PROCEEDINGS

OF THE

CAMBRIDGE ANTIQUARIAN SOCIETY

(INCORPORATING THE CAMBS & HUNTS ARCHAEOLOGICAL SOCIETY)

VOLUME LXXI

1981

IMRAY LAURIE NORIE AND WILSON

1982

PROCEEDINGS OF THE CAMBRIDGE ANTIQUARIAN SOCIETY

(INCORPORATING THE CAMBS & HUNTS ARCHAEOLOGICAL SOCIETY)

PROCEEDINGS

OF THE

CAMBRIDGE ANTIQUARIAN SOCIETY

(INCORPORATING THE CAMBS & HUNTS ARCHAEOLOGICAL SOCIETY)

VOLUME LXXI

1981

IMRAY LAURIE NORIE AND WILSON

1982

Published for the Cambridge Antiquarian Society (incorporating the Cambs and Hunts Archaeological Society) by Imray Laurie Norie and Wilson Ltd, Wych House, Saint Ives, Huntingdon

ISSN 0309-3606

UNIVERSITY PRINTING SERVICES · CAMBRIDGE

CONTENTS

A BURIED PEAT BAND AT MANEA - AND ITS POSSIBLE IMPLICATIONS

DAVID HALL AND ROY SWITSUR

The soils of the fenlands vary greatly in detail, and are the chief source of evidence for reconstructing the former landscapes. The simplified stratigraphical sequence in the southern fenlands consists of a Neolithic Lower Peat, a marine deposit of Fen Clay, formed approximately between 3000-2000 BC, and an Upper Peat which developed until the 17th century. In the Wisbech region, there was a second marine flooding that laid down clayey, silty and sandy deposits, mostly before the Roman era; these deposits are usually called the 'Silt Fen', but 'Marshland' may be a more appropriate word, as large areas are of clayey deposits. The details of the soil sequence and the dating evidence have recently been summarised by Evans and Mostyn,[1] and Seale.[2]

Further evidence on the dating of the onset of the second marine flooding has been derived from a section exposed near Manea (Grid Reference TL 47909300). The acidity of the dated buried peat band may imply that not all the Upper Peat is a fen peat derived from reeds and sedges growing in pools and swamps.

Stratigraphy at Manea (Fig. 1, p. 80)

At Manea a large rodham was being levelled for agricultural purposes. It was about 60m wide and up to 2m high. The laminations of the coarse silt-loam/very fine sandy-loam rodham-deposits showed the complexity of the silting process. These deposits overlay a thin band of peat, less than 0.15m thick, at about 1.7m depth from the top of the rodham. Fragments of wood were common in the peat. Adjacent to the rodham the peat band formed the base of the excavation, or was just below the surface. Within the rodham deposits, at about 1.5m depth was an occasional pocket of peat. Below the peat was a silty clay which merged into a similar deposit within the rodham, where it overlay, for a short distance, the fringing peat band.

The sequence of deposition was probably as follows:

1) The lower silty clay is the Fen Clay; a lagoonal deposit merging upward into a tidal marsh deposit.
2) Above the silty clay a layer of peat formed, which is equivalent to the lower part of the Upper Peat.
3) The formation of the rodham. The merging of the Fen Clay and the clay of the rodham, and the inward sloping peat band, suggests that a water course was in existence here prior to marine flooding, and that with the onset of flooding, clays were deposited under quiet-water conditions. The coarser deposits of the rodham were laid down in channels in which water-flow was rapid; and the peat on the banks of the channel was eroded. Clay was deposited in the last channel of the rodham.
4) The dark, humose topsoil suggests a former peat cover over the rodham which, away from the rodham, merged with the buried peat band.

pH of the peat

Samples of the peat and rodham deposits were taken and placed in polythene bags; these were sealed and taken back to the laboratory. Field-moist samples were diluted with distilled water to form a 1:2.5 suspension. This was stirred for 15 minutes, a glass electrode was then immersed into the suspension, and the pH value recorded. The results are given in Table 1. The high pH values in the coarse sediments are due to the presence of comminuted shells.

Age of the peat

A sample of the peat was taken (sample 1, Fig. 1) and dated by the radiocarbon method. The radiocarbon determination was carried out after the peat sample had been purified to remove any contaminating substances of a different age, that might have been brought into the peat layer by ground water movement, e.g. humic acids from decaying plant materials from a more recent period. The peat containing the carbon radioactivity was converted to pure benzene for scintillation spectrometry. A sub-sample of the material was used to measure the stable isotopes ratio, $^{13}C/^{12}C$ using a mass spectrometer. This latter value $\beta^{13}C = -26.40$ per mille, served two purposes, (a) to indicate the origin of the sample and (b) as a correction factor in the age calculation. The value was well within the range of fractionation expected from a typical acid peat sample.

The 'conventional' radiocarbon age for the peat was found to be:

2,555 ± 45 B.P. (Laboratory Reference Q-2113).

TABLE 1. pH VALUES

		pH			
		1.	2.	3.	Mean
1)	Floor of excavation; at 17m depth; hard, compact, little contamination with alluvium; wood fragments common up to 5cm long and 2cm wide.	4.08	4.10	4.07	4.08
2)	2-3m west from (1); at 1.7m depth below coarser creek deposits and thin band of clayey marsh deposits; hard peat; with occasional small fragments of wood.	4.40	4.37	4.28	4.35
3)	Detached peat in channel deposits; at 1.5m depth; friable peat, intimately mixed with creek alluvium; occasional plant remains.	7.00	6.90	7.00	6.99
4)	Channel deposits; at 1.5m depth; coarse silt loam to very fine sandy loam; sampled 20m from samples 1 and 2.	8.53	8.21	8.28	8.34
5)	Channel deposits; at 0.6m depth 3.5m S of samples 1 and 2; coarse silt loam to very fine sandy loam.	8.54	8.78	8.58	8.67
6)	Channel deposits; at 0.4m depth; silty clay – last phase of marsh silting.	7.98	8.08	8.25	8.10

This is based on Professor Libby's half-life determination for the ^{14}C isotope of 5,568 years and using the standard reference year AD 1950. This conventional radiocarbon date may be calibrated, using the latest calibration tables in *Radiocarbon* to yield a calendar date lying between 440 and 820 B.C. The true date has a certainty of 95% of lying between these values. (Klein et al. *Radiocarbon* 1982)[3]

Discussion

The rodham became tidal after 2555 ± 45 B.P., (or 820 to 440 B.C.). This is earlier than the dates quoted by Churchill[4] for, what is probably the same band of buried peat at Saddle Row,[25] near Kings Lynn dated at Q-549, 1875 ± 110 B.P., Q-550, 2070 ± 110 B.P. which when calibrated become 155 B.C. to 255 A.D. and 390 B.C. to 200 A.D. respectively, and Nordelph Q- , 2270 ± 90 B.P. It is later than those for Flaggrass[25] (Q-532, 4055 ± 110 B.P. and Q-531, 3065 ± 120 B.P. which calibrate to 2905 B.C. to 2335 B.C. and 1585 to 1100 B.C. respectively) and Magdalen Bend,[25] Runcton Holme, Norfolk Q-547, 3305 ± 120 B.P. which calibrates to 1875 B.C. to 1400 B.C. However, it is suggested that at Flaggrass, near March and Magdalene Bend the peat band was incomplete and that the upper parts may have been scoured away by example wave or tidal action. This was not evident at Manea and the age of the upper peat band here may be more reliable. Nevertheless, this buried peat formed during a period of some 2000 years before the Christian era[1,5,6] and its date of inundation will depend upon its position, thickness and elevation, since the peat extends over an undulating surface[1,4] with a height range of about -2m O.D. to +2m O.D.

The date when Manea became affected by tides is in accord with the archaeological evidence which requires the marine deposits to be laid down before, rather than during the Roman era. Thus, there was an extensive Roman occupation of the silt and marshland deposits dating from the end of the 1st century A.D., but nothing earlier.

The acidity of the peat band is puzzling. Generally, the Upper Peat is considered to have formed from reeds and sedges which grew in mineral-rich waters and swamps of neutral or alkaline reaction. The peat band may have become more acid because of the drainage of the Fens and subsequent oxidation of iron pyrites (iron sulphide, FeS_2) resulting in the release of acidic sulphate ($SO_4{}^2$) ions.[7] But chemical oxidation is slow at pH above 4.0, whereas oxidation is rapid at lower pH because of the presence of a micro organism, *Thiobacillus ferro-oxidans*.[8] In the laboratory there was no growth of the *Thiobacillus ferro-oxidans* at pH 4.0, but there was at pH 3.5.[8] The water percolating through the coarse rodham deposits is likely to be calcareous or neutral, which would inhibit oxidation. It seems unlikely, therefore, that at this site the acidity of the peat band is due to the release of acid sulphate ions by the oxidation of iron pyrites.

An alternative is that the peat developed its acidity during, or after its formation, but before it was buried by the calcareous tidal deposits. The evidence from the stable isotope ratio is that this was a typical acid peat sample. An explanation can be offered.

If, as is suggested by Godwin and his co workers,[9] the sea level regressed between the end of Fen Clay deposition and the beginning of the post 800 B.C. inundation, at the beginning of this period the surface of the Fen Clay, whilst swampy, would not everywhere be inundated by standing water. In these pools and swamps reeds and sedges would grow, if the ground water was neutral or alkaline. However, they could only grow until the decaying reeds and sedges had accumulated to the level of the ground water table; thereafter, unless the water table rose, different plant communities would colonise the surface. These communities would be tolerant of the drier conditions which would develop once the ground surface was above the water table and liable to drying out in summer. Soil nutrients would also become leached out of the peat by rainwater (pH 4.5), and the peat would become more acid.

At Manea the peat band contains much wood, suggesting there were trees and shrubs at the locality, forming on a drier, more acid peat.

The end result of this sequence of decalcification is the formation of an acidic plant community. Poore[10] notes that at Woodwalton Fen the Fen Clay is overlain by reed peat which gives way to a wood peat containing birch, pine and possibly juniper and yew. Over much of Woodwalton Fen this layer is in turn overlain by peat comprised of moss (*Sphagnum*), heather (*Calluna*) and cotton grass (*Eriophorum*). This type of peat can maintain its own growth, as the water table rises with the growth of the Sphagnum. The source of the water for the growth of the raised, or blanket bog is rainfall, not ground water.

There is no evidence at Manea of the presence of *Sphagnum* peat, nor is there over much of it in the Peat Fens. Only at the margins is there evidence of *Sphagnum* peat[10,11,12,13,14,15,16]. The suggestion that there may have been large areas of raised or blanket bog cannot be proved because of the wastage of the peat since the onset of drainage in the mid-17th century by shrinkage, oxidation and wind-blow. For instance, since draining Whittlesey Mere in 1852, about 3.6m of peat has disappeared at the Holme Fen Post[17]. Poore[10] points out that acid peat is better than alkaline peat for fuel, so probably much of it was cut and used in this way.

Moreover, in areas where peat survives, that below the plough level is frequently acid in reaction[14,15,16,18]. This acidity may not be an inherent property of the peat but engendered by the oxidation of pyrites or leaching following drainage. On the other hand, the presence of a moderately acid (pH of about 5 to 6) organic layer below the plough depth is not an indicator of a fen peat. In a soil profile description of the Prickwillow series[16] at Ramsey Hollow a spongy *Sphagnum* peat (over Fen Clay) has a pH of 5.9, presumably because of the downward leaching of the lime applied to the topsoil.

However, there is some indirect evidence which suggests that acid peats may have been more widespread in the Cambridgeshire and Norfolk Fens than is presently considered.

1) Wicken Fen, still a managed Fen with a high water table, partly comprises a *Molinia* purple moor grass community[19,20] because the peat in parts has become acidified. Godwin and Bharucha[19] show that in summer at Wicken Fen, transpiration by vegetation can lower the water table by 0.45-0.75m. This drying out causes peat to acidify as any basic minerals are leached by humic acids and rainwater to the water table. Plants which are tolerant of more acid conditions do not return bases to the soil, and further acidification will ensue. Bog forming plants tolerant of acid conditions may then invade the *Molinia* community. This process could have been widespread during peat formation.

2) In the literature it is common[20] for the following peat sequence to be described, given that the water table is not rising. In a hollow with a high water table a fen peat forms first if the water has a high base status. Secondary mires then form beyond the margins of the hollow, the peat itself retaining water and acting as the water supply. The third, and most acid stage is when the peat grows beyond the limits of the ground water and, by capillarity, maintains a perched water table above the ground water table. This is

the raised bog stage. This sequence is common around the margins of the Fen[10,11,12,13] away from the limits of the Fen Clay, and may have been so in the Fens away from the rivers.

3) The close juxtaposition of mineral rich and mineral poor peats is also noted frequently in the literature. The width of the mineral rich fen peats being largely controlled by the width of the mineratrophic water body, and the distance into the adjacent peat swamp that water will percolate. Often the water level in the fen is little affected by the rising and falling of the water level in the drains.[10,19] Except for flooding, mineral rich waters will therefore only affect a short distance either side of the waterway. This effect was seen on a large scale at Whittlesey Mere prior to its drainage in 1852. Around the Mere were reeds and sedges for a width of 45-150m, but thereafter, on the moor, cotton grass grew.[10]

Hence, away from the through-flowing rivers the ground water would not be rich in nutrients, particularly when over Fen Clay, which is acid. Fen peat, therefore, may have been found mainly adjacent to water courses but away from these, more acid peats may have developed.

4) The post-800 B.C. marine deposits hardly penetrate into the southern Cambridgeshire and Norfolk Fens, except along major river channels. Presumably the Upper Peat stopped the encroachment of these deposits.

The surface of the Fen Clay is often at 0 O.D.[22], but can be as low as −1.8m O.D. in the Downham Market Fens.[23] The heights attained by the later marine deposits are 3.0-3.6m O.D.[23]. It could be that a fen peat accumulated at the same rate as the water table rose during the marine incursion, but this seems unlikely; and a sequence of marine alluvium/peat beds could be expected. However, other than the Dowels soil series[18] of post 800 B.C., marine alluvium over peat over Fen Clay, like that described at Manea, forming a narrow zone along major channels, there is no evidence for widespread intercalating alluvium and peat deposits.

It may be that the level of silting was controlled by the height of the peat, which had already attained that height prior to the marine incursion. For peat to have attained this height, it seems likely it was a raised bog peat.

Conclusion

Although there is little direct evidence for a mosaic of fen and acid peats, it seems a reasonable hypothesis to explain the lack of marine deposits further south and east in the Cambridgeshire and Norfolk Fens.

There could have been continuing growth of peat, therefore, from the Neolithic period to the mid-17th century which in later periods did not depend on the presence of a ground water table. This raised bog formation may also explain why there are references between 1589 to 1665 to the surface of the peat fen being 1.2 to 1.8m higher than the adjacent Marshland to the north.[24]

ACKNOWLEDGEMENTS

The authors are grateful to Dr R. Evans, Soil Survey, Cambridge, for much help and pointing out many relevant references. Thanks are also due to Mr A. Sears and Mr C. Sears of Manea, for access to the rodham.

REFERENCES

1. R. Evans and E. J. Mostyn, The Stratigraphy and Soils of a Fenland Gas Pipeline. MAFF, ADAS Land Service, (1980) 26pp.
2. R. S. Seale, Ancient Courses of the Great and Little Ouse in Fenland. *P.C.A.S.* LXIX (1979) 1-20.
3. J. Klein, J. C. Lerman, P. E. Damon and E. K. Ralph, Calibration of Radiocarbon Dates, *Radiocarbon.* 1982 v 24, 103-150.
4. D. M. Churchill, Post Neolithic to Romano-British Sedimentation in the Southern Fenlands of Cambridgeshire and Norfolk. In *The Fenland in Roman Times*, Editor C. W. Phillips, Royal Geographical Research Series No. 5 (1970) 132-142.
5. R. W. Gallois, King's Lynn and The Wash, Sheet 145 and part of 129, Solid and Drift Geology, Institute of Geological Sciences (1978).
6. E. H. Willis, Marine transgression sequences in the English Fenlands. *Annals New York Academy of Sciences*, 95 (1961) 368-376.
7. C. A. H. Hodge, Acidity in Wood Walton, Conington and Holme Fens, Appendix III. In *Soils in Cambridgeshire I*, Sheet TL 18E/28W (Stilton), R.G.O. Burton and R. S. Seale, Soil Survey Record No. 65, Harpenden (1981) 163-172.
8. C. Bloomfield, The Oxidation of Iron Sulphides in Soils in Relation to the Formation of Acid Sulphate Soils, and of Ochre deposits in Field Drains. *Journal of Soil Science* 23 (1972) 1-16.
9. H. Godwin, *Fenland: its Ancient Past and Uncertain Future.* Cambridge University Press (1978) 196pp.

10. M. E. D. Poore, The Ecology of Wood Walton Fen. *Journal of Ecology* 44 (1956) 455-492.
11. H. Godwin and M. E. Clifford, Controlling Factors in the Formation of Fen Deposits, as Shown by Peat Investigations at Wood Fen, near Ely. *Journal of Ecology* 23 (1935) 509-535.
12. H. Godwin and M. E. Clifford, Studies in the Post-Glacial History of British Vegetation Parts I and II. *Phil. Trans. R. Soc.* B229 (1938) 323-406.
13. H. Godwin and Vishnu-Mittre, Studies of the Post-Glacial History of British Vegetation. Part XVI. *Phil. Trans. R. Soc.* B270 (1975) 561-604.
14. R. G. O. Burton and R. S. Seale. *Soils in Cambridgeshire I, Sheet TL18E/28W (Stilton).* Soil Survey Record No. 65, Harpenden (1981) 178pp.
15. C. A. H. Hodge and R. S. Seale, *The Soils of the District Around Cambridge.* Memoir, Soil Survey of Great Britain, Harpenden (1966) 183 pp.
16. R. S. Seale, *Soils of the Chatteris District of Cambridgeshire.* Soil Survey, Special Survey No. 9, Harpenden (1975) 126pp.
17. J. N. Hutchinson, The Record of Peat Wastage in the East Anglian Fenlands at Holme Post, 1848-1978 A.D. *Journal of Ecology* 68 (1980) 229-249.
18. R. S. Seale, *Soils of the Ely District.* Memoir, Soil Survey of Great Britain, Harpenden (1975) 253pp.
19. H. Godwin and F. R. Bharucha, Studies in the Ecoloy of Wicken Fen II: The Fen Water Table and its Control of Plant Communities. *Journal of Ecology* 20 (1932) 157-191.
20. B. D. Wheeler, Plant communities of Rich Fen Systems in England and Wales. I. Introduction. Tall Sedge and Reed Communities. *Journal of Ecology* 68 (1980) 365-395.
21. P. D. Moore and D. J. Bellamy. *Peatlands* Elek Science, London (1974) 221pp.
22. R. Evans, The Early Courses of the River Nene. *Durobrivae* 7 (1979) 8-11.
23. R. Evans, unpublished.
24. H. C. Darby, *The Draining of the Fens.* 2nd Edition, Cambridge University Press (1956) 314pp.
25. H. Godwin and E. H. Willis, Cambridge University Natural Radiocarbon Measurements III. *Radiocarbon.* v 3 (1961) 60-76.

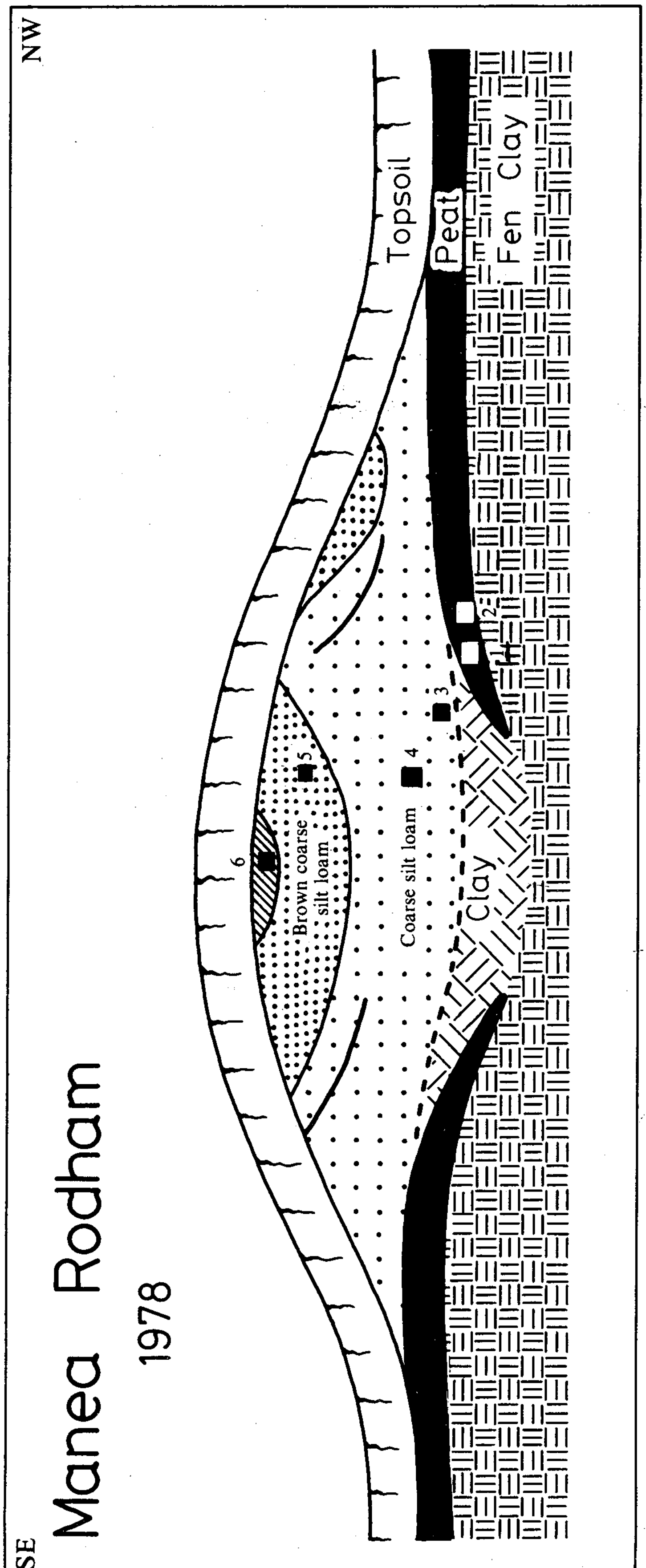

Fig. 1. Diagrammatic section of Manea rodham. Linear scale approximately 50 metres, vertical scale 2 metres. The numbered boxes show where the samples described in Table 1 were extracted.

PROCEEDINGS OF THE CAMBRIDGE ANTIQUARIAN SOCIETY

VOLUME LXXI

1981

Price £4.00 net for members, £5.50 for non-members