Occurrence of Callianassid Coprolites in the Cretaceous of New Jersey

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ABSTRACT - The occurrence of masses of callianassid thalassinidean coprolites in the Cretaceous exposures of Ramanessin Brook and Big Brook, Monmouth Co., New Jersey, is discussed. Comparisons with occurrences of currently recognized ichnospecies show that these recently discovered specimens represent a new temporal occurrence and range extension for callianassid coprolites: the first confirmed Campanian records of this ghost shrimp ichnofossil for North America.

Introduction

The callianassid crustacean Protocallianassa has left a rich fossil record in the Cretaceous of New Jersey. Body fossils (mostly pincers and other arm segments) show callianassid shrimp to be one of the most commonly preserved infaunal elements - as well as the most common crustaceans in general - of this Campanian ecosystem. Trace fossils of callianassids in the form of burrows (Ophiomorpha) are also common in many local outcrops and are important bioturbation features (Frey et al. 1978) of the Cretaceous sediments of Monmouth County. Reported here is the first identification and description of another callianassid trace fossil type: coprolite masses.

Modern and fossil fecal pellets from ghost shrimp are easily identified by the bilaterally symmetrical arrangement of two groups of canals (haemorrhodilates sensu Pryor 1975) that run the length of the pellets parallel to the long axis (Moore 1932). These canals derive from projections extending from the posterior margin of the rear gut (Brönnimann 1972, 1976) that leave their mark on the still-fluid feces as it travels past them. These projections likely divert larger particles in the feces, which might irritate the tissues of the shrimp, away from the pellet edges (Pryor 1975). The pattern of canals is species-specific and aids ecologists studying modern ecosystems in identifying the pellet’s producers (Bromley 1990).

Localities

The first specimen (AMNH–FI–47145) was collected by Fiona Brady on 6 March 1999 as float on a gravel bar about 1/2km upstream (north) of route 520 and west of Ramanessin Brook Greenway Trail in Holmdel, NJ. The second specimen (AMNH–FI–50168) was collected by the author on 28 July 2001 as screened float upstream (northwest) of the Boundary Road Bridge between Holmdel and Marlboro, NJ.

AMNH–FI–47145 is 27.5mm in its longest dimension (Fig. 1). Exposed on its surface are several hundred individual coprolites (or pellets) with little or no visible cementing ground mass (Fig. 2). Each coprolite is about .75mm in diameter and up to 2mm long. Most of the visible coprolites are eroded, show negligible relief, and, owing to their organizational disarray, exhibit a variety of cross-sections. Several of the pellets are sectioned parallel to the long axis and expose the canals along their length (Fig. 3). Those that are sectioned perpendicularly to the long axis display the pattern of canals necessary for identification (Fig. 4).

AMNH–FI–50168 is 15mm in its longest dimension and 1cm in diameter (Fig. 5). The shape of the mass is finger-like and slightly oblong in cross section. Opposite the rounded end, the mass is broken and reveals some unweathered pellets. Otherwise, the preservation of the mass and individual pellets is similar to AMNH–FI–47145.

The canals in the coprolites of both the Ramanessin and Big Brook specimens seem to show a crescent-like cross-section (sensu Brönnimann 1972), which would place it in the ichnogenus Palaxius (Brönnimann and Norton 1960). There
appear to be 10 canals in each individual pellet arranged in much the same pattern as the five described 10-canal Palaxius ichnospieses (Blau 1993-2000, Blau et al. 1993) (Fig. 6). The canal cross-sections also appear to show somewhat expanded ends most similar to the Middle Jurassic to Oligocene P. decemlunulatus (Parejas 1948, Senowbary-Daryan and Kuss 1992), although the pellets of the new specimens are slightly larger than those described by Parejas.

**Discussion**

The genus Palaxius is known from as far back as the Middle Triassic (Joachim Blau, pers. comm.). Currently, North American Palaxius (P. salataensis Brönnimann, Cros & Zaninetti 1972) is only described from the Triassic, along with other crustacean coprolites: Parafavreina thoronetensis (Bonnimann, Caron & Zaninetti 1972, Thoronetia quinaria Brönnimann, Caron & Zaninetti 1972, and Payandea shastaensis Kristan-Tollmann & Tollmann 1983 (Blau et al. 1993, Kristan-Tollman and Tollman 1983). Brönnimann and Norton (1960) describe Favreina salevensis from the Upper Jurassic of Texas and mention thalassinidean-type coprolites from the Upper Jurassic of Alabama and the Lower Cretaceous of Florida. The Jurassic Alabama coprolites (identified as Parafavreina and Palaxius) are also mentioned by Andrew K. Rindsberg (Uchman and Rindsberg 1999) of the Geological Survey of Alabama as a future investigation by him and his colleague David C. Kopaska-Merkel. To date, the only Late Cretaceous records for Palaxius come from Colombia (P. cau­caensis Blau, Moreno & Senf 1995, Joachim Blau, pers. comm.) and Egypt (P. decemlunulatus Senowbary-Daryan and Kuss 1992).

Lauginiger (1988) states, “coprolites from sharks, bony fish, and arthropods are very common fossil finds in the Cretaceous sediments of Delaware,” but does not provide a description or figures of the specimens, nor is any institution mentioned that might hold specimens. Pryor (1975) mentions Atlantic Coastal Plain vermiform glauconite pellets and suggests a decapod fecal pellet origin for them, but the specimens reported here are the first definitive records of thalassinidean coprolites for this time period and area.

The Palaxius identification here is tentative as the appear-

**Figure 1.** Three views of AMNH–FL–47145. Scale bar equals 1 cm.

**Figure 2.** Areas on AMNH–FL–47145 with no adhering matrix show that there is little or no ground mass separating the individual coprolites. Notice that individual pellets abut one another (particularly the two above the scale bar) and that the majority of the photograph shows coprolitic (as opposed to ground mass) material. Scale bar equals 1 mm.
ance of the canals as crescents may be a diagenetic artifact resulting from the coalescence of adjacent rounded canals (Brönimann 1972, 1976). Due to variations inherent in each pellet, the effects of diagenesis, and the complication of polishing sandy samples, there can be difficulty in obtaining a single cross-section with all the identifying characteristics (Moore 1932). The specimens contain a large number of individual coprolites, thus increasing the chances of building up a composite image of a representative cross-section. Fine-tuning of the taxonomic identification awaits future laboratory preparation of the specimens.

Protocallianassa is the only thalassinidean in the paleo-fauna found at Ramanessin Brook (Poore 1994, Rathbun 1935) and the coprolites described here exhibit the very specific characters for thalassinideans, a group to which Protocallianassa belongs. Although connection of coprolites to their makers is notoriously unreliable, assignment of the coprolite masses to Protocallianassa is currently the most parsimonious explanation. Other varieties of invertebrate coprolite masses are fairly common in these beds, but do not exhibit the thalassinidean coprolite characteristics.

Each coprolite mass is interpreted here as the product of a single individual callianassid. Callianassid shrimp rarely leave the safety of their burrows (Bromley 1990), and by means of a current created by the beating of their pleopods, the individual shrimp propels waste out of its system of tunnels. These pellets can accumulate at the burrow exit (Bromley 1990). Although tidal currents can transport and concentrate callianassid fecal pellets into beds (Pryor 1975), such beds are not encountered at this site. It therefore seems unlikely that each of these masses represents a random fecal accumulation of more than one individual. However, it is possible that pellets from several individuals, concentrated by currents, filled a cavity creating a discrete mass.

The individual pellets of thalassinideans are very compact and greatly resistant to disintegration (Bromley 1990, Pryor 1975), but it is presently unclear how or why they remained adhered as masses.

Callianassid coprolites offer stratigraphic, morphologic, and possibly even dietary information, but have traditionally been neglected in the literature (Brönimann 1976). It is hoped that with this report will come a refined search-image in those working in the Cretaceous of New Jersey, as well as recognition by those who work on invertebrate coprolites that the range of deposits producing this type of specimen has been expanded, and a temporal gap filled.

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Figure 5 Four views of AMNH-FI-50168. Scale bar equals 1 cm.

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Literature Cited


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Fig. 6 Natural cross-section of one coprolite of AMNH–FI–47145 showing the sagittal line of symmetry ("sl" in diagram) and the pattern of canals interpreted here as two sets of five crescent-shaped canals (dotted lines in diagram show location of 10 canals). Scale bar equals 1 mm.