

FOSSIL INSECT WINGS FROM THE EARLY PERMIAN WHITE BAND FORMATION, SOUTH AFRICA

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ABSTRACT

Fossil insect remains are reported for the first time from the Lower Karroo White Band in South Africa. The wings of two individuals have been recovered from separate localities 140 km apart in the southern Cape fold-belt. They unfortunately supply little useful information on the depositional environment of the White Band as they were probably transported some distance to their final site of preservation.

INTRODUCTION

A variety of fossil insects has been recorded from the Irati Formation in Brazil (Pinto, 1972a, b). The White Band in South Africa is the time and lithological equivalent of the Irati (Du Toit, 1937; Martin, 1961), but no insect remains have previously been reported from the White Band.

In 1975 we fortuitously discovered the remains of two isolated insects at separate localities in the southern Cape Province; the material is now housed at the Bernard Price Institute for Palaeontological Research. In July 1975 we sent latex moulds of the specimens to Professor Irajá D. Pinto at the Federal University of Rio Grande do Sul, Brazil, followed later by the photographs and line drawings reproduced here. He supplied us with preliminary identifications of the specimens and, with L. Pinto de Ornellas, will be publishing the formal taxonomy elsewhere (Pinto and De Ornellas, in press).

The purpose of the present note is to record and illustrate the insect wings and comment briefly on their significance.

GENERAL GEOLOGY AND PALAEOONTOLOGY OF THE WHITE BAND

The White Band is a black pyritic shale formation which contains subordinate bands and lenses of fine-grained dolomite. The insect wings are preserved as compressions within the dolomite.

The discovery of insect wings augments the fossil record from the White Band. The assemblage includes the aquatic reptile *Mesosaurus tenuidens* Gervais 1865, the fish *Palaeoniscus capensis* Broom 1913, the crustacean *Notocaris tapscotti* Broom 1931 (McLachlan and Anderson, 1973), rare limulid trackways (Anderson, 1975), plant fragments (Anderson and McLachlan, 1976) and monaxon sponge spicules.

In combination, the lithological and palaeontological evidence indicates that the White Band sediments probably accumulated in an enormous stratified lake with little or no access to the world ocean (McLachlan and Anderson, 1977; Anderson, McLachlan and Oelofsen, in press). The sites at which the insects were preserved were apparently a considerable distance from land.

THE INSECT WING LOCALITIES

(i) Modderdrift (33°09'S; 22°32'E)

The insect remains from the farm Modderdrift P.A. Q. 2–21 (fig. 1) were found in a loose boulder of finely laminated slump-deformed dolomite resting on the persistent metre-thick band of dolomite near the middle of the White Band succession (McLachlan and Anderson, 1977), and there is no reason to believe that it did not derive from this band. Fragmentary crustacean remains, presumably *Notocaris*, are widespread in the metre-thick dolomite and also occur in the boulder containing the insect wings.

Two similar but incomplete wings are present and a torn fragment between them may represent a third wing (fig. 2). The most complete wing is 6 mm long.

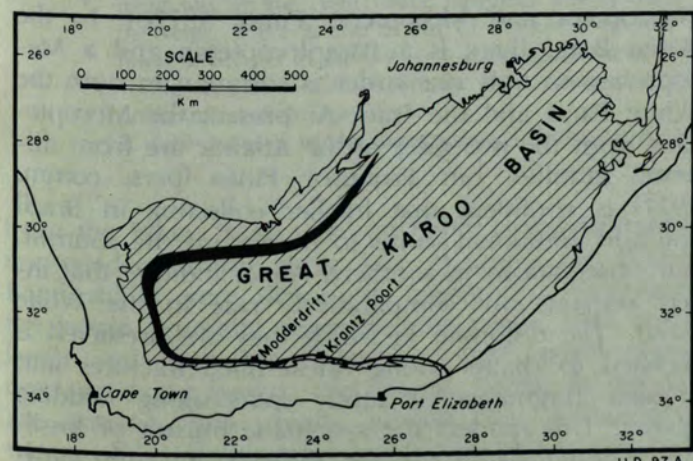


Figure 1. Sketch map of the Karoo Basin in South Africa showing the two insect wing localities in the White Band. The White Band outcrop is indicated in heavy black.

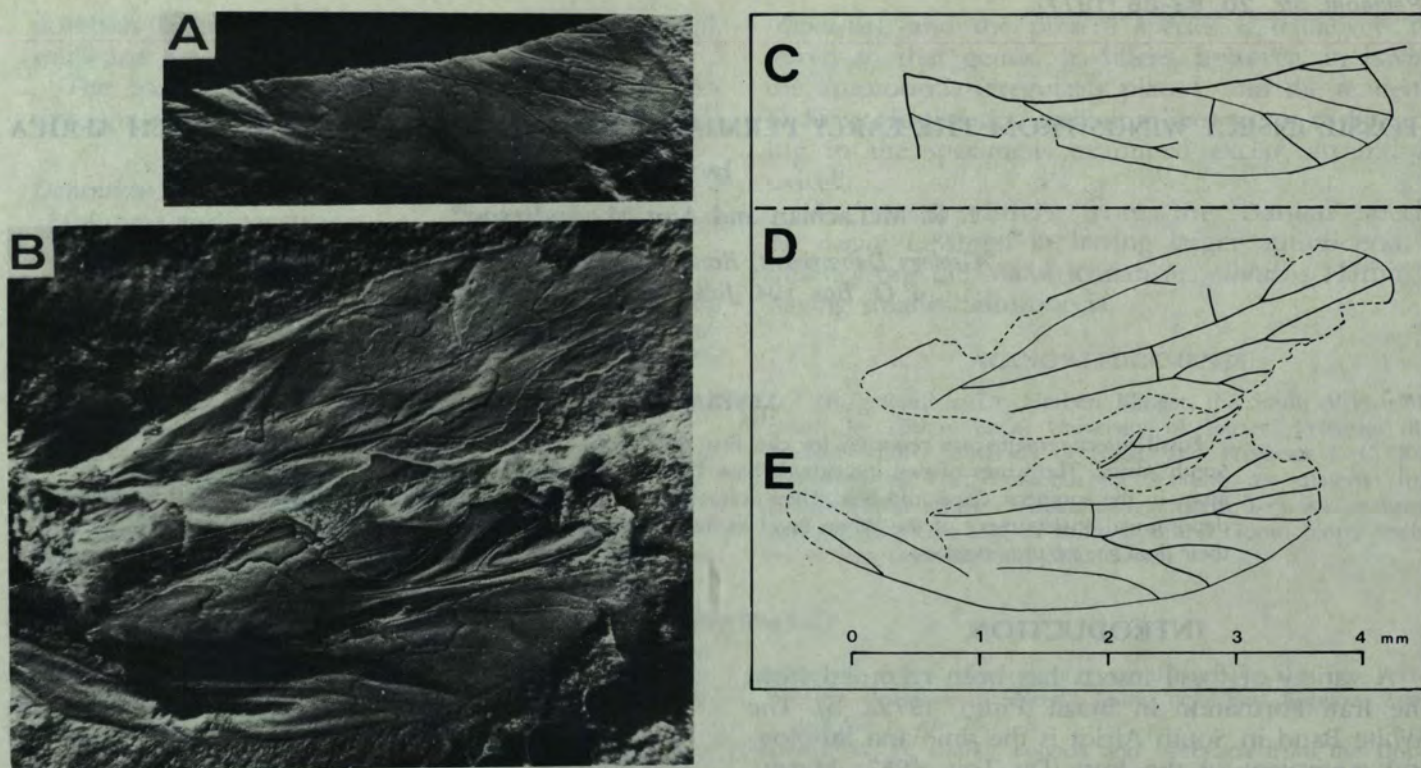


Figure 2. The Mecopteran insect wings from Modderdrift. Mod./K W.B.1 (Approx. $\times 20$).

A. and B. Photographs of the specimens. The wing tip in A is the only surviving portion of the counterpart of the more complete specimen shown in B. It is the counterpart of the upper wing in B as figured. There are two large wings in B. As they are on slightly different levels, the photograph is a composite constructed from two frames, with one wing in focus in each. The configuration of the specimens illustrated in both this figure and the next is such that it is not possible to illuminate them correctly with the lighting from the top/left: the photographs as printed, with the leading edge of the wings towards the top of the page, therefore present a misleading visual impression of the relief, the positive areas appearing to be negative and vice versa.

C. to E. Line drawings of the venation on the wings shown in A and B above. There appears to be a disconnected wing fragment lying between the major wings D and E. Point of attachment to the body was on the left.

The two large wing surfaces are preserved on slightly different levels and each is a little folded. This may be a reflection of the original disposition of the wings or the result of differential compaction of the dolomite.

All the fragments clearly belonged to one individual, apparently a member of the order Mecoptera.

(ii) *Krantz Poort* ($33^{\circ}2'30''S$; $24^{\circ}03'E$)

The insect remains from the farm Krantz Poort Uit. Q. 10-57 were found in a loose block of dolomite in a roadside quarry within the White Band (fig. 1).

A large part of the venation belongs to one wing with its tip torn away (fig. 3). The venation in the proximal half of the wing is superimposed on what appears to be a separate venation. This suggests that a second wing may be present. Three or four body segments appear to be present as well, but they are very indistinctly preserved. The long, straight, cylindrical moulds might represent legs, although there are no discernible joints. The entire complex spans 3 cm. The proximal part of the major wing is slightly folded longitudinally. The membrane between the veins is frequently finely pleated. The pleating may be a preservational feature or the re-

sult of desiccation shrinkage before deposition.

The remains appear to be those of a member of the order Paraplecoptera.

CONCLUSION

The diverse insect fauna recovered from the Irati Formation in the Parana Basin in Brazil (Rio Grande do Sul State) includes Homoptera, Coleoptera, Neuroptera and Mecoptera (Pinto, 1972b). In the White Band there is a Paraplecopteran and a Mecopteran, so only one order is common to both the White Band and the Irati. At present the Mecopterans from the two sides of the Atlantic are from different families, but Professor Pinto (pers. comm. 1977) is confident that further collecting in Brazil will add additional forms to the record. By contrast, our observations in southern Africa indicate that insect remains are comparatively rare in the White Band. The dolomite in which they are preserved is inclined to shatter along calcite-filled fractures into angular fragments: it rarely splits along bedding planes. This renders the systematic pursuit of fossils on bedding plane surfaces difficult and unrewarding. A determined search would nevertheless probably produce more specimens.

The larval stages of the insects recovered to date

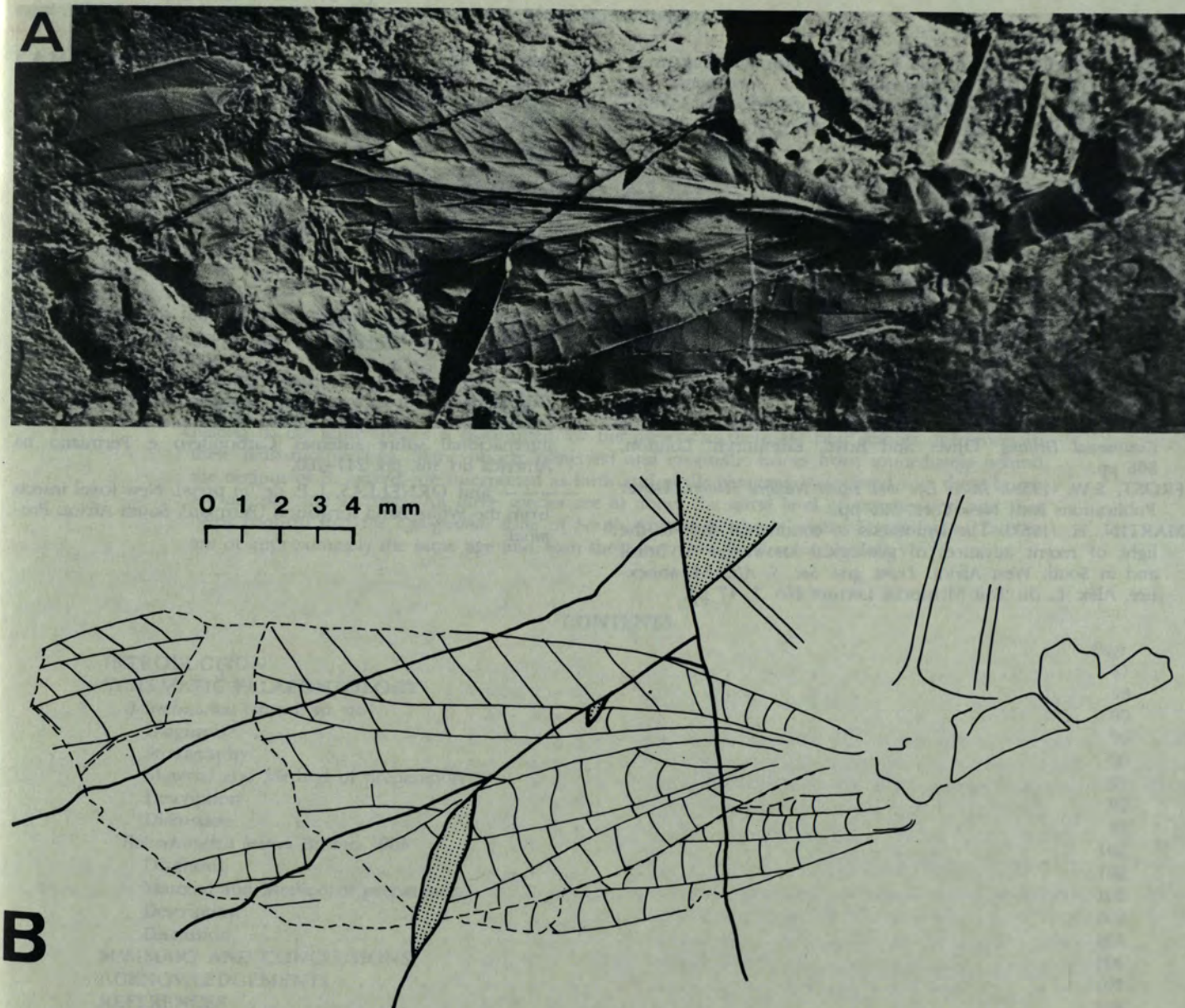


Figure 3. The Paraplecopteran insect fragments from Krantz Poort. K.P./K. W.B.1 (Approx. $\times 6$).

A. Photograph of the specimen. (There is no counterpart.) Most of the venation clearly derives from one wing, but the triangle of venation at the bottom/right appears to be distinct and may be portion of another, underlying, wing. The attachment was on the right; some indistinct bits of body remain. Notice the fine pleating of the membranous areas between the veins. There is also a mat of disjointed pleated fragments at the distal end of the large intact wing. The prominent linear structures in the top right hand quadrant of the picture may be the proximal segments of long legs, but no joints are visible. The row of three circular holes alongside the proximal upper edge of the veined surface is an artifact produced in preparation of the specimen.

B. Line drawing of the insect remains shown in A above.

from the White Band were probably land based and not resident in the great lake in which the White Band shales were deposited. Mecopteran (scorpion fly) larvae generally resemble caterpillars, and both larvae and adults are believed to feed largely upon dead or dying insects; Plecopteran (stone fly) larvae are aquatic, but usually inhabit the well-aerated waters of fast-flowing streams, where the larvae and the adults (which tend to stay in the vicinity of the streams) both feed chiefly on plants, including algae (Frost, 1959). The winged Mecopteran and Paraple-

copteran adults were at any rate tree fliers and might easily have been blown, dead or alive, far from their usual haunts to the sites of fossilisation. The wings might also have floated in the lake waters for some distance, as the occasional fragment of leaf and twig (Anderson and McLachlan, 1976) might have done as well. The application of the fossils will therefore be in providing information on the evolution and general distribution of the insect groups rather than in the elucidation of the depositional environment of the White Band itself.

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