Traces of a Lepidopterous Insect from the Middle Waikato Coal-Measures.

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[Read before the Wellington Philosophical Society, Geological Section, 8th October, 1930; received by Editor, 18th October, 1930; issued separately, 30th September, 1931.]

In February of this year, Professor J. A. Bartrum, of Auckland University College, was good enough to forward to me for examination some small pieces of coal from the Glen Afton mine, near Huntly, which appeared to show a somewhat abnormal structure. The coal was finely laminated and, on the faces of most of the laminae, were one or more small, almost circular, and definitely fringed impressions, many of which had an irregular, highly coloured central spot. The coal had been sent to Professor Bartrum by one of his former students, Mr F. L. Swan, and later (May, 1930) a further similar specimen was forwarded by Mr A. F. Papesch.

In order to determine whether the fringed bodies had any appreciable thickness, small slices of the coal were ground for examination under the vertical illuminator, and during the preliminary examination of one or two of these slices the writer's attention was drawn to some very small pinkish striated fragments which, owing to their high reflecting power, stood out very clearly from the generally dull surface of the coal.

In one slice, ground (by sheer good luck) to just the right plane, an almost unbroken and well striated example of the pinkish bodies was found and, on closer examination, appeared to be an insect scale.

The accompanying photomicrographs, B19 and B191 in plate (X 520) show the scale as it lies in the coal surface. The photographs were taken with the iris diaphragm of the vertical illuminator almost closed, and, in consequence, the surrounding coal, which lies at a slightly lower level (owing partly to the grinding process and partly to the slight upward curvature of the scale), is only dimly shown.

Dr R. J. Tillyard, Chief of the Division of Economic Entomology of the Commonwealth of Australia, to whom the photographs were sent for criticism, was kind enough to supply the following comments: "Although there are several points that are puzzling in your photomicrographs, yet I think I am prepared to state that they represent an insect scale. An examination of the longitudinal and cross-striation shows that it probably belongs to the Lepidoptera. Scales occur in other orders of Insects, notably in the Collembola, the Thysanura, the Copeognatha, the Coleoptera, the Diptera, and the Trichoptera. The type of striation in all of these is markedly different from that of the higher Lepidoptera, which alone, of all these, have the longitudinal striations divisible into two groups, viz., a few relatively thick striae separated one from another by two,
three, or more finer parallel striae, and the whole bound together by more or less distinct cross-striaions." After referring to the fact that all insect scales have very narrow bases of insertion and noting that, at first sight, the photograph (v. B19, where the scale appears to be cut off irregularly) "seems to show a broad base of insertion," he suggests that "the insertion end of the scale may be distorted by the upturning of the slender stalk. In that case, the scale might easily belong to a Hepialid or Tineid moth."

"The length of your object is apparently 0.16 mm. The average length of a series of Hepialid scales which I studied some years ago was 0.15 mm., so that your object comes very close to this. I have not measured the average length of scales from the wings of Charagia virescens or any of the New Zealand species of Porina, but I should imagine they would be pretty close to this. The pink colour rather suggests to me a scale from the wing of a Porina."

The possibility of distortion (or actual fracture) of the stalk of the scale referred to by Dr Tillyard, turns to a very likely probability in the mind of one familiar with the comparatively rough treatment which a coal receives in the grinding and polishing processes. It is quite probable that during these processes the stalk was torn out completely, assuming of course that it was still in position when the scale found its resting place in the coal-forming debris.

When the scale was first seen emerging from the coal surface, it appeared that it might possess the rarer form of attachment in which the scale margins project backwards on either side of the true point of insertion (see photograph C in plate, which clearly shows this form in a scale from the forewing of Vanessa gonerilla), but it afterwards became fairly evident that the scale was of the more usual type and that the forked end was its distal end.

An examination of scales from Lepidoptera belonging to several families showed that normal insertion coupled with a “fish-mouth” distal end was quite common in the Sphingidae, and not uncommon in the Hepialidae. A photomicrograph of a scale from the forewing of Sphinx convolvuli (A in plate) is reproduced for purposes of comparison.

The striae shown in the scale from the coal correspond very closely with those of Porina signata, a scale from which insect is shown in photograph B of the plate. Using a lens the striales, or joining-bars, connecting the main longitudinal striaions, can be seen plainly.

Perhaps all that can be said fairly about the scale in the Glen Afton coal is that it belonged to one of the higher Lepidoptera. It seems quite possible, however, that it actually came from a Porina of Oligocene age, though proof there can of course be none.

Porina belongs to the Hepialidae, a family "of an undoubtedly primitive type," and at present "very well represented in New Zealand by twenty species, most of which are large and conspicuous insects."

†Hudson, G. V.; Butterflies and Moths of New Zealand, (1928), pp. 359 and 357.
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"As regards New Zealand, the fossil record"—i.e., of insects—"is almost a blank. Some fossil insects of Oligocene age were discovered many years ago by Mr Thomas Esdaile, who presented his collection to the Otago Museum. The insects, however, were never studied and remained undescribed, and the valuable collection appears to have been lost."

It is an interesting instance of the "law of chance" that the next trace of fossil insects to be found in New Zealand should have been stumbled upon in the examination of a piece of coal—an examination most certainly not made with a view to finding insect remains.

Acknowledgments.

The writer wishes to express his thanks to those who sent the coal to him for examination; to Dr R. J. Tillyard for his advice; and to Miss A. Castle, of the Dominion Museum, and Miss E. A. Plank, of Victoria University College, who were good enough to prepare mounted specimens of scales from the Hepialidae, Tineidae, and many other families.

The age of the Middle Waikato coal-measures was long a matter for controversy. They are now held to be definitely of Oligocene age. In his presidential address to the Geological Section, Fourth Science Congress of New Zealand Institute, January, 1929, Dr J. Henderson states:—"The coal-measures are of two types and were formed under conditions predominantly, either estuarine and fresh-water, or littoral and salt-water. The first type occurs in the neighbourhood of Huntly and consists of grey and yellow semi-refractory clays up to 300ft. thick which grade upward into, and are interbedded with, the blue clays of the Whangaroa series. Near the base there are one or more thick seams of coal containing a very small amount of sulphur." . . . The "fresh-water coals are pre-Whangaroa in age." (Henderson, J.; Trans. N.Z. Inst., vol. 60, 1929, p. 276).