Hoxnian

Sites and faunas (Fig. 7.1, Table 7.2)

Fossil vertebrates of Hoxnian age are known in abundance from a very limited number of sites, and have mostly been obtained in conjunction with archaeological excavations. Unfortunately, in most cases there are problems in attempting to determine the exact stratigraphical horizons of these fossils. Nevertheless, a few pollen-dated records are available, and it is possible to assign at least tentatively most of the fossil assemblages to pollen zones using other palaeontological or stratigraphical evidence.

Interglacial fluviatile deposits of the 'Clacton Channel', comprising silts and sands with organic horizons and rich in artefacts and mammal bones, were formerly exposed in the cliffs and foreshore at Clacton-on-Sea, Essex (Warren 1951, 1955). These freshwater deposits are overlain by estuarine clays and silts which occupy much of the cliff. Pollen analyses by Pike and Godwin (1952) showed that these deposits are of Hoxnian interglacial age. The uppermost estuarine beds were assigned to zone Ho IIIb and the top freshwater loamy organic sands to zone Ho IIIa. Subsequent investigations by Turner and Kerney (1971) demonstrated that the freshwater deposits date from at least as far back as zone Ho IIb, the latter date appertaining to bed y of Warren, from which he obtained the majority of artefacts and bones. It is probable therefore that the majority of the fauna relates to subzone Ho IIb, but some fossils could be from pre-Ho IIb horizons, or as late as subzone Ho IIIa.

Recent archaeological excavations at the Clacton Golf Course site have produced many more artefacts and some vertebrate remains from fluviatile gravels (Singer *et al.* 1973). These authors tentatively consider that this horizon pre-dates zone Ho I, i.e. belongs within the preceding Anglian Cold Stage, but the pollen analyses on which this view is based may be questioned, especially as primary pollen is unlikely to be preserved in gravels. Moreover, the occurrence of beech (*Fagus*) pollen raises the suspicion that the deposits contain Flandrian pollen, as this tree is not recorded from other stages in the British Pleistocene. It seems more likely that the Golf Course deposits are part of the 'Clacton Channel' complex, and that the artefacts and fauna are of much the same age as the other material.

The pollen and plant macrofossil analyses for the subzone Ho IIb samples (Turner, in Kerney 1971) indicate a river floodplain with marshland and occasional dry grassland habitats, with fairly dense mixed oak forest on higher ground. The non-marine mollusc analyses are consistent with this picture, and show considerable similarities with the Lower Loam faunas of Swanscombe.

The mammalian fauna, listed by Sutcliffe (1964), with additions from the Clacton Golf Course Site (Singer *et al.* 1973), is given in Table 7.2. It is very similar to, but less rich than, the Swanscombe Lower Gravel and Lower Loam faunas, with woodland elements such as straight-tusked elephant *Palaeoloxodon antiquus*, wild boar *Sus scrofa*, and fallow deer *Dama dama*. The presence of lion *Panthera leo*, horse *Equus ferus*, and an extinct rhinoceros *Dicerorhinus hemitoechus*, which probably fed on low-growing vegetation (Ch. 5), is consistent with the palaeobotanical evidence for areas of herbaceous vegetation on the floodplain.

Numerous flint tools, from which the Clactonian industry is named, and a wooden spear have been recovered from the 'Clacton Channel' deposits (Ch. 10).

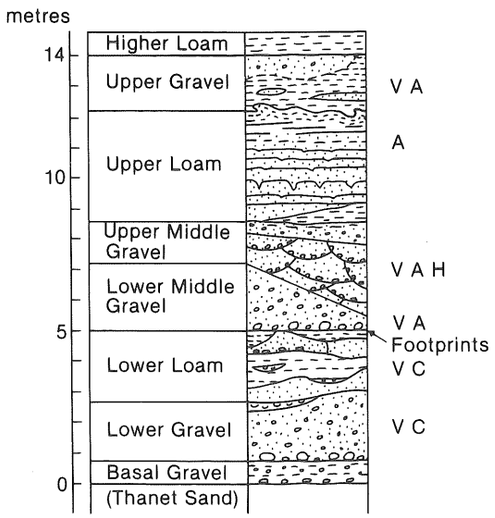


Fig. 7.6. Generalized section of Hoxnian and early Wolstonian deposits at Barnfield Pit, Swanscombe (modified and simplified from Conway & Waechter, in Shephard-Thorn & Wymer 1977). Note ice wedge casts (V-shaped) in upper beds. V, vertebrate fossils; H, human skull; C, Clactonian artefacts; A, Acheulian artefacts.

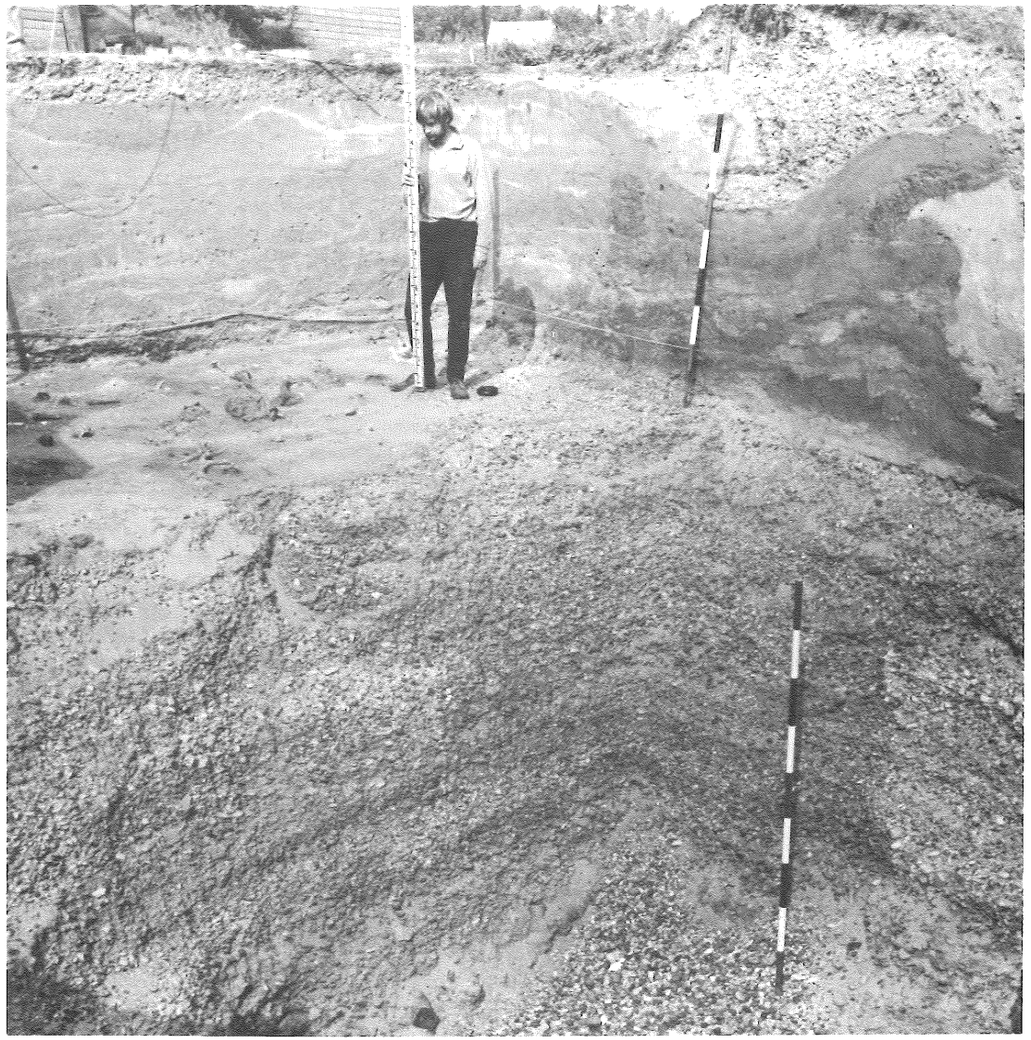


Fig. 7.7. Section in the lower part of the sequence of Hoxnian deposits at Barnfield Pit, Swanscombe, showing Lower Gravel (beneath figure) overlain by Lower Loam and Lower Middle Gravel. Note horizon rich in bones on surface of Lower Gravel.

At Barnfield Pit, Swanscombe, Kent – the famous human-skull site – a series of fluviatile gravels, sands and silts occupy a broad channel cut by an early River Thames (Figs. 7.6, 7.7). The stratigraphy, archaeology and palaeontology of the site were described in some detail in the memoir edited by Ovey (1964).

Subsequent excavations (1968–72) have been directed by J. Waechter and the findings are summarized by Conway and Waechter (in Shephard-Thorn and Wymer 1977).

As discussed in Chapter 2, the archaeology and vertebrate and molluscan faunas strongly suggest that at least the bulk of the sequence belongs within the Hoxnian Interglacial, and Kerney (1971) attempted to assign the beds to particular Hoxnian pollen zones. He suggested that the Lower Gravel and Lower Loam were deposited in zone Ho II,

whereas the Middle Gravels did not begin to accumulate until the end of zone Ho III, and deposition probably continued into the early part of the succeeding cold stage (Wolstonian).

The mammal faunas are listed in full (Table 7.2) based on data in Sutcliffe (1964) and material from the recent excavations. Artefacts are numerous in the deposits and show a succession from Clactonian flakes and cores in the Lower Gravel and Lower Loam, with Acheulian hand axes in the later deposits (Ch. 10). Some of the faunal material may be human food debris, but much of it was probably incorporated by natural processes and subsequently water-transported, as were the assemblages from other fluviatile deposits (Ch. 4).

According to Kerney, the terrestrial mollusc fauna of the Lower Gravel and most of the Lower Loam indicates reedswamp and fen, close to the depositional site, with drier open ground, and dry open woodland, probably of hazel (*Corylus*).

The mammalian fauna (Table 7.2, Swanscombe a) is consistent with regional mixed oak forest, including such woodland elements as macaque monkey *Macaca* sp., beaver *Castor fiber*, pine marten *Martes martes*, wild cat *Felis sylvestris*, *Palaeoloxodon antiquus*, *Sus scrofa*, *Dama dama* and *Capreolus capreolus*. Taxa consistent with probably rather local, more open habitats include rabbit *Oryctolagus cuniculus*, extinct pine vole *Pitymys arvaloides*, voles *Microtus* spp., *Panthera leo*, *Equus ferus*, *Dicerorhinus hemitoechus* and giant deer *Megaceros giganteus*.

From the vertebrate point of view, one of the most exciting results from the 1968–72 excavations was the discovery of an horizon of fossil footprints at the eroded junction between the weathered surface of the Lower Loam and the overlying gravels. A 5 m square yielded 92 prints mostly deer, but also including horse, bovid, rhino and elephant (see Fig. 5.35). Presumably these represent animals living immediately prior to the deposition of the Middle Gravels, that trampled the river bank when visiting the river to drink.

The terrestrial molluscs from the base of the Lower Middle Gravel suggest a more closed forest with subordinate open ground, whereas those from the Upper Middle Gravel indicate damp open grassland, which Kerney suggests belongs to the closing phases of the Hoxnian interglacial. Unfortunately, although fossil vertebrates occur in the Lower Middle Gravel, they were not collected separately from material from the higher beds. The Upper Middle Gravel mammal fauna (Table 7.2, Swanscombe b) is on the whole very similar to that of the Lower Gravel and Lower Loam. The smaller number of species recorded is probably due to the fact that far fewer fossils have been collected from the Upper Middle Gravel.

Contrary to the mollusc evidence, the records of *Palaeoloxodon antiquus* and especially *Dama dama* strongly suggest forest (and therefore a date within the interglacial), although other woodland indicators recorded from the older horizons may be absent. Most of the indicators of more open vegetational conditions, e.g. horse, giant deer, do however continue from the Lower Gravel and Lower Loam, joined by mountain hare *Lepus timidus* and the now arctic-boreal Norway lemming, *Lemmus lemmus*.

The fragments of human cranium were found about one metre above the base of the Upper Middle Gravel, at the same horizon as a number of pointed Acheulean hand axes.

The Swanscombe Lower Gravel has also yielded remains of pike *Esox lucius* (Patterson in Ovey, 1964), and birds identified as shoveller *Anas clypeata*, red-breasted merganser *Mergus serrator*, garden warbler *Sylvia borin* and others (Harrison 1979b). Cormorant *Phalacrocorax carbo*, eagle owl *Bubo bubo* and serin *Serinus serinus* are recorded by Harrison from the Lower Loam.

Shelly sands in Dierden's Pit, Ingress Vale, about 400 m north-west of Barnfield Pit, have also produced an abundance of vertebrate material. Kerney (1971) considered that the mollusc assemblage suggested a zone Ho III age. The mammal fauna (Sutcliffe 1964) (Table 7.2) is very similar to that of the Swanscombe Lower Gravel and Lower Loam, and to the Clacton Channel. It includes extinct beaver *Trogontherium cuvieri*, recorded from Clacton and other Hoxnian sites, but not Swanscombe. The find of a dolphin *Tursiops* sp. vertebra may represent an individual which swam up the river and perhaps became stranded.

Of particular interest is the record from Ingress Vale of European pond tortoise *Emys orbicularis* (Stuart 1979). Frog and/or toad bones, and teeth of cyprinid fishes, have also been found. Capercaillie *Tetrao urogallus* is recorded from this locality by Harrison (1979b).

At Hoxne, Suffolk, the type site for the Hoxnian Interglacial stage, organic lacustrine deposits occupy a basin in the Anglian Chalky Boulder Clay and are overlain by a series of fluviatile, lacustrine and solifluction deposits (Gladfelter & Singer 1975; Wymer 1974) (Table 7.3).

Table 7.3. Stratigraphical succession at Hoxne, Suffolk. (Based on West 1956; Gladfelter & Singer 1975; Turner, in West 1977c)

Beds (nomenclature after West 1956 (C to G); Gladfelter & Singer 1975 (1–10)).		Thickness (m)	Stage/pollen zone
9–10	Sand, gravel, silt	0.5–2.5	Wolstonian
7–8	Sands with ice-wedge casts	1.8	Wolstonian
6	Gravel	0.3	? Wolstonian
5	Sandy silt	0.5	? Wolstonian
1–4 (= C in part)	Silts and clays with seams of fine Chalk gravel, brecciated clay and clay-mud pebbles (Main faunal and archaeological horizon at base of Bed 1)	3.5	? Hoxnian, Ho III–IV
D	Lacustrine detritus mud	0.4	Hoxnian, Ho IIIa
E	Lacustrine clay-mud	6.5	Hoxnian, Ho IIa–c
F	Lacustrine clay-mud and marl	0.5	Late Anglian to Hoxnian Ho I
G	Chalky till (chalky boulder clay)	7.5	Anglian (glaciation)

Of the few vertebrates recovered from the lake deposits, *Trogontherium cuvieri* is recorded from Bed E (zone Ho II) and a mandible of *Palaeoloxodon antiquus* and bones of teeth of *Equus ferus* from the same bed can be dated more precisely to subzone Ho IIc. Flint flakes and an Acheulian hand axe, apparently in primary context, were also recovered from this subzone (Ch. 10). The palaeobotanical evidence (West 1956) indicates regional mixed oak forest throughout most of zone Ho II, with very limited open ground. Both the straight-tusked elephant and artefacts, however, come from an horizon within subzone Ho IIc, the 'Hoxne high non-tree pollen phase', marked by a temporary decline in forest and spread of herb communities (West 1956).

Abundant, but generally fragmentary, vertebrate remains have been recovered from two main horizons within the upper sequence. The lower horizon (Bed 1) has vertebrate and archaeological material, apparently in primary context, and immediately overlies lake muds of subzone Ho IIIa age, so that its age may lie within zones Ho IIIb to Ho IV. The fauna is being studied at present and only preliminary determinations are given here.

The mammal fauna (Table 7.2 – Hoxne c) includes *Macaca* sp., *Castor fiber Dama dama* and *Capreolus capreolus* indicative of forest. A number of flint blades, flakes, cores, scrapers and Acheulian hand axes have been recovered from this horizon. Bird and frog and/or toad bones were also found, together with a number of fishes including pike *Esox lucius*, three-spined stickleback *Gasterosteus aculeatus* and cyprinids.

Vertebrates recorded from Beds 4 and 5 are generally similar to those recorded from the lower archaeological horizon, Bed 1, with e.g. *Macaca* sp., *Trogontherium cuvieri* and *Equus ferus*, but Russian desman *Desmana moschata* and the nowadays arctic-boreal *Lemmus lemmus* also occur.

Archaeological material includes cores, scrapers, flakes and hand axes.

The faunal assemblage, with juxtaposed forest elements and *Lemmus lemmus*, may represent the closing phases of the interglacial (i.e. zone Ho IV), perhaps an interstadial within the early Wolstonian.

Lacustrine deposits at Copford, Essex, have yielded pollen characteristic of the Hoxnian interglacial (Turner 1970). Fossils found during the last century include a bear *Ursus* sp. and *Trogontherium cuvieri*. Fishes recorded from Hoxnian lacustrine deposits at Nechells, Birmingham, include rudd *Scardinius erythropthalmus*, roach *Rutilus rutilus*, bleak *Alburnus alburnus*, pike *Esox lucius* and perch *Perca fluviatilis* (Shotton & Osborne 1965).

Hoxnian faunal history

The small number of sites and the stratigraphical uncertainties preclude any detailed analysis of the faunal history of the Hoxnian Stage. Nevertheless the appearance of *Lemmus* late in the interglacial, perhaps in response to opening out of the forest,

parallels the situation in the Ipswichian and probably Cromerian interglacials. The most striking observation on the Hoxnian faunal succession is that *Dama dama* and *Palaeoloxodon antiquus* evidently persisted until late in the stage (? zone Ho IV), whereas in the Ipswichian they disappeared much earlier. Other characteristics of the Hoxnian which contrast with the Ipswichian, include the presence of the rhinoceros *Dicerorhinus kirchbergensis* in addition to *D. hemitoechus*, and the apparent absence of mammoth *Mammuthus primigenius*, extinct bison *Bison priscus*, and spotted hyaena *Crocuta crocuta*.

The single record of *Emys orbicularis* indicates that summer temperatures in southern England, at least in the middle part (? zone Ho III) of the interglacial, were higher than those of the present day.

Comparison with Continental faunas

On the European Continent faunas which can be attributed with reasonable confidence to the Holsteinian (= Hoxnian) Interglacial are rare. River gravels at Steinheim, Würtemburg, in southern Germany have yielded a fauna resembling those of the Lower Gravel and Lower Loam at Swanscombe and of the Clacton Channel, with the interesting additions of extinct bison *Bison priscus* and extinct buffalo *Buffelus murrensis* Burkemer (Adam 1954, 1975). This is also the locality of the famous human skull which compares closely with the much less complete specimen from Swanscombe (Ch. 3). Buffalo occurs also at Schönebeck, East Germany, in association with a temperate fauna. The assemblage from a cave deposit at Heppenloch, Swäbische Alb, West Germany, has also been attributed to the Holsteinian (Adam 1975). The species recorded compare closely with those of Steinheim and Swanscombe, with the interesting addition of an extinct dhole *Cuon alpinus*.

Lacustrine clays, dated by pollen spectra to the Holsteinian interglacial, occur at Neede, Netherlands. Vertebrate finds include the extinct beaver *Trogontherium cuvieri* (Hooijer 1959). Conspicuously absent from all European faunas of this stage are spotted hyaena *Crocuta crocuta* and hippopotamus *Hippopotamus* sp. Of considerable interest is the lack of bison *Bison priscus*, buffalo *Buffelus murensis* and mammoths *Mammuthus* spp. in the British Hoxnian. This and the corresponding lack of aurochs *Bos primigenius* in central Europe indicates some geographical differences in faunas relating to the degree of oceanity or continentality of the climate.

Ipswichian

Sites and faunas (Fig. 7.8, Table 7.4)

From the vertebrate point of view the Ipswichian is by far the best known of the interglacials, only excepted the Flandrian. Vertebrate records from a large number of open sites, generally with fluviatile deposits, can be assigned with varying degrees of precision to particular pollen assemblage zones or subzones (Table 7.4). In addition, on the assumption that *Hippopotamus amphibius* is diagnostic of

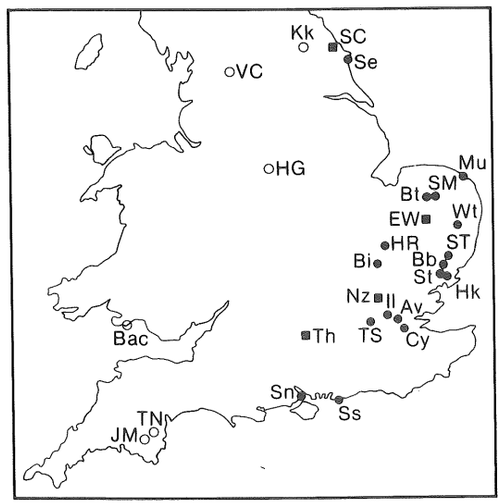


Fig. 7.8. Location map of Ipswichian and Flandrian vertebrate sites. ●, Ipswichian; ■, Flandrian; (cave sites shown by open symbols). Av, Aveley; Bac, Bacon Hole; Bb, Bobbitshole, Ipswich; Bi, Barrington; Bt, Beetley; Bur, Burwell; Cy, Crayford; EW, East Wretham near Thetford; HG, Hoe Grange Cave; Hk, Harkstead; HR, Histon Road; Il, Ilford; JM, Joint Mitnor Cave; Kk, Kirkdale Cave; Mu, Mundesley; Nz, Nazeing; SC, Star Carr; Se, Sewerby; SM, Swanton Morley; Sn, Stone; Ss, Selsey; St, Stutton; ST, Stoke Tunnel; Th, Thatcham; TN, Tornewton Cave (Hyaena Stratum); TS, Trafalgar Square; VC, Victoria Cave; Wt, Wortwell.

Fig. 7.9. View of fossiliferous Ipswichian organic deposits (subzones Ip IIa, b), overlain by Devensian gravels, at Swanton Morley, Norfolk.

the Ipswichian, rather than the Hoxnian, a number of cave and open-site faunas lacking pollen can also be dated fairly confidently to the Ipswichian interglacial. The small-mammal fauna is, however, less well known than might be expected from the lists of larger mammals.

The faunas from most of the important Ipswichian sites were previously discussed by the author (Stuart 1976a). The opportunity is taken here of revising and up-dating this account.

Horse *Equus ferus* is recorded from freshwater deposits covering the end of the Late Wolstonian to Ipswichian subzone Ia at Selsey, Sussex (West & Sparks 1960). During these zones birch woodland and pine replaced the late-glacial herb-dominated vegetation. Later horizons, zones Ib to early IIb, have yielded typical mid-Ipswichian taxa, plus evidence of man (Ch. 10).

So far the only recorded fauna of definite subzone Ip IIa age comes from Swanton Morley, Norfolk (Fig. 7.9), in association with palaeobotanical evidence for temperate mixed coniferous-deciduous forest and local herb-dominated communities (Coxon *et al.* 1980). This fauna resembles faunas of Ip IIb age from a number of sites, except that European pond tortoise *Emys orbicularis* (not definitely recorded from subzone Ip IIb) and northern vole *Microtus oeconomus* are recorded from this subzone Ip IIa horizon. The fossil assemblage includes large-mammal bones chewed by spotted hyaena *Crocuta crocuta*, and hazelnuts opened by wood mouse *Apodemus sylvaticus* (Ch. 5).

The same locality has yielded a sparse and unremarkable zone Ip IIb fauna, and the sole record (two individuals) of *Hippopotamus amphibius* from early in zone Ip III.

The best pollen-dated fauna of subzone Ip IIb age is from Barrington, Cambridgeshire, where around the turn of the century a spectacular assemblage of mammal bones were recovered from calcareous fluvial sediments of a tributary of the River Cam (Gibbard & Stuart 1975) (Fig. 7.10). The pollen spectra indicate regional mixed oak forest, but the extraordinarily high herb pollen levels suggest that

Table 7.4. Pollen-dated records of Ipswichian mammals and *Emys orbicularis* (N.B. no pollen spectra have been obtained from Crayford, which is only tentatively assigned to zone Ip IV). (Modified from Stuart 1976a) Wo; Wolstonian

Site:	Selsey	Selsey Mundesley	Bobbitshole	Swanton Morley	Beetley	Beetley Barrington Trafalgar Square Stone Wortwell Swanton Morley Aveley	Swanton Morley Aveley	Stutton	Harkstead Ilford	Lexden Stoke Tunnel Crayford
Pollen zones:	IWo–Ia	Ib–early IIb	IWo–IIb	IIa	IIa–IIb	IIb	early III	III (?–IV)	?III (?–IV)	?IV
MAMMALIA										
Insectivora										
1. *Sorex araneus* L., common shrew	–	– –	–	+	–	– – – – – – –	– –	+	– –	– – –
2. *Sorex minutus* L., pigmy shrew	–	– –	–	+	–	– – – – – – –	– –	–	– –	– – –
3. *Neomys fodiens* (Pennant), water shrew	–	– –	–	–	–	– – – – – – –	– –	+	– –	– – –
4. *Crocidura* cf. *suaveolens* (Pallas), lesser white-toothed shrew	–	– –	–	–	–	– – – – – – +	– –	–	– –	– – –
Primates										
5. *Homo sapiens* L., man (artefacts)	–	+ –	–	–	–	– – – – – – –	– –	+	– ?	– + +
Rodentia										
6. *Spermophilus* sp., suslik	–	– –	–	–	–	– – – – – – –	– –	–	– –	– – +
7. *Castor fiber* L., beaver	–	+ –	+	–	–	– – – – – – –	– –	+	– +	– – –
8. *Dicrostonyx torquatus* (Pallas), arctic lemming	–	– –	–	–	–	– – – – – – –	– –	–	– –	– – +
9. *Lemmus lemmus* (L.), Norway lemming	–	– –	–	–	–	– – – – – – –	– –	–	– –	– – +
10. *Clethrionomys glareolus* (Schreber), bank vole	–	– –	+	+	–	– – – – – + +	– –	–	– –	– – –
11. *Arvicola cantiana* (Hinton), extinct water vole	–	– –	+	+	–	– + – – – + +	– +	+	+ +	– + –
12. *Microtus agrestis* (L.), field vole	–	– –	(+)	+	–	– + – – – (+)(+)	– –	+	– –	– + –
13. *Microtus oeconomus* (Pallas), northern vole	–	– –	–	+	–	– – – – – – –	– –	+	– –	– + +
14. *Apodemus sylvaticus* (L.), wood mouse	–	– –	+	+	–	– – – – – + –	– –	+	– –	– – –
Carnivora										
15. *Canis lupus* L., wolf	–	– –	–	–	–	– + – – – – –	– –	–	– –	– + +
16. *Ursus arctos* L., brown bear	–	– –	–	–	–	– + – – – – –	– –	–	– +	– (+) +
17. *Meles meles* (L.), badger	–	– –	–	–	–	– + – – – – –	– –	–	– –	– – –
18. *Crocuta crocuta* Erxleben, spotted hyaena	–	– –	–	+	–	– + – – – – –	– –	–	– –	– – –
19. *Panthera leo* (L.), lion	–	– –	–	–	–	– + + – – – –	– –	+	– +	– + +
Proboscidea										
20. *Palaeoloxodon antiquus* Falconer & Cautley, (extinct) straight-tusked elephant	–	+ +	–	–	+	– + + + + + +	– –	+	+ +	– – –
21. *Mammuthus primigenius* Blumenbach, (extinct) Mammoth	–	– –	–	–	–	– – – – – – –	– +	+	+ +	+ + +
Perissodactyla										
22. *Equus ferus* Boddaert, horse	+	– –	–	–	–	– – – – – – –	– +	+	+ +	– + +
23. *Dicerorhinus hemitoechus* (Falconer), extinct rhinoceros	–	+ –	–	–	–	– + (+) – – – –	– –	–	– +	+ – +
24. *Coelodonta antiquitatis* Blumenbach (extinct) woolly rhinoceros	–	– –	–	–	–	– – – – – – –	– –	–	– –	– + +
Artiodactyla										
25. *Hippopotamus amphibius* L., hippopotamus	–	– –	–	–	–	+ + + – – – –	+ –	–	– –	– –
26. *Megaceros giganteus* Blumenbach, (extinct) giant deer	–	– –	–	–	(+)	– + + – – – –	– –	+	– +	– +
27. *Dama dama* (L.), fallow deer	–	– –	–	(+)	–	– + + – – + –	– –	–	– –	– –
28. *Cervus elaphus* L., red deer	–	– –	–	+	+	– + + – – – –	– +	+	+ +	– + +
29. *Bos primigenius* Bojanus, (extinct) aurochs	–	– –	–	+	–	– + + – – – –	+ –	–	– +	– – +
30. *Bison priscus* Bojanus, extinct bison	–	– –	–	–	–	– + + – – – –	– –	–	– +	– – +
31. *Bos* sp., aurochs, or *Bison* sp., bison	–	– –	–	+	–	– – – – – – +	– +	+	+ –	– + –
32. *Ovibos moschatus* (Zimmerman), musk ox	–	– –	–	–	–	– – – – – – –	– –	–	– –	– – +
REPTILIA										
Chelonia										
33. *Emys orbicularis* L., pond tortoise	–	+ +	+	+	–	– – – – – – –	– –	–	+ –	– + –

Fig. 7.10. Excavating a rhinoceros *Dicerorhinus hemitoechus* skull from Ipswichian marls, sands and gravels at Barrington, Cambridgeshire, in 1900.

the broad river valley was largely deforested, probably due to the activities of large herbivores. Thus situation appears to be reflected in the fauna, which includes *Crocuta crocuta* and lion *Panthera leo*, neither of which favour dense forest at the present day (Ch. 5). The presence of a number of fossils, including two skulls of *C. crocuta*, a species generally very unusual in faunas from open sites, perhaps suggests that the hyaenas were scavenging close to the river, and were occasionally drowned. The presence of a giant deer *Megaceros giganteus* in which the males had enormous outspread antlers, is consistent with an open or lightly wooded environment. The extinct rhinoceros *Dicerorhinus hemitoechus* appears to have fed on grasses and other low-growing herbs rather than leaves, and the extinct *Bison priscus* was also probably a grazer (Ch. 5). *Hippopotamus amphibius* at Barrington presumably fed on grasses and probably other herbs, for which it may have travelled for a considerable distance away from the river, as do the living African animals.

Species more at home in the forest, including badger *Meles meles*, fallow deer *Dama dama*, and probably also straight-tusked elephant *Palaeoloxodon antiquus*, were however also present. Interestingly enough there is no trace of horse *Equus*, even though the local habitat would appear to have been very suitable.

Several other pollen-dated faunas and isolated records are available for this subzone (Table 7.4). It should be pointed out, however, that the associated

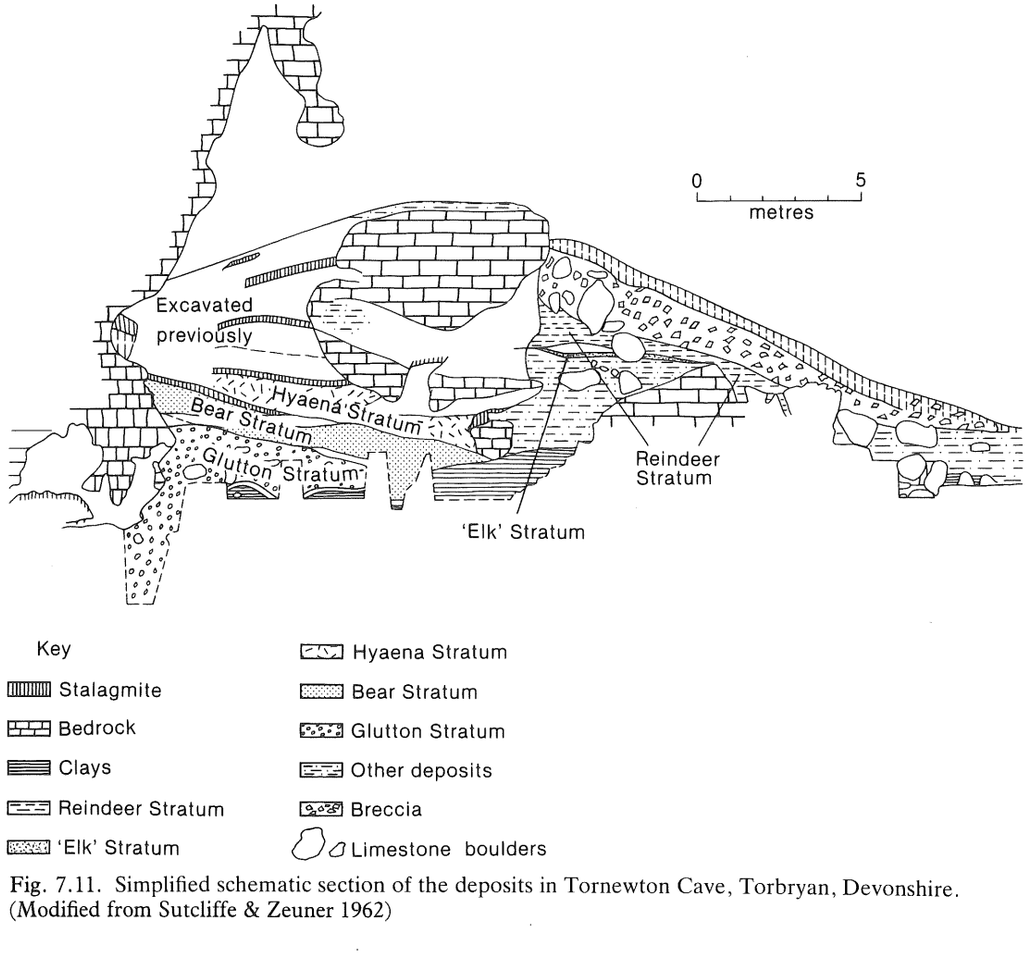


Fig. 7.11. Simplified schematic section of the deposits in Tornewton Cave, Torbryan, Devonshire. (Modified from Sutcliffe & Zeuner 1962)

herb pollen levels are extremely variable but generally very much lower than those recorded from Barrington. *Palaeoloxodon antiquus, Emys, orbicularis* and a skeleton of red-throated diver *Gavia stellata* were found in deposits of zone Ip Ib-IIb age at Mundesley, Norfolk (Newton 1883). Large-mammal faunas including *Crocuta crocuta, Palaeoloxodon antiquus, Dicerorhinus hemitoechus, Hippopotamus amphibius, Dama dama*, etc., but lacking *Equus ferus*, i.e. resembling faunas pollen-dated to subzone Ip IIb, are known from a number of open and cave sites in England and Wales. They probably date from zone Ip II or possibly, in part, even from zone I, since comparative dated faunas from the early part of the stage are almost unknown.

The faunas from two carefully excavated cave sites, Joint Mitnor Cave (Sutcliffe 1960) and Tornewton Cave (Hyaena Stratum) (Fig. 7.11). Sutcliffe & Zeuner (1962), both in Devon, include taxa not so far recorded from pollen-dated sites, namely a hare *Lepus* sp., red fox *Vulpes vulpes*, wild cat *Felis sylvestris* and wild boar *Sus scrofa*. Roe deer *Capreolus capreolus* is recorded only from Hoe Grange Cave, Derbyshire, in cave deposits of probable Ipswichian age (Bemrose & Newton 1905).

The rich fauna from a single thin horizon at Kirkdale Cave, Kirkby Moorside, Yorkshire, is of considerable historical importance, having first been described by Buckland (1822) (see Ch. 1). The faunal list revised by Boylan (1972; and in Catt 1977) is very similar to that of Joint Mitnor Cave, and can similarly be attributed to the middle of the Ipswichian interglacial.

Victoria Cave, near Settle, Yorkshire (latitude 54° 05′ N) is the most northerly site so far discovered to yield an Ipswichian-type fauna, including *Hippopotamus amphibius, Palaeoloxodon antiquus* and *Dicerorhinus hemitoechus* (Boylan, in Catt 1977). The cave is in a prominent Carboniferous Limestone cliff (Langcliffe Scar) at a height of 440 m O.D. The isolated record of *H. amphibius* from Stockton-on-Tees (latitude 54° 35′ N), however, marks the northernmost known occurrence of any of these species (Ch. 5).

'Hippopotamus faunas', probably dating from the middle of the Ipswichian, but possibly dating from earlier within this interglacial, are known from numerous sites in England and Wales. Significantly, all of the localities (Fig. 7.12) are south of the maximum limit of advance of the Devensian ice sheets, except for some caves in which the fossiliferous deposits were protected from glacial erosion, and the raised beach deposits at Sewerby, exposed in coastal section beneath Devensian till (Boylan 1967a).

Interglacial deposits north of the Devensian glacial ice limit would have mostly either been destroyed or buried beneath glacial deposits.

At Aveley, Essex, fluviatile organic deposits containing pollen characteristic of subzone Ip IIb yielded much of a skeleton of *Palaeoloxodon antiquus* (West 1969). The horizon has otherwise produced a sparse vertebrate assemblage which, however, includes the only British Pleistocene recorded of lesser white-toothed shrew *Crocidura* cf. *suaveolens*. The pollen spectra indicate temperate mixed oak forest vegetation. Immediately above the first elephant was found a second skeleton, this time of mammoth *Mammuthus primigenius* in sediments of zone Ip III age (Fig. 7.13), with pollen indicating a less dense forest cover. *Equus ferus* is also recorded. The situation of the elephant skeletons, marginal to the river channel cut in London Clay (Eocene), suggests that they became mired in the soft sediments and were unable to extricate themselves because of the steep slippery clay bank.

Unoxidized sediments with plant fossils are un-

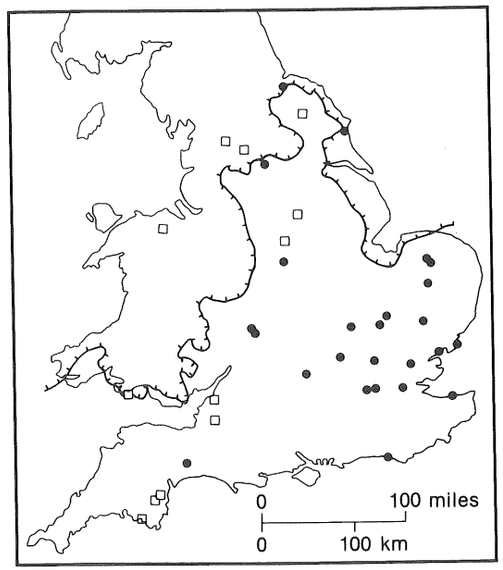
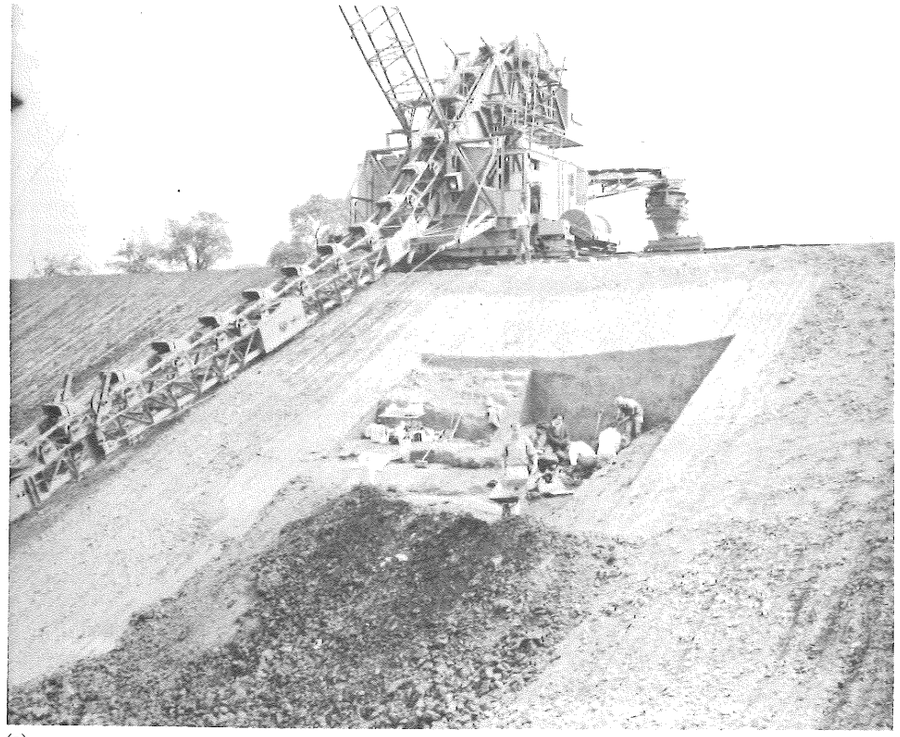


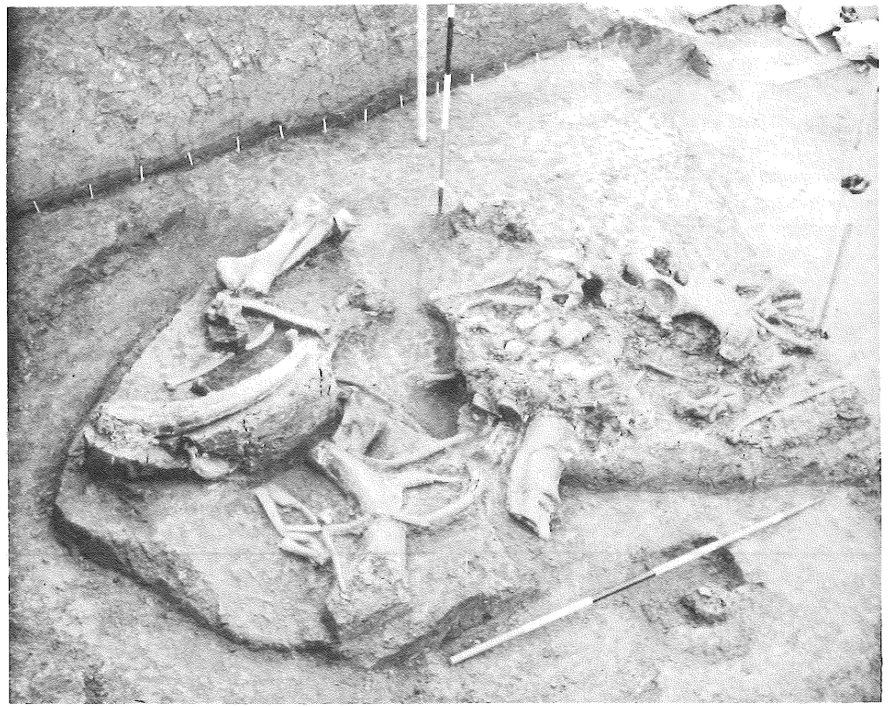
Fig. 7.12. Map showing representative finds of hippopotamus *Hippopotamus amphibius* either dated to, or presumed to date from, the Ipswichian Interglacial (cave sites are shown by open squares). The Devensian till limit is also shown.



(a)

(b)

Fig. 7.13. *For caption, see over*



(c)

Fig. 7.13. Excavations of skeletons of straight-tusked elephant *Palaeoloxodon antiquus* and mammoth *Mammuthus primigenius* found in Ipswichian deposits, channelled into London Clay, at Aveley, Essex. (a) general view; (b) excavating the skeletons – *P. antiquus* below (subzone Ip IIb), *M. primigenius* above (zone Ip III); (c) skeleton of *M. primigenius* after excavation.

fortunately rather rare from the second half of the Ipswichian, so that it is difficult to assign many vertebrate assemblages to precise pollen zones. For example, the fauna from Stutton, on the Stour Estuary, Suffolk, comes from oxidized sandy silts ('brickearths'), often rich in non-marine Mollusca (Fig. 7.14), about 1–2 m above the horizon of a single pollen spectrum, fortunately highly characteristic of zone Ip III (Sparks & West 1963). Taxa recorded include *Palaeoloxodon antiquus, Mammuthus primigenius, Equus ferus* and *Microtus oeconomus*. A similar fauna with the addition of *Emys orbicularis* is known from similar deposits at the same height at nearby Harkstead. The general stratigraphical position of the Stutton fauna is confirmed by an almost identical fauna from several pits in 'brickearths' at Ilford, Essex (Cotton 1847; Woodward & Davies 1874). The Ilford vertebrate assemblages appear to post-date subzone Ip IIb organic deposits occupying a channel at Seven Kings, Ilford (West *et al.* 1964) (see Ch. 2). Harrison and Walker (1977) record a swan *Cygnus* sp., white-fronted goose *Anser albifrons*, greylag goose *Anser anser*, mallard *Anas platyrhynchos* and a large crane '*Grus primigenia*' (sarus crane *Grus antigone*). The latter is nowadays restricted to India, Burma and Thailand. The sparse fauna from Histon Road, Cambridge, formerly attributed to a zone Ip III–IV horizon (Stuart 1976a), is now known to include fallow deer *Dama dama* (Lister 1981) which suggests that some material comes from an earlier horizon.

Mammalian fossils were recovered from the base of terrace gravels of the River Stour at Brundon, Suffolk, in association with artefacts of Levalloisian type (Moir & Hopwood 1939). The fauna includes *Palaeoloxodon antiquus, Mammuthus primigenius, Equus ferus, Cervus elaphus, Megaceros giganteus, Bos primigenius* abd *Bison priscus*. The height relationships and mollusc fauna suggest correlation

Fig. 7.14. Detail of sandy silts ('brickearth') of late Ipswichian age, rich in molluscan shells, including *Corbicula fluminalis*, and small vertebrates, at Stutton, Suffolk.

with Stutton, i.e. approximately zone Ip III, and this is supported by the close similarity of the vertebrate faunas of the two sites.

An extensive series of pits in Thames terrace 'brickearths' and sands in the area of Grays and West Thurrock, Essex, yielded large quantities of mammalian remains, chiefly during the last century. Deposits of more than one interglacial appear to be present in this area, but most of the faunal material is probably of Ipswichian age. The fauna from the Tunnel Cement Works Quarry, West Thurrock, was listed by Abbot (1890) and the surviving material revised by Carreck (1976), who attributed the deposits at this site to the later part of the Ipswichian. The fauna appears to be similar to that of Ilford.

Evidence for the faunas at the very end of the Ipswichian is provided mainly by the assemblages from Crayford, Kent (Kennard 1944), and Stoke Tunnel, Suffolk (Layard 1920). The 'brickearths' from the former site are at a similar height to the 'brickearths' of Ilford, Aveley and other Lower Thames localities. The fauna, however, which includes a suslik *Spermophilus* sp., lemmings, woolly rhinoceros *Coelodonta antiquitatis*, and musk ox *Ovibos moschatus*, together with more typically interglacial species, appears to be transitional to a typically Devensian fauna and would therefore be rather later than the other interglacial sites. A similar but less rich assemblage from Stoke Tunnel, which however also includes *Emys orbicularis*, is associated with organic sediments within a sequence of 'brickearths' and gravels. A preliminary pollen analysis by C. Turner (Turner, in West 1977c) is not inconsistent with a zone Ip IV age. Harrison and Walker (1977) record smew *Mergus albellus*, jungle fowl *Gallus gallus* and coot *Fulica atra* from Crayford.

At Bacon Hole Cave, on the coast of Gower, South Wales, a series of about 8 m of sands, clays, cave earths and breccias have yielded a succession of faunas at a single site, apparently covering much of the Ipswichian interglacial (Stringer 1975, 1977). The lower beds contain much marine mollusc

material, while its absence from the younger beds suggests recession of the sea from the vicinity of the cave. The oldest beds ('orange and grey sands') contain horse *Equus ferus* and a large form of northern vole *Microtus oeconomus* (Ch. 11) and may date from the Late Wolstonian or early Ipswichian. The next group of beds ('sandy breccio-conglomerate' and 'sandy cave earth') have yielded a temperate fauna including *Palaeoloxodon antiquus*, *Cervus elaphus*, lion *Panthera leo*, wood mouse *Apodemus sylvaticus*, bank vole *Clethrionononomys glareolus*, field vole *Microtus agretis* and water vole *Arvicola cantiana*, but *Microtus oeconomus* is virtually absent. These beds may date from about the middle of the interglacial. The faunas from the succeeding beds ('grey clays, silts and sands', 'coarse brown sands', 'upper cave earth') show the return of *M. oeconomus* in association with a largely temperate fauna, which includes spotted hyaena *Crocuta crocuta*. Mammoth *Mammuthus primigenius* occurs in the 'grey clays and sands', while *P. antiquus* occurs in the 'upper cave earth'. This part of the sequence may represent much of the second half of the Ipswichian, but not the final phases.

Ipswichian faunal history

A summary of the important changes in the Ipswichian vertebrate fauna is given in Fig. 7.15.

Equus ferus is known from the very beginning of the Ipswichian (or the very end of the Wolstonian) in association with probable open birch and pine woodland or open grassland. No other zone Ip I fauna is available, and a subzone Ip IIa fauna is known from one site only. The latter, however, suggests that most of the elements of the subzone Ip IIb faunas were already present by Ip IIa, in association with regional mixed coniferous-deciduous forest. The occurrence of *Emys orbicularis*, assuming that the fossils represent breeding populations, indicates that summer temperatures in subzone Ip IIa were rather higher than at the present day.

The classic Ipswichian faunal assemblage ('hippopotamus fauna') of subzone Ip IIb age, associated with regional mixed oak forest, but generally also with probably local herbaceous vegetation, includes *Crocuta crocuta*, *Palaeoloxodon antiquus*, *Dicerorhinus hemitoechus*, *Hippopotamus amphibius* and *Dama dama*. *Mammuthus primigenius* and curiously also *Equus ferus* appear to have been absent from this subzone. Similar fossil assemblages from a number of cave and open sites also lack these taxa, so that it is almost certainly a real phenomenon, perhaps related to the density of the regional forest cover. On the other hand, the apparent absence of man from subzone Ip IIb is less certain (see Ch. 10).

Zone III saw the reappearance of mammoth and horse, possibly reflecting a regional opening out of the forest cover. Neither *Dama dama* nor *Crocuta crocuta* are recorded later than subzone Ip IIb, but the latter species is in any case rare from open sites so that its apparent absence may not be significant.

Hippopotamus amphibius is recorded at one site from the beginning of zone Ip III, but it presumably disappeared shortly afterwards.

By zone Ip IV, rather open coniferous forest had replaced the earlier temperate woodlands. *Palaeoloxodon antiquus* had disappeared, and arctic-boreal species *Dicrostonyx torquatus*, *Lemmus lemmus*, *Ovibos moschatus*, and an extinct characteristically cold-stage species *Coelodonta antiquitatis*, had appeared. Another remarkable addition was *Spermophilus* sp. since this genus is now found in non-forested biotopes including steppe. These taxa were, however, accompanied by several interglacial species including *Bos primigenius* and *Emys orbicularis* – the latter indicative of considerable summer warmth (Ch. 5).

Such a fauna would be consistent with a continental climate, in the sense of large seasonal temperature fluctuations – a conclusion in agreement with the vegetational evidence (Ch. 2).

The faunal succession from Bacon Hole Cave appears, to a large extent, to corroborate the succession pieced together from a number of open sites, and strongly suggests that they all belong to a single (Ipswichian) interglacial (Ch. 2).

Comparison with Continental faunas

The rich fossil vertebrate assemblages from travertine deposits in Thüringia, East Germany, have been described in great detail in a series of publications edited by Kahlke (1974, 1975c, 1977, 1979). The faunas from Weimar Ehringsdorf (Lower Travertine), Taubach near Weimar, and Burgtonna are remarkably similar to one another. The presence of vertebrates, molluscs and macroscopic plant fossils of temperate character indicates interglacial conditions, and the deposits very probably

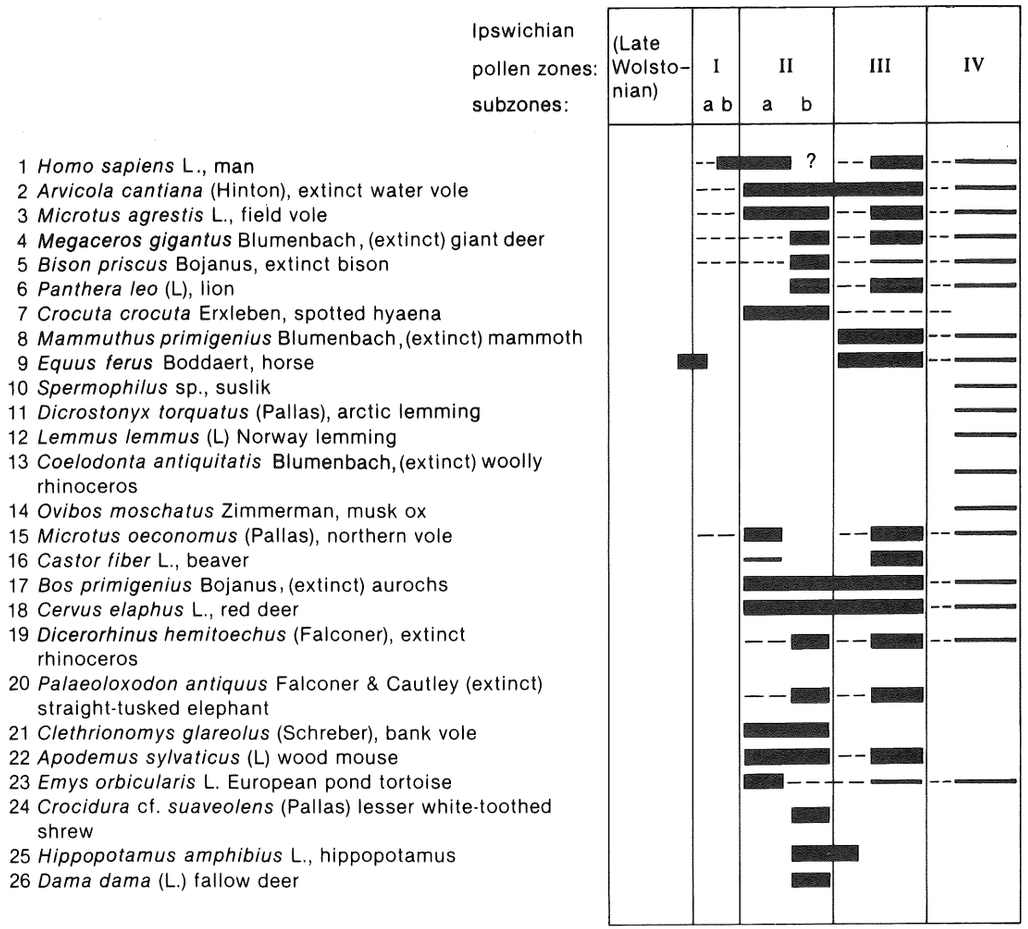


Fig. 7.15. Summary of faunal changes during the Ipswichian Interglacial in southern England.

date from the middle of the Last (Eemian, Ipswichian) Interglacial. The faunas closely resemble those of Ipswichian zone Ip II age from England, with certain very interesting exceptions. *Hippotamus amphibius* and *Bos primigenius*, common in English faunas, are unknown from Germany, while conversely an elk, referred to a subspecies of *Alces latifrons*, and common hamster *Cricetus cricetus* are present in Germany but not England. Moreover, horse *Equus ferus*, abundant at the German sites, is absent from Ipswichian zone II in England. These differences probably reflect regional distributions of species in response to the degree of oceanity or continentality of the climate.

Aesculapian snake *Elaphe* cf. *longissima*, now found considerably further south in Europe, is present in the German Eemian faunas, implying rather higher summer temperatures in the past.

Neanderthal man *Homo sapiens neanderthalis*, is represented by both bones and artefacts at Ehringsdorf, and artefacts only at Taubach. The apparent absence of man from the mid-Ipswichian in Britain is not readily explicable (Ch. 10).

Faunas of probable Eemian age and resembling those of the mid-Ipswichian in England, including *Hippopotamus amphibius*, are recorded from Spain (e.g. Olazagutia Cave, Yacimiento de Coscobilo, Navarra, France (e.g. Grotte du Prince, Ligurie italienne) and Italy (Saccopastore, Porta Pia, Rome) (Kahlke 1975a; Segre 1948). The last site, like Ehringsdorf, has also yielded artefacts and skeletal remains of Neanderthal man.

The '25 foot' raised beach at Belle Hougue Cave, Jersey, Channel Islands, has yielded remains of a very small red deer *Cervus elaphus*. These finds, of probable Last Interglacial age, appear to represent a dwarf island form (Zeuner 1946).

Flandrian

Sites and faunas (Figs. 7.8, 7.16)

The Flandrian falls well within the range of radiocarbon dating, and is in fact defined as the period post-dating 10 000 radiocarbon years B.P. (Ch. 2). In addition, both the vegetational history and archaeological sequence of cultures are known in far greater detail than for earlier stages.

The history of the wild vertebrate fauna through the stage has not been comprehensively studied, however, and would undoubtedly repay a thorough investigation. None the less, a great deal can be gleaned from the available information, since fortunately there exist good well-dated faunas from the very beginning of the stage and the modern fauna is of course well known. There is also documentary evidence for the existence of several nowadays extinct large mammals in historical times, together with a number of dated records of isolated finds, but few faunas, scattered throughout Flandrian time, which help to build up an overall picture of Flandrian faunal history. An attempt to synthesize the available evidence is given in Fig. 7.16.

At Thatcham, near Newbury, Berkshire, algal marls overlying gravels of the River Kennet yielded Mesolithic bone and flint artefacts together with numerous vertebrate remains (Wymer 1962; Churchill 1962). Both the pollen spectra, representing zones IV to VIa (Fl Ia–IIa), and the series of radiocarbon dates, ranging from 10 365 ± 170 to 8 480 ± 160 years B.P., show that the deposits cover a long period of time. Nevertheless, the bulk of the artefacts and fauna were found in the lower deposits of broadly zone IV (Fl Ia) age, when the region was probably clothed by birch and pine forest, with areas of herbaceous and marsh vegetation around the depositional site.

Lacustrine muds at Star Carr, East Yorkshire, with radiocarbon dates of 9 488 ± 350 years B.P. and 9 557 ± 210 years B.P., have produced spectacular evidence of lake-side occupation by Mesolithic hunter-gatherers. The deposits have yielded numerous flint and antler artefacts together with animal bone food debris (Clark 1954). Pollen analyses indicate occupation within the later part of zone IV (Fl Ia). Closed birch and pine woods clothed the dry land but a few open herb communities probably grew between the forest and the water's edge. Narrow reedswamp fringed the shore and aquatic plants grew in deeper water (Godwin, in Clark 1954).

At both sites the fossil assemblages are made up almost entirely of the remains of animals killed by Mesolithic hunters, and are therefore a biased sample of the fauna of that time, especially in the scarcity of small vertebrates. The Thatcham and Star Carr mammal faunas are very similar (Table 7.5). Of particular interest are the records of domestic dog (Degerbøl 1961; Wymer 1962), which are among the earliest in the world. The occurrence of hedgehog *Erinaceus europaeus*, badger *Meles meles*, wild boar *Sus scrofa* and aurochs *Bos primigenius*, in association with regional birch-pine forest is also noteworthy (see below). Other important records from Thatcham only, are of rabbit *Oryctolagus cuniculus*, which the excavators stress was sealed by algal marl and therefore not a modern intrusion, and horse *Equus ferus*, probably associated with generally open vegetational conditions at the beginning of pollen zone IV (Fl Ia), or from the very end of the Late Devensian, pollen zone L-De III.

Not surprisingly, most of the bird species recorded nowadays frequent lakes and fens.

Wheeler (1978) has interpreted the absence of

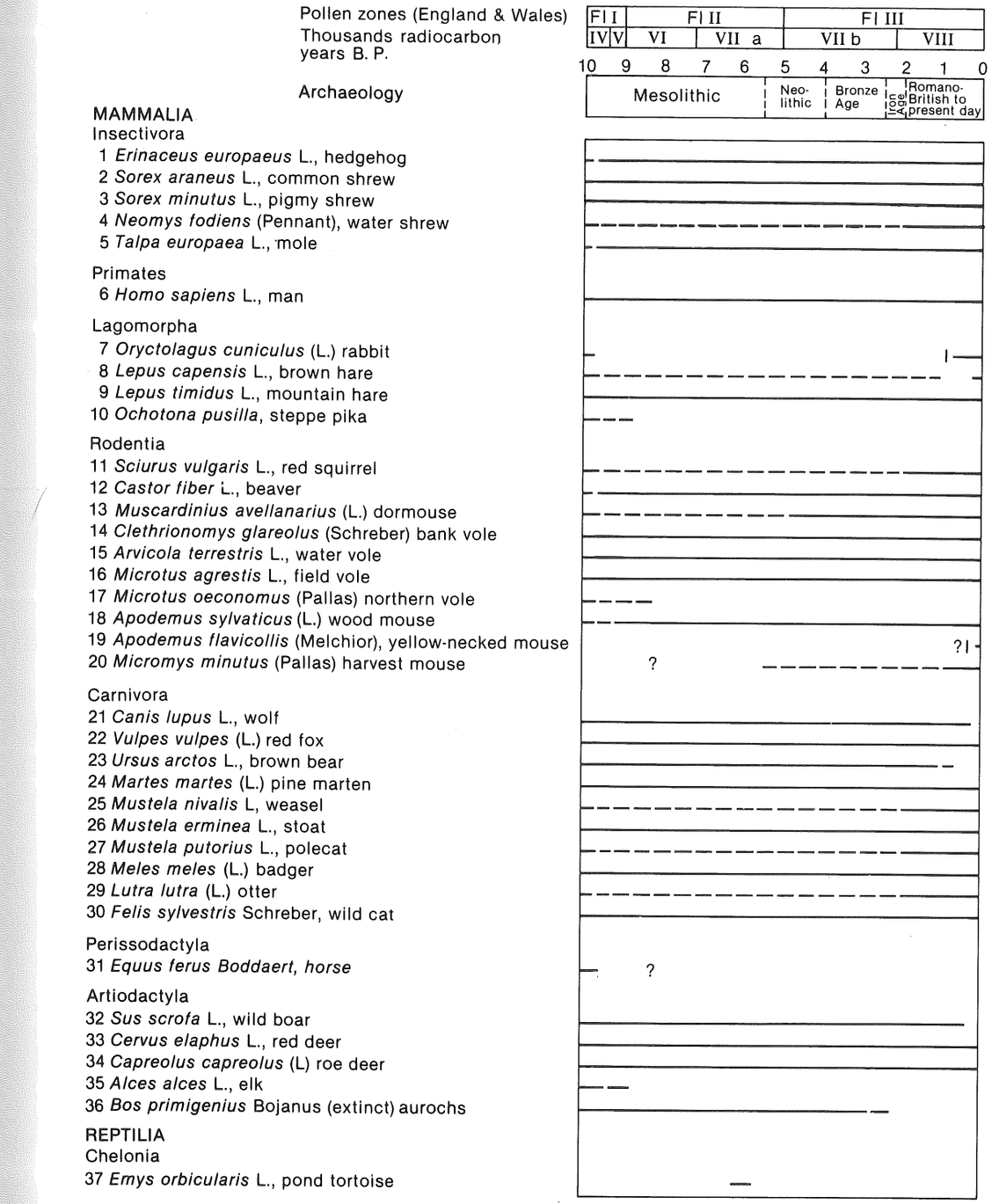


Fig. 7.16. Summary of faunal changes during the Flandrian in Britain. [1] introduced