

MESOZOIC INSECTS OF QUEENSLAND.

No.5. MECOPTERA, THE NEW ORDER PARATRICHOPTERA, AND
ADDITIONS TO PLANIPENNIA.

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(Text-figs. 23-28).

The fossils dealt with in this Part belong to the *third* collection of fossil Insects from the Upper Trias of Ipswich, Queensland, already referred to in No.3 of this series (4, p.417). In No.1 of this series (3) I dealt with the Planipennia, Trichoptera, and Protomecoptera from the *second* collection made by Mr. Dunstan (if we count in also the Simmonds collection, this would be the *third* collection made at Ipswich altogether). As the new insects throw much light upon the important Orders which they represent, it seemed best to deal with them as soon as possible, even though many other fossils from the earlier collections still remain undescribed.

The material dealt with consists of two Mecoptera, two Trichopterous-like insects, one Planipennian, and one wing of uncertain position within the Panorpid Orders. The Mecoptera are not well preserved, and one is too fragmentary to merit a name. The Planipennian, though not a complete wing, is one of the most beautifully preserved and most important of the new types found at Ipswich. One of the Trichopterous-like fossils is an almost complete and very beautifully preserved forewing, showing some quite new and unexpected characters, which prove that the wings from the Ipswich Trias which we have hitherto regarded as true Trichoptera, do not really belong to that Order, but to a distinct group separated from it by two very important characters. My original intention was to place these within a

new Suborder Paratrachoptera of the Order Trichoptera. But this has been found to be quite incompatible with more recent evidence forthcoming from a fine new fossil wing found in the Upper Coal Measures of Newcastle, which I shall shortly deal with in a separate paper. It is therefore necessary, in this paper, to propose the recognition of a new Order Paratrachoptera for the four genera of Trichopterous-like wings so far found at Ipswich, and to explain carefully the essential differences between the two types of venation found in the Trichoptera on the one hand and the new Order on the other.

Order **MECOPTERA**.

Family STEREOCHORISTIDÆ, fam.nov.

Small Scorpion-flies having the radial sector four-branched, the media six-branched. Cubital fork placed close to base; Cu_1 united to M by an oblique vein, the posterior arculus (*pa*), which appears to be itself a true branch of M; the vein formed by the union of *pa* with Cu_1 continues as a straight, strong, convex vein for some distance, and then stops suddenly short, dividing into two weak and widely divergent branches, one joining up with M_4 above, and the other with $Cu_2 + 1A$ below. Cu_2 fuses with 1A not far from its origin.

Originally I placed the genus *Mesochorista* in the family *Panorpidae*. But its affinities are very great with the recent genus *Tæniochorista* from Brisbane; and this genus, in its turn, is allied to the better known genus *Chorista*. These genera, distinguished amongst other characters by the five- or six-branched media of the forewings and the primitive form of the abdomen in the male, most certainly deserve to be separated out from the *Panorpidae* as a separate family, *Choristidae*. I therefore now propose to adopt this family, and to place the Triassic fossil *Mesochorista* in it, together with the two recent genera *Chorista* and *Tæniochorista*. The affinities of the Permian *Permochorista* with the *Choristidae* are so close that it may also be advisable to reduce the *Permochoristidae* to the status of a subfamily of the same family.

Genus *STEREOCHORISTA*, n.g. (Text-fig.23).

Characters of the family, with the following additions:— Forkings of Rs and M placed close together, at a level about two-fifths from base of wing. Apical forkings of the branches of Rs placed more than usually far distad. An oblique cross-vein connecting Rs with M at a level just before that of the origin of the posterior arculus. Branches of M intimately connected by three cross-veins, which form three well-defined closed cells distad from the median fork. 1A apparently three-branched.

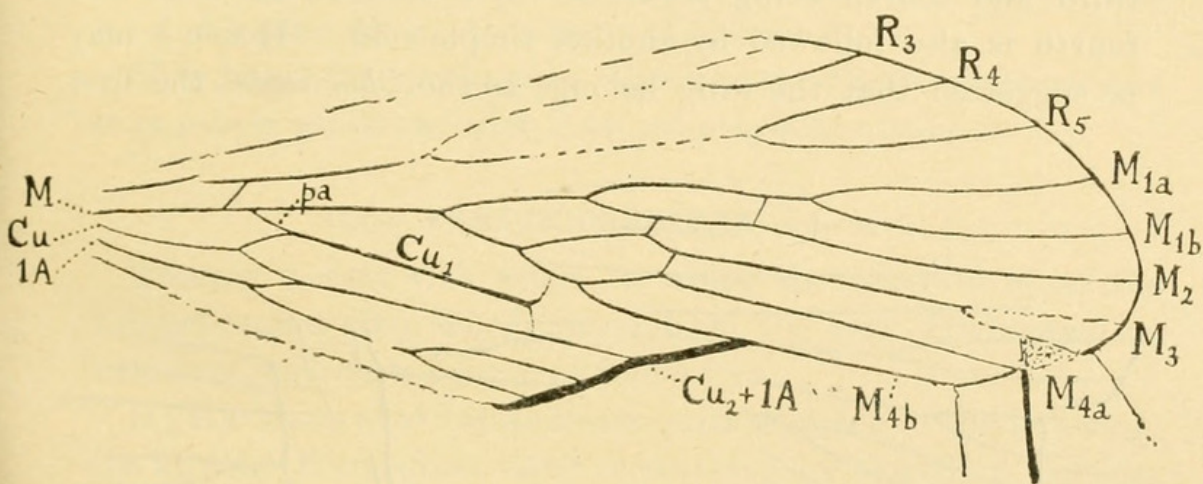
G e n o t y p e, *Stereochorista frustrata*, n.sp. (Upper Triassic, Ipswich, Q.).

This genus would appear to be allied to *Mesochorista* (2, p.29) from the same horizon; but the remarkable characters of the presence of a true posterior arculus and the shortened Cu_1 are absolutely unique, and appear to warrant the formation of a new family for its reception. I do not know of any other Mecopteron in which the posterior arculus can be definitely picked out; either it is reduced to a transverse vein, not distinguishable from a cross-vein, or else it is entirely obliterated by reason of the complete fusion of Cu_1 with the main stem of M for a short distance. In this connection, it should be noted that, within the single family *Rhyacophilidae* in the Order Trichoptera, species can be found showing all three conditions. Undoubtedly the most archaic condition is that exhibited by *Stereochorista*, in common with such species as *Agapetus fuscipes* Curtis (fam. *Rhyacophilidae*) and with the majority of the *Micropterygidae*, viz., the presence of a true posterior arculus in the form of an oblique vein connecting the main stem of M with Cu_1 , not far distad from its origin at the cubital fork. The condition in *Stereochorista* strongly suggests that the vein usually called Cu_1 , distad from *pa*, is in reality a fused vein consisting of Cu_1 and a posterior branch of M, which we may call M_5 , and of which *pa* is the basal free piece. If so, then the name *posterior arculus*, due to Comstock, is a misnomer, and should be altered either to *anterior arculus* (this being the part of the Odonate arculus formed from M) or simply to *arculus*.

Further evidence on this interesting point may be found on p.207 of this paper.

STEREOCHORISTA FRUSTRATA, n.sp. (Text-fig.23).

Total length 7.5 mm., this being almost the full length of the wing (a little of the base missing). *Greatest width* of preserved portion, 2.3 mm., representing an actual greatest width of the complete wing of about 3 mm. The impression of the wing is faint but good; there can be no doubt of the correctness of the condition of Cu_1 as drawn, but the tracing of the closely arranged branches of M is not an easy matter. Cu_1 can be followed quite



Text-fig.23.

Stereochorista frustrata, n.g. et sp., forewing. Upper Trias of Ipswich, Q.
pa, posterior areculus. Rest of lettering as usual in Comstock-Needham notation; ($\times 12$).

clearly as a strong vein for some distance, when it suddenly ends quite definitely, sending very weak and widely diverging branches (possibly cross-veins) to M_4 above and $Cu_2 + 1A$ below. A careful examination of these two veins shows us that M_{4b} and $Cu_2 + 1A$ are definitely tending to converge, so that there is not a sufficiently wide space left between them distally for Cu_1 to be continued; this may possibly account for the peculiar manner in which it ends. I have carefully examined the whole of the wing in this region, and can find no evidence of any break or damage; the condition of Cu_1 is evidently a natural one, though certainly most unusual.

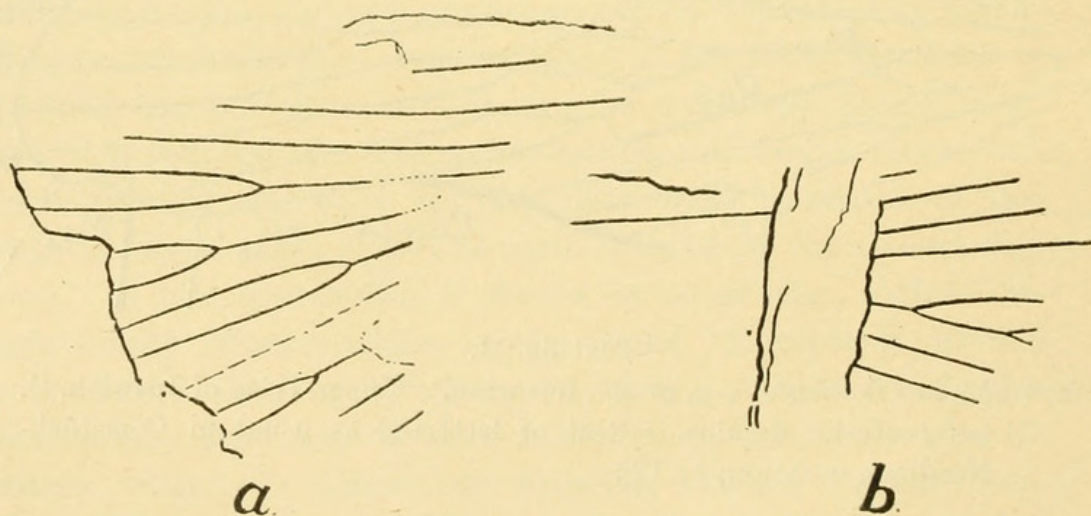
The preserved wing was almost certainly the forewing of a highly reduced type, which may very possibly have closely resembled the recent *Nannochoristidae* in appearance.

Type, Specimen No.218 (Coll. Queensland Geological Survey).

Horizon: Upper Triassic, Ipswich, Q.

MECOPTERON INCERTÆ SEDIS. (Text-fig.24).

Specimen No. 168a, b, consists of two fragments of a small Mecopterous wing, fairly well preserved, but not sufficiently complete to merit a name. Text-fig.24 shows the venation of these fragments. In the larger there are four forked veins, the third and fourth being separated by a simple vein, while the fourth is also followed by another simple vein. Hence it may be suggested that the wing belongs to the *Choristidae*, the first



Text-fig.24.

Two fragments (a, b) of Mecopterous wings from Upper Trias of Ipswich, Q.; Specimen No.168a, b; ($\times 13$).

two forked veins representing the branches of Rs (with R, Sc, and the costal border indicated above them in order); while the third and fourth forked veins, together with the simple vein between them, and the simple vein posterior to the fourth, represent the six branches of the media. The positions of these veins, and their angles of divergence from one another, agree closely with those of other *Choristidae*, but the relative positions of the

dichotomous branchings are quite different from those of any known form.

PANORPOID INSECT INCERTÆ SEDIS.

Specimen No.114*b* is a badly-preserved wing which appears to belong to one of the Panorpooid Orders, but which cannot be determined with certainty. Parts of Sc, R, M, and Cu₁ are visible. R₁ is forked distally, Rs dichotomously forked many times over, M apparently five-branched, and Cu₁ straight and unforked. Length of fragment, 9.5 mm.; greatest breadth, 3.5 mm. The costal space was moderately wide, and shows portions of an archedictyon; there are also some slight signs of the same kind of meshwork in other parts of the wing.

This insect may perhaps be related to the Protomecoptera; but is so poorly preserved that I do not propose to name it.

Order **PARATRICHOPTERA**, ordo nova.

Triassic insects with wings in which the venation is on the Trichopterous plan, but differing from the true Trichoptera in two very important points, as follows:—

(1) The three anal veins remain quite separate in the forewing. (In all true Trichoptera these three veins are looped up together in a very typical manner).

(2) Cu₁ is a strong, straight, convex vein, without any apical fork. (In all archaic genera of the true Trichoptera, Cu₁ is forked apically).

A separate costal vein may be present. Rs and M both four-branched, as in archaic genera of recent Trichoptera; both the radial and median cells closed.

The discovery of the almost complete and remarkably well-preserved wing of *Aristopsyche*, n.g., shows that I was in error, in No.1 of this Series(3), in restoring the forewings of *Mesopsyche* and *Triassopsyche* on the typical Trichopterous plan, as regards the looping-up of the anal veins. I may also have been wrong in determining the presence of the wing-spot (a difficult thing to be certain of, in any fossil) since neither of the two new genera here dealt with shows any signs of it.

The archaic condition of the anal veins, and the unforked Cu_1 , connect the new Order with the Mecoptera. It seems likely also that the Paratrachoptera were closely allied to the Diptera, which also have an unforked Cu_1 , though the anal veins have undergone a reduction due to narrowing of the base of the wing.

The four genera of Paratrachoptera now known from Ipswich may be provisionally included within a single family, *Mesopsy-chidæ*, the characters of which were defined in No.1 of this Series (3, p.180). The following key will distinguish them:—

- | | | | |
|-----|---|---------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| (1) | { | A short costal vein present, separate from the costal margin;
all four apical forks free of cross-veins ARISTOPSYCHE, n.g. | |
| | | No separate costal vein (or basal part of costa not preserved);
at least one apical fork with definite cross-veins 2. | |
| (2) | { | Sc and R very close together; pterostigmatic region very
long and narrow 3. | |
| | | Sc and R further apart; pterostigmatic region not so narrow,
less regularly shaped; third apical fork with a cross-vein..
..... TRIASSOPSYCHE Tillyard. | |
| (3) | { | Only two or three costal veinlets present; second apical fork
subdivided into three cells by cross-veins.... MESOPSYCHE Tillyard. | |
| | | Numerous costal veinlets present; first apical fork with two
cross-veins; second apical fork undivided NEUROPSYCHE, n.g. | |

Genus ARISTOPSYCHE, n.g. (Text-fig.25).

Characters of forewing:—Large wing with broadly rounded apex and very regular scheme of venation; no excess cross-veins in distal part of wing. A short but distinct costal vein present, ending on costal margin at about one-fifth of the total wing-length; veinlets are present both between this vein and the costal border, and also between Sc and the same border. Sc and R both straight, fairly close together; pterostigmatic region moderately long and narrow, with one veinlet. Both the radial (discoidal) and median cells closed, with all four apical forks sessile upon them, though the third fork is only just so. Cu_1 a very strong, convex vein slightly bent downwards distally; not forked, but giving off two very strong, oblique, posterior branches to join the vein below, which is probably Cu_2 . Cu_1 distinctly

joined to M near base. Anal veins distinct and quite separated distally.

G e n o t y p e, *Aristopsyche superba*, n.sp. (Upper Triassic, Ipswich, Q.).

This genus would appear to be fairly closely allied to both *Mesopsyche* and *Triassopsyche*. The form of the radial cell resembles that of the latter genus very closely, while the form of the median cell, with its peculiarity of having the medio-cubital cross-vein attached almost exactly to the origin of M_4 , resembles that of the former genus. In the peculiar form of Cu_1 there is also a close resemblance to *Triassopsyche*; in this latter genus, only enough of the wing is preserved to show the more distal of the two descending branch-veins, and the more distal part of Cu_1 is somewhat zigzagged, through being braced by excess cross-veins, not present in *Aristopsyche*.

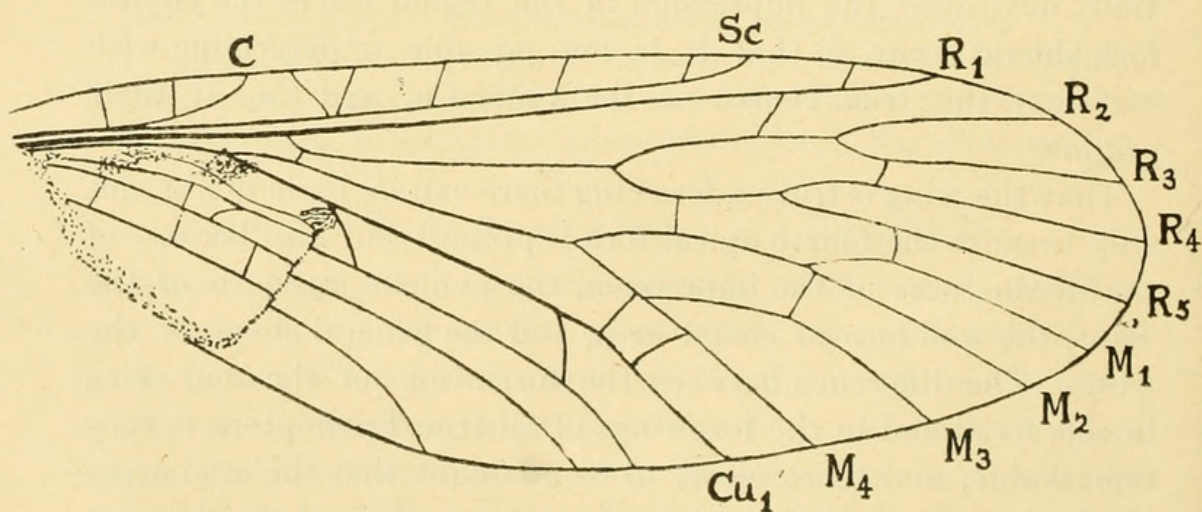
It is much to be regretted that, perfect as this fossil is (with the exception of a single break across the anal veins), some cuts made by the knife in exposing it have, most unfortunately, partially destroyed the impression in the region where the cubital fork should occur, so that it is not possible to determine with certainty the true course of the veins Cu_1 and Cu_2 at their origins.

That the wing is truly a forewing there can be little doubt, not only because the fourth apical fork is present, but also because of the distinctness of the impression, the evident strength of the veins, the well-formed costal area, and the general shape of the wing. The difference between the formations of the anal veins in this fossil and in the forewings of all true Trichoptera is very remarkable; and there seems to be no doubt that the anal areas of the forewings of the other three genera from Ipswich must closely resemble this also. For *Triassopsyche* is so close to *Aristopsyche* that we are bound to conclude a close similarity in the form of their anal veins, though these are not preserved in the former genus. Moreover, in *Neuropsychyche*, n.g., which will be seen to be equally close to *Mesopsyche*, some of the anal area is preserved, and is found to be closely similar to that of *Aristopsyche*.

ARISTOPSYCHE SUPERBA, n.sp. (Text-fig.25).

Greatest length of fossil, 24 mm. (representing a complete wing about 25 mm. long, with a small piece of the extreme base missing); *greatest breadth*, 8.2 mm.

This fossil is perfectly preserved, except for a small portion of the base and anal area; the wing had evidently been torn transversely across the anal veins before becoming fossilised, so that these veins are all slightly displaced basally. A weak, irregular curved line below the basal portion of Cu_1 appears to represent the crinkle in the wing-membrane due to this displacement. The first vein lying below this crinkle should be Cu_2 , the second 1A, and the third 2A, 3A being apparently obliterated owing to the poor state of preservation of the wing near the base anally. It might be maintained, however, that these three veins were the three anals, Cu_2 being represented either by one of the two oblique descending branches from Cu_1 , or possibly even by the weak, curved line which I have preferred to interpret as a crinkle in the membrane.



Text-fig.25.

Aristopsyche superba, n.g. et sp., forewing. Upper Trias of Ipswich, Q.

C, distal end of short costal vein; rest of lettering as usual in Comstock-Needham notation; ($\times 4$).

Cross-veins present are:—two between the costal border and the short separate vein C; five between the costal border and Sc, of which the most basal is bent backwards towards the tip of

C; one in the pterostigmatic space; one between R_1 and R_{2+3} ; one between R_3 and R_4 , closing the radial cell distally; one from R_{4+5} to M_{1+2} ; one from R_5 to M_1 ; a short one connecting R_s with M , quite close to the origin of the former; one between M_2 and M_3 , closing the median cell distally; one from near the origin of M_4 to Cu_1 , with a second somewhat distad from it; an oblique one (possibly a branch veinlet) from $1A$ to Cu_2 ; and three between $1A$ and $2A$. The two oblique veins running from Cu_1 downwards are very strongly marked, and quite different from the other cross-veins; so that I have little doubt that they represent true branches of this vein.

Type, Specimen No. 148a. (Coll. Queensland Geological Survey).

Horizon: Upper Triassic, Ipswich, Q.

Genus *NEUROPSYCHE*, n.g. (Text-fig. 26).

Characters of forewing:—A moderate-sized wing with narrow costal area and very narrow, elongated radial cell; pterostigma very long, without any veinlets. Numerous veinlets in costal area, also a number of excess cross-veins scattered irregularly. Sc and R very close together. First and second apical forks very narrow and close together; third and fourth broad and normally placed. Cu_1 a straight vein without any branches in the preserved part; the same is true of Cu_2 and $1A$. Both radial and median cells closed, the first, second, and fourth apical forks sessile, the third very definitely stalked.

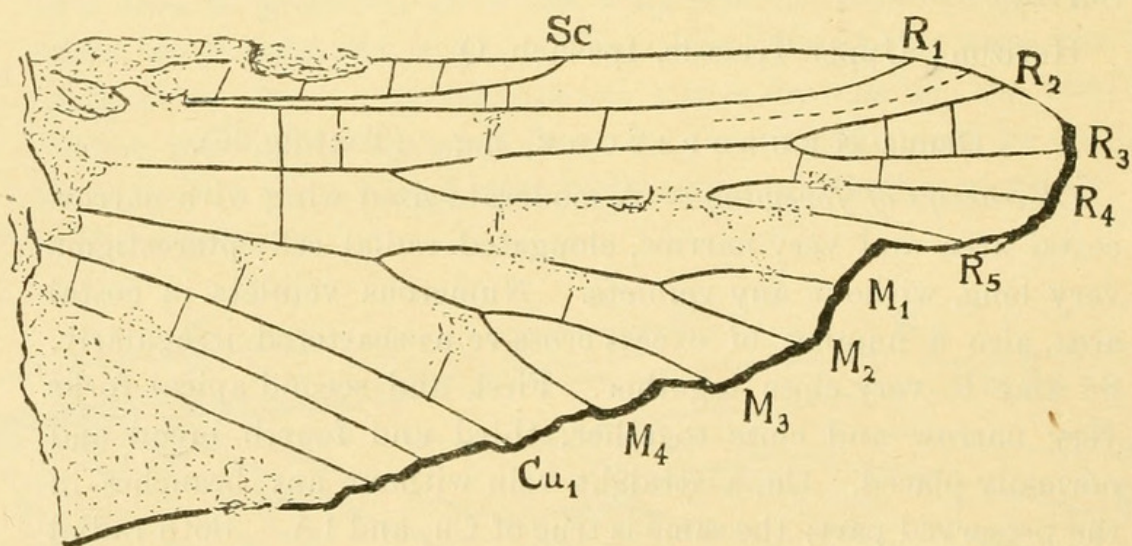
Genotype, *Neuropsycha elongata*, n.sp. (Upper Triassic, Ipswich, Q.).

Evidently closely allied to *Mesopsyche* from the same horizon. It differs from the latter genus in lacking the subdivision of the second apical fork into three separate cells, but possesses instead two cross-veins in the first apical fork. In *Mesopsyche* the costal area is not crossed by numerous veinlets, nor is the third apical fork stalked, but arises exactly from the upper distal angle of the median cell. *Mesopsyche* also lacks the excess cross-veins which are so conspicuous in the new genus.

NEUROPSYCHE ELONGATA, n.sp. (Text-fig.26).

Greatest length of fragment, 11 mm, representing a wing whose total length was about 16.5 mm. *Greatest breadth*, 4.8 mm.

The impression is a faint one, but can be made out with very little difficulty in a good light. All the basal part of the wing, together with the extreme distal part, from the apex obliquely downwards to the distal ends of Cu and 1A, is missing. In the short distal end of the costal area preserved, no less than four veinlets are visible; so that it is fairly certain that this area was well supplied with veinlets the whole way along. Below the apical end of Sc, two small cross-veins pass downwards to R; but the whole of the true pterostigma is smooth and free of veins.



Text-fig. 26.

Neuropsyche elongata, n.g. et sp., forewing. Upper Trias of Ipswich, Q; ($\times 8$). Lettering as usual.

The pterostigmatic furrow is well marked, between R_1 and R_2 . Other cross-veins present are:—four between R_1 and R_5 , of which the most basal passes on in a straight line to M; two between R_3 and R_4 , one closing the radial cell, the other slightly distad from it; one (not well preserved) between R_{4+5} and M_{1+2} ; one closing the median cell distally; two between M and Cu_1 ; and two between Cu_1 and Cu_2 .

Type, Specimen No. 228a. (Coll. Queensland Geological Survey).

Horizon: Upper Triassic, Ipswich, Q.

A study of the four genera of Paratrachoptera now known from Ipswich makes it extremely questionable whether they can be regarded as lying in the direct ancestral line of the present Trachoptera. It is, of course, quite certain that recent Trachoptera must have been originally derived from Trachopterous-like insects in which the high specialisation of the anal veins, now present throughout the Order, had not been established. But all archaic recent Trachoptera have a very definite dichotomy of the first cubitus distally, forming the *fifth apical fork*; whereas it is quite evident that the Paratrachoptera did not possess this fork, but had instead a straight Cu_1 , of the type seen in all fossil and recent Mecoptera.

Order **PLANIPENNIA.**

Family PROHEMEROBIDÆ.

In No.1 of this Series (3, p.178), I described from Ipswich the genus *Protopsychoptis*, placing it in the above family for reasons there given. Since then, I have received a very beautifully preserved fragment of a Prohemerobiid wing, showing most of the basal part of the wing, with all the most important veins preserved. This fossil appeared at first to be so exactly like the recent *Megapsychoptis illidgei* that I began to think that the family *Prohemerobiidæ* could no longer be maintained. However, a careful study of the new fossil shows certain important differences, which, taken in conjunction with our knowledge of the Liassic and Jurassic *Prohemerobiidæ* of Europe, and of the recent *Psychoptidæ*, make it quite certain that the former family must be maintained; while it is now capable of definite proof that the latter family is a direct descendant therefrom. This proof will be furnished below, after the definition of the new genus, and the description of the fossil, have been given.

Genus **ARCHEPSYCHOPS**, n.g. (Text-fig.27).

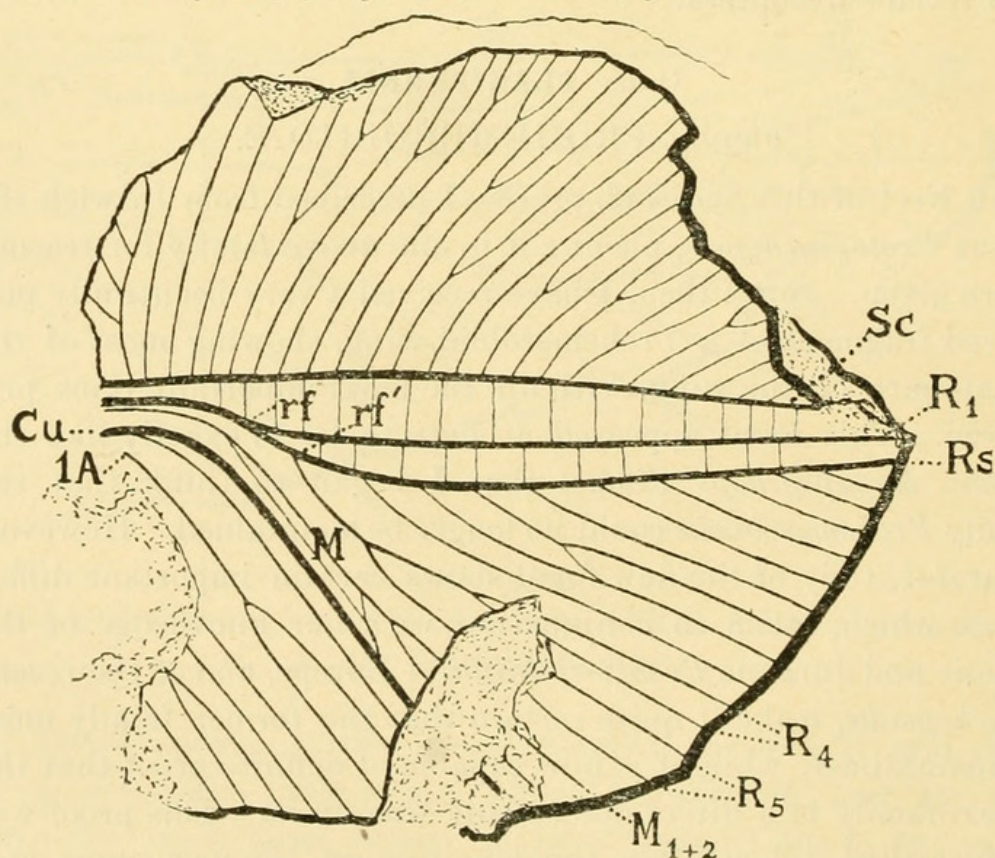
Characters of preserved basal part of forewing as in the recent *Megapsychoptis*, with the following differences:—Costal veinlets at extreme base arising at right angles to Sc, the recurrent vein

giving off anterior branches only (as in hindwing of *Megapsychops*); further distad, the direction of these veinlets changes rapidly, until, at the most distally preserved part of the wing, they make an angle of only about 30° with Sc. *No costal series of cross-veins between the costal veinlets.* The most basal branch of $R_s (= R_{4+5})$ still preserves its dichotomous branching, and both R_4 and R_5 again branch dichotomously in the preserved part. $1A$ also dichotomously branched.

Genotype, Archepsychops triassica, n.sp. (Upper Triassic, Ipswich, Q.).

ARCHEPSYCHOPS TRIASSICA, n.sp. (Text-fig.27).

Greatest length of fragment, 6.7 mm.; greatest breadth, 6 mm.



Text-fig.27.

Archepsychops triassica, n.g. et sp., preserved portion of forewing. Upper Trias of Ipswich, Q.; *rf*, primary radial fork; *rf'*, secondary radial fork; rest of lettering as usual; ($\times 10\frac{1}{2}$).

(Measurements of the corresponding portions of the forewing of *Megapsychops illidgei* are almost exactly the same size; so that

the fossil should represent a portion of a large wing of about the same size as that of *M. illidgei*, viz., about 27 mm. long). All the main veins and branches beautifully preserved, very strongly formed; the cross-veins, which are only present between Sc and R₁, and between R₁ and Rs, are weak and difficult to make out, but can be clearly seen in oblique evening sunlight. Sc, R₁, Rs, and Cu₁ are exceptionally strong veins, as also in *M. illidgei*. The direction of Cu₁, which makes an angle of as much as 50° with Rs, is quite exceptional, but is about the same as in the forewing of *M. illidgei*; likewise the weak formation of Cu₂, and its position parallel and very close up to Cu₁, is similar in both. No less than ten branches of Rs are present in the preserved portion of the wing; so that the total number of branches must have been very large, as also in *M. illidgei*. The formation of M is peculiar. Owing to the strength and thickness of Cu₁, which stands on a high ridge, it is not easy to make out the exact formation of the much weaker concave vein M near its base. But, viewed with a good light in the right direction, there can be seen a weak posterior branch of M arising from the main stem quite close to the base, and running between and parallel to M and Cu₁, until it meets with an oblique cross-vein descending from M just before the first clear dichotomy; it then curves in to join Cu₁ just below the dichotomy of M. Being in doubt as to the interpretation of this peculiar formation, I examined the forewing of *M. illidgei*, and there found, in the same position, a distinct but weak branch of M arising in the same manner, and ending on a cross-vein descending from the first evident dichotomy of M, as shown in Text-fig. 28, a. As this character appears to be of some importance, I also examined the forewing of *Psychopsis elegans* (Guér.), and was surprised to find a closely similar formation there. I think that there can be little doubt that this vein, which I unfortunately overlooked in my previous studies of the *Psychopsidæ*, is really the posterior branch from the first dichotomy of M, and should therefore be called M₅. It must evidently be the homologue of the vein called the *posterior arculus* by Comstock in the Trichoptera and Lepidoptera, and also visible in the Mecopteron *Stereochorista* described on p. 196

of this paper. It will follow from this that the primary median fork, like the primary radial and cubital forks, lies close to the base of the wing, and that the more distal fork, which has hitherto been regarded as the median fork, is really the secondary median fork, homologous with the secondary radial and cubital forks. Beyond the formation already described, only one dichotomy of M_{1-4} can be seen in the fossil; but there were almost certainly further dichotomies in the lost portion, judging by the somewhat diverging directions of the branches of M and of R_{4+5} . (M has at least four branches in *M. illidgei*, apart from the vein M_5 already mentioned).

Type, Specimen No. 137a. (Coll. Queensland Geological Survey).

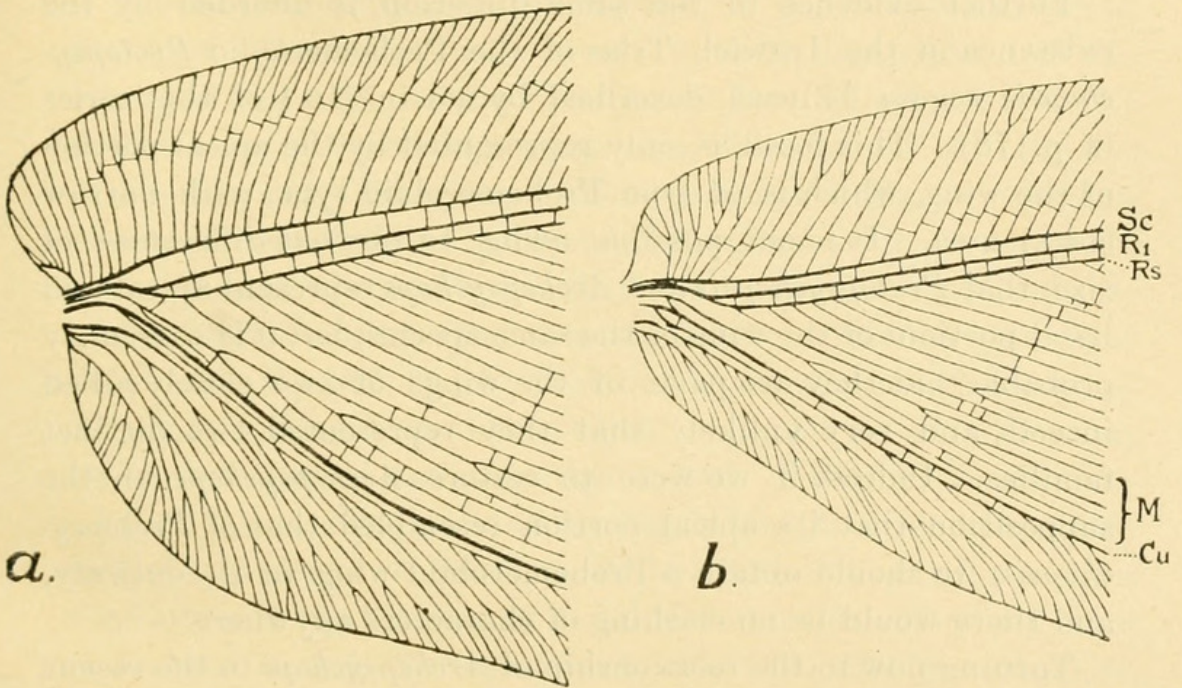
Horizon: Upper Triassic, Ipswich, Q.

Discussion of the Relationship between the Fossil Prohemerobiidæ and the Recent Psychopsidæ.

In Text-fig. 28, I show the bases of fore- and hindwings of *Megapsychops illidgei* (Froggatt), the most archaic of existing *Psychopsidæ*, for comparison with the fossil *Archepsychops*. It should be stated, at the start, that the venation of *Megapsychops* is absolutely unique, and that there is no other known insect, fossil or recent, which possesses the same characters, or anything closely approaching them. From the rest of the *Psychopsidæ* it is widely separated by the large number and closeness of the branches of R_s , the four- to six-branched media, and the remarkable structure of the cubitus.

Comparing Text-figs. 27-28, we see that the forewing of the fossil *Archepsychops* is intermediate between the fore- and hindwings of *Megapsychops* in the form of the costal veinlets—the immense breadth of the costal space resembling that of the forewing of this latter genus, while the type of branching of the recurrent costal veinlet is that found in the hindwing only of *Megapsychops*. Apart from the absence of the costal series of cross-veins, which never occurs in any Prohemerobiid, the principal difference between the forewings of *Archepsychops* and *Megapsychops* is the great change in the direction of the costal

veinlets in the former, even in the short space of the wing preserved in the fossil. This character might be passed over as of little importance, were it not quite incompatible with the fundamental character of the family *Psychopsidæ*, viz., the broadly rounded apex, with wide costal area from base to tip. Those Liassic and Jurassic *Prohemerobiidæ* which are best preserved



Text-fig. 28.

Megapyschops illidgei (Froggatt). Basal third of forewing (a) and hindwing (b) for comparison with Text-fig. 27; ($\times 5$).

show, for the most part, a costal area fairly broad at the base, but rapidly narrowing towards the apex, which is always much less rounded than that of the *Psychopsidæ*; concurrently with this more primitive shape, there is an entire absence of any formation of a *vena triplica*, the three veins Sc, R₁, and Rs remaining primitive in form from base to apex. Now, if we turn to the study of the wings of any *Psychopsid*, we see that the broad apex, together with the specialisation of the greater parts of Sc, R₁, and Rs as a *vena triplica*, is correlated with a condition of the costal veinlets which is quite different from that found in the fossil. In the *Psychopsidæ*, these veinlets, from near the base right up to near the end of the *vena triplica*, come

off at an angle exceeding 45° , and all are approximately parallel to one another. Thus, a little thought will show us that the condition of these veinlets shown in the fossil is definite proof that the wide costal area existing at the base does not continue further distad, and that the more distal portion is of the narrower Prohemerobiid type.

Further evidence in the same direction is afforded by the existence in the Ipswich Trias of the Prohemerobiid *Protopsy-chopsis venosa* Tillyard, described by me in No.1 of this series (3, p.178). This fossil is only represented by the apical portion of the wing, which is of true Prohemerobiid type, with narrow costal area. It is not possible, owing to obvious differences of size, that *Protopsy-chopsis* and *Archepsy-chops* represent apical and basal portions of the wing of the same species; but it is extremely probable that they are parts of the wings of two closely allied insects, and very unlikely that they represented two distinct families. Indeed, if we were to restore *Archepsy-chops* on the supposition that its apical portion resembled that of *Protopsy-chopsis*, we should obtain a Prohemerobiid wing in its entirety, and there would be no clashing of characters anywhere.

Turning now to the relationship of *Archepsy-chops* to the recent *Megapsy-chops*, we see at once that *there is not a single character present in the former which is incompatible with its being considered as the direct ancestor of the latter*. When we consider how unique *Megapsy-chops* is in its venation, we must see that this is a very remarkable thing. If we add to this, that the differences in size of the two insects, and in the strength and closeness of their veins, are practically negligible, and that *Megapsy-chops* at the present day is only known to inhabit an isolated mountain-top situated some thirty miles from the Ipswich Fossil Beds, we see how strong a case there is for considering the fossil *Archepsy-chops* to be the *direct ancestor* of the recent *Megapsy-chops*. If this be accepted, then it has also been demonstrated that the *Psychopsidae*, as a family, are the direct descendants of the older *Prohemerobiidae*; the changes required to evolve the one from the other, through the immense period of geological time beginning with the Upper Trias, being really

only a change in the shape of the wing, with its consequent alteration in the size and direction of the costal veinlets, and with a correlated specialisation in three parallel main veins, to form the *vena triplica* (as a kind of backbone or rachis for the widened wing), and a further strengthening of the veinlets by formation of the costal series of cross-veins.

There is one other point of interest in the venation of *Archepsychops*. Comstock, in a recent work (1), has elaborated the theory of the origin of the Planipennia from an older stock with dichotomously branching wing-veins, such as we find in the Mecoptera and Trichoptera. The condition of R_{4+5} in the new fossil is direct evidence in favour of this, but *not* in favour of the restriction of the number of dichotomous branches of both Rs and M to *four*, which Comstock also holds. For it is quite clear that both R_4 and R_5 , in this fossil, are again dichotomously branched not far from their origins; and quite possibly they may be even branched again, further distad. Thus, we should conceive of the ancestral form as having, indeed, truly dichotomously branching sectors of Rs and M, but without any unnecessary limitation of the number of those dichotomies. Such a type is to be seen in the Protomecoptera, also from the Ipswich Trias, in which the number of branches of Rs is very large, but all are clearly *primitive dichotomies*. If we could find the type that gave rise to both *Archipanorpa* and *Archepsychops*, we should most probably have discovered the ancestor of the whole of the Panorpoide Orders.

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3. ————, 1917.—“Mesozoic Insects of Queensland. No.1. Planipennia, Trichoptera, and the new Order Protomecoptera.” These Proceedings, xlii., Part 1, pp.175-200, text-figs.1-7, Pl. vii.-ix.
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Note on Archipanorpa magnifica (Order Protomecoptera):— In No.1 of this series(3), I gave two drawings of the archedictyon or primitive meshwork of the wings of this fine fossil, one in Text-fig.6, the other on Pl. viii., fig.6. I now desire to draw attention to the fact that I have succeeded in making photomicrographs of this structure, and that they have recently been published in Part 2 of "The Panorpoid Complex" (These Proceedings, 1918, xliii., Part 3, Pl. lxvii.). These photographs give a much more accurate idea of the true appearance of the archedictyon, the previous drawings having been diagrammatic, and, therefore, possibly somewhat misleading as regards the detailed structure of the meshwork.

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