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GEOLOGIA

First Palaeozoic arachnid from Iberia: Aphantomartus areolatus Pocock (basal Stephanian; prov. León, N.W. Spain), with remarks on aphantomartid taxonomy(*)

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ABSTRACT

A specimen of *Aphantomartus areolatus* Pocock is described from middle-upper Cantabrian (lower Stephanian) silty mudstone of the Prado Formation, recovered from the borehole Prado 1 drilled in the IGME project: «Investigación en el área carbonífera de León-Palencia» north of Cerezal in the western part of the Guardo Coalfield, province of León, Cantabrian Mountains, N.W. Spain. A literature survey revealed that errors in interpretation had resulted in the separation of two genera, *Trigonomartus* and *Aphantomartus*, which are synonymous. The latter name takes precedence, as does Aphantomartidae over Trigonomartidae.

RESUMEN

Se describe el primer ejemplar de una araña fósil del Paleozoico español encontrado en una lutita limolítica de la Formación Prado (Cantabriense medio a superior), en el sondeo denominado Prado 1 efectuado en el proyecto del IGME «Investigación en el área carbonífera de León-Palencia» al norte de Cerezal, en la parte occidental de la cuenca minera de Guardo (León). Se trata de *Aphantomartus areolatus* Pocock. Las referencias anteriores indican que el género *Trigonomartus* es sinónimo de *Aphantomartus*, al igual que ocurre con la familia Aphantomartidae, que tiene prioridad sobre Trigonomartidae.

1. INTRODUCTION

Discovery of an extinct arachnid is always noteworthy, owing to their relative scarcity as fossils. The specimen described herein, whilst belonging to a known species, is particularly important in being the first described pre-Tertiary arachnid from Iberia, as far as the authors are aware. It is a trigonotarbid, an order which ranges from Lower Emsian (STORMER, 1970) to middle Stephanian (PETRUNKEVITCH 1955b).

The specimen was obtained from borehole CZ2 (Prado 1), 1 km north of the village of Cerezal in the western part of the Guardo Coalfield in northeastern León Province, Cantabrian Mountains, N.W. Spain. This borehole was sunk in strata of the Prado Formation in the southern flank of the Taranilla Syncline (WAGNER and FERNÁNDEZ-GARCÍA in press). The Prado Formation is of mid to late Cantabrian (early Stephanian) age, and is an almost exclusively terrestrial interval between two substantial marine formations. The early Stephanian age of the specimen is the youngest record for the family Aphantomartidae.

The Guardo Coalfield constitutes the western part of the post-Leonian sedimentary basin which entends from north-eastern León into northern Palencia (WAGNER *et al.* 1977).

2. SYSTEMATIC DESCRIPTION

Phylum CHELICERATA HEYMONS, 1901
Class ARACHNIDEA LAMARCK, 1801 *(nom. transl.* VAN DER HAMMEN 1977)
Order TRIGONOTARBIDA PETRUNKEVITCH, 1949
Family APHANTOMARTIDAE PETRUNKEVITCH, 1945
(=TRIGONOMARTIDAE PETRUNKEVITCH, 1949)

Remarks

PETRUNKEVITCH (1945) created Aphantomartidae for *Aphantomartus areolatus* POCOCK, which PE-

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TRUNKEVITCH believed to possess 7 abdominal tergites; *Trigonomartus* was placed at that time in Eophrynidae on the basis of its possession of 8 abdominal tergites. In 1949, PETRUNKEVITCH created the new family Trigonomartidae; then recognising that *Aphantomartus* indeed had 8 abdominal tergites, he stated (p. 256). «This means that the Family Aphantomartidae becomes a synonym of Trigonomartidae, the number of abdominal segments having served as the only character of distinction.» As the two family names are synonyms, the older, Aphantomartidae, should be used.

On evidence presented herein (discussion below), the abdomen of *Aphantomartus* bears 8 dorsal plates, but these belong to 9 somites, and 2 more are probably present in the anal pygidium. The family diagnosis is therefore emended below. In view of the extensive revision required to PETRUNKEVITCH's taxonomy of Phalangiotarbida (KJELLESVIG-WAERING 1978, & in press), Trigonotarbida are also in need of review, which may result in the reappraisal of genera referred to Trigonomartidae by PETRUNKEVITCH (1949).

Emended diagnosis: Carapace subtriangular; opisthosoma of ?11 segments (8 tergites, the 2nd a macrotergite representing opisthosomal segments 2+3, ?9 sternites and ?2 segments in anal pygidium) and broadly joined to prosoma. Posterior opisthosomatic tergite with marginal plates and limited to dorsal surface.

Genus *APHANTOMARTUS* POCOCK, 1911
(=*TRIGONOMARTUS* PETRUNKEVITCH, 1913)
Type species *Aphantomartus areolatus*
POCOCK, 1911

Remarks.

Trigonomartus was erected by PETRUNKEVITCH (1913) for *Anthracomartus pustulatus* SCUDDER (1884). Three specimens of this species (including the holotype), excellently preserved in ironstone nodules of Pennsylvanian age from Illinois, U.S.A., were described and figured by PETRUNKEVITCH (1913). Like many Carboniferous arachnids, and Recent Ricinuleida, on death the dorsal surface of the abdomen becomes concave and the subsequent external mould may give the misleading impression of being a cast or internal mould. PETRUNKEVITCH (1913, p. 104) was aware of this, and also noted that «The cephalothorax being much harder, kept more or less its shape, and what appears on it as the median crest was in reality a deep groove. The irregular, polygonal depressions appearing as such both on the abdomen and cephalothorax were evidently thickened areas of the chitin and formed in life low elevations.» However, his generic definition (PETRUNKEVITCH, 1913, p. 102) stated erroneously «Carapace triangular with a median crest in the posterior half, covered with irregular polygonal depressions.» This error was perpetuated (PETRUNKEVITCH 1949, 1953) until the 'Treatise' (PETRUNKEVITCH 1955a) which stated «Carapace triangular, high, with median crest and a pustulose surface, without eyes. Abdomen with pustulose surface.» Thus pustules were then recognised, but the «median crest» remained. Eyes, or at least a pair of circular structures on a raised area termed the «ocular tubercle» by POCOCK (1911) in *Aphantomartus*, are present in *Trigonomartus pustulatus*, and easily seen in PETRUNKEVITCH's (1913) Pl. 9, figs. 49 & 51.

Apart from the poorly preserved parts of the *Trigonomartus pustulatus* specimens figured by PETRUNKEVITCH (1913) (e.g. the lateral parts of the carapace), the description of *Aphantomartus areolatus* by POCOCK (1911) could almost equally apply to *Trigonomartus*. They share the same overall shape of carapace and abdomen. The carapaces of both have a deep median groove which terminates anteriorly in an «ocular tubercle», and are sculptured with irregular tubercles. The abdominal tergites of both genera are sculptured with large, low polygonal tubercles, and particularly evident are large triangular tubercles at the lateral extremities of the median plate of most tergites. Thus the features which served to distinguish *Trigonomartus* and *Aphantomartus* in PETRUNKEVITCH's key (1953) (presence or absence of eyes, abdominal sculpture of flattened tubercles or polygonal depressions, median crest on carapace of *Trigonomartus)* are not, and have never been, valid. Evidently, *Aphantomartus* and *Trigonomartus* are syonyms, and *Aphantomartus* POCOCK 1911 has priority.

Illustrations purporting to distinguish the two genera in the 'Treatise' (PETRUNKEVITCH 1955a, fig. 80, 1 & 3) are unrepresentative, and differ only in that they emphasise different characters of the same genus; the finer sculpturing in *Trigonomartus* and the arrangement of larger tubercles in *Aphantomartus*. Figure 80, 3 is neither *Aphanto-*

martus areolatus nor one of PETRUNKEVITCH's own figures, as stated, but a copy of PRUVOST's (1919) figure 42 of *A. pococki* with ?eyes drawn on incorrectly.

The following species are referred provisionally to *Aphantomartus: areolatus* POCOCK, *dorlodoti* (PRUVOST), *pococki* PRUVOST, *pruvosti* (VAN DER HEIDE), *pustulatus* (SCUDDER), *villeti* (PRUVOST) and *woodruffi* (SCUDDER). It would be unwise to suggest synonymies of the constituent species without an examination of the type specimens. However, on the basis of published photographs, *Trigonomartus* (?) *dorlodoti* PRUVOST (1930) (VAN DER HEIDE 1951) and *Aphantomartus pococki* PRUVOST (1912, 1919) appear to be conspecific with *A. areolatus* (PETRUNKEVITCH 1953, p. 92 also suggested the latter synonymy). *Trigonomartus woodruffi* (SCUDDER) (1893) (PETRUNKEVITCH 1913) and *T. (?) villeti* (PRUVOST) (1912, 1930) are poorly preserved and their identification may be uncertain. *Trigonomartus* (?) *pruvosti* VAN DER HEIDE (1951) is probably not an *Aphantomartus* but an eophrynid. *Aphantomartus areolatus* and *Trigonomartus pustulatus* would appear to be distinct on the basis of the more prominent tuberosity and indistinct median transverse groove on the carapace of the latter, but both of these features may be preservational artefacts. It is important to realise that some specimens are preserved three-dimensionally in ironstone nodules whilst others are flattened in siltstones; there factors can enhance or diminish the tuberosity.

Diagnosis: as in POCOCK, 1911, p. 79) but emended and augmented as follows: opisthosoma with 8 tergites, 1st differs from the rest but commonly concealed beneath the carapace. Lateral parts of median plate of 3rd to 7th tergites ornamented with large subtriangular tubercle which may be divided. A similar tubercle on posterior part of 2nd (macro-) tergite, the anterior part of which bears a row of large tubercles which diminish in size adaxially.

Aphantomartus areolatus POCOCK, 1911.
(Plate 1, figs. 1-4; Text-fig. 1).

1911 POCOCK: 81, text-fig. 41, pl. III, fig. 6. 1912 PRUVOST: 94, text-fig. 2, pl. IV, figs. 3 & 4. 1913 PETRUNKEVITCH: 99. 1913 PRUVOST: 928. 1919 PRUVOST: 352. 1949 PETRUNKEVITCH: 257. 1953 PETRUNKEVITCH: 91, pl. 48, figs. 167-170. *Not* 1955a PETRUNKEVITCH: fig. 80, 3.

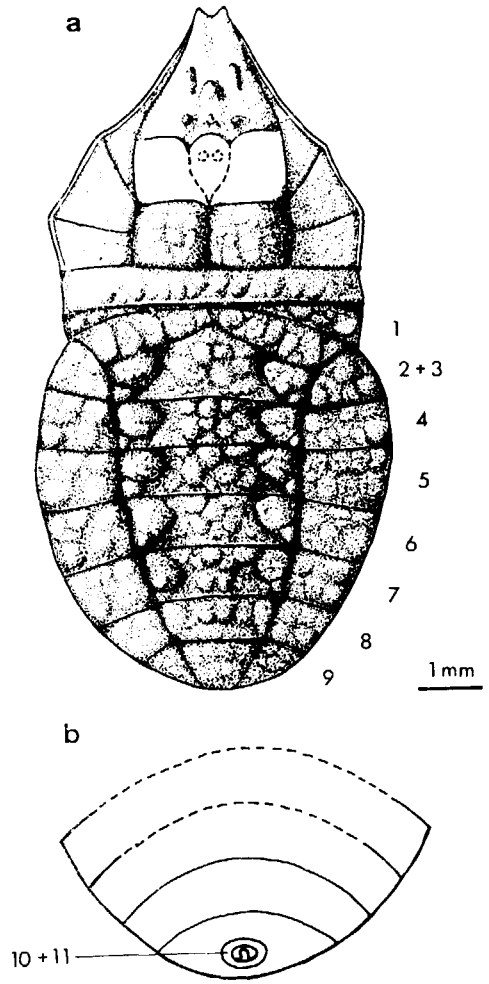

Figura 1.—*Aphantomartus areolatus* POCOCK, reconstruction based on specimen described herein. a, dorsal surface of prosoma and opisthosoma, ocular tubercle inferred. b, ventral surface of posterior opisthosoma. Numbers refer to presumed opisthosomal somites.

Material.

Internal and external moulds of dorsal surface of prosoma and opisthosoma, and superimposed anal region of ventral surface. Appendages not preserved. Preserved in dark grey siltstone with carbonised plant debris. Specimen (part and counterpart) in Museo del Instituto Geológico y Minero de España, Madrid. (Catalogue No. 10.001).

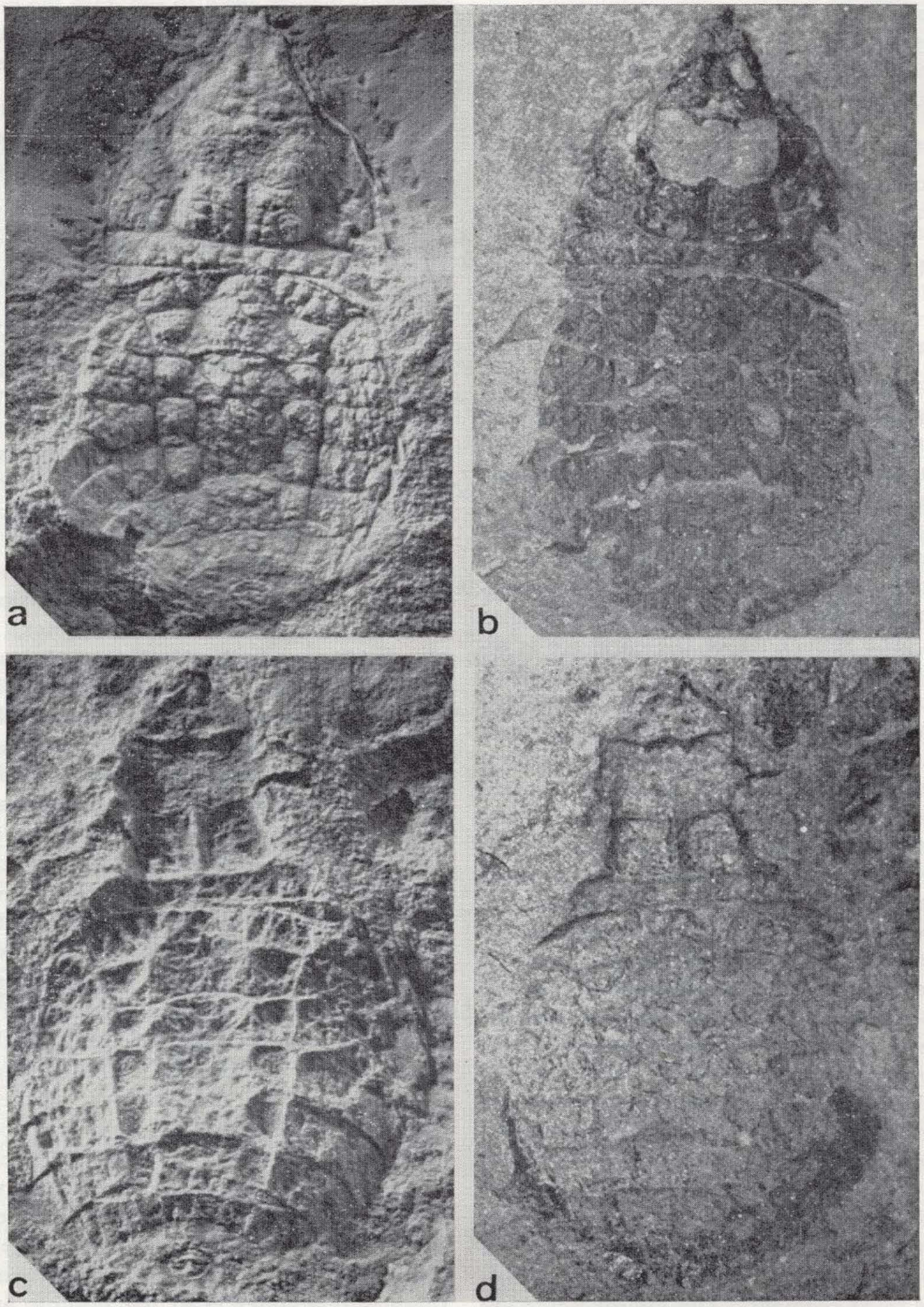

Figura 2.—*Aphantomartus areolatus* Pocock (×8), lit from NW. a, b, internal mould. c, d, external mould. a, c, whitened with ammonium chloride sublimate. b, d, under paraffin.

Horizon and locality.

Middle to upper Cantabrian (basal Stephanian), Carboniferous. Borehole in the Prado Formation (WAGNER and FERNÁNDEZ-GARCÍA in press), near Cerezal (León Province), Cantabrian Motuntains, N.W. Spain.

Measurements. Dimensions in mm.

Length of carapace	4.75
Width of carapace across posterior margin.	5.5
Length of abdomen	6.5
Width of abdomen at midlength	6.5

Description.

The carapace is slightly wider than long and subtriangular in outline. The lateral borders are scalloped into three wide embayments, and the anterior apex of the carapace terminates in two acute cusps. The carapace is divided into 4 regions. Posteriorly, a transverse rib, about 10 times as wide as long, occupies the full with of the carapace. This rib is ornamented with 6 posteriorly - directed tubercles with minor tubercles inbetween. The remainder of the carapace is divided longitudinally into 3 parts with the median part forming a raised ridge running down the length of the carapace. The ridge is gently convex dorsally with steeply sloping sides and is divided into three segments of unequal length by 2 transverse furrows. The anterior segment is subtriangular in outline and carries 4 prominent tubercles forming the corners of a square. The anterior tubercles are the larger, are forwardly-directed, and between them a lower, forwardly-directed, bercle is present, The surface of this area is otherwise quite smooth. The second segment is slightly shorter than the anterior one and although the surface is not preserved, two notches on the anterior margin possibly represent the anterior end of the longitudinally elliptical ocular tubercle. The third segment is divided by a median furrow which is deep and angular; the segment bears an ornament of low, irregularly-shaped tubercles. The lateral fields of the carapace are flatter, though with steeply sloping sides, and bear a similar but more subdued ornament as the median part of the third segment. The lateral fields are divided by furrows which run forwards and outwards from the median ridge to the scalloped lateral margins. The most posterior of these furrows starts just anterior to the midlength of the third median segment; the second furrow starts at the junction between the second and third median segments. Furrows also separate the lateral fields from the median part of the carapace, and the posterior rib from the remainder of the carapace.

The abdomen is elliptical in outline with a nearly straight anterior margin. The dorsal surface bears tergites which consist of a median plate with a lateral plate on each side. The plates are separated by furrows which extend from the antero-lateral borders of the abdomen to the posterior border. At the midlength of the abdomen the median plate is just under half the abdominal width. The longitudinal furrows converge backwards in a gentle sinuous curve and at about their midlength turn adaxially. The anterior tergite (see discussion) is only visible at the outer margins of the abdomen as wedge-shaped plates which appear to thin towards, and die out before reaching, the midline. The second tergite is considerably longer than the other tergites and probably represents two fused tergites. The position of the large tubercles (see below) indicates that fusion has probably occurred. The next 4 tergites (i.e. of segments 4-7) are similar in shape and ornament and are about 8 times as wide as long. The seventh tergite (of segment 8) is narrower and the ornament more subdued. The number of tergites posterior to this is not certain, but is probably only one (the presence of a faint furrow near the anus and curving strongly backwards is the junction of ventral sternites impressed onto the dorsal surface). The most prominent ornament on the abdomen consists of two rows of large, flat, subtriangular tubercles running down the adaxial side of the longitudinal furrows. These tubercles carry a finer ornament of smaller, rounded tubercles, and the posterior angle of the triangle is separated by a small furrow from the main part of the tubercle. The anterior part of the macrotergite, which corresponds to segment 2, bears a row of 4 tubercles which decrease in size adaxially. The rest of the abdomen is covered with small tubercles which, in turn, are ornamented with finer tuberculation. Between the large triangular tubercles on the median plate of each tergite there is one tubercle in the midline at the anterior margin, a pair of tubercles either side of the midline at the posterior margin and 1 or 2 further, smaller tubercles on either side of these at both margins. All these tubercles are posteriorly-direct-

ed, rather irregular and vary in prominence on each tergite, possibly due to preservation. The lateral plates of each tergite bear 4 main tubercles with subsidiary tuberculation. The anterior three-fifths of the abdomen is gently convex dorsally, the rest is gently concave; this is almost certainly the result of preservation.

The sternites of posterior segments appear as impressions on both parts of the specimen and extend beyond the lateral edge of the dorsal surface. This is presumably because in life the ventral surface of the abdomen was more convex than the dorsal (as in Recent Ricinuleida) and hence when flattened after death the sternites cover a wider area. Each of the more anterior of the preserved sternites consists of a single, curved plate, with parallel anterior and posterior borders. Sternite 9 is oval (long axis transverse) and bears the anal pygidium slightly posterior of the middle. The anal pygidium appears oval in otline (long axis transverse), and segmented.

3. DISCUSSION

In comparison with known species now referred to *Aphantomartus*, the present specimen corresponds most closely to *A. areolatus*. Comparison with *A. (Trigonomartus) dorlodoti* (PRUVOST) (1930) (VAN DER HEIDE 1951) may also be made, but as suggested above, this species may prove to be synonymous with the type. The main difference between the present specimen and *A. areolatus* is the less prominent tuberculation on the tergites. This can be explained by differences in preservation. However, in the holotype of *A. areolatus* (PETRUNKEVITCH 1953, pl. 48, fig. 167) and POCOCK's drawing of it (1911, fig. 41) a rosette of tubercles on the second tergite is emphasised. Interestingly, PRUVOST (1930, 208) also mentions «une rosace» of tubercles in his description of *dorlodoti*. Neither the present specimen nor other specimens referred to *areolatus* (e.g. PETRUNKEVITCH 1953, pl. 48, figs. 168-170) show this rosette of tubercles quite so well, and so preservational differences are suspected.

The segmentation of the opisthosoma, upon which much of PETRUNKEVITCH's familial taxonomy is based, is very difficult to discern from dorsal tergites, particularly if the anterior sternites are not preserved. However, study of the extremely well preserved Devonian Palaeocharinidae, and of HIRST's (1923) excellent figures of them, has greatly aided interpretation of the abdominal anatomy in Aphantomartidae. In the Rhynie palaeocharinids, the tergite belonging to the first abdominal segment is commonly partly concealed beneath the posterior edge of the caparace, and may form part of a locking device between prosoma and opisthosoma (cf. Ricinuleida). This is revealed particularly well in sagittal sections, but can also be seen in HIRST's (1923) Text-fig. 4. A similar arrangement in Aphantomartidae would explain the first abdominal tergite appearing only as wedge-shaped pieces emerging from beneath the carapace, and also the contracted («locked») positions of prosoma and opisthosoma in *Aphantomartus pustulatus* seen in PETRUNKEVITCH (1913) figs. 47-50.

Nine sternites are present in Palaeocharinidae, but according to HIRST (1923) and STORMER (1970) only 8 tergites. It is possible that the second tergite is fused 2+3 as supposed herein in Aphantomartidae, although the anterior (segment 2) part of this macrotergite is quite narrow in both *Alkenia* (STORMER 1970, Text-fig. 7) and the Rhynie species (HIRST 1923, Text-fig. 4). This would explain the supernumerary sternites. Note that the fusion of tergites does not imply the fusion of segments, and that this is much more advanced for example in Phalangiotarbida (KJELLESVIG-WAERING in press) and Ricinuleida.

Two segments are present in the anal pygidium of *Palaeocharinus*, and these are clearly seen in HIRST (1923, Text-figs. 9 & 10, pl. 12, fig. c) where this organ is everted. It would not be unreasonable to suppose that where the anus appears in *Aphantomartus* (and other trigonotarbids) as 2 concentric circles that 2 segments are also present. This brings the number of opisthosomal somites to 11 in both Palaeocharinidae and Aphantomartidae. In which case, perhaps the latter family is directly descended from the former, and the two could be united. It may eventually be found that the segmentation described above is chacarteristic of the whole order Trigonotarbida, with familial differences reliant on dorsal abdominal sclerotization and other characters. Of related interest, the subtriangular carapace with scalloped edges, raised median area and furrowed flanks is found in a number of genera scattered throughout the Trigonotarbida, in for example, *Aphantomartus, Alkenia, Phrynomartus, Eophrynus, Kreischeria* and other Eophrynidae.

4. CONCLUSIONS

The first recorded Palaeozoic arachnid from the Iberian region is of note. The taxonomy of *Aphantomartus*, to which the specimen belongs, is in some confusion which has been resolved in part herein. It is obvious however, in the light of previous interpretative errors and the recent, major, taxonomic revision necessary to another fossil arachnid group, Phalangiotarbida (KJELLESVIG-WAERING in press), that a full revision of the Trigonotarbida, perhaps in conjunction with Anthracomartida, is needed.

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