Fossil Insects from the Sweet Track

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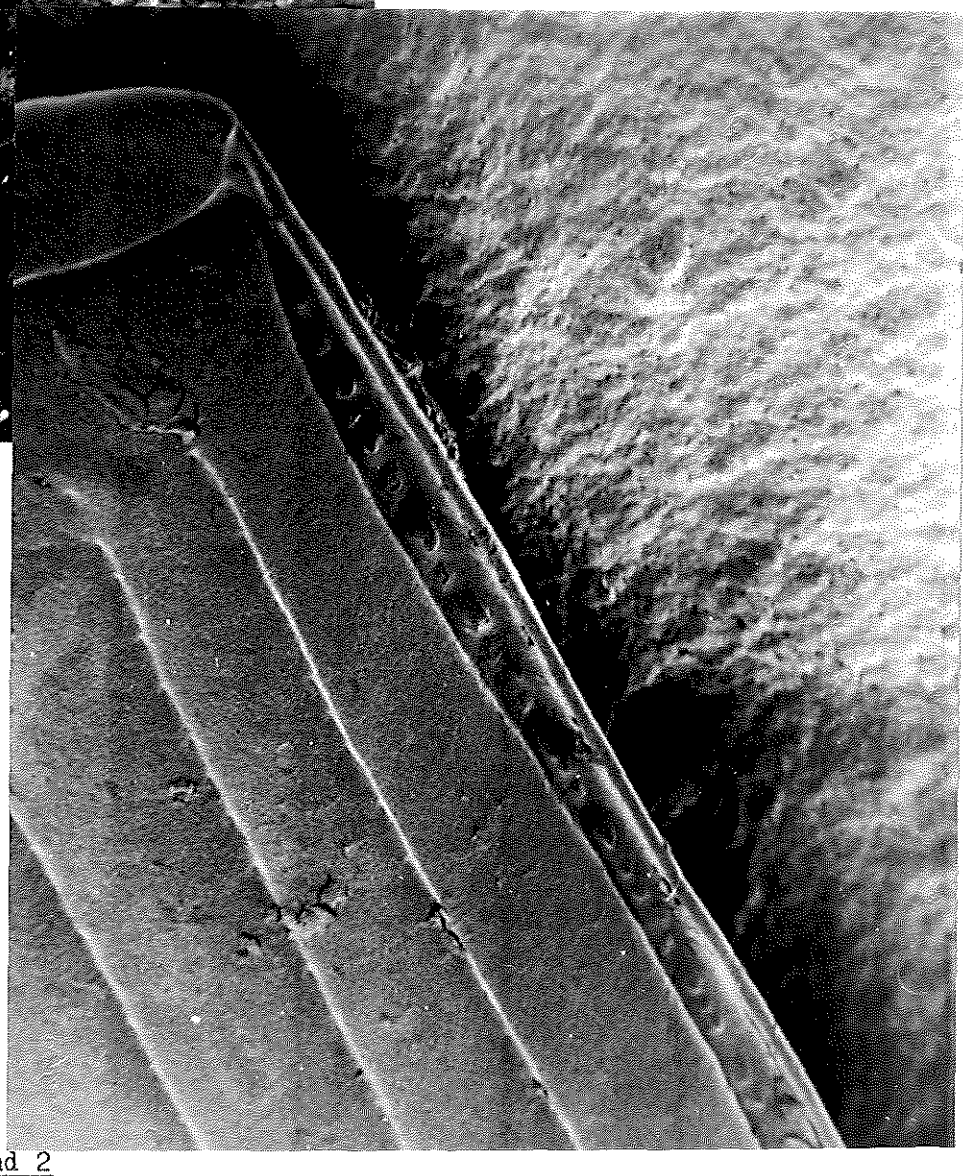
The Sweet Track is a complex wooden structure which, despite its sophisticated design, is the oldest wooden trackway known from Europe. Radiocarbon dates from timbers and surrounding peats range from 5200-5100bp. The excavation of part of the Sweet Track at the Railway site between 1971-1975 has already been reported in Somerset Levels Papers, 2, 1976, pp 34-76. A further exposure of the structure at the Drove site was excavated in 1977 during which a full palaeoecological programme was carried out. The results of the analysis of insect remains from samples collected during this excavation form the basis of this report.

As part of the palaeoecological investigations of the Sweet Track, samples for insect analysis were collected during the 1976 excavation at the Drove site. In conjunction with samples for botanical investigation, peat was collected from several localities along the trackway at positions underlying and overlying rails, planks and pegs. In addition, a vertical monolith of 24 samples taken at 5cm intervals from a point about 20cm above the trackway, was sited at the northern end of the excavation and comparison of the monolith faunas with those of the trackway level was undertaken to isolate possible environmental changes. Finally the trackway timbers themselves were sampled during the lifting of the structure, particularly where the wood appeared to be rotten or insect infested.

In the laboratory insect recovery from the peat samples was carried out by paraffin flotation. The timbers were individually examined for signs of insect attack, then peat adhering to the wood was sorted and any that contained insects were added to the fauna from the trackway level. The list of species recovered from the Sweet Track samples is given in Appendix I.

Species of Interest

Three beetles from the samples which are no longer native in this country; Oodes gracilis, Micropeplus caelatus and Anthicus gracilis have all previously been recorded from Somerset Levels sites. At the Sweet Track site. O. gracilis is accompanied by the British representative of the genus; O. helipoides, an association often noted today from the areas in Europe where their ranges overlap (Lindroth 1945). The two species are very similar in appearance, the main distinguishing character being the constriction, in gracilis, of the shallow ridge on the outer elytral edge with a loss of punctures at the narrowest part. Scanning electron studies of



Plates 1 and 2

1: Oodes gracilis 2: Oodes helipoides (S.E.M. X 50)

Right elytral base. Note constriction and loss of puncturation in gracilis

this feature in individuals from the trackway level are shown in Plates 1 and 2. Also present are elytra of M. caelatus in which the four elytral and one sutural ridges (Tottenham 1954) are rugose and the interstices are shining and coarsely punctured and the characteristically sculptured heads and pronota of Anthicus gracilis. The present ranges of the three extinct species are shown in Figure I.

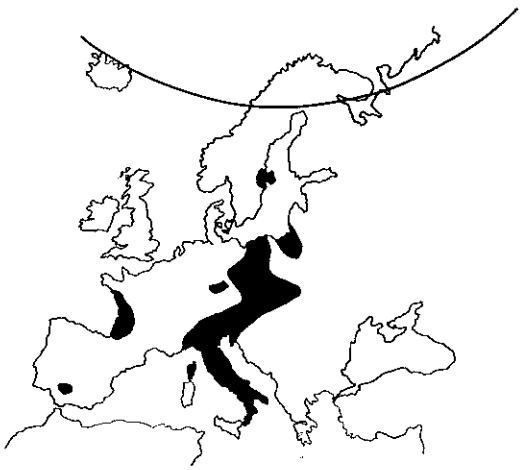
As in previous sites, two common members of the aquatic fauna are Hydroporus scalesianus and Hydraena palustris. Collecting records indicate that the species share a common habit, swampy moss with clear water (Balfour-Browne 1958) but that both species, particularly H. scalesianus, are now very rare. The occurrence in sample 15 of a complete abdomen of Hydraena palustris permitted the recovery of the male genitalia figured in Plate 3. The pronotum of Hydrochus carinatus, another considerable rarity in the British fauna, is shown in Plate 4.

Several of the species from the site which have not previously been recorded from Somerset Levels sites are beetles associated with wood. Prionychus melanarius, formerly an Alleculidae but now included in Tenebrionidae (Watt 1974) is today known only from Nottinghamshire and Sussex and is very rare in Europe. Its habitat is fungus-attacked or 'worm-eaten' wood (Reitter 1911, Buck 1954). Another wood-feeder from the same sample is Ochina ptinoides whose host tree is ivy. Other new species include Oedemera lurida, the larvae of which feed on plant stems or rotten wood and the weevil Rhyncholus lignarius a species also found in rotting wood.

General Environment

Considered as a unit, the beetle assemblages from the site present a fairly uniform pattern of eutrophic fen conditions existing up to and during trackway construction and useage. The main faunal variation encountered in the monolith samples is in population levels, here inferred to be related to

a



b

c

Figure 1

Present day western European ranges of a) Oodes gracilis, b) Micropeplus caelatus and c) Anthicus gracilis.

Plate 3

Hydraena palustris aedeagus (S.E.M. X 300)

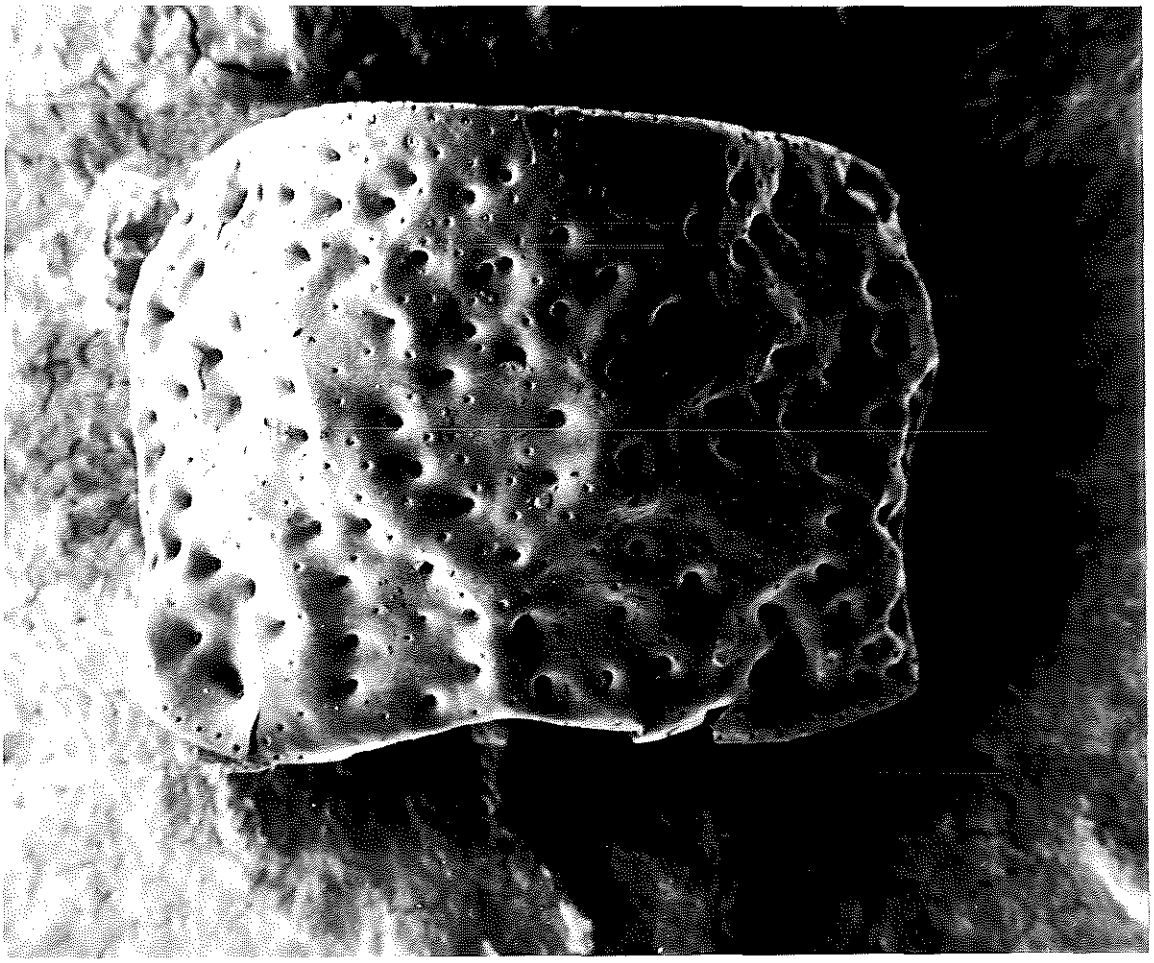


Plate 4

Hydrochus carinatus pronotum (S.E.M. X 80)

changing water levels at the site. Otherwise, a gradual reduction in higher peat levels of species which demand strongly entrophic habits can be attributed to the loss of nutrients as peat accumulation raised the fen surface above the influence of base-rich ground water. At the Sweet Track site the entomological studies supports the botanical evidence that the peat succession did not continue to the phase of raised bog development (see S L Beckett page), and the re-appearance of certain beetles a t higher peat levels suggests renewals of nutrient supply during the wettest phases.

The earliest monolith sample, number 24, collected at about 10cms above the clay/peat interface, contains a rich fen fauna. Typical ground beetles include Bembidion fumigatum, a species of wet marshes, B. assimile, which is found at the edge of water amongst Carex and Phragmites - rich vegetation and Odacantha melanura, common in accumulations of reeds or overwintering in the stems of Typha latifolia.Other inhabitants of reed litter include Anthicus gracilis, Corylophus cassidoides and probably Micropeplus caelatus. The phytophages from the lowest samples are predominantly reed and rush feeders. The commonest phytophage is Plateumaris braccata whose host plant is Phragmites communis, and also present are P. sericea, which lives on Iris pseudocorus and Carex, Donacia vulgaris whose aquatic plant hosts include Typha, Sparganium and Carex and D. cinerea which lives on Typha, Phragmites and Sparganium. Tanysphyrus lemnae, a small weevil which feeds on duckweed, is present in low numbers at the monolith base.

A study of numbers of individuals per monolith sample (Figure 2) demonstrates a population low rising to a peak in sample 21. At this level there is also a rise in the numbers of true water beetles and in the Hydrophilid and Hydraenid families which live in shallow ponds, pond edges and in damp vegetation. Whilst

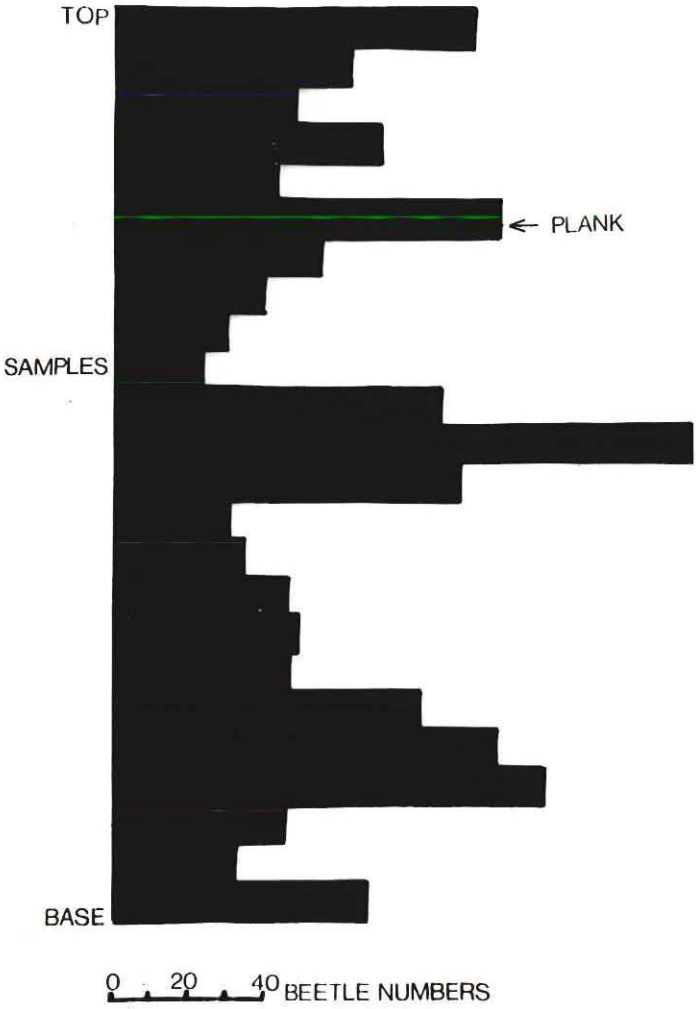


Figure 2
Beetle numbers per sample with variations attributed to flooding phases

this enrichment of the aquatic fauna might reflect the overall population rise, it could also have resulted from a phase of flooding which increased the numbers of available habitats. Lacking the impact of calcareous water flooding on to acidic raised bog, as seen for example at Meare Heath (Coles and Orme 1976, Beckett 1978) the flooding of existing entrophic fen would be more difficult to establish from the remains of beetles. Nevertheless, one interesting correlation supports the hypothesis of flooding at this site; the increase of numbers of T. lemnae following the population maximum (Fig 3). The habitat of this beetle is stagnant pools or slowly moving streams and rivers in which Lemna is established, and surface flooding would undoubtedly increase the availability of this pabulum and possibly account for the higher numbers of beetles observed at the site. Coinciding with this level of faunal increase is the appearance of Hydraena britteni, represented by a minimum of 16 individuals. This species which occurs in no other samples except at the trackway level, lives in pools or streams and it is another possible indicator of increased wetness at this stage.

After the faunal maximum at samples 21 and 20 there is a steady decline to sample 14 in numbers of beetles. Accompanying this population reduction, there is a reduction of certain stenotopic fen species, particularly those associated with reed and rush habitats. For instance Psammoecus bipunctatus disappears at sample 19, and Plateumaris braccata continues in low numbers up to sample 11, where a single teneral specimen present. Other species however, reinforce an interpretation of fen conditions, perhaps with some carr developmen replacing areas of reed swamp. Examples occurring at these and higher levels include Pterostichus atterimus, known from sedge areas of the east England fens and more recently marshes in the New Forest (Appleton 1969) and both Oodes species which are characteristic of rich organic soils on thickly vegetated pond edges.

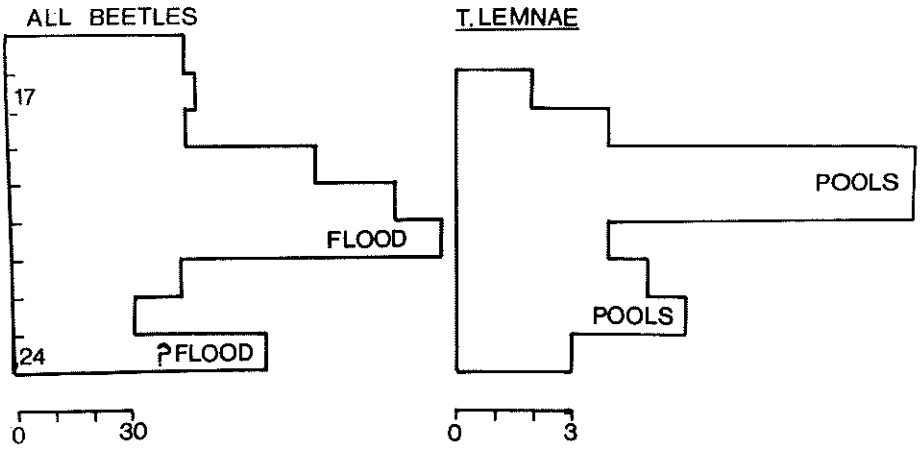


Figure 3

Totals of Tanysphyrus lemnae compared with overall abundance illustrating possible relationship between flooding phases and availability of ponds.

Trackway Environment

The complexity of the Sweet Track structure introduces the problem of determining the contemporary fen surface, particularly if the structure was slightly raised or if the timbers sank into the peat. Despite this it is immediately apparent that the position of the supporting rail (sample 7) and plank (sample 5) span a further period of increasing numbers of beetles with the plank level coinciding with the population maximum, or time of flooding. More significant than this faunal increase, however, is the occurrence in the peat samples collected around the timbers of Esolus parallelepipedus, a beetle found mainly in running water. The main requirement of this and other Elmidae appears to be a high oxygen content of the water, hence their preference for running water or the wave-lap zone at the edge of lakes where constant agitation introduces oxygen into the water (Holland 1971). It is unlikely that E. parallelepipedus would have found a suitable habitat in the fen pools at the site, but was probably confined to streams, rivers and lakes in the area and was swept across the surface during a phase of flooding. Other aquatic species which occur at the track level include Gyrinus marinus, G. suffriani and Bidessus unistriatus. A phase of surface flooding from surrounding areas could also explain the reintroduction of the stenotopic species Bembidion fumigatum and Odacantha melanura. The phytophages from these and higher samples are Cyperaceae feeders and include Limnobaris pilistriata and Thryogenes pilistriata, a species often taken on Sparganium. Also present are a number of tree dependant species whose signigicance is discussed later.

It appears that the Sweet Track was constructed in an area of fen subject to periodic flooding, and that it was emplaced after passage across the surface was again impeded by revewed surface water. While the track was in use, the flooding could have been severe enough to have produced large areas of continuous open water. The evidence from above the track is less easily interpreted, but Dr Beckett suggests that the peat stratigraphy might indicate very wet conditions.

Insect attack on the Trackway Timbers

A total of 12 wood dependent beetles have been recovered from the samples, of which 8 occur exclusively at the trackway level, 2 further species occur lower in the monolith in addition to the trackway, and two species are unrelated to the trackway level. The host trees for these beetles are given in Figure 4. As the site is close to the Burtle sand island it is conceivable that woodland there provided possible habitats, and as Scolytidae are generally strong fliers, the island can not be ruled out as a source of the tree feeders. The concentration, however, of most of the species at the trackway level argues for the derivation for at least some of the beetles from the timbers themselves. Ash, the host of Hylesinus oleiperda and lime the host of Ernoporus cancasicus are both recorded in the trackway and the introduction of an ivy-covered tree might have accounted for the presence of Ochina ptinoides. Trees infested with the rotten wood feeders Rhyncolus lignarius, Prionychus melanarius and Oedemera lurida whilst unlikely to have been good quality timber could have been brought to the site, or alternatively these species might have found suitable habitats in the constructed track.

BEETLE SPECIES	HOST TREE
Ampedus sp.	Rotting wood
**Ochina ptinoides*	Ivy
Anobium punctatum	Dry deciduous wood
**Cerylon ferrugineum*	Rotten deciduous wood
**Prionychus melanarius*	Fungus attacked wood
**Oedemera lurida*	Rotten wood and flowers
**Rhyncolus lignarius*	Rotton deciduous wood
**Rhynchaenus* sp.	Deciduous leaves
**Hylesinus oleiperda*	Mainly ash
Acrantes vittatus	Elm
**Ernoporus caucasicus*	Lime
**Xyleborus dispar*	Oak, Holly, Fruit trees, Elder etc.

FIGURE 4

Host trees for the tree dependent beetles

(*species found at trackway level).

Examination of the trackway timbers themselves has revealed that a number do in fact display clear signs of insect infestation. 69 timber samples selected during trackway lifting, yielded 19 probable cases of insect attack, ranging from small borings to very infested wood attacked by more than one species.

The most frequently noted were Cerambycid attacks. These are the 'long horn' beetles which live either in living or dead trees, and the channels noted in the Sweet Trackway timbers were sometimes packed with frass, the powdery wood residue passed through the body of the tunnelling larva. There are several well documented cases of the survival of one species Cerambyx cerdo L. in east English bog oaks dated to about 4,000 years bp, and often their state of preservation is remarkable (Duffy 1961, Harding and Plant 1977), but unfortunately no similar remains were recovered from the characteristically channelled timbers. Several shallow Scolytid channels were noted on the outer sap wood of some timbers including an elm. In life they live in and under the bark, but this is rarely preserved. It is probable that these attacks originated before the trees were cut down for timber. Two and possibly a third instance of Anobiidae borings were observed from the timbers. Many of the Anobiid species are of particular relevance to man as they attack dead wood and can therefore cause serious damage to structural timber. It is possible, that the Anobiid attacked timbers were already 'worm-eaten' when they were incorporated in the track, alternatively, the affected timbers, two rails and a rail or peg, may have provided suitable habitats during their use if the wood was not permanently innundated. Examples of insect attack in the Sweet timbers are shown in Plates 5-8.

Sweet Track

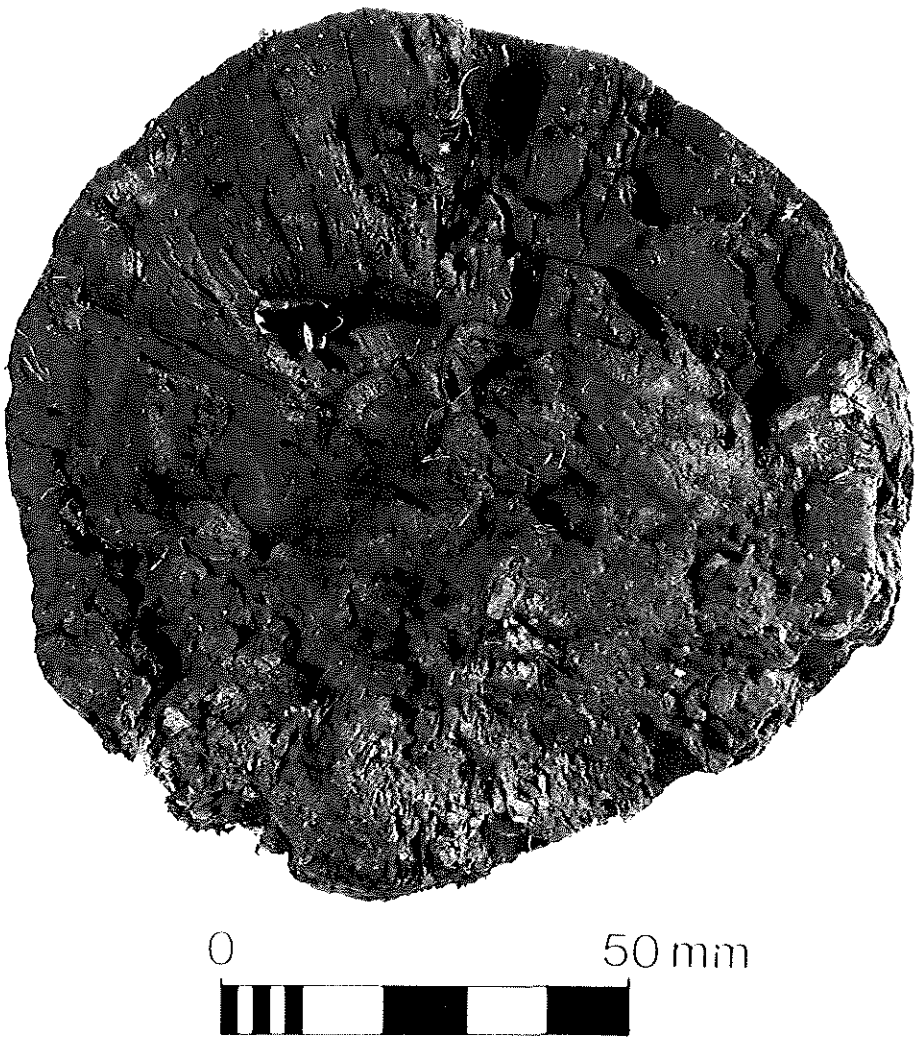


Plate 5

Trackway timber SWD 594 with Cerambycid channels visible in section.

Plate 6

Trackway timber SWD 594a with large Cerambycid channels.

Plate 7

Detail of Plate 6 (SWD 594a) showing diverging channel.

Plate 8

Trackway timber SWD 312 with possible Scolytid channels

The most significant fact noted from the study of the timbers is the concentration of attacks in wood identified by the archaeologists as strays. Whilst the proportion of attacked wood from all the samples was 27.5%,of the 11 strays examined, 8 were attacked, and the most severe attacks were in this group. As any insect channel would provide a focus for fungus attack (which is often strongly associated with insect borings or a prerequisite for certain beetle attacks), badly bored wood would probably rot more quickly than sound wood, especially in the damp peat bog environment. It is tempting therefore to suggest that the stray timbers along the line of the trackway represent wood deliberately discarded during the repair of the trackway. If true this perhaps has a bearing on how long the trackway was used.

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Appendix 1

The Sweet Track insect fauna

The nomenclature follows Pope's 1977 revision of Kloet and Hincks and the numbers given for each taxa are based upon the total of any coleopteran skeletal element.

EC

1	1	2	3	4	5	T	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Tot.
ARTEROPODA																										
INSECTA																										
HEMIPTERA	41	3	14	27	8	36	28	8	2	6	3	7	17	12	2	5	2	6	5	8	3			1		244
TRICHOPTERA	2	1	2			9	1	1	6	2	2	9	4	1				3	1	2						46
PLECOPTERA											1															1
COLEOPTERA																										
Carabidae									1																	1
Carabus sp.																										
Bembidion assimile Gyll.								?1																	1	1(+?1)
B. fumigatum (Dufts.)						1														4	2	8	2	3	5	25
Pterostichus atterimus (Herbst)						2		1	2	1	1						1									8
P. diligens (Sturm)		1		2										1					1		1					6
P. minor (Gyll.)	2	1		2		3	1																			9
P. nigrita (Payk.)																					1					1
P. vernalis (Panz.)						1	1						1													3
Pterostichus sp.						1																				1
Agonum fuliginosum (Panz.)																					1					1
Agonum spp.		1				1	1	1		1																5
Amara sp.							1																			1
Badister dilatatus Chaud. or peltatus (Panz.)																									1	1

	1	2	3	4	5	T	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Tot.
*Oodes gracilis Villa						1						1														2
O. helipoides (F.)				2				1																		3
O. gracilis or helipoides						1																				1
Odacantha melanura (L.)				1		2	1					1							1		2	1	2		1	12
Haliplidae																										
Haliplus sp.						1						1							1							3
Noteridae																										
Noterus clavicornis (Deg.)	2												1							1		2	1		1	8
Dytiscidae																										
Bidessus unistriatus (Schrank)						6	2																			8
Hygrotus decoratus (Gyll)	1					1						1	1					2		1						7

2	1	2	3	4	5	T	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Tot
H. inaequalis (F.)						1			3	1	1		1						1			1				9
Coelambus impressopunctatus (Schall.)																								1		1
Hydroporus scalesianus Steph.	2	3		1	1	3	3						4		1	1	1	1	1	1				1		25
Hydroporus spp.	2					5	3		1	1			4	5	1	1										23
Graptodytes granularis (L.)			4			6	9	3				1	5	2		2										32
Copelatus haemorrhoidalis (F.)								1												1						2
Agabus bipustulatus (L.)		1																								1
Agabus spp.				2		1	1					1								1						6
Ilybius sp.	1							1	1			1						1		1						6
Colymbetes fuscus (L.)																		1		1		1				3
Dytiscus sp.						1																				1
Gyrinidae																										
Gyrinus marinus Gyll						1														1	1					3
G. suffriani Scriba						1		1																		2
Gyrinus spp.												1	1						1	1						4
Hydrophilidae																										
Hydrochus carinatus Germ.																			1							1
Helophorus sp.						1																				1
Coelostoma orbiculare (F.)	5	2	1	5	3	14	4	3	3	2	1	2	5			1		1		1						53
Cercyon spp.												1	2	3			1	1		5	3	5	2	3	2	28

	1	2	3	4	5	T	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Tot
Megasternum obscurum (Marsh.)																					1					1
Hydrobius fuscipes (L.)																						1				1
Anacaena globulus (Payk.)		1																								1
Helochares spp.	2			1	1	11	3		1																	19
Enochrus spp.	11	4	1	1	2	18	4	6	5	5	1	10	29	4					3	2	2	8	2	1	3	122
Cymbiodyta marginella (F.)									1				1							1						3
Chaetarthria seminulum (Herbst.)	2		1	2	4	7	3	2														1				22
Hydraenidae																										
Ochthebius dilatatus Steph.	1																					2			5	8
O. minimus (F.)	1	2				21	2	5	2	1		1	5	1			1	2		3	3	7		2	3	62
Ochthebius spp.						1		3			1															5
Hydraena britteni Joy						2															16					18
H. palustris Er.		1		2		6	6	2	1			3	7	19	10	9	5	3	3	2	1	2		1		83
H. testacea Curt.						1															2					3
Limnebius aluta (Bed.)	1					6	3	4		4	2	5	7	3			2			1	1				2	41
Limnebius sp.						1		1																		2

3	1	2	3	4	5	T	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Tot
Ptiliidae																										
Gen. et spp. indet.																	1				4				2	7
Silphidae																										
Silpha atrata L.					1		1																			2
Scydmaenidae																										
Gen. et sp. indet.																					1					1
Staphylinidae																										
*Micropeplus caelatus Er.																		2							1	3
Lesteva heeri Fauv.	1	1	8	7	3							6														26
Carpelimus or Thinobius sp.						1																1			4	6
Anotylus rugosus (F.)																						1				1
Anotylus sp.																					1					1
Stenus spp.	6	6	9	9	5	13	5	2	2	3	1	2	2	4	1	1	2	5	2	5	4	3	1		1	94
Euaesthetus ruficapillus Bois and Lac.	1					1									2		2									6
Paederus sp.	2	1						1	1	1	1	1	3									1				12
Lathrobium terminatum Grav.	2	1	1			2	2						2							1						11
Lathrobium spp.	2	1	2	2	1	1	2					1	1	1	1	1	1	1			3	1			1	23
Ochthephilum fracticorne (Payk.)			1		1		3																			5
Lithocharis sp							1	1			1		1	1												5
Xantholinus linearis (Ol.) or longiventris Heer.						1																				1

	1	2	3	4	5	T	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Tot
Erichsonius cinerascens (Grav.)	1			2		3	3	1					1				1			1	1					14
Philonthus spp.	1					1		1	1			2										1			1	8
Staphylinus sp.						1																				1
Quedius spp.								1				1	1								1				1	5
Gymnusa brevicollis (Payk.)							1																			1
Aleochara sp.									1																	1
Aleocharinae indet.	6	2	1	1	1	5	5	1			1	3	5	2			1	1	1	2	3	12	1	1	7	62
Pselaphidae																										
Bibloplectus sp.																				1						1
Bryaxis spp.		1	1	1		1	2	1				1	1	3	2	1					1					16
Brachygluta spp.	4	2	1	1		3	1	1		2	1	6	8		1	1	1	1	1	2						37
?Trissemus impressa (Panz.)														5												5
Pselaphus heisei (Herbst)	1																									1

	1	2	3	4	5	T	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Tot
Geotrupidae																										
Geotrupes sp.						1	1		1																	3
Scarabaeidae																										
Aphodius rufus (Moll.)		1																								1
Aphodius spp.	1		1							1																3
Phyllopertha horticola (L.)				1																						1
Scirtidae																										
Gen. et spp. indet.	14	13	8	9	8	19	10	1	3	5	5	24	35	31	6	16	17	12	7	14	5	12	3	1	5	283
Byrridae																										
Cytilus sericeus (Forst.)	1	1				1	1																			4
Simplocaria semistriata (F.)												1														1
Dryopidae																										
Dryops spp.	2	3	1	5	3	13	6	2	1		1	1	2	1			1	1	2	1	1	2	1			51
Elmidae																										
Esolus parallelepepidus (Mill.)						3																				3
Elateridae																										
Ampedus sp. (=Elater)	1																									1
Cantharidae																										
Cantharis sp.																										
Silis ruficollis (F.)																						1				1
Anobiidae																										

	1	2	3	4	5	T	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Tot
Ochina ptinoides (Marsh.)					1																					1
Anobium punctatum (Deg.)																			1							1
Melyridae																										
Cerapheles terminatus (Mén.)												2	3													5
Nitidulidae																										
Gen. et sp. indet.													1													1
Silvanidae																										
Psammoecus bipunctatus (F.)																				2	3	1			1	7

5	1	2	3	4	5	T	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Tot
Cryptophagidae																										
Atomaria spp.																		1	2	1	1					5
Phalacridae																										
Phalacrus caricis Sturm																					1					1
Stilbus testaceus (Panz.)						1					1	5	4							1	10		1		3	26
Cerylonidae																										
Cerylon ferrugineum Steph.						1															1					2
Corylophidae																										
Corylophus cassidoides (Marsh.)					1	4		1	8		1	1	1	1	1		2	1	3	3	4		2		1	35
Coccinellidae																										
Scymnus sp.						1																				1
Chilocorus sp.						1	1																			2
Lathridiidae																										
Corticorina sp.	1						1															2				4
Tenebrionidae																										
Prionychus melanarius (Germ.)					1																					1
Dedemeridae																										
Oedemera lurida (Marsh.)										1																1
Anthicidae																										
*Anthicus gracilis													1	1							1				1	4

	1	2	3	4	5	T	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Tot
Chrysomelidae																										
Donacia cinerea Herbst																								1		1
D. vulgaris Zsch.																	1							1		2
Donacia spp.																					1		1		1	3
Plateumaris braccata (Scop.)						1						1	1	3	3			1	1	3	8	10	15	4	8	59
P. ?discolor (Panz.)	1	3	2																							6
P. sericea (L.)				6	2	4							1								1		2	4		20
Prasocuris phellandrii (L.)																				1	1	1	2		1	6
Phyllotreta sp.	1	1																								2
Longitarsus sp.	1				1	4	5	1																		12
Altica sp.																		1								1
Apionidae																										
Apion spp.	6	5	1	1	1	1	1					1	5							1	1					24
Curculionidae																										
Tanysphyrus lemnae (Payk.)																	2	4	13	12	12	4	5	6	3	61
Bagous frit (Herbst)		1																?1								1(+?1)
B. subcarinatus Gyll.																							1		1	2
Bagous spp.	1					2											1			1						5
Thryogenes scirrhosus (Gyll.)	2			1		4	1	5									1									14
Limnobaris pilistriata (Steph.)	3	3	1																		1			2		10

	1	2	3	4	5	T	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Tot
Rhynchaenus sp.				3	1													1		1						6
Rhyncolus lignarius (Marsh.)						1																				1
Scolytidae																										
Hylesinus oleiperda (F.)							1																			1
Acrantus vittatus (F.)	1																									1
Ernoporus caucasicus Lind.							1																			1
Xyleborus dispar (F.)						1																				1
HYMENOPTERA																										1738
Parasitica	5				1	7	3	1	3			6	6					1								33
Formicidae	1	1			1		1					1	1													6
DIPTERA																										
Tipulidae	2	1	1			1			1	1						1										8
Indet.	4	2		2			1			1			8			1	1	2		3		5	8			38
																										376
ARANAE	4	4				1				1	1	3	2													16
CHARA										1																1

Appendix 2 : Insect attack in the Sweet Track Timbers

Samples of the timbers from the Sweet Track were collected for insect investigation, particularly where examination in the field by the archaeologists suggested that some attack had taken place. A number of obvious beetle attacks were identified in the laboratory and from the size and shape of the borings, the most likely culprits were Cerambycidae and Scolytidae. The presence of the infested timber, likely occurrence of infestation and the possible introduction into the samples of Scolytidae from attacked timbers have been described in the main text. Here, methods of examination and a description of the timbers examined are given.

Method

Each timber was examined externally then possible insect borings were dissected to reveal whether frass (the powdery remains of the partly digested wood) was present. Insect remains, especially unemerged adults or larval mouthparts were also sought but the only exoskeletal parts discovered were of beetles whose presence was undoubtedly accidental. The remains of several Hydroporus spp. (aquatic beetles) were found in crevices in the wood, these individuals were probably washed into place after the trackway had been laid down. The timbers which appeared to have insect attack, once examined and photographed, were individually broken into small pieces in water and any peat or frass was washed into 300 micron sieves and then examined for beetle remains. This technique was largely unproductive. Timbers which were not thought to have any insect infestation were also washed and the insect remains were added to the list of species recovered from the trackway level.

List of timbers examined

SWD 158; rail; no obvious attack.
SWD 186; central rail; no obvious attack.
SWD 192; stray oak; no obvious attack.
SWD 200; dislodged plank ? lime; Cerambycid gallery with frass, also rotting at edges.

SWD 201; oak plank; very rotten, no obvious insect attack.
SW2 202; centre rail; rotten towards heart, no obvious attack.
SWD 203; centre rail; rotting and/or damage towards end, one possible ?Cerambycidae channel in heart.
SWD 206; plank; no obvious attack.
SWD 208; rail; soft but no obvious attack.
SWD 214; large timber, fairly sound but with shallow attack under bark level, possibly Scolytidae.
SWD 227; post; sound but with slight rotting at ends and possible shallow Scolytidae attack as in 214.
SWD 239; oak plank; soft and rotten, numberous root holes but no obvious insect attack.
SWD 240; rail peg; ? frass at heart, possible Cerambycidae attack.
SWD 246; central rail; slight rotting in part of outer section, no obvious insect attack.
SWD 248; central rail; one section very rotten, possible Anobiidae attack (small Anobium sized borings running longitudinally).
SWD 273; central rail; very rotten, no insect attack.
SWD 278; post; sound wood but with later damage by roots.
SWD 281; stray ash branch; no attack.
SWD 283; stray; very rotten, one probably Cerambycid boring but mainly root damage.
SWD 284; oak plank; dark staining and more rotten towards heart, no obvious attack.
SWD 284A; part of 284; no obvious insect attack but possible white rot along ray.
SWD 291; oak slat; dark staining, no insect attack.
SWD 293; rail peg; no borings but very rotten especially at heart.
SWD 294; rail peg; very rotten, possible frass in section.
SWD 297; stray; very rotten, especially heart, no obvious borings.
SWD 312; ash plank; attack under bark, possibly Scolytidae (plate).
SWD 317; ash plank or board; rotten along rays, no obvious insect attack.
SWD 339; ash ? peg, ? rail; shallow boring in sap wood, probably a Cerambycid, also possible transverse boring by Anobiidae.
SWD 344; stray; very rotten wood with large, transverse frass-filled channel probably of a Cerambicid.
SWD 357; rail peg; sound but with slight decay at one end and later root damage.
SWD 358; chips (? dry rot); no obvious insect attack.
SWD 361; plank fragment, ? lime; very rotten but no visible borings.
SWD 402; rail; sound, root holes but no visible boring.
SWD 403; plank; frass filled channel ? Cerambycid.
SWD 406; oak plank; frass filled borings up to 5 mm (not A.punctatum).
SWD 408; oak plank; sound but root damage, especially along rays.
SWD 418; oak plank; fairly sound with no obvious damage.
SWD 419; rail; 3 pieces, all rotten and damaged by roots.
SWD 420; oak slat; sound.
SWD 421; ? ; no insect damage.
SWD 423; ? , sound, no obvious boring, but with root damage.
SWD 429; stray; rotten towards heart and with localized area of insect attack under bark, (? Scolytidae). Perhaps deliberately discarded during repair.
SWD 430; stray slat; possible borings. Like 429, possibly deliberately discarded.
SWD 438; rail peg; decayed along root lines. Root damage but no obvious insect attack.
SWD 441; stray ash branch; rotten although no obvious insect attack. ? discarded during repair.

SWD 445; oak stray; white fungus attack along rays (unknown if this is an original feature or a recent attack).
SWD 450; central rail; insect attack, probably Anobiidae, concentrated in sap wood area.
SWD 452; oak board; dark coloured or stained, no obvious attack.
SWD 485; oak slat; decayed but no obvious attack.
SWD 517; ? ; decay along rays and much root penetration.
SWD 520; rail peg; a (above water level) slight decay around knot, b (below water level) root damage but no attack.
SWD 527; cf peg; sound except for decay along rays and root damage.
SWD 530; rail or rail packing; some decay but no obvious boring.
SWD 531; oak slat; decayed and root damaged but no borings.
SWD 535; stray slat; decayed but no obvious borings.
SWD 531; oak slat; decayed but no boring.
SWD 540; rail peg; sound.
SWD 543; central rail; possible fungal attack following line of an insect boring.
SWD 544; slat; sound.
SWD 547;)
SWD 568;) no samples.
SWD 579; stray; probably Cerambycid boring and fairly decayed possibly a deliberately discarded timber.
SWD 580; stray; as 579, well rotten and with Cerambycid borings. Again, deliberately discarded?
SWD 582; peg (rail); slight decay and much root penetration.
SWD 586; no sample.
SWD 594; stray elm; (sample a) Scolytid attack immediately under bark and a large frass-filled longitudinal Cerambycid channel (plate).
SWD 604; ash plank; decayed especially towards heart, but no obvious insect attack.
SWD 638; slat; decayed with fine borings probably of insect origin.