SOILS IN THE WISTMAN'S WOOD FOREST NATURE RESERVE

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WISTMAN'S WOOD occupies a site on the eastern valley side of the West Dart River at an elevation of 366m (1200 ft.), about 3 kilometres (2 miles) north of Two Bridges. Environmental and historical factors have been responsible for the preservation of this isolated fragment of oak wood, and it can be assumed that the soils contribute to the network of environmental relationships in the area. This paper, based on fieldwork in 1968, 1969 and 1970, describes the soils and their distribution, and discuss a pollen diagram constructed after an analysis of pollen from peat in the reserve.

Recent literature on Wistman's Wood includes papers by Archibald (1966), Simmonds (1964) and an account of field-work by Courtney and Hardy (1967). The only published work on the soils of central Dartmoor is based on reconnaissance surveys (Clayden and Manley, 1964). A general introduction to the vegetation history of Dartmoor is given by Simmons (1964).

Geology

The Reserve is on granitic head deposits. The thickness of head and weathered rock, or growan, is variable, but nowhere more than 1 metre in the Reserve. The sequence of weathered deposits over granite is described by Waters (1964) and Brunsden (1964), and much land in the Reserve is covered by granite boulders or clitter, the 'migratory layer" described by Waters (1964).

The Soil Mapping Units[1]

Fig. 1 shows the areas of different types of soil that occur. The soils are described below.

The peat complex

The gently sloping valley floor is covered with a mixture of peat and alluvium. The basin and flush peats vary in thickness from more than 2 metres to only a few centimetres and are over granitic material. The basin peat varies vertically, less humified *Sphagnum* and *Eriophorum* fibrous peat overlying highly humified black amorphous peat. Flushes (areas where water comes to the ground surface) are common and often have a surface mat of *Sphagnum* over waterlogged peat mostly of dead *Sphagnum*. In places, layers of alluvial gravels and peat alternate. The degree of decomposition of the *Sphagnum* depends on the wetness of the soil, and the distribution of the peats is closely related to past and present

1. In this account a number of technical terms are used in describing the soils. A short glossary of terms is appended. The reader is referred to Clayden (1964) or Clayden (1971) for a more detailed exposition.

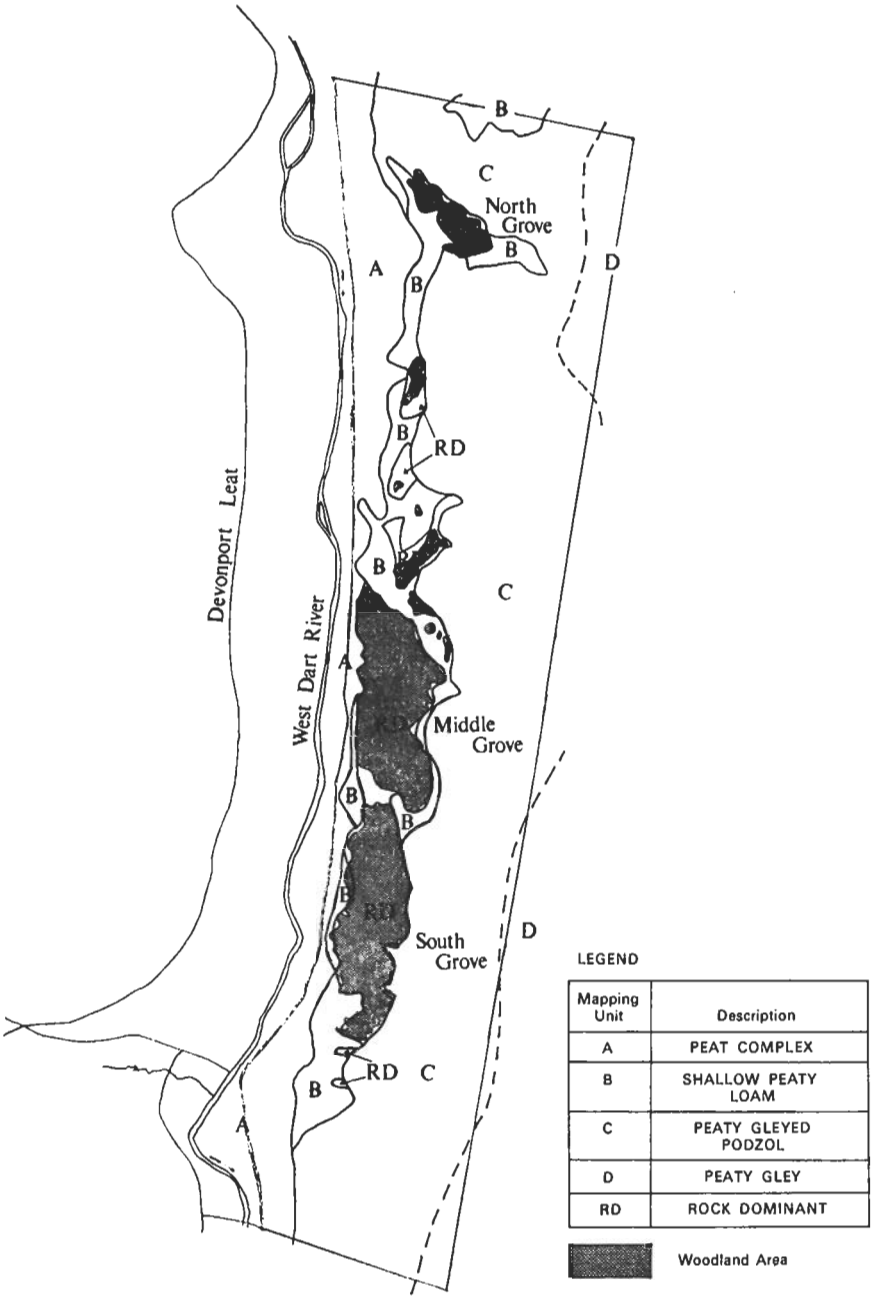

Fig. 1. *Soil Map.*

drainage channels. The results of pollen analysis of samples from a section in the peat are given below.

Shallow peat loams

These soils occur in a belt on moderately steep[2] slopes (7-11°) along the valley side, generally bordering the area dominated by rock. Loamy textures and black colours predominate and the soils have much organic matter. Granitic gravel occurs at between 14 and 36 cm from the surface. Often these soils can be distinguished by their cover of bracken (*Pteridium aquilinum*) and there are many granite boulders on the surface, generally about 1 metre apart.

In certain restricted areas (for example, east of Middle Grove) there are slightly deeper soils with browner colours and finer textures (silt loam) in the subsurface horizon. These have not been mapped separately here because of their small area.

Peaty gleyed podzols

Most of the soils in this mapping unit correspond closely to the Hexworthy series (Clayden and Manley, 1964). They occur in a broad belt on moderately steep slopes above the wood, and on the valley sides north and south of the wood. Surface boulders are far apart, although there are some areas with much clitter.

There is between 16 and 40 cm of peat over the mineral soil, which has many bleached sand grains and usually a polygonal structure when dry. The top 6cm of the mineral soil consists of a black gritty loam with subangular stones. Below is about 30 cm of mottled loam which can be over a horizon of loive brown gritty sandy loam. A thin iron-pan commonly occurs at between 40 and 50 cm from the surface but this is very variable and the pan can be very thin and sometimes absent. Below this a thin (less than 10 cm) layer of loam usually overlies a horizon of dark brown gritty loam which passes into compact granite gravel.

Peaty gley soils

These cover the gently sloping areas above the wood where the peat thickens to more than 40 cm and grade into blanket peat on flat ground. Generally the soils are very poorly drained, and carry purple moor grass (*Molinia caerulea*). A typical profile has about 30 cm of black amorphous peat or loamy peat over 20 cm of humose loam, over heavily mottled pale brown or olive loam passing into compact granite head. The boundary between these soils and the peaty gleyed podzols is difficult to draw and is shown by a dotted line on the map.

Rock dominant

Large areas of the hillside are covered by granite boulders (clitter) up to 3 metres in diameter with pockets of peaty loam between. Many tree roots grow in these pockets and it is suggested (Tansley, 1949) that the contortions of the aerial parts of the trees are due to restriction of their root structure.

2. The reader is referred to Curtis, Doornkamp and Gregory (1965) for an explanation of slope terms.

Pollen Analysis

Peat samples were obtained from a 2 metre basin peat profile in the valley floor west of Wistman's Wood and indicated on the map. The samples were taken with a Hiller peat borer and pollen was extracted by the KOH/Acetolysis method outlined by Faegri and Iverson (1964). Pollen grains were then counted under a microscope. The numbers of each pollen and spore type were noted, counting being discontinued when 3-400 grains had been examined. (This figure is the total accepted when studying a dominantly open landscape: Crabtree, (1964)). Interpretation of pollen analysis rests upon the assumption that the pollen extracted from a peat sample represents the pollen rain (that is, the total pollen received at a site) over the site during the period of deposition. This pollen rain represents, in part at least, the vegetation in the area at the time.

The results (Fig. 2) show pollen and spore frequencies as a percentage of total tree pollen counts. The ratio between tree and non-tree pollen indicates the density of woodland in the locality. Changes in relative pollen frequencies can be used to delineate zones, following the scheme outlined by Godwin (1956). The Late- and Post-glacial periods are divided into a total of eight

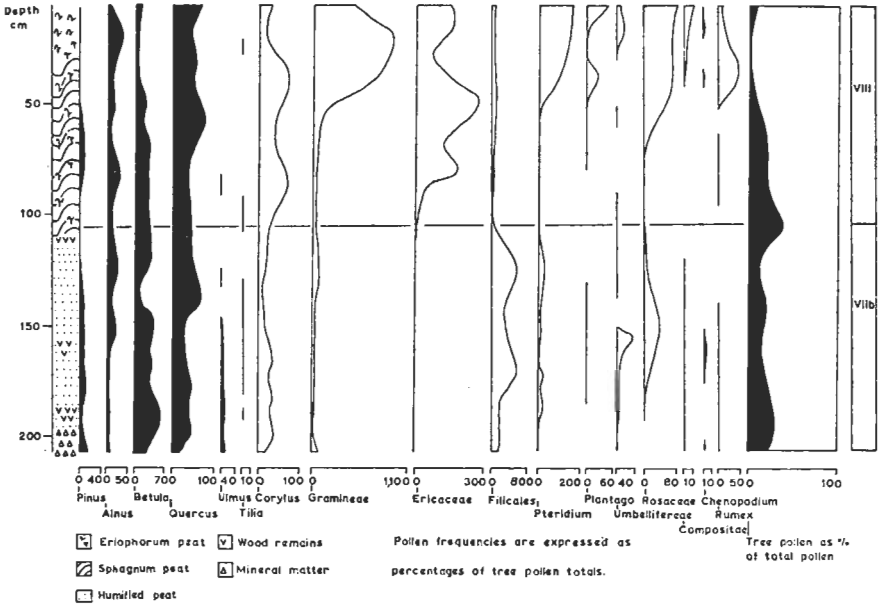

Fig. 2. *Pollen Diagram.*

zones, and here only the last two zones, (VIIb and VIII) are present[3]. These zones represent approximately the last 4,000 years. The boundary between zones VIIb and VIII is placed where amorphous peat gives way to fibrous cotton/bog moss (*Eriophorum/Sphagnum*) peat; a well documented change (Simmons, 1964a).

The main feature of zones VIIb is the moderate amount of tree pollen, which progressively declines, although there is a significant increase at the VIIb/VIII zone boundary. Lime, *Tilia* sp., occurs sporadically and the elm, *Ulmus* sp., curve is not continuous for the whole of the zone. Much fern, *Filicales* sp. suggests increasingly wet conditions producing luxuriant epiphytic growth within the woodland. The occurrence of plantain (*Plantago* sp.), goosefoot (*Chenopodium* sp.) and sorrel (*Rumex* sp.) indicates considerable agricultural activity by Bronze Age man, probably following forest clearance.

The completion of forest clearance is illustrated in zone VIII by the fact that tree pollen totals decline to a very small value. The great increase in heaths (*Ericaceae*) (mostly ling, *Calluna vulgaris*) and grasses could be due to deteriorating soil conditions consequent upon forest clearance and a worsening climate. The greater amounts of herbaceous pollen towards the top of the diagram suggest a very open landscape, while the late increase of bracken (*Pteridium* sp.) could reflect a very local vegetation change. Late clearance around the edge of the wood, where there are deeper and better drained soils, could have led to a local invasion of bracken which prefers better drained soils. The clearance here can be attributed to tinners who needed wood for tin smelting, although the widespread increase of bracken over the moor as a whole could be linked to grazing.

Although there is not direct evidence from these results to show that Wistman's Wood is a relic of natural woodland (since the oak pollen could have come from woodland fringing the moor) the lack of a distinct break in the pollen line and the increase of oak pollen in relation to other tree species supports the idea that the site has been continuously occupied by oak since the Bronze Age. The distribution of the soils and, in particular, the high density of clitter on steep slopes would undoubtedly help to maintain an undisturbed oakwood here.

3. The dating is placed as follows: Following Smith (1960) and Seddon (1967), the junction of the VIIa/VIIb sones may be placed at approximately 3000 BC. The low elm, *Ulmus* sp., and sporadic lime, *Tilia* sp., levels occurring at the base of the diagram (Fig. 2) indicate that the profile is post-*Ulmus* decline, that is not earlier than zone VIIb.

Appendix

SHORT GLOSSARY OF TERMS USED

Gley soils — soils with greyish colours and/or rusty mottling, due to periodic or permanent water saturation.

Horizon — a horizontal layer in the soil visibly different from the layers above and below and usually distinctive in a number of physical and chemical respects.

Loam — soil with relatively even mixtures of different grades of sand and of silt and clay.

Peat, basin — an accumulation of organic material preserved by an anaerobic (waterlogged) environment, usually in a low-lying site receiving both surface and ground-water.

Peat, blanket — a continuous layer of organic material usually on gently sloping hill/mountain tops, preserved by an anaerobic environment due to much rain. (Also termed 'climatic moor'.)

Peat, flush — organic material on a spring or heavily flushed site.

Podzol — soil in which percolating acid water removes iron from the upper horizons and redeposits it lower in the profile in an iron pan.

Profile — the section of soil exposed in a pit about 1 metre deep.

References

Archibald, J. F. (1966). Wistman's Wood: A Forest Nature Reserve. *J. Devon Trust for Nature Conservation*, 11, 423-428.

Brunsden, D. (1964). The Origin of the Decomposed Granite. In: Simmons, I. G., ed., *Dartmoor Essays*, Devon Ass. Adv. Sci. Torquay.

Clayden, B. (1964). The Soils of the Middle Teign Valley District of Devon. *Soil Survey of Great Britain, Bulletin No. 1* Harpenden.

Clayden, B. (1971). *The Soils of the Exeter District of Devon*. Soil Survey of England and Wales.

Clayden, B. and Manley, D. J. R. (1964). The Soils of the Dartmoor Granite. In: Simmons, I. G., ed., *Dartmoor Essays*, Devon Ass. Adv. Sci. Torquay.

Courtney, F. M. and Hardy, D. A. (1967). Wistman's Wood Forest Nature Reserve. *J. Devon Trust for Nature Conservation*, 13, 533-540.

Crabtree, K. (1968). Pollen Analysis. *Sci. Prog. Oxf.* 56, 83-101.

Curtis, L. F., Doornkamp, J. C. and Gregory, K. J. (1965). The Description of Relief in the Field Studies of Soils. *J. Soil Sci.*, 16, 1, 16-30.

Faegri, K. and Iverson, J. (1964). *Textbook of Pollen Analysis*. Muuksgaid, Copenhagen.

Godwin, H. (1956). *History of the British Flora*. University Press, Cambridge.

Seddon, B. (1967). Prehistoric Climate and Agriculture: A Review of Recent Paleoecological Investigation. *Weather and Agric* 173-185.

Simmons, I. G. (1964a). *Vegetation History of Dartmoor*. Ph.D. Thesis. University of London.

Simmons, I G. (1964b). An ecological history of Dartmoor. In: Simmons, I. G., ed. *Dartmoor Essays*. Devon Ass. Adv. Sci. Torquay.

Smith, A. G. (1960). Atlantic-Sub Boreal Transition. *Proc. Linnaen Soc.*, p. 38,

Tansley, A. G. (1949). *The British Isles and their Vegetation*. Cambridge: University Press.

Waters, R. S. (1964). The Pleistocene Legacy to the Geomorphology of Southern Dartmoor. In: Simmons, I. G., ed., *Dartmoor Essays*. Devon Ass. Adv. Sci. Torquay.

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