

## Evidence from Lincolnshire of the age and intensity of the mid-Devensian temperate episode

THE study of fossil beetles from several sites has indicated a period of temperate climate in the middle of the Devensian (Weichselian)<sup>1</sup>. Upton Warren (Worcestershire), dated at about 42,000 yr BP, yielded an assemblage composed, in part, of thermophilous beetles<sup>2</sup>. At Four Ashes (Staffordshire) deposits of the same age which contain warm species overlie Devensian silts of arctic aspect<sup>3</sup>. A further warm fauna of this age has been investigated from Isleworth, Middlesex (personal communication from G. R. Coope). New faunal and <sup>14</sup>C evidence from this critical period of mid-glacial climatic change is currently being investigated from Tattershall Castle Pit, Lincolnshire (map ref. TF570210).

At this pit organic horizons of several ages lie in sands and gravels above a till rich in Jurassic and Cretaceous erratics. The lowest organic deposit, a shell marl containing a terrestrial snail fauna characteristic of open conditions, may be of Upper Wolstonian age (personal communication from J. G. Evans). This is overlain by compact woody peat assigned on pollen evidence to subzone Ip IIB of the Ipswichian interglacial (personal communication from L. Phillips). An extensive beetle fauna extracted from this peat includes non-British beetles such as *Brachytemnus submuricatus* Schön. and *Valgus hemipterus* L. previously recorded from interglacial deposits<sup>4,5</sup> and *Isorhipis melasoides* Lap. and *Pycnomerus terebrans* Ol., species noted in Postglacial deposits<sup>6,7</sup> but now extinct in Britain<sup>8</sup>. Wood-boring genera such as Cerambycidae and Scolytidae are well represented and species of Anobiidae include *Xestobium rufovillosum* (Deg.), *Anobium fulvicorne* Sturm and *A. punctatum* (Deg.). Examples of other tree-dependent species, *Melasis buprestoides* (L.), *Dryophthorus corticalis* Pk., the oak leaf-miner *Rhynchaenus quercus* (L.) and the predators *Colydium elongatum* (F.) and *Dasytes plumbeus* (Müll.), demonstrate the presence of mature, mainly deciduous forest. Other environmental factors—rich humic soils, areas of marshy vegetation, influent streams and in particular, warmer summer temperatures than in South England today—are indicated by this interglacial fauna.

Above this peat are two mid-Devensian organic silt horizons. The lower of these, which occurs within frost-disturbed gravels or directly on the peat, has <sup>14</sup>C ages of 42,100  $\pm 1400$  yr B.P. (Birm 309) and 44,300  $\pm 1600$  yr BP (Birm 408), and it has yielded a cold, impoverished fauna. Characteristic foreign species include *Diachila arctica* Gyll., *D. polita* Fald. and *Dyschirius septentrionum* Munst. (Carabidae), *Helophorus obscurus* Popp. and *Ochthebius kaninensis* Popp.<sup>9</sup> (Hydrophilidae), *Olophrum boreale* Pk., *Boreaphilus henningianus* Sahlb. and *B. nordenskiöldi* Pk. (Staphylinidae). These are now largely confined to areas of high latitude or extreme continentality. Several other species are now restricted to Northern Britain. This fauna indicates tundra conditions, with tracts of sterile soil between low plants and ephemeral ponds.

Stratigraphically above and thus demonstrably younger than this 'arctic' silt is a more continuous horizon which has yielded a remarkably thermophilous fauna. Its <sup>14</sup>C ages of 43,000  $\pm 1400$  yr B.P. (Birm 341) and 42,000  $\pm 1,000$  yr BP (Birm 409), apparently overlapping those of the 'arctic' silt, underline the closeness in age of the two horizons, despite their marked faunal contrast. Noticeable among the several hundred species which make up the warm assemblage are certain non-British beetles such as *Hydrochus flavipennis* Kust. (R. B. Angus, unpublished work) which is today found in Southern Europe and *Aphodius bonvouloiri* Har., now found only in Spain. *Pseudocleonus cinnereus* Schrank and *Chrysolina limbata*

L. are Central and Southern European species, and *Helophorus discrepans* Rey lives in East Europe and at high altitudes in Spain. A high proportion of the species today found in Britain, including *Nebria livida* (L.), *Porcinolus murinus* (F.), *Crypticus quisquilius* (L.) and *Otiorrhynchus ligustici* (L.) occur only in the southern half of the country. Clearly this assemblage requires average July temperatures at least as high as those of South England. Despite the occurrence of certain East European species, there is no evidence for marked continentality and it is unlikely that the total fauna would survive particularly low winter temperatures.

The duration of this warm, mid-glacial episode was short. A cold, continental fauna from deposits of 39,300  $\pm 1350$  BP (Birm 333) at Queensford, Oxfordshire (G. R. Coope personal communication) indicates that a considerable degree of cooling had occurred by this time. At Tattershall the reduction in the numbers of thermophiles in successively younger samples from this horizon may be the result of falling temperatures. The structure and ecological requirements of this interstadial fauna provides further evidence of the shortness of this climatic oscillation; this may be illustrated by comparison with the earlier interglacial fauna. Both assemblages indicate warm conditions at the time they were deposited, but the mature, deciduous forest habitat of many of the interglacial beetles obviously developed during a long period of climatic stability. Such vegetation maturity is not demanded by the interstadial fauna which is largely composed of species that feed on low plants and grasses, as well as abundant Scarabaeidae associated with the large mammal population which grazed the area. This insect fauna, able to respond rapidly to climatic change by colonising a newly favourable area<sup>4</sup>, lacks any species whose habitats require a long period of development. In particular, tree-dependent species are absent although temperatures were high enough to permit forest growth. This fact, while dispelling any idea that this fauna is interglacial, supports the stratigraphical and radiocarbon evidence of its mid-glacial age.

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MAUREEN A. GIRLING

Department of Geology,  
University of Birmingham,  
PO Box 363,  
Birmingham B15 2TT, UK

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