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REMIPEDIA, A NEW CLASS OF CRUSTACEA FROM A MARINE CAVE IN THE BAHAMAS

Jill Yager

ABSTRACT

Speleonectes lucayensis, new genus and species of cavernicolous crustacean from the Bahamas, is described. It possesses characteristics indicating that it represents a new class of Crustacea.

Four individuals of a new species of crustacean have been collected from Lucayan Cavern, an anchialine cave (Holthuis, 1973) on Grand Bahama Island, Bahamas. The cave system is approximately one kilometer from the North Atlantic Ocean and connects to the sea via passages which open into a tidal, salt-water creek. Three surface openings expose a fresh-water layer that has an average depth of 14 meters. A distinct halocline is maintained by density gradients. The sea-water temperature is seasonally variable from 23–25°C. Temperature of the fresh water remains constantly around 22°C. All specimens were collected in a zone of total darkness, in salt water, at a depth of 19 m. Scuba gear modified for cave diving was used to gain access to the environment. Other aquatic inhabitants of the cave system include several species of amphipods, *Stygiomysis* sp., an undetermined species of thermosbaenacean, and a blind cave fish (*Lucifuga spelaeotes*). In over three years of exploration of the cave system, *Speleonectes lucayensis*, new genus, new species, has been observed fewer than 12 times. This paper deals with the characteristics of this marine, troglobitic animal which does not fit into any presently defined class of Crustacea.

Remipedia, new class

Diagnosis.—Cephalic shield present. Cephalon bearing pair of preantennular frontal processes. First antenna biramous. Maxilla 1 and 2 and maxilliped well developed, prehensile. Maxilliped segment fused to cephalon. Natatory; trunk with numerous, similar segments, essentially all with homonomous, laterally directed, biramous swimming appendages.

Etymology.—From the Latin word *remipedes*, meaning oar-footed.

Speleonectidae, new family

With characters of the class.

Type-genus.—*Speleonectes*, new genus.

Etymology.—From the Greek words *spelaiion*, meaning cave, and *nectes*, meaning swimmer.

Speleonectes, new genus

With characters of the class.

Type-species (by monotypy).—*Speleonectes lucayensis*, new species.

Speleonectes lucayensis, new species

Type Material.—Holotype. Adult, 21.5 mm. USNM Cat. No. 184343 (Fig. 1) in salt water, Lucayan Cavern, Grand Bahama Island, Bahamas, 13 March 1980. Paratypes. Three adults, 22–24 mm, from

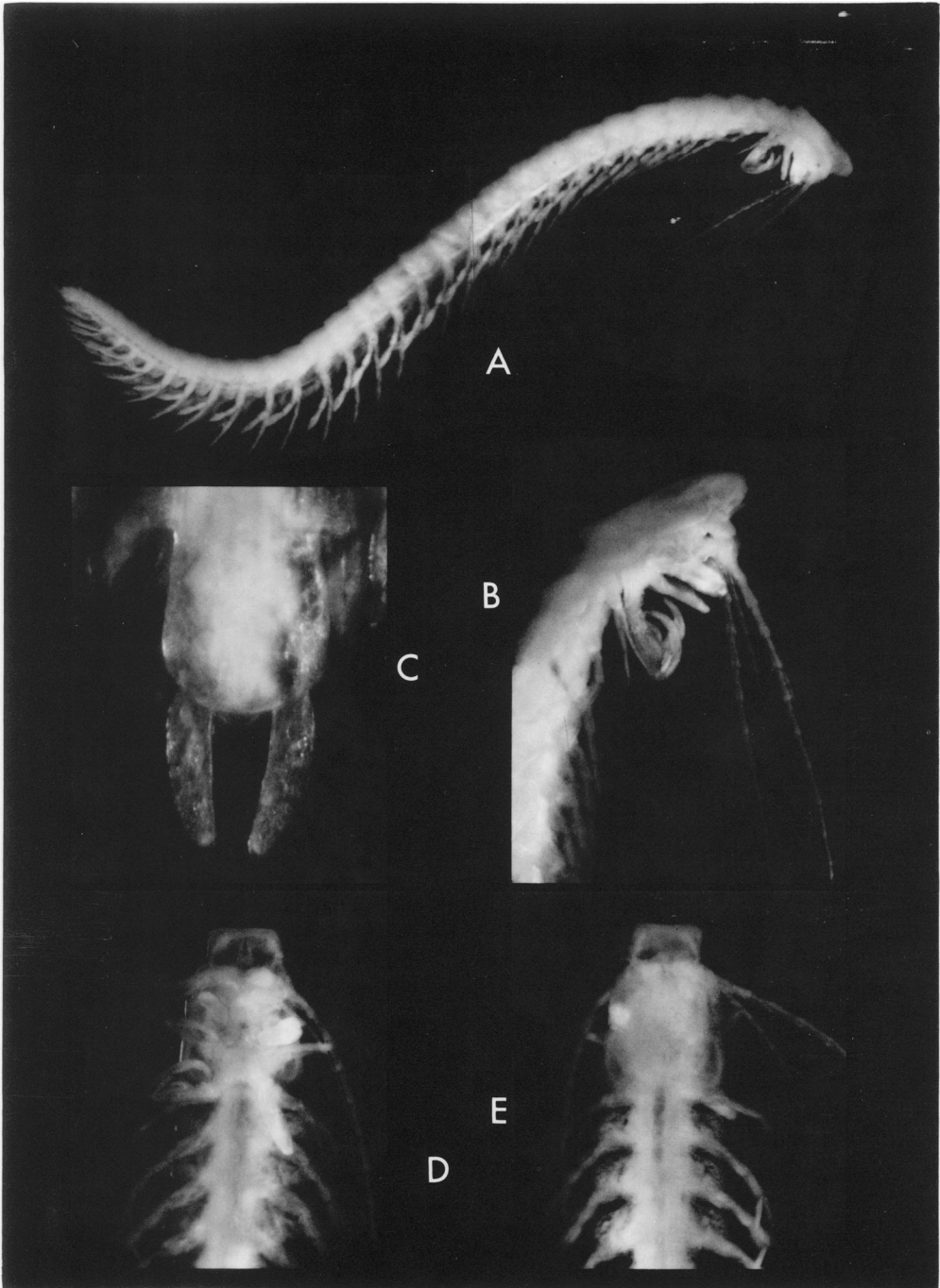


Fig. 1. *Speleonectes lucayensis*, new species. (A) Lateral view; (B) Cephalic shield and appendages (lateral view); (C) Telson and caudal rami (dorsal view); (D) Cephalic shield and appendages (ventral view); (E) Cephalic shield and appendages (dorsal view).

type locality; from continuous sampling between October 1979 and November 1980; in author's collection.

Description.—Body elongate, slender, subcylindrical (Fig. 2A); without pigment or eyes. Cephalon small, about $\frac{1}{12}$ total body length. Cephalic shield tapering anteriorly; faint medial transverse grooves present. 31–32 free, pretelsonic trunk segments with distinct platelike, rounded tergites produced laterally into short pleura; tergite of first segment reduced and partly covered by cephalic shield. Tergites 2–30 rounded anteriorly and concave posteriorly; last tergite reduced and partly fused with telson. Anterior sternites as transverse bars through segment 25, as triangular flaps in segments 26 to 29. Sternite of segment 14 with markedly concave posterior margin. Free trunk segments bearing laterally directed, homonomous, biramous, paddlelike swimming appendages; last pair reduced or absent. Telson a little longer than broad, with cylindrical caudal rami (Fig. 2K). Caudal ramus length equaling or slightly exceeding width of telson; 1 moderately long and 6–8 short terminal setae and 3 mediolateral setae.

Pair of small, rodlike frontal processes anterior to base of antenna 1, terminally tapered; single thick process on posterior surface (Fig. 2B).

Antenna 1 long, segments slender. Two-segmented peduncle; proximal segment enlarged with 3–4 rows of numerous, long, ribbonlike aesthetes. Dorsal ramus 12-segmented, about twice length of the cephalon; ventral ramus shorter, 8-segmented. Ramal segments slender, with setal tufts of distomedial margins. Distal-most segments with 2–4 terminal setae (Fig. 2C).

Antenna 2 of moderate size, biramous, with 2-segmented protopod bearing short plumose setae anteriorly. Endopod with 3 flattened segments curved laterally around exopod. Exopod a single large, oval segment. Both rami bearing long, plumose setae (Fig. 2D).

Labrum subtriangular, prominent, narrow anteriorly, broad and rounded posteriorly, with transverse suture. Posteromedial surface with short row of denticles or short setae. Labrum forming atrium oris, with mouth directed posteriorly.

Mandible with 3-cusped incisor process, 3-cusped lacinia-like process, and densely setose, truncate molar process (Fig. 2E).

Paragnath a round, platelike lobe with finely setose margin.

First maxilla 7-segmented, uniramous, robust, prehensile. Proximal segment with platelike endite, with long apical spines, some barbed. Segment 2 with broad, thick endite lobe inserting diagonally; numerous short stout spines and slender setae along margin. Segment 3 with medial lobe, bifurcate into conical projections having strong terminal spines and several setae subterminally. Segment 4 with single medial projection, terminal strong spines and many setae subterminally. Segment 5 with setae on medial margin; segment 6 with dorsal and medial setae. Articulation between segments 1 and 2 weak (Fig. 2F).

Second maxilla 7-segmented, long, uniramous, prehensile. Protopod bearing 4 acute, gnathobasic plates; indistinctly subdivided, with division running between 3rd and 4th endites. Each endite with marginal row of setae. Medial margin of segments 3–6 with setae; segments 5 and 6 with 1 or more dorsal setae. Maxillary gland exiting via papilla on posterolateral margin of first segment. Segment 7 with at least 2 terminal, stout, curved spines. Subterminal thumblike pad having many long setae extending over spines. Limb subchelate, with flexure between segments 3 and 4 (Fig. 2G, I).

Maxilliped similar in appearance to maxilla 2, but slightly larger, 7 or 8 segments. Articulation between protopodal segments weak. First segment simple, with several medial setae. Distal segment with 2 stout terminal spines and opposed subterminal setose pad. Inner margins of all segments with long setae.

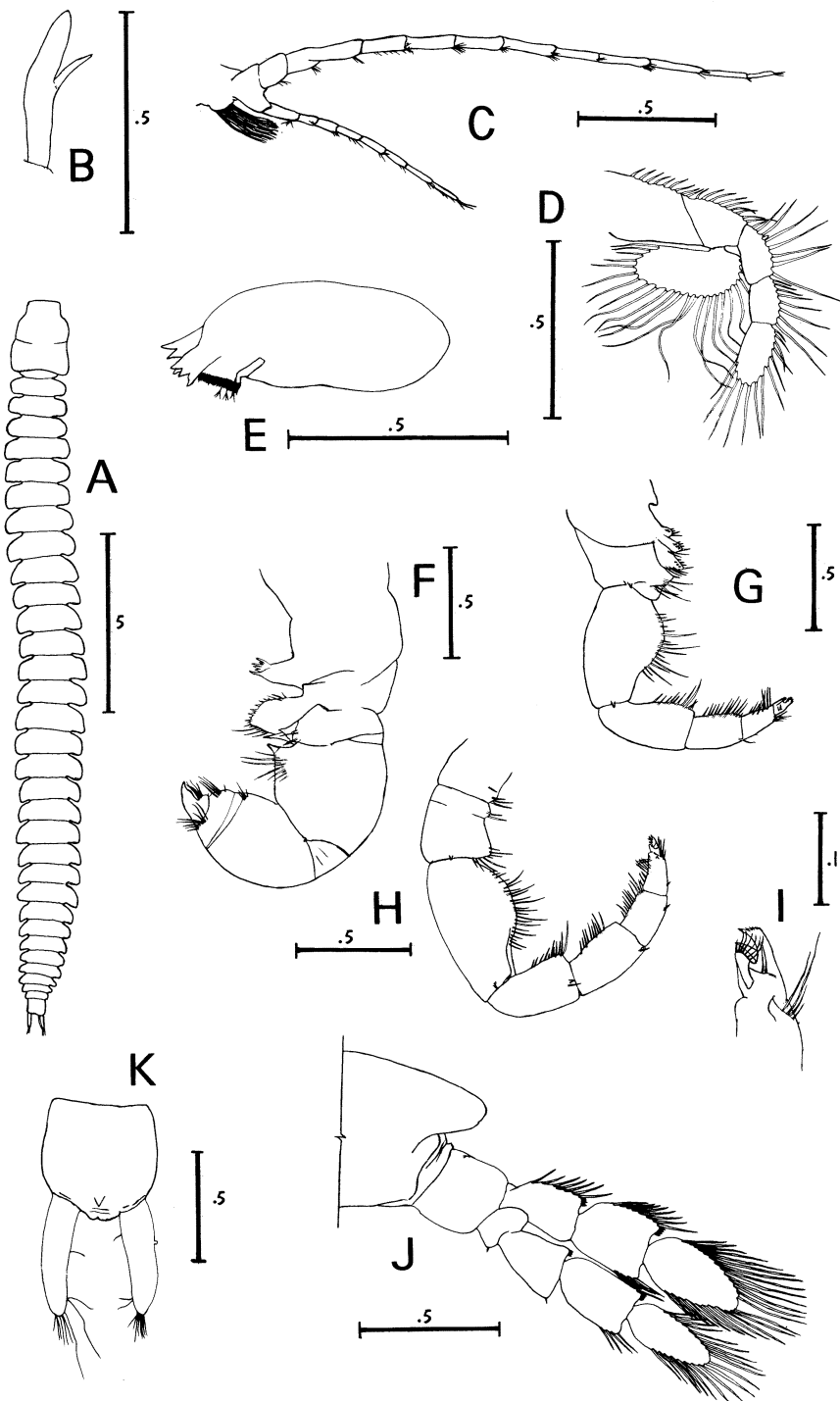


Fig. 2. *Speleonectes lucayensis*, new species. (A) Dorsal view (appendages omitted); (B) Pre-antennular process; (C) First antenna; (D) Second antenna; (E) Mandible; (F) 1st maxilla; (G) 2nd maxilla; (H) Maxilliped; (I) 2nd maxilla distal segment; (J) Trunk appendage; (K) Telson and caudal rami. Scales in mm.

Penultimate segment with several dorsal setae. Limb subchelate with flexure between segments 3 and 4 (Fig. 2H).

Trunk appendages biramous, flattened, setose paddles, directed laterally (Fig. 2J). Protopod without setae. Four-segmented endopod; proximal segment short and triangular, terminal segment oblong. Endopodal segments fused on trunk appendages 30 and 31. Exopod 3-segmented; segment 3 oblong.

Animal swims ventral side up, with metachronal beating of swimming appendages. Live specimens translucent.

Major Features of Internal Anatomy.—Ladderlike ventral nerve cord with ganglia on each trunk segment. Paired lateral digestive diverticula in each pretelsonic trunk segment. Gonadal material seen as strand leading from second maxilla to approximately 14th free trunk segment. Apparent eggs found in one specimen near anterior end of trunk. Large maxillary glands occupying posterolateral corners of cephalon.

DISCUSSION

The characteristics of *Speleonectes* make it difficult to relate to any other class of Crustacea. The similarities are superficial and indicate a weak affinity, at best.

The cephalic shield, well-developed pleura or tergites, and caudal furca of *Speleonectes* are similar to those of the Cephalocarida. However, the orientation of trunk appendages to the body is different, being lateral in *Speleonectes* and ventral in the Cephalocarida. The trunk limbs of *Speleonectes* lack epipodites or endites.

The biramous 1st antenna is a character of both Malacostraca and *Speleonectes*. However, in malacostracans, the trunk limbs are differentiated into tagmata and are ventrally oriented.

The large number of trunk segments is a character of both Branchiopoda and *Speleonectes*. However, the lack of limbs on the posterior part of the trunk, reduced unsegmented antennules, and reduced maxillae are branchiopodan characteristics that are not found in *Speleonectes*.

Many characteristics of *Speleonectes* superficially resemble those of the parasitic copepods. The dorsal pleura or tergites of the trunk segments are similar to the epimeral areas of the metasomal segments of *Brychiopontius falcatus* Humes (1974). The second antenna with its single-segmented exopod is also a shared characteristic. The biramous, flattened swimming legs of *Speleonectes* bear a general similarity to the pattern found in copepods. However, *Speleonectes* differs from the Copepoda in its long series of limbed trunk segments.

There are several similarities of *Speleonectes* to the Pennsylvanian crustacean *Tesnusocaris goldichi* Brooks (1955). The cephalic shield of *Tesnusocaris* is similar in shape and apparently projects posteriorly over the first postcephalic segment as in *Speleonectes*. The posteriorly projecting, subtriangular labrum resembles that of *Speleonectes*. The most striking similarity between the two animals is the presence of a long series of similar segments and biramous, paddlelike appendages which decrease in size posteriorly. Although *Tesnusocaris* differs from *Speleonectes* in many ways, the similarities suggest the possibility of affinity.

Speleonectes shares several characteristics with another fossil crustacean, *Lepidocaris rhyniensis* Scourfield, 1925. The many body segments, some with lateral pleura, and caudal furca of *Lepidocaris* are similar to those found in *Speleonectes*. The presence of a series of eight pairs of copepod-like trunk limbs adapted for swimming in *Lepidocaris* may also indicate possible affinity with *Speleonectes*.

The true identity of the pair of pre-antennular frontal processes of *Speleonectes* remains a problem. Although it resembles a reduced true appendage, no apparent musculature can be seen. However, if in later investigation musculature can be distinguished, this would require reassessment of the taxonomic affinities of *Speleonectes* because no known arthropod possesses three pairs of premandibular appendages. Neglecting this, the cephalic anatomy is compatible with that of the Crustacea, particularly as indicated by the presence of the maxillary gland.

The large number of trunk segments, each with similar, laterally directed, biramous, swimming appendages, plus the combination of the other characteristics precludes the placement of *Speleonectes lucayensis* into any class of Crustacea as presently defined.

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