

the setæ chiefly following a line along the middle of each interval. The microsculpture is rather faint, isodiametric or slightly transverse. Underside sparsely setulose, claws rather strongly denticulate.

Not unlike *R. (Tetragonica) fuscus*, Motch., but a little smaller, sparsely pilose instead of glabrous, and with an apical flavous border. Head with smaller and more prominent eyes; prothorax not dilated behind, the angles less reflexed; elytra much shorter and more convex, the striæ only faintly impressed, the pores on interval 3 similarly placed.

MADRAS: Madura (*C. Somers-Smith*) and Shembaganur (coll Alluaud); Palni Hills, Kodaikanal (*Dr. T. V. Campbell*—coll. E. A. Butler), Kukkai, 6500 feet, on jungle-trees, and Kodaikanal Lake, 6850 feet, under stones (*Dr. S. W. Kemp*—Ind. Mus.).

Risophilus psilus, sp. n.

Very nearly allied to the preceding species and of nearly the same size and form, but differing as follows:—The surface, instead of being minutely punctulate and setose, is glabrous, the underside only showing a slight and hardly visible pubescence. Upper surface black; joint 1 of antennæ and femora flavous; joints 2-3 of antennæ, knees, tibiæ, and tarsi more or less piceous. The head hardly differs. *Prothorax* narrower, sides distinctly sinuate behind, the angles sharper and even projecting a little laterally. *Elytra* differing chiefly in the absence of the light apical border, but the truncature is more distinctly emarginate on each side and the outer angles less rounded.

MADRAS: Palni Hills, Kodaikanal (*T. B. Fletcher*—Agric. Res. Inst., Pusa, and *Dr. T. V. Campbell*), 2 ex. I am indebted for the type to Dr. E. A. Butler.

XLVI.—*On some Arachnid Remains from the Old Red Sandstone (Rhynie Chert Bed, Aberdeenshire).* By STANLEY HIRST.

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[Plates XI.-XV.]

THIS note deals with fossil Arachnids from the Rhynie Chert. The Arthropods found in this deposit show a considerable amount of structural detail, even the secondary offshoots of the hairs being distinctly visible in certain cases. Unfortunately these remains are often fragmentary. There can

be little doubt, however, that, if a sufficient number of specimens could be collected from the Rhynie Chert, very important results throwing light on the ancestry of the Arachnida and other groups of Arthropoda would be obtained.

According to Handlirsch, Insecta do not occur either in the Silurian or Devonian strata. He states that *Palaeoblattina* from the Silurian, which was formerly believed to be an orthopterous insect, is part of a Trilobite, whilst *Protocimex* possibly is only a *lusus naturæ*.

Peach has already shown that certain fossil myriopods (*Kampecaris* and *Archidesmus*) are found in the Old Red Sandstone. It seems probable that the forms described in the present paper are the earliest-known terrestrial air-breathing Arachnida discovered so far, for it is believed by Lankester and others that the Silurian scorpion (*Palaeophonus*) was an aquatic animal. The mite is of especial interest, for members of this group have previously only been found as far back as the Tertiary period. The difficulty of detecting such small Arachnids in the fossil state, even when well-preserved, should be borne in mind, however.

Sincere thanks are due to Dr. W. T. Calman, F.R.S., Mr. W. Cran, and Mr. D. J. Scourfield, for their kindness in allowing me to describe these fossil Arachnids.

The drawings illustrating this paper have been prepared by Mr. Percy Highley and Mr. A. J. Engel Terzi, with the aid of a camera lucida, under my personal supervision.

Order ACARI.

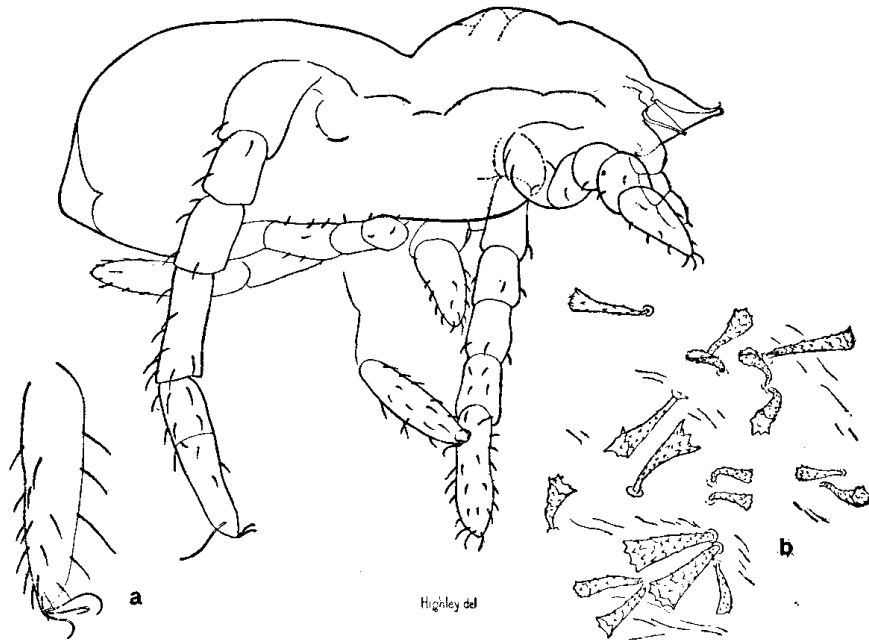
• Family Eupodidæ (?).

Protacarus crani, gen. et sp. n.
(Pl. XI. figs. *a* & *b*; text-figs. 1 & 2.)

Body apparently not segmented and moderately elongated. The anterior end can be seen in specimen no. 2 (see list at end of description); there is a little curved process or cone in the median line anteriorly, projecting above the chelicerae; a few very minute hairs are present on this process and a little further back on each side of the cephalothorax there is a longer hair, possibly plumose, which is perhaps a pseudostigma. Nearer the middle of this specimen there seems to be a transverse line running across the dorsal surface of the body. A number of hairs are present on the body—most of them are short, but some of the posterior ones seem to be longer. A cast skin shows a number of fan-shaped hairs

(text-fig. 1*b*), but it is a little uncertain whether they belong to this species. It seems probable that the integument of the body was weakly chitinized, for it is wrinkled and cockled in all specimens, the outline being irregular. Apparently the chelicera consists of two segments, the tip of the distal one tapering to a point which seems to have been strongly chitinized, for it is dark in colour; it is difficult to ascertain if there were terminal fingers. *Palp* more slender and much shorter than the legs; apparently it consists of six free segments, and possibly also there may be a fixed proximal segment. *Legs* well developed, being fairly long and apparently having six free segments, the tarsus being the

Text-fig. 1.



Protocarus crani. Sketch of specimen No. 3.

a. Tarsus of leg, greatly magnified.

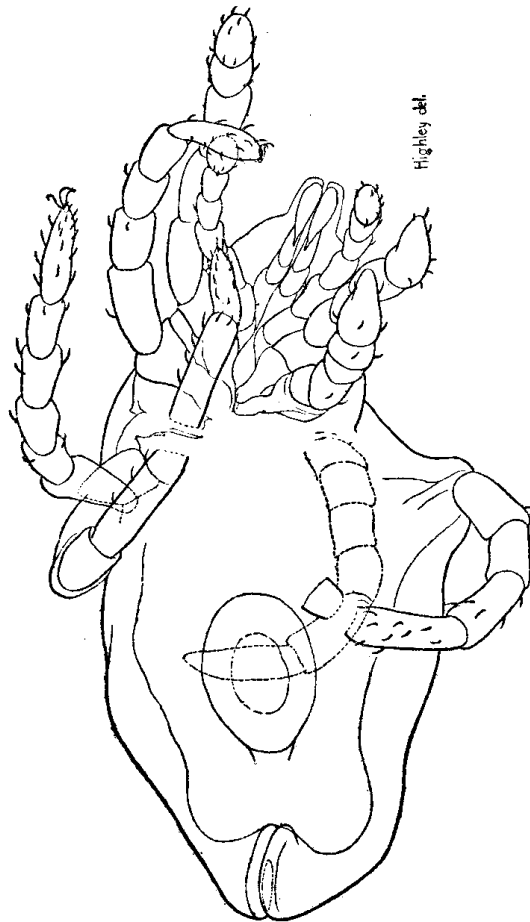
b. Fan-shaped hairs, greatly magnified.

longest. A number of short hairs, which are usually slightly curved, are present on the legs. In specimen no. 3 the fourth tarsus seems to be furnished with a long dorsal hair, but this is doubtful. Tarsi of legs ending in three terminal hairs shaped like claws but very thin. All four pairs of legs seem to be placed rather close together, the posterior pairs being only a little behind the others. In specimen no. 4 they are situated very close together, but this example is larger than the others and perhaps referable to another species.

Length of body of specimen no. 1, 290μ ; of specimen no. 2, ?; of specimen no. 3, 310μ ; of specimen no. 4, 440μ .

Many authorities consider the Acari to be a degenerate group of Arachnida; it is surprising therefore to find a mite-like form so early as the Devonian strata. The minute size and apparent lack of segmentation seem to indicate, however, that this fossil form is one of the Acari. Moreover,

Text-fig. 2.



Protacarus crani (?). Ventral aspect of specimen No. 4.

in general appearance this species closely resembles the Eupodidæ, which are considered by Banks to be the most primitive group of mites.

There are six pieces of chert containing examples of this fossil mite. The following is a brief description of them:—

No. 1. A specimen seen sideways, and practically complete; all the legs are visible, except the last one which is

not in this splinter of chert. Fig. *a* (Pl. XI.) is drawn from this specimen. (Cran collection.)

No. 2. A specimen (the type of the species) with the anterior end clearly displayed (see fig. *b*, Pl. XI.).

No. 3. The mite is placed sideways in the matrix, the front end is sectioned, parts being missing. Second and fourth legs well extended (see text-fig. 1).

No. 4. A rather distorted specimen, with the ventral side uppermost. Appendages well displayed, especially the palpi (text-fig. 2).

No. 5. Parts of mite, including the end of the legs. The tarsus of this leg has been sketched (see text-fig. 1*a*).

No. 6. A number of cast skins of mites in a fragment of chert. Some curious fan-shaped hairs are visible (text-fig. 1*b*).

It has been possible to examine all this material with a $\frac{1}{6}$ objective and also with a $\frac{1}{7}$ oil immersion objective. Slide No. 5 can be examined with $\frac{1}{12}$ oil immersion, for the fragment of chert is very thin.

Order ARANEÆ(?). (Pl. XI. fig. *c*.)

Palæocteniza crassipes, gen. et sp. n.

Only a single example of this form has been discovered (Cran coll.), and its structure is difficult to make out, owing to the position of the legs and the crumpled state of the abdomen*. In general appearance it is rather like a trap-door spider. The cephalothorax is obscured by the legs, which have been pressed upwards and are arched. There is a raised structure or hump anteriorly, which may be part of the cephalothorax or is perhaps due to the distortion of some limb. Near the end of the abdomen there is a little detached piece of chitin in the matrix, which, judging from its proportions, might perhaps be the cephalothoracic carapace, presumably having become separated from the rest of the body. The dotted line in the figure labelled "A" represents the outline of this piece of chitin drawn by camera lucida from the detached fragment and placed in its supposed position.

* I have followed Petrunkevitch in retaining the words "cephalothorax" and "abdomen" for the two principal divisions of the body.

Owing to the poor state of preservation of the abdomen, it is impossible to be quite certain whether this is segmented or not. There is, however, at least one definite transverse dividing-line, perhaps representing that one which is present in all recent spiders just in front of the apertures of the anterior pulmonary sacs; a few short parallel transverse striations are present immediately behind this line in the fossil—possibly they are the beginnings of the lung-books. It is possible that the spinneret-like structures shown in the figure are merely folds of the skin—on the other hand, they may prove to be true spinnerets.

Legs fairly well preserved, being stout and rather short; the segments seem to be few in number, apparently five (?). The legs, however, are incomplete, so that the full number of segments cannot be ascertained.

Length of body about .9 mm.

Order ANTHRACOMARTI.

Palæocharinidæ, fam. nov.

Body divided into two main divisions, viz., cephalothorax and abdomen, the latter segmented. Tergites of abdomen subdivided into median and lateral divisions; including the prægenital one, there are nine sternites. Two small caudal segments are also present. Palp shaped like a leg, but shorter and with fewer segments. Legs of the normal terrestrial (ambulatory) type. A conical protuberance above the end of the tarsi of the legs, as in the recent scorpions, and also in some of the recent Amblypygi (Pedipalpi).

PALÆOCHARINOIDES, gen. nov. (Pl. XII.; text-fig. 3.)

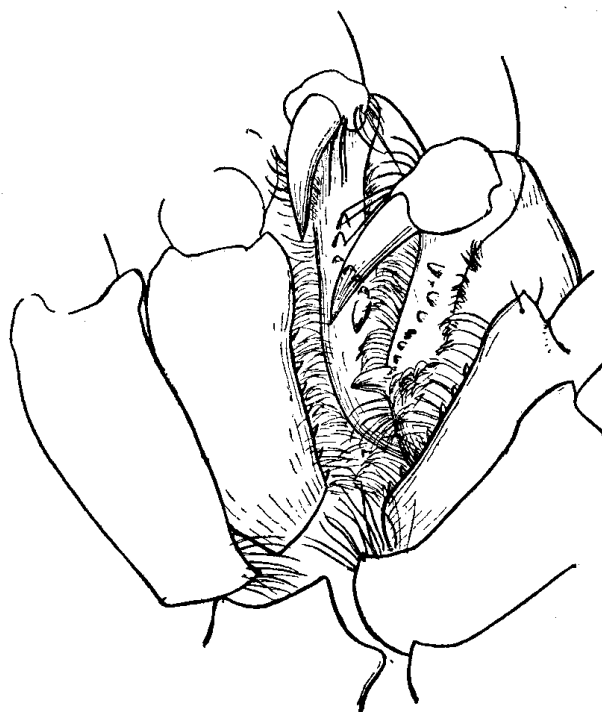
Differs from the allied genus *Palæocharinus* (see p. 462) in having the sternum bluntly pointed posteriorly instead of truncated.

Palæocharinoides hornei, sp. n.

Cephalothorax a little longer than wide. A pair of terminal denticles, or processes, is present at the front end of the upper surface of the cephalothorax as in *Palæocharinus*, but there does not seem to be any more very distinct denticles on the dorsal surface of this anterior part of the carapace, except for one or two on the slight ridges. The curious elongate-oval structures (possibly compound eyes?) are present (one on each side) in this species. As in the species

of *Palæocharinus*, the sternal plate does not reach further back than the anterior end of the fourth coxæ; as mentioned above in the generic description, the sternum is bluntly pointed posteriorly, the posterior margin consisting of two oblique lines meeting to form the blunt tip, the latter being slightly indented. Without including the two minute caudal segments, there seem to be nine abdominal sternites (owing to the position of the fossil in the matrix, the exact number of tergites cannot be ascertained with certainty). Sternites narrow and furnished with very short hairs, distributed as

Text-fig. 3.



Palæocharinoidea hornei, sp. n. Chelicera, enlarged.

shown in Pl. XII. First sternite with a median projection; the two following sternites project slightly in the middle also. The genital opening (between the second and third sternites) is not very distinct in this species, but seems to be present. The two minute caudal segments are overlapped by the last of the large abdominal sternites, instead of being terminal as in *Palæocharinus* *.

* Minute caudal segments of a similar type seem to be present also in the Carboniferous *Eophrynus prestvici*, but they are very much reduced in size.

Chelicera furnished with seven or eight teeth (text-fig. 3), the first (proximal) tooth being very large, then come three or four very minute denticles running rather obliquely to join a straight row of three medium-sized teeth, of which the two distal ones are slightly larger than the other one. Coxa of palp with sharp conical spinules on its inner surface, presumably stridulatory in function. Coxæ of legs, especially the anterior ones, with the inner anterior angle somewhat curved forwards, forming a slight hook or spur.

This description is based on a single well-preserved example from the Rhynie Chert, collected by the author, and now in the British Museum collection. Total length of body 2.2 mm.

PALÆOCHARINUS, gen. nov.

Dorsum (carapace) of cephalothorax strongly convex and not segmented, being fairly wide but narrowed anteriorly; cephalic part considerably narrowed and bearing a number of paired dorso-lateral denticles, of which the anterior ones are sometimes larger than the others. Posterior margin apparently straight or slightly concave. Eyes present*. Sternal plate with the posterior margin truncated. Tergites of the large abdominal segments subdivided into three parts—a large median part and narrower lateral parts. Chelicera of the normal Arachnid type, being very like that of a recent Amblypygous Pedipalp or of a Mygale spider; the fang strong and moving against the main part of the chelicera; edge of the latter grooved and furnished with teeth. Projecting lobe of maxillary palp armed with granules or denticles, and, besides these, a row of curiously modified denticles and hairs may be present on its outer surface, possibly forming part of a stridulatory apparatus (see fig. *h*, Pl. XV.). Palp shaped like a leg, but shorter, apparently consisting of four (five?) segments. Legs of a terrestrial type, being exactly like those of many recent Arachnids; segments seven in number, viz., a coxa or epimeron which is rather closely attached to the body, possibly being partly fused with it, also a bulbous coxa, trochanter, femur, patella, tibia, protarsus, and tarsus—the femur and tarsus being the longest segments. Tarsus provided with a dorsal conical

* In some more recently collected specimens of *Palæocharinus* a pair of small but distinct circular median eyes, apparently with a simple (single) lens, are visible just above the anterior sloping part of the cephalothorax, being placed midway between the two large oval lateral structures; presumably the latter are compound eyes, for a number of minute circular structures, possibly facets, are present on them.

protuberance and excavation near it, as in the recent scorpions and certain of the recent Pedipalpi. A pair of claws are also present.

It seems pretty certain that the genera *Palæocharinoides* and *Palæocharinus* belong to the order Anthracomarti. The general shape of both the main divisions of the body, shape of the sternum, the presence of lateral abdominal spinules, and the subdivision of each tergite into median and lateral sclerites all seem to indicate their relationship to the Carboniferous Anthracomarti. In having a conical protuberance above the distal end of the tarsi, *Palæocharinus* resembles the recent scorpions and also certain recent forms of Pedipalpi (Amblypygi). The presence of two small caudal segments is a peculiar character and necessitates the creation of a new family.

Palæocharinus scourfieldi, sp. n. (Pl. XIII.)

Specimen no. 9 has the cephalothorax practically complete, its shape is shown in fig. *d*; the narrowed anterior (cephalic) portion is furnished with a longitudinal series of denticles on each side, forming the boundary between the narrow flat upper surface and the steep sides of this portion of the carapace; the anterior denticles are the largest. Posterior margin of cephalothorax almost straight. Sternal plate truncated posteriorly and reaching as far backwards as the anterior end of the last coxæ. Chelicera with one very large proximal tooth and two or three smaller teeth nearer the distal end. In the same piece of chert as the type-specimen there is part of another example, presumably of the same species, with one of the chelicerae turned sideways showing one large and three smaller teeth. Femur of first? leg almost complete, being elongated and furnished with minute granules and slight longitudinal ridges on its ventral surfaces.

Measurements. Length of carapace about 1.75 mm., its width about 1.65 mm. Length of chelicera about .58 mm.; of femur of first leg .70 mm. (Specimen collected by the author; type in British Museum coll.)

Palæocharinus rhynienis, sp. n. (Pl. XIV.)

Carapace of this form (specimen no. 10) apparently a little longer than wide, the cephalic part of it being furnished with the usual dorsal processes, the anterior one being rather long and bifurcated; a secondary granule or denticle may be present on the fork. Lower margin of front (*clypeus*) of cephalic part of carapace with the usual little median process,

but it does not bear any granules. A little posteriorly to the cephalic part there is a rather elongated oval structure on each side which is probably a compound eye: on one side of the specimen it is convex, apparently consisting of a single large lens; on the other side it is flat, apparently having collapsed. Posteriorly the middle part of the carapace is rather uneven, being marked by fairly large but shallow pits. Near the middle of the posterior margin there seems to be a pair of tubercles. Sternum small and narrow on the margin; laterally it is provided with short paired processes situated opposite the coxæ of the first and second legs, whilst its posterior margin is practically straight. The coxæ are slightly displaced in this specimen, but it seems as if the sternum did not reach further back than opposite the posterior margin of the third coxæ. Laterally the outer sclerite of the anterior tergites is thickened or compressed, so as to form a kind of edge bearing a little tooth or spinule.

Apparently the first abdominal sternite has a conical process in the middle of its anterior margin. Second sternite with paired median lobes on its posterior margin, and they seem to guard slit-like openings. Anterior margin of third sternite apparently slightly produced in the middle. It is difficult to see the structure of the chelicera, but it seems to have one large proximal tooth and several smaller teeth on its edge. Maxilla with the usual minute triangular spinules on its inner surface; possibly they are merely the thickened bases of hairs. Femur of third leg with several spinules or teeth on its ventral surface, including a large distal one. Trochanter of fourth leg with a fairly large internal process on its inner surface; femur of this leg apparently with only one or two ventral teeth, besides the large distal one; patella, tibia, and protarsus each with a large distal tooth ventrally.

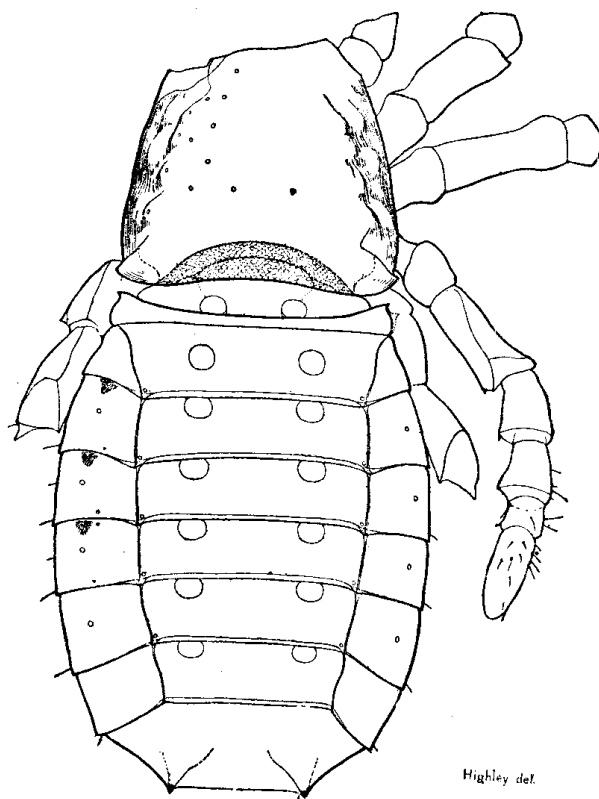
Measurements. Length of carapace about 1.50 mm.; its width about 1.15 mm. Length of chelicera about .38 mm. Length of trochanter of fourth leg .27 mm., its height .24 mm.; length of femur of same leg .55 mm., its height .26 mm.; length of patella .27 mm., its height .21 mm.; of tibia .27 mm., its height .22 mm. (Specimen collected by the author; type in British Museum coll.)

Palæocharinus sp. (Text-figs. 4 & 5.)

The greater part of the body of this example is present, and many important details of the structure can be made out. Unfortunately, the anterior end of the cephalothorax and

also the two little posterior segments of the abdomen are missing. The cephalothorax and abdomen seem to be articulated by a ball-and-socket arrangement, the concave surface or socket being formed by the cephalothorax, which is hollowed out to receive the rounded off surface or ball formed by the middle part of the first (prægenital?) segment of the abdomen. Tergites subdivided into the three usual divisions, the large central division of each tergite being

Text-fig. 4.

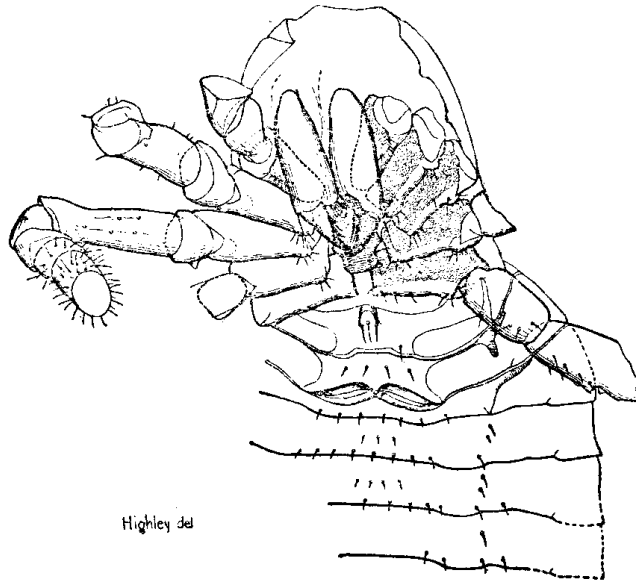
*Palæocharinus*. Dorsal aspect.

marked with a pair of small oval impressions. There are also some very minute and inconspicuous circles distributed as shown in text-fig. 4. Sternal plate wide and short, its posterior margin is practically truncated. Genital opening very distinct, being situated between the second and third sternites. It is shaped as shown in figure, consisting of a narrow aperture almost divided into two by slight median processes of the two sternites and guarded also by narrow

lip-like edges. A number of short hairs are present on the sternites. Inner anterior angles of coxæ apparently not produced to form curved conical processes, as they are in *Palæocharinoides hornei*.

Length of abdomen about 2 mm. (Specimen collected by E. Browning.)

Text-fig. 5.



Palæocharinus sp. Ventral aspect of same specimen as text-fig. 4.

Palæocharinus calmani, sp. n. (Pl. XV. figs. a, b, c.)

The anterior end of the carapace of the cephalothorax of the specimen (no. 11) of this species is complete on one side, and is furnished with a conspicuous bifid forwardly-directed process or thorn; a little behind this thorn there is a pair of minute denticles situated a short distance apart from one another. Integument both of body and coxæ ornamented with minute scale-like markings. Chelicera with two large proximal teeth (whereas only one large proximal tooth is present in *P. scourfieldi*) and three smaller teeth, the more proximal of these smaller ones being very slender.

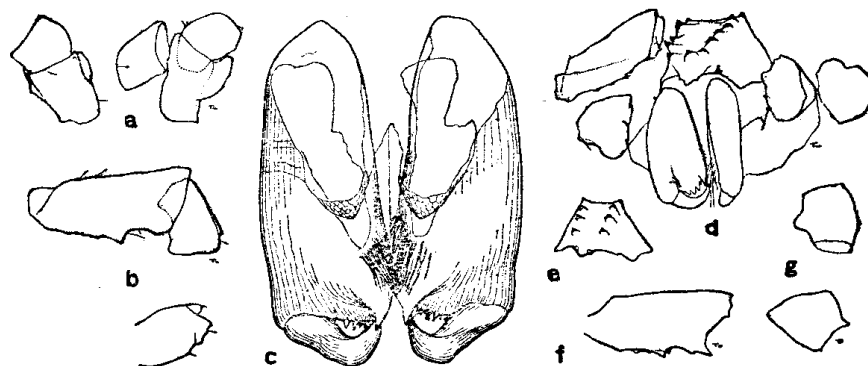
Measurements. Chelicera about .45 in length (not including claw). (Specimen collected by the author; type in British Museum coll.)

Palæocharinus sp. (Text-fig. 6.)

In specimen no. 12 the lateral spinules arranged in a longitudinal row bordering the narrow, almost flat, dorsal strip, which is the highest part of the cephalic part of the

carapace, are quite sharp. In the middle line of the front (clypeus) there is the usual small process pointing between the chelicerae, and, as in specimen no. 13, it is furnished with three minute granules, the lowest of them being unpaired and pointed. It is difficult to see the proximal tooth on the edge of the chelicera, but the other teeth are fairly distinct, the middle ones being slender, whilst the two teeth nearer the distal end are a little larger and stouter.

Text-fig. 6.

*Palaeocharinus* sp.

a, b, f, and g, portions of legs; *c*, chelicerae, greatly enlarged; *d*, anterior end of cephalothorax and chelicerae; *e*, anterior end of cephalothorax of another example.

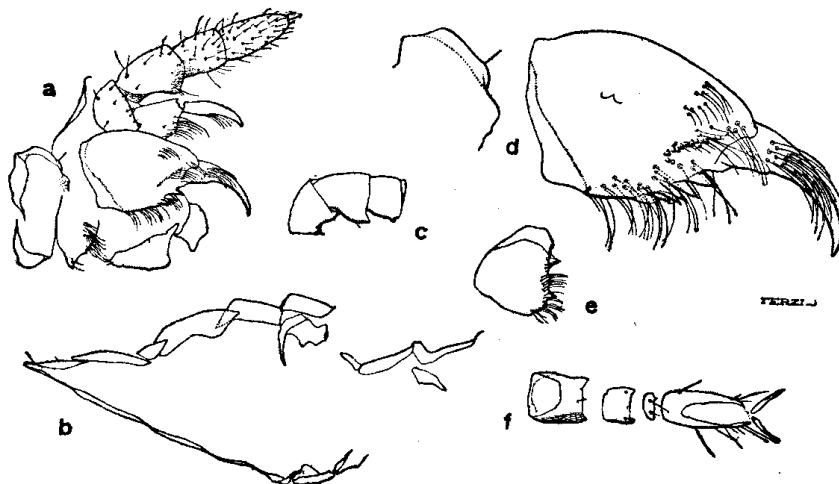
Specimen no. 13 (fig. 6 *e*) has spinules very like those present in no. 12, bordering the upper part of the cephalic portion of the carapace, and also shows the little central process of the lower margin of the clypeus. Figure 6 *f* depicts an isolated femur occurring in the same piece of chert and, therefore, possibly belonging to the same specimen. This femur has the usual ventral denticles, including a large distal one.

Palaeocharinus kidstoni, sp. n. (Text-fig. 7.)

The description of this form of *Palaeocharinus* is based on a section of chert mounted on a slide labelled no. 175 B2, belonging to the series made by Hemingway for Dr. Kidston, and subsequently sent to me by Dr. Cran. Apparently there is no large proximal tooth on the edge of the chelicera, but possibly it has been rubbed off in making the section. A row of four teeth is present near the distal end; they are all placed together, the two proximal ones being very slender, the others stouter. Palp well preserved, especially the three

distal segments, which are furnished with fine hairs. In places the segments of the palp are marked with a fine reticulate scale-like sculpturing. Second? segment with a minute lateral spinule and another ventrally, both being situated distally. There is a section of an abdomen on the same slide, but it is difficult to see the segmentation of the sternites, which seemed fused for a considerable distance (?). Parts of a leg are also present (see fig. 7 *c*), the segments being high and produced ventrally to form distal spinules. Judging by its small size, it seems improbable that this leg belongs to the same specimen as the chelicera and palp described above. Some sectioned segments of a leg also

Text-fig. 7.



Palaeocharinus kidstoni, sp. n.

a, chelicera and palp; *b*, section of abdomen; *c* and *f*, fragments of legs; *d*, chelicera, highly magnified; *e*, section of another chelicera found in the same matrix.

occur on this slide, the paired claws being well shown (see fig. 6 *f*).

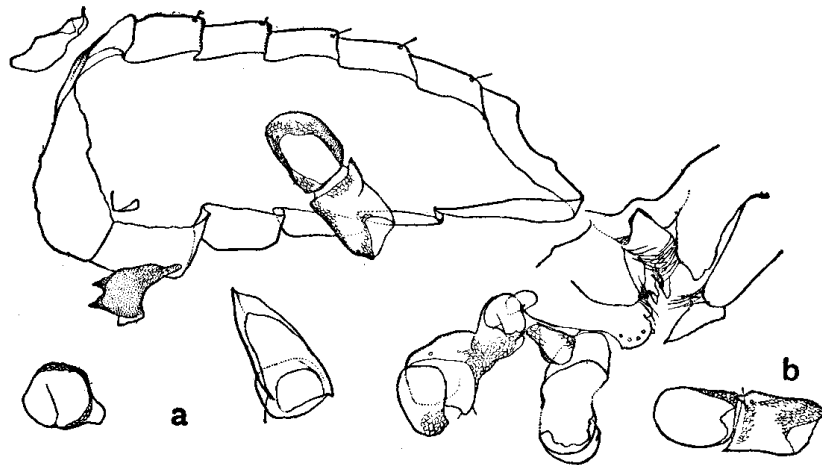
Measurements. Length of chelicera (not including claw) .54 mm. Length of antepenultimate segment of palp .31 mm., its height .22 mm.; length of penultimate segment .21 mm., its height .17 mm., length of tarsus of palp about .32 mm., its height .16 mm.

Palaeocharinus sp. (Text-fig. 8.)

Another slide made by Hemingway for Dr. Kidston shows the abdomen of a *Palaeocharinus* sectioned so that the segmentation is clearly visible, seven large segments being

present. The mouth-parts are also sectioned, showing the tufts of hairs of the chelicerae and part of the maxilla with spinules. Some fragments of legs also occur on this slide ;

Text-fig. 8.



Palaeocharinus sp. Section of abdomen, showing the segmentation.
a and b, fragments of limbs.

they end distally in strong pointed processes, and their surface is marked with scale-like markings.

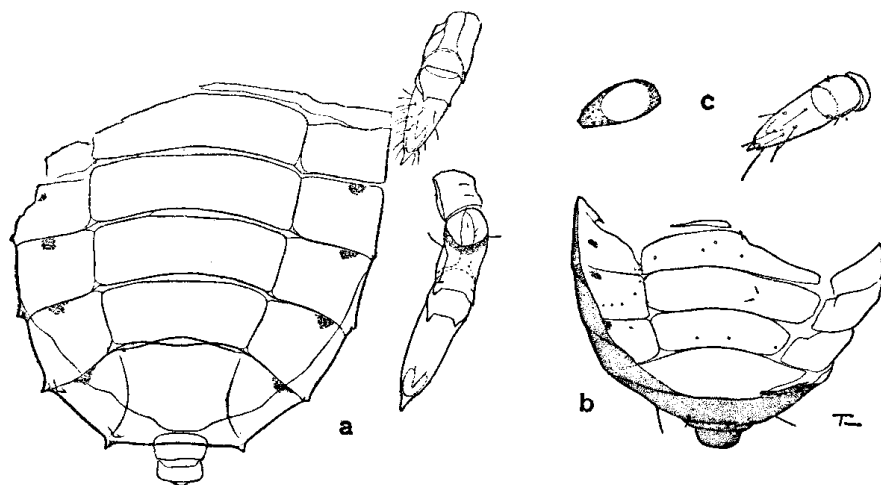
Palaeocharinus sp. (Text-fig. 9 a.)

This specimen consists of part of the posterior end of the abdomen, together with the terminal segments of two of the legs, collected by Mr. Scourfield. Unfortunately, only the dorsal surface is present, and, owing to its position in the matrix, it has to be examined from the inner side. The segmentation is very clear, however. There are five large tergites, which are of approximately equal length, except the posteriormost one which is a little longer than the others. Each tergite consists of three parts : a large median portion, which is practically rectangular being transversely elongated, and a smaller sclerite on each side. Minute denticles are present laterally near the hinder margin of the posterior tergites. The two caudal segments are very small, and shaped as shown in the figure. From their position it seems certain that the legs situated in the matrix near this portion of abdomen are the third and fourth ones. Three distal segments of the third leg are present and three distal segments, and part of the preceding segment of the

fourth. The penultimate and antepenultimate segments (tibia and protarsus) each have a pair of distal spinules on their ventral surface. Whilst a conical protuberance is present on the dorsal surface of the tarsi, the end of the latter being pointed.

Length of last four segments of abdomen + the two small caudal segments 1.44 mm.; length of third large segment from posterior end .3 mm., its width 1.50 mm.; length of first caudal segment .12 mm., its width .21 mm. (Scourfield coll.)

Text-fig. 9.



Palaeocharinus sp. *a*, abdomen and distal segments of posterior legs; *b*, abdomen of another specimen and distal segments of posterior legs (*c*).

Palaeocharinus sp. (Text-fig. 9 *b* & *c*.)

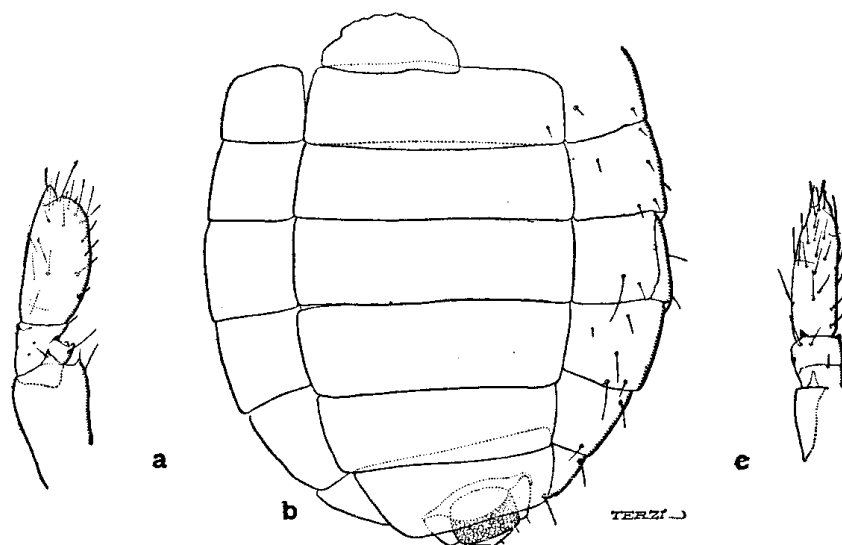
Only the posterior tergites of the abdomen and the distal end of two legs, presumably of the third and fourth of this specimen, are present in the fragment of chert. Lateral sclerites of tergites narrow and apparently without any lateral denticles. Protarsus of legs with only a single very minute denticle on one side distally, instead of the well-developed ones present on each side in the specimen just described above. Tarsus with a well-developed dorsal conical protuberance.

Measurements. Width of abdomen about 1.25 mm., of minute caudal segment .19 mm. Length of tarsus of posterior leg .36 mm.

Palæocharinus sp. (Text-fig. 10.)

The example consists of six large abdominal tergites and two little caudal segments. Also some detached fragments of limbs. Lateral sclerites of abdomen rather narrow; lateral spinules are not visible. The anterior of the two little caudal segments seems wider than the other. Tibia of leg rather high, distally it has two dentiform ventral processes. Protarsus very short and with a pair of very short distal denticles ventrally. Tarsus with a large dorsal cone. It is probable that the body and portions of legs of

Text-fig. 10.



Palæocharinus sp. *a* & *c*, distal segments of legs; *b*, abdomen showing tergites and two little caudal segments.

this specimen have been altered somewhat in shape by pressure.

Measurements. Width of abdomen (somewhat crushed) 1.74 mm. Length of one of the larger tergites about .33 mm.; width of last (small) caudal segment .22 mm.

Palæocharinus sp. (Plate XV. fig. 6.)

Cephalothorax with short paired processes anteriorly in this form, but they are placed on the lower margin and apparently directed downwards. They seem to be homologous with the projections present near the insertion of the chelicerae in many recent forms of Arachnida. (Note: In

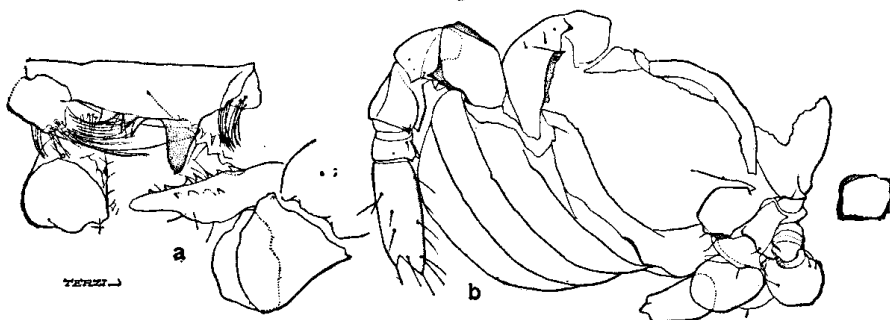
grinding down the fragment of chert in order to make the structure of the chelicera more visible these processes have been accidentally destroyed—they are depicted, however, in fig. 8.) On the outer surface of the maxilla there is a row of hairs, and also another row of flattened conical or triangular setæ, possibly stridulatory in function. Intermingled with these modified setæ there are some slightly plumose hairs. Distal edge of maxilla with two or three minute denticles or granules, and two or more are present on the tip of the maxillary lobe. Tibia and protarsus of leg high, and their ventral surface ends in a pair of spinules or teeth distally.

Palæocharinus sp. (Pl. XV. figs. *d, e, c.*)

Specimen no. 14 apparently has part of the upper surface of the carapace of the cephalothorax sectioned off and the left side is also slightly distorted, still the general shape of this part of the body is well shown. The usual anterior spinules are well developed. Laterally the cephalothorax seems to be furnished with slight rounded bosses or protuberances. Its posterior margin is somewhat concave, but this may be partly due to distortion. Parts of five of the large abdominal segments of the body are also present, the integument of these segments being ornamented with a fine scaly reticulation.

Measurements. Length of cephalothorax 1.15 mm; its width (at posterior margin) about 1 mm.

Text-fig. 11.



Palæocharinus sp. *a*, part of chelicera and palp; *b*, showing abdominal sternites and one leg.

Palæocharinus sp. (Text-fig. 11 *b.*)

Several of the anterior sternites of this species are present. They do not show any signs of subdivision into median and lateral portions. One of the legs is almost complete and is of the usual type.

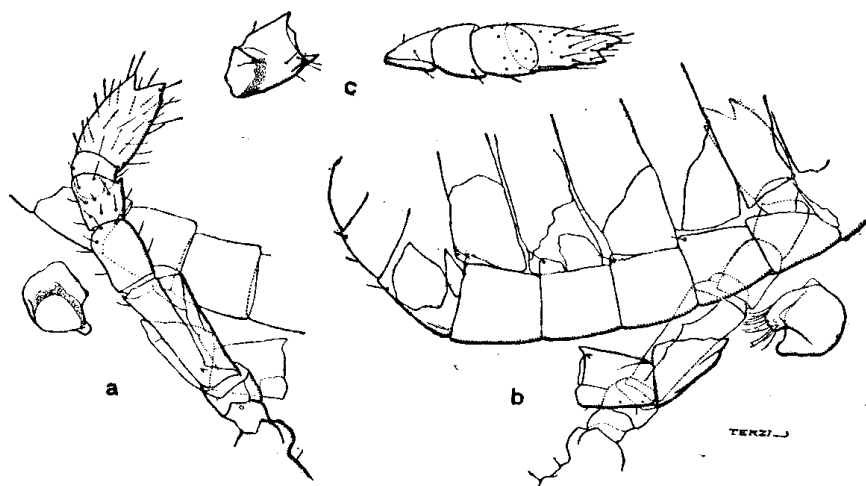
Palaeocharinus sp. (Text-fig. 11 a.)

Specimen no. 15 consists of a chelicera and a few fragments of the palp. There is one very large and stout proximal tooth and three smaller teeth, the more proximal one of the latter being very slender. It is possible that this chelicera belongs to *P. scourfieldi*.

Palaeocharinus sp. (Text-fig. 12.)

This specimen consists of part of the abdomen and also a complete leg, together with a few other fragments of limbs. Portions of six tergites are visible and also one or two ill-defined posterior ones; the lateral sclerites are narrow, and

Text-fig. 12.



Palaeocharinus sp. a and b, part of abdomen and also an entire leg; c, portions of another leg.

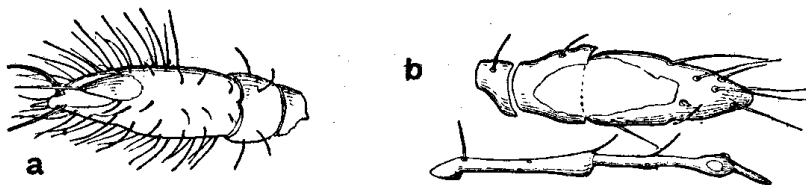
their inner posterior angle projects slightly. One of the maxillary lobes is present lying detached in the matrix; it is shaped as shown in figure 12 b, having a knob-like process, besides the main lobe, the latter being furnished with long hairs and little denticles. Trochanter of leg with a little knob-like protuberance fitting against the coxa (epimeron). Femur fairly long and with a ventral ridge furnished with denticles. Apical spinules of legs rather long. The protarsus short and its distal spinule minute, however.

Palaeocharinus sp. (Text-fig. 13 a.)

In one fragment of chert (Cran coll.), there is a beautifully preserved tarsus and protarsus of a leg of a *Palaeocharinus*. A dorsal cone bearing a single hair is present above the claw and there is the usual hollow below it. Paired claws

well developed, and there is a short straight ventral seta possibly representing the unpaired claw. It will be seen that this leg is of a type met with in recent scorpions and in the Amblypygi.

Text-fig. 13.



a, tarsus of leg of *Palaeocharinus*; *b*, distal segments of appendages of Arachnid.

Order?

In a mounted section of Rhynie Chert prepared by Hemingway, there are the distal ends of two appendages lying side by side. One is obviously the end of a normal leg of an Arachnid, but the other is curiously modified, the segments (metatarsus and tarsus?) being very slender (text-fig. 13 *b*). Some of the Pedipalpi have the end of the first leg narrowed, but in that order the tarsus is subdivided into from eight to very numerous false joints; whereas in this fossil form, although very slender, the tarsus does not appear to be subdivided.

EXPLANATION OF THE PLATES.

PLATE XI.

Figs. a & b. Protacarus crani, gen. et sp. n.
Fig. c. Palaeoecteniza crassipes, gen. et sp. n.

PLATE XII.

Palaeocharinoides hornei, gen. et sp. n. *a*, lateral view of cephalothorax; *b*, dorsal view of cephalothorax; *c*, ventral view of entire specimen.

PLATE XIII.

Palaeocharinus scourfieldi, sp. n. *a*, ventral aspect; *b*, remains of another example in the same matrix; *c*, mandible of the same enlarged; *d*, dorsal aspect.

PLATE XIV.

Palaeocharinus rhyniensis, sp. n. *a & b*, lateral views; *a'*, anterior extremity from above; *c*, ventral view of coxæ, sternal plate and anterior sternites of abdomen; *d*, lateral view of anterior end of abdomen, S i, S ii, S iii, sternites.

PLATE XV.

a & b, lateral views of *Palaeocharinus calmani*, sp. n.; *c*, chelicera of same, greatly enlarged; *d*, *Palaeocharinus* sp., from above; *e*, another fragment of same from below; *f*, *Palaeocharinus* sp., lateral view; *g*, a leg and coxæ of same; *h*, chelicera of same specimen greatly enlarged, showing stridulatory apparatus.