

**FOSSIL COLEOPTERA FROM WEICHSELIAN DEPOSITS AT  
VOORTHUIZEN, THE NETHERLANDS**

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**ABSTRACT**

An account is given of fossil from two organic layers in Weichselian deposits at Voorthuizen, The Netherlands. On radiocarbon and stratigraphic evidence these beds apparently date from between the Brorup and Upton Warren interstadials. Although the samples analysed were small and gave meagre fossil assemblages, the lower bed clearly represents tundra conditions, with average July temperatures below 10°C. The upper bed gave a climatically nondescript fauna from which no firm inferences can be made. However, it is considered that had this bed been deposited under conditions as cold as those represented by the lower bed, the fossils would have given some indication of this, and it therefore seems likely that it reflects somewhat warmer conditions, with average July temperatures of about 10°C.

Through the courtesy of Dr. W. Zagwijn of the Rijks Geologische Dienst, Haarlem, samples of organic material from Pleistocene deposits at Voorthuizen have been sent to the Quaternary Entomology Laboratory of the Birmingham University Geology Department, for investigation of the coleopterous fauna.

Voorthuizen lies to the south of the Zuider Zee, at latitude 52° 14', longitude 5° 37' E. The samples come from a pit in beds deposited during the Last (Weichselian) Glaciation. The stratigraphical diagram sent by Dr. Zagwijn shows four organic beds, lying between six and twelve metres below the ground surface. The top of the uppermost organic bed is taken as a zero datum for stratigraphical purposes, and the depths below this of the other beds are as follows: Bed 2, 188–194 cm; Bed 3, 225–265 cm; Bed 4, 335–341 cm. Bed 1 has a <sup>14</sup>C date of >44,450 BP (GrN 5923) and Bed 3 has a date of >50,800 BP (GrN 5940). These dates indicate that the deposits predate the British Upton Warren Interstadial, but give no indication of their age relative to the Brorup or Amersfoort Interstadials. However, an unpublished date obtained from a <sup>14</sup>C enriched sample from Bed 4, done by Dr. Grootes at Groningen, suggests that the deposits were all laid down after the Brorup Interstadial.

The samples sent to Birmingham were from Beds 2, 3 and 4. Each sample amounted to about 1 kg. of material. The fossil Coleoptera were extracted from them by the method described by C o o p e (1969). Bed 4, which consisted almost entirely of moss fragments, yielded no identifiable fossils, but the other two both gave rather meagre samples of their faunas. These are described below, starting with the oldest. The beetles are listed by families, and the nomenclature is that used in current textbooks. Each species is followed by the minimum number of individuals represented by the fossil fragments, and species which are today absent from The Netherlands and northwest Germany are marked with an asterisk (\*).

Bed 3

CARABIDAE: *Elaphrus riparius* (L.), 1; *\*Diacheila polita* Fald., 1; *Notiophilus* sp., 1; *Dyschirius globosus* (Herbst), 5; *Bembidion bipunctatum* (L.), 3; *Bembidion* sp., 1.

STAPHYLINIDAE: *\*Arpedium brachypterum* (Grav.), 5; *\*Boreaphilus nordenskiöldi* Makl., 2; *Olophrum fuscum* (Grav.), 1; *Bledius* sp., 3; *Stenus* sp., 1; Aleocharinae, 4.

BYRRHIDAE: *\*Simplocaria metallica* Sturm, 1.

DRYOPIDAE: *Dryops ernesti* Des Gozis, 1.

CURCULIONIDAE: *Otiorhynchus rugifrons* (Gyll.), 1; *\*Notaris aethiops* (F.), 1.

This gives a total of 11 named species, at least 5 unnamed ones, and a minimum of 32 individuals.

Although this is a small sample it includes a number of species which indicate a tundra environment. Thus *Diacheila polita* and *Boreaphilus nordenskiöldi* are both typical tundra animals, distributed along the shores of the Arctic Ocean from the tip of the Kola peninsula eastwards, extending across the Bering Strait into America. Both species extend into the taiga of the Lena valley in eastern Siberia, but this is an area where buried ice permits a number of Arctic insects to extend their ranges southwards (for example, *Helophorus splendidus* J. Sahlb. (Hydrophilidae) at Ust Aldan (Poppius, 1907)).

Three further species which are absent from Holland today are *Arpedium brachypterum*, *Simplocaria metallica* and *Notaris aethiops*. These all occur in northern Europe —

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Scandinavia and Russia, and in the mountains of central Europe. The *Arpedium* and *Notaris* also occur in northern Britain.

The remaining species are all more widely distributed, but all range far to the north.

Although the sample is very small, it is consistent with a tundra environment with thin patchy short vegetation, and no trees. Thus, *Elaphrus riparius* requires some open sandy or silty ground, *Diacheila polita* is typical of open tundra situations, *Arpedium brachypterum*, *Olophrum fuscum* and probably also *Boreaphilus nordenskiöldi* require damp moss or vegetable litter, *Simplocaria metallica* is a moss eater, and *Notaris arthiops* feeds on *Sparganium* and other Caricaceae near water.

From the environmental data provided by the beetles it appears that this bed was deposited under conditions of arctic severity, with a tundra landscape and average July temperatures below 10°C. The sample contains no exclusively east Siberian species which would have indicated extreme continentality of climate, but with such a small sample it is possible that this merely reflects inadequate sampling.

Bed 2

CARABIDAE: *Helobium multipunctatum* (L.), 1; *Bembidion bipunctatum* (L.), 1.

DYTISCIDAE: *Hydroporus* sp., 3; *Rantus* sp., 1.

HYDRAENIDAE: *Ochthebius* sp., 2.

HYDROPHILIDAE: *Helophorus grandis* Ill., 1; *Helophorus* sp., 1; *Enochrus* sp., 1; *Cercyon* sp., 1.

STAPHYLINIDAE: *Acidota crenata* (F.), 1; *Olophrum fuscum* (Grav.), 1; *Oxytelus rugosus* (F.), 1; *Euaesthetus ruficapillus* Boisd. & Lacc., 2; *Stenus* spp., 7; *Philonthus* sp., 1; *Quedius* sp., 1; Aleocharinae, 4.

SCARABAEIDAE: *Aphodius* sp., 1.

HELIODIDAE: 2.

This gives a total of seven named species, at least twelve un-named ones, and a minimum of 33 individuals.

Although this sample is similar in size, both in number of species and individual specimens, to that obtained from Bed 3, it does not contain any species whose present distributions are restricted in ways which would enable precise climatic inferences to be made. All the species occur in Holland today, but all range well to the north in either Scandinavia or Russia, and all occur as fossils in sites dating from cold phases of the Last Glaciation in England.

The tundra assemblage present in Bed 3 suggests that the July average temperatures may have been appreciably lower than 10°C (the maximum consistent with tundra conditions), possibly as low as 8°. The climatically nondescript assemblage obtained from Bed 2, lacking as it does, all the typical tundra species present in Bed 3, may reflect July average temperatures somewhat above 10°C. However, it seems unlikely that conditions would have been much warmer than this as experience with British faunas dating from temperate episodes suggests that had Bed 2 been deposited under temperate conditions, the sample would have yielded a larger and more diverse assemblage of Coleoptera.

One other feature of the environment indicated by the fauna of Bed 2 is the greater prominence of aquatic habitats. These are indicated by the Dytiscidae, Hydraenidae and Hydrophilidae other than *Cercyon*, as well as the presence in the sample of remains of Trichoptera (Caddis larvae) and Crustacea-Notostraca (possibly *Lepidurus arcticus* Pall.). However, Bed 3 contains riparian species such as *Elaphrus riparius*, *Dryops ernesti* and *Notaris aethiops*, so there must have been aquatic habitats at this time as well. Thus the differences between the faunas of the two beds cannot be attributed entirely to the presence or absence of aquatic habitats.

Thus, the climate represented by the Voorthuizen deposits was at times severe, with average July temperatures not exceeding 10°C. If, as suggested earlier in this paper, the deposits date from the period between the Brorup and Upton Warren interstadials, these climatic inferences agree well with those obtained from other sites of similar age. Thus A n n e M o r g a n (1973) described a fauna from Four Ashes locality 20, which has a <sup>14</sup>C dat of >43,500 (Birm-74). This fauna contains an assemblage of cold-adapted species, including both *Diacheila polita* and *Boreaphilus nordenskiöldi* but lacks any exclusively east Siberian species. At Tattershall in Lincolnshire there is also an arctic insect assemblage in deposits which overlie eroded Eemian strata and are followed immediately by others containing an insect fauna typical of the temperate phase of the Upton Warren interstadial (G i r l i n g, 1974).

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