

On the east side of this enclosure, slightly decalcified Snargate and Finn soils occupy narrow ridges and if the Fairfield soils in the adjacent pools subside further (they have thick peat below about 30 in.), the shallow clayey creek bed crossing this part, which is peatless to at least 48 in., will presumably appear as a ridge.

There are also Romney, Agney and Fairfield soils elsewhere in this area, particularly in another late enclosure or re-enclosure north of Little Cheyne Court (TQ 983219), transitional to the Land Type with Common Creek Relics. Here, there are moderately well drained Romney soils at the southern end on the highest part, and the land slopes down to pools with Fairfield soils. This land is lower than the New Marshland, as can be seen along the western boundary, where a former sea wall has been levelled. Elsewhere, Romney and Agney soils on lower land north of Hook Wall (TQ 995246) have a high shell content, possibly because they remained swampy for a long period.

CALCAREOUS (NEW) MARSHLAND

Land Type with Common Creek Relics

In this land type (Fig. 10) most innings have wide zones of moderately well drained Romney and/or Agney soils on levee-like ridges bordering the main creek relics, with Newchurch and/or Walland soils on the lower land between and on lower ridges fringing minor creek distributaries. Normally there is a

* Indicated on the soil map as blown sand, but now known to be water-deposited (Green and Askew 1958a).

wide, intermediate zone of imperfectly drained Romney and/or Agney soils, *e.g.* west of New Cheyne Court (TQ 979237) and east of Appledore, or by Guldeford soils, *e.g.* near Barn Farm (TQ 967216). Guldeford soils are also widespread in innings with narrower relic channels, enclosed after clays were deposited over sand flats and creek infillings, *e.g.* bordering the Highknock Channel south of Appledore. This series also occurs in younger peripheral innings to the west and south, where clays of the Newchurch series are often over sands at depths greater than 42 in. and peat is either lacking or deeply buried. By contrast, thick peat is common below 6 ft in central areas between East Guldeford and Becket's Barn (TQ 963266) and north of Woodruff's (TQ 970275), where even moderately well drained Romney and Agney soils are over a clay-on-peat sequence, *e.g.* bordering the Creek Bed complex associated with the Five Watering Sewer just north of Woodruff's. An Agney soil on one minor ridge (TQ 966270) has 3 ft of loam and clay loam over 5 ft of silty clay* overlying peat. With Walland soils in the adjacent pool, this suggests a final sedimentary phase in which a clayey landscape has been buried by coarser deposits. If so, it evidently involved a change in sedimentary conditions, or renewed flooding due to wall breaching. Walland soils are scarce in the youngest parts of this New Marshland, west of the Five Watering Sewer between Appledore and Rye, and silty clay rather than clay loam types of the Guldeford and Newchurch series are common.

Between New Cheyne Court (TQ 979237), New Building (TQ 963246) and Great Cheyne Court (TQ 968228), Romney and/or Agney soils occupy small but well-defined ridges marking the finer ramifications of creek systems thereabouts, and clearly show the influence of inversion (p. 30).

There are so many shallow distributaries in some places that the ground is corrugated, and soil patterns very intricate, drainage and/or texture of soils in the narrow creek beds contrasting with those of levees and the land between. Thus, east of Barn Farm moderately well drained Walland soils (TQ 972220) grade to soils of the Finn series on the narrow levees and to imperfectly drained Newchurch soils in the relic channels. The dominant Walland soils are mapped.

Moderately well drained Romney and Agney soils are widespread to the south and south-east of this New Marshland, particularly on high and flat land around Lower and Upper Agney (TQ 997215 and TR 011226) and in the well silted Wainway channel (Fig. 16). Here there was formerly a wide channel, still important in 1617 according to Poker's map. The land was clearly enclosed systematically as it silted up and, to judge from the narrowness of some relic channels, accretion was well advanced in some parts before reclamation, *e.g.* around Lower Agney. Romney and Agney soils are also very common south of Appledore, where a former course of the river Rother was progressively contained and associated creeks prevented from further silting; a low area with imperfectly drained Romney and Agney soils by Stone Bridge (TQ 947265) is a section of its former bed.

There are interesting differences in soils on this New Marshland related to age. The younger soils between Appledore and Rye are less mature, because they have more calcium carbonate in their surface horizons, are paler or greyer and often less well structured (Chapter 3). Sedimentary laminations of clay and

* The surface of this clay (at approximately 6 ft O.D.) is 4 ft above that of clay about 2 ft thick which caps the peat in the Old Marshland near Fairfield Church just to the south, and it is unlikely that the surfaces are of equivalent age.

fine sand are found nearer the surface than elsewhere, and the silty clay types of the Newchurch and Guldeford series are much more common. To a lesser degree, soils in the Old Wainway Channel are also immature, particularly in innings towards Rye.

Clayey Land Type

This land type (Fig. 10) is dominated by Newchurch soils with large areas of both drainage phases. Imperfectly drained Newchurch soils, commonly the silty clay type, occupy slightly lower land, as near Newchurch and bordering Lower Wall Road. Moderately well drained Walland and Newchurch soils are found together in many places, but the former are seldom well developed and much less common than in Walland Marsh. Fine textured soils, including scattered areas of the Guldeford series, account for about 95 per cent. of the area, so that, in farming terms, the land is "heavy", particularly when the excellent fine blocky and granular structure developed in topsoils under old pasture has been lost by cultivation. Agney soils, which occur in a few scattered areas, mostly border narrow relic channels, although the narrow tract parallel to and south of Lower Wall Road is oriented at right angles to such features. Some parts are higher and possibly mark a levee fringing a former broad channel to the north.

The surface horizons do not have as much calcium carbonate as soils in the youngest part of the New Marshland, and in colour and degree of structure development, they are more mature. Such differences are consistent with early reclamation (p. 36).

Rhee Wall Land Type

Agney soils occur on low levees bordering relic channels, particularly west of Appledore station, and these and Romney soils are found towards New Romney, but otherwise Walland and Newchurch soils are dominant.

Land Type with Mounds

This land type (Fig. 10) comprises relatively high land, and as most deposits are readily permeable, moderately well drained soils are dominant. Romney soils on the high mounds west of Belgar (TR 059228) and adjoining New Romney are mostly sandy loams, becoming sandier with depth; loamy sand, for example, occurs to a depth of at least 9 ft at TR 058231. Other banks, and the land between, commonly have finer textured horizons with soils of the Agney series. Thick silty clays, however, are uncommon except in patches west of New Romney, where the Newchurch, Walland and Guldeford soils are mapped.

Land Type with Shingle Banks

South of Ferryfield Airport the Beach Bank soils on the shingle ridges are associated with imperfectly drained soils of the Agney and Newchurch series, the latter towards the closed end of most lows or more widely, as between Lydd and Galloways Coastguard Station. North of the Airport, however, Romney and Agney soils are common, many with an unusually coarse sandy subsurface horizon or substratum, and some are moderately well drained. The Beach Bank soils are of the coarse textured type, and Greatstone and Guldeford soils occur at the closed ends of the lows.

Most fields have contrasting soil series. The thin droughty Beach Bank soils

usually carried native acidophilic plants; crop growth on them depends on elevation, the thickness of the non-stony cover and the texture of interstitial material, and it can be satisfactory on the fine textured type in lower sites, even where the shingle is thinly covered. Nevertheless, they are usually much less productive than the deeper and more moisture retentive Agney, Newchurch and Guldeford soils, so that crop growth is uneven.

Land Type founded on Late Sand Flats

Guldeford and Greatstone soils are dominant in this relatively flat land (Fig. 10), because the underlying sandy deposits, which are unusually coarse (p. 43 and the soil map), are seldom buried by thick deposits of silty clay. In some parts, however, Guldeford soils grade into Newchurch or Walland soils, particularly north-east of New Romney. More commonly they pass into Agney soils on one side as the overlying deposit grades to thick clay loams, and into the silty clay type of the Greatstone series on the other as the silty clay thins out over the coarse sand. In some areas, as south of New Romney station, an old sea wall divides the Guldeford and Greatstone soils. The latter occupy most of the area between this wall and the coastal shingle and dunes, the series being divided for mapping purposes into two groups, the silty clay and clay loam types and those of coarser texture. The recent installation of a pump at Greatstone-on-Sea should improve the drainage, particularly in low areas behind the dunes north of Denge Beach, where some sandy soils are poorly drained.

East of Lydd, in the southern part of the land type, soils are progressively more gleyed and finer in texture towards Denge Beach. Moderately well drained Romney soils are dominant near the town, but Agney soils occur more frequently to the east, the clay loam type tending to replace the loam type, and the imperfectly drained phase being most common adjacent to the Land Type with Shingle Ridges north-east of Denge Beach.

MISCELLANEOUS LAND TYPES

Old Beaches

Dungeness soils occur on beaches of the Dungeness promontory and others south-east of Rye and near Hythe, but narrow, irregular zones of Beach Bank soils fringe their inland boundaries wherever wash or windblown deposits from the adjacent thick alluvium thinly cover the shingle and where there is fine material in its interstices. The Dungeness soils occur in patches or long narrow zones corresponding to successive shingle fulls, so that in many parts the development of the beaches is apparent from the pattern of parallel vegetation stripes (Plate III). The latter are often along or close to the ridge crests, and pebble size is an important factor controlling soil development and plant growth, because barren "lows" often have larger pebbles. The humus of the Dungeness soils is derived from plant species of diverse character, ranging from various lichens, mosses and grasses to large bushes, e.g. gorse (*Ulex europaeus*) and wind-shaped holly thickets (*Ilex aquifolium*). Acidophilic herbs, such as sheep's sorrel (*Rumex acetocella*) and foxglove (*Digitalis purpurea*), are common. Several characteristic plant communities occur and, according to Scott (1965) who described the dry acid heath vegetation at Dungeness, prostrate broom (*Sarothamnus scoparius*) plays the most important part in a complete autogenic xerosere, the succession beginning with lichens encrusting the pebbles and

reaching a climax with the development of holly wood, which is well developed on Holmstone. The prostrate broom, like other species present, such as viper's bugloss (*Echium vulgare*) and holly, develops roots able to reach moisture many feet below the surface.

The sparsely vegetated and barren shingle is very loose, but often holds a little fine black material, very dusty when dry, between 9 and 18 in. This may originate from a partial crust of dark material on pebbles near the surface,* but the composition is not the same, and the amount does not differ with the age of the beach, suggesting that it is not an accumulation.

The coarse textured type of the Beach Bank series occurs widely at Lydd, shingle often being within an inch or so of the surface, but Lydd soils fringe the east, south and west sides of the town. Those to the east commonly have clayey horizons or substrata below about 30 in., but elsewhere they include pebbles or overlies shingle at depths below 24 in. Pebbly Lydd soils are also typical of the older parts of New Romney, but stones are absent, and clayey substrata are common where the series straddles the road to St. Mary-in-the-Marsh and occupies a strip running north-east to St. Mary's Bay. The shingle beach adjoining this strip is partly excavated and used as a refuse dump, but where undisturbed or not covered by dunes there are coarse textured Beach Bank soils. Such soils also dominate the shingle of The Warren and the land behind the coast at Littlestone, though Lydd soils occur locally.

Saltings

All the Saltings soils are strongly gleyed, and most are fine textured and poorly structured, particularly below 12 in.

Calcareous Saltings

Typical soils, such as profile K48a, have a dark greyish brown Ag horizon of nearly structureless, plastic silty clay loam or silty clay with rusty staining along old root channels. This merges below 6 in. to a pale greyish brown weakly developed Bg horizon of plastic silty clay loam or silty clay with brown or weak ochreous mottling; its structure is weak medium to coarse prismatic, the ped faces being grey or pale bluish grey. Pale brown colours and distinct ochreous mottling occur inside peds between 18 and 30 in.; grey colours are still associated with ped faces, but, with the weak coarse prismatic structure typical at these depths, they are less evident. At greater depths there is a gradual change to grey structureless material, at first with distinct, rusty tubes round vertical pores, eventually passing to bluish black material.

Some soils of coarser texture on slightly higher land, between Rye and Rye harbour, have up to 30 in. of loam to sand over silty clay loam or silty clay.

Decalcified Saltings

Large mounds made by the mound ant are common in the Decalcified Saltings, and profile K114 includes one of these. The cavities and holes and the

* Analyses of the two materials gave:

Per Cent.	Black Dust	Black Crust on Pebbles
C	7.6	
Fe	3.6	57.0
Mn	50.1	1.5

fine calcareous frass in the decalcified horizons are due to the burrowing of this species, but the thin Ag horizon over grey or bluish grey soil with prominent ochreous mottling is typical, as also is the weak, very coarse soil structure between 12 and 30 in. Such soils surround and are surrounded by Beach Bank and Dungeness soils.

Representative profile descriptions

PROFILE NO.: K48a from the Calcareous Saltings (analysis, p. 146).

Location: north-west of Northpoint (grid ref. TQ 934199).

Relief: flat area dissected by complex of creeks.

Vegetation: fairly mature salt marsh vegetation.

Horizons:

in.

- 0-6 **Ag** Dark greyish brown (2.5 Y 4/2) plastic and sticky very calcareous silty clay loam with abundant yellowish red (5 YR 5/6-4/6) staining along old root channels; fine to very fine subangular blocks developed locally, otherwise structureless; merging boundary.
- 6-18 **Bg** Greyish brown (2.5 Y 5/2) and strong brown (7.5 YR 5/6) very sticky and plastic very calcareous silty clay loam with a weakly developed coarse and medium prismatic structure; ped faces and root holes greyish brown (2.5 Y 5/2) and grey (5 Y 6/1); a few fine pores; fine fibrous roots common, decreasing with depth; merging boundary.
- 18-26 **Bg/Cg** Pale brown (10 YR 6/3) very sticky and plastic very calcareous silty clay loam with many distinct strong brown (7.5 YR 5/6) and greyish brown (2.5 Y 5/2) mottles; weak, coarse prismatic structure, the ped faces mainly greyish brown (2.5 Y 5/2); a few fine pores; few fine fibrous roots; merging boundary.
- 26-60+ **Cg** Pale brown and light brownish grey (2.5 Y 6/2) structureless very calcareous silty clay loam with many distinct strong brown to yellowish red (7.5 YR 5/6-5 YR 4/6) mottles; fine pores and roots rare; becomes greyer and siltier below 36 in., but with rusty vertical pipes to about 48 in.; dark bluish grey below about 60 in.

PROFILE NO.: K114 from the Decalcified Saltings (analysis, p. 146).

Location: South Brooks, Lydd (grid ref. TR 031192).

Relief: microrelief due to abundant large anthills (height 6-18 in., diameter 12-24 in.).

Land use: rough permanent pasture.

Horizons:

in.

- 12-0 **Anthill** Dark greyish brown (2.5 Y 4/2-2/2) calcareous silty clay with dark brown (7.5 YR 4/4) mottling common locally. Abundant ramifying channels up to 2 cm diam. and some larger cavities occur, partly lined with very fine frass; mound ants very active; fine roots common; sharp boundary.
- 0-3 **A(g)** Black (10 YR 2/1) partly calcareous organic silty clay with common dark brown (7.5 YR 4/4) mottling in lower part; some fine subangular blocks and many holes up to 1 cm diam.; ants active; fine roots common; narrow boundary.
- 3-5 **Blg** Grey (5 GY 7/1) partly calcareous very firm silty clay with many prominent yellowish red to dark reddish brown (5 YR 4/6-3/4) mottles; moderately strong medium prismatic structure the ped faces very dark greyish brown (2.5 Y 3/2-2/2) with many prominent dark reddish brown (5 YR 3/4) mottles; many holes up to 1 cm diam., some with very fine frass; ants active; fine roots common; merging boundary.

Horizons:*in.*

- 5-14 Bluish grey (10 GY 6/1) very firm silty clay with many prominent yellowish red to dark reddish brown (5 YR 4/6-3/4) mottles; moderate coarse prismatic structure, the ped faces dark grey to grey (N 4/1-10 Y 5/1); many irregular cavities and interconnecting holes (up to 1 cm diam.), with similar grey coatings, some with much very fine frass; a few fine roots, mainly along the holes; completely calcareous below 8 in.; merging boundary.
- 14-26 Bluish grey (10 GY 6/1) very firm silty clay with many prominent yellowish red to dark reddish brown (5 YR 4/6-3/4) mottles; weak very coarse partly laminated prismatic structure, the fine sandy bands being similarly mottled; ped faces grey (10 Y 5/1-7/1) and brown to dark reddish brown (7.5 YR 4/2 to 5 YR 3/4); irregular cavities and interconnecting holes as above, the very fine frass being partly greyish, partly ochreous; a few fine roots mainly along channels.

Creek Bed Complex

Collectively this includes a range of soils with differences in drainage, texture, calcium carbonate and salt content. Broadly speaking, the soils on the widest beds are either very clayey or quite sandy, and related to the dominant texture in the land originally served by the creek. The widest parts in some cases are swampy and flood deeply in very wet seasons, *e.g.* those associated with Beaconsfield Fleet (TQ 982241), whereas others rarely flood and contain useful agricultural soils, *e.g.* south of Snargate (TQ 983272). The two soils described below, K51 and K54, are typical of the wetter Creek Bed areas. Creek Bed soils in the New Marshland are always calcareous, and those in the Old Marshland are not always decalcified.

The representation of creek beds on the map also serves a cartographic purpose because the smaller distributaries have low levees with coarser textured and/or better drained soils than in adjacent areas; these differences cannot be mapped at the scale used, although as far as possible the dominant soil type is shown (p. 118). Many such channels are no longer evident due to infilling or to burial of their levees by spoil following the adaptation of the channels as sewers. Differences in soil become progressively more evident "downstream" as the creek relics and ridges widen and develop more clearly.

Representative profile descriptions

PROFILE NO.: K51 from the Creek Bed complex (analysis, p. 146).

Location: relic bed of Wainway Creek, Ivychurch (grid ref. TQ 979197).

Relief: low area between sewer and adjacent sandy levee.

Land use: old wet pasture.

Horizons:*in.*

- 4-0 Very dark brown to black (10 YR 2/2 to 2/1) calcareous sandy peat with abundant matted fine and medium roots, many stained dark red (2.5 YR 3/6); many small shells; beetles, grubs and earthworms occur; sharp boundary.
- 0-4 Very dark brown (10 YR 2/2) very calcareous organic loam with a very weak fine prismatic and medium subangular blocky structure; abundant roots; many stained as above; many small shells; no fauna seen; sharp boundary.
- Ag

Horizons:

- in.*
- 4-9 Grey (10 YR 6/1) structureless calcareous loamy sand with common vertical yellowish red (5 YR 5/8 and 4/8) pipes mostly with a grey peripheral zone around a root channel; fine roots (dead and alive) common; many shells; earthworm burrows occur, many with humose linings; narrow boundary.
- 9-24 Grey (5 Y 6/1) calcareous loamy sand with yellowish red (5 YR 4/6) mottling, the latter partly as vertical pipes as above; some thin peat lenses occur between 13 and 17 in. and peat laminations are present between 24 and 26 in.; abundant shell fragments; a few fine live roots and several earthworm burrows, the latter penetrating the peat and having dark organic linings.
- 24-96+ Grey (5 Y 5/1) and dark bluish grey calcareous sand.
- C3g

PROFILE NO.: K54 from the Creek Bed complex (analysis, p. 146).

Location: relic creek bed containing Kent ditch, East Guldeford (grid ref. TQ 927703).

Relief: low area between Kent ditch and adjacent sandy levee.

Land use: old wet pasture.

Horizons:

- in.*
- 0-6 Very dark greyish brown (10 YR 3/2) very humose calcareous clay loam with a weak fine and very fine subangular blocky structure; abundant roots, living and dead; a few shells occur; merging boundary.
- A
- 6-11 Dark greyish brown (2.5 Y 4/2-5/2) very calcareous plastic loam grading to greenish grey material with inclusions of humus; light grey mottling and rusty staining associated with old root holes; weak fine subangular blocky structure; many shells; a few fine pores; fine fibrous roots (alive and dead) abundant; narrow boundary.
- Ag
- 11-13 Light grey (5 Y 6.5/2) structureless very calcareous loam tinged with greenish colours and with faint lighter grey mottling; plastic and sticky; abundant shells; a few fibrous roots, living and dead; narrow boundary.
- C1g
- 13-23 Grey (5 Y 6/1) very sticky very calcareous clay loam to clay tinged with greenish colours and with a few vertical rusty "root pipes" in the lower levels; structureless; shells common; a few fibrous roots; narrow boundary.
- C2g
- 23-29 Light yellowish brown (10 YR 6/4) very calcareous sandy loam with fine horizontal banding (sedimentary laminations) and many vertical rusty root holes lined internally with grey colours; structureless; many shells; merging boundary.
- C3g
- 29-36 Light grey (5 Y 6.5/2) very calcareous laminated loam with many rusty root holes; structureless; many shells; no roots.
- C4g
- 36-121+ (Auger data); grading to bluish black structureless loam; vertical rusty root holes continuing to about 48 in.
- C5g

CHAPTER VI

Agriculture

HISTORICAL INTRODUCTION

Recounting Edward IV's attempt to persuade his subjects to live in the Marsh, Lambard (1576) claimed that "it is bad in winter, worse in summer and at no time good, only fit for those vast herds of cattle which feed all over it". Sheep farming has traditionally been the cornerstone of Romney Marsh agriculture. The dominance of this enterprise in the period 1866-1939 is evident from Table 9,

TABLE 9
Agricultural Statistics for Parishes wholly within the Marsh *

Year	Tillage acres	Temporary Grass acres	Permanent Grass acres	Rough Grazing acres	Total Area acres	Tillage Acreage per cent.	Cattle	Sheep
1866	5,776	711	31,606	—	38,093	15	1,104	77,168
1870	7,049	472	32,101	—	39,622	18	1,974	169,960
1881	8,159	1,036	31,971	—	41,166	20	2,660	172,922
1891	7,819	1,454	33,739	—	43,012	18	2,838	179,633
1901	6,214	841	33,340	1,845	42,240	15	2,163	150,401
1911	6,520	767	32,035	2,401	41,723	16	3,626	165,156
1918	8,018	1,100	30,600	3,366	43,084	19	3,431	137,196
1921	7,313	1,175	28,834	2,546	39,868	18	3,256	129,229
1931	2,824	590	32,917	3,145	39,476	7	3,849	160,057
1939	3,892	765	35,178	3,767	43,602	9	3,739	178,176
1944	14,141	2,174	21,085	974	38,374	37	3,509	99,990
1948	13,884	3,654	21,629	1,652	40,819	34	5,748	98,713
1965	15,477	5,335	17,880	2,698	41,390	37	4,366	136,329

* Burmarsh, Newchurch, Dymchurch, St. Mary's, Brenzett, Snargate, Brookland, Ivychurch, Old Romney, New Romney, Lydd, St. Thomas the Apostle, East Guldeford and Broomhill.

showing agricultural statistics for 14 parishes wholly within the Marsh. These lands (Fig. 42) account for about 40,000 acres of the total agricultural area of nearly 50,000 acres, and it will be seen that the acreage of arable land was never high during this period, fluctuating between 15 and 20 per cent. in the earlier years and falling below 10 per cent. before the Second World War.

The traditional sheep farming system depended on permanent pastures grazed by the Kent or Romney breed of sheep, an indigenous and world renowned breed able to withstand the rigorous climate, of bleak winters with exposure to keen northerly and easterly winds in spring, and able to thrive with little attention. These hardy sheep (*Plate IXb*) yield a good clip of wool, graze pastures evenly (Garrad 1936) and, particularly important in the Marsh, sustain winter wetness under foot in pastures stocked at 2 to 3 sheep per acre even in winter.

Under this system the Marsh grazier recognized different classes of pasture according to the number of sheep they would fatten or maintain per acre. The

chief differences were well summarized in 1786 by Daniel Jones, who referred to grassland of two different grades of goodness "the breeding land which is the general quality of the Marsh and is supposed to be not sufficiently good to fatten, at least in so short a time as some other lands will, and the fatting land, which are the prime pieces and very rich. The best of the breeding lands will do to bring the sheep forward to a certain degree of fatness, after which they are removed to the best lands to what they call finish them where in a few months

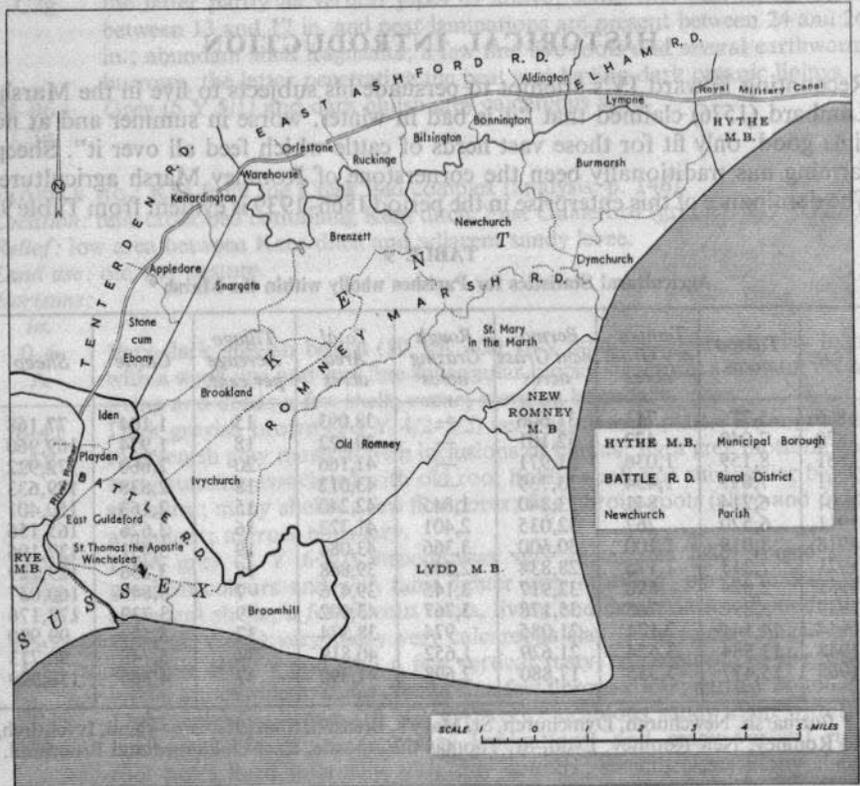


Fig. 42. Parish Boundaries in 1960

they become sufficiently fat for the butcher." Four grades of pasture are listed by Cole and Dubey (1932) and by Garrad (1954), Grade I being fatting land, Grades II and III breeding land and Grade IV rough grazing land. Garrad makes the following comments regarding Grade I pastures: "These occur on the most productive soils and will carry and fatten from 6 to 10 sheep per acre in summer without cake or corn. On some of the most famous of these pastures even higher numbers can be fattened. These figures, however, do not mean very much because the number of sheep a pasture will fatten in a summer depends on the condition and age of the sheep when they are put into the pasture and the length of time they are kept there. During the winter fatting pastures will carry about 3 sheep per acre." By contrast, Grade II pastures "support from 4 to 6 sheep per acre in growing condition in summer and about 2 sheep in winter", Grade III pastures "carry 2 to 4 sheep per acre in summer" and Grade

IV pastures "carry 2 sheep or less per acre in summer". Many fattening pastures have been ploughed up in recent years, and the management of others has changed to meet new demands, but formerly the stocking rate was continually adjusted to keep them closely grazed; a sixpence lost after being thrown as far as possible in such a field was reckoned to indicate under-grazing. Such pastures were generally found, and still occur in many parts of the Marsh, as individual fields surrounded by pastures of lower quality, their distribution being determined chiefly by soil type and management (pp. 135-6).

The acreage of arable land has expanded or contracted with changing economic and social conditions, and Hall and Russell (1911) comment on the period up to 1911:

"The depopulation of Romney Marsh is said to have begun with the Black Death up to which time it was mainly under the plough; much of it was again broken up at the time of the Napoleonic Wars and again about 1850-60 when corn prices were high but since then it has returned to pasture. Many of the field names show that they were at one time arable."

It is unlikely that arable land was so dominant in the Middle Ages as this suggests, however, particularly as depopulation is commonly inferred from the size and number of churches in Romney Marsh. Laing (1836) notes:

"In Romney Marsh fifteen or sixteen churches may be seen within a space which, altogether, would only be in extent one considerable parish, and in some of them there never have been above half a dozen families. But if it was a common practice in those ages for the feudal lord to impart to his vassals full hereditary rights to their lands, in consideration of a payment which he laid out in pious uses, such as the building of churches, it would be evident that the quality of the land and value of the right ceded to the vassal would have more to do than the number of the inhabitants, in determining the size and number of their parish churches; and it is precisely in the rich alluvial lands gained from the rivers and fens, that most of such parish churches (erected without reference to a population) are found. In Romney Marsh, a tract of alluvial land studded with churches, many of which are spacious, there are no indications that it has ever been so densely populated as to require so many and such large places of worship, as there are no traces of former inhabitants, no marks of the plough, no vestiges in the churchyard of numerous resting places of former generations; and the land would never have been cultivated so as to need a large resident agricultural population."

After visiting Romney Marsh in 1823, William Cobbett commented unfavourably on the sparseness and poverty of its inhabitants in sharp contrast to the "fatness of the flocks and herds and the fields loaded with corn". His first impressions were evidently of a pastoral economy:

"In quitting this Appledore I crossed a canal and entered on Romney Marsh. This was grassland on both sides of me to a great distance. The flocks and herds immense. The sheep are of a breed that takes its name from the Marsh. They are called Romney Marsh sheep. Very pretty and large . . . the cattle appear to be all of the Sussex Breed. . . . With cattle of this kind and with sheep such as I have spoken of before, this Marsh abounds in every part of it; and the sight is most beautiful."

After passing through Snargate and Brenzett, however, he continues:

"The next village, which was two miles further on, was Old Romney, and along here I had, for great part of the way cornfields on one side of me and

grassland on the other. I asked what the amount of the crop of wheat would be. They told me better than five quarters to the acre. . . . I never saw corn like this before."

And again on the way to Dymchurch, he records:

"From New Romney to Dymchurch is about four miles; all along I had the sea-beach on my right and, on my left, sometimes grassland and sometimes corn-land."

Steam ploughing was once common in the Marsh, and Garrad (1954) comments:

"The practice was to steam plough the heavy land directly after harvest; and if wheat was sown before the ground got too wet, a heavy crop was assured."

AGRICULTURE 1930-1965

A fall in market prices of sheep and wool around 1930 led Garrad (1936) to examine traditional practices and to suggest changes in the system of agriculture. Sheep-sick pastures were then considered a serious problem, and another was the two-year-old wether which produced poor quality mutton and joints too big for the normal market. By this time half-bred sheep were common in the Marsh, the most popular and successful being a cross between the Kent ewe and the Southdown ram, which, growing faster and maturing more quickly than the pure bred Kent, produced a smaller boned sheep more in keeping with market requirements. Unfortunately the poor condition of the agisted lambs, that is those returning to the Marsh in April or May having been wintered on upland farms, made them unfit to graze the fattening pastures, since the rich herbage and/or heavy worm burden tended to make them scour. The proper management of such fields therefore depended on retaining scarcely profitable two-year-old wethers. Among many suggestions, Garrad proposed that some old sheep-sick pastures should be rested by cutting the best of them for the sale of indigenous perennial ryegrass and wild white clover seed and that selected breeding pastures should be ploughed up for leys and/or for growing peas, beans, potatoes, corn, market-garden crops and miscellaneous seeds. He considered that such procedures, combined with better control of parasitic worms and the use of sheep licks, could alleviate the prevalent diseases and the economic problem.

A change in the pattern of farming was hastened after 1939 by the Government policy of maximum home food production, and during the war years the cropping acreage increased more than four-fold (Table 9). Ploughing up followed the removal of nearly half of the sheep to other parts of the country, and excellent crops of wheat, potatoes and other crops were grown (*Plate XIb*). An account of these war-time activities is given in the Agricultural Land Commission Report (1949), and by Garrad (1954). In the post-war period the change from grass to arable was encouraged by the much greater profitability of arable farming compared with traditional sheep farming, and the trend was stimulated by an influx of farmers from Lincolnshire who adapted the Fenland style of farming to the Marsh. The change was also favoured in 1949 by an Agricultural Land Commission, whose recommendations included the following:

- (1) Ley farming is the proper system for general adoption in Romney Marsh to ensure full and efficient use of the land for agriculture, although

intensive arable farming and market gardening should not be discouraged where conditions are suitable.

(2) In the national interest there should be maintained in Romney Marsh a minimum tillage area of 20,000 acres, which, allowing for the area necessarily under temporary grass, will give an arable acreage of 25,000.

There were also recommendations for the extension of water and electricity services, the construction of houses for the anticipated increase in the labour force, and for sundry public and farm road improvements.

Under these influences the acreage of arable land and temporary grass has increased considerably since the end of the war, ploughing commonly being preceded by extensive tile drainage. Diverse enterprises, such as bulb-growing, propagation of disease-free strawberry runners and semi-intensive beef production, have been introduced. Allanson (1961) recorded the state of the Marsh system of sheep farming, and for the Kent sheep recommended close attention to breeding and feeding to increase profits. Table 10, which summarizes the agricultural returns of 4th June 1950 and 1965 for eleven Kent parishes situated entirely in the Marsh, shows the continuing trend to arable and ley farming and illustrates the agriculture of the whole area.

Wheat and barley production has increased considerably since 1950, while grassland has decreased, although a 10 per cent. fall in permanent grass has been accompanied by a 6 per cent. increase in temporary leys. The loss of nearly 2,000 acres of good grazing land has been accompanied, however, by a considerable increase in the sheep population, a feature partly attributable, no doubt, to the high productivity of the leys. Nearly 17,000 of the 22,000 extra sheep are lambs under one year, and the wethers and other non-breeding sheep are now much less important in the economy. The substantial decrease in the total number of workers during the period is partly due to greater mechanization, and the smaller total of holdings reflects amalgamation of farms.

SOILS IN RELATION TO AGRICULTURE AND HORTICULTURE

Profitable crop production depends on suitable climate and good management, combined with favourable soil and site characteristics. For optimum growth normal agricultural crops require moist, well aerated soils, with all necessary nutrients in available forms. A good depth of soil freely exploitable by roots is needed to store sufficient moisture for growth to continue in dry periods, while the soil and substrata should be sufficiently permeable and so sited that excess rain in winter is rapidly removed. Land use capability is also influenced by slope, altitude and aspect, and ease of cultivation or suitability for differing crops is also determined by factors such as stoniness.

Low nutrient status and an acid reaction can normally be cheaply and profitably rectified by applications of fertilizers, and other unfavourable soil conditions may be ameliorated by good husbandry. Thus the structure of the surface soil can be gradually modified to improve seed-bed conditions and, by increasing the content of organic matter, the moisture and nutrient holding capacity of the soil can be enhanced. Seasonal waterlogging can be dealt with by artificial drainage, making the soil more tractable, and, by encouraging more extensive root growth, developing a better-structured subsoil. Conversely, in

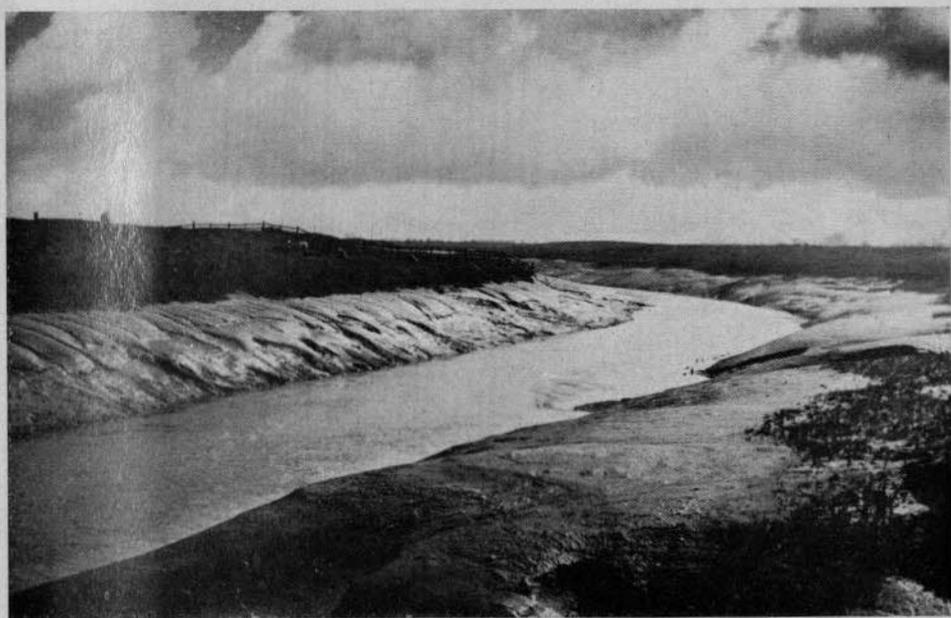
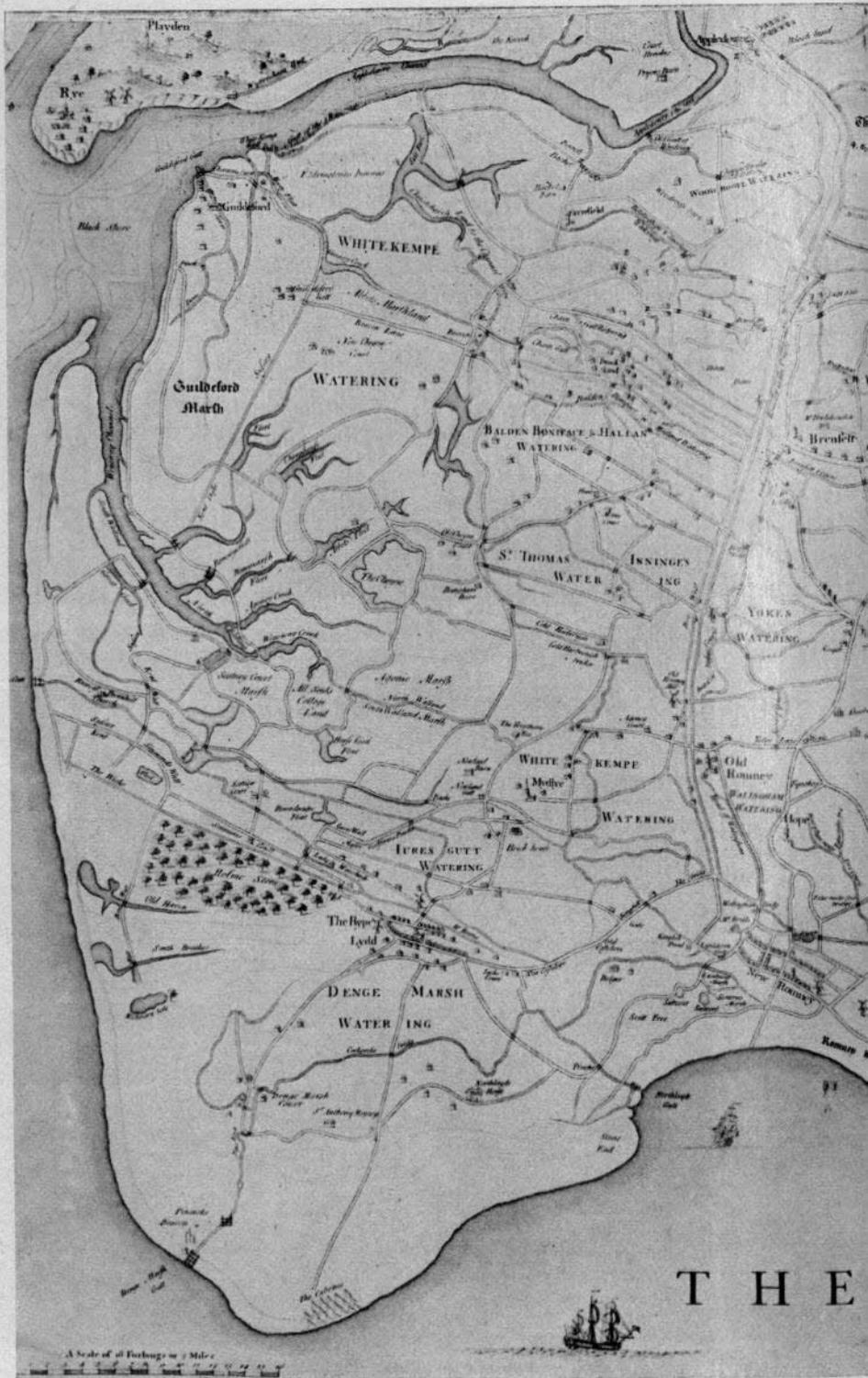


Plate IXa. The Rother with bordering saltings north-east of Rye. The river is tidal as far as Scott's Sluice and flooding of the marshland is prevented by low walls, one of which is seen along the far bank.



Plate IXb. Drinking hole on trunk creek ridge near Lydd.



T H E

Plate X. James Cole's engraving of M...



Plate XIa. Fairfield and Dowels soils flooded near Fairfield Church in January 1961. The land on the left is part of the old sea wall. Minor creek ridges are not flooded.



Plate XIb. Potato harvesting in the Land Type with Creek Ridges near Brenzett. Soils of the Snargate and Brenzett series.

dry summers shallow or coarse textured soils may be irrigated where adequate water resources are available.

These treatments counteract, rather than fundamentally alter, unfavourable soil properties, and many basic characteristics, such as slope, thickness of soil, texture, stoniness and permeability of substrata, cannot be altered in ordinary farming practice. The more important relationships between productivity and soil conditions in Romney Marsh are discussed below.

Romney, Agney, Guldeford, Walland, Newchurch, Snargate, Finn, Ivychurch, Brenzett and Dymchurch Series

These highly productive soils are those on which the reputation of the Marsh rests. They occupy nearly 50,000 acres; 96 per cent. of the reclaimed soils on alluvium (51,600 acres) and about 81 per cent. of the whole area. They largely accommodated the increase in the arable acreage during the war and post-war periods, much of it ploughed out of grassland for the first time. The moderately well drained medium textured soils (Snargate, Romney, Finn and Agney series) are the most adaptable as regards cropping, because they warm up more quickly in the spring, although the coarsest Romney and Snargate soils, *i.e.* the sandy loam types, tend to be "hungry", and crops may suffer in summer because of their inability to retain water. Typical moderately well drained Finn and Agney soils are especially valuable because their loamy A horizons are readily cultivated, and contain sufficient clay to develop a good structure, the finer textured B horizons retain moisture and a structure good enough to permit water movement, while the loamy to sandy substratum provides good under-drainage.

With proper drainage, liming and fertilization, however, all the series successfully carry a variety of crops, including specialized produce such as bulbs; under careful management very productive leys are readily established, and yields of 40-50 cwt per acre of wheat are common. Excepting moderately well drained Snargate soils, tile drainage is normally necessary for optimum production of arable crops, but such drains are useful for only a short period, and may be unnecessary in moderately well drained medium textured soils, if excess winter water can be discharged to sea more rapidly (p. 138).

The following specific points may be made for these soils with respect to requirements of macro- and micro-nutrients and the maintenance of a satisfactory soil structure:

Lime: The calcareous soils (Romney, Agney, Walland, Guldeford and Newchurch series) need no lime, and in most places are unlikely to do so for many decades. The decalcified soils are commonly quite acid, and heavy dressings of lime are necessary in some parts. Certain crop failures, *e.g.* on Midley soils and the sandy loam type of the Snargate series, have been ascribed to soil acidity. Land where the slightly decalcified phases are mapped is seldom so acid (Figs. 28 and 29). Soil testing is always advisable, because soil reaction varies widely, samples from one soil series in one field ranging between pH (H₂O) 5.0 and 8.0. Thus, in a field mapped as Finn, slightly decalcified phase, 10 random samples of surface soil (0-4 in.) had the following reactions:

pH (H₂O): 5.2, 5.4, 5.9, 6.2, 6.3, 6.8, 6.9, 7.1, 7.6, 7.9

and the pH of a mixture of equal parts of all samples was 6.5. Samples with a reaction higher than pH 7.0 mostly include calcareous subsurface material

introduced by ants (p. 54). Table 11 shows the variations in pH of surface soils (0-4 in.) from the Finn series, mostly from the deeply decalcified phase.

Allowance should be made for this when assessing lime requirements from pH determinations with bulked random samples. Preferably, however, calcareous and non-calcareous samples should be bulked separately and the numbers of each class noted for every field sampled.

TABLE 11
Reaction of Surface Soil in the Finn Series

	pH (H ₂ O)					
Ant nest material (a)	7.6	7.5	7.7	7.5	7.7	7.7
Adjacent undisturbed soil (b)	5.4	5.4	5.5	5.8	5.7	6.0
Mixture (bulk sample of (a) and (b))	6.8					
Mixture (12 random cores)	6.9					

Potash: Analyses of both fine and medium textured soils under old grassland shows that all contain some potash, presumably from the parent material (Table 17). All fine textured soils tested have medium to very high levels of available potash to at least 3 ft, but the medium textured soils are more variable, commonly having low or very low contents below the A horizon. All but two of 25 samples from A horizons of these and other representative soils under old grassland, however, had medium to very high contents. Arnold (1960) tested the ability of widely differing British soils to release non-exchangeable potassium to ryegrass in greenhouse experiments and reported that a representative soil from the Marsh (Brenzett series) showed a high rate of release.

Phosphate: Amounts of available phosphate in B horizons of the soils mentioned in the last paragraph were invariably low or very low, and there were many similar values in samples from the A horizon of about 50 soils. Soils of the decalcified group were more often deficient in phosphate than soils of the calcareous group.

Fields in which soils of these series occur together may have widely differing fertilizer requirements from one part to another, e.g. in a field south of Bonnington (TR 054338) Dymchurch soils needed no lime or potash and were very low in available phosphate, whereas Finn soils along one margin needed over 4 tons of lime to the acre and were low and very low in available potassium and phosphate respectively.

Micro-nutrients: In 1936 Furneaux and Glasscock reported that "marsh spot" occurred widely in peas in Romney Marsh and that its incidence could be correlated with fine textured soils and high water-table levels. Following the first confirmation that marsh spot in this country was directly attributable to manganese deficiency in the plant (Pethybridge 1936), Heintze (1938) showed that in the Marsh it was closely related to soil reaction, being present on all alkaline soils examined. Studies of the incidence and economic importance of this and other micro-nutrient deficiencies in Romney Marsh have been carried

out since, firstly by Lewis (1939), who showed that a dilute solution of a manganese salt sprayed on peas was effective in controlling marsh spot. More recently Roach (1944, 1945) and Roach and Barclay (1946) investigated the effects of manganese and other micro-nutrient elements on crop yields, e.g. wheat and peas, and reported increases in crops sprayed with dilute manganese sulphate solution and, in some instances, that other micro-nutrient elements, such as zinc and copper, or combinations of these, were beneficial. In 1953 the N.A.A.S. carried out a survey of micro-nutrient deficiencies in arable crops and diagnosed manganese deficiency, generally as small patches, in 35 out of a total of 172 fields inspected (Rose and Dermott 1960). Wheat, oats, peas, sugar beet, mangolds, turnips for seed, kale and potatoes were affected, and incidence was always associated with high soil pH, which, however, was not always accompanied by manganese deficiency. Excepting a mild case of boron deficiency in mangolds, no visual evidence of other micro-nutrient deficiencies was found. Following this, twenty experiments were carried out in which foliar sprays of zinc, copper and manganese sulphates were applied to wheat, peas and potatoes. Except with potatoes, yields were significantly increased with manganese treatment in three out of eight wheat experiments and four out of six with peas. A copper sulphate spray gave small decreases in yield in three of the wheat experiments (one on an acid soil) and in one of the pea experiments. Rose and Dermott concluded that "no benefit is to be expected from spraying crops on Romney Marsh with solutions of zinc or copper sulphate".

Eighteen of these experiments, including all seven showing significant yield increases due to manganese treatment, were on calcareous soil series (mostly Newchurch, Agney and Romney). There was visual evidence of manganese deficiency on untreated plots in six of the seven wheat and pea experiments, but Rose and Dermott suggested that spraying might be worthwhile for all crops on alkaline or near-alkaline soils on the Marsh, as in practice symptoms of deficiency may appear too late for spraying to be fully effective. Later (1962) the same authors reported that a manganese sulphate/superphosphate mixture added to such soils before peas were sown gave a substantial yield increase and some control of marsh spot.

Little study has yet been made of levels of micro-nutrients in grasses and their effect on stock, but preliminary studies at the N.A.A.S. sub-centre at Wye have indicated that low levels of cobalt occur in herbage on the alkaline soils of the Romney and Newchurch series.

Soil Structure: With the present trend to intensive arable farming the maintenance of satisfactory structure in the Ap horizon may become increasingly important. Blowing has already occurred from some medium textured soils, and plough pans and unfavourable structure in fine textured surface horizons are important causes of the "stale arable" soils common in some parts. The structure and consistence of the A horizon of fine textured soils is appreciably altered after long arable use, the well developed fine blocky to granular structure and friable consistence typical under old grassland being replaced by moderately developed coarse clods or angular blocks which are dense and very firm. Such soils develop a striking "frost tilth" of medium to very fine blocks and granules when ploughed in autumn and left in a rough state, but this can be unsatisfactory as a seed-bed in the spring, particularly where buried organic residues of the previous crop have decomposed anaerobically due to waterlogging above an impervious plough pan.

Difficulties arise when the content of organic matter becomes seriously depleted and, particularly for the fine textured soils, when agricultural operations involving heavy equipment are carried out when the soil is wet. These may also be aggravated, particularly with the wetter fine textured soils, by a practice of progressively incorporating more and more of the B1 horizon into the ploughed layer. The cloddy A horizons are gradually modified under a ley, although a moderately well drained Newchurch soil examined towards the end of a three-year ley after long arable use showed little structural change and grass roots were mainly restricted to ped faces. Structure below 12 in. was similar to that in soils of this series under old grass and, in contrast to the Ap horizon, porosity and structure appeared unimpaired.

Lydd and Midley Series

Because of their coarse texture and relatively elevated position, crops and grass can suffer from drought on these soils, and farmyard manure might usefully increase their capacity to retain moisture and nutrients. There is little information available about phosphate and potassium requirements, but a need for lime has been established.

In Holland sandy banks like those occupied by these soils are commonly levelled and, with a controlled water-table and fertilizers, grow first-class bulbs. This might prove worthwhile in parts of Romney Marsh, particularly where low-lying, fine textured soils occur nearby which could benefit from additions of sandy materials.

Dungeness and Beach Bank Series

The Dungeness series, with little or no fine earth, has no agricultural value, although the establishment of well developed holly bushes on Holmstone show how well deep-rooting plants can survive and create a local habitat for other plants unable to tap the water-table.

The Beach Bank soils, although with rather more fine earth, are also very droughty and unsatisfactory agriculturally, except as dry standings for stock. Fields where they interdigitate with deep soils are in arable, and where the interstitial fine earth is clayey and present for several feet their cropping is certainly worthwhile in an average season, though they are commonly very acid.

Greatstone Series

This series, with a thin skin of variably textured material overlying sands, mostly occupies a relatively flat area west of Greatstone and Littlestone. Its agricultural value has been increased by recent drainage improvements, and there may be scope for farming with a controlled water-table.

Appledore, Dowels and Fairfield Series

These series occupy the lowest parts of Romney Marsh, and their agricultural value is limited by poor soil structure and drainage; high salt contents in the ground water have also been found in many places, and Appledore soils have much exchangeable sodium and magnesium. Drainage has been improved in some parts in recent years, e.g. The Dowels, and further remedial measures may be uneconomic (p. 138).

PERMANENT PASTURES AND THE TRADITIONAL SHEEP FARMING SYSTEM

The differing quality of the permanent pastures has been a frequent cause of comment and research, particularly as good, bad and indifferent pastures are commonly juxtaposed. Hall and Russell (1911) noted:

"The amount of stock the more famous fields of the marsh will carry and fatten is incredible and these rich fields are sometimes only separated by a ditch or fence from others that will do no more than keep the sheep on them in a growing condition."

These workers studied pairs of closely adjacent fattening and non-fattening fields in three parts of the Marsh, examining the herbage and sampling the soils in 1 ft layers down to the water-table. They reported (1912) that the species composition of each pair was remarkably similar and that although perennial ryegrass was always dominant, the proportion varied from 30 to 80 per cent. according to locality. From this they concluded that the value of a pasture is not determined by the botanical composition of the herbage, but observed a leafy habit of growth in the fattening fields and a stemmy habit in the others. The soils concerned, evidently sandy loams to clay loams, were clearly not extremes either in texture or drainage, and they concluded that: "The soils of the fattening fields possessed no constant properties revealed by ordinary chemical or mechanical analyses. Their striking characteristic was the high rate at which nitrates were produced; they also contained a relatively large amount of total phosphoric acid." Cole and Dubey (1932), who defined nine soil series, related pasture performance to soil type and concluded that "the soil profile shows a direct relationship to pasture fertility". They found that fattening pastures are on the better drained medium textured soils (mostly moderately well drained phases of the Finn, Snargate, Agney and Romney series in the present survey) and at the other extreme that rough grazing land is either on well drained or excessively drained pebbly soils (now called Beach Bank series) or on poorly drained, shallow clays over peat (Appledore series). Soils intermediate in texture and drainage they correlated with two grades of breeding pasture, and from this proposed a fourfold classification of the pastures based as above "on soil profile only". Harrison (1934) then made botanical analyses using the "percentage area method" of assay and reported that the best fattening pastures carried a uniform herbage dominated by perennial ryegrass (averaging 75 per cent. of area), with wild white clover (9 per cent.) and bent grass (8 per cent.) as the next important constituents. These pastures were all on one soil type (moderately well drained Finn or Agney series) and were compared with lower-quality fattening pastures on sandier soils (moderately well drained Snargate or Romney series) and with good-quality breeding pastures on finer textured, less well drained soils. The latter both contained less perennial ryegrass (averaging 56 per cent.) and more miscellaneous grasses and herbs than the best fattening pastures. In addition, tillering of the grasses was not as good, particularly in breeding pastures.

The present work confirms Cole and Dubey's conclusion that soil profile is directly related to the quality of permanent pastures, but first class breeding and fattening pastures are on moderately well drained medium textured soils, whereas second and third class fattening as well as breeding pastures are associated with

imperfectly drained soils or moderately well drained fine textured soils *i.e.* pasture performance is determined by management, and pasture grade by soil type. The nutritional importance of fresh, young grass is well known, and sheep are most likely to find such grass in the carefully managed fattening pastures, where the preferential treatment would be reflected in the habit of the grasses, as, for example, the leafier growth observed by Hall and Russell and the better tillering noted by Harrison. The value of keeping intensive grazings extremely short has long been appreciated in the Marsh, as is clear from the following extract from a letter written by Daniel Jones in 1786: "So late as about thirty years back they [the Marsh graziers] suffered the grass to grow long and rank, thinking they could never have too much grass for their stock . . . but now, they find that sheep do not require a long bite . . . that they do much better by nipping it as it springs. They therefore keep more stock upon the land and feed it as close to the ground as they can without starving their sheep whereby the land carries more stock." Garrad (1954) postulated that the preferential management of fattening pastures, *i.e.* skilful stocking and grazing only by fattening animals, would tend to make the best land better and better. On the other hand, the breeding land would tend to deteriorate "as the result of playing second fiddle to the better land and the constant removal from it of the constituents of milk and bone by breeding ewes and growing lambs". It is interesting that fattening pastures mostly occur near a farm and/or road and, extending Garrad's comments, the exceptional pastures may have developed on "finishing land", located conveniently for market. They were not necessarily better originally than adjacent pastures (breeding fields adjoining fattening pastures are often on similar soils), but gradually improved because of careful management and the relatively low demands made on their native fertility. Farmsteads and roads often lie on the highest and driest land and, excluding those on shingle banks, the best soils. The latter are moderately well drained medium textured soils in many parts of the Marsh (p. 111), correlated by Cole and Dubey with the fattening fields. Nevertheless, there are less-well-sited farms where the best soils are finer and/or imperfectly drained but where fattening pastures of lower carrying capacity developed, *e.g.* fields north of North Fording House (TR 053284), west of Norwood (TR 048304) and adjoining the road and the Royal Military Canal south of Bonnington (TR 058342). This agrees with Hall and Russell's comments (1911) that "the mechanical analyses of the Marsh soils fail to throw any light on the superiority of one field over its neighbour" and with the later finding (1912) that the soils of the fattening pastures contained relatively large amounts of total phosphoric acid.

The best pastures in Romney Marsh, particularly the fattening pastures, have a deep thick dark A horizon with an "open" structure of crumbs and granules on which the herbage "forms a thick close sole with a characteristic spring under the foot" (Hall and Russell 1911). Young leys produced by reseeding after ploughing and cropping the old pastures are not like this, but they are often very productive. An important factor here is fertilizer applications; the stock-carrying capacity of the permanent pastures could be increased by dressings, particularly of phosphates, to the breeding pastures to counteract losses incurred through years of grazing by suckling ewes and growing lambs. The productivity of the rough grazing land can also be increased by fertilizers.

REGIONAL DRAINAGE AND THE SOILS

The drainage of Romney Marsh, particularly from the 13th century onwards, has converted nearly every part into high-quality farming land. In spite of continuing improvements, such as widening and deepening the main sewers, the problem remains, however, of too much water in winter and too little in summer. The present removal of surplus water is inadequate to prevent high water-table levels in winter (Figs. 24-27), and rainfall is insufficient in most summers for optimum growth of crops, particularly of grassland on medium and coarse textured soils. This situation is aggravated to some degree because in many places the latter are juxtaposed to fine textured soils on lower land, and improved drainage of the latter could leave the coarsest soils excessively drained.

A water-table within 2 ft (probably even 3 ft) of the surface for long periods in winter and early spring is detrimental to the best pasture grasses because their roots are seasonally killed below such levels and their subsequent renewal is at the expense of leaf formation. Bondarenko (1964) reported that with meadow grasses the growth of the root mass in the top 8 in. of soil is associated with a slowing down of the growth of tops, and vice versa. One important phase in root development occurs at the end of the growing period and continues into late autumn. If this applies throughout the depth of rooting it is wasteful that such roots, drowned and killed off during the winter and early spring, are not available later to assist growth.

The grazier traditionally expected sewers to serve as wet fences as well as drains throughout the year and to provide drinking-water for stock. Piped water can now provide trough drinking, an advantage, anyway, where there is brackish ground water. Apart from fences, which can be provided in other ways, the grazier feels that in retaining the last of the winter water by stop boards in the sewers in early spring he is safeguarding water-table levels against a dry spring and summer and maintaining pasture growth. At such times pastures suffer severely from water shortage, often aggravated by the death of deeper roots through winter waterlogging (Figs. 24-27) and, as suggested by Furneaux (1943), "a deep root system is the best insurance against drought". However, the damage is already done by the time the stop boards are inserted because the huge volume of winter water cannot be discharged to sea quickly enough, partly because drainage outfalls become tide-locked on the rising tide and may remain so for appreciable periods during stormy weather; provision of special reservoirs or direct discharge to sea by pumping would probably be necessary to solve this problem satisfactorily.

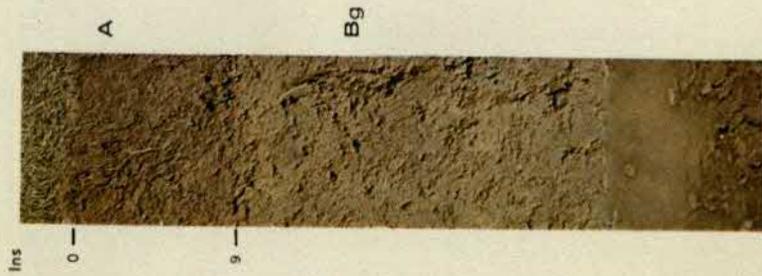
The arable farmer has a different attitude from the grazier, preferring water levels to be as low as possible throughout the winter and early spring. The Drainage Boards strive to compromise between the conflicting interests. Furneaux (1943), commenting on pastures in Romney Marsh, suggested that 3 ft is about the most favourable level for the winter water-table and that the more constant the water-table can be held throughout the year, the better the results from the pasture.

In 1949 the Agricultural Land Commission recommended scientific studies to determine the water level best suited to differing soils and crops. At present the natural permeability of soil subsurface horizons and substrata is not fully utilized to drain the land in the spring and to allow it to warm up quickly. With

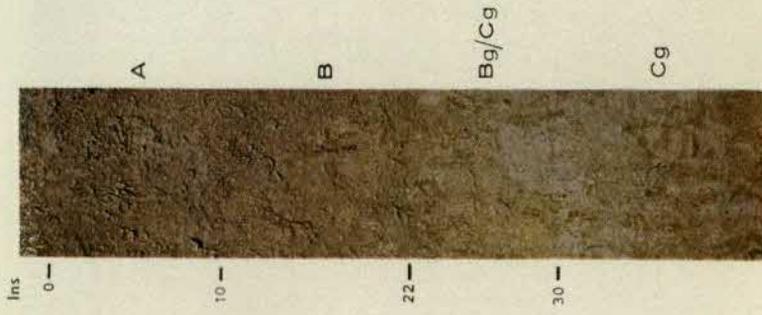
deep and properly maintained sewers many large-scale tile-drainage schemes in old pasture land destined for arable use could probably be less intensive, or would be unnecessary, if drainage water always flowed freely to the River Authority outfalls. The tiles are laid in or close to loamy or sandy substrata or subsurface horizons in many soils, and commonly lie well below the winter water level. Clayey horizons are also known to have very high hydraulic conductivities locally, sometimes being comparable to gravelly sands below 30 in. (Childs *et al.* 1957). Such soils are highly porous and quite common (Green and Askew 1965), but little is known about the continuity of the macropores on a field scale, and their importance in drainage.

A controlled water-table régime suitable for every part is not possible because of the complicated soil pattern and the relationship between soil texture and relief, but elimination of high winter water levels in the soils would help. Ideally, supplementary water is necessary to make good the summer deficiency, and plans exist for bringing water from the river Rother, but at present only limited supplies are available from water impounded in the Royal Military Canal each spring. Better control of water-table levels for limited areas might be possible by following the example of Mr. D. Clifton in his adaptation of creek bed relics as reservoirs. Barnfleet (TQ 988224), formerly an extensive, swampy area near Little Cheyne Court, is the best example, being enclosed with earth banks and new sewers added. Water levels for the whole farm are regulated by a pump and surface irrigation practised. Similar features elsewhere in the Marsh might well be adapted, although some of the water is brackish, and care might be necessary before using it for surface irrigation.

Improvement of the existing drainage needs careful consideration in some parts, particularly in The Dowels, Indraft and Fairfield Brack areas. Better drainage would doubtless increase productivity, particularly of Appledore, Dowels and Fairfield soils, by improving structure and allowing roots to penetrate into the peat, but overall land subsidence might also follow, cancelling out the benefit until the peat thickness is much further reduced. In places where thick peat is absent below sandy creek ridges but present below clayey pools differential subsidence is possible, and improved drainage of such areas may cause the coarser Snargate soils to become excessively drained.



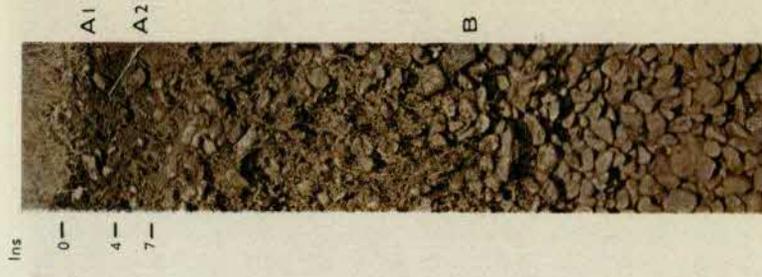
(a) NEWCHURCH SERIES
(Imperfectly drained phase)



(b) SNARGATE SERIES
(Moderately well drained phase)



(c) MIDLEY SERIES



(d) BEACH BANK SERIES

APPENDIX I

Analytical Data

Analytical data obtained on samples of horizons from 43 profiles are given on the following pages. Determination of particle-size distribution, calcium carbonate equivalent and pH were made on all the profiles described in the text; organic-carbon content, total nitrogen and soluble cations were determined for selected horizons. Results of these analyses are in Tables 12-15. Exchangeable cations and cation-exchange capacity were determined for six profiles (Table 16) and available potassium and phosphorus in 2 : 1 Morgan's extract for 10 (Table 17).

SUMMARY OF METHODS

1. Particle-size distribution: clay (e.s.d. $<2 \mu$) and silt (e.s.d. $2-50 \mu$) were determined: (a) by the pipette method after treatment with H_2O_2 and dispersion with Calgon (sodium hexametaphosphate); or (b) by a modification of the hydrometer method (Bouyoucos 1951), using Calgon with sodium hypochlorite as the dispersing agent. Appropriate B.S. sieves were used to separate the coarser fractions.
2. Calcium carbonate: a calcimeter described by Bascomb (1961) was used.
3. pH measurements were made on 1 : 2.5 suspensions of soil in water and in M/100 $CaCl_2$, using a glass electrode assembly.
4. Exchangeable cations were determined in a neutral normal ammonium acetate leachate, after evaporation to dryness and treatment with nitric acid and H_2O_2 to remove organic matter. Soluble cations were determined in 1 : 5 water extract. Magnesium was determined spectrographically using the porous-cup technique, calcium by a versenate back-titration procedure, and sodium and potassium using an EEL flame photometer.
5. Organic carbon: by a wet digestion method in accordance with the recommendations of Tinsley (1950).
6. Nitrogen: a Kjeldahl digestion followed by steam distillation using a Markham micro-distillation apparatus. The ammonia liberated is absorbed in boric acid solution and titrated with 0.01N HCl.

TABLE 12
Analytical Data: Calcareous Soils

Soil Series	Profile No.	Horizon	Depth in.	Particle-size Distribution (per cent.)				Carbon %	Nitrogen %	C/N	CaCO ₃ %	pH		Soluble Cations in 1:5 Extract (m.e./100 g)	
				Sand 200 μ-2 mm	Sand 50 μ-200 μ	Silt 2-50 μ	Clay <2 μ					H ₂ O 1:2.5	M/100 CaCl ₂	Na	Mg
Newchurch (p. 66)	K37	A	0-9	1	2	48	49	3.0	0.4	7.5	4.7	7.3	6.7		
		B1	9-21		43	47	0.7				18.8	8.7	8.0		
		Bg/Cg	21-36 36-40		46 43	46 44	0.5				20.5 20.1	8.5 8.6	7.9 7.9		
Newchurch (p. 66)	K53	A	0-8	1	9	45	46	4.6			3.6	7.0	6.9	0.3	0.3
		B1g	8-19		47	48	0.8				14.4	7.8	7.4	0.5	0.4
		B2g Cg	19-31 31-45		49 44	41 42					16.2 15.6	7.9 7.8	7.5 7.4	0.5 0.5	0.4 0.4
Walland (p. 67)	K14	A	0-12	1	40	36	23				4.1	7.7	7.3		
		B2g	18-30		44	45					14.1	7.9	7.4		
Walland (p. 68)	K55	A(g)	0-9	1	7	48	39	3.6			3.0	7.8	6.9	1.4	2.4
		Bg	9-21		48	34					13.4	8.6	7.8	3.2	2.5
		Bg/Cg Cg	21-33 33-44		43 43	45 46					14.0 10.0	8.6 8.5	7.8 7.7	4.2 4.0	4.2 3.4
Guldeford (p. 69)	K41	Ap	0-10	1	19	41	40				0.9	7.8	7.1		
		B	10-21	1	7	50	42				11.9	8.3	7.7		
		Bg/Cg C1g C2g	21-28 28-44 44-48		33 28 20	17 7 3					12.5 11.7 10.6	8.4 8.5 8.5	7.8 7.8 7.6		
Guldeford (p. 69)	K47	A	0-9	1	1	48	50				14.5	7.8	7.4	0.5	1.3
		B1g	9-16		57	39					17.6	8.0	7.4	0.5	1.2
		B2g	16-21		46	44					19.2	7.9	7.4	0.6	2.5
			21-35		45	38				17.9	7.9	7.5	0.6	2.2	
			35-45		29	15				12.9	7.9	7.5	0.6	2.2	
			45-49		10	7				6.9	7.6	7.1	0.5	1.4	

Fairfield (p. 71)	K24	O A1g A2g IIBg III	1-0 0-2½ 2½-6 6-23 23-44	2	22	41 46 38	35 30 52	17.5	1-67	10-5	11-3 29-6 0-6	7-5 8-2 8-5 8-2 7-2	7-4 8-1 8-3 7-9 7-4
Agney (p. 72)	K13	A A/B B Cg	0-4 4-10 10-18 18-40	1	35 36	37 38 34 31	27 25 28 21	2-9 1-1 0-5	1-01		3-0 8-2 11-6 10-9	7-6 8-0 8-2 8-2	7-2 7-5 7-6 7-6
Agney (p. 73)	K10	A B1 B2(g)ca Cgca	0-6 6-14 14-26 26-45	3	16	44 44 42 41	38 37 40 41				1-0 5-6 15-3 15-8	7-2 7-1 8-4 8-1	7-0 6-9 7-9 8-0
Romney (p. 74)	K52	A B B/C C1(g) C2g C3g	0-7 7-16 16-28 28-35 35-43 43-49	2	42	36 37 20 38 8 8	20 15 11 26 7 5				5-9 8-4 11-6 15-5 8-8 9-3	7-5 8-2 8-4 7-8 7-4 7-5 7-9	0-4 0-4 0-4 0-4 0-5 0-2 0-2
Romney (p. 75)	K105	A1 A2 B/Cg C1g C2g	0-4 4-7 7-14 14-28 28-35			29 25 23 24 14	12 16 12 18 11	5-0 2-9 0-6			3-2 4-6 9-8 12-3 8-1	7-1 7-4 8-0 8-1 8-1	6-6 6-4 7-0 7-2 7-2
Romney (p. 75)	K16	Ap Bg C1g C2g	0-12 12-20 20-28 28-36	2	27	48 45 40 16	24 26 22 11				5-5 12-6 13-6 8-5	7-8 8-1 8-1 8-2	7-5 7-7 7-6 7-6
Greatstone (p. 76)	K61	A1g A2g IIBg/Cg IICg	0-10 10-14 14-21 21-36 36-40	1	3	53 31 7 18 0	43 21 8 15 3				15-4 11-1 6-3 9-2 4-2	8-0 8-4 8-5 8-7 8-0	7-5 7-8 7-9 8-0 7-7
Greatstone (p. 77)	K62	A(g) Bg/Cg C1g IIC2g IIC3g	0-7 7-9 9-14 14-21 21-25	14	54	20 21 40 8 1	11 14 23 8 2				8-6 11-4 13-8 7-0 4-7	7-7 8-5 8-6 8-8 8-7	7-4 7-9 7-9 8-0 8-0

TABLE 13
Analytical Data: Decalcified Soils

Soil Series	Profile No.	Horizon	Depth in.	Particle-size Distribution (per cent.)				Carbon %	Nitrogen %	C/N	CaCO ₃ %	pH		Soluble Cations in 1:5 Extract (m.e./100 g)	
				Sand 200 μ-2 mm	Sand 50-200 μ	Silt 2-50 μ	Clay <2 μ					H ₂ O 1:2.5	M/100 CaCl ₂	Na	Mg
Dymchurch (p. 79)	K111	A	0-6	1	20	45	34					6.0	5.4		
		A/B	6-15	1	17	44	39				0.2	6.9	6.3		
		B1g	15-24	1	6	43	51				0.1	7.2	6.4		
		B2gca	24-36	1	4	53	43				6.1	8.1	7.3		
Dymchurch (p. 80)	K108	A1(g)	0-5	1	6	51	43	5.0	0.54	9.0		5.5	4.8		
		A2g	5-12	1	6	47	46	1.6				6.1	5.4		
		B1g	12-19			41	50					6.8	6.3		
		B2gca B3g/Cg	19-27 27-36			44 51	47 44				1.4 10.0	7.7 8.0	7.2 7.3		
Dymchurch (p. 81)	K25	A _g	0-10	1	5	43	52					6.6	6.2		
		B1g	10-18			41	55					8.1	7.8		
		B2gca	18-31			42	53					8.4	7.8		
		C _g	31-37 37-50			47 48	45 45					8.6 8.6	8.1 8.0		
Brenzett (p. 82)	K19	A	0-4		21	44	35					6.5	6.3		
		A/B	4-16		21	42	37					6.8	6.5		
		B1	16-26			39	42					8.1	7.5		
		B2gca	26-40			36	52					8.2	7.8		
Brenzett (p. 82)	K45	A1	0-5	1	19	48	33					7.1	6.7	0.4	0.5
		A2(g)	5-11	1	17	48	34					6.7	6.2	0.5	0.5
		IIBg	11-17		6	38	38					6.9	6.5	0.5	0.5
		IIC1g IIC2g IIICg	17-38 38-48 48-51		5 5 2	52 37 25	35 53 67				12.7 13.5 0.9	8.4 8.1 7.5	7.5 7.3 7.3	0.6 0.9 1.2	0.6 1.2 1.6

TABLE 14
Analytical Data: Stony Soils

Soil Series	Profile No.	Horizon	Depth in.	Particle-size Distribution (per cent.)				Carbon %	Nitrogen %	C/N	CaCO ₃ %	pH	
				Sand 200 μ-2 mm	Sand 50-200 μ	Silt 2-50 μ	Clay <2 μ					H ₂ O 1:2.5	M/100 CaCl ₂
Beach Bank (p. 96)	K110	A1	0-3	4	16	58	22					4.6	3.5
		A2	3-6	3	8	64	25					4.2	3.2
			6-16	3	12	54	31						3.7
Beach Bank (p. 97)	K112	A1	0-5	5	30	34	22					7.4	6.5
		A2	5-11	7	45	29	19					7.7	6.8
		B1	11-19	9	18	54	19					7.9	7.1
		B2	19-30	42	3	32	23					8.2	7.3
Beach Bank (p. 97)	K113	A	0-10	17	78	3	2					5.9	4.7
		B	10-24	7	43	34	16					7.0	6.3
		B/C	24-28	2	10	56	32					8.1	7.3
Beach Bank (p. 97)	K115	A1(g)	0-4	1	23	53	24					5.0	4.2
		A2(g)	4-12	1	18	55	27					5.0	4.1
		Bg	12-17	1	10	53	36					7.4	6.6
		IIAg	17-20	1	4	57	38					7.3	6.4
		IIBg	20-25	1	3	58	38					6.7	6.2
	25-30	4	8	45	43					6.6	6.3		
	30-36	1	2	45	45					tr	7.0	6.2	

TABLE 12

TABLE 15
Analytical Data: Soils of Miscellaneous Land Types

Soil	Profile No.	Horizon	Depth in.	Particle-size Distribution (per cent.)				Carbon %	Nitrogen %	C/N	CaCO ₃ %	pH		Soluble Cations in 1:5 Extract H ₂ O (m.e./100 g)	
				Sand 200 μ-2 mm	Sand 50-200 μ	Silt 2-50 μ	Clay <2 μ					H ₂ O 1:2.5	M/100 CaCl ₂	Na	Mg
Calcareous Saltings (p. 122)	K48a	Ag	0-6	1	1	52	46	3.5			16.2	7.6	37.0	9.7	
		Bg	6-18		52	40	52	40	1.3		16.4	8.2	22.1	5.0	
		Bg/Cg	18-26		52	40	52	40	0.9		23.0	8.1	21.6	3.9	
		C1g	26-43		52	36	52	36	0.7		22.1	8.0	23.7	3.9	
		C2g C3g	43-49 49-60		51 53	32 28	51 53	32 28	0.7 0.8		25.3 20.1	8.1 8.1	26.8 24.5	3.4 3.6	
Decalcified Saltings (with anthill) (p. 122)	K114	(anthill)	12-0	1	6	53	41				5.2	8.7			
		A(g)	0-3	1	4	53	43				2.7	8.3			
		B1g	3-5	1	2	53	44				1.8	7.7			
		B2g	5-8	1	2	54	44				0.4	7.6			
		Bg/Cg	8-14 14-26	1 1	10 10	57 57	39 32				4.7 7.6	8.7 8.3			
Creek Bed (Sandy) (p. 123)	K51	O	4-0	1	50	33	15				2.3	7.2	1.1	0.9	
		Ag	0-4	1	58	34	17	5			3.1	7.1	0.8	0.6	
		C1g	4-9		15	5	7	7			7.5	7.2	0.7	0.6	
		C2g	9-24		12	10	10	9			10.5	8.1	0.4	0.4	
		C3g	24-26 26-30		10 3	3	3	3			11.5 10.9	8.2 8.0	0.4 0.4	0.5 0.5	
Creek Bed (Clayey) (p. 124)	K54	A	0-6	3	19	44	34				16.5	7.2	2.8	2.9	
		Ag	6-11	2	27	48	23				14.8	7.4	1.5	1.0	
		C1g	11-13		45	22	45	22			32.8	7.9	1.4	0.7	
		C2g	13-23		33	40	33	40			20.4	8.2	2.1	2.2	
		C3g C4g C5g	23-29 29-36 36-121		17 29 27	14 23 21	17 29 27	14 23 21			10.7 14.7 12.5	8.4 8.4 8.2	1.7 2.4 2.3	2.2 2.5 2.3	

TABLE 16
Analytical Data: Exchangeable Cations and Percentage Base-saturation

Soil Series	Profile No.	Horizon	Depth in.	Exchangeable Cations (m.e./100 g)				Cation Exchange Capacity m.e./100 g	Percentage Base- saturation
				Ca	Mg	K	Na		
Dymchurch (p. 79)	K111	A	0-6	19.3	2.4	1.49	0.19	31.5	74
		A/B	6-15	17.7	1.6	0.78	0.20	23.2	88
		B1g	15-24	20.9	2.1	0.83	0.21	26.2	92
Ivychurch (p. 83)	K92	A	0-6	10.6	2.5	0.60	0.15	21.5	64
		A/B	6-11	9.1	2.0	0.53	0.15	17.7	67
		B1(g)	11-18	15.4	2.9	0.57	0.23	24.2	79
		B2g	18-32	15.4	4.6	0.48	0.22	21.5	96
Dowels (p. 86)	K106	Ag	0-9	26.6	7.2	0.69	0.31	40.6	86
		Bg	9-21	34.6	8.5	0.55	0.84	45.3	98
		Bg/Cg	21-26	22.1	7.6	0.52	0.95	32.7	95
		Cg	26-31	33.0	11.1	0.57	1.7	50.5	92
Appledore (p. 87)	K107	Ag/Bg	2-7	29.8	12.3	0.70	3.19	53.4	86
		Bg	7-13	17.9	10.2	0.85	3.97	37.3	88
		Bg/Cg	13-18	45.9	24.0	1.01	7.82	69.9	84
Snargate (p. 91)	K43	A1	0-5	8.1	1.8	0.45	0.09	17.2	60
		A2	5-15	5.3	0.8	0.29	0.09	11.9	55
		B	15-26	6.1	1.1	0.27	0.09	9.5	80
Midley (p. 94)	K44	A2	3-10	0.70	0.10	0.03	0.03	5.9	15
		Ea	10-24/28	0.44	0.07	0.03	0.04	1.5	40
		B1e1	24/28	0.72	0.08	0.02	0.03	4.7	17
		B1e2	24/28-34	0.04	0.06	0.02	0.02	1.2	8
		C	34-38	0.23	0.11	0.04	0.03	1.1	36

TABLE 17
Analytical Data: Available Potassium and Phosphorous

Soil Series	Profile No.	Horizon	Depth in.	Available Phosphorous and Potassium (p.p.m. in 2:1 Morgan's Extract)	
				P	K
Newchurch, imperfectly drained	K36	A	0-7	1.9 M	68 VH
		Bg	7-16	0.25 VL	37 MH
		Bg/Cg	16-28	0.25 VL	43 MH
		Cg	28-44	0.8 L	47 H
Newchurch, moderately well drained (p. 66)	K37	A	0-9	0.8 L	29 M
		B1	9-21	0.3 VL	22 L
		B2g	21-36	0.25 VL	26 M
		Bg/Cg	36-40	0.5 VL	30 M
Agney, moderately well drained (p. 72)	K13	A	0-4	10.5 VH	70 VH
		A/B	4-10	0.8 L	60 H
		B	10-18	0.45 VL	28 M
		Cg	18-40	0.9 L	21 L
Romney, moderately well drained	K56	A	0-9	1.9 M	76 VH
		B	9-18	0.9 L	50 H
		C1g	18-25	0.6 L	28 M
		C2g	25-42	0.4 VL	17 L
Romney, imperfectly drained (p. 75)	K105	A1	0-4	0.55 L	34 M
		A2	4-7	0.2 VL	20 L
		B/Cg	7-14	0.4 VL	11 VL
		C1g	14-28	0.55 VL	12 VL
Dymchurch, imperfectly drained	K90	A	0-9	1.3 M	70 VH
		B1g	9-19	0.05 VL	50 H
		B2g	19-30	0.15 VL	54 H
		B3g	30-36	0.05 VL	66 VH
Dymchurch, imperfectly drained	K95	A	0-9	0.4 VL	96 VH
		B1g	9-14	0.05 VL	44 MH
		B2g	14-25	0.05 VL	33 M
		B3g	25-36	0.05 VL	30 M
Finn, moderately well drained (p. 89)	K17	A1	0-6	3.5 MH	27 M
		A2	6-14	0.9 L	21 L
		B(g)	14-23	0.25 VL	25 L
		B(g)ca	23-30	0.55 L	20 L
		Bg/Cg	30-37	0.55 L	16 L
		Cg	37-47	1.0 L	11 VL
Snargate, moderately well drained (p. 91)	K43	A1	0-5	2.3 MH	48 H
		A2	5-15	0.6 L	33 M
		B	15-26	0.05 VL	32 M
		Cg	26-42	0.05 VL	10 VL
Snargate, imperfectly drained (p. 92)	K28	A1(g)	0-5	1.3 M	14 VL
		A2(g)	5-12	0.25 VL	21 L
		Bg	12-21	0.15 VL	16 L
		Bg/Cg	21-36	0.1 VL	14 VL

N.B. Very low and low levels of available phosphorus were found in 53 soil samples from the A horizons of 116 Decalcified Soils under old pasture (46 per cent.), but in only 23 soil samples from the A horizons of 118 Calcareous Soils under old pasture (20 per cent.).

APPENDIX II

Methods and Terms used in Profile Descriptions

The terminology used in soil description in this Bulletin is defined in the *Field Handbook of the Soil Survey of Great Britain* (Soil Survey Staff 1960). A brief outline of the more important of these terms is given below.

Site Characteristics

The site is described under locality, map reference, vegetation and relief, including aspect, elevation and slope.

Depth and Clarity of Horizons

The depths of horizon boundaries are measured in inches from the surface of the mineral soil, and where they fluctuate widely the range of variation is noted. Horizon boundaries may be described as *even*, if at the same depth across the face; *undulating*, if upward or downward projections are wider than their depth; or *irregular*, if pockets are deeper than their width.

The clarity is described as *sharp*, if the transition zone is less than 1 in. wide; *narrow*, if the transition zone is 1–2 in. wide; or *merging*, if there is a gradual transition through more than 2 in.

Colour

This is described by comparing the colour of a moist soil fragment with the Munsell Soil Color Charts. According to the Munsell system of notation, each colour may be considered as a resultant of three variables: the *hue* indicating its relationship to the spectral colours yellow, red or blue; the *value* its lightness or darkness, and the *chroma* the strength or departure from a neutral colour of the same value. Thus the hue 10 YR, the value 5 and the chroma 6 are combined to give the notation 10 YR 5/6; the colours are grouped under standard names, the name "yellowish brown", for example, covering the notations 10 YR 5/4, 10 YR 5/6 and 10 YR 5/8.

Many soil horizons, particularly those which are incompletely weathered or subjected to seasonal waterlogging, have variegated colours, and the self-explanatory terms mottled and speckled are then used. Mottles are described in terms of contrast (faint, distinct, prominent), abundance (few, common, many) and size.

Texture

Texture refers to the particle-size distribution of inorganic soil material which passes a 2 mm sieve. Standard methods of mechanical analysis are used in the laboratory, but in the field a soil is assigned to a texture class (Fig. 21a) by estimating the proportions of sand (2.0–0.05 mm), silt (0.05–0.002 mm) and clay (less than 0.002 mm) particle-size grades in a small sample of moist soil worked between finger and thumb. In assessing the texture of surface horizons, allowance has to be made for the influence of organic matter, significant amounts of which tend to make both sandy and clayey soils feel more silty.

Structure

Soil structure refers to the arrangement of primary particles into compound units or aggregates separated by voids or surfaces of weakness. The structure of the surface soil is greatly affected by land use, and especially by cultivation, which commonly results in disruption of natural soil aggregates or peds, and fabrication of more or less transient, artificial units or clods that slake with repeated wetting and drying.

Field descriptions of soil structure note the shape and arrangement, the average size, and the distinctness and durability of the structural units. Terms used to describe the shape and size are as follows:

(1) Units with the vertical axis longer than the horizontal are called *prismatic* if the tops are mainly flat or angular, *columnar* if they are rounded. They are described as fine (<2 cm), medium (2-5 cm) or coarse (>5 cm) according to their average width.

(2) Units with the horizontal axis longer than the vertical are described as *platy* or *laminated*.

(3) Units with axes roughly equal are subdivided into—

(a) *Blocky*—angular or subangular peds with distinct edges and smooth faces which fit closely together; further described according to average size as fine (<1 cm), medium (1-2 cm) or coarse (>2 cm).

(b) *Granular*—small (<1 cm), rough-surfaced, sub-rounded or irregular aggregates without distinct edges or faces; the term *crumb* is reserved for soft porous granular aggregates resembling bread-crumbs.

Many soil horizons have *compound* structures consisting either of peds of different shapes and sizes or of smaller peds held together to form larger ones. Thus, many surface horizons contain both subangular blocky and granular peds (the latter often as worm casts or fragments of them); fine textured subsoil horizons frequently consist of large prisms, which when disturbed fall into distinct angular blocky peds.

The grade or degree of structure, representing the difference between cohesion within structural units and adhesion between them, is estimated in the field by noting the distinctness of the units and the extent to which they are broken or destroyed when the soil mass is displaced or gently crushed. The following terms are used:

Structureless—no orderly lines of weakness nor observable aggregation occur in either the moist or dry condition; *massive* if coherent, *single-grain* if non-coherent.

Weak—poorly formed, indistinct units which break easily on displacement, yielding much unaggregated or fragmental material.

Moderate—well formed, distinct units that are moderately resistant to disruption on disturbance.

Strong—well formed units, distinct in undisturbed moist soil, which adhere only weakly to one another, and can be separated without disruption when the soil is disturbed.

Consistence

Consistence expresses the degree and kind of cohesion and adhesion of the soil and its resistance to deformation or rupture. It is closely related to both texture and structure, but whereas structure results from variations in the forces of attraction within a soil mass, consistence results from the strength and nature of the forces themselves.

As consistence varies with moisture content, terms are necessary for each significant moisture state: thus a ped or clod may be hard when dry, plastic when wet (moisture content at or above field capacity) and friable when moist (moisture content between air-dry and field capacity). The range of moisture content for which the soil remains

friable is an important characteristic affecting its workability. Terms used to describe consistence are:

Loose—non-coherent either moist or dry.

Friable—when moist, crushes under gentle pressure, but coheres when pressed together.

Firm—when moist, crushes under moderate pressure, but resistance is distinctly noticeable; very firm soil materials are difficult to crush between finger and thumb.

Soft—weakly coherent and fragile when dry; breaks to powder or individual grains under slight pressure.

Hard—when dry, moderately resistant to pressure; can be broken in the hands, but barely breakable between finger and thumb; very hard soil materials can be broken in the hands only with difficulty.

Cemented—brittle and hard at all moisture contents.

Compact—denotes a combination of firm consistence and close packing or arrangement of particles.

Plastic—when wet, retains an impressed shape and can be moulded into a wire or thin rod without disruption; very plastic soil materials require little pressure for deformation, and are normally fine textured.

Sticky—when wet adheres to other bodies; noted in the field by the degree to which the soil clings to the skin after pressing between thumb and forefinger.

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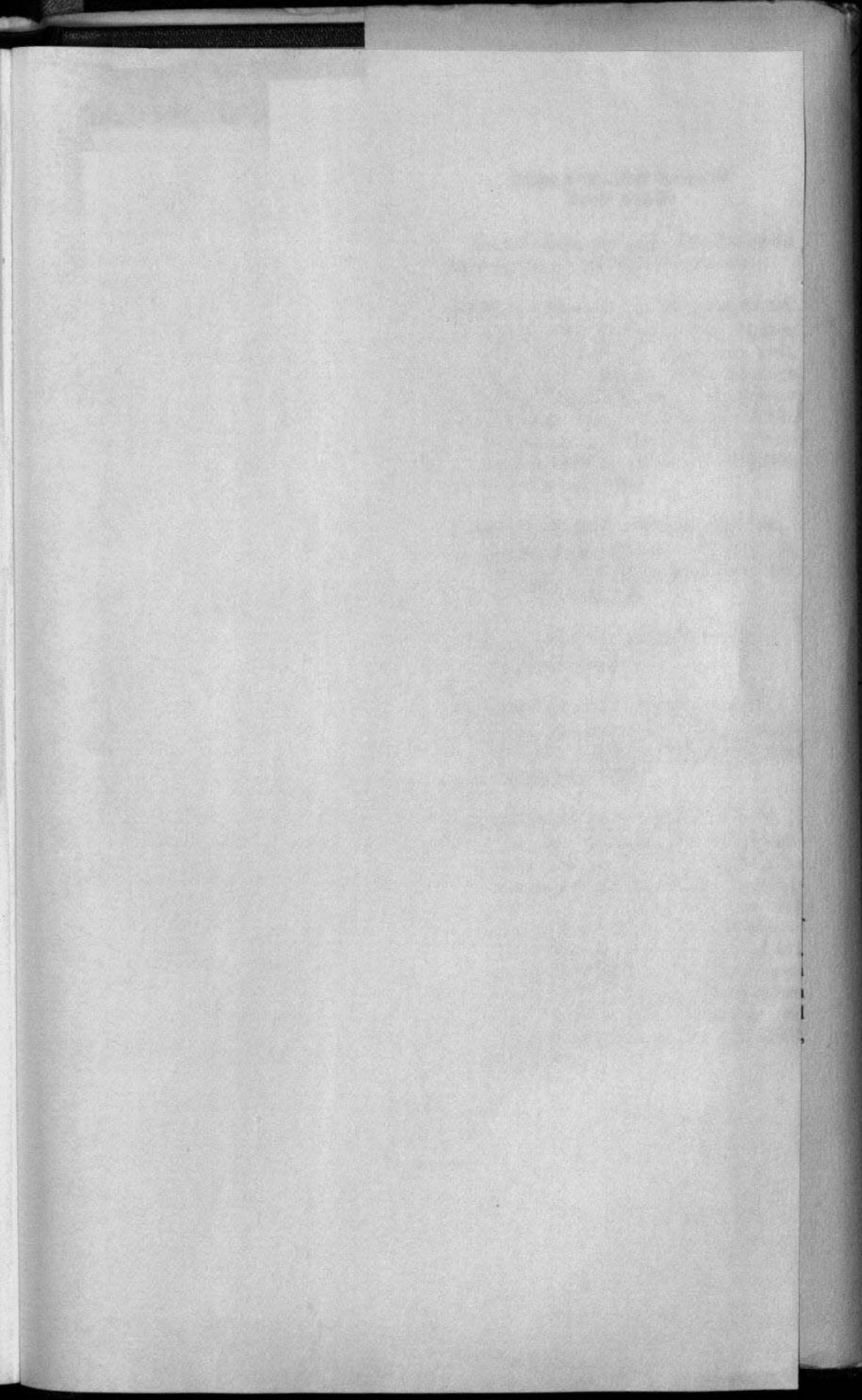
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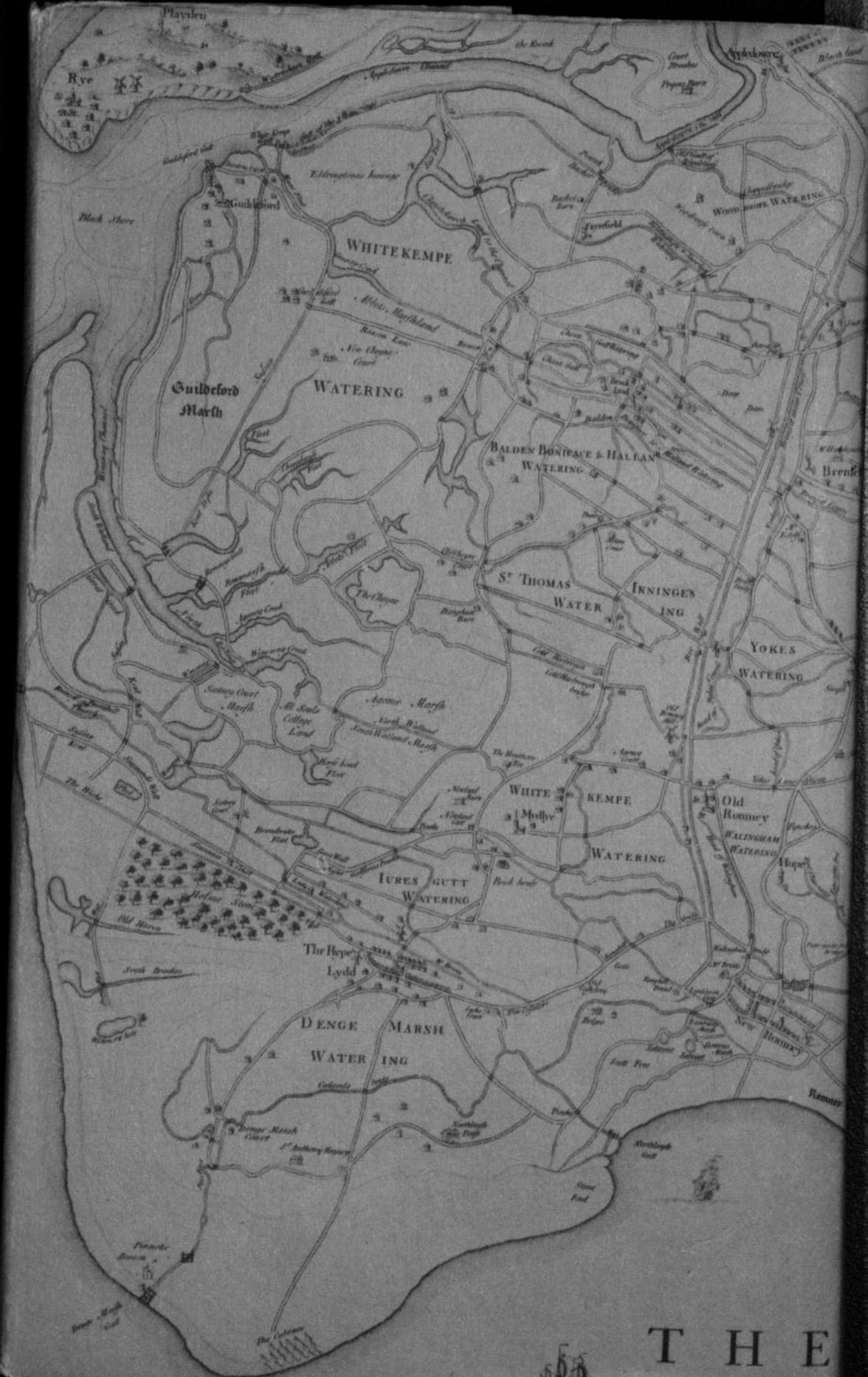
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