PERMIAN INSECTS FROM THE PARANA BASIN, SOUTH BRAZIL I. MECOPTERA

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ABSTRACT  This paper describes the first Permian insects of the Family Permochoristidae, Order Mecoptera, discovered in Brazil: Petromantis rieki Pinto, sp. nov., Petromantis evansi Pinto, sp. nov., and Asianchorista beckermidioae Pinto, sp. nov.; the age of the Irati Formation is discussed and the bearing of these discoveries on the problem of Continental Drift is pointed out.

RESUMO  São descritas as primeiras insetos permianos da família Permochoristidae, ordem Mecoptera, descobertos no Brasil: Petromantis rieki Pinto, sp. nov., Petromantis evansi Pinto, sp. nov., e Asianchorista beckermidioae Pinto, sp. nov. do Estado do Rio Grande do Sul, encontrados com insetos das famílias: Prosbolidae, Pereboridae, Permidumidae e Cupidae, associados a crustáceos, mesosauroideos e flora Glossopteris; é discutida a idade da Formação Irati e salientada a importância dessas descobertas para o problema da deriva dos continentes.

INTRODUCTION  Several years ago, on a field trip to the coal mining area of the State of Rio Grande do Sul, Brazil, the author, with his assistants A. D. Cauduro and Y. T. Sanguinetti, found the first unquestionable fauna of Permian insects in Brazil in an outcrop at km 79 at the side of the road from Porto Alegre to Uruguaiana. Formerly Euzcio de Oliveira (1908), in a letter to Woodward, mentioned the discovery of insects at Teixeira Soares, Paraná, and F. M. Carpenter (1930) described one as Phyloblatta oliveirai, which, according to Dr. David White, was possibly of Lower Permian age. Later, several authors considered that this formation was Carboniferous, but the original suggestion may be the correct one. From this same area two other insect wings were described: Phyloblatta roxoi Petri, 1945, and Phyloblatta pauloi Mezzalira, 1948. The latter may not belong to Phyloblatta. On several other field trips to the same locality in Rio Grande do Sul, the author found other specimens after a prolonged search. Meanwhile on a student field trip, a second outcrop with insects was found at Passo de São Borja (São Gabriel, RS). These finds are of considerable interest because they throw new light on the age of the sediments on the one hand, and provide new data concerning the problem of Continental Drift on the other.

Only the Mecoptera are described here. Some other groups such as Prosbolidae, Pereboridae, Permidumidae, Cupidae and others have also been found, and the results of their study will be published as all the data become available.

Stratigraphical Position, Geographical Distribution and Biological Association  The insects were found in sediments of the Irati Formation, of the Passa Dois Group that occupies over 1,000,000 square kilometers of the Brazilian part of the Paraná Basin and extends into neighbouring areas of Uruguay and Paraguay. This Formation consists of

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**Esse departamento tem recebido auxílios do CNPq, BNDE, FAPERGS e C. P. da UFRGS
layers of bituminous greyish-black to black shales with pyrite and grey limestone lenses and, in part, weathered yellow silty shales or yellow siltstones containing mesosaurid reptiles, fish scales, pygocephalomorph crustaceans and glossopterid flora in addition to the insects.

The insects here described were found in the State of Rio Grande do Sul, South Brazil (see map), in two places: Peleomanni riiki, sp. nov., in the grey limestone of a limestone lens in an outcrop on the right bank of the Santa Maria River — the Passo de São Borja,
locality (Lat. 30°30'S Long. 52°45'W); *Petromantis evansi*, sp. nov., and *Asiachorista becker-migdisovae*, sp. nov., in a yellow siltstone in a road cutting at km 79 on the Porto Alegre-Uruguayana road near the Minas do Leão coal mines (Lat. 30°15'S, Long. 52°15'W).

At Passo de São Borja the insect wing was found associated with *Mesosaurus brasiliensis* in a limestone formed by carapaces of crustaceans (*Pygocephalomorpha*). At km 79 on the Porto Alegre-Uruguayana road in addition to these insect wings, others wings belonging to insects of the families *Prosbolidae*, *Pereboridae*, *Permithonidae*, *Cupidae*, and others were found, associated with fish scales, crustaceans (*Pygocephalomorpha*) and leaves of *Glossopteris*.

**Age of Irati Formation** The Irati Formation was supposed to belong to the lower part of the Permian, but several facts suggest that it is younger. These are:

1) Until the present discoveries, not a single good index fossil, which would allow its age to be determined, had been found.

2) Almost all the insects found in this Formation can be related to Russian and Australian ones of Upper Permian age, mostly from the Kazanian of USSR. One species, however, is quite close to one Russian form from the upper part of the lower Permian, Kuznets Series.

3) The Genus *Pygaspis* Beurlen, 1934 (Type species: *Pygaspis brasiliensis*), is a *Pygocephalomorpha*, quite similar to, if not identical with, *Notocaris Broom, 1931* (Type species: *Notocaris tapscotti*), from the Dwyka Formation of South Africa of Upper Permian age as recorded by Pinto 1971.

4) The sediments below the Irati that constitute the Rio Bonito Formation, hitherto considered to be of Upper Carboniferous age, are now believed to be of Permian age as a result of recent Palynological analysis.

5) Rodendorf *et al.*, 1961, p. 529, draw attention to the fact that the *Petromantis* from Illinsk have the SG3 vein beginning at the base of RS whilst the species from the upper Permian of European Russia have it starting in front of the base of RS, as do the present species. All these facts lead the author to think that the age of the Irati Formation is Upper Permian and probably Kazanian.

**The Bearing of these Discoveries on the Continental Drift Problem** For a long time, the author has been intrigued by the similarities between the Flora of Asiatic Russia and the Gondwana Flora and has considered that a detailed revision of the *Parsongia* and *Glossopteris* Flora must be made to see if they really differ. Now, with the discovery of this astonishing similarity between these fossil insect faunas from Southern Brazil and Russia, the author is more than ever convinced of the necessity of a detailed comparative revision between the Flora and Fauna of these places. Three years ago this led the author to create, with the help of Brazilian colleagues, a Centre for Gondwana studies at Porto Alegre, whose main scope is to foster comparative studies of all the localities where Gondwana of similar faunas and floras occur.

The above facts lead the author to put forward the hypothesis that, in Permian times, Asiatic Russia lay just to the West of South Africa and was linked with Gondwanaland.

**Systematics Problems of the Present Study** If one bears in mind: a) that in the living forms of *Mecoptera (Panorpa communis)* many small variations occur such as the variation in the number and disposition of the cross-vein (as shown by Martinov, 1948, p. 194-196, Figs. 1 to 4) and b) that, on the other hand, the same phenomenon occurs in fossil forms with respect to the distance of bifurcation of RS as in *Petromantis boeotae* (as was also shown by Martinov, the same paper, p. 197, Fig. 5); then one must be careful in studying other
Figure 1-8 — For better comparison between them, all the figures represent the species as if they had the same size. The source from where the figures were redrawn, the name and the place of occurrence of the species and the real size of them are registered below each figure.
species of insects, especially when dealing with species of the same group, that variation may not also occur in other characters that in many cases have been taken as specific, such as the size of the wing. For instance, it is known that, in some species, the females are bigger than the males, and it has been shown that the size varies in *Petromantis borealis* from 5 to 9 mm, even without knowing if they are males or females. Taking into account all the above considerations, when comparing Brazilian forms with several described Russian forms, one begins to doubt if all the species are really valid or are simply variations of a single species. This is particularly true in comparing (see Pl. I, Fig. 1-7) the species of the genus *Petromantis* designated as: *P. borealis, P. kamensis, P. major, P. robusta* and the Brazilian form under study, *P. rieki*, sp. nov. If one disregards the size of this species which varies between 8 and 12.7 mm (which is the same range of variation shown by *P. borealis*) and enlarges all the specimens to the same length (as Pl. I, Fig. 1-8) to facilitate the comparison, and if, on the other hand, one does not take into account the presence or absence of one or more cross-veins (for the reasons stated above), it will be amazing that their veins correspond almost exactly. The very small differences observed could be simply a reflection of the quality of illustration. It is essential that one makes use of other differences such as the relation between the length and width of the anal region and the outline form of the wing to distinguish between the species or even between genera (see Pl. I, Fig. 8 *Asiachorista neuburgae* Martinova, 1958 — type species).

Acknowledgments

The search for insects in Brazil has been very difficult and until now they have been quite rare, so that the help of colleagues and students has been extremely important. For this reason the author wished to express his thanks to all of them, and especially to his colleagues Lilia Pinto de Ornellas and Ivone Purper, who have helped him in collecting insects on many field trips.

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**Systematics**

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**Genus** *Petromantis* Handlirsch, 1904

*Idalopanorpa* Zalesky, 1929, p. 18, fig. 7

*Martinowiella* Handlirsch, 1937, p. 109

**Generic diagnosis**

Costal and sub-costal areas broad, almost the same size or the costal wider; branches of SC smooth and long; RS with four long branches, RS\(_{1+2}\) and RS\(_{3+4}\) being relatively short and almost the same size. M with not more than six branches.

**Type species** — *Petromantis rossica* Handlirsch, 1904

**Petromantis rieki** Pinto, sp. nov.

Pl. II, Fig. 1; Pl. III, Fig. 1a and b

**Designatio nominis**: in honour to Dr. E. F. Rick

**Holotypus** — One impression of the forewing deposited at the M.P., U.F.R.G.S., n.º-1-9256

**Locus typicus** — In a lens of limestone at Passe de São Borja outcrop. Mun. São Gabriel, Rio Grande do Sul, Brazil

**Stratum typicum** — Irati Formation — Permian

**Diagnosis**

Wing large, elongate oviform, 12.7 mm long. SC with the normal three branches: the first two convex toward R, the third (SC\(_3\)) slightly convex toward C; RS\(_{3+4}\) very short and RS\(_{1+2}\) almost twice the length of RS\(_{3+4}\).

**Description**

Wing large, elongate oviform, the costal margin almost straight; the outer margin appears to be almost rounded but is, in fact, broken; the inner margin divides into two portions; the proximal part until the vein CuP is slightly convex, the distal part from the vein CuP to the outer margin is convex. The length is approximately three times the width. The width of the costal area is slightly smaller than that of the Sub-costal. Shape of pterostigma semi-lunar, SC\(_1\) ends distally of the mid-length of the wing and reaches the pterostigma; SC\(_2\) ends just distal of the mid-length and both are convex toward R; SC\(_3\) shorter and concave toward R. R is bent at the junction of a cross-vein which connects it to SC\(_1\); another cross-vein links it to RS\(_1\); M six-branched and divided as usual, with a cross-vein linking the bifurcation of M\(_4\) to CuA; CuA situata beginning with a distinct
Y-shaped figure and linked also at one third the length by a cross-vein to CuP; CuP thin, oblique and sinuous; Anal almost parallel; A₁ and A₂ forming an inconspicuously elliptical basal cell closed by a feeble cross-vein; other faint cross-veins connect A₁ to A₂ and to CuP. These and other faint cross-veins (represented by dotted lines in Pl. II, Fig. 1) can be seen only in a very well preserved specimen and at certain angles of illumination.

**Dimensions**
- Length of fore-wing: 12.7 mm
- Maximum width: 4.3 mm

**Remarks** Petromantis robusta sp. nov. described by Martinov (1932) from the Arkhangelsk District, USSR, shows very strong similarities to the species under description. The veins differ from Martinov's holotype only in the presence of several cross-veins. However, the paratype of Martinov's species does show cross-veins. Only two cross-veins occur in the anal region and lie in the same position as in the present species. Another similarity is the size. Martinov's holotype is 12 mm long, a little shorter than the present species which is 12.7 mm, but his paratype which is 12.5 mm long is almost the same size. The author had the opportunity of examining the types and found that they could be distinguished from the present species, not on the basis of the cross-veins but through the form of the wing. *Petromantis robusta* is wider and more triangular in form than the Brazilian species. The paratype of *P. robusta* looks a little different from Martinov's drawing of it, being more triangular.

Other species which show similarities to the Brazilian species are *P. borealis*, *P. kamensis* and *P. major*. However, all of these are much wider and more triangular than the present species. In consequence, the present form must be considered a new species.

Two particular comments, however, must be made. Firstly, in some forms, such as *Petromantis robusta* and the present species, the size of vein SC and the differences between the Costal and Sub-Costal area are such that they could be placed either in the genus *Petromantis* or in *Asioschorista*. As SC₃ in the present case is more smoothly curved than the typical SC₃ of *Asioschorista*, the author has placed it in *Petromantis* as Martinov has done for *P. robusta*. Secondly, Martinov suggested that *P. similis* and *P. kamensis* were synonymous but the differences such as the presence of an extra vein appear to be too important for his suggestion to be upheld.

**Occurrence** In a limestone lens of the Irati Formation (Permian) in an outcrop on the right bank of the Santa Maria River, at Passo de São Borja, São Gabriel, RS, Brazil. Collected by the author.

*Petromantis evansi* Pinto sp. nov.

**Designatio nominis:** In honor to Dr. J.W. Evans

**Holotype:** One impression of the forewing and its counter-part deposited at the M.P., U.F.R.G.S., n.º 1-5258

**Locus typicus:** A cutting at km 79 on the Porto Alegre-Uruguayana road, Rio Grande do Sul, Brazil

**Stratum typicum:** Irati Formation — Permian

**Diagnosis** Wing claviform, medium size, 8 mm in length. SC branching a little after the branching of R, its branches being elongated with SC very long, reaching almost the
Figure 1 - *Petromantis rielli* Pinto, sp. nov. Forewing of the holotype: MP. UFRGS n° 1-5256. The distal end (dotted line) reconstructed in base of the counter-part. Length: 12.7 mm

Figure 2 - *Petromantis rouani* Pinto, sp. nov. Forewing of the holotype: MP. UFRGS n° 1-5258. Length: 8 mm

Figure 3 - *Asiachorista beckermegdisovae* Pinto, sp. nov. Forewing of the holotype: MP. UFRGS n° 1-5257. Length: 11.85 mm
Figure 1a, b – *Petrozamantis ricki* Pinto, sp. nov. Forewing of the holotype: MP. UFRGS n.° 1-5256. From Passo de São Bója outcrop, São Gabriel county, Rio Grande do Sul. Irati Form., Permian. Length: 12.7 mm.

Figure 2a, b – *Petrozamantis couesi* Pinto, sp. nov. Forewing of the holotype: MP. UFRGS n.° 1-5258. From a cutting, at km 79 of the Porto Alegre-Uruguaiana road, Rio Grande do Sul. Irati Form., Permian. Length: 8 mm.

Figure 3a, b – *Asiancharista beckermigdsonae* Pinto, sp. nov. Forewing of the holotype: MP. UFRGS n.° 1-5257. From a cutting, at km 79 of the Porto Alegre-Uruguaiana road, Rio Grande do Sul. Irati Form., Permian. Length: 11.85 mm.
level of the end of $M_3$; RS and $M$ branching almost at the same level; $RS_{3+4}$ almost the same size as $RS_{1+2}$; $RS_3$ and $RS_4$ about 8 times the length of $RS_{1+2}$; Anal $A_1$ and $A_2$ parallel oblique; $A_3$ only slightly inclined in relation to the others.

**Description**  
Wing claviform, medium size; Costal margin straight; outer margin rounded acuminate; inner margin straight for three-quarters of its length curving abruptly to the apex; Costal area slightly smaller than the Sub-Costal. The nature of the preservation makes it impossible to see the pterostigma. SC branches shortly after $R$ branches and the branches $SC_1$ and $SC_2$ are elongated; $SC_2$ covered by a piece of wood; $SC_1$ is very long reaching almost to the level of the end of $M_4$; $RS$ short and twice the size of $RS_{3+4}$; $RS_{1+2}$ branching just after $RS_{3+4}$; $RS_3$ and $RS_4$ are about 8 times the length of $RS_{3+4}$; $M$ branches at almost the same level of $RS$, and is linked to it, by very feeble cross-veins; branching of $M$ normal, $M_{1+2}$ being long; $CuA$ gently curved at the beginning, linked proximally to $M$ by one branch of the Y-shape figure, the cross-vein, being obscured by a piece of wood; $CuP$ very thin and parallel to $CuA$; $A_1$ and $A_2$ gently curved, oblique, and linked by a cross-vein forming a closed elliptical basal cell. $A_3$ slightly inclined forming an angle with $A_2$.

**Dimensions**  
Length of the forewing: 8 mm  
Maximum width: 3 mm

**Remarks**  
This species is quite similar to *Petromantis robusta* Martinov, 1932, differing from that species in the relative proportions of $R_{1+2}$ and $R_{3+4}$ the proportions being 5:4; while in the holotype of *Petromantis robusta* the proportions are 9:4. It also differs in its much shorter length of 8 mm, while *P. robusta* is 12 mm long. Martinov described, but did not figure, a specimen he called *Petromantis* sp. (Specimen n." 339/2455. Iva-Cora, 1929, Gundersen) noting that the venation was quite similar to that of *P. robusta* and the size was 8 mm. It is possible that this specimen is comparable with the species under description. The present species is also similar to *Petromantis kamensis* Martinov, 1928 in size, but, differs in that RS and $M$ branch at almost the same level while in *P. kamensis*, $M$ branches earlier, i.e., more proximally. Again in the present species $M_{1+2}$ branches much more distally than $RS_{3+4}$, while in *P. kamensis* $M_{1+2}$ branches almost at the same level, i.e., just before $RS_{3+4}$. *P. evansi* sp. nov. differs from *P. rieki*, sp. nov., in having $RS_{1+2}$ and $RS_{3+4}$ branching at almost the same level; $RS$ and $M$ branching at the same level; and $M_{1+2}$ branching much more distally.

**Occurrence**  
In an yellow silty shale of the Irati Formation (Permian), in a cutting at km 79 on the Porto Alegre-Uruguaiana road, Rio Grande do Sul, Brazil. Collected by the author.

**Genus** *Asiachovista*, O. Martinova, 1958

**Generic diagnosis**  
The anterior margin of the wing slightly convex; $SC_1$, $SC_2$ are long and $SC_3$ very short; $RS$ with four branches which have their distal ends straight; $M$ with six branches; no definite apex.

**Type species** *Asiachovista neuburgae* O. Martinova, 1958
Asiachorista beckermigdisvae Pinto, sp. nov.
Pl. II, Fig. 3; Pl. III, Fig. 3a and b

Designatio nominis: In honour to Dr. E. E. Becker-Migdisova

Holotypus – One impression of the forewing and its counterpart deposited at the M.P., U.F.R.G.S. n.º 1-5.257

Locus typicus – A cutting at km 79 on Porto Alegre-Uruguayana road, Rio Grande do Sul, Brazil

Stratum typicum – Irati formation – Permian

Diagnosis Wing claviform, large, 11.85 mm long; RS\textsubscript{1+2} and RS\textsubscript{3+4} short and of the same size, more than twice as short as RS; the branches of RS\textsubscript{1+2} and RS\textsubscript{3+4} eight times the size; branches of M\textsubscript{2} long; A\textsubscript{3} branched.

Description Wing claviform; costal margin slightly convex; outer margin rounded acuminate; posterior margin straight for three-quarters of its proximal length, then curving smoothly toward the apex; costal area narrow and sub-costal area wide, fusiform; the nature of preservation made it impossible to see the pterostigma; SC branching at the level of M and a little before RS; the branch SC\textsubscript{3} is short, straight and slightly inclined forward; SC\textsubscript{2} and SC\textsubscript{1} long; SC\textsubscript{1} reaching the level of branching of M\textsubscript{2}; R smoothly sinuous and linked by a cross-vein to SC\textsubscript{1}; RS a little more than twice the length of RS\textsubscript{1+2} and RS\textsubscript{3+4}; RS\textsubscript{1+2} and RS\textsubscript{3+4} are the same size and are about one-eighth the length of their branches. M is straight, branching a little before RS and has the six normal branches, with the branches of M\textsubscript{2} relatively long and of the same size as the branches of M\textsubscript{4}. CuA beginning with the Y-shaped figure is straight as far as the cross-vein that links it to M\textsubscript{4}, from there onwards it is curved; CuP straight and with triangular development on the proximal side; A\textsubscript{1}, A\textsubscript{2} and A\textsubscript{3} oblique parallel; A\textsubscript{1} and A\textsubscript{2} linked by a cross-vein forming a closed elliptical basal cell; A\textsubscript{3} branched. Some of the cross-veins are very difficult to see. Several are shown on the drawing but others probably exist.

Dimensions Length of the forewing 11.85 mm
Maximum width 4.5 mm

Remarks This species is extremely close to Asiachorista neuburgae O. Martinova, 1958 (see Pl. I, Fig. 8) in the venation pattern; but it differs in the different proportions from the branches of RS; A. neuburgae has the proportions 7 : 4 : 20 and A. beckermigdisvae, sp. nov., 7 : 3 : 21, i.e., A. neuburgae has RS less than twice RS\textsubscript{1+2} or RS\textsubscript{3+4} while in A. beckermigdisvae, sp. nov., RS is more than twice RS\textsubscript{1+2} or RS\textsubscript{3+4}; in A. neuburgae the branches of RS\textsubscript{1+2} are five times its length in A. beckermigdisvae, sp. nov., they are eight times its length. In addition A. beckermigdisvae, sp. nov., is bigger (11.85 mm) than A. neuburgae (9.25 mm).

Occurrence In an yellow silty shale of the Irati Formation, in a road cutting at km 79 on the Porto Alegre-Uruguayana road, Rio Grande do Sul, Brazil. Collected by the author.
BIBLIOGRAFIA


CARPENTER, F. M. – 1930 – A Permian Blattid from Brazil. Serv. Geol. Mineral. Brazil, Bol. 50, pp. 4-10, 1 Pl.


