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A new fossil record of a tanaidacean (Crustacea, Peracarida), from the Eocene Barton Clay Formation of the Hampshire Basin

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Abstract

A new fossil of a tanaid from the Eocene Barton Clay Formation of the Hampshire Basin is described. At the present time fossil tanaids are known from the Carboniferous up to, and including the Cretaceous. The new species, *Barapseudia prima* gen. et sp. nov., from the Eocene will fill a hiatus from the Eocene, extending to the Recent, in our knowledge of the Tanaidae. Burrows which could be associated with tanaids were found in the same deposit.

Key words: Peracarida, tanaidaceans, burrows, Eocene, Barton Clays, England.

Introduction

The Barton Beds of Christchurch Bay, Hampshire, have long been known for their rich fossil fauna, though very few crustaceans are known. Woodward (1867) described a crab, *Goniocypoda edwardsi*, from the Lower Eocene of Christchurch Bay; Burton (1933, p. 162) drew attention to the presence of chelae of *Calappa* sp.= (*Calappilia*) and of a xanthoid crab not commonly found at Horizon A3 (Burton, 1929). Crane (1981) described a new species, *Goniocypoda quaylei*. Since then sixteen Eocene species of crabs and a lobster have been described, from the Eocene of the Hampshire Basin, Barton Clay Formation (Quayle and Collins, 1981; Quayle, 1987). First mention of an isopod (*Palaega collinsi*) was made by Quayle (1981). The new species represents the first known occurrence of a member of the Tanaidacea, it occurs rarely in A3 as opposed to the previous species which is known from A2, A3 and F. This new species from the Eocene, Barton Beds, will help to fill the hiatus in the fossil record between the Cretaceous to Recent tanaids. Fourteen specimens varying in size between 5.5 mm to 11.0 mm length were found in Horizon A3, Barton Clay Formation, Christchurch Bay, Hampshire, which consists of grey tenacious clay with sands.

With the collection of new material and the re-examination of the old, all known fossil tanaidaceans were examined by Schram, Sieg, and Malzahn (1986), which resulted in a complete taxonomic revision being given. The age of these range from the Carboniferous to the Cretaceous and are as follows; *Anthracocaris scotica* (Peach, 1882, and *Eucryptocaris asherorum* Schram, 1989 pro *Cryptocaris hootchi* Schram, 1986) from the Carboniferous: both of these species had some alterations to the reconstruction of the figures. *Ophtalmapseudes rhenanus* (Malzahn, 1957), from the Permian, was reassigned to the suborder Anthracocaridomorpha Sieg, 1980; *Opthalmapseudes* sp. (Vegh and Bachmayer, 1965) from the Triassic, was described as a non descript chela. The holotype of *Palaeotanais quenstedti* (Rieff, 1936), could not be found and until new material can be obtained, interpretation is from the literature. *Ophthalmapseudes friedericianus* Malzahn, 1965 and *O. acutirostris* Sachariewa-Kowatschewa and Bachmayer, 1965 from the Jurassic had a new superfamily Jurapseudoidea, and a new genus *Jurapseudes*. The holotype of *O. giganteus* Malzahn, 1979 from the Cretaceous was placed in this superfamily with a new genus and species, *Carlclausus emersoni*. The remaining specimens of *O. giganteus* were placed in a new genus *Cretitanais*. In the Lower Jurassic 'Insect Marls,' *Opsipedon gracillis* Heer, 1865, was redescribed by Etter (2004), who pointed out that this was Middle Jurassic age not Lower Jurassic.

Polz (2005) described the new genus and species, ?*Niveotanais brunnensis*, from the Jurassic, Upper Kimmeridgean Brunn Plattenkalk of south Germany. In 2007, we have the first recorded tanaids preserved in amber, Vonk and Schram (2007) described three new species from the Lower Cretaceous, Àlava Amber, Northern Spain: *Alavatanais carabe*, *Proleptochelia tenuissima* and *P. euskadiensis*. Schram (2013), included a list of 'The Taxonomy of Fossil Tanaidaceans', this showed all fourteen known fossil species which included *Ophthalmapseudes* sp., *P. tenuissima* and *P. euskadiensis*. Sanchez-Garcia, Penalver and Garcia, 2014, made an emended diagnosis for the genera's *Alavatanais* Vonk and Schram, 2007, and *Proleptochelia* Vonk and Schram, 2007.

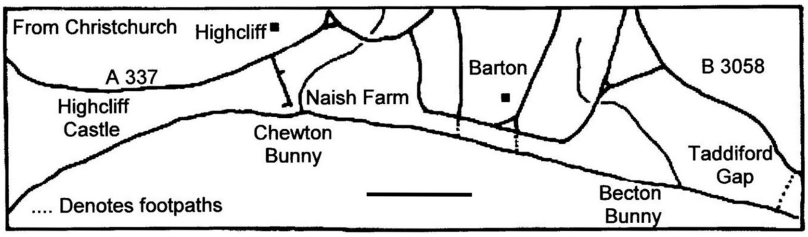


Fig. 1. Map of Barton-on-Sea, Dorset and Hampshire. Scale bar 1 km, approximately.

P. euskadien was considered a junior synonym of *A. carabe*; *Proleptochelia* together with its type, was left without familial placement within Paratanoidea. They also described three new species, *Alavatanais margulisae*, *Eurotanais terminator* and *Electrotanais monolithus* from the Early Cretaceous resin producing forests in North Iberia, bringing the known fossil species to fourteen. Jones, Feldman and Garassino (2014) described three new isopod species and a new occurrence of *Niveotanais brunnensis* Polz, 2007 from the Jurassic Plattenkalk Beds of Monte Fallano, Italy.

In contrast, Recent tanaids are usually small, varying in size from 2.0 mm to 5.0 mm, but can reach a total length of 120 mm in the adult stage. They are mostly bottom dwellers, living in depths ranging from estuarine to abysmal (9,000 meters), in burrows, under stones, in coral, or they may glue sand and/or vegetation together to form an open ended tube.

Geological setting

The type locality for the Barton Beds, is in Christchurch Bay, Dorset and Hampshire, it extends from the west of Highcliff Castle (SZ 199928) to Taddiford Gap (SZ 261923), a distance of approximately (6.3 km). Barton-on-Sea, from whence the deposits derive their name, is situated about midway between these localities.

When mapping the relevant areas the Geological Survey (Reid, 1898) used the terms Barton Clay (Prestwich, 1847, pp. 334–335) and Barton Sands (Prestwich, 1857, p. 108) to define the Section. Burton (1929), however, divided the Barton Beds into fourteen lettered Horizons, largely on their fossil assemblages, but the divisions coincide with distinct lithological changes, such as sands and nodule bands. Hooker (1986, pp. 203–205) designated the Barton Clay Formation and erected as a new unit the Becton Sand Formation to replace the Barton Sands.

Murray and Wright (1974, pp. 50–51), considered the beds at Barton Cliff on the basis of foraminiferids. Beds B-E, were considered to have been formed underwater, 50-100m deep and beds A2 and F - lower H, no deeper than 50 m; these were cycles 3–5 (Hooker, 1986, p. 432). Lower and higher strata referred to an intertidal or estuarine environment. Murray and Wright (Ibid) conclusion was that the Barton Beds at their type locality, had a full marine cycle, consisting of continental deposits, through marsh, inshore and off shore shelf, then back to shallow water conditions, this was possibly repeated later in the sequence (Hooker, 1986, p. 432).

For the purpose of this work and to comply with earlier work carried out, Burton's stratigraphic Horizons have been adopted.

Material and methods

Crustacea from Horizon A3 are usually found with their shell surfaces preserved; to find these specimens, the blocks of clay are split along the bedding plane. The surfaces are then examined with the naked eye or hand lens. Usually the specimen comes out in part and counterpart, any cleaning is carried out with a fine needle. Ideally this consists of various sized hypodermic needles fitted to a small bore plastic tube and coupled to an aquarium air pump. At this Horizon tanaids have been found at more than one level, usually associated with fine fragments of vegetation and tanaid debris. Specimen (NHM IC1179 (1), pl. 1, fig. 3) was found in a woody pocket consisting of fragments of twigs and a coniferous leafy shoot (NHM IC1179 (2), pl. 2, fig. 9), which possibly indicates an inshore deposition. Directly under some of the specimens, were burrows, possibly made by the same animals. Four samples of burrows were taken, two of these are figured (NHM IC1190 (1), NHM IC1190 (3), pl. 2, figs. 4, 5). The average diameter of these burrows varies, averaging between 0.4 mm to 0.9 mm; when scaled with one of the smaller tanaids (NHM IC1187 (1), pl. 2, figs. 7, 8), they are comparatively favourable in size; on samples, NHM IC1190 (2) and NHM IC1190 (4) the surface is riddled with burrows of all sizes, plus a few small pieces possibly of vegetation. There is at the moment, only one case of a tanaid? being found in a burrow at this locality (NHM IC1178 (2) b, pl. 2, fig. 6).

Two methods of photography were used; a Richo GX 200 Digital Camera using a macro setting and a Veho. Discovery VMS-001 x 200.

All specimens prefixed NHMIC have been deposited in the Department of Earth Sciences, The Natural History Museum, London (NHM).

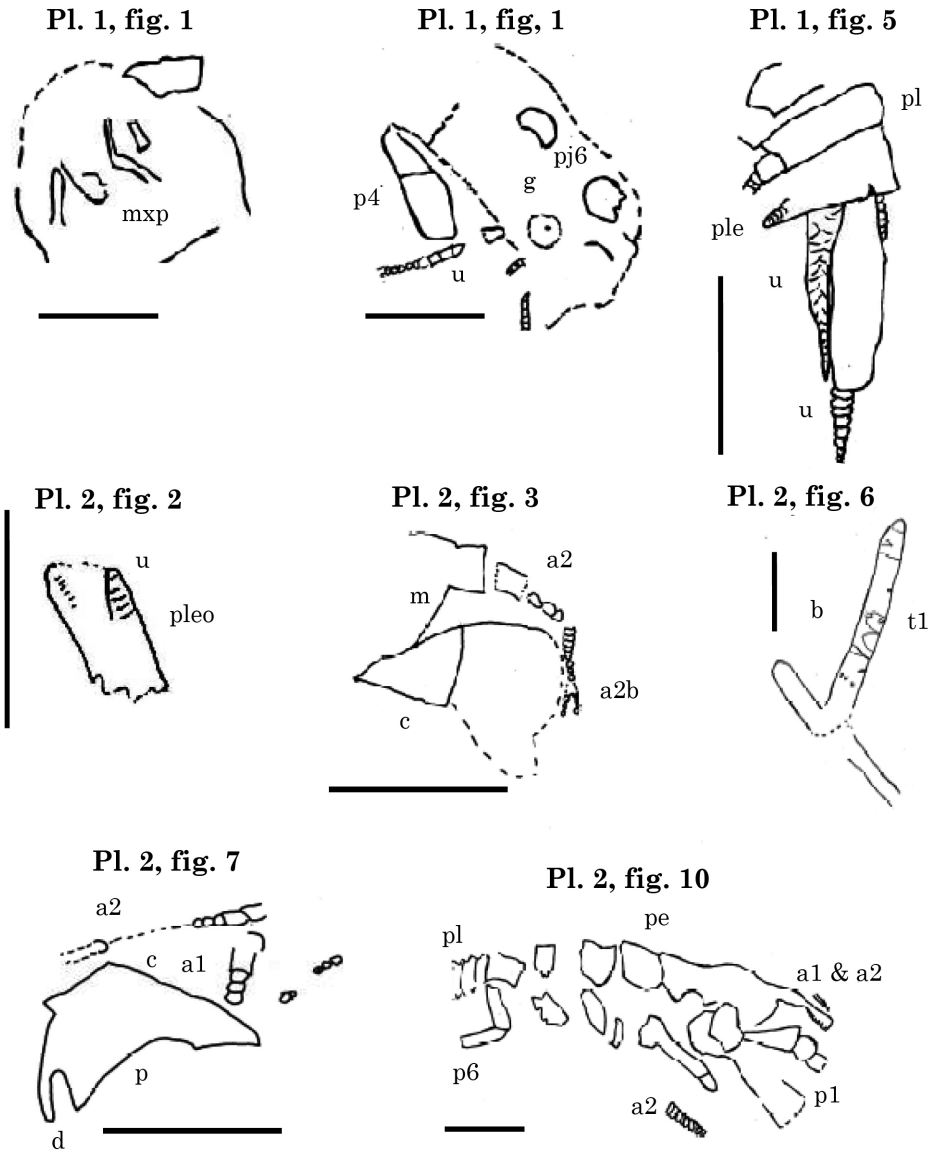


Fig. 2. Key to position and Identification of important areas on Plates 1 and 2. Scale bars equal 1.0 mm, approximately. a1, antennule; a2, antenna; a2b, antenna branch; b, burrow; c, carpus; mxp, maxilliped; m, merus; p, pereiopod; p1, 1st pereiopod; p4, 4th pereiopod; pj6, 6th pereiopod joint; pe, perieomeres; pl, pleomeres; ple, pleopods; pr, propodus; u, uropod.

Systematic palaeontology

Order Tanaidacea Hansen, 1895
Suborder Apseudomorpha Sieg, 1980
Superfamily Apseudidae Leach, 1814
Family Apseudidae Leach, 1814

Genus *Barapseudia* gen. nov.

Type species: *Barapseudia prima* sp. nov, by monotypy.

Diagnosis: Body length of specimen NHM IC1186 (pl. 1, fig. 2.), approximately 6.5 mm, with rostrum 8 mm, flattened dorsoventrally; cephalothorax very slightly longer than wide or equal; rostrum one third the length of cephalothorax; large, rounded vaulted (branchial) areas over two thirds of carapace width; orbits pointed at external angles; six free periomeres, five free pleomeres, pleotelson rectangular, width one third the length.

Derivation of name: *Barapseudia*: Bar a contraction of Barton-on-Sea, Hampshire with *apseudia* being of the family.

Barapseudia prima sp. nov.

(Pl. 1, figs. 1–6, p1. 2, figs. 1–3, 7, 8, 10)

Diagnosis: As for genus.

Material: The material collected by the author, consists of thirteen specimens on slabs of clay, with no counterpart and a further two with counterparts. They have all been deposited in the Department of Earth Sciences, London.

Type designation: Holotype, NHM IC1188 (pl. 1, figs. 4–6); Paratypes, NHM IC1186 (pl. 1, fig. 2), NHM IC1184 (pl. 1, fig. 1), NHM IC1179 (2) (pl. 1, fig. 3), NHM IC1187 (pl. 2, figs. 7, 8), NHM IC1183 (pl. 2, figs. 1–3), NHM IC1189 (pl. 2, fig. 10) and NHM IC1180.

Further material: Burrows NHM IC1190 (1), (3), (pl. 2, figs. 4, 5) and NHM IC1190 (2), (4); burrow NHM IC1178b (2) (pl. 2, fig. 6), coniferous leafy shoot NHM IC1179 (2) (pl.2, fig. 9), NHM IC1181a, b, NHM IC1182 (1), (2) and NHM IC1185.

Derivation of name: prima: from the Latin - first, alluding to the first recorded Eocene tanaid from the Barton Beds, Hampshire.

Description: Antennules consist of a stout, long, basal article (NHM IC1186, pl. 1, fig. 2), extending beyond the rostral tip; pores indicating sites for bristle attachment run along the inner margin; the second article is one fifth the length of the first. Distal part of the antennules beaded, NHM IC1186 (pl. 2, fig. 7). An antenna, preserved on NHM IC1183 (1) (pl. 2, fig. 3), consists of four basal sections then three smaller sections (beads), followed by a branched beaded flagella, the base is hidden by the basis? of the first pereiopod which has a longitudinal row of setae. A stout, pointed rostrum, approximately one third cephalothorax in length (pl. 1, fig. 2), the eyes not preserved. The ratio of length to width of the cephalothorax is equal. Large, rounded, vaulted branchial areas are followed by a smaller rounded-oblong vaulted area which lays on the margin of the first and slightly overlaps the second free pereiomere; length of first free pereiomere is slightly less than that of the second; the third and fourth are slightly longer, the fifth and sixth pereiomeres are consecutively smaller. Measurements of the ventral surface on NHM IC1184 (pl. 1, fig. 1) are for the six pereiomeres: 0.7 mm, 0.85 mm, 0.9 mm, 0.9 mm, 0.85 mm and 0.8 mm. Where preserved some of the pereiomeres, are decorated with small, rounded, vaulted areas either side of the centre line and a fissure that expands to oblong vaulted margins. A single genital pore is preserved on the sixth pereiomere NHM IC1184 (pl. 1, fig. 1).

The first pereiopod has a long, broad basis; the chela NHM IC1187 (1) (pl. 2, figs. 7, 8) is also present on specimen NHM IC1183 (1) (pl. 2, fig. 3); basis similar length? to carpus; triangular merus; carpus, inner margin dentate, outer margin finely dentate. Propodus slightly longer than carpus, the outer margin to rear of dactylus-propodus articulation has a large forward pointing spine, followed by other smaller spines diminishing in size; cutting edge of fixed finger finely dentate, with a small depression, approximately one half the length from front. Dactylus slender, finely dentate with 2 or 3? larger blunt teeth. Little is known about the pereiopods since only fragments have been preserved. The sixth pereiopod is flattened, basis equal in length to ischium plus merus; fragments of pereiopod four and five have basis comparable to that of the sixth.

All of similar size and decoration, the pleon consists of five free pleomeres consisting of a rounded ridge, running around the circumference of the tergum which finishes on the pleuron process, and terminates in a point. The pleopods are multi-articulate and cone shaped. The pleotelson, 1.5 mm in length, see NHM IC1188 (pl. 1, fig. 5), is rectangular with a cone shaped appendage (uropod?) either side; the approximate width and length, equals one third, and three fourths the length of the telson. The posterior margin has two uropods (pl. 1, fig. 5), these are triangular, with the base half the width of the pleotelson and one third the total length; these would have formed a 'swallow tail.'

Comparison: Hitherto tanaids have been known fossil from the Carboniferous, Permian, Triassic, Jurassic, Cretaceous, thus the present recognition of tanaids from the Barton Beds of Christchurch Bay, provides an important link in their evolution to the abundance of Recent species. *Barapseudia prima* sp. nov., is the first tanaid to be recorded from the Eocene and closely resembles the Recent genus *Apseudes* Leach, 1814. *Barapseudia prima* differs from all other known forms principally by; the round branchial lobes occupying most of the carapace width, being four times the width of the urogastric region NHM IC1186 (pl. 1, fig. 2); in *J. friedericianus*, *J. acutirostris* and *C. emersoni*, the urogastric region takes up a third of cephalothorax width, whereas in *B. prima* it is only a fifth of the total width; none of the Cretaceous or Jurassic tanaids has decoration on the free periomeres similar to that of *B. prima*; it has an equal cephalothorax length width ratio, whereas in O. gracillis, *J. friedericianus* and *J. acutirostris* the length width ratio is greater. The basal joint of the antennules in *B. prima* is longer than any of the figured species of fossil tanaids and is similar to the Recent forms of *Apseudes* spp.

The other known fossil forms differ markedly from *B. prima*, *C. giganteus* lacks a rostrum and has a broad inflated carapace, a well tapered body from the carapace to the telson and cylindrical antennules. *Eucryptocaris asherorum* has a shorter basal joint to antennules, which are cylindrical, larger orbits, a smaller rostrum and branchial area, and a shorter pleotelson. *Ophtalmapseudes rhenanus* has a shorter basal joint to antennules, smaller branchial areas, a shorter pleotelson, also the ratio of cephalothorax length to width is greater. *Niveotanais brunnensis* has a smaller rostrum, the telson is semi-circular and shorter in length, outer and inner margins of claw smooth, the main marked areas on the surface of the cephalothorax differs considerably. In *A. carabe* and *A. margulisae* the cephalothorax is sub-triangular. The propodus and dactylus on *A. carabe* has a smooth outline, without spines and the first antennular article, twice as long as second. The second article of the antennules of *E. terminator*, is nearly

half the length of the first article, cephalothorax, oval in outline, is 1.6 longer than maximum width. *E. monolithus*, has a sub-square, nearly as long as wide cephalothorax. The new species, *Barapseudia prima* has, in possessing antennules with a long flattened basal article, a short second joint NHM IC 1186 (pl. 1, fig. 2), with pores on the inner edge, branched antennae with four? basal sections, large, rounded, vaulted branchial areas, occupying most of the carapace width and an equal cephalothorax length width ratio, *B. prima* has a greater similarity to members of the Apseudidae which suggests placement within that family (Fig. 3).

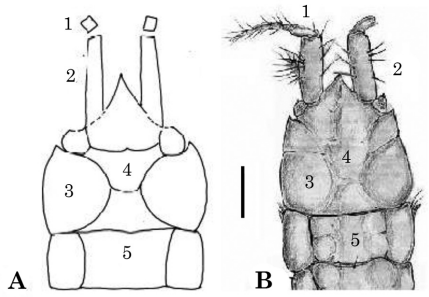


Fig. 3. Comparison of a fossil and Recent tanaid cephalothorax: A. *Barapseudia prima* gen. et sp. nov., from the Eocene Barton Clay Formation of the Hampshire Basin. B. *Apseudes quasimodo* Blazewicz-Paszkowycz and Bamber, 2012, from the Bass Strait, Victoria, Australia. Scale bar equals 1.0 mm. Key: 1. Second article of antennule, 2. First article of basal joint of antennule, 3. Branchial area, 4. Urogastric, 5. First free pereiomere.

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PLATE 1

Holotype and Paratypes of *Barapseudia prima* gen et sp. nov. from Horizon A3, Eocene Barton Clay Formation of the Hampshire Basin.

Fig. 1. NHM IC1184, Paratype, ventral surface – cephalothorax and pereiomeres.

Fig. 2. NHM IC1186, Paratype, basic joints of antennules and second joint on left side, cephalothorax, four free pereiomeres.

Fig. 3. NHM IC1179 (1), Cephalothorax and 1st free pereiomere.

Figs. 4–6. NHM IC1188, Holotype.

Fig. 4. Cephalothorax, first four free pereiomeres, last four free pleomeres and pleotelson.

Fig. 5. Three free pleomeres, pleopods, pleotelson and uropods.

Fig. 6. Cephalothorax and three free pereiomeres.

Scale bars equal 1.0 mm.

PLATE 2

Barapseudia prima gen et sp. nov. from Horizon A3, Eocene Barton Clay Formation of the Hampshire Basin.

Figs. 1–3. NHM IC1183 Paratype.

Fig. 1. NHM IC1183 (1).

Fig. 2. Part pleotelson with base of uropods.

Fig. 3. Part of propodus, carpus, merus, basis and antennae.

Figs. 4–5. NHM IC1190 (1), (3)

Fig. 4. Burrows associated with tanaids?

Fig. 5. Burrows associated with tanaids?

Fig 6. NHM IC1178 (2), burrow with tanaid?

Figs. 7–8. NHM IC1187 (1) Paratype.

Fig. 7. NHM IC1187 (1) Propodus, dactylus, carpus and merus with antennae.

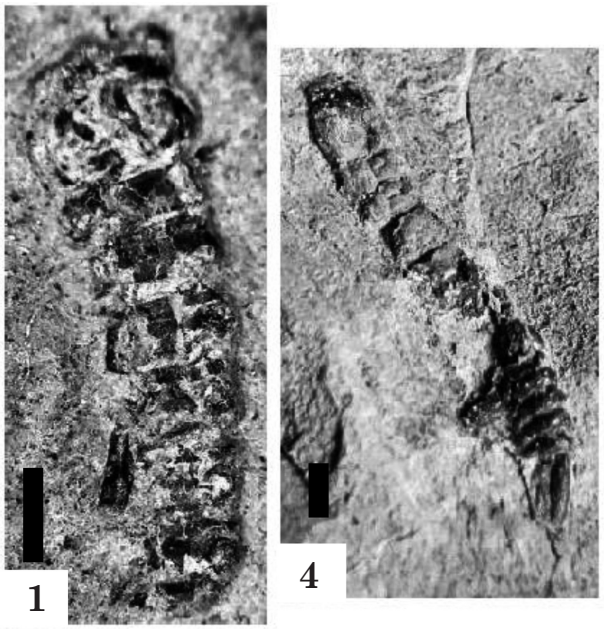
Fig. 8. NHM IC1187 (1).

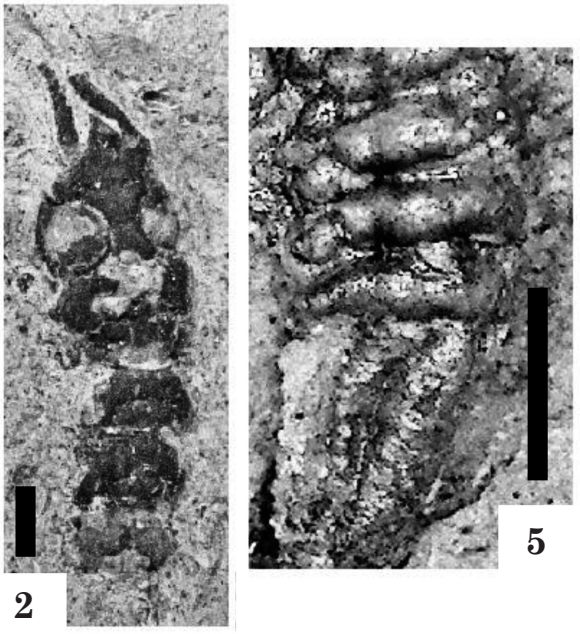
Fig. 9. NHM IC1179 (2), coniferous leafy shoot.

Fig. 10. 1189 Paratype, fragments of limbs.

Scale bars equal 1.0 mm.

PLATE 1





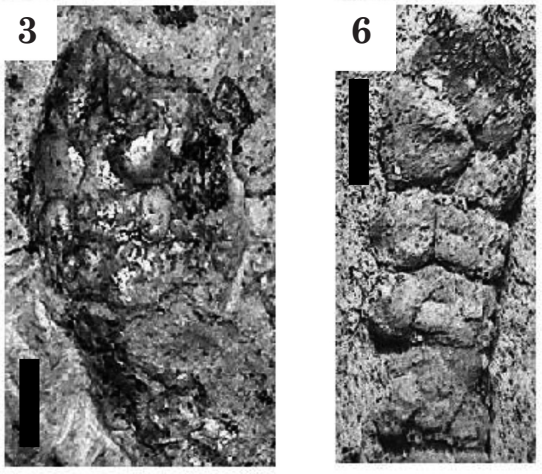


PLATE 2

