

## NINE NEW SPECIES AND A NEW GENUS OF DOMINICAN AMBER ANTS OF THE TRIBE (CEPHALOTINI HYMENOPTERA: FORMICIDAE)

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Received 15 November 1994; Revised 27 March 1995

### Abstract

Fossils of *Cephalotini* ants are frequently encountered in Dominican amber. Of 22 specimens examined 18 belong to species not known from the *Cephalotini* fauna of today. Four specimens could not be identified to the species level. Five species of the genus *Zacryptocerus* are described as *Z. alveolatus* n.sp., *Z. integerrimus* n.sp., *Z. obscurus* n.sp., *Z. pseudo-aztecus* n.sp. and *Z. squamosus* n.sp., together with four species of the newly raised genus *Exocryptocerus* (*E. elevatus* n.sp., *E. serratus* n.sp., *E. truncatus* n.sp. and *E. janseni* n.sp.).

The *Cephalotini* fauna of the Caribbean of today is poor in regard to the past and consists of only four well defined species. This low number indicates a depauperation of the ant fauna and possibly the whole insect fauna in the Caribbean. Most likely this depauperation was caused by a geological and climatical change before or shortly after the Flood.

### Introduction

In view of the number of available Dominican amber ants for study, our knowledge of these ants is restricted. C. Baroni Urbani and E.O. Wilson have studied these ants most intensively, with the aim to retrace the supposed evolution of this group of social insects. Wilson, 1985b, however, concluded that these ants did not live "in the most crucial time frame in which to study fossils in order to understand the key events of ant evolution." Only 5% of the genera and "well-defined" subgenera in the Dominican amber were unknown from the living world fauna. Because the entomological fauna of Dominican amber is so similar to our current ant fauna, evolutionists lose interest in them. For largely the same reason Baroni Urbani\* (1992) discontinued the study of amber ants. Despite this, the similarity of the ants in amber with living ants is not overly pronounced. All species recorded appear to be new, but they are not definitely known to be absent from the ant fauna living today. If some of these species are living, then they are uncommon. The study of a number of representatives of a large genus from Dominican amber can result in new information about the similarities with the living species and their distribution. The genus *Zacryptocerus*, formerly known as *Paracryptocerus*, is suitable for this purpose, a genus occurring both in Dominican amber and with many present day forms. The genus belongs to the sharply distinct tribe *Cephalotini*.

The occurrence of the *Cephalotini* in Dominican amber with the genus *Paracryptocerus* is already known (Spahr, 1987). Urbani and Saunders (1983) published some drawings of undescribed species of this genus from Dominican amber. Up until now, however, no specimens from Dominican amber belonging to the *Cephalotini* have been identified to the species level.

The living *Cephalotini* were revised by Kempf based on morphological characters (Kempf, 1951; 1952, 1958). He divided the *Cephalotini* in four genera (Kempf, 1973) and approximately 105 species. Of these, the

genus *Paracryptocerus* with 67 species is obviously the largest. In Kempf's classification *Paracryptocerus* is regarded as a junior synonym of *Zacryptocerus*, that originally consisted of only two species.

*Zacryptocerus* is almost exclusively Neotropical in distribution, as well as the entire tribe of *Cephalotini* ants. Only a few species of the tribe occur in the southernmost part of the Nearctic region (Arizona, Texas and Florida). All species seem to be arboreal and lignicolous. From an economic point of view the entire tribe is insignificant (Kempf, 1951). Their arboreal way of life caused the entrapment of these ants in the resin of trees. It is for this reason that inclusions of *Cephalotini* ants are not particularly rare in Dominican amber.

### The Material Studied

In this study *Cephalotini* ants from the amber collection of the Museum of Comparative Zoology (Cambridge, Massachusetts) and the collection of the second author were studied. Respectively 12 and 10 amber specimens were examined for their taxonomical position. For comparison some present day *Cephalotini* ants were selected. Only those specimens were investigated, whose morphological description in the literature agrees well with the morphology of the amber ants.

Specimens of the following collections were studied:  
 JS = J. Scheven, Hohenlimburg, Hagen, Germany  
 MACN = Museo Argentino de Ciencias Naturales "Bernardino Rivadavia," Buenos Aires, Argentina  
 MCZ = Museum of Comparative Zoology, Cambridge, Massachusetts  
 NMNH = National Museum of Natural History "Smithsonian Institution," Washington, D.C.  
 NMW = Naturhistorisches Museum Wien, Vienna, Austria

### Descriptions of the *Cephalotini* in Dominican Amber

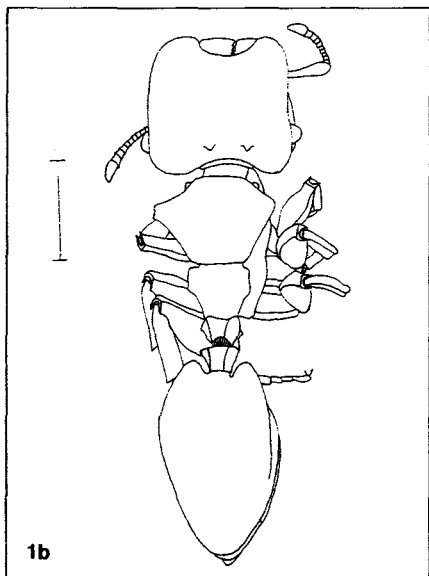
All identified ants in amber were workers, each enclosed in a separate amberstone. They appear to belong to nine species and two genera. Of these, five species could be placed within the largest genus of the *Cephalotini*: The genus *Zacryptocerus*. A new genus is raised to fit the remaining four species. The most striking difference between this genus and the known *Cephalotini* genera is found in the form of the hairs on the dorsum of the head and thorax (filiform respectively linear).

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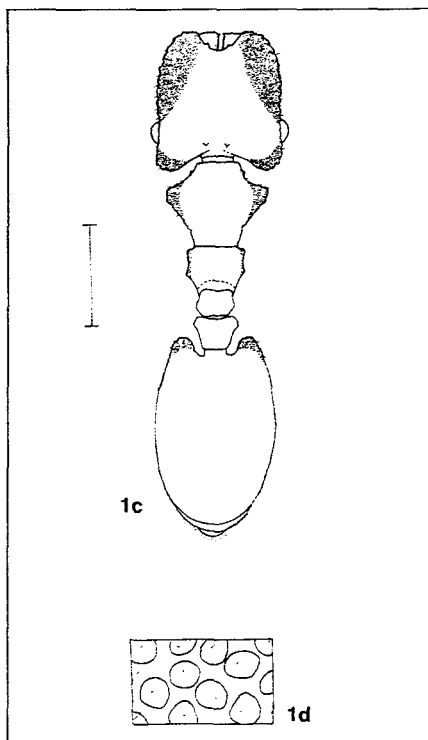
\*\*In a recent note Dr. Baroni Urbani indicated that in the last few years one of his students has continued with the work on amber ants.



1a



1b



1c

1d

Figure 1. Worker of *Exocryptocerus serratus* n.sp.  
1a. In Dominican amber (photo J. C. Vierbergen)

1b. Habitus (bar: 1 cm)  
1c. Dorsum, without appendages (bar: 1 cm)  
1d. Dorsal sculpture vertex (magnification approx. 120 x)

#### *Exocryptocerus* n.gen.

Diagnosis worker.\* The characters given for the worker of the tribe Cephalotini by Kempf (1951) apply here, except the articulation of the postpetiole, which can be absent. Additionally: Dorsum covered with filiform hairs; on dorsum of head, thorax and peduncular segments each of these hairs placed in the center of fovea or foveola.

Head. Front and sides of head disk more or less crenulate. Dorsal sculpture foveate to reticulate. Denticles on vertex present. Posterior border of occiput with lamina.

\*There are several castes among ants. One of these castes is the worker caste which are numerous and easy to collect. Normally, in insect species descriptions of males or females are sufficient for species diagnosis, but in ants, workers play the role.

Thorax. Segments unarmed; laminae partly present or absent. Dorsal sculpture as on headdisc, but sometimes additional striae present (propodeum). Pronotum and mesonotum more or less fused dorsally; line of divorce commonly partly developed.

Peduncular segments. Unarmed; sometimes laminae of postpetiole present.

Gaster. Antero-marginal laminae poorly developed or absent.

Type species: *Exocryptocerus serratus* n.sp.

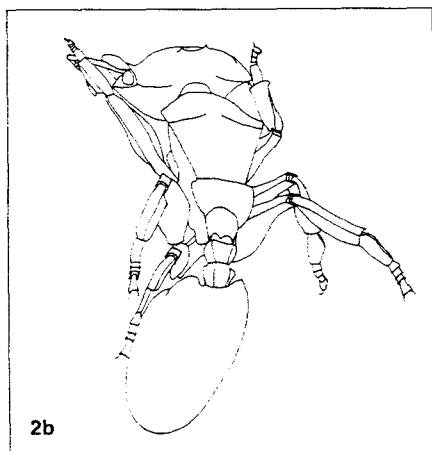
#### *Exocryptocerus serratus* n.sp. (Figures 1a-1d)

Diagnosis worker. Total length 5.2 mm. Dorsum covered with standing slightly bent hairs. Medium length hairs on head disc 0.08 mm. On head, thorax and peduncular segment each hair stands in the middle of a fovea.

Head. Length 1.4 mm; width 1.4 mm. Front and sides of head disc serrated. Dorsal sculpture reticulate-



2a



2b

Figure 2. Worker of *Exocryptocerus elevatus* n.sp.

2a. In Dominican amber

2b. Habitus (bar: 1 cm)

2c. Dorsum, without appendages (bar: 1 cm)

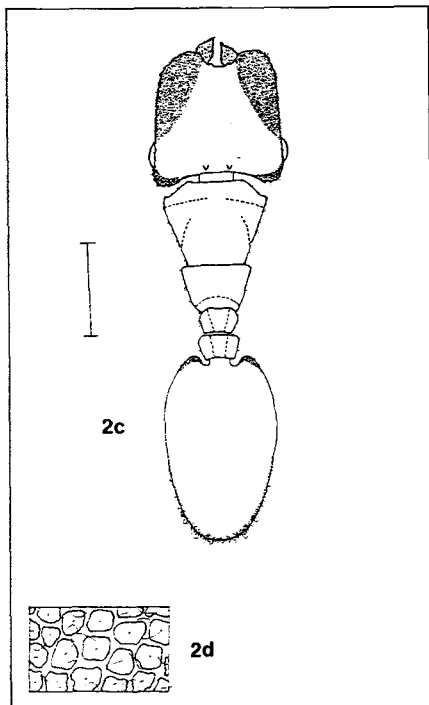
2d. Dorsal sculpture vertex (magnification approx. 120 x)

foveate. Denticles on vertex present. Posterior border of occiput with broad lamina.

Thorax. Total length 1.4 mm. Pronotum and mesonotum completely fused. Length promesonotum 0.9 mm; width 1.2 mm. Dorsal sculpture as on headdisk, but especially on propodeum less regular. Striae absent. On each side of promesonotum a small tooth present anteriorly. Lamina on both sides of promesonotum broad and truncate. On sides of propodeum this lamina small and with very blunt teeth.

Peduncular segments. Petiole unarmed. Postpetiole with blunt teeth; width 0.4 mm. Both segments without laminae or carinae.

Gaster. Length 2.1 mm; width 1.2 mm. Antero-lateral borders with a small lamina. A few hairs present on the lamina and on all tergites, except tergite I.



2c

2d

Remarks. This species is named after its strong serration around the borders of the head disk. The description above is derived from a worker which is deposited in the collection of JS. Two additional workers studied are in the collection of the MCZ.

#### *Exocryptocerus elevatus* n.sp. (Figures 2a-2d)

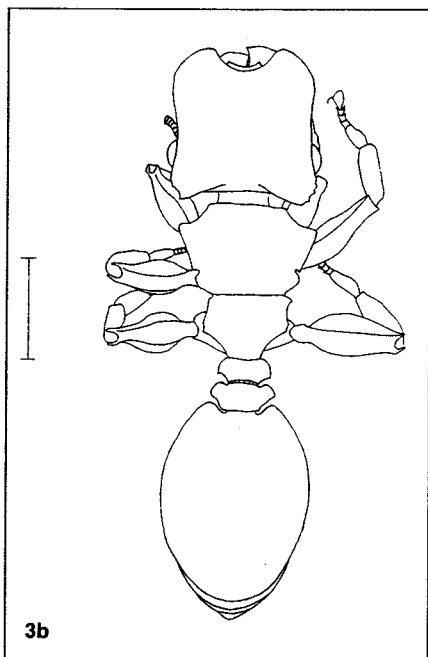
Diagnosis worker. Total length approximately 5.3 mm. Dorsum covered with descending hairs. In the middle of each foveola always one hair. Hairs numerous posteriorly on tergite I of gaster.

Head. Head disc flat dorsally. Dorsal sculpture reticulate-foveolate. Crenulate sides nearly straight. Posterior border of occiput with broad lamina. On vertex close to the middle a pair of denticles. Borders of headdisk elevated marginally.

Thorax. Total length 1.4 mm. At sides lacking laminae completely. Line of divorce between pronotum and mesonotum slightly visible at sides; medially pronotum and mesonotum completely fused. Length of promesonotum 1.0 mm, width 1.4 mm. Promesonotum in upper half with a broad transverse carina. Propodeum with reticulate-striate sculpture dorsally. Dorsal sculpture of promesonotum between head type and propodeum type.



3a

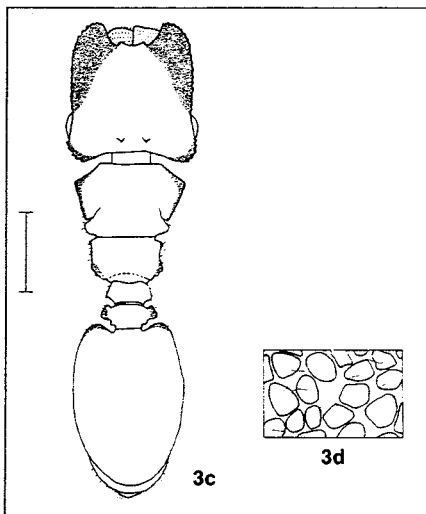


3b

Peduncular segments. Petiole unarmed and without lamina. Postpetiole obtuse and without lamina; width 0.4 mm.

Gaster. Length 2.2 mm; width 1.4 mm. Antero-lateral borders with a small lamina.

Remarks. The name of *E. elevatus* is derived from the strong elevation of the margins of the headdisk. The only worker studied is deposited in the collection of JS.



3c

3d

Figure 3. Worker of *Exocryptocerus truncatus* n.sp.

3a. In Dominican amber

3b. Habitus (bar: 1 cm)

3c. Dorsum, without appendages (bar: 1 cm)

3d. Dorsal sculpture vertex (magnification approx. 120 x)

*Exocryptocerus truncatus* n.sp. (Figures 3a-3d)

Diagnosis worker. Total length 5.5 mm. Dorsum covered with standing bent hairs. On head and pronesonotum each hair originates from the center of a fovea.

Head. Length 1.6 mm; width 1.6 mm. Dorsal sculpture foveate. Frontal carinae and small postero-marginal laminae crenulate. On vertex a pair of denticles present. Postero-marginal laminae small.

Thorax. Length 1.5 mm; width 1.5 mm. Pronotum and mesonotum fused, but dorsally divided by a short suture on both sides; both sutures divide the posterior half of the pronesonotum for about a fourth the width of this half. Dorsum of pronesonotum reticulate. Pronesonotal lamina small, hooked. Dorsum of propodeum reticulate-striate. Epinotal lamina small, interrupted and with a few blunt teeth.

Peduncular segments. Dorsum reticulate, without carina. Petiole without lamina, but armed with small backwards pointing teeth. Postpetiole with a broad truncate lamina at both sides. Width postpetiole 0.67 mm; without laminae 0.49 mm.

Gaster. Length 2.1 mm; width 1.5 mm. Antero-marginal laminae small and with few hairs. A number of long hairs caudad.

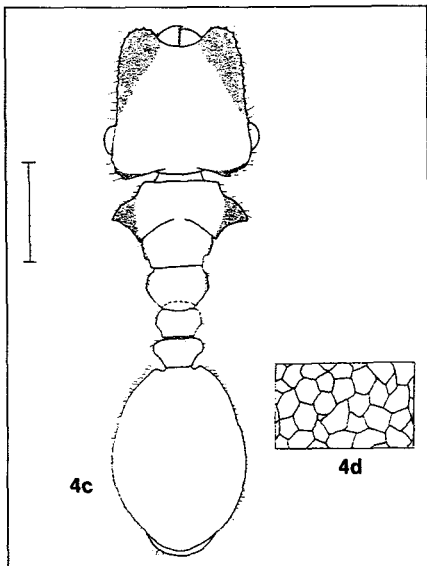
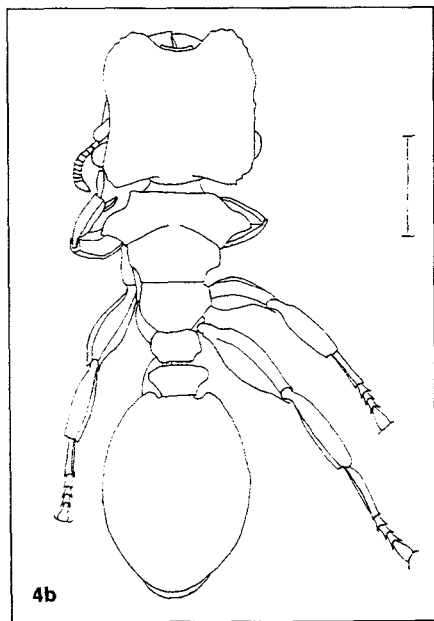
Remarks. The species is named after its typical truncate laminae of the postpetiole. The worker-type is deposited in the collection of JS.

*Exocryptocerus jansei* n.sp. (Figures 4a-4d)

Diagnosis worker. Total length 5.8 mm. Body and legs pubescent. On dorsum of head and thorax in the



4a

Figure 4. Worker of *Exocryptocerus jansei* n.sp.

4a. In Dominican amber

4b. Habitus (bar: 1 cm)

4c. Dorsum, without appendages (bar: 1 cm)

4d. Dorsal sculature vertex (magnification approx. 120 x)

centre of each fovea a single slightly bent long filiform hair (hair length 0.09 - 0.13 mm). Head. Length 1.5 mm; width 1.5 mm. Dorsal sculature deeply reticulate. Frontal carinae and very small postero-marginal laminae crenulate. Denticles on vertex present, but very small.

Thorax. Length 1.4 mm; width 1.5 mm. Dorsal sculature reticulate (pronotum and mesonotum) and reticulate-striate (propodeum). Pronotum and mesonotum dorsally divided by an incomplete suture; in the middle this suture absent. Pronotum armed with tooth-like laminae (width of each lamina: 0.4 mm). Meso- and epinotal laminae small.

Peduncular segments. Dorsum reticulate and without carina. Laminae absent. Unarmed. Postpetiole slightly broader than petiole.

Gaster. Length 2.1 mm; width 1.6 mm. Antero-marginal laminae completely absent.

Remarks. This species is named in honour of Dr. J. Janse (Ede, The Netherlands). His remarks on the species concept were very valuable for this publication. The type-specimen is present in the collection of JS. A second worker of *E. jansei* is deposited in the MCZ.

#### *Zacryptocerus integerrimus* n.sp. (Figures 5a-5d)

Diagnosis worker. Total length ~ 3.8 mm. Appressed linear hairs within foveola are present on all body segments. Caudad on the gaster erect linear hairs present.

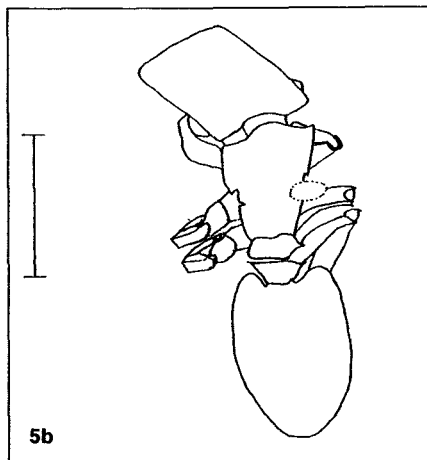
Head. Length 1.1 mm, width 1.0 mm. Dorsal sculature foveolate. Sides almost straight; lateral and postero-lateral margins not crenulate. Denticles on vertex absent. Margin of occiput with small lamina.

Thorax. Total length 0.9 mm. Pronotum and mesonotum completely fused. Length promesonotum 0.6 mm; width 0.8 mm. Anterior border of promesonotum slightly arcuate. Striation absent on entire dorsum of thorax.

Peduncular segments. Unarmed petiole shortly pointed at both sides. Postpetiole laterally armed with short spines.



5a



5b

Gaster. Length 1.5 mm; width 1.0 mm. Anteriorly with a broad thin lamina.

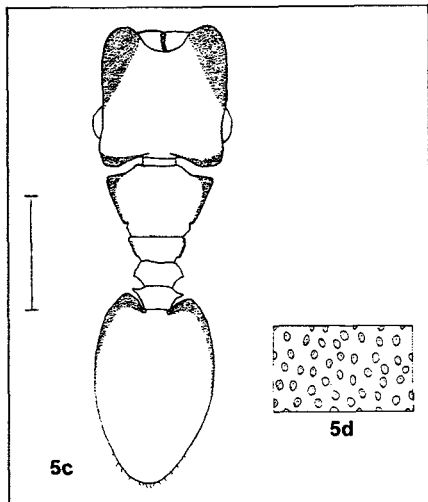
Remarks. This species is named for the margins of the whole body, which are completely entire. The only known worker of *Z. integerrimus* is deposited in the collection of JS.

*Zacryptocerus squamosus* n.sp. (Figures 6a-6d)

Diagnosis worker. Total length 5.5 mm. All linear body hairs appressed and situated within fovea, except a number of linear hairs, which stand laterally on tergite 2, 3 and 4 of gaster.

Head. Length 1.5 mm, width 1.5 mm. Dorsal sculpture foveate. Sides slightly convex. Lateral margins not crenulate. Denticles on vertex absent. Margin of occiput with a thin lamina.

Thorax. Total length 1.4 mm. Length pronesonotum 0.9 mm, width 1.3 mm. Pronesonotal suture slightly developed. Sculpture on pronesonotum with very weak striation; on propodeum foveolate-striate. Small thin lamina attached to the lateral borders of the pronesonotum and propodeum.



5c

5d

Figure 5. Worker of *Zacryptocerus integerrimus* n.sp.

5a. In Dominican amber

5b. Habitus (bar: 1 cm)

5c. Dorsum, without appendages (bar: 1 cm)

5d. Dorsal sculpture vertex (magnification approx. 120 x)

Peduncular segments. The unarmed petiole seen from above bell-shaped. Postpetiole width 0.6 mm, laterally armed with a spine at each side.

Gaster. Length 2.2 mm; width 1.5 mm. Anteriorly with a broad foliaceous lamina.

Remarks. Four specimens of *Z. squamosus* have been studied. Differences between the specimens are small; the length of the body is between 5.2 and 5.7 mm; the spine at each side of the postpetiole was most variable, it varied from blunt to acute. The species is named after the great number of linear scalelike-hairs on the dorsum of the body and legs. The worker-type is present in the collection of JS as well as two other workers of this species. Another worker is present in the collection of the MCZ.

*Zacryptocerus pseudo-aztecus* n.sp. (Figures 7a-7d)

Diagnosis worker. Total length 4.0 mm. Only appressed linear hairs present on all body segments. Dorsally most of these hairs appear as canaliculate silvery scales within each foveola.

Head. Length 0.92 mm, width 1.23 mm. Sculpture of dorsal surface foveate to reticulate-foveate. Sides rather straight. Denticles on vertex absent. A few linear hairs project from the posterolateral very slightly crenulated corners.

Thorax. Line of divorce between pronotum and mesonotum completely absent. Pronesonotum and propodeum with longitudinal striation; on pronesonotum striation weaker than on propodeum. Lateral border of pronesonotum and propodeum with a foliaceous lamina; the edge of this lamina rather straight.

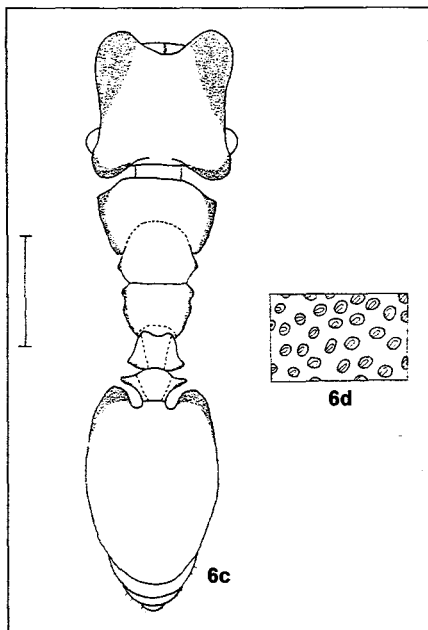
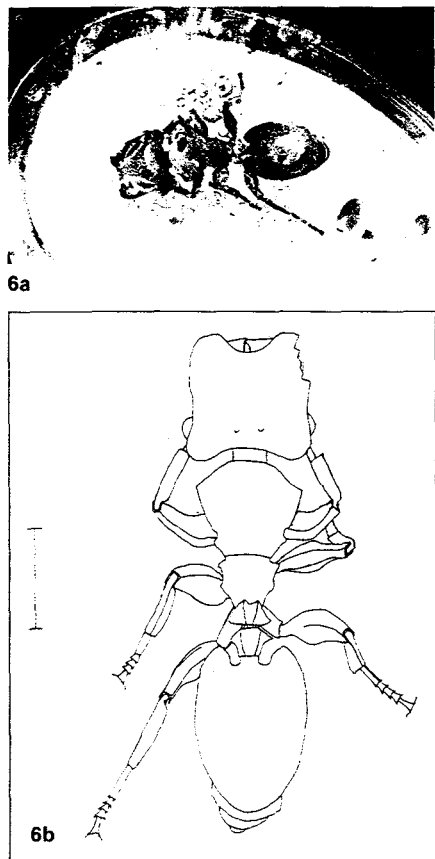


Figure 6. Worker of *Zacryptocerus squamosus* n.sp.  
 6a. In Dominican amber  
 6b. Habitus (bar: 1 cm)  
 6c. Dorsum, without appendages (bar: 1 cm)  
 6d. Dorsal sculpture vertex (magnification approx. 120 x)

and major workers, other than soldiers, support the consideration of *Z. pseudo-aztecus* as a valid species. The soldiers found in the genus can be separated easily by the shape of the head disk. The worker-type of *Z. pseudo-aztecus* is deposited in the amber-collection of JS. Worker-paratype: collection of the MCZ.

*Zacryptocerus obscurus* n.sp. (Figure 8)

Diagnosis worker. Total length ~ 4.5 mm. Most body hairs appressed and linear. A few hairs are standing distally on leg segments and posteriorly on the segments of the gaster.

Head. Length ~ 1.5 mm; width 1.4 mm. Dorsal sculpture alveolate. Each alveolus contains a relatively long appressed canaliculate linear hair. Borders of disc entire. Denticles on vertex absent.

Thorax. Total length 1.1 mm. Dorsal striation absent. Pronotum and mesonotum dorsally divided by a very short suture on both sides; less than one fourth of an imaginable complete suture present. Length of promesonotum 0.7 mm; width 1.3 mm. Lamina on lateral borders of promesonotum truncate.

Peduncular segments. Petiole and postpetiole with a very small lamina. Petiole with a blunt tooth on each

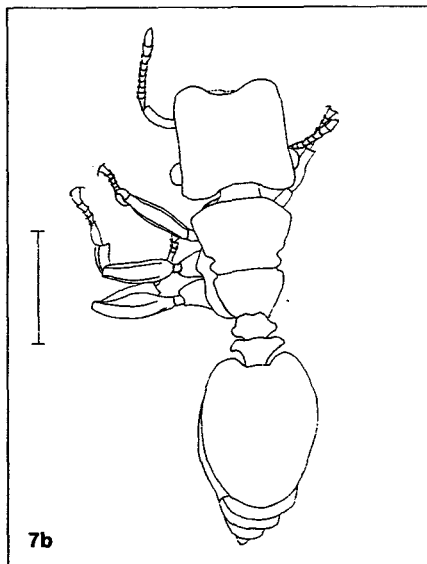
Peduncular segments. Petiole and postpetiole with a small foliaceous lamina. Width postpetiole 0.53 mm.

Gaster. Width 1.33 mm. Anterolaterally with a broad foliaceous lamina.

Remarks. The species-name of *Z. pseudo-aztecus* is given for the similarity with *Z. aztecus* Emery, an extant species (for differences between these two species see below). Additionally, *Z. squamosus* n.sp. (described in this study) is morphologically comparable with *Z. pseudo-aztecus* and possibly identical. The main differences are the size of the body, the margins of the head and the presence or absence of a promesonotal suture on the promesonotum. *Z. pseudo-aztecus* can be regarded as a small form of *Z. squamosus*, but the absence in the living *Zacryptocerus* species of minor



7a

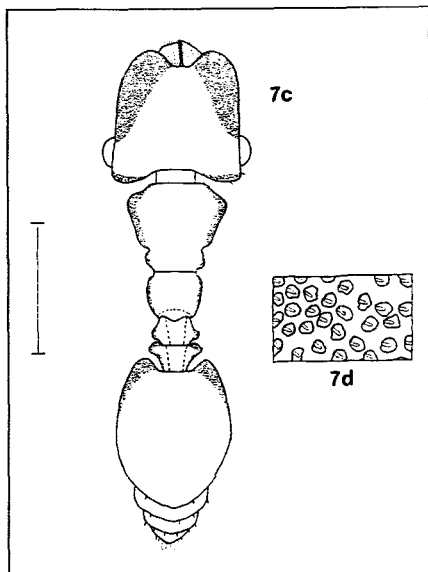


7b

side. Postpetiole broader than petiole and with a blunt spine on each side. Width postpetiole 0.6 mm.

Gaster. Width approximately 1.3 mm. Antero-lateral borders with small laminae.

Remarks. The only worker of *Z. obscurus* available is deposited in the MCZ. The length of the head and thorax could not be measured due to the inconvenient position of the ant in the amber; both the head and gaster are strongly bent downwards. A drawing of the dorsum of the body could not be performed for the same reason. The position of the head of the holotype worker in the amber hampers a complete observation and is responsible for the name given. The species is very close to the next one described. For the discriminating characters see below.



7c

7d

Figure 7. Worker of *Zacryptocerus pseudo-aztecus* n.sp.  
7a. In Dominican amber  
7b. Habitus (bar: 1 cm)  
7c. Dorsum, without appendages (bar: 1 cm)  
7d. Dorsal sculpture vertex (magnification approx. 120 x)

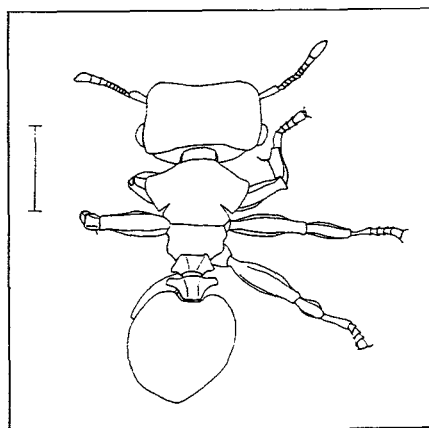


Figure 8. Habitus of worker of *Zacryptocerus obscurus* n.sp. (bar: 1 cm)



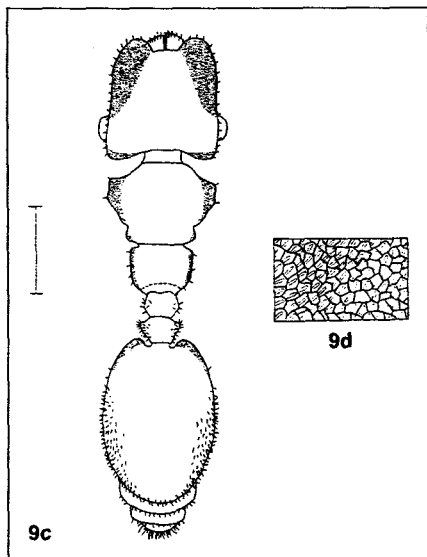
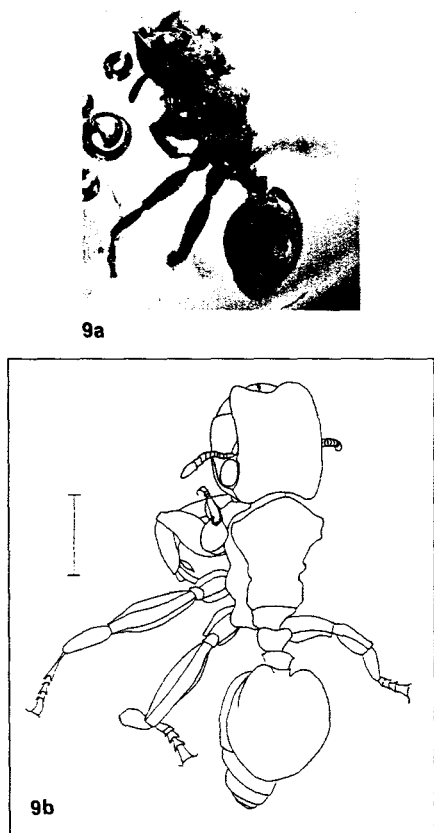


Figure 9. Worker of *Zacryptocerus alveolatus* n.sp.  
 9a. In Dominican amber  
 9b. Habitus (bar: 1 cm)  
 9c. Dorsum, without appendages (bar: 1 cm)  
 9d. Dorsal sculpture vertex (magnification approx. 120 x)

Peduncular segments. Unarmed petiole without lamina. Postpetiole laterally unarmed and without lamina. Width postpetiole 0.5 mm.

Gaster. Length 2.1 mm; width 1.3 mm. Antero-lateral border with small lamina.

Remarks. *Z. alveolatus* is named after its numerous alveola present on the dorsum of the head, thorax and peduncular segments. The only worker available is deposited in the collection of JS. The species is very close to *Z. obscurus*. It differs in the unarmed peduncular segments and the numerous outward pointing linear hairs on the lateral border of tergite I of the gaster.

#### The Other Cephalotine Ants from Amber

Four Cephalotine amber ants from Dominican amber could not be identified to the species level. These four ants were workers. Either the position of the ant in the amber or the presence of fungal hyphae hampered the observation of crucial parts of the ant. The presence of these hyphae on and in amber insects is not uncommon. The insect is not always embedded in the tree resin completely at once. So, if the time period between dying of the insect and the total inclosure is long, then fungi may profit from this period in the moist tropical circumstances of the amber-producing forest by attacking the dead ants.

The four ants belong undoubtedly to the genus *Zacryptocerus*. Two of them are close to or identical with *Z.*

#### *Zacryptocerus alveolatus* n.sp. (Figures 9a-9d)

Diagnosis worker. Total length 5.5 mm. Most body hairs appressed and club-shaped. A small number of these hairs stand laterally on dorsal surface of the peduncular segments and posteriorly on tergite I of gaster. On the lateral borders of all body segments many club-shaped hairs point outwards horizontally. Together these hairs give the body surface a ciliate appearance.

Head. Length 1.6 mm; width 1.4 mm. Dorsal sculpture alveolate. The alveola contain relatively long appressed canaliculate club-shaped hairs. Sides straight; disc posteriorly entire. Denticles on vertex absent.

Thorax. Total length 1.4 mm. Dorsal striation absent. Pronotum and mesonotum completely fused. Length of pronesonotum 1.0 mm; width 1.4 mm. Lamina on antero-lateral borders of pronesonotum truncate.

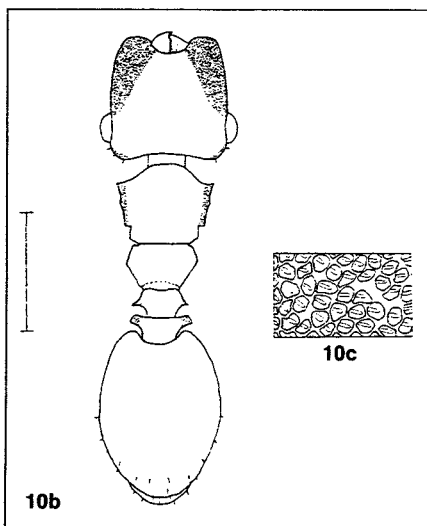
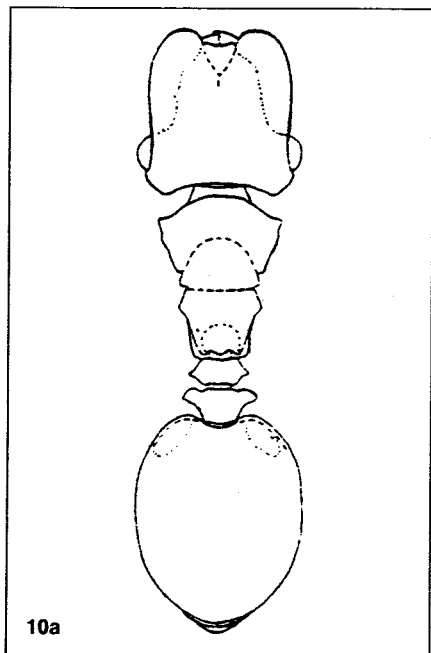


Figure 10. Worker of *Zacryptocerus aztecus* (Forel)  
 10a. Habitus, from Kempf, 1958  
 10b. Dorsum, without appendages (bar: 1 cm)  
 10c. Dorsal sculpture vertex (magnification approx. 120 x)

pseudo-aztecus and one with *Z. squamosus*. The remaining one could not be associated with any of the species described above. These four ants are deposited in the MCZ.

#### Comparison with Living Species

Representatives in Dominican amber of *Exocryptocerus* are not known from the living ant fauna. From the description of the genus *Exocryptocerus* (see above) it is clear that this genus is distinct from the four present-day genera of the tribe. Several amber species of the genus *Zacryptocerus* are close to some present day species of the same genus. For comparison a selection of *Zacryptocerus* species has been performed based on corresponding morphological features given by Kempf (1951; 1958). Five species have been studied for this purpose.

*Zacryptocerus aztecus* (Forel) (Figures 10a-10c)

Material: Mexico, Morelos: Cuernavaca, (date unknown); leg. W.M. Wheeler, det. S.P. Cover: one worker (MCZ).

*Z. aztecus* (Forel) is a species known from only one location in Mexico (Kempf, 1958). It is close to *Z. pseudo-aztecus* n.sp. Morphologically *Z. pseudo-aztecus* differs from *Z. aztecus* in the characters given in Table I.

The following species of *Zacryptocerus* studied can be separated from the species of *Zacryptocerus* in amber by the presence of an inclination on the promesonotum and a combination of characters given for each species below.

*Zacryptocerus fiebrigi* (Forel) (Figure 11)

Material: Argentina, Cordoba: Alta Gracia, La Granja, I-1925; leg. C. Bruch, det. W.W. Kempf: two workers (MACN).

Differential characters:

- Sides of headdisk weakly crenulate.
- At the border of the fused pro- and mesonotum a weak, but distinguishable inclination.
- Peduncular segments without carina; armed with strong spines.
- Thorax not lamellate, but at sides with a few teeth.
- Dorsal sculpture of thorax without striae

*Zacryptocerus iheringi* (Emery) (Figure 12)

Material: Brasilia, Rio Grande do Sul (date, locality and leg. unknown), det. C. Emery: seven workers (NMW).

Differential characters:

- Dorsum of head and thorax weakly reticulate and with relatively long linear hairs as in *Z. alveolatus* n.sp.
- Linear hairs rarely standing; normally lying within foveola.
- At the border of the fused pro- and mesonotum a weak, but distinguishable inclination.



Figure 11. Worker of *Zcryptocerus fiebrigi* (Forel)



Figure 13. Worker of *Zcryptocerus multispinosus biguttatus* (Emery)



Figure 12. Worker of *Zcryptocerus iheringi* (Emery)

- Dorsal sculpture of thorax without striae.
- Sides of propodeum with strong teeth.
- Peduncular segments armed with teeth.

*Zcryptocerus multispinosus biguttatus* (Emery)  
(Figure 13)

Material: Costa Rica, Santa Clara Province, Hamburg Farm, 9-VIII-1923; leg. F. Nevertmann, det. W.W. Kempf; three workers (NMNH).

Differential characters:

- Dorsal sculpture of head foveate, as in *Z. squamosus* n.sp.
- Vertex with a pair of denticles.
- Sides of head smooth.
- At the border of the fused pro- and mesonotum a weak, but distinguishable inclination.
- Pronesonotum and propodeum dorsally finely reticulate, striae absent.
- Peduncular segments without carina.

*Zcryptocerus haemorrhoidalis* Latreille (Figure 14)

One of the species with monomorphic workers occurring in the Dominican Republic needs special attention here. *Z. haemorrhoidalis* was formerly the only representative of the genus *Hypocryptocerus* (Kempf, 1973). The known distribution area of the species is quite small: Hispaniola Island. Six forms of the species have been described, of which five forms have been studied:

Table 1. Discriminating morphological characters of *Z. pseudo-aztecus* n.sp. and *Z. aztecus* (Forel)

	<i>Z. pseudo-aztecus</i>	<i>Z. aztecus</i>
lamina head posteriolaterally	present	absent
dorsal sculpture head	foveate to reticulate	foveate
lateral lamina propodeum	present	absent
lamina petiole laterally	truncate	acute
lamina gaster anteriorly	present	absent

*Z. haemorrhoidalis* ssp. *affinis* (Wheeler): Haiti, Porte Terre Rouge, 5-X-1934; leg. J.P. Darlington: two workers (cotypes, MCZ);

*Z. haemorrhoidalis* ssp. *auricomus* (Wheeler): Dominican Republic, Sanchez, 22-27-V-1915 (two workers) and 28-31-V-1915 (one worker); leg. Watson (cotypes, MCZ);

*Z. haemorrhoidalis* ssp. *signatus* (Wheeler): Haiti, Mt. Basil, 9-IX-1934; leg. J.P. Darlington: one worker (cotype, MCZ);

*Z. haemorrhoidalis* ssp. *unimaculatus* (F. Smith): Dominican Republic: Samana, 2-6-VI-1915; leg. Watson: one worker (cotype, MCZ);

*Z. haemorrhoidalis* ssp. *vinosus* (Wheeler): Haiti, Mt. Rochelouis; leg. W.J. Eijerdam: six workers (cotypes, MCZ).

The six forms of *Hypocryptocerus haemorrhoidalis* can possibly be raised to species rank, but the availability of only one or a few worker specimens of most forms and the questionable identity of *H. haemorrhoidalis* (Wheeler, 1936; Kempf, 1951) make decisions precarious. The adult (male) has been described from only one form (*Hypocryptocerus haemorrhoidalis hamulus* (Roger), Wheeler and Mann, 1914). *H. haemorrhoidalis* has the monomorphic worker in common with the amber ants. Likewise the species also has the lack of an inclination on the pronesonotum in common with most of the amber ants, but *H. haemorrhoidalis* can be easily distinguished from the amber specimen by the possession of two 0.5 - 0.7 mm long spines posteromarginally on the propodeum and numerous erect 0.13 - 0.20 mm long linear hairs on the dorsal surface of head and thorax.

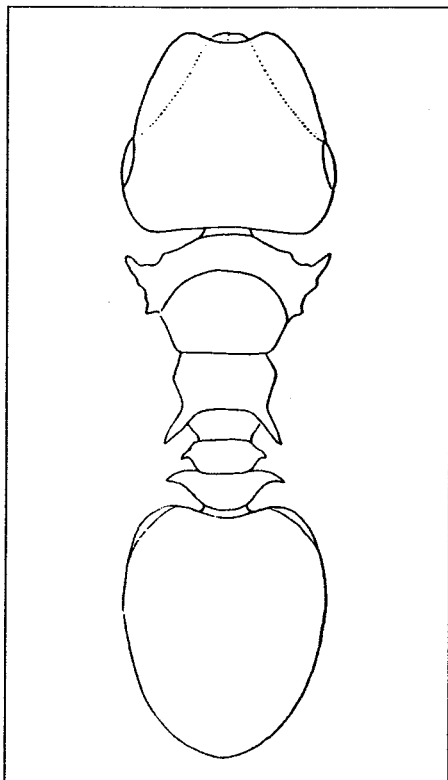


Figure 14. Worker of *Zacryptocerus haemorrhoidalis* Latreille; from Wheeler & Mann, 1914

### The Living Cephalotini of the Caribbean

The living Cephalotini are distributed exclusively in the Neotropics and most of them have a continental distribution. Of the about 105 species described only 13 or 14 species belonging to three genera that live in the Caribbean. In the Caribbean the genus *Procrypto-cerus* is represented with four species just on Trinidad. This is also true for four species of the genus *Zacryptocerus*. Of the genus *Cephalotes* only one species occurs in the Caribbean (*C. atratus* Linnaeus); it is known only from Trinidad and St. Thomas (Virgin Islands). On St. Thomas, however, it is supposed to have been introduced by man (Kempf, 1951). This means that nine, more than half of the 13 or 14 Caribbean species, are only known from Trinidad. The fauna of Trinidad, however, is regarded as being strongly influenced from the South American mainland (Kempf, 1951). *Z. curvistratus* is known from an interception in the USA with beans (in 1946), possibly originating from the Dominican Republic (Kempf, 1951). It is doubtful if

this species is of Caribbean origin, because all other recorded interceptions of this species are from Costa Rica and Guatemala (Kempf, 1951; Vierbergen, 1992). So, the remainder, four species, are "true" inhabitants of the Caribbean. These species do belong to *Zacryptocerus* and are *Z. haemorrhoidalis* (Latreille), with seven exclusively Caribbean biotypes, *Z. emeryi* (Forel), *Z. pallens* (Klug) and *Z. varians* (F. Smith). *Z. haemorrhoidalis* is restricted to Hispaniola and from its biotypes only few specimens are available. New material and especially males and females of each biotype have to be collected for a well-considered decision on the problem of the variation. It is not unlikely that some of the biotypes can be raised to species level. *Z. emeryi* is only known from the type specimens, which were collected on Curacao (Kempf, 1951). *Z. pallens* has a wide distribution area, ranging from Argentina to Mexico. *Z. varians* is very close to *Z. pallens* and occurs in southern Florida, on the Bahamas, Cuba and Jamaica (Kempf, 1958).

### Discussion and Conclusions

A study of 18 of 22 available Cephalotini in Dominican amber showed a classification into nine species. These species can be distinguished from the living Cephalotini in several morphological characters.\* The high number of amber species indicates the Cephalotine fauna of the Caribbean was more numerous in the past than it is today (four species). An explanation could be the extinction of a specific habitat for the ants. So, it is known that the Dominican amber originates from the extinct tree *Hymenaea protera* Poinar. A strong linkage to a particular tree species of the Cephalotini found, is, however, unlikely, because the well known living species of the Cephalotini were collected from plants belonging to several different plant families (Wheeler, 1942). There is no indication whatsoever of any linkage of a Cephalotine ant to a specific tree.

The four extant species of Caribbean *Zacryptocerus* bear no close relationship to the nine species from the amber described in this study. Apparently a large number of species became extinct. This and the high number of other ant genera in Dominican amber reported by Wilson (1985) and Poinar (1992), the presence of most ant sub-families in this amber and the absence of genera like the Australasian *Leptomyrmex* in the modern fauna of the Caribbean (Baroni Urbani and Wilson, 1987) indicate that the ant fauna and possibly the entire insect fauna of the Caribbean is now poor in comparison to the past.

Also investigations of spiders in Dominican amber show decreasing species numbers. Recently the spiders in amber have been investigated thoroughly (Wunderlich, 1988). The number of extant spider species of Hispaniola (at most 500) is assessed to be as high as the number of spiders in Dominican amber (approximately 300-500). Of the spiders many extant species are exclusively 'ground living'. In considering this, the number of 'tree living' species must have been higher in the past than the number living in trees today. The faunistic diversity has very probably decreased significantly in diversity.

\*An identification key to the amber species based on the keys published by Dr. W. W. Kempf is available and can be provided on request from the authors.

All insects and spiders found in Dominican amber belong to families, whose representatives live in tropical climates today. This indicates that the present climate in the Caribbean does not significantly differ from the climate in the "amber period." The cause of the depauperation in species is probably the result of major geographical and/or climatical changes in the region. The Cephalotini do not require a very specific habitat, but the area of distribution is restricted to the tropics of the New World. It is not clear yet, if the Dominican amber originates from the time before or after the Flood. If the origin is from after the Flood, then it has to be considered that drastic geological and/or climatical changes took place during this period.\*

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- \*Editor's Note: It is interesting that these amber ants that are supposed to have been fossilized millions of years ago are so similar to modern ant species that there is a tendency for evolutionists to stop their research on them because they cannot be used to formulate theories of macroevolution! Creationists are understandably interested in similarities like these which seem at once to conflict with macroevolutionary change and long-age speculations.

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## LETTERS TO THE EDITOR

### Correlating Tree Rings

In W. H. John's letter on tree rings (Volume 30, pages 129-131). He presented two bar charts supposedly showing continuity of ring thickness in the BC period for Irish oak trees. He used data from Pilcher, Hillam, Baillie and Pearson (1977). However, the data in that article were not actual ring thicknesses but they had been "converted to indices by fitting a polynomial curve to the data and expressing the yearly values as a ratio to the polynomial curve at that point . . . LONG TERM TRENDS ARE REMOVED" (p. 722, my capitals). The only information on ring width was given in Appendix 2 (p. 726), where the mean ring width for each site chronology was given (in units of 0.05 mm—not stated in the article but in personal communication from M. Baillie). Nevertheless, I suspect that the data, if available, would show little change from the average of approximately one mm ring width that seems to prevail for Irish bog oaks in the BC period. I have yet to see published widths for AD oaks.

For some years I have advocated two rings per year in the BC period until c. 500 BC which is the change point from Sub-boreal to Sub-Atlantic climate. Unfortunately this theory suffers from a severe lack of evidence! Another area of attack lies in dendrochronologists' use of the t-test, the statistical method by which individual trees or site chronologies are compared. A key criticism by Yamaguchi (1986) has never to my knowledge been answered. Yamaguchi wrote: "Since tree-rings are typically serially correlated, cross-cor-

relation coefficients [e.g., t-test numbers] between standardized tree-ring series may be spurious and inflated" (Yamaguchi, 1986, p. 47) and "Tree-ring studies whose conclusions rest on 'significant' cross-correlation coefficients are therefore suspect. One example is the extensive use of CROS [a computer program] to date floating oak chronologies in western Europe . . . because chronologies from this region show strong autocorrelation" (Yamaguchi, 1986, p. 51).

Where does that leave the European oak chronology? The final link-up across the first millennium BC for the British oak chronology was published in 1984 (Pilcher, Baillie, Schmidt and Becker, 1984, Fig. 2)—it depends on t-test values of about four which would be reasonable proof if the t-test has been properly applied. In the light of Yamaguchi's comments, t-test values of four may be worthless. A few decades or even a few centuries reduction in the first millennium BC will not solve all our problems but it may be a step in the right direction.

Most dendrochronologies have never been published in any detail, so it is impossible for an outsider to check the method or the figures. I would suggest that for all important chronologies there should be publication of ring width indices for each local chronology and the statistics linking the local chronologies. This would not require a vast amount of journal space. Until this has been done a chronology cannot be regarded as "published" let alone proven. As an example of what can become apparent when a chronology is fully published,

consider Kuniholm, Tarter and Griggs (1993); a local Anatolian dendrochronology produced no less than three different matches to the master chronology, each with t-values of four to five (Kuniholm et al., 1993, p. 189) and each apparently correct to a high degree of certainty! Until such time as Yamaguchi's points have been answered, a 'rule of thumb' might be to consider t-values of seven or more as certain, six as likely and five as probable. Is there a dendrochronology that does not depend on t-values of less than seven for the first millennium BC? If so, let it be properly published, otherwise there is no proven dendrochronology.

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## Would The Global Flood Have Created A Big Mud Bowl? A Further Reply to Mr. Yake\*

Yake comment: The ratio of the Flood waters to the uniformitarian Phanerozoic Eon sediments is estimated to be approximately two to one by volume. The volume of water being  $1,350 \times 10^6$  and the volume of Phanerozoic "Flood sediments" being  $654 \times 10^6$ . This ratio would have resulted in a "mud bowl." Life (both continental and oceanic) could not have survived this environment. The local Flood theory better explains the survivability of "species."

One of the more popular creationist Flood models, based on physical evidence, starts with the Pangaea supercontinent as the pre-Flood landmass. I support the breakup of the Pangaea supercontinent during the Flood event, when it was covered in water generated from atmospheric and subterranean sources. The continent broke apart and spread (following the Plate Tectonic theory for spreading continents) during the Flood event (Gen 7:11) (see Nevins, 1978; Froede, 1994). However, other creationists (e.g., Tippett, 1979; Howe, 1979; Northrup, 1987) have suggested that the Pangaea breakup followed the Flood event, hence the creationist model for Plate Tectonics remains under investigation.

Antediluvian continental sediments during this Flood event would be destroyed, reworked, or precipitated as the Flood waters served to destroy terrestrial life

\*This is part of a continuing series of letters answering objections that have been raised against a global or total flood.

(especially mankind—Gen 6:7) on earth. Reworked sediments would serve to bury flora and fauna rapidly in depocenters, creating the scattered "paleontological stratigraphic record." The creationist Woodmorappe (1993) has compiled and interpreted much of the paleontological record in such a manner in his excellent papers.

The Bible states that the Flood waters covered the pre-Flood earth's highest points by as much as 22 feet (Gen 7:19-20). The Antediluvian earth is not believed to have had mountains as high as those of today (Whitcomb and Morris, 1961, p. 77), so the Flood waters did not need to be tens of thousands of feet deep in order to flood the earth. If the earth's surface were in fact mud then the Bible would be in error and the Ark would have rested on a rising mud slurry instead of rising waters.

The Bible states that Noah could see the tops of mountains (Gen 8:5) as the Flood waters receded. This supports the belief that tectonic activity such as continental uplift and oceanic subsidence was occurring to accommodate the draining Flood waters. Lithified sediment is required in order to yield the uplifted mountains of Gen 8:5. The earth's highest mountains (i.e., Himalayas) have marine fossils within their strata and this would require both stratification of the original sediments and their subsequent lithification which would not fit with the "mud" theory. Much creationist research remains to be performed to define and refine the young earth Creation/Flood model. However, we can be assured that the Bible provides an accurate account of physical events which are evident in the modern geological record.

Today the earth's landmasses comprise approximately 25 percent of the earth's surface and the oceans make up approximately 75 percent. The mean elevation of those landmasses has been calculated at +2,756 feet and the mean ocean depth at -12,304 feet (Davis, 1977, p. 19). Clearly the oceans contain sufficient size both in magnitude and depth of water to inundate the earth's terrestrial surface if tectonic uplift of the oceanic crust is invoked. Much more water exists than is currently seen in our oceans and seas. Using the same mechanisms fostered by uniformitarians to raise and lower sea-level (i.e., tectonics and glaciation), we advocates of a global Flood can also explain how water covered the earth.

### Was There A Local Flood?

The fact that both Flood water depth and the "first" observation of mountains are recorded in Gen 7:20 and Gen 8:5, respectively, tends to refute the concept of a local flood. If the Flood were local then mountains would already exist and should have become visible immediately after the end of the 40 days and nights of rain. Noah should have been able to see "mountains" following the end of the rain, so why would it be reported as taking 7.5 months (compare Gen 7:11 and Gen 8:5) for Noah to see mountains if the Flood were local? If the Flood were local then water would be deep only within that limited area and the fact that it covers "something" by 22 feet

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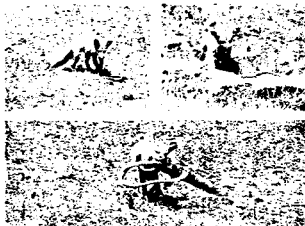
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*Creation Research Society Quarterly* is published by the Creation Research Society, P.O. Box 980, Ashland, OH 44805 0989.  
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## CREATION RESEARCH SOCIETY

**History** The Creation Research Society was organized in 1963, with Dr. Walter E. Lammters as first president and editor of a quarterly publication. Initially started as an informal committee of 10 scientists, it has grown rapidly, evidently filling a real need for an association devoted to research and publication in the field of scientific creation, with a current membership of over 600 voting members (with graduate degrees in science) and over 1100 non-voting members. The *Creation Research Society Quarterly* has been gradually enlarged and improved and now is recognized as the outstanding publication in the field.

**Activities** The society is solely a research and publication society. It does not hold meetings or engage in other promotional activities, and has no affiliation with any other scientific or religious organizations. Its members conduct research on problems related to its purposes, and a research fund is maintained to assist in such projects. Contributions to the research fund for these purposes are tax deductible. The Society operates two Experiment Stations, the Grand Canyon Experiment Station in Chino Valley, Arizona and the Grasslands Study Site in Weatherford, Oklahoma.

**Membership** Voting membership is limited to scientists having at least an earned graduate degree in a natural or applied science. Dues are \$20.00 (\$24.00 foreign) per year and may be sent to Glen W. Wolfrom, Membership Secretary, P.O. Box 969, Ashland, OH 44805-0969. Sustaining membership for those who do not meet the criteria for voting membership, and yet who subscribe to the statement of belief, is available at \$20.00 (\$24.00 foreign) per year and includes a subscription to the *Quarterlies*. All others interested in receiving copies of all these publications may do so at the rate of the subscription price for all issues for one year: \$23.00 (\$27.00 foreign).

**Statement of Belief** Members of the Creation Research Society, which include research scientists representing various fields of successful scientific accomplishment, are committed to full belief in the Biblical record of creation and early history, and thus to a concept of dynamic special creation (as opposed to evolution), both of the universe and the earth with its complexity of living forms. We propose to re-evaluate science from this viewpoint, and since 1964 have published a quarterly of research articles in this field. In 1970 the Society published a textbook, *Biology: A Search for Order in Complexity*, through Zondervan Publishing House, Grand Rapids, Michigan 49506. All members of the Society subscribe to the following statement of belief:

1. The Bible is the written Word of God, and because it is inspired throughout, all its assertions are historically and scientifically true in all the original autographs. To the student of nature this means that the account of origins in Genesis is a factual presentation of simple historical truths.
2. All basic types of living things, including humans, were made by direct creative acts of God during the Creation Week described in Genesis. Whatever biological changes have occurred since Creation Week have accomplished only changes within the original created kinds.
3. The Great Flood described in Genesis, commonly referred to as the Noachian Flood, was a historical event worldwide in its extent and effect.
4. We are an organization of Christian men and women of science who accept Jesus Christ as our Lord and Saviour. The account of the special creation of Adam and Eve as one man and woman and their subsequent fall into sin is the basis for our belief in the necessity of a Savior for all people. Therefore, salvation can come only through accepting Jesus Christ as our Savior.