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NEW FOSSIL INSECTS FROM THE WHITE BAND FORMATION (PERMIAN), SOUTH AFRICA

Irajá Damiani Pinto *
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SINOPSE

São descritos dois novos gêneros e duas novas espécies: *Afrochoristella maclachlani* Pinto et Ornellas, gen. et sp. nov. (MECOPTERA) e *Sharovia permiafricana* Pinto et Ornellas, gen. et sp. nov. (PARAPLECOPTERA) da Formação White Band, Permiano da Africa do Sul.

ABSTRACT

Afrochoristella maclachlani Pinto et Ornellas, gen. et sp. nov. (MECOPTERA) and *Sharovia permiafricana* Pinto et Ornellas, gen. et sp. nov. (PARAPLECOPTERA) from the White Band Formation, Permian of South Africa, are described.

INTRODUCTION

Some time ago by the kindness of Drs. Ian R. McLachlan and Ann M. Anderson, the authors received rubber casts of two insect wings from the White Band Formation of South Africa. As they were a little tilted, broken and rested upon other wings, it was very difficult to get the real structure of the veins. After hundreds of drawings, the authors expect to have got the most possible accurate representation of them.

The stratigraphical position of the outcrop where the insects were found will be described and discussed in a paper by Drs. McLachlan and Anderson (1977) to whom the present authors present their deepest thanks for sending them the rubber casts of the specimens and giving them the opportunity to describe these insects.

The authors want to thank also CNPq and FAPERGS, for the continuous help given to their research.

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SYSTEMATICS

ORDO – MECOPTERA
SUB-ORDO – EUMECOPTERA

FAMÍLIA – NANNOCHORISTIDAE Tylliard, 1917

Diagnosis
Family characterized by reduced branching of RS (R2 + 3 being simple) and marked fusion of M and CuA near their bases; Sc varies in structure.

Afrochoristella Pinto et Ornellas, gen. nov.

Diagnosis
Sc long forked distally; R forked at the distal portion; Rs three-branched, M four-branched; CuA and M fused for some distance. Rs and CuA arised very basally, Rs and M forking very distally, and R, curving outward leaving a wide free space on the central part of the wing.

Type-species *Afrochoristella maclachlani* Pinto et Ornellas, gen et sp. nov.
White Band Formation, Permian, Modderdrift, South Africa.

Remarks
Riek (1953) creates two new fossil genera of Nannochoristidae: *Nannochoristella* and *Neochoristella*. The new genus *Afrochoristella* as *Neochoristella* differ from *Nannochoristella* by having four branches in M; and the former differs from *Neochoristella* by having the origin of Rs and CuA very basally. Differs from both genera in having the forks of Rs and M very distally; R curving outward, leaving a wide free space on the central part of the wing and Sc linked to R.

Afrochoristella maclachlani Pinto et Ornellas, gen. et sp. nov.
Text-fig. 1, 2; pl. I, fig. 1

Derivato nominis: in honour of Drs. Ian R. McLachlan and Ann Anderson
Holotypus: B. P. I. P. R. Mod./K. W. B. 1
Castotypus: UFRGS Nº MP-I-6180
Locus typicus: farm Modderdrift between Prince Albert and Willowmore, South Africa.
Stratum typicum: White Band Formation, Permian, South Africa.

Diagnosis
Wing very small and narrow, length around 6.0mm.

Description
Wing oval-elongate, very small; anterior margin slightly convex; apex rounded; posterior border convex; greatest width beyond the middle, base rather narrowed; costal space very narrow and somewhat expanded over most of its length; Sc long, sinuous linked to R at the middle length. Subcostal space widespread at the proximal half. R long slightly bended, forking at the extremity where it reaches the anterior border near the branch R2+3. Rs arising very basally; R2+3 simple and arising very distally. R4+5 forking before the forking of M1+2. M1+2 and M3+4 with two branches each. M and CuA fused for a short distance. The area of cubital and anal veins too tilted turning difficult to see clearly their structure apparently they are as represented in the illustrations.

Remarks
It was very difficult to get out the real structure of the wings because they were tilted and broken and rested upon other wings. Fig. 2 represents the reconstruction based on the anterior part of one wing and the posterior of the other.

First and second branches of Rs forking after the first and second branches of M, respectively.

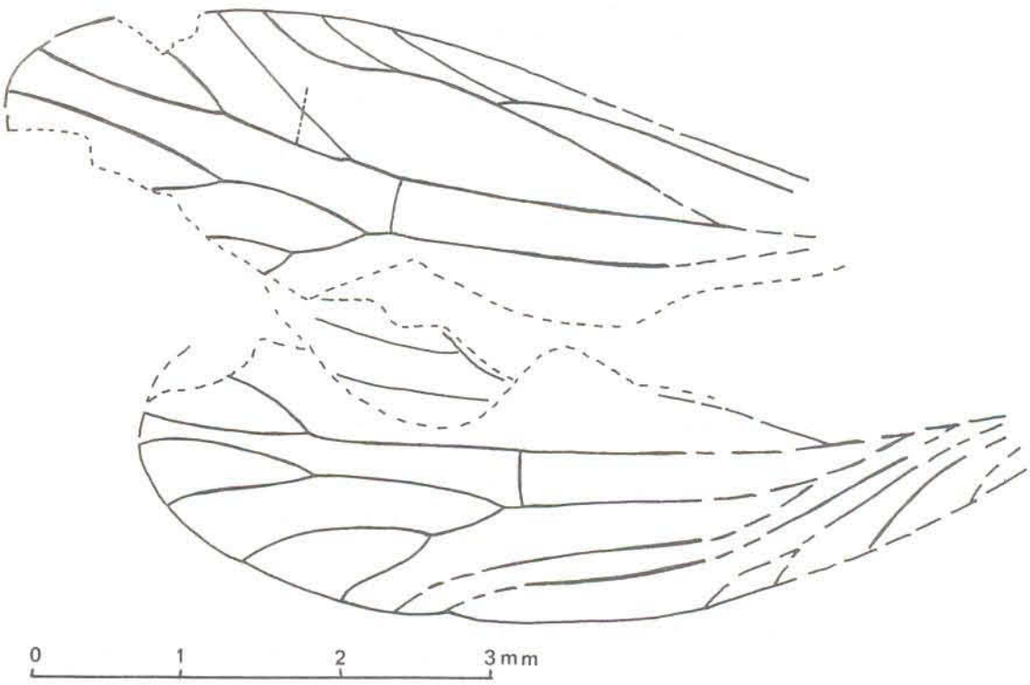

Fig. 1 – *Afrochoristella maclachlani* Pinto et Ornellas, gen. et sp. nov.

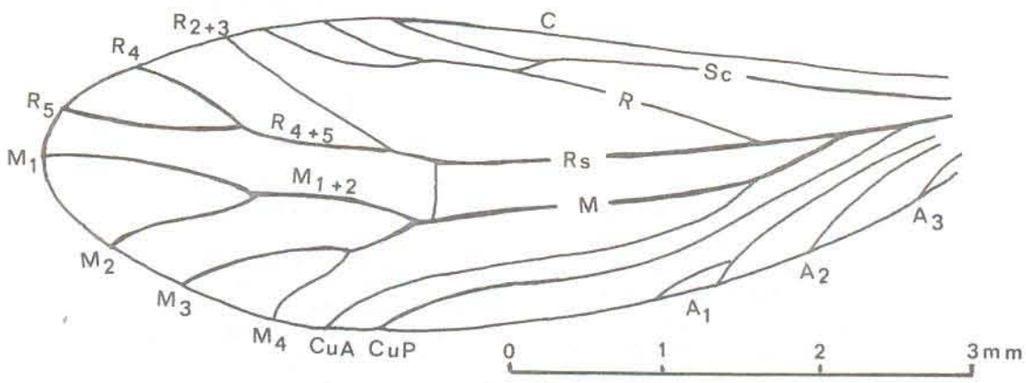

Fig. 2 – *Afrochoristella maclachlani* Pinto et Ornellas, gen. et sp. nov. (Reconstruction)

ORDO – PARAPLECOPTERA
SUPER FAMÍLIA – LIOMOPTERIDEA

FAMÍLIA – LIOMOPTERIDAE Sellards, 1909

Remarks

Sellards (1909) at creating this family for Protorthopterans insects gave the following characteristics to it: "Includes a group of robust insects. The subcostal vein in this family is straight or nearly so, never arched, and gives off numerous oblique strong branches resembling in this respect many of the modern mantid species. The radius gives off oblique branches beyond the termination of the subcosta. The radial sector is several times branched. The media divides early. Cu2 is simple. Cul and the media are variable in their branching.

The hind wing is shorter and broader than the front. The anal area is imperfectly known. It is however, marked off by a deeply impressed cubitus, and is doubtless expanded and folded. The legs are preserved, in part, on the type specimen and are seen to be relatively long and stout. The thorax is also partly preserved and is somewhat elongated".

Carpenter (1950) maintained this family in the Ordo Protorthoptera characterizing it as follow: "small to medium in size, the largest having a wing expanse of about 65mm. The fore wings were membranous and were at least partially covered with short but conspicuous hairs. The subcosta terminated on the costa, about two-thirds the wing-length from the base, and the costal area contained numerous cross-veins, nearly uniformly slanted and with very little branching and cell formation. The radius extended well to the apex of the wing and its sector (Rs) arising before mid-wing, had at least two terminal branches. The media was forked at about level of the origin of Rs (or slightly basal), forming a main anterior branch (MA), usually with several terminal branches, and a main posterior branch (MP), usually forked. MA and MP were not anastomosed with other veins. The cubitus (Cu) was formed as characteristic of this whole group of protorthopterous families, with the anterior cubitus (CuA) arising basally, diverging anteriorly, and then forking into two main branches; the outer (CuAl) had at least two terminal branches, but the inner was always unbranched. The wide space between CuA and CuP contained at most a double row of cells. The posterior cubitus (CuP), apparently as in all the Protorthoptera, was unbranched. The first anal (1A) was also unbranched but 2A was at least forked. Cross-veins were numerous in the wing, and in some species formed a coarse reticulation, but not with more than two rows of cells between veins.

Climaconeuridae Handlirsch, 1919

Khosaridae Martinov, 1937 (pars);

The hind wing, which is known only in *Liomopterum ornatum*, had a narrower costal space than the fore wing, and Rs arose nearer the base; M and CuA were fused to form a single stem; CuA was a strong vein, deeply forked; CuP was very weak; 1A was close to CuP and straight; 2A was forked. The anal area was well developed, with many radial veins.

The body structure is known in *Liomopterum* and *Semopterum*, n. gen., but all members of the family probably had the same general features. The antennae were multisegmented and fully as long as the body of the insect; the head was hypognathous and the eyes prominent; the prothorax had conspicuous lateral expansions, apparently membranous, but completely surrounding the pronotum itself; the cerci were long, and the legs slender, the hind legs being much longer than the others though not modified for jumping; the tarsi were 5-segmented."

Sharov (1962) put this family in a Superfamily Liomopteridea which has the forewings wide-oval, sometimes with acute angular apice. Normally membranous partially or fully covered by short hairs, rarely without hairs. M normally (few exceptions) forks before Rs. MP did not fuse with CuA. The proximal branch of CuA (CuA2) almost always separate from the other branches of CuA and runs parallel to CuP. Normally, at the distal half of the wing are simple cross-veins. Only the families Phenopteridae and Sylvaphlebiidae are exceptions, most of their species show wings with a doble row of cells between the longitudinal veins. The hindwing with a wide anal fan, clearly distinct.

The head is prognathous, the pronotum with protuberant lateral paranotal lobes that extend the pronotum at the anterior and posterior border forming a ring around the notum. Sometimes, darkness veins are found in these lobes resembling the wing veins.

Ovipositor reduced, sometimes strongly reduced.

Carboniferous-Jurassic.

To characterize the family Liomopteridae he has registered the following characteristics: costal field relatively wide, normally wider than the subcostal. MP forming two branches, rarely three. Al commonly simple but sometimes forming a terminal branch. A2 forms at least 4 branches. At the distal half of the wing, with exception of the field between R and Rs, occur alwavs simple cross-veins.

Carboniferous to Permian. 19 genera.

Sharovia Pinto et Ornellas, gen. nov.

Diagnosis
Costal field twice wider than the subcostal, narrowing basally; oblique branches of Sc simple and regularly disposed, Sc field with simple cross-veins. Radial field a little larger than the subcostal and with few simple cross-veins. Sc and R parallel and curving slightly distally to the anterior border. Origin of Rs before the middle length. M arising from R near the base. MA parallel to R and Rs. MP forking soon. CuA forking near the base before the origin of M; CuP simple, slightly sigmoidal. Legs strong.

Type-species *Sharovia permiafricana* Pinto et Ornellas, gen. et sp. nov.
White Band Formation, Permian, Kranz Poort. South Africa

Remarks
This new genus presents some characteristics that does not agreed fully with none of the already known families. For example: Sellards (1909) mentions that Sc "is straight or nearly so, never arched" for Liomopteridae. The present specimen has Sc and R slightly arched. Carpenter (1950) says, as part of the characteristics of this family that "The wide space between CuA and CuP contained at most a double row of cells" what is not very clearly seen in the present specimen. The present genus has the structure of the veins almost identical to one species of the Family Lemmatophoridae *Biarmopteron protoblattoides* Zalessky, 1952 fig. 2 and fig. 3A, including the origin of M from R, but differs fundamentally in having a wide costal field and simple cross-veins where *Biarmopteron* put by Sharov (1962) as Sylvaphlebia has a narrow costal field and reticulate cross-veins. This genus is denominated in honour to Dr. A. G. Sharov.

Sharovia permiafricana Pinto et Ornellas, gen. et sp. nov.
Text-fig. 3,4; pl. 1, fig. 2.

Derivatio nominis: from Permian of Africa
Holotypus: B.P.I.P.R. K.P./K. W.B. 1
Castotypus: a cast of 2/3 of the wing. UFRGS nº MP-I-6181
Locus typicus: farm Krantz Poort.,
Locus typicus: farm Krantz Poort, between Willowmore and Klipplaat. South Africa.
Stratum typicum: White Band, Permian, South Africa.

Diagnosis
Forewing about 23mm; costal space narrowing to the extremities and bearing more than ten oblique branches. Sub-costal space one half less wide than the costal space and narrower than the radial space. MP bifurcating twice. CuA curves slightly to M and bifurcates near the base in CuA1 and CuA2; CuP simple.

Description
The specimen is represented by some parts of the body, legs and parts of a forewing rest upon other wing. The basal part has a length of 17mm and the distal part 4mm. These broken and tilted wings lead to a great difficulty to make a correct interpretation of the veins structure. However it was possible to determine that it is a medium size wing that probably had about 25mm of length; that Sc is slightly arched, sigmoidal, sending many obliques branches to C; R parallel to Sc and linked to it basally and also through several cross-veins, both veins converging distally to C; Rs rises distally beyond the mid-length of the wing; M linked for some distance to R and bifurcating before Rs; MP bifurcate soon, before Rs also; CuA divides in two branches just before M and apparently presents between the branches a double row of cells; CuP simple. Only parts of stout legs and of the thorax is seen.

The environment where have been found Paraplecopterans insects (Protorthoptera or Protoperlaria of some authors) specially of the familia Lemmatophoridae and closely related families as Liomopteridae and Mecoptera, specially of the familia Nannochoristidae is quite similar.

The living forms are essentially terrestrial insects, the adults resting on the surface of foliage of rank herbage growing on the banks of shaded streams and damp woods where there is an undergrowth of herbaceous plants, also among moss or beneath stones. Most of them undergoing their pupation in the soil. The larvae live in moss, rotten wood or the rich mud and humus around seepage areas in densely wooded situations. However others as the genus *Nannochorista* have aquatic nymphs as believed by Tillyard.

Their food consist of various types of organic matter: dead insects or other animals, nectar, pollen, petals, fruits and mosses.

The fossils is believed to live in similar conditions.

Carpenter (1935) when discussing about the great quantity of fossil insects found at the Elmo limestone (USA) says: "The occurrence of so many individuals is almost certainly due in large measure to the fact that these species were aquatic in the nymphal stages and bred in the same body of water which deposited the limestone in which they are preserved. That such was the case is demonstrated by the presence of many nymphs which undoubtedly belong to these insects."

Tasch and Zimmerman (1962) about the same area say: "A striking feature of the bed is the number of specimens that occur in the same few square centimeters of surface. On one plane, less than a square foot in area, thirty different specimens were found. The large number of small specimens suggests that wind had been a strong factor in depositing the insects on the small ponds or surrounding mud flats which apparently served as sedimentation surfaces. This is further suggested by the fact that insects are chiefly represented by wings or other unconnected parts such as abdomens, antennae, prothoraces, legs and heads."

Tillyard (1926) making comments on clima and evolution of hemimetabolous to holometabolous insects says: "We may therefore rule out of account the idea that the pupal stage became interpolated in the life-history as a protection against severe cold, and may accept the geological evidence as being strongly in favor of drought and heat as having been the determining factors in the evolution of the holometabolous type. This is in agreement with the known life-history of the archaic Australian Choristidae, which are closely related, not only to the known Upper Permian forms from Australia, but also to the majority of the new forms about to be described in this paper from the Kansas beds. Adult Choristidae are delicate insects which live for a few weeks only in sheltered localities in eastern Australia during a period of the year (April) when dews are frequent. Their eggs are laid in the soil, in shady places, and the larvae grow rapidly, feeding at night on vegetable debris, moss etc., on the ground, and hiding by day in short tunnels underground. When fulled, they hollow out an oval chamber an inch or two below ground in some well-shaded spot, and there spend the whole of the succeeding spring and summer, finally pupating in March, only three weeks before emergence as the perfect insect. The shole of this life-history indicates the adaptation of an originally moisture-loving type to dry, arid conditions, and would strongly point to the pupal stage having been evolved as a protective device in the life-history of some small, weak, but originally hemimetabolous form of the Carboniferous era, when exposed to the much severer climate of the Lower Permian."

All these data lead to the conclusion that the insects described have lived probably in some shaded places, with undergrowth herbaceous plants and near water bodies.

Repository: The holotypes will be kept at Bernard Price Institute for Paleontological Research, Witwatersrand University Johannesburg. The castotype at the Museu de Paleontologia da Universidade Federal do Rio Grande do Sul, Porto Alegre, Brasil.

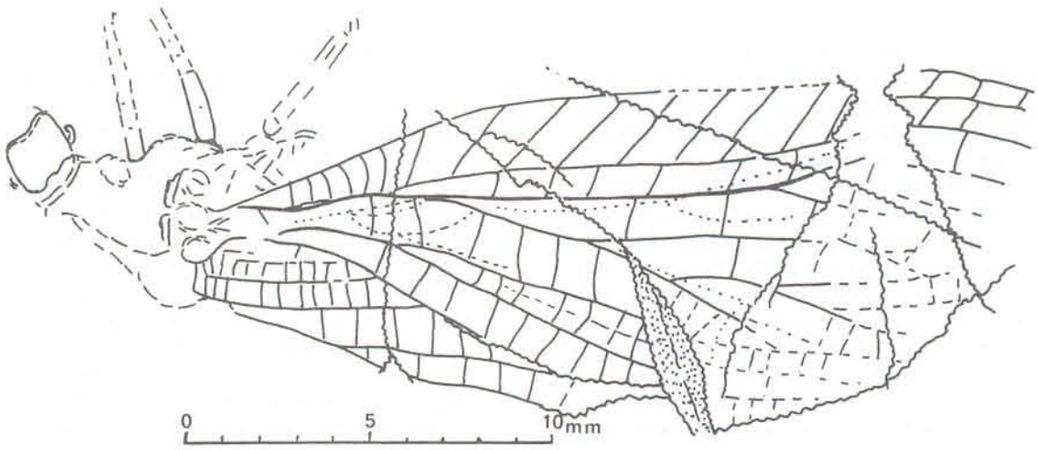

Fig. 3 – *Sharovia permiafricana* Pinto et Ornellas, gen. et sp. nov.

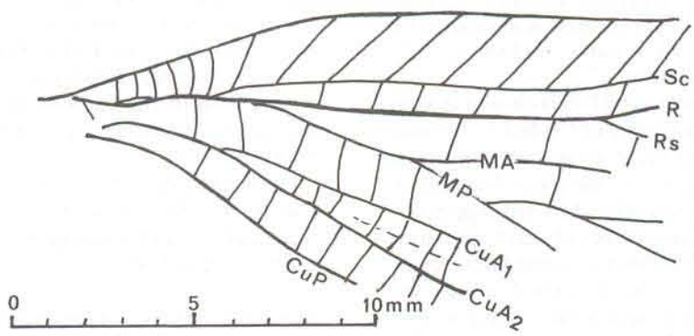

Fig. 4 – *Sharovia permiafricana* Pinto et Ornellas, gen. et sp. nov.

BRONGNIART, C. 1893. *Recherches pour servir a l'histoire des insectes fossiles des temps primaires.* Saint-Étienne, Théolier, Text. 638p. and Atlas 44p., 30pl.

CARPENTER, F. M. 1950. The Lower Permian insects of Kansas. 10. The order Protorthoptera: the family Liomopteridae and its relatives. *Proceedings of American Academy of Arts and Sciences,* Boston, *78*(4):185-219, pl. 1-3.

— 1953. The Lower Permian insects of Kansas. 7. The Order Protoperlaria. *Proceedings of American Academy of Arts and Sciences,* Boston, *70*(4):103-46, pl. 1-2.

MARTINOVA, O.M. 1961. Ordo Mecoptera. Skorpionnitsevy (p.487-589, Tab. 21-28, 36-40). In: ROHDENDORF, B. B.; Becker-Migdisova, E. E.; SHAROV, A. G. - *Palaeozoic insects of the Kuznetsk Basin.* Trudy Paleontologitcheskogo Instituta, Izdatelstvo Akademii Nauk SSSR, Moscou, *85*:1-705, pl. I-XL (In Russian).

McLACHLAN, I. R. & ANDERSON, A. M. 1977. Fossil insect wings from the Early Permian White Band Formation, South Africa. *Palaeontologia Africana* (in press).

RIEK, E. F. 1953. Fossil Mecopteroid insects from the Upper Permian of New South Wales. *Record Australian Museum,* Sydney, *23*(2):55-87, il., pl. V-VI.

— 1976. New Upper Permian insects from Natal, South Africa. *Annals of the Natal Museum,* Pietermaritzburg, *22*(3):755-89, il.

SELLARDS, E. H. 1909. Types of Permian insects. III. Megasecoptera, Oryctoblattinidae and Protorthoptera. *American Journal of Science,* New Haven, *27*(158):151-73, il.

SHAROV, A. G. 1961. Ordo Paraplecoptera (p. 164-224, Tab. X-XVII). In: ROHDENDORF, B. B.; BECKER-MIGDISOVA, E. E.; SHAROV, A. G. *Palaeozoic insects of the Kuznetsk Basin.* Trudy Paleontologitcheskogo Instituta, Izdatelstvo Akademii Nauk SSSR, Moscou *85*:1-705, pl. I-XL (in Russian).

— 1962. Classis Insecta Nasekomvie (p. 29-374). In: ROHDENDORF, B. B. ed. Arthropoda et Chelicerata. *Osnovy Paleontologii,* Izdatelstvo Akademii Nauk SSSR, Moscou, 560 p., il.

TASCH, P. & ZIMMERMAN, J. R. 1962. The Asthenohymen-Delopterum bed: a new Leonardiam insect horizon in the Wellington of Kansas and Oklahoma. *Journal of Paleontology,* Tulsa, *36*(6):1319-33, il.

TILLYARD, R. J. 1926. Kansas Permian insects. 7. The order Mecoptera. *American Journal of Science,* New Haven, 11(62, 5.s.):133-64, il.

1928. Kansas Permian insects. 10. The new order Protoperlaria: a study of the typical genus *Lemmatophora* Sellards. *American Journal of Science,* New Haven, *26*(93):185-220, il.

ZALESSKY, G. M. 1939. *Études des insects permiens du Bassin de la Sylva et problémes de l'evolution dans la classe des insectes.* III. – Nouveaux representants des Protohymenoptera, Homoptera, Hemipsocoptera, Psocoptera, Protoperlaria, Isoptera et Protoblattoidea *5*:33-91, pl. 1-3.

— 1952. About precursors from Permian Formations of the Ural. *Doklady Akademy Nauk of SSSR, 82*(6):985-8, il. (In Russian).

ZEUNER, F. E. 1939. *Fossil Orthoptera Ensifera.* London, The British Museum (Nat. Hist.) text, 321p. et Atlas: pl. I-LXXX.

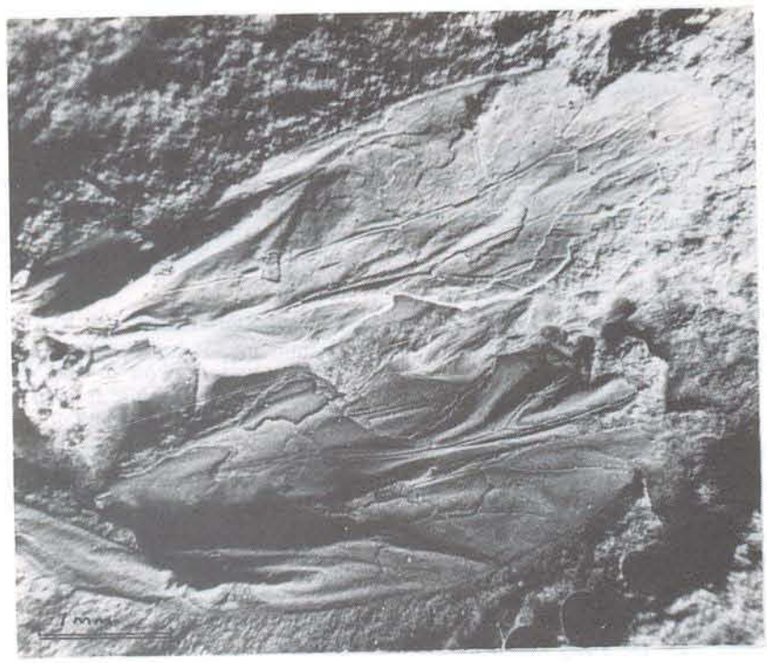

Fig. 1 – *Afrochoristella maclachlani* Pinto et Ornellas, gen. et sp. nov.
Permian – Modderdrift, South Africa. Holotype. Nº Mod/K. W.B. 1 and castotype UFRGS, MP-I-6180

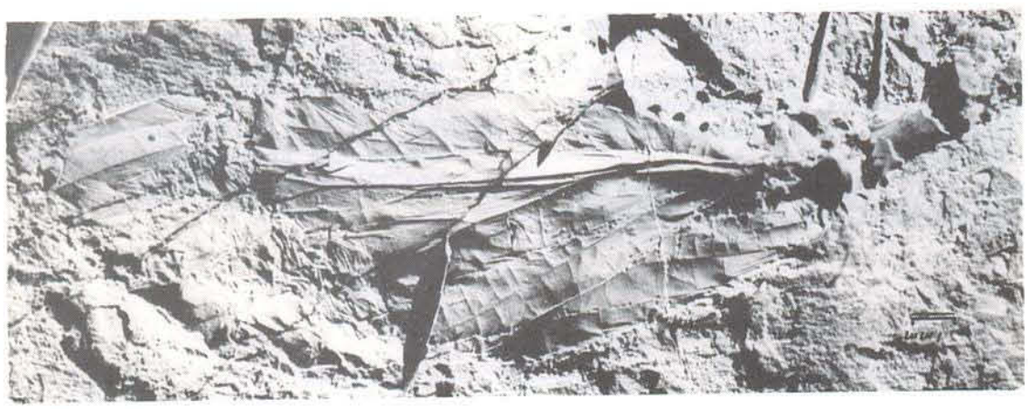

Fig. 2 – *Sharovia permiafricana* Pinto et Ornellas, gen. et sp. nov.
Permian – Kranz Poort, South Africa. Holotype Nº K.P./K. W.B. 1 and castotype UFRGS, MP-I-6181