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FOSSIL MECOPTEROID INSECTS FROM THE UPPER PERMIAN OF NEW SOUTH WALES.

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(Plates v—vi; Text-figures 1–167.)

This paper deals with the Mecoptera and all the related orders of insects collected from the Upper Permian strata between Belmont and Warner's Bay, New South Wales. All the material described is in the Collection of the Australian Museum, Sydney. Tillyard published several papers dealing with the early collections of insects from these beds but the more recent and rather extensive collections remain unworked except mainly for the Homoptera and Psocoptera. The present material extends considerably our knowledge of the previously described species and has brought to light a great wealth of new forms.

Tillyard, in his papers on the orders under consideration, allowed practically no variation within a species and was often led astray by irregularities in the preservation of the specimens. It is considered, from a study of very long series, that these Permian species showed considerable variation and also that great care must be taken to allow for the effects of preservation.

Of the Mecopteroid orders the true Mecoptera are dominant in the fauna. In addition to Eumecoptera there are the primitive suborders Protomecoptera and Paramecoptera as well as the Protodiptera which also are best considered within the Mecoptera. The Neuroptera are represented by a number of interesting types. Trichoptera are recognized from these beds for the first time, and this, I believe, is the first record of the order from Permian strata.

I greatly appreciate the opportunity to study this material for which I am grateful to the Director and staff of the Australian Museum; to Mr. O. le M. Knight (who collected a considerable portion of the material) for the loan of literature, and to the Chief of the Division of Entomology, C.S.I.R.O., for permission to devote a little of my official time to the study of fossil insects.

Order MECOPTERA.

This order is expanded to include not only the Eumecoptera but all the Mecopteroid forms which do not fall into any of the recognized living orders. In the suborder Protomecoptera, which includes the families Platychoristidae and Permomeropidae, and the suborder Paramecoptera, CuA is forked in the forewing. In the other fossil suborder, Protodiptera, CuA is simple in both wings. The Paratrichoptera were inaccurately diagnosed by Tillyard and are considered as a family within the Eumecoptera.

Suborder PROTOMECOPTERA.

Tillyard first used the name Protomecoptera for the Triassic *Archipanorpa*. This genus shows a distinct costal vein so that its Mecopterous affinity is doubtful. Subsequently the group was expanded to include *Platychorista* and *Permomerope*. The Recent genera *Merope*, *Austromerope* and *Notiothauma* are also included in the suborder. The name is best retained in the altered sense to include all the above genera except *Archipanorpa*.

Forewing.—CuA forked, anals looped, a complete series of costal veinlets, veins with many branches.

This suborder differs from typical Mecoptera chiefly in the looped anals and forked CuA. It is separated from the Trichoptera because of the many branches to the veins and in general, on the complete series of costal veinlets. CuA is not regularly, strongly bifid, as in Trichoptera.

Family PERMOMEROPIDAE, nov.

Allied to the Permian Platychoristidae but differing in the type of forking to CuA and the more regularly dichotomic branching of Rs and M. There is only one genus from the Upper Permian of New South Wales.

Forewing.—Costal space broad, with a number of oblique veinlets from Sc to the costal margin; pterostigma well-developed; Rs and M with numerous dichotomous branches; CuA forked near apex, not regularly strongly bifid; CuP simple; 1A simple, 2A looped on to 1A and 3A on to 2A.

Hindwing.—Costal space with a number of oblique veinlets from Sc to the costal margin; pterostigma well-developed; Rs and M with numerous dichotomic branches; CuA forked near apex, not regularly bifid.

The family might better be placed in the Planipennia on the structure of CuA which is sometimes pectinately branched near its apex. The family Permosisyridae of the Russian Permian shows the transition to the Planipennia even more distinctly. One species, *Permosisyra punctata* Martynov, 1933, is very close to *Permomerope* but the species *Permosisyra latipennis* is distinct and a true Planipennia.

Genus **Permomerope** Tillyard, 1926.

Genotype *Permomerope australis* Tillyard, 1926.

Forewing.—Costal space slightly expanded over the basal half; Rs dichotomously branched, branches numerous (14); M normally eight-branched; CuA forked at least once near apex.

Hindwing.—Costal space narrow basally; Sc not reaching the pterostigma but fused to R_1 just before the pterostigma; pterostigma well-developed, lying in the apical fork of R_1; Rs with fewer branches than in the forewing, variable in their arrangement, but generally dichotomously branched; M generally with eight regularly dichotomous branches; cubito-median Y-vein not clearly preserved; CuA forked at least once, generally twice, near apex.

The genus differs from *Cladochorista* (Order Trichoptera) mainly in the extra forking to all veins, in the development of a distinct pterostigma and in the irregularly forked CuA.

Permomerope australis Tillyard, 1926.

(Plate v, B, figs. 6–7; Text-figs. 1–3.)

Permomerope australis Tillyard, 1926, Proc. Linn. Soc. N.S.W., li, 275.

Forewing.—Long, length of fragment 10 mm., rather narrow, apex fairly sharp; costal space not markedly expanded, costal veinlets evenly spaced, more oblique towards the apex; R kinked slightly at the base before the origin of Rs; pterostigma and apex of Sc not preserved; Rs fourteen-branched, with an occasional branch showing an additional end-twigging, origin of the branches not preserved but apparently arising dichotomously; M eight-branched, the first fork well towards the base, M_{3+4} forking well before M_{1+2}; cubito-median Y-vein area not preserved; CuA three- or four-branched near its apex, with a distinct cross-vein to M close to the apical fork; CuP parallel to and well-separated from CuA; 1A close to CuP, simple, reaching the wing margin, 2A looped on to 1A near its apex and with a branch to the wing margin, 3A similarly looped on to 2A; cross-veins preserved at various levels between the branches of Rs.

Hindwing.—Long, length of fragment 8·5 mm., broader than forewing, apex well rounded; costal veinlets evenly spaced, usually more oblique towards the apex; pterostigma strongly formed, without definite veinlets, bordered by a branching of R_1 around it; R_1 straight until the pterostigma, where it takes a decided bend; Rs dichotomously branched, with ten branches, the extra two branches being on the forks of R_5; M regularly eight-branched, M_{3+4} forking well before M_{1+2}; cubito-median Y-vein area not preserved; CuA three-branched near its apex.

Type.—Holotype, fragment of hindwing, F.28045 in the Australian Museum Collection (No. 100 of Mitchell Collection). The counterpart of the type is in the Cawthron Institute. The forewing is described from F.40108, Australian Museum Collection.

There are two additional specimens of this species. F.41239 and counterpart F.41274 is a laterally compressed complete insect but the venation of all wings is confused. F.43119 and counterpart F.43120 shows clearly the structure of the posterior half of the wing, including the looped anal veins.

Permomerope nanus, sp. nov.
(Text-fig. 4.)

Forewing.—Small, length of complete wing 7·5 mm., long, rather narrow, apex rounded; costal space not greatly expanded, Sc ending well before the apex of the wing, connected to R_1 by a short cross-vein; pterostigma well-developed; Rs dichotomously branched, eight-branched, the forking of R_3 reduced, the other three veins with a more pronounced fork; M eight-branched, forking before the forking of Rs, M_{3+4} forking before M_{1+3}; basal origin of Cu not distinct, CuA forked towards apex, a distinct cross-vein to M_{3+4} near origin of fork; CuP simple; 1A simple, reaching the wing margin very close to CuP, 2A simple, looped on to 1A, 3A looped on to 2A.

Type.—Holotype forewing F.40233 in the Australian Museum Collection.

This species differs from preserved portions of *australis* not only in size but also in the reduced branching of Rs and CuA. It shows very clearly the looping of the anal veins.

INSERTAE SEDIS.

Genus **Aphryganoneura** Tillyard, 1926.

Genotype, *Aphryganoneura anomala* Tillyard, 1926.

" Distinguished from all other Mecoptera by the branches of the main veins being parallel, separated by grooves as in Neuroptera Planipennia, and unbranched distally ..... ". Branches very numerous.

Aphryganoneura anomala Tillyard, 1926.

Aphryganoneura anomala Tillyard, 1926, Proc. Linn. Soc. N.S.W., li, 276.

Type.—Holotype F.28050 and counterpart F.29033 in the Australian Museum Collection.

There are no additional specimens of this species.

Suborder PARAMECOPTERA.

Similar to Eumecoptera, but CuA normally forked in forewing, simple in hindwing; anal veins not looped; cubito-median Y-vein very prominent, arms almost equal; Rs typically six-branched and M four-branched. This suborder may be ancestral to the Hymenoptera.

Family BELMONTIIDAE.

Belmontiidae Tillyard, 1919, 1922, 1926; Martynova, 1942.

Parabelmontiidae Tillyard, 1922, 1926; Martynova, 1942.

Insects of rather large size.

Forewing.—Costal space not very broad and with very few cross-veins; Rs with more branches than M, normally six-branched; M four-branched; cubito-median Y-vein strongly formed; CuA typically forked apically, CuP simple; anal veins simple, connected by cross-veins.

Hindwing.—Similar to the forewing but shorter and broader; Rs seven-branched (this may be a variant); CuA simple; cubito-median Y-vein distinct.

The family contains the two genera *Belmontia* (forewing) and *Parabelmontia* (hindwing), which will probably become synonymous when a complete insect is found.

Genus **Belmontia** Tillyard, 1919.

Genotype, *Belmontia mitchelli* Tillyard, 1919.

Forewing.—Costal space narrow, not expanded near base; Sc forked near its apex, connected to R_1 by a cross-vein; no distinct pterostigma; R_1 simple, Rs six-branched, R_1 and R_4 simple; M four-branched; occasionally five-branched; cubito-median Y-vein well-developed; CuA normally forked near apex, CuP simple; anal veins simple, connected by cross-veins.

Hindwing.—Not known definitely.

Belmontia mitchelli Tillyard, 1919.

(Plate v, B, figs. 12–13; Text-figs. 5–6.)

Belmontia mitchelli Tillyard, 1919, Proc. Linn. Soc. N.S.W., xliv, 234.

Forewing.—Wing of rather large size, length 18 mm., narrow at base, with a slightly pointed apex; Sc branched over its apical quarter or more, one or two costal veinlets before the forking of Sc, the veinlets less oblique; R_1 simple; Rs arises rather close to the base, stem of Rs long, R_{2+3} forking early and R_3 branching again before the wing margin; R_{4+5} branches very close to its origin, before R_{2+3} and R_5 fork again; M four-branched, M_{1+2} forking after M_{3+4}; cubito-median Y-vein large, the arms almost equal; a well-developed cross-vein between M and CuA near the forking of CuA; CuA forked close to the wing margin; CuP simple, distinct; 1A, 2A and 3A simple, connected by cross-veins.

Type.—Holotype forewing F.28469 in the Australian Museum Collection (No. 40 of Mitchell's Collection).

There is a second almost complete wing, F.40970, referred to this species. The costal margin is missing and CuA_1 appears as a fork on M_4 with CuA appearing simple.

Tillyard's figure of the type is inaccurate in some respects. The basal cross-vein connecting M to the stem of R is not distinguishable. The fork shown to R_4 is really a cross-vein to the fork of R_3, which vein was regarded as simple. There is no second branch to R_5, or to M_4. This interesting fossil species with its typically forked CuA differs from Trichoptera mainly in the unlooped condition of the anal veins but the very large cubito-median Y-vein is also distinctive.

Genus **Parabelmontia** Tillyard, 1922.

Genotype, *Parabelmontia permiana* Tillyard, 1922.

Forewing.—Not known definitely.

Hindwing.—Costal space narrow, not expanded near the base; no distinct pterostigma; R_1 simple, Rs six- or seven-branched; M four-branched; cubito-median Y-vein distinct; CuA simple, CuP simple; anal veins simple.

This genus, which is very probably the hindwing of *Belmontia*, differs from it only in the simple CuA and the shape of the cubito-median Y-vein. If *Parabelmontia permiana* is considered a forewing, then there is no character on which it can be retained in the Paramecoptera.

Parabelmontia permiana Tillyard, 1922.
(Plate v, B, fig. 14; Text-fig. 7.)

Parabelmontia permiana Tillyard, 1922, Proc. Linn. Soc. N.S.W., xlvii, 286.

Hindwing.—Wing of rather large size, length 18 mm., broad, apex rounded; Sc forked over at least the apical half, the branches oblique, particularly the apical one; R_1 forked at apex, lying close to Sc; Rs seven-branched, R_2 simple, R_{4+5} forks before R_{2+3} and the branches of R_3 reunite before the wing margin (as an individual variation); M four-branched, M_{1+2} forking after M_{3+4}; cubito-median Y-vein distinct, with the branch from M strongly developed and continuing straight as CuA to the wing margin; CuP simple, widely separated from CuA; three simple anal veins, 3A quite small and strongly curved.

Type.—Holotype hindwing F.28461 in the Australian Museum Collection. (No. 54 of Mitchell's Collection.)

F.41188 is a rather crumpled fragmentary wing of this species. Tillyard's figure of the type is inaccurate in many details, most notably in the structure of M. This vein shows the typical four-branched condition, the extra forks shown on M_1 and M_3 are not present in the fossil. The lower arm of the cubito-median Y-vein is simple and there is no sign of an apical cross-vein between CuA and CuP.

Suborder EUMECOPTERA.

Five families of this suborder have been recognized in these beds. The Mesochoristidae, Agetopanorpidae and Xenochoristidae contain species of moderate size but in the Mesopanorpodidae and Nannochoristidae the species are from small to minute.

If one considers the total number of specimens then the Mesochoristidae is the dominant family. However, it contains only a few species, one of which is represented by about one hundred and fifty specimens. The very small Mesopanorpodidae are abundant but the other three families are represented by very few specimens.

Family MESOCHORISTIDAE Tillyard.

Insects of from moderate to rather large size.

Forewing.—M six-branched, with extra forks on M_2 and M_4; Rs variable, four- to six-branched, often tending to pectination; Sc two-branched.

Hindwing.—M four-branched; Sc forked near apex; R as in the forewing.

Two genera occurring in these beds, *Mesochorista* and *Parachorista*, are placed in this family which, in its restricted redefinition, is almost entirely confined to Australia. In *Mesochorista* Rs is typically four-branched while in *Parachorista* it is six-branched, pectinate. Species of *Parachorista* are of rather large size, while those of *Mesochorista* are more generally of medium size but some are quite small.

Genus **Mesochorista** Tillyard, 1916.

Genotype, *Mesochorista proavita* Tillyard, 1916.

Genotype, *Mesochorista proavita* Tillyard, 1916.

Mesochorista Tillyard, 1916.

Permochorista Tillyard, 1917, 1922, 1926.

? *Petrochorista* Martynov, 1931 (in part).

Forewing.—Sc forked, two-branched; Rs four-branched, R_{4+5} forking before R_{2+3}; M six-branched, the extra forks on M_2 and M_4; CuA simple; cubito-median Y-vein variable; CuP and anals simple, except 3A which is forked close to its base.

Hindwing.—Sc shorter, simple; R as in forewing; M only four-branched; CuA simple; CuP and 1A fused for part of their length; 2A and possibly 3A simple.

There is some variation in the forking of Rs and M, in both wings, the number of branches being either increased or reduced.

Most of the Russian species referred to this genus have a three-branched Sc in the forewing and should be considered preferably in the genus *Petromantis* Handlirsch. The hindwing differs from *Mesochorista* in having a five-branched media. Tillyard separated the Permian species generically from *Mesochorista proavita* from the Triassic on very slight characters which are considered to be only of specific value.

Mesochorista australica (Tillyard), 1917.

(Plate v, A, figs. 1–17; Text-figs. 8–17.)

Permochorista australica Tillyard, 1917, Proc. Linn. Soc. N.S.W., xlii, 733.

Permochorista mitchelli Tillyard, 1917, Proc. Linn. Soc. N.S.W., xlii, 734.

Permochorista sinuata Tillyard, 1922, Proc. Linn. Soc. N.S.W., xlvii, 287.

Permochorista affinis Tillyard, 1922, Proc. Linn. Soc. N.S.W., xlvii, 288.

Permochorista collinsi Tillyard, 1926, Proc. Linn. Soc. N.S.W., li, 269.

Permochorista pincombei Tillyard, 1926, Proc. Linn. Soc. N.S.W., li, 269.

Permochorista angustipennis Tillyard, 1926, Proc. Linn. Soc. N.S.W., li, 270.

Permochorista osbornei Tillyard, 1926, Proc. Linn. Soc. N.S.W., li, 271.

Permochorista inaequalis Tillyard, 1926, Proc. Linn. Soc. N.S.W., li, 272.

Forewing.—Wing of moderate size, length about 10 mm., costal space slightly expanded, apex evenly rounded; Sc long, forked after the origin of Rs, the lower branch extending well beyond the upper branch, ending on the wing margin at or included in the pterostigma; a distinct cross-vein from Sc_2 to R_1 well before the pterostigma; humeral cross-vein distinct, close to base; R_1 simple, sigmoid, concave at the origin of Rs, convex just before the pterostigma and then concave again around the pterostigma; pterostigma well-defined, extending below R_1 but not touching R_2, basal margin more or less truncate; subcostal space wide at origin of Rs; Rs arising at junction of basal and middle thirds of R, four-branched, R_{4+5} forking well before R_{2+3}; M arising close to base, at least before the humeral cross-vein, six-branched, forking at or before the forking of Rs, with M_{3+4} forking well before M_{1+2}, extra forks on M_2 and M_4; cubito-median Y-vein distinct, the arms tending to be equal but the cubital branch the longer; CuA straight over its basal half, sigmoidally curved over the apical half, with a distinct cross-vein to M_4 close after its origin; CuP simple, converging slightly to CuA except at its apex; a distinct cross-vein to CuA about halfway from the cubito-median Y-vein to the wing margin, 1A and 2A simple, 3A forked close to its base; a short jugal vein also present; cross-veins rather widely dispersed between most branches of the veins; macrotrichia present on the main veins, including CuP.

Hindwing.—Similar in shape to forewing but costal margin straighter and hind margin a little more rounded; costal area not expanded; Sc shorter than in forewing, simple, slightly curved away from R, ending on wing margin soon after the first forking of Rs, from close to its apex a very distinct cross-vein to R_1, humeral cross-vein as in forewing;

R_1 almost straight, a slight kinking near the level of the humeral cross-vein, forked at apex, both branches enclosed in the distinct pterostigma; Rs arising rather closer to the base than in the forewing, four-branched, forking of R_{4+5} before R_{2+3} but both forking well before the wing margin; M arising from the stem of R before the level of the humeral cross-vein, four-branched, forking at or before the level of the first forking of Rs, M_{3+4} forking before M_{1+2}; cubito-median Y-vein not present, CuA fused to M for a short distance, continuing the basal line of M to the wing margin so that M appears as a branch of CuA; CuA very gently sigmoidally curved, CuP simple, almost parallel to CuA; 1A fused to CuP over most of its basal half, apical half free and also the extreme base; 2A simple, 3A apparently simple.

Type.—Holotype F.39318 in the Australian Museum Collection (No. 24 of Mitchell's Collection). The types of *sinuata* F.38270 and counterpart F.28463 (paratype F.28460); *pincombei* F.19796; *angustipennis* F.28043; *affinis* F.28466; *mitchelli* F.39317; *collinsi* F.28042 and counterpart F.29031 and *inaequalis* F.19792 are also in the Australian Museum Collection. The type of *osbornei* is stated to be in the Cawthron Institute Collection.

There are 140 additional specimens of this species. Most are isolated wings or wing fragments but a few show overlapping fore and hindwings. The body and legs are unknown. This species is dominant in the fauna and it is remarkable that no body structures were preserved.

There are many inaccuracies in the figures of the types given by Tillyard. It was only after an examination of the original specimens, with the exception of *osbornei*, that the above synonymy was established.

There is some variation in structure, particularly in the branching of M and, to a less extent, of R and the cubito-median Y-vein. Three specimens show a seven-branched media, the extra branch being on M_1, M_3 or M_{4b}. Six specimens show a reduced branching, M being only five-branched with M_2 simple. The type of *mitchelli* shows this condition. In F.40139, though M is six-branched, the forking of M_2 is reduced to a small twigging. Rs is fairly constant in structure. In only two specimens is there a reduced branching of R_{2+3}. F.40139 shows this vein forked near the margin; F.40131 has lost the apex of the wing and the vein appears simple but it is possibly forked close to the margin. In the type of *collinsi*, F.29031, R_2 shows an additional twigging, Rs being five-branched, and the same condition occurs in two other specimens, in F.40196 and counterpart F.40212 and in F.40225.

F.41700, F.40201 and F.43137 show associated fore and hindwings. F.40208 and counterpart F.40195 has four partly overlapping wings, both forewings with only a five-branched media and hindwings normal for the species.

There is some variation in the hindwings, notably in the position of the fork on R_{2+3}. One specimen, F.40213 and counterpart F.40215, shows a small extra fork on M_2 but has the typical forking of R_{2+3}. The holotype of *inaequalis* Tillyard, F.19792, is a hindwing.

The wing pigmentation pattern is preserved in some specimens, notably F.39982, F.40149 and F.40124. It is different in all three specimens but as it is impossible to distinguish them on venational characters there is no value in separating them specifically because the great majority of specimens are preserved without pattern.

At first it might be considered that forms with only a five-branched media in the forewing belong in the family Neorthophlebiidae but they differ markedly from such species in the expanded costal margin, distinctly dichotomic Sc and in having CuA and M either just touching or with a very reduced cubito-median Y-vein. The Neorthophlebiidae may have arisen through such a form as *Mesochorista* but certainly not along this line. The affinity to the Recent Choristidae is marked and had such a specimen occurred on its own it would undoubtedly have been considered in that family as a genus differing only in the structure of Sc, this vein being less distinctly forked in the Recent forms though, on rare occasions, such a condition does persist.

One specimen, F.40208 and counterpart F.40195, shows this five-branched media in both wings. Both hindwings are preserved and these have the normal four-branched media of the Mesochoristidae and Choristidae. On this example there would be some justification in considering it within the Choristidae, but preferably all these forms should be considered (and those with other variations of M) within a very variable species of *Mesochorista* which has reached an incipient stage of speciation.

Mesochorista jucunda (Tillyard), 1926.
(Plate v, B, figs. 4–5; Text-figs. 18–19.)

Permochorista jucunda Tillyard, 1926, Proc. Linn. Soc. N.S.W., li, 268.

Forewing.—Wing of moderate size, length 7 mm., rather long and narrow, costal space only slightly expanded, apex evenly rounded; Sc long, forked after the origin of Rs, the lower branch extending for almost the length of the stem, almost parallel to R_1; Sc_2 ends at the pterostigma; a distinct cross-vein from Sc to R_1 after the origin of Sc_2; R_1 simple, with a slight sigmoid curvature, concave at the origin of Rs but almost straight for the remainder of its length; pterostigma distinct, extending below R_1; subcostal space widest at the origin of Rs; Rs arising a quarter of the wing length from the base, four-branched, R_{4+5} forking before R_{2+3}, both forks very long; M arising close to the base of the wing, at least before the humeral cross-vein, six-branched, forking at or before the forking of Rs, with M_{3+4} forking well before M_{1+2}, extra forks on M_2 and M_4; cubito-median Y-vein not present, CuA touching or fused to M for a short distance or, if present, with arms very unequal; CuA with a slight sigmoid curvature over its apical third; CuP almost straight, slightly curved at apex; 1A and 2A simple, 3A possibly forked near base.

Hindwing.—Costal area narrower than in forewing, hind margin more rounded; Sc short, simple, ending on the costal margin about the first forking of Rs, with a distinct cross-vein to R_1 from near its apex; R distinctly concave at the origin of Rs, then continuing, almost parallel to the anterior margin, till near its apex; R_1 simple, though it is possible that there are weak cross-veins to the costal margin at the pterostigma; pterostigma clearly defined, extending well below R_1; Rs arising well towards the base of the wing, four-branched, similar to the forewing; M arising close to the base, before the curvature of R, four-branched, forking at or before the first forking of Rs, M_{3+4} forking before M_{1+2}; cubito-median Y-vein not present, CuA fused to M for a short distance, continuing the basal line of M to the wing margin so that M appears as a branch of CuA; CuA straight; CuP simple, free from 1A over more than its apical half; 1A simple fused almost basally to CuP; other anal veins not preserved.

Type.—Holotype F.38269 in the Australian Museum Collection (No. P.167 of Pincombe's Collection). The counterpart of the type is also in the Australian Museum. Collection, F.29032, and not in the Cawthron Institute Collection.

There are a number of additional specimens. F.40209 and counterpart F.41183 is a perfect wing which does not preserve the jugal region and 3A appears simple; F.41383 is perfect except for a little of the costal and apical margins and the jugal region; F.40221 lacks only the extreme apex of the wing and a small portion of the anal veins; F.41114 is an almost perfect wing; F.41748 has fore- and hindwings super-imposed; F.41189, F.40135, F.41195, F.41322 and counterpart F.41321 and F.41365 are more fragmentary. The description of the hindwings is based on F.42495, which lacks both the extreme base and the apex.

This species is similar to *australica* but differs in having a narrower wing in which the costal space is not expanded. The forking of Sc in the forewing is very different. In the hindwing Sc is shorter and R_1 not obviously forked near its apex. Without an almost complete wing it is hard to separate the two species but *jucunda*, on the average, is much smaller than *australica*.

Mesochorista dubia, sp. nov.

(Plate v, B, fig. 3; Text-fig. 20.)

Forewing.—Wing of moderate size, length 9·5 mm., costal space expanded somewhat over the basal half, apex rounded, greatest width well beyond the middle; Sc long, extending into the pterostigma, two-branched, branching at about its middle; R_1 simple, gently sigmoidally curved; pterostigma distinct, but margins not sharply defined; Rs arising towards the base of the wing, four-branched, its stem short, R_{2+3} forking very early, not much after R_{4+5} so that all four branches are extremely long; M arising from close to the base of the wing, six-branched, the first forking at a level with the first forking of Rs, M_{3+4} forking again very early, well before M_{1+2}, extra forks on M_2 and M_4; cubito-median Y-vein not present, CuA and M fused for a short distance; CuA simple; with a slight sigmoid curvature over its apical third; CuP simple, weak, well-separated from CuA (partly obscured by a slight fold of the wing membrane); 1A and 2A long, simple, subparallel, 3A apparently simple, also long and subparallel to 2A.

Type.—Holotype forewing F.41287 in the Australian Museum Collection.

F.42108 and counterpart F.42109 is referred only provisionally to this species, for in this specimen the forking of R_{2+3} is closer to the wing margin. The species differs from *jucunda* in the branching of R_{2+3} and in its larger size.

Mesochorista phipa, sp. nov.

(Plate v, B, figs. 1–2; Text-fig. 21.)

Forewing.—Wing small, length 6 mm., costal space not expanded, apex evenly rounded, greatest width well beyond the middle of the wing; Sc long, forked after the origin of Rs, the upper branch appearing almost as a cross-vein, lower branch long, ending before the pterostigma and with a cross-vein to R_1 from near its apex; R_1 simple, sigmoidally curved near base, straight over its apical half; pterostigma small but distinct, with R_1 passing through its middle; subcostal space widest at origin of Rs; Rs arising less than a third the length of the wing from the base, four-branched, R_{4+5} forking before R_{2+3}, both forks long; M arising from the stem of R close to the base of the wing, six-branched, forking well before the first forking of Rs, M_{3+4} forking well before M_{1+2} and before the first forking of Rs, extra forks on M_2 and M_4; cubito-median Y-vein not present, M and CuA fused for a distance; CuA with a slight curve near the wing margin; CuP simple, weak; 1A and 2A simple, 3A as preserved simple, possibly forked near origin.

Type.—Holotype F.40125 and counterpart F.40180, a complete forewing in the Australian Museum Collection. There are no additional specimens.

This species is smaller than the others of the genus. It shows a different branching of M_{3+4} and Sc is distinctive, as is also the more complete fusion of M and CuA near their bases. It is closely allied to *jucunda*, but has a different forking of Sc and more fusion of M and CuA.

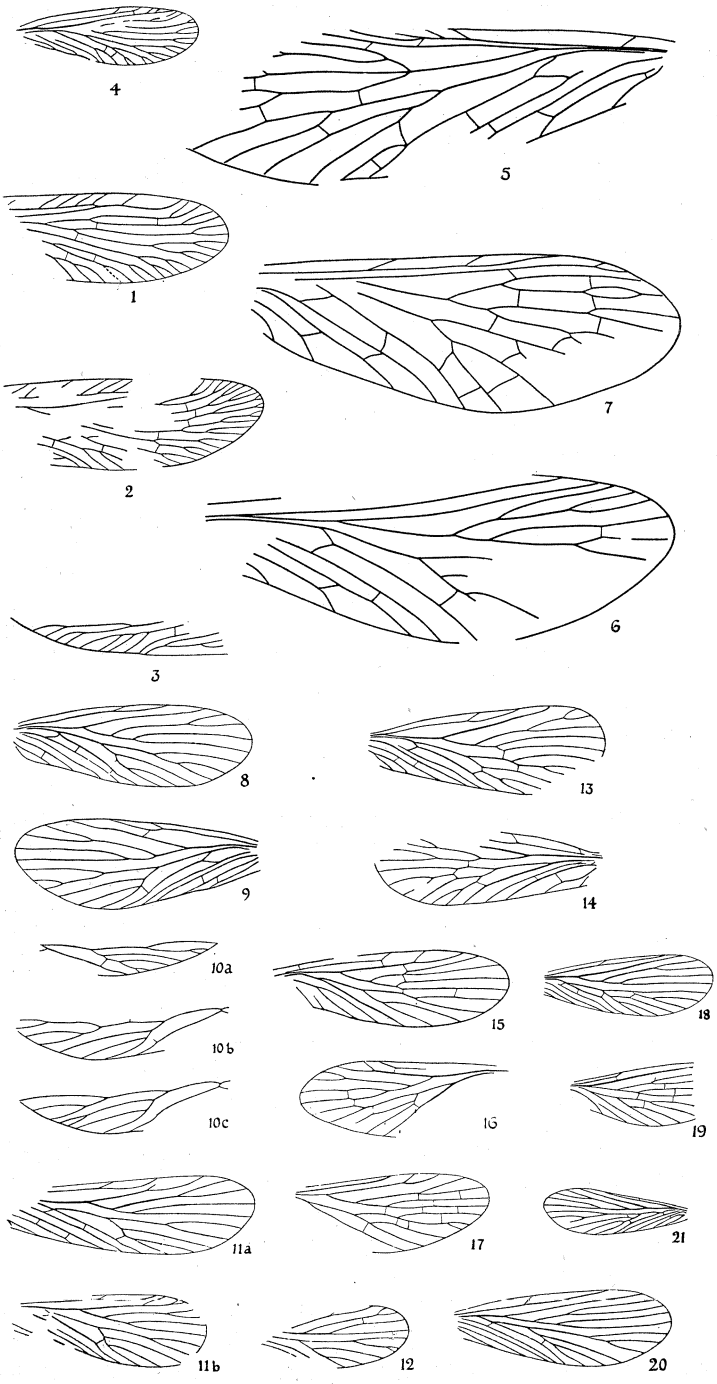
Genus **Parachorista** Tillyard, 1926.

Genotype, *Parachorista pincombeae* Tillyard, 1926.

Forewing.—R_{2+3} forming a pectinate series of four or occasionally only three branches; R_{4+5} branching only into R_4 and R_5; M six-branched, the extra forks being on M_2 and M_4; CuA and anal veins simple; cubito-median Y-vein distinct.

Hindwing.—R branching similar to forewing; M only four-branched; CuA fused to M for a short distance.

Martynov (1932 and 1940) has described two species and Martynova (1942) one species of this genus from the Russian Permian, but they differ markedly in the branching of M and the structure of Sc and R_1 and are best considered generically distinct. The extra fork on Rs may be only an individual variation in which case the specimens would fall within the group of species they have placed in *Permochorista* which already have been shown to differ generically from the Australian species.



Text-figures 1–7.

All figures x 3 ca.

1, F.28045, holotype of *Permomerope australis* Tillyard.—2, F.40108, forewing of *Permomerope australis* Tillyard.—3, F.43119, *Permomerope australis* Tillyard.—4, F.40233, holotype of *Permomerope nanus*, sp. nov.—5, F.28469, holotype of *Belmontia mitchelli* Tillyard.—6, F.40970, *Belmontia mitchelli* Tillyard.—7, F.28461, holotype of *Parabelmontia permiana* Tillyard.

Text-figures 8–21.—*Mesochorista* spp.

All figures x 3 ca.

8–17, *Mesochorista australica* (Tillyard). 8, F.41286.—9, F.40189.—10, *a*. F.40176; *b*. F40229; *c*. F.40141. Variants of M, with seven branches.—11, *a*. F.40801; *b*. F.39317 (holotype of *mitchelli*). With simple M_{3+4}.—12, F.40139. Reduced branching of R_{2+3} and of M_{3+4}.—13, F.29,031 (holotype of *colkinsi*). Additional branch on R_3.—14, F.43122, Reduced branching of R_{1+3}.—15, F.40132, Hindwing with deeply forked R_{1+3}.—16, F.40224, Hindwing with reduced forking on R_{2+3}.—17, F.40213, Hindwing with extra fork on M_4. 18, F.38269,holotype of *Mesochorista jucunda* (Tillyard).—19,F.42495,? hindwing of *Mesochorista jucunda* (Tillyard).—20, F.41287,holotype of *Mesochorista dubia*, sp. nov.—21, F.40125, holotype of *Mesochorista phipa*, sp. nov.

There are two species of the genus in these beds; one is based on the forewing and the other on the hindwing, so it seems most probable that there is really only a single species. As the hindwing is a little larger than the forewing the two specific names have been retained.

Parachorista pincombeae Tillyard, 1926.

(Plate v, B, figs. 10–11; Text-figs. 22–23.)

Parachorista pincombeae Tillyard, 1926, Proc. Linn. Soc. N.S.W., li, 273.

Parachorista warnerensis Tillyard, 1926, Proc. Linn. Soc. N.S.W., li, 273.

Forewing.—Wing rather large, length of preserved portion 12 mm., apex evenly rounded; Sc forked towards apex, two-branched only; costal space not markedly widened over basal half; R_1 simple; pterostigma well developed, large, extending well below R_1, almost touching R_3; stem of Rs rather short, Rs six-branched, R_{4+5} branching early, slightly before R_{2+3}, R_2 three-branched, forming with R_3 a pectinate series; M six-branched, with extra forks on M_2 and M_4, with M_{3+4} forking well before M_{1+2}; cubito-median Y-vein distinct, the cubital branch the longer; CuA simple, slightly sinuated near the wing margin; CuP simple, connected to CuA by a cross-vein about the middle of its length or somewhat before the middle; 1A and 2A simple, 3A not preserved.

Type.—Holotype forewing F.38272 and counterpart F.28041 in the Australian Museum Collection. (Holotype No. 83 of Mitchell's Collection, counterpart No. 55 of Pincombe's Collection.) The type of *warnerensis* Tillyard (No. P.164 of Pincombe's Collection) is also in the Australian Museum Collection, F.28049.

There is a further fragmentary specimen, F.43110, of this species. Tillyard's figure of *warnerensis* is quite inaccurate. The forking of M is identical with that of *pincombeae*, the extra forks being on M_2 and M_4, not on M_2 and M_3 as figured. R_1 is simple in both specimens.

Parachorista splendida Tillyard, 1926.

(Plate v, B, figs. 8–9; Text-fig. 24.)

Parachorista splendida Tillyard, 1926, Proc. Linn. Soc. N.S.W., li, 274.

Hindwing.—Wing rather large, length 15 mm., triangular, with the apex somewhat pointed; costal space narrow; Sc simple, but with an apical cross-vein to R_1, ending a little before the pterostigma; R_1 forked at apex and with the lower branch bent around the pterostigma; stem of Rs rather short, R_{2+3} forking at or before the forking of R_{4+5}, R_2 forking again to give a five-branched Rs; M four-branched, M_{3+4} forking well before M_{1+2}; cubito-median Y-vein absent, CuA and M fused for a distance; CuA simple, CuP simple, fused to 1A for part of its length; 1A, 2A and 3A all simple, connected by single cross-veins.

Type.—Holotype hindwing F.28048 and counterpart F.28462 in the Australian Museum Collection. (Holotype No. 107 of Mitchell's Collection.) Specimen No. 108*a* of Mitchell's Collection is the counterpart of the type, though no mention is made of it in the original description.

There are a further two specimens of this species, F.41023 and F.41094. In both, Rs is six-branched, but in other characters they are similar to the type. Sc is not quite so sharply angled at the cross-vein to R_1. The pterostigma is clearly defined in each of these specimens and shows a truncate base, more or less parallel to the branch of R_1.

Family AGETOPANORPIDAE Carpenter, 1930.

Allied to the Mesochoristidae on the typically six-branched media but, in general, differing in the branching of Sc and Rs.

Forewing with Sc three-branched, dichotomic, the branches long; M normally six-branched, with extra forks on M_2 and M_4 or rarely five-branched (*Agetochoristella*, gen. nov.) with an extra fork only on M_2; Rs four-branched, or five-branched with R_2, R_3 or R_5 forking; cubito-median Y-vein normally distinct.

From these Upper Permian beds four new genera are placed in this family mainly because of the three-branched Sc. In three of them the media has the normal six branches but in the fourth, *Agetochoristella*, gen. nov., M is only five-branched in the forewing, as well as in the hindwing.

The family is dominant in the Upper Permian of Russia where there are several genera including *Petromantis* Handl. and *Agetochorista* Mart. (syn. *Oochorista* Mart.). The family also occurs in the Lower Permian of Kansas, being represented by the genera *Agetopanorpa* Carpenter and *Protochorista* Till. (syn. *Protopanorpa* Till.).

The genera grouped in the family show a very diverse branching of Rs but all have a three-branched Sc and, except for the one genus, a six-branched M, with the extra branches on M_2 and M_4. The hindwing, where known, has a five-branched M with the extra fork on M_2 and this condition occurs in both the fore and hindwings of *Agetochoristella*. There is a group of genera with Rs five-branched, with the extra fork on R_5, as in *Agetopanorpa*, *Agetochorista* and *Neoageta*. In *Petromantis* and *Neopetromantis*, gen. nov., Rs is only four-branched. In the forewing of *Protochorista* it is five-branched with the extra fork on R_3 or six-branched with the extra forks on R_5 and R_2; in the hindwing the branching is also variable, R_3 being with or without a fork and R_5 sometimes forked. In *Phipoides*, gen. nov., Rs is five-branched with the extra fork on R_2 so that there is a tendency to pectination.

Some of the genera would fall within the Mesochoristidae except for the branching of Sc. Considerable weight has been placed on the development of the cubito-median Y-vein in the separation of some genera as this vein is normally well developed in this family.

Genus **Phipoides**, nov.

Genotype, *Phipoides elegans*, sp. nov.

Forewing.—Costal space expanded, Sc three-branched; Rs five-branched, extra fork on R_2, so that there is a tendency to pectination; M six-branched, the branching similar to that of *Mesochorista*.

Hindwing? : Costal space not expanded; Sc short, simple; R_1 forked near its apex; Rs similar in structure to that of the forewing; M four- or possibly five-branched; Cu and anal veins not well preserved.

The forewing of this genus is close to that of *Protochorista* from the Lower Permian of North America but the forking of Rs is different, tending to be pectinate in *Phipoides* and Sc shows a more dichotomic branching. It differs from *Agetochorista* Martynov in the forking of Rs and in the development of the cubito-median Y-vein.

Phipoides elegans, sp. nov.

(Plate vi, A, fig. 1; Text-fig. 25.)

Forewing.—Wing small, length 8 mm., rather narrow at base, costal space expanded, apex rounded; Sc three-branched, forked twice over its apical half, ending on the costal margin at the junction of the middle and apical thirds of the wing; a transverse cross-vein from the apical branch to R_1; costal space expanded over the basal half of the wing narrowing towards the apex; R_1 simple, or possibly forked in the pterostigma; pterostigma not distinct; Rs arising in the basal third of the wing, stem rather short, five-branched, R_{4+5} forking early, somewhat before R_{2+3}, extra fork on R_2, all branches long; M arising from the base of the wing, six-branched, forking at or after the first forking of Rs, M_{3+4} forking M_{1+2}, extra forks on M_2 and M_4; cubito-median Y-vein reduced, the stem to M being quite reduced, branch from Cu very weak, not as strong as the inter-cubital cross-vein; CuA simple, slightly sinuated near the wing margin, with a distinct cross-vein to the stem of M_4; CuP simple, almost parallel to CuA and connected to it by a cross-vein towards its base; 1A and 2A simple, 3A apparently simple, connected by single cross-veins, 3A short.

Hindwing.—Costal margin not expanded; Sc short, simple, reaching the costal margin a little after the forking of Rs; from near its apex an oblique cross-vein to R_1; pterostigma indistinct; R_1 almost straight, slightly sinuated near its apex where it gives off two short branches to the costal margin; Rs arising very close to the base of the wing, five-branched, R_{4+5} forking early, before R_{2+3}, extra fork on R_2, all branches long; M arising from the base of the wing, fused to CuA for some distance, possibly five-branched, not clearly preserved near the wing margin, first forking at or before the first forking of Rs, M_3 and M_4 simple; CuA straight, strong; CuP and anals indefinite.

Type.—Holotype forewing F.40144 and counterpart F.40117 in the Australian Museum Collection. The description of the hindwing is based on F.40177 which is associated with the forewing on the structure of Rs. It has a structure similar to the hindwing *Parachorista splendida*, but it is only half the size. The length of Sc and the forking of Rs are a little different.

Genus **Neoageta**, nov.

Genotype, *Neoageta elongata*, sp. nov.

Forewing.—Differs from *Agetochorista* in lacking a distinct cubito-median Y-vein. Sc three-branched; Rs five-branched with the extra fork on R_5; M six-branched, extra forks on M_2 and M_4; CuA, CuP simple; 1A, 2A and 3A apparently simple; CuA and M touching.

This cannot be considered an abnormal specimen of *Agetochoristella* described below as, in addition to the six-branched M, there is no distinct cubito-median Y-vein which is normally well developed in genera of this family.

Neoageta elongata, sp. nov.

(Plate vi, A, fig. 6; Text-fig. 26.)

Forewing.—Wing of moderate size, length 12 mm., costal space slightly expanded, apex somewhat pointed, greatest width well beyond the middle; Sc long, extending almost to the pterostigma, forked over its apical half, three-branched, the basal branch short, second branch longer, more oblique but not half apical branch; R_1 simple, very gently curved; pterostigma not clearly defined; Rs arising well towards the base, four-branched, with stem of R_{4+5} very short and all branches very long; M and CuA touching, no cubito-median Y-vein; M six-branched, normal; CuA simple, slight curves near margin; CuP simple, well separated from both CuA and 1A; 1A and 2A simple, 3A apparently so, connected by cross-veins, 3A very short, almost transverse, wing narrowed at base.

Type.—Holotype complete forewing F.43969 in the Australian Museum Collection.

Genus **Neopetromantis**, nov.

Genotype, *Neopetromantis australis*, sp. nov.

Forewing.—Costal space not expanded, Sc forked, three-branched; Rs four-branched; M six-branched, extra forks on M_2 and M_4; CuA and CuP simple; anals probably simple, at least 1A.

The genus differs from *Petromantis* Handlirsch in the type of branching to Sc and in lacking a cubito-median Y-vein.

Neopetromantis australis, sp. nov.

(Plate vi, A, figs. 2–3; Text-fig. 27.)

Forewing.—Wing of moderate size, length of preserved portion 5 mm., costal space not expanded, apex rounded, greatest width well beyond the middle; Sc long, extending almost to the pterostigma, forked over its apical half, three-branched, the two basal branches short, almost transverse, a cross-vein to R_1 after the first forking; R_1 simple, only very gently curved; pterostigma not clearly defined; Rs arising towards the base of the wing, four-branched, the forking of R_{2+3} and R_{4+5} almost in line, both towards the wing margin so that their stems are longer than the stem of Rs; M fused to CuA for

some distance, no cubito-median Y-vein, six-branched, forking well before the first forking of Rs, M_{3+4} forking before M_{1+2}, extra forks on M_2 and M_4; CuA simple, almost straight, CuP simple, well separated from both CuA and 1A; 1A apparently simple, 2A and 3A not preserved.

Type.—Holotype forewing F.40211 in the Australian Museum Collection.

F.40173 and F.41120, though fragmentary, are referred to this species. F.43122, an almost perfect wing, is referred provisionally to this species though it lacks the anterior margin beyond the first forking of Sc. The species is very similar to "*Petrochorista*" *dubia* Martynov but differs in the forking of Sc. Except for the three-branched Sc this species would fall within *Mesochorista*.

Genus **Agetochoristella**, nov.

Genotype, *Agetochoristella adscita*, sp. nov.

Forewing.—Sc three-branched, costal space somewhat expanded; Rs five-branched, dichotomously, extra forking on R_5; M five-branched, extra forking on M_2; cubito-median Y-vein distinct; CuA and CuP simple; 1A and 2A simple.

Hindwing.—Sc short, probably simple; R_1 forked near its apex; Rs five-branched, similar to forewing; M five-branched, extra fork on M_2; cubito-median Y-vein distinct; CuA simple; CuP and 1A fused for part of their length; 2A apparently forked, 3A not preserved.

Although this genus shows a branching of Rs and M similar to that of *Protochorista tetraclada*, it differs markedly in the forking of Sc and R_1 and in the structure of the cubito-median Y-vein, whether *Protochorista tetraclada* be considered a fore- or hindwing. The genus *Protochorista* is better removed from the Permopanorpidae to this family.

Agetochoristella adscita, sp. nov.

(Plate vi, A, figs. 4–5; Text-figs. 28–32.)

Forewing.—Wing of moderate size, length 10 mm., costal space somewhat expanded over most of its length, apex evenly rounded; Sc long, three-branched, the first forking about the middle of its length, branches evenly spaced, first branch more or less transverse, second and third increasingly oblique; an oblique cross-vein from the middle of the apical branch to R_1 and possibly a second cross-vein nearer its apex; R_1 simple, almost straight, passing to the wing margin through the pterostigma; pterostigma well defined, extending below R_1, basal border obliquely truncate; subcostal space not wider at the origin of Rs; Rs arising at the level of the first forking of Sc, five-branched, R_{4+5} forking before R_{2+3} but both forks long, extra forking on R_5 after the forking of R_{2+3}; M arising close to the base, at least not after the level of the humeral cross-vein, five-branched, forking at or before the first forking of Rs, M_{3+4} forking before M_{1+2}, extra fork on M_2; cubito-median Y-vein distinct, the arms slightly unequal, CuA continuing the same line as the M branch to the wing margin; CuP widely separated from CuA, simple, connected by a cross-vein closer to the fork of Cu than to the wing margin; 1A and 2A simple.

Hindwing?.—Wing of moderate size, costal space not expanded, costal margin almost straight, apex a little pointed, greatest width beyond the middle; Sc short, simple or possibly with short transverse branches to the costal margin, from near its apex an oblique cross-vein to R_1; R_1 almost straight, close to Sc, with two short branches to the costal margin from near its apex; pterostigma extending below R_1; Rs arising close to the base, in the first quarter of the wing length, five-branched, first forking on a level with the apex of Sc, R_{4+5} forking before R_{2+3}, extra fork on R_5; M arising from the stem of R close to the wing base, five-branched, forking before the level of the first forking of Rs, M_{3+4} forking just before M_{1+2}, extra fork on M_2; cubito-median Y-vein distinct, M branch considerably shorter than Cu branch; CuA simple, straight; CuP and 1A fused for part of their length, free and diverging over their apical halves; 2A apparently forked, 3A not preserved.

Type.—Holotype forewing F.43656 in the Australian Museum Collection, complete except for the extreme base. An underlying hindwing projects only at the anterior apex and shows branched R_1 and reduced branching of R_{2+3}. The description of the hindwing is based on F.39890 and counterpart with the same number in the Australian Museum but designation of a type hindwing is left till there is more definite association.

There are a number of additional specimens. F.46223 is complete except for the posterior border ; F.40159 is without the extreme base and the anal veins; F.40183 has the anterior third of the wing preserved and this shows the branching of Sc and of Rs. F.40185 is of the posterior half of the wing showing the branching of M and with the anals almost complete. F.43124, which shows the body of an insect with overlapping fragmentary wings, is only doubtfully referred to this species. Two hindwings, F.26975 and F.41018, are only doubtfully referred to this species. They are complete except for the anal fields and have only a four-branched Rs.

Family XENOCHORISTIDAE, nov.

Forewing.—M four-branched; Rs four-branched; Sc three-branched, dichotomously; cubito-median Y-vein distinct, well-developed.

This family is separated largely on the structure of Sc and of the cubito-median Y-vein, which recalls that seen in the Paramecoptera (*Belmontia*). On the structure of the radial and median fields it would fall in the succeeding family, Mesopanorpodidae. It could be derived from the Agetopanorpidae through *Agetochoristella* by reduced branching of M.

Genus **Xenochorista**, nov.

Genotype, *Xenochorista splendida*, sp. nov.

Forewing.—Costal space moderately expanded, Sc forked over its apical half, three-branched; Rs and M four-branched; cubito-median Y-vein well-developed; CuA CuP and anals, with possible exception of 3A, simple.

Xenochorista splendida, sp. nov.

(Plate vi, A, fig. 9; Text-fig. 33.)

Forewing.—Wing rather large, length 11 mm., costal space moderately expanded, apex evenly rounded, greatest width somewhat beyond the middle; Sc long, extending into the pterostigma, forked over its apical half, three-branched, the branches evenly spaced, a cross-vein from the apical branch to R_1; margins of pterostigma not clearly defined; subcostal space widest at the first forking of Sc; R_1 simple, sigmoidally curved, concave at origin of Rs, smaller curves over the apical half; Rs arising in the basal third of the wing, four-branched, R_{4+5} forking before R_{2+3}, a strong cross-vein from the forking of R_{2+3} to R_1; M arising from R at its basal curve, four-branched, forking well before the first forking of Rs, M_{3+4} forking well before the first forking of Rs and also before M_{1+2}; cubito-median Y-vein distinct, arms almost equal, that from M the shorter; CuA simple, a slight sigmoid curve over the apical half; a distinct cross-vein from CuA to M_4 close to its origin; CuP simple; 1A and 2A simple, 3A small, apparently simple.

Type.—Holotype forewing F.40157 in the Australian Museum Collection.

Xenochorista sobrina, sp. nov.

(Plate vi, A, figs. 10–11; Text-fig. 34.)

Forewing.—Wing rather large, length 10 mm., costal space markedly expanded, apex rather pointed, greatest width about the middle; Sc long, forked after the origin of Rs, apparently three-branched, apical branch not clearly preserved; R_1 simple, with a slight sigmoid curvature; pterostigma large, almost touching R_2 below; Rs arising in the basal third of the wing, four-branched, R_{4+5} forking after R_{2+3}, all branches long; M arising close to the base of the wing, four-branched, forking before the first forking of Rs, M_{3+4}

forking well before M_{1+2} and also before the first forking of Rs; cubito-median Y-vein distinct, the branch from M the shorter; CuA simple, straight, except near the wing margin; a distinct cross-vein from CuA to M_4 close to its origin; CuP simple; 1A and 2A simple, 3A apparently simple, connected by cross-veins; cross-veins rather numerous in the radial and median fields.

Type.—Holotype forewing F.43123 in the Australian Museum Collection.

It is possible that this specimen is conspecific with *splendida*, the different structure of Rs being only an individual variation, but as it is abnormal in Mecoptera for R_{2+3} to fork before R_{4+5} the two specimens are treated separately. F.43101 is considered to be the hindwing of this species. It is perfect except for slight distortion at the base and shows a structure of Rs and M identical with that of the forewing. In most features it resembles the hindwing of *Mesochorista*.

Family MESOPANORPODIDAE Tillyard, 1918.

Mesopanorpidae Tillyard, 1917.

Mesopanorpodidae Tillyard, 1918.

Tillyard (1917) described *Mesopanorpa* from Triassic beds of New South Wales, unaware of *Mesopanorpa* Handlirsch 1908 (of the family Orthophlebiidae), but changed the name to *Mesopanorpodes* in 1918.

M four-branched; Rs four-branched; Sc two-branched; cubito-median Y-vein variable.

This family is well represented in the fauna, being next in importance to the Mesochoristidae. It is possible that the species grouped here are not closely related, for the wing structure is reduced almost to its simplest, with both Rs and M four-branched and Sc two-branched. Generic division is based on slight characters, such as the structure of the cubito-median Y-vein area of the wing.

Genus **Mesopanorpodes** Tillyard, 1918.

Genotype, *Mesopanorpa wianamattensis* Tillyard, 1917.

Mesopanorpa Tillyard, 1917 (non Handlirsch, 1908).

Mesopanorpodes Tillyard, 1918.

Forewing.—Sc forked, two-branched; Rs four-branched; R_{2+3} forking before R_{4+5}; M four-branched; cubito-median Y-vein variable; CuA and CuP simple; anal veins simple, although 3A is possibly forked close to its base. The forking of Rs is abnormal and recalls that of Trichoptera.

The costal veinlets recorded for *wianamattensis* are not present in the holotype which is in the Australian Museum, F.39326.

Mesopanorpodes belmontensis, sp. nov.

(Plate vi, A, figs. 12–13; Text-fig. 35.)

Forewing.— Wing of moderate size, length 8 mm., costal space not expanded, apex evenly rounded, greatest width somewhat beyond the middle; Sc long, extending to the pterostigma, forked over its apical third, two-branched, the upper branch almost transverse; a cross-vein to R_1 just before the pterostigma; R_1 simple, sigmoidally curved; pterostigma well defined, extending well below R_1; Rs arising at the junction of the basal and middle thirds of the wing, four-branched, R_{4+5} forking after R_{2+3}, branches rather short; M arising from the base of the wing, taking a very decided bend towards R at the point of contact with CuA, four-branched, forking at or before the first forking of Rs, M_{3+4} forking before M_{1+2}; CuA simple, just touching or slightly fused to M, no distinct cubito-median Y-vein; a cross-vein from CuA to the stem of M_{3+4}; CuP simple, well separated from CuA; 1A and 2A simple, 3A only partly preserved, simple.

Hindwing.—Basal portion not preserved, Sc short, ending on wing margin at level of first forking of Rs, with a distinct curved cross-vein to R_1; R_1 forked near apex, with two short branches to the anterior margin; Rs only three-branched (possibly as an individual variation), R_{4+5} simple; M four-branched, similar over its apical half to the forewing; CuA simple.

Type.—Holotype forewing F.40166 in the Australian Museum Collection. The description of the hindwing is based on F.41237 which shows partly overlapping fore and hindwings.

F.40962 and counterpart F.40961 lacks the anal field. F.43480 shows reduced branching of R_{2+3} as in the forewing of F.41237. F.42499 and counterpart F.42498 shows reduced branching on R_{2+3} and M_{1+2} and may be specifically distinct. The species differs from *wianamattensis* in the much more strongly arched M after its separation from CuA.

The origin of M and the cubito-median Y-vein area recall the structure seen in Recent Bittacidae but in the fossil species there is no narrowing of the base of the wing and all three anal veins are well-developed.

Mesopanorpodes robustus, sp. nov.
(Plate vi, A, fig. 14; Text-fig. 36.)

Forewing.—Wing considerably larger than the other two species, posterolateral areas missing; costal space not expanded; Sc long, extending into the pterostigma, forked over its apical third, two-branched; R_1 simple, sigmoidally curved; Rs arising at the junction of the basal and middle thirds of the wing, four-branched, R_{4+5} forking almost in line with R_{2+3} and not greatly after it; M arising from the base of the wing, taking a very decided bend towards R at the cubito-median Y-vein, which is well-developed with almost equal arms but that from Cu a little longer; M four-branched, forking at about the level of the first forking of Rs, M_{3+4} forking before M_{1+2}; CuA only partly preserved, CuP weak, widely separated from CuA; 1A and 2A simple, 3A forked near its base.

Type.—Holotype forewing F.40787 and counterpart F.40788 in the Australian Museum Collection.

The counterpart shows clearly the anal veins and the basal structures of the wing, but the apical portion is missing.

Genus **Prochoristella**, nov.

Genotype, *Prochoristella megaloprepia*, sp. nov.

Forewing.—Sc long, forked, two-branched; R_1 simple; pterostigma well-developed; Rs four-branched; M four-branched; cubito-median Y-vein variable, from arms equal to CuA just fused to M; CuA and CuP simple; 1A and 2A simple, 3A apparently so.

Hindwing.—Sc short, simple; R_1 forked near apex or possibly simple; pterostigma well-developed; Rs four-branched; M four-branched; CuA fused to M basally; CuP and 1A fused for part of their length.

It has not been possible to associate definitely the hindwings in this genus so they are described separately. The genus is possibly more closely allied to the Nannochoristidae than to the Mesopanorpodidae.

Prochoristella megaloprepia, sp. nov.
(Plate vi, A, figs. 16–17; Text-fig. 37.)

Forewing.—Wing small, length 6·5 to 7·0 mm., costal space not expanded, wing rather narrow, apex evenly rounded; Sc long, forked about the middle of its length, after the origin of Rs, upper branch short, lower branch extending to the pterostigma ; a distinct cross-vein from about the middle of Sc_2 to R_1; humeral cross-vein distinct; subcostal space moderately expanded at the origin of Rs; pterostigma large, clearly

defined, almost touching R_2; R_1 simple, slight sigmoid curvature before the origin of Rs, after that almost straight; Rs arising in the basal third of the wing, four-branched, R_{4+5} forking before R_{2+3}, all branches long; M arising from R before the level of the humeral cross-vein, four-branched, forking at or before the first forking of Rs, M_{3+4} forking before M_{1+2} and also before R_{4+5}, M_{1+2} forking on a level with R_{2+3} or sometimes a little after, depending on the forking of that vein; cubito-median Y-vein somewhat variable, in the holotype with the arms almost equal, in other cases with the branch from M a little reduced; CuA almost straight, a slight curve beyond the cross-vein to M_{3+4}; CuP simple, well separated from both CuA and 1A; 1A and 2A simple, 3A apparently forked close to its base; cross-veins not abundant, ill-defined in most cases.

Type.—Holotype forewing F.40123 in the Australian Museum Collection, a perfect wing.

There are a number of additional specimens. F.40766 is complete but not well-preserved; F.41060 is complete except for the cubital and anal fields. F.40127, F.40214, F.41594, F.41113 and F.40129 are more fragmentary. F.40081 is only doubtfully referred to this species; it shows a well-preserved body but the wings are fragmentary.

Prochoristella anagaura, sp. nov.

(Text-figs. 38–40.)

Forewing.—Wing very small, 5·0 mm., similar to *megaloprepia* but differing typically in the forking of Rs and more particularly in the structure of the cubito-median Y-vein; R_{2+3} normally forking after the forking of M_{1+2}, but branches R_2 and R_3 long; CuA and M touching, no distinct cubito-median Y-vein.

Type.—Holotype forewing F.41319 in the Australian Museum Collection, complete except for the extreme base.

There are a number of additional specimens but most are fragmentary. F.40151; F.40184; F.41184; F.41213 and counterpart F.41214; F.43103 and counterpart F.43102 and F.40966 and counterpart F.40967. F.41254 and counterpart F.41255, doubtfully referred to this species, is of the apical two-thirds of a wing, which has only a three-branched media. In F.41074 and counterpart F.41049 the forking of M_{1+2} is reduced. F.41598 is an almost perfect wing in which R_{2+3} forks before M_{1+2} while in F.41311 they are almost in line.

Some of the specimens placed in this species are separated from *megaloprepia* mainly on shape and size and the structure of the cubito-median Y-vein. The size difference seems to be too great for them to be associated and there is no distinct Y-vein.

Prochoristella exilis, sp. nov.

(Plate vi, A, fig. 18; Text-fig. 41.)

Forewing.—Wing small, 5·5 mm., costal space not expanded, greatest width about the middle, apex evenly rounded; Sc long, forked after the origin of Rs, upper branch short, lower branch almost as long as the stem, extending to the pterostigma; a distinct cross-vein from about the middle of Sc_2 to R_1; R_1 sigmoidally curved, simple; pterostigma well-developed; subcostal space very wide, particularly at origin of Rs; Rs arising in basal third of the wing, four-branched, R_{4+5} forking well before R_{2+3}, stem of R_{2+3} as long as branches R_2 and R_3; M arising from the base of the wing, forking before the first forking of Rs, M_{3+4} forking almost immediately, nearly on a level with the first forking of Rs, M_{1+2} forking after R_{4+5}; cubito-median Y-vein with the branch from M reduced; CuA straight over its middle portion, a distinct curve after the cross-vein to M_4 or M_{3+4}; CuP simple, weak; 1A and 2A simple, 3A apparently simple.

Type.—Holotype forewing F.40168 in the Australian Museum Collection, perfect except for the extreme base.

F.39907 and counterpart with the same number lacks the anals and costal margin and F.40142 and counterpart F.40146 is slightly buckled and lacks the anals.

This species differs from *anagaura* in the forking of M, particularly M_{3+4}, the curved CuA and more strongly curved R. The forking of Rs is also slightly different. Both species show R_3 as well as R_2 curving up at the wing margin. This contrasts with *megaloprepia*.

Prochoristella pusilla, sp. nov.
(Plate vi, A, fig. 19; Text-fig. 42.)

Forewing.—Wing very small, 4·5 mm., costal margin not preserved, apex rounded; Sc not fully preserved; R_1 simple, almost straight, a distinct sigmoid curvature at base; pterostigma large, well-defined, almost touching R_2; Rs arising from towards the base of the wing, four-branched, R_{4+5} forking before R_{2+3}, R_{2+3} forking on a level with the pterostigma; M arising close to the base, four-branched, forking before the first forking of Rs, M_{3+4} forking before M_{1+2}, M_{1+2} forking before R_{4+5}; CuA simple, fused to M for a short distance, no distinct cubito-median Y-vein; CuP simple, weak; 1A and 2A simple, 3A apparently so.

Type.—Holotype forewing F.40061 and counterpart F.40190 in the Australian Museum Collection. There are three additional specimens, F.41091, F.40045 and F.40113 which preserve the radial and median fields.

This species is characterized by the branching of Rs and M, each succeeding branch forking before the one preceding it. It approaches the Protodiptera in the basal structure of R, but has three distinct anal veins.

Prochoristella belli (Tillyard), 1926.
(Plate vi, A, figs. 20–21; Text-figs. 43–44.)

Permochorista belli Tillyard, 1926, Proc. Linn. Soc. N.S.W., li, 272.

Hindwing.—Wing rather broad, apex rounded; Sc short, ending on the costal margin close to the level of the first forking of Rs, a cross-vein from near its apex to R_1; R_1 forked near its apex, both branches passing through the pterostigma; pterostigma well-developed, extending only a short distance below R_1; Rs arising close to the base of the wing, four-branched, R_{4+5} forking before R_{2+3} but at the level of the pterostigma, branches R_2 and R_3 short; M four-branched, M_{3+4} forking before M_{1+2} which branches slightly after R_{4+5}; CuA simple; CuP and anals not clearly preserved.

Type.—Holotype hindwing F.19795 in the Australian Museum Collection.

F.41376 shows the origin of Rs while F.39873 shows CuA and some of the anal veins. F.41229 and counterpart F.41228 and F.40187 are referred to this species only doubtfully.

Prochoristella concinna, sp. nov.
(Plate vi, A, fig. 22; Text-fig. 45.)

Hindwing.—Wing small, length 5·0 mm., costal space not expanded, apex rounded, greatest width beyond the middle; Sc short, ending on costal margin at a level before the first forking of Rs, a cross-vein from near its apex to R_1; R_1 almost straight, rather close to the costal margin, possibly simple; pterostigma well-developed; subcostal space narrow; Rs arising close to the base, four-branched, stem long, R_{4+5} forking well before R_{2+3}, well before the level of the pterostigma; M four-branched, forking before the level of the first forking of Rs, M_{3+4} forking before M_{1+2}, and before R_{4+5}; CuA fused to M basally, no cubito-median Y-vein; CuP weak, fused to 1A for part of its length, 1A simple, free at wing margin, 2A and 3A not clearly preserved, both very short.

Type.—Holotype hindwing F.40182 in Australian Museum Collection. There are no additional specimens.

This species differs from *belli* in the forking of R_{4+5}. It is most probably the hindwing of *anagaura*.

Family NANNOCHORISTIDAE Tillyard.

The family is characterized by the reduced branching of Rs (R_{2+3} being simple) and marked fusion of M and CuA near their bases; Sc varies in structure.

The two Recent genera, *Nannochorista* and *Choristella*, differ in the number of cross-veins, there being fewer in *Choristella*.

Two new genera are described from these beds. *Neochoristella* has Rs three-branched and M four-branched as in the Recent genera but *Nannochoristella* has both Rs and M only three-branched. In both the fossil genera Sc is very long and there is only slight fusion between M and CuA.

Genus **Neochoristella**, nov.

Genotype, *Neochoristella optata*, sp. nov.

Forewing.—Sc long, probably forked; R_1 simple; Rs three-branched; M four-branched; cubito-median Y-vein absent, CuA and M fused for some distance; CuA and CuP simple; 1A and 2A simple, 3A apparently so.

This genus differs from *Choristella* in having a longer Sc and less fusion between CuA and M. The long Sc is somewhat similar to that of *Nannochorista holostigma* Tillyard.

Neochoristella optata, sp. nov.

(Text-fig. 46.)

Forewing.—Wing very small, length 4·0 mm., narrow, costal space not expanded, apex rounded, greatest width beyond the middle; Sc long, apparently forked about its middle, reaching the costal margin close to R_1; no distinct pterostigma, subcostal space narrow; R_1 simple, with slight bends; Rs arising about one-third the wing length from the base, three-branched, R_{4+5} forking early, R_{2+3} simple, at least almost to the wing margin which is broken. M arising close to the base, four-branched, forking at or before the level of the first forking of Rs, M_{3+4} forking well before M_{1+2}, which forks well after the forking of R_{4+5}; CuA fused to M for a distance, almost straight, with a slight bend after the cross-vein to M_{3+4}; CuP simple, weak, well-separated from both CuA and 1A; 1A and 2A simple, 3A apparently so.

Type.—Holotype forewing F.41608 in Australian Museum Collection.

This small narrow wing differs in the branching of both Rs and M and in the length of Sc from *Prochoristella*, gen. nov., so that it cannot be considered an abnormal specimen of that genus.

Genus **Nannochoristella**, nov.

Genotype, *Nannochoristella reducta*, sp. nov.

Forewing.—Similar to *Nannochorista* but with a reduced branching of M. Both Rs and M only three-branched; no cubito-median Y-vein but M and CuA fused for a short distance; Sc forked.

Hindwing.—Wing with apex a little more rounded; branching of Rs and M as in forewing; Cu and anals not preserved.

The genus differs from *Nannochorista holostigma*, as far as can be ascertained from the preserved specimen, only in the three-branched M, less fusion between M and CuA and more basad origin of M.

Nannochoristella reducta, sp. nov.

(Text-fig. 47.)

Forewing.—Length 5 mm., apex somewhat sharply rounded; Sc long, forked about its middle, ending on the costal margin, with a transverse cross-vein to R_1 from towards its apex; R_1 simple, slightly curved near its apex; Rs arising before the middle of the

wing, R_{2+3} simple; first forking of M obscured, M_{3+4} simple; M and CuA fused for a short distance; CuA simple, slightly curved at the wing margin; CuP and anal veins simple, 3A apparently so.

Hindwing.—Imperfect, only apical third preserved; R_1 straight at apex, with a transverse branch to the costal margin; Rs and M both three-branched as in the forewing; CuA simple at apex; CuP and anals not preserved.

Type.—Holotype F.39968 in the Australian Museum Collection preserves portions of all four wings and the body. The wings of the left side almost completely overlap and those on the right side are separated, but only the posterior margin of the forewing is preserved. The abdomen is exposed over the missing basal portion of the hindwing.

There are no additional specimens. It is possible that this is only a variant of *Neochoristella* with only a three-branched M, but as it shows such marked reduction in the branching of Rs and M it has been considered distinct.

Suborder PROTODIPTERA.

Differing from true Diptera in possessing four wings and in the base of the wing not being distinctly petiolate.

Rs three- or four-branched; M four-branched; anals reduced, two or rarely three.

Tillyard (1937) figures an almost complete specimen of a Protodipteron in *Nature* (p. 66), but does not give a name or specific description. The location of this specimen is not known. It is not in the Australian Museum Collection.

Martynova (1948) has erected a new species and genus, "*Robinjohnia tillyardi*", without seeing the specimen or knowing of its location.

Family PERMOTANYDERIDAE, nov.

Genus **Permotanyderus**, nov.

Genotype, *Permotanyderus ableptus*, sp. nov.

Forewing.—Sc long and simple, close to the costal margin; pterostigma well-developed; Rs four-branched; M four-branched; CuA simple, bent over its apical portion; CuP weak; anals two.

Permotanyderus ableptus, sp. nov.

(Plate vi, A, fig. 23; Text-fig. 48.)

Forewing.—Wing very small, length 5·0 mm., long and narrow, costal margin almost straight, apex rather pointed, posterior border rounded, tapering slightly to base, greatest width well beyond the middle; Sc simple, long, lying close to the costal margin, ending on the costal margin in the pterostigma; humeral cross-vein near base, distinct; a transverse cross-vein from R_1 soon after its origin to Sc; R_1 distinctly kinked close to its base, straight for most of its length, simple; pterostigma well-developed, extending well below R_1; Rs arising at junction of basal and middle thirds of the wing, four-branched, R_{4+5} forking soon after its origin, well before R_{2+3} which forks at or after the level of the pterostigma; M arising from close to the base, at the bend of R, four-branched, forking at or after the forking of Rs, with M_{3+4} forking a little before M_{1+2}, M weak after the cubito-median Y-vein; cubito-median Y-vein distinct, arms about equal; CuA simple, a distinct bend at the cross-vein to M_{3+4}; CuP simple, weak, connected to CuA by a cross-vein close to the cubito-median Y-vein; 1A simple, long, sigmoidally curved, 2A much shorter, almost straight, only two anal veins; R_1, CuA and the basal stem of M are more strongly developed than the other veins and the stem of M and CuP are the weakest.

Type.—Holotype wing F.40675 in the Australian Museum Collection.

There are three additional specimens. F.40140 and counterpart F.40203 shows a pair of superimposed wings complete except for the extreme base including part of the anal veins. It shows the first anal and what is either the second anal or the wing margin. F.41326 and counterpart F.41327 is complete except for some of the branches of the media and Rs. It shows clearly the anal area with two anal veins and not particularly narrowed wing base. F.41369 is more fragmentary.

Genus **Choristotanyderus**, nov.

Genotype, *Choristotanyderus nanus*, sp. nov.

Hindwing?.—Sc long, close to the costal margin; pterostigma well-developed, well before the apex of the wing; Rs arising at the basal third of the wing, four-branched; M four-branched; cubito-median Y-vein present; CuA with a slight bend towards its apex; only two anal veins.

It is quite possible that this is the hindwing of *Permotanyderus*, for the wings differ only in shape and the position of the pterostigma. Both have only two small anal veins.

Choristotanyderus nanus, sp. nov.

(Text-fig. 49.)

Hindwing?.—Wing very small, length 4·0 mm., triangular, costal space not expanded, apex rather pointed, greatest width beyond the middle, base rather narrowed; Sc apparently simple, long, extending into the pterostigma; R_1 almost straight, simple; pterostigma large, well defined, situated well before the apex of the wing; Rs arising in the basal third of the wing but near the middle of R_1, four-branched, R_{4+5} forking early, well before R_{2+3}; M arising close to the base, well separated from Rs, four-branched, forking after the first forking of Rs, M_{3+4} forking before M_{1+2}, on a level with R_{4+5}; CuA simple, a distinct bend towards the apex where it sends a cross-vein to M_{3+4}; CuP simple, closer to CuA than to 1A; 1A simple, with a slight sigmoid curvature, long, 2A well separated, much shorter; apparently only two anals.

Type.—Holotype wing F.39964 in the Australian Museum Collection.

The abdomen preserved with the type shows clearly the terminalia. The holotype was a male with terminalia of the mecopteroid pattern.

Family PERMOTIPULIDAE.

Genus **Permotipula** Tillyard, 1929.

Genotype, *Permotipula patricia* Tillyard, 1929.

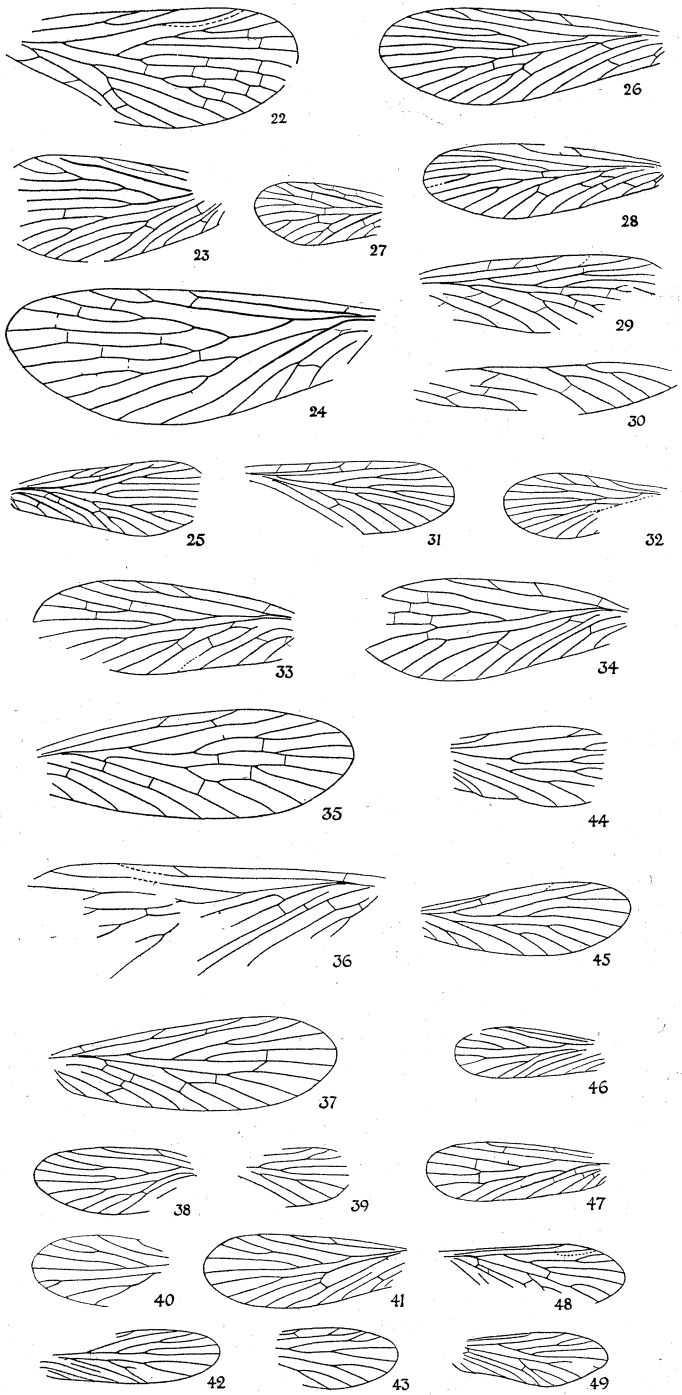
Sc rather short, reaching only to the middle of the wing; pterostigma well-developed; Rs three-branched, R_{2+3} simple; M four-branched, arising close to the base; cubito-median Y-vein still distinguishable, arculus not distinctly formed; CuP reduced; only two anal veins.

Permotipula patricia Tillyard, 1929.

Permotipula patricia Tillyard, 1929, Nature, cxxiii, 779.

Tillyard gives a figure of this species from which the specific characters can be ascertained.

Type.—It was not stated where the holotype was deposited. It is not in the Australian Museum Collection.



Text-figures 22–49.

Figures 22–34 x 3 ca; 35–49 x 5 ca.

22, F.38272, holotype of *Parachorista pincombeae* Tillyard.—23, F.28049, *Parachorista pincombeae* (holotype of *P. warmerensis* Tillyard).—24, F.28048, holotype of *Parachorista splendida* Tillyard.—25, F.40144, holotype of *Phipodites elegans*, sp. nov.—26, F.43969, holotype of *Neoaeta elongata*, sp. nov.—27, F.40211, holotype of *Neopetromanthis australis*, sp. nov.—28, F.43656, holotype of *Agetochoristella adscita*, sp. nov.—29, F.46223, forewing of *Agetochoristella adscita*.—30, F.40185, forewing of *Agetochorista adscita*. Posterior portion showing anals.—31, F.39890, hindwing of *Agetochorista adscita*.—32, F.26975, hindwing of *Agetochorista adscita*, with a four-branched Rs.—33, F.40157, holotype of *Xenochorista splendida*, sp. nov.—34, F.43123, holotype of *Xenochorista sobrina*, sp. nov.—35, F.40166, holotype of *Mesopanorpodes belmontensis* Tillyard.—36, F.40787, holotype of *Mesopanorpodes robustus*, sp. nov.—37, F.40123, holotype of *Prochoristella megalogrepia*, sp. nov.—38, F.41319, holotype of *P. anagaura*, sp. nov.—39, F.41254, *P. anagaura*?.—40, F.41074, *P. anagaura*.—41, F.40168, holotype of *P. exilis*, sp. nov.—42, F.40061, holotype of *P. pusilla*, sp. nov.—43, F.10795, holotype of *P. belli* (Tillyard).—44, F.39873, *P. belli*.—45, F.40182, holotype of *P. convenna*, sp. nov.—46, F.41608, holotype of *Neochoristella opiata*, sp. nov.—47, F.39968, holotype of *Nannochoristella reducta*, sp. nov.—48 F.40675 holotype of *Permotanyderus ableptus*, sp. nov.—49, F.39964, holotype of *Charistotanyderus nanus*, sp. nov.

Order TRICHOPTERA.

This order has not been recognized previously from the Australian Upper Permian fauna. The true position of the single species, *Cladochorista belmontensis* Tillyard, 1926, was not recognized from the fragmentary type. Additional specimens have elucidated the complete wing structure, which differs from that of living species (except *Perissoneura*), mainly in the strong development of the costal veinlets. Prior to this Permian record the oldest undoubted Trichoptera were the small types of the family Necrotauliidae, found in the Rhaetic, Lower and Upper Lias of England and Germany.

Family CLADOCHORISTIDAE, nov.

Costal space expanded over the basal half; Sc connected to R_1 by an oblique cross-vein, R_1 branched beyond this point; pterostigma only weakly developed; Rs four-branched; M four-branched; CuA with a well-developed fork; CuP simple; 1A simple, 2A and 3A looped on to the preceding vein.

Genus **Cladochorista** Tillyard, 1926.

Genotype, *Cladochorista belmontensis* Tillyard, 1926.

Costal space with numerous oblique cross-veins; R_1 branched at apex; R_{2+3} branching before R_{4+5}; a distinct cross-vein between Sc and R before the origin of Rs; M four-branched; cubito-median Y-vein distinct; CuA branched at or beyond its middle; CuP simple, weak; anal veins looped.

Cladochorista belmontensis Tillyard, 1926.

(Plate vi, A, figs. 7–8; Text-figs. 50–52.)

Cladochorista belmontensis Tillyard, 1926, Proc. Linn. Soc. N.S.W., li, 273.

Forewing.—Wing of moderate size, apex rounded; costal space with a series of from six to nine simple, oblique veinlets; Sc long, ending on the anterior margin; R_1 straight, forking beyond the apex of Sc, with two or three branches; no distinct pterostigma preserved; a basal cross-vein before the origin of Rs connects R and Sc; Rs arising towards the base of the wing, four-branched, stems of R_{2+3} and R_{4+5} both short, with that of R_{2+3} the shorter so that R_{2+3} branches before R_{4+5}; M four-branched, the forking of M_{1+2} after that of M_{3+4} and also after that of R_{4+5}; cubito-median Y-vein well-formed, the arms almost equal; CuA forked over its apical third or so, the forking before the forking of M_{3+4}; CuP parallel to CuA, rather widely separated from it, weak; 1A simple, straight, parallel to CuP, 2A shorter, looped on to 1A, 3A quite small, looped on to 2A; 2A and 3A lie well away from the wing margin.

Type.—Holotype forewing specimen F.28054 in the Australian Museum Collection (No. 96 of Mitchell's Collection). The counterpart of the type (F.28962), which is more complete basally, was not mentioned in the original description.

There are ten additional specimens referred to this species. F.43133 and counterpart F.43134 are two almost complete over-lapping wings; F.41374 and F.41372 show the looping of the anal veins; F.40155 and counterpart F.40035, F.41008, F.40220 and F.42482 show the forked CuA, while the remaining specimens, F.40219, F.40118, F.40147 and counterpart F.40120, though more fragmentary, show the characteristic branching of R_{4+5} and the development of the costal veinlets.

A re-examination of the fragmentary type shows how Tillyard was misled in his interpretation of the venation, particularly in the median and cubital fields. The more basad cross-veins of the costal space are poorly preserved and so were easily overlooked. The portion of the wing in the region of the cubito-median Y-vein is not preserved so that CuA has been regarded as the posterior branch of M and CuP is labelled Cu_1 (CuA). M_1 of Tillyard forks just at the edge of the preserved portion of the fossil and is really M_{1+2}

dividing into M_1 and M_2; M_2 is M_3 and M_{3a} is M_4 which arises as a branch of M_3 and is connected to CuA_1 by a cross-vein. The M_{3b} and M_4 of Tillyard are the two branches of the forked CuA.

In *Permomerope*, both forking of CuA and looping of the anal veins occur, but that genus, on the structure of Sc and R_1 and with much-branched veins, is best considered a Mecopteron (suborder Protomecoptera).

Order NEUROPTERA (PLANIPENNIA).

The species of Neuroptera described from these beds have been placed in four genera, all in the family Permithonidae. With the examination of many additional specimens one of these is considered a synonym. There are some quite marked differences between these genera so that it seems advisable to separate one of the three. *Permorapisma* is allied to *Permithone* (syn. *Permosmylus*) and is retained in the Permithonidae. *Permopsychops* is quite different and is placed in a separate family, differing from the Permithonidae in the limited number of cross-veins between R_1 and Rs, limited end-twigging to the numerous pectinate branches of Rs and in the distinctive anal field. Two new genera are described in this paper. One is placed in a new family related to the Recent Osmylidae and the second belongs to the family Permoberothidae. The discovery of a representative of this last family, which previously was known only from the Lower Permian of Kansas, is perhaps the most interesting find of all, though it is only doubtfully considered to be a Neuropteron.

Key to Families and Genera.

1. Wing almost entirely divided into cellules; a distinct groove between MA and MP; no pterostigma.....
Family Permoberothidae.....Genus *Permoberothella* nov.
— Wing not divided into cellules, cross-veins variable; no marked groove between MA and MP; a distinct pterostigma... 2
2. Rs with numerous, pectinate branches (10 or more); only three strong cross-veins between R_1 and Rs and limited to apical half; 1A with a simple fork near apex; CuP simple; end-twigging of Rs limited.....
Family Permopsychopsidae.....Genus *Permopsychops* Tillyard.
— Rs with limited branches; cross-veins from R_1 to Rs generally four or more, evenly spaced over the distance; 1A pectinately branched near apex, CuP simple or with small terminal twigging.....Family Permithonidae.
(i) Intercubital space reticulate.....Genus *Permorapisma* Tillyard.
(ii) Intercubital space with simple cross-veins.....Genus *Permithone* Tillyard.
— Rs with ten or so branches; cross-veins from R_1 to Rs reduced (obscured); 1A pectinately branched near apex; CuP deeply forked..... Family Archeosmylidae.....Genus *Archeosmylus*, nov

Family PERMOBEROTHIDAE.

Wings subequal.

Forewing.—Costal area broader than in hindwing; Sc terminating on the costal margin, a series of costal veinlets connecting it to the anterior margin; pterostigma absent; Rs arising from R near the base of the wing; MA coalesced with Rs for a short distance proximally, then continuing as a nearly straight vein almost to the very apex of the wing; MP coalesced proximally with CuA for a short distance, then continuing close to MA and parallel to it; between MA and MP there is a distinct groove, as in Recent Hemerobiidae and other families of Neuroptera; Cu forking at base into CuA and CuP, CuA coalesced with MP for a short distance, simple; CuP is a faint but distinct straight vein.

Hindwing.—Sc close to R and terminating on R_1 not far from mid-wing; Rs arising from R as in forewing and coalesced with MA for a greater interval than in the forewing; Rs forked as in the forewing; MA, MP, CuA and CuP essentially as in the forewing; groove present between MA and MP.

The family is represented by one genus in the Lower Permian of Kansas and a new genus from the Upper Permian of New South Wales. The new genus differs primarily in the branching of MP (CuA_1), more complete cross-veins and complex cross-veins of the anal field.

Genus **Permoberothella**, nov.

Genotype, *Permoberothella perplexa*, sp. nov.

Forewing.—Costal margin not preserved, Sc only partly preserved; R, Rs and MA as in *Permoberotha*; between MA and MP a distinct groove; MP two-branched with terminal twigging; CuA and CuP simple; three simple anal veins connected by irregular cross-veins.

Permoberothella perplexa, sp. nov.
(Plate vi, A, fig. 24; Text-fig. 53.)

Forewing.—Length 7 mm., width of preserved portion 2 mm., anterior margin not preserved; only median portion of Sc preserved; R with a slight downward bend near the base just after the origin of Rs and there with a short oblique cross-vein to Sc; R_1 simple, continued around the margin of the wing almost to the apex; MA arising from R very close to the base and there strongly deflected away from it, continuing almost straight, as a simple vein, to the wing margin just below the apex; Rs arising as a triad very close to MA, zig-zagged, forking well before the middle of the wing, the two branches uniting just before the wing margin; MP arising from CuA between the origin of MA and of Rs from R, forking just before the forking of Rs, then each of these two branches forking almost at the wing margin; CuP simple, close to CuA; CuA forked at wing margin; three simple anal veins; cross-veins very numerous, there being more than one hundred in the preserved portion of the holotype, simple except between 2A and 3A and possibly between 1A and 2A. A distinct groove between MA and MP and a single cross-vein towards the wing margin. The forking of Cu is not preserved and the anal field is torn at the base. Macrotrichia are discernible on most of the veins and cross-veins.

Type.—Holotype forewing F.42520 in the Australian Museum Collection.

Additional Specimens.—F.40270 preserves the radial field and shows macrotrichia clearly. F.40657 preserves the apical half of the anterior margin to as far as MA. In this specimen Rs is three-branched, with the extra fork occurring on R_{2+3} soon after its origin. The two branches, R_2 and R_3, unite before the wing margin and the united vein unites with R_{4+5} also just before the wing margin. The reunion of the branches of Rs would seem to be a specific character and not an individual variation.

The species differs markedly from the other Neuroptera of these beds and there does not seem to be any close affinity with them.

Family PERMITHONIDAE.

Forewing.—Costal veinlets simple or more often somewhat branched and connected by irregular cross-veins; Sc fused with R_1 distally; numerous cross-veins between R and Rs; Rs pectinately branched but branches few in number; a distinct cubito-median Y-vein; CuP simple or with only small terminal twigging; anal veins well-branched, with irregular cells between 2A and 3A and sometimes between 1A and 2A.

Hindwing.—Imperfectly known, costal space not as wide as in forewing, costal veinlets simple.

The Permithonidae seem to have evolved from a Permosisyrid-like form by increased end-twigging, extra forking of Rs and by the fusion at the apex of Sc and R_1. In the Permosisyridae, however, there is the advanced feature of a strongly forked CuP which is absent in the Permithonidae.

The Sialidopsidae of Zalessky is considered to fall within the Permithonidae though Sc and 1A are a little different but only of generic significance.

The family seems to be ancestral to both the Berothidae and the Osmylidae. The Berothidae can be derived from a form such as *Permithone* by more complete forking of the costal veinlets in the forewing, deep forking of CuP and a general reduction in the cross-veins both between R_1 and Rs and in the gradate series which are still irregular

in *Permithone*, The Osmylidae, more especially the Protosmylinae (*Gryposmylus*), can be derived from *Permithone* by increased pectination of Rs, CuA and CuP and the arrangement of gradate series of cross-veins and also the prolongation of the pterostigma round the curved anterior border towards the apex.

An early Osmylid type is described later in this paper but so far a Berothid-like form has not been recognized in these Permian beds.

Genus **Permithone** Tillyard, 1922.

Genotype, *Permithone belmontensis* Tillyard, 1922.

Permithone Tillyard, 1922, 1926.

Permosmylus Tillyard, 1926.

Forewing.—Sc fused to R_1 distally; costal space expanded at base; costal veinlets near base usually branched and connected by a few irregular cross-veins or else all simple; numerous (6–7) cross-veins from R to Rs; Rs with only a few pectinate branches (4–5 not including MA); MP forking towards the base of the wing, before the forking of " Rs "; a distinct cubito-median Y-vein; CuA branched, generally pectinately; CuP simple or at most with a short fork near apex; 1A pectinately branched; 2A and 3A branched, enclosing an irregularly-celled area; cross-veins between CuA and CuP simple or irregular.

Hindwing.—Costal space narrow, costal veinlets normally simple and without cross-veins; CuA pectinately branched; CuP simple; M forks at or before the first forking of Rs; CuA touching or fused to M for a short distance, no cubito-median Y-vein.

Permithone differs from *Palaemerobius* mainly in the structure of the anal veins, fusion of Sc with R_1 and in having a distinct cubito-median Y-vein.

Permithone belmontensis Tillyard, 1922.

(Plate vi, B, figs. 1–3; Text-figs. 54–55.)

Permithone belmontensis Tillyard, 1922, Proc. Linn. Soc. N.S.W., xlvii, 290; Tillyard, 1926, Proc. Linn. Soc. N.S.W., li, 278.

Permosmylus pincombeae Tillyard, 1926, Proc. Linn. Soc. N.S.W., li, 281.

Forewing.—Length of wing 9–11 mm.; costal space strongly expanded over its basal half; costal veinlets sometimes branched and connected by a few irregular cross-veins over the basal half; Sc fused to R_1, which shows little if any deflection in the pterostigmatic region; numerous cross-veins, six or seven, between R and Rs; Rs (including MA) arising close to the base of the wing, with only a few pectinate branches, five or six, each branch forking again not before its middle and with limited end-twigging to the branches; MP dichotomously branched, the first forking before the first forking of Rs, M_{3+4} forking a little before M_{1+2} and each of these branches forking at least once more before the wing margin; a distinct cubito-median Y-vein, the arms unequal; CuA branched at its apex, generally pectinately; CuP simple or with a short terminal twigging; 1A pectinately branched, 2A and 3A branched, enclosing an irregularly-celled area; cross-veins mostly simple except those between 2A and 3A and in some cases, including the type, between CuA and CuP.

Type.—Holotype F.28465 in the Australian Museum Collection. (Specimen No. 52 of Mitchell's Collection.)

The holotype of *pincombeae*, F.19794, is also in the Australian Museum Collection. There is a poorly preserved specimen (No. 97 of Mitchell's Collection), determined by Tillyard, in the Cawthron Institute Collection. There are two additional specimens referred to this species. F.40272 and counterpart F.40156 is a complete wing showing clearly the structure of the anal field. F.40268 is also a complete wing but it differs in some respects from the type in having all the costal veinlets simple and CuA four-branched, dichotomously.

Permithone oliarcoides Tillyard, 1926.
(Plate vi, B, figs. 8–9; Text-figs. 56–57.)

Permithone oliarcoides Tillyard, 1926, Proc. Linn. Soc. N.S.W., li, 278.

Hindwing.—Length of wing 10 mm.; costal space not markedly expanded; costal veinlets simple; Sc fused to R_1 which is slightly deflected around the pterostigma; numerous cross-veins between R and Rs; Rs (including MA) arising close to the base of the wing, with only a few (five) pectinate branches; M forking before the first forking of Rs, M branching dichotomously; CuA pectinately branched over its apical third, with at least three branches; CuP only partly preserved, connected to CuA by simple cross-veins. In a second wing M_{3+4} touches or fuses with CuA towards its apex, so that there is some doubt as to the actual branching of these two veins, CuA may have three branches, the other three branches may be those of M_{3+4}. Stem of MA from M to the stem of Rs near its origin, very oblique.

Type.—Holotype F.28052 and counterpart F.28024 in the Australian Museum Collection. Tillyard does not mention the counterpart in his original description.

There are only two additional specimens referred to this species. F.40265 is a wing, folded longitudinally on itself; F.40269 is complete except for the anal field and extreme base and there is some distortion towards the base. It preserves clearly the free base of MA.

This species very probably represents the hindwing of *Permithone belmontensis*, known only from the forewing, but, until the two can be associated, the species will be kept distinct. The branching of Rs and the position and direction of the cross-veins between R and Rs are similar in the two. In *oliarcoides* the costal space is narrower and the pterostigma shorter.

Permithone neoxenus, sp. nov.
(Plate vi, B, fig. 4; Text-fig. 58.)

Forewing.—Length of wing 11 mm.; costal space only slightly expanded over its basal half; costal veinlets occasionally branched over the basal half; Sc probably fused to R_1, obscured; cross-veins between R and Rs more than three; Rs (including MA) arising close to the base of the wing, with six pectinate branches, each branch forking again not before its middle, except for the third branch, and all branches with limited end-twigging; M dichotomously branched, the first forking before the first forking of Rs, partly obscured in the type, M_{3+4} forking a little before M_{1+2} and all of the branches forking at least once before the wing margin; a small, distinct cubito-median Y-vein, the arms about equal; CuA pectinately branched at its apex, CuP simple; 1A and 2A pectinately branched, 3A not preserved. The one preserved cross-vein from CuA to CuP simple.

Type.—Holotype F.40271 in the Australian Museum Collection.

This species, described from a single specimen, differs from *belmontensis* in the shape of the cubito-median Y-vein, the more basad origin of Rs, almost in line with the cubito-median Y-vein and more pronounced end-twigging of all veins including CuP. The cross-veins between R_1 and Rs are reduced.

Genus **Permorapisma** Tillyard, 1926.

Genotype, *Permorapisma biserialis* Tillyard, 1926.

Forewing.—Costal space enlarged near base; Sc fused to R_1 distally. Costal veinlets often branched and connected by numerous irregular cross-veins. R and Rs connected by numerous (ten or more) cross-veins. Rs including MA with numerous (nine) pectinate branches, end-twigging dense. M forking at or after the forking of Rs. A distinct cubito-median Y-vein (the branch from M reduced). CuA branched towards apex. CuP simple or with a short fork at apex. 1A, 2A and 3A pectinately branched. Cross-veins from CuA to CuP not simple, reticulate, forming two or three cells between the two veins. Similar reticulate cross-veins between 1A and 2A and between 2A and 3A.

Permorapisma biserialis Tillyard, 1926.

(Plate vi, B, figs. 5–6; Text-figs. 59–63.)

Permorapisma biserialis Tillyard, 1926, Proc. Linn. Soc. N.S.W., li, 279.

Permorapisma triserialis Tillyard, 1926, Proc. Linn. Soc. N.S.W., li, 279.

Forewing.—Length of wing 19–20 mm.; costal space expanding rapidly from the base and then decreasing again towards the pterostigma. Costal veinlets often branched and connected by numerous irregular cross-veins. Sc fused with R_1 at the pterostigma which is short and broad, R_1 curved around it slightly. Ten or more cross-veins between R and Rs. Rs arising close to the base of the wing, with eight or nine pectinate branches, each branch forking at about its middle or a little more distad, with further branches closer to the wing margin. M dichotomously branched, M_{3+4} forking well before M_{1+2} and with a greater number of terminal branches. A distinct cubito-median Y-vein, arms unequal. CuA branched dichotomously over its apical third, CuP simple or with a fine end-twigging. Anal veins all pectinately branched. Intercubital cross-veins reticulate, varying from a biserial to a triserial condition. Cross-veins between 1A and 2A and between 2A and 3A reticulate, but irregularly so.

Type.—Holotype forewing F.28053 and counterpart F.29034 in the Australian Museum Collection (Specimens No. 95 and 95*a* of Mitchell's Collection).

The type of *triserialis* (F.28051 and counterpart F.28959) is also in the Australian Museum Collection (No. 86 and 86*a* of Mitchell's Collection).

There are a number of additional specimens of this species. F.40266 and counterpart F.40267 is an almost complete forewing, somewhat larger than the holotype, showing the transition from a biserial to a triserial condition of the intercubital cross-veins. The anal field is very clearly preserved. F.43076 and counterpart, in two pieces, F.43075 and F.43077, F.41088, F.42465, F.40274, F.41340 and F.41738 are more fragmentary. Somewhat doubtfully referred to this species are specimens F.41362, F.40775 and counterpart F.40774 and F.41005.

The biserial condition of the intercubital cross-veins appears to be more normal and no other specimen with the triserial arrangement as well-developed as the type of *triserialis* has been found. There are two specimens which show an intermediate condition, F.40266 and F.43076.

The hindwing of this species has not been recognized.

Permorapisma differs from *Permithone* only in slight characters. M forks after the first forking of Rs, the costal veinlets are more irregular and the veinlets between CuA and CuP either biserial or triserial in *Permorapisma*.

Family PERMOPSYCHOPSIDAE, nov.

Forewing.—Costal space not greatly expanded, costal veinlets simple or at most forked; cross-veins between R and Rs limited in number, only three; 1A with only an apical forking, 2A and 3A well-branched but not enclosing an irregularly-reticulated area.

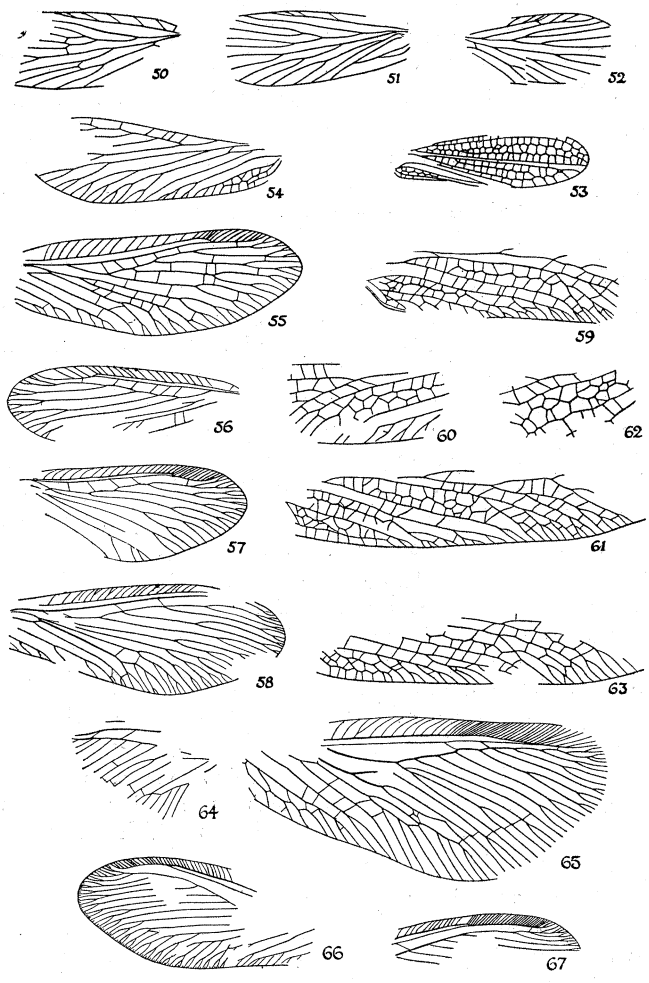
There is only one genus placed in the family, but *Eopsychops* Martynov 1933 from the Russian Permian may belong here. If so Martynov's interpretation of the venation is inaccurate. MA is fused with the stem of Rs and the vein he indicates as MA is really MP; MP is CuA; CuA is CuP; 1A is not labelled; A_1 is 2A and A_2 is 3A. It differs from *Permopsychops* in the late branching of MP and the forked CuP.

Genus **Permopsychops** Tillyard, 1926.

Genotype, *Permopsychops belmontensis* Tillyard, 1926.

Permopsychops Tillyard, 1926.

Permithone Davis, 1943 (in part).



Text-figures 50–67.

All figures x 3 ca.

50, F.28962, counterpart of holotype of *Cladochorista belmontensis* Tillyard.—51, F.41374, *Cladochorista belmontensis*.—52, F.40035, *Cladochorista belmontensis*.—53, F.42520, holotype of *Permoberothella perplexa*, sp. nov.—54, F.40272, *Permithone belmontensis* Tillyard, lower half.—55, F.40268, *Permithone belmontensis*.—56, F.28052, holotype of *Permithone oliarcoides* Tillyard.—57, F.40269, *Permithone oliarcoides*.—58, F.40271, holotype of *Permithone neoxenus*, sp. nov.—59, F.28053 *Permorapisma biserialis* Tillyard showing cubital and anal fields.—60, F.28051, *Permorapisma biserialis* (holotype of *triserialis* Tillyard).—61, F.40266, *Permorapisma biserialis* cubital and anal fields.—62, F.43076, *Permorapisma biserialis*.—63, F.40274 *Permorapisma biserialis*.—64, F.19793, holotype of *Permopsychops belmontensis* Tillyard.—65, F.39867, *Permopsychops belmontensis* (holotype of *Permithone venosa* Davis).—66, F.40264, holotype of *Archeosmylus pectinatus* sp. nov.—67, F.41000, *Archeosmylus pectinatus*. Fragment of hindwing.

Forewing.—Sc fused to R_1 distally; costal veinlets simple or at most branched, not connected by cross-veins; R and Rs connected by three cross-veins; Rs with numerous pectinate branches; M forking towards the base of the wing, before the forking of Rs; a distinct cubito-median Y-vein present, the M branch reduced; CuA branched, CuP simple; 1A forked near its apex, 2A and 3A branched.

The genus was placed provisionally in the Prohemerobiidae by Martynov (1928) along with *Eopsychopsis* from the Russian Permian but when the latter genus was removed to the Palaemerobiidae in 1933 no mention was made of *Permopsychops*.

Permopsychops belmontensis Tillyard, 1926.
(Plate vi, B, fig. 7; Text-figs. 64–65.)

Permopsychops belmontensis Tillyard, 1926, Proc. Linn. Soc. N.S.W., li, 281.

Permithone venosa Davis, 1943, Proc. Linn. Soc. N.S.W., lxviii, 11.

Forewing.—Length of wing 15 mm.; costal space not greatly expanded; Sc fused with R_1 at the pterostigma; R_1 only very slightly deflected by the pterostigma; costal veinlets simple or occasionally branched, without connecting cross-veins; the veinlets change the direction of their curvature in the region of the pterostigma; R_1 and Rs connected by only three cross-veins which are more or less limited to the apical half; Rs arising well towards the base of the wing, pectinately branched, the branches numerous, the most basal branch forking again almost immediately, the other branches generally forking at least once before the wing margin; M dichotomously branched, the first fork before the first fork of Rs, M_{3+4} forks again early but M_{1+2} only towards the wing margin; a distinct cubito-median Y-vein, arms unequal; CuA branched over almost the apical half, CuP simple; 1A forked near the wing margin, 2A and 3A branched, the branches connected by irregular cross-veins; intercubital cross-veins simple. There are distinct grooves in the wing between CuP and 1A and between 1A and 2A. These were interpreted as the veins Cu_2 and 2A by Consett Davis who went to some length to justify his conclusions.

The above description is based mainly on the type of *venosa* as the holotype is so fragmentary.

Type.—Holotype fragment F.19793 in the Australian Museum Collection (Specimen P.156 in Pincombe's Collection).

The type of *Permithone venosa* Davis is also in the Australian Museum Collection, F.39867. This specimen and the holotype are the only known specimens of the species. The type of *venosa* is a beautifully preserved wing, complete except for small areas at the base and apex. Tillyard's description of the type fragment is inaccurate in many respects, notably in the branching of M and CuA (all designated as M by Tillyard). The second specimen differs slightly from the holotype but not sufficiently so for specific separation.

Family ARCHEOSMYLIDAE, nov.

Resembling Recent Osmylidae, more especially Protosmylinae, but without regularly arranged gradate cross-veins and with simpler CuP and anal veins. CuP rather deeply forked but not pectinately branched; anal veins simple for most of the length but with short pectinate branches near the wing margin.

The family would seem to be derived directly from the Permithonidae (*Permithone*) by increased pectination of Rs, enlarged pterostigma, rather deep forking of CuP and more distinctly pectinate CuA.

Genus **Archeosmylus**, gen. nov.

Genotype, *Archeosmylus pectinatus*, sp. nov.

Forewing.—Costal veinlets, at least mainly, simple; pterostigma long; Sc fused with R_1; Rs with numerous pectinate branches (at least ten), end-twigging dense; CuA with (at least four) pectinate branches; CuP deeply forked; 1A and 2A pectinately branched near apex, 3A less so, short.

Hindwing.—Pterostigma very long and not reaching so far round towards apex, but otherwise an anterior margin similar to the forewing; CuA with (at least six) pectinate branches.

Archeosmylus pectinatus, sp. nov.

(Plate vi, B, fig. 10; Text-fig. 66–67.)

Forewing.—Length of wing 11 mm.; costal space not greatly expanded, slightly so over the basal half; Sc fused to R_1, both veins bending at the point of fusion; pterostigma long and relatively narrow; Rs arising near base of wing, pectinately branched, number of branches large, each branch forking a number of times near the wing margin, so that the end-twigging is rather dense; M abundantly branched, dichotomously near the wing margin; CuA with abundant pectinate branches, at least five and each of these forks before the wing margin, the most basal one preserved forks twice; CuP only partly preserved, connected to CuA by simple cross-veins; 1A straight, with only slight end-twigging; 2A straight, pectinately branched near apex, five or six branches, but all short; 3A short, only slightly branched. A single free short intercalary at the wing margin between all of the terminal branches of the veins.

Hindwing.—Preserved portion similar to forewing, but pterostigma very long and narrow and CuA with at least six pectinate branches, each branch forking before the wing margin.

Type.—Holotype F.40264, an almost complete forewing (with fragments of an overlying hindwing and another pair of overlapping wings), and paratype F.41000, fragment of a hindwing, in the Australian Museum Collection.

F.41342 and counterpart F.41343 is referred doubtfully to this species.

The species is only imperfectly preserved, but the structure of CuA and the anal field and of the pterostigma are characteristic. A notable feature is the clear preservation of the regular short intercalary veins, which are very obvious in the better preserved forewing.

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Explanation of Plate V.

A. Figures 1–17.—*Mesochorista australica* (Tillyard) x 3 ca.

1, F.41286, perfect wing.—2, F.41040, perfect wing.—3, F.40189, perfect wing.—4, F.40141, extra branch on M_3.—5, F.40801, reduced branching on M, M_2 simple.—6, F.40229, extra branch on M_1.—7, F.39317, type of *mitchelli* Till., showing reduced branching of M, M_2 simple.—8, F.40133, hindwing, preserving anals.—9, F.40213, hindwing, with an extra twigging on M_2.—10, F.39982, forewing preserving wing pigmentation-pattern.—11, F.40124, forewing preserving wing pigmentation-pattern.—12, F.40149, forewing preserving wing pigmentation-pattern.—13, F.40802, reduced branching of M, M_2 simple.—14, F.29031, type of *collinsi* Till., R_2 shows an additional twigging.—15, F.40132, hindwing, with deep forking of $R_2 + _3$.—16, F.40224, hindwing, with reduced forking of $R_2 + _3$.—17, F.40208, specimen preserving all four wings, but each forewing with only a five-branched M.

B. All figures x 3 ca.

1, *Mesochorista phipa*, sp. nov. F.40180.—2, *Mesochorista phipa*, sp. nov., holotype, F.40125.—3, *Mesochorista dubia*, sp. nov., holotype, F.41287.—4, *Mesochorista jucunda* (Tillyard), holotype, F.38269.—5, *Mesochorista jucunda* hindwing, F.42495.—6, *Permomerope australis* Tillyard, holotype hindwing, F.28045.—7, *Permomerope australis* Tillyard, forewing, F.40108.—8, *Parachorista splendida* Tillyard, holotype, F.28048.—9, *Parachorista splendida* Tillyard, F.41094.—10, *Parachorista pincombeae* Tillyard, type of *mitchelli* Till., F.28049.—11, *Parachorista pincombeae* Tillyard, holotype, F.38272.—12, *Belmontia mitchelli* Tillyard, holotype, F.28469.—13, *Belmontia mitchelli* Tillyard, F.40970.—14, *Parabelmontia permiana* Tillyard, F.28461.

Explanation of Plate VI.

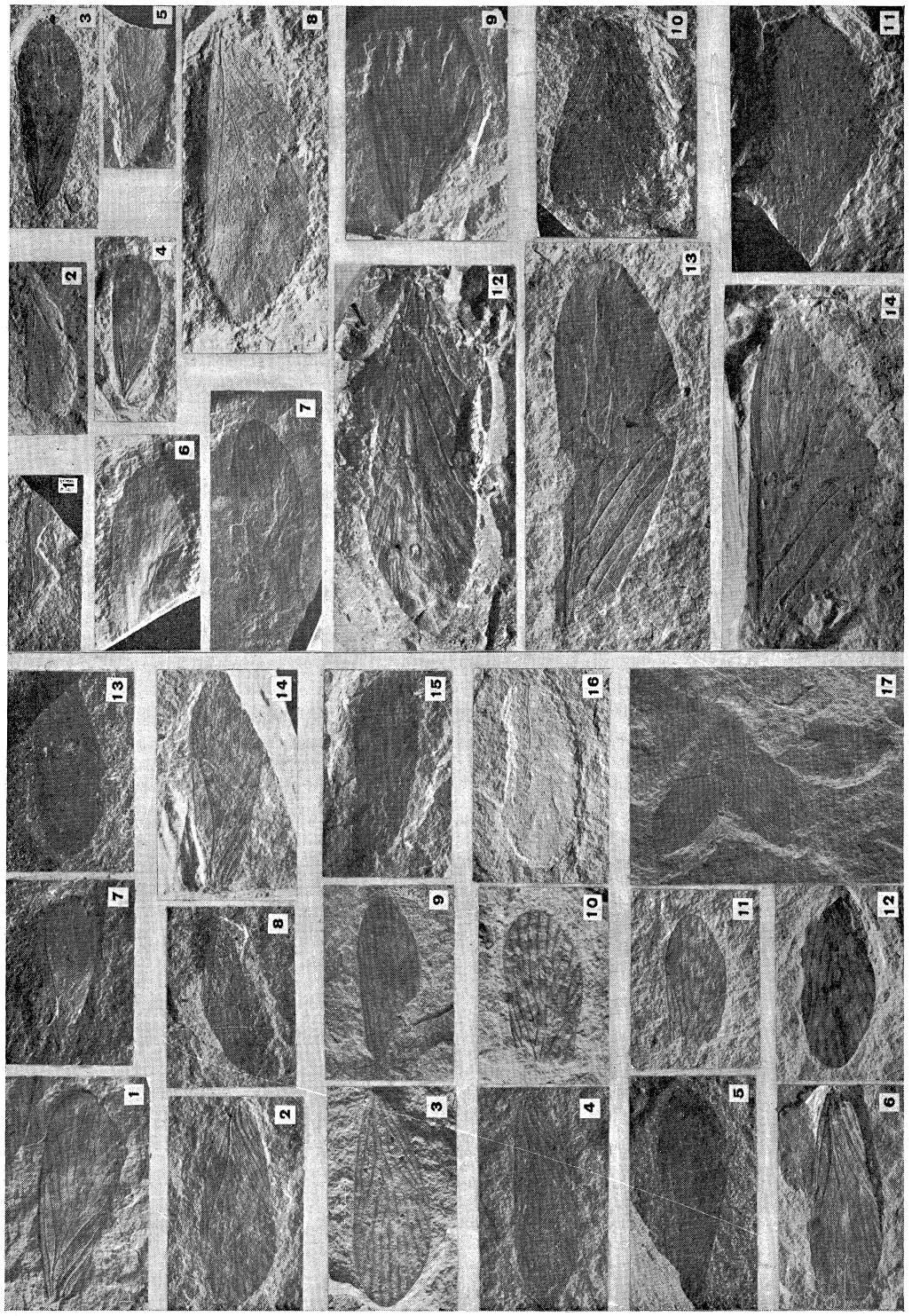
A. All figures x 3 ca.

1, *Phipoides elegans*, gen. et sp. nov., holotype, F.40144.—2, *Neopetromantis australis*, gen. et sp. nov., holotype, F.40211.—3, *Neopetromantis australis*?, F.43122.—4, *Agetochoristella adscita*, gen. et sp. nov., holotype, F.43656.—5, *Agetochoristella adscita*, gen. et sp. nov., F.46223.—6, *Neoageta elongata*, gen. et sp. nov., holotype, F.43969.—7, *Cladochorista belmontensis* Tillyard, F.40035.—8, *Cladochorista belmontensis* Tillyard, counterpart of holotype, F.28962.—9, *Xenochorista splendida*, gen. et sp. nov., holotype, F.40157.—10, *Xenochorista sobrina*, sp. nov., holotype, F.43123.—11, *Xenochorista sobrina*, sp. nov., F.43101.—12, *Mesopanorpodes belmontensis*, sp. nov., hooltype, F.40166.—13, *Mesopanorpodes belmontensis*, sp. nov., hindwing, F.41237.—14, *Mesopanorpodes robustus*, sp. nov., holotype, F.40787.—15, *Mesopanorpodes wianamattensis* Tillyard, holotype, F.39326.—16, *Prochoristella megaloprepia*, gen. st sp. nov., F.40123.—17. *Prochoristella megaloprepia*?, showing body, F.40081.—18, *Prochoristella exilis*, sp. nov., holotype, F.40168.—19, *Prochoristella pusilla*, sp. nov., F.41091.—20, *Prochoristella belli* (Tillyard), holotype, F.19795.—21, *Prochoristella belli* (Tillyard), F.39873.—22, *Prochoristella concinna*, sp. nov., holotype, F.40182.—23, *Permotanyderus ableptus*, gen. et sp. nov., holotype, F.40675.—24, *Permoherothella perplexa*, gen. et sp. nov., holotype, F.42520.

B. All figures x 3 ca.

1, *Permithone belmontensis* Tillyard, variant, F.40268.—2, *Permithone belmontensis* Tillyard, F.40156.—3, *Permithone belmontensis* Tillyard, F.40272.—4, *Permithone neoxenus*, sp. nov., holotype, F. 40271.—5, *Permorapisma biserialis* Tillyard, F.40266.—6, *Permorapisma biserialis* Tillyard, holotype, F.28053.—7, *Permopsychops belmontensis* Tillyard, holotype of *venosa* Davis, F.39867.—8, *Permithone oliarcoides* Tillyard, F.40269.—9, *Permithone oliarcoides* Tillyard, holotype, F.28052.—10, *Archeosmylus pectinatus*, gen. et. sp. nov., holotype, F.40264, lower specimen.

Sydney: A. H. Pettifer, Goyernment Printer—1953.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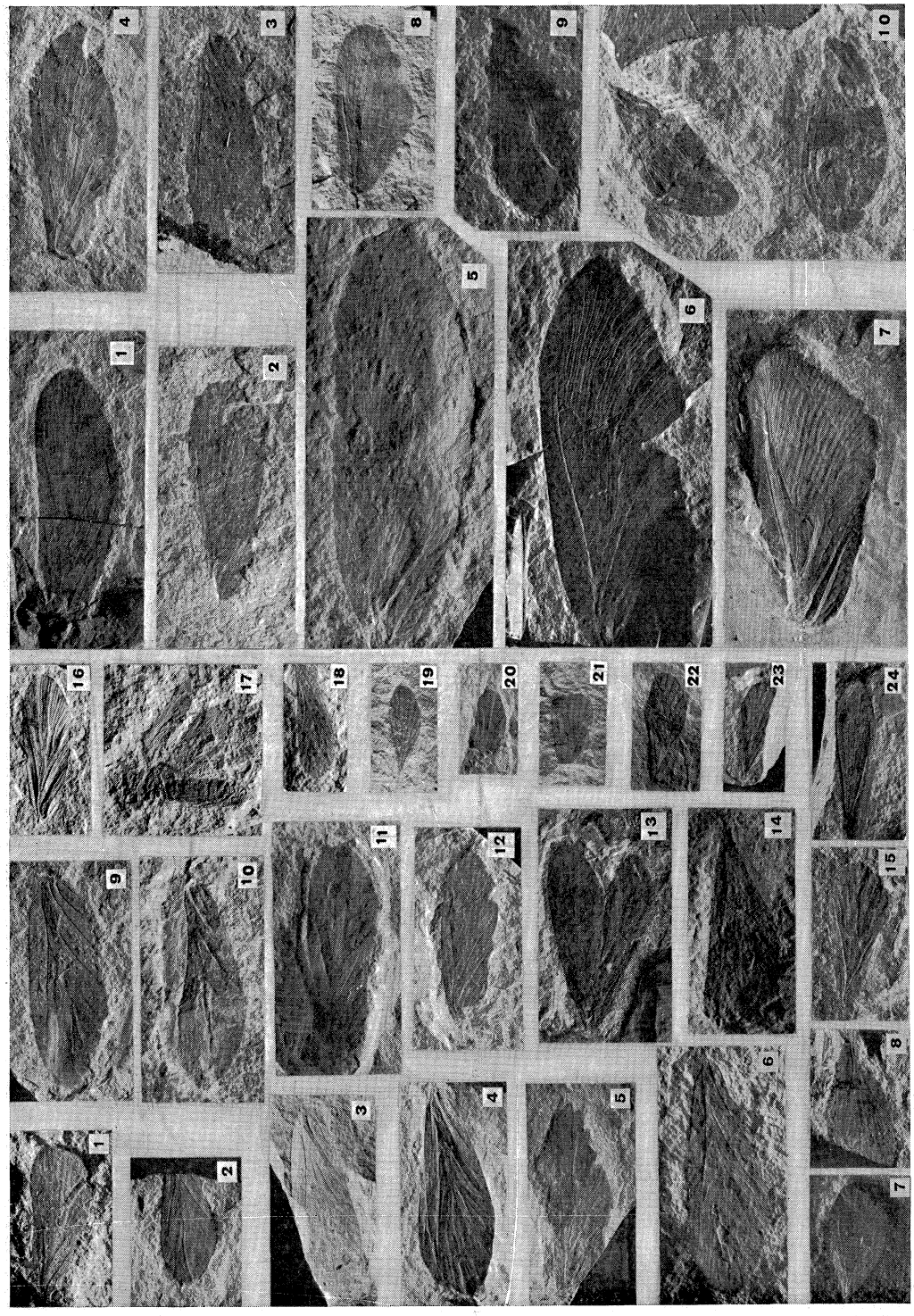
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