GENERAL SCIENCE NOTES

BEETLES INDICATE A FAUNAL CHANGE IN THE ARCTIC DURING CENOZOIC TIME

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Change in the fauna of the polar region during Cenozoic time is suggested by the fact that woolly mammals no longer roam the area but are known only from Pleistocene fossils. Insects may also indicate a faunal change. Presented here are data based on two genera of weevils (Coleoptera: Curculionidae) which, because they are known to exist both as living species and as fossils, may show evidence of a faunal change.

The first genus, *Lepidophorus*, contains about ten species occurring in Siberia, Alaska and in the mountains of western North America and North Carolina. The second genus, *Vitavitus thulius* (Kissinger 1973), was described from a single female specimen collected in 1913 by the Canadian Arctic Expedition north of the Arctic Circle at Bernard Harbour, NWT. Both genera contain small insects between 2.5 and 5 mm in length. The biology of neither genus is known; for instance, we do not know whether the larvae develop in the ground, which may be probable, or develop instead in or on some plant. In any case, the fossils of these genera can be identified with a high degree of certainty.

The fossils mentioned in this note are heavily sclerotized, disarticulated parts of beetles, such as head, pronota and elytra. They are much like museum specimens in quality, except they have been abraded to some extent and in the case of weevils lack scales on surfaces where these would normally occur. Such fragments of Coleoptera make up a good percentage of the fossils of animals found in silts from Alaska.

Matthews (1968) has presented some notes on the Pleistocene silts from Fairbanks, Alaska. It is believed that the silt was removed by wind from the Tanana river flood-plain and deposited as loess on hillsides and valleys near Fairbanks. The valleys may contain loess deposits that are 100 feet or more in depth. The silt of the valleys is different from that of the slopes because it is bedded, perennially frozen and contains much organic material. The miners call it “muck” because it has a bad odor when thawed. The upland silt is like the loess of the mid-continent of North America in that it is oxidized, buff brown in color and contains few if any fossils (Péwé 1955). Near Fairbanks frozen muck is exposed by cuts caused by placer gold mining. The sediments containing muck overlie early Pleistocene gravels that contain gold.

In the cut described by Matthews the gold-bearing gravel is covered by silt to a depth of 35 m. At points down the face of the cut, various fossiliferous mucks were examined for small mammal fossils. Each sample consisted of several thousand pounds of silt from a two-foot interval at the exposure. This material was screened through 40 mesh per inch screens. A portion of the organic material remaining on the screen was processed for fossil insects. Since the insects were quite abundant, only a small sample was needed to get a larger number of specimens. The residue was washed through 80 mesh per inch screen to remove the remaining silt, then immersed in lightweight oil. The oil-soaked mass was placed in hot water and many insect fragments rose to the surface. These fossils were stored in alcohol, later examined with a binocular microscope, and mounted on slides similar to those used for Foraminifera. This procedure facilitated storage and examination of the fossils.

Fossils of *Vitavitus thulius* Kissinger were found at four widely separated areas in sediments considered to be of Pliocene to late Pleistocene age, 5.7 million to 27,000 years before the present (BP) according to Matthews 1972. *Lepidophorus lineaticollis* Kirby was present in the last two assemblages.

SITE 1

Lava Camp Mine, Inmachuk River Valley, northern part of Seward Peninsula, Alaska, near the Bering Strait; see Hopkins et al. (1971) for details about the Pliocene flora and insect fauna from this site. The alluvium is typically 3-4 m thick. The lower part consists of gravel and grades upward into interbedded sand, silt and peat containing lenses of fine gravel and abundant wood. The alluvium rests on an irregular bedrock surface carved in schist and metalimestone. It is covered by 95 m of basalt which was dated by the potassium-argon method at 5.7 million years BP. The alluvium contains gold and has been prospected and mined since 1900. The wood in the alluvium includes logs as large as 23 cm in diameter and 2 m long. Some of the logs are recumbent. Other wood fragments representing roots and rooted stumps project downward from the lava roof. Peat and wood that lie within a few centimeters of the base of the lava are baked to charcoal. At lower levels some of the wood is relatively fresh, but other wood fragments have a brown lignitic appearance. The alluvial sequence evidently consists of basal gravel deposited in an open river channel and an overlying mass of finer sediment deposited on a forested flood-plain. The base of the lava shows pillow-like convexities which suggest that the lava flowed across a moist surface. Samples of lava showed negative magnetic polarization and may have been deposited when the earth's magnetic field was oriented opposite to the present state.

Pollen and plant megafossils from the Lava Camp Mine include such items as sitca spruce (*Picea sitchenis*), hemlock (*Tsuga* spp.), fir (*Abies*) which today exists 850 km or more to the southeast, and hazel (*Corylus*) which reaches its northern North American limit in British Columbia and Newfoundland. It is concluded that tundra was not represented by the Lava Camp assemblage.

Along with plant fossils, the beds exposed in the Lava Camp Mine contain fossils of predacious and plant-feeding insects and oribatid mites. Some of these species now apparently are extinct; others show a relatively wide distribution in Alaska and Canada. A conclusion is that a similar assemblage of living insects and mites could not be collected on the modern tundra of Seward Peninsula nor in the boreal woodlands of present-day interior Alaska. A comparable assemblage of insects probably could be collected in southern British Columbia or northern Washington.

SITE 2

Cape Deceit Formation exposed near Deering, north coast of Seward Peninsula, Alaska. Sediments from this site contain fossil insects, plant macrofossils, and pollen spectra which indicate tundra conditions (Guthrie & Matthews 1971). A large series of more than 290 isolated heads, pronota, and elytra of *Vitavitus* was found in unit 2 of the Cape Deceit Formation which is dated at 400,000 to 700,000 years BP (Matthews 1972). One of the specimens was an articulated mesothorax, metathorax, and abdomen. The abdomen contained female genitalia which were very similar to the female genitalia of the type specimen.

SITE 3

Old Crow River, northern Yukon Territory. J. V. Matthews, Jr. (Geological Survey of Canada) is in the process of studying this assemblage. Preliminary evidence indicates that the site represents a flood-plain environment within a region of open spruce forest. Some fossils of tundra insects are present in the assemblage. Carbon-14 dates suggest that the age of the assemblage is greater than 40,000 years BP (Matthews 1972). Remains of *Lepidophorus lineaticollis* Kirby are present in this assemblage along with fragments of *Vitavitus*.

SITE 4

Watino, north central Alberta (Westgate et al., personal communication). The fossil assemblage represents a flood-plain containing ephemeral ponds. Age of the unit containing *Vitavitus* fossils is approximately 27,400 years BP (Matthews 1972). *L. lineaticollis* Kirby and *Vitavitus* fragments were found in the assemblage.

Interested in documenting changes of the tundra fauna during the Pleistocene, Matthews considered small mammals (Guthrie & Matthews 1971), carabid beetles (Matthews 1968) and staphylinid beetles (Matthews 1970). In a letter, he stated that one of the few examples of qualitative taxonomic difference in composition was the occurrence of *Vitavitus* without *Lepidophorus* in the early Pleistocene assemblages in contrast to late Pleistocene assemblages which contained *Lepidophorus* without *Vitavitus*. For the most part the difference between early and late Pleistocene assemblages involved differences in the abundance of taxa found in both.

In general the four assemblages mentioned here appear to contain the kind of insects that one would expect to collect at a particular location. The nature of the condition of the fossils and their taxa seem to preclude the possibility that the assemblages represent some distant fauna which was transported somehow to the present location. A second conclusion is that the apparent time sequence of the assemblages suggests that the range of *Vitavitus* was invaded and possibly replaced by members of a second genus, *Lepidophorus*. Hopkins et al. (1971) suggest that the Lava Camp Mine assemblage represents the situation when there may have been a land connection between Alaska and Siberia. Possibly *Vitavitus* represents a portion of the fauna which may have come across such a bridge. The apparently late appearance of *Lepidophorus* on the other hand may indicate that it was arriving from a southerly route, possibly across any newly established connection between South and North America. The current distribution of the species of *Lepidophorus* in the high altitudes of the United States may indicate that such populations are relics of the time when the climate of the southern part of the North American continent was cooler and such dispersal was possible.

In conclusion, the data presented above provide further evidence that significant climatic change has taken place in post-flood times. The evidence seems to indicate an ecological succession. It is interesting to speculate as to what geophysical events would allow an apparently warmer climate to exist where presently there is a colder one. In addition, the potential for microfossils, such as described above, as a marker for climatic change may not yet have been fully utilized.

LITERATURE CITED

Guthrie RD, Matthews Jr. JV. 1971. The Cape Deceit fauna — early Pleistocene mammalian assemblage from the Alaskan Arctic. Quaternary Research 1:474-510.

Hopkins DM, Matthews Jr. JV, Wolfe JA, Silberman ML. 1971. A Pliocene flora and insect fauna from the Bering Strait region. Palaeogeography, Palaeoclimatology, Palaeoecology 9:211-231.

Kissinger GG. 1973. A new weevil genus from America north of the Arctic Circle and notes of fossils from Pliocene and Pleistocene sediments (Coleoptera: Curculionidae). Coleopterists' Bulletin 27:193-200.

Matthews Jr. JV. 1968. A paleoenvironmental analysis of three late Pleistocene Coleopterous assemblages from Fairbanks, Alaska. Quaestiones Entomologicae 4:202-224.

Matthews Jr. JV. 1970. Two new species of *Micropeplus* from the Pliocene of western Alaska with remarks on the evolution of Micropeplinae (Coleoptera: Staphylinidae). Canadian Journal of Zoology 48:779-788.

Matthews Jr. JV. 1972. Ecosystem evolution during Quaternary time at Deering, Alaska. Unpublished manuscript.

Péwé TL. 1955. Origin of the upland silt near Fairbanks, Alaska. Geological Society of America Bulletin 66:699-724.