Report on Pseudoscorpions in Cretaceous New Jersey Amber

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Abstract

The Summary list of Fossil Spiders and their Relatives presented by Dunlop, Penney, and Jekel (2019) makes no mention of pseudoscorpions in New Jersey amber. However, pseudoscorpions do exist in New Jersey amber, but have yet to be studied (Harms & Dunlop, 2017; Grimaldi *et al*., 2002). Therefore, I will make the first identification and official report of pseudoscorpions preserved in the Turonian-aged New Jersey amber. The identification of these specimens will be added to the New Jersey amber faunal assemblage and provide additional fossil context for Pseudoscorpiones in the Mesozoic era.

New Jersey Amber

- Primary source of New Jersey is in Sayreville, New Jersey (Figure 1: red star)
- Depositional setting was marginal marine along an ancient Atlantic Ocean shoreline (Figure 2). Lithology shows an interdistributary delta fed by slow-flowing streams exposed to tidal effects and alternating between freshwater and brackish anoxic conditions (Grimaldi *et al*, 1989; Grimaldi & Nascimbene, 2010).
- New Jersey amber is found *in situ* in the South Amboy fire clay and the Old Bridge sand members of the Raritan Formation (Figure 1: red arrow) (Christopher, 1979; Grimaldi *et al*. 1989).
- The South Amboy Fire Clay is 6-7m deep and interbedded with thinner layers of sand and coarse lignitic peat (Figure 3:red arrow) (Christopher, 1979).
- A Cupressaceae tree is the botanical origin of the New Jersey amber (Anderson, 2006; Grimaldi, 2000; Grimaldi & Nascimbene, 2010).
- The Raritan amber nodules have a similar chemical make-up but varies in size, shape, and color (Grimaldi et al, 1989).
  - Pieces range from small droplets and nodules several millimeters in diameter (Grimaldi & Nascimbene, 2010; Grimaldi *et al.*,1989).
  - Smaller nodules are mostly transparent and vary from pale yellow to deep red. Larger pieces are translucent to complete opaque (Grimaldi *et al.*, 1989).
- The New Jersey has preserved plants, fungi, and four animal phyla (Nematoda, Tardigrada, Arthropoda, and Vertebrata.
  - 15 orders of insects
  - Three groups of arachnids present (Araneae, Acari, and Pseudoscorpiones.

Figure 1:New Jersey State. Red Star: collecting locality; blue dashed line indicates ancient shoreline

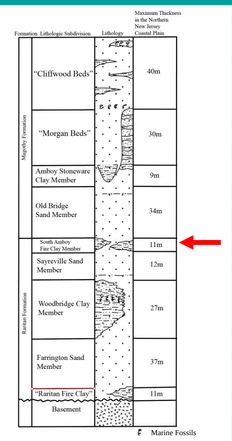

Figure 3: Stratigraphic Column of Raritan and Magothy Formations. Red arrow: the member where amber is found.

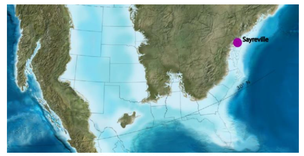

Figure 2: Late Cretaceous Paleogeographic map (credits: Blakey)

Pseudoscorpions in Cretaceous Amber

- Most pseudoscorpion fossils are preserved in amber because of their relatively soft body (Harms & Dunlop, 2017).
- Pseudoscorpions first appeared in the Devonian Period (419-358mya) (Harms & Dunlop 2017).
- Currently, there are only five pseudoscorpion species described from the Mesozoic Era (Table 1).
- The Burmese contains the most pseudoscorpions with over 50 specimens in collections (Grimaldi *et al*., 2000). They are currently being studied (Selden & Ren, 2017), but many of the other ambers go unstudied (Figure 34
- Pseudoscorpions exist in Lebanese and New Jersey amber, but have gone unstudied (Grimaldi *et al*, 2002; Whalley, 1980).

Amber	Family	Genus	Species	Author/Determiner
Burmese	Chthoniidae	*Weygoldtiella*	*plauses*	Harvey *et al*., 2018
	Feaellidae	*Protofeaella*	*peetersae*	Henderickx *in* Henderickx & Boone, 2016
	Garypinidae	*Amblyolpium*	*burmiticum*	Cockerell, 1920
	Cheiridiidae	*Electrobisium*	*acutum*	Cockerell, 1917
Archingeay	Cheliferidae?	indet.	indet.	Judson, 2009
	Cheliferidae?	*Heurtaultia*	indet	Judson, 2009
	Cheliferidae?	*Heurtaultia*	*rossiorum*	Judson, 2009
Canadian	Chernetidae	indet.	indet.	Schawaller, 1991
Lebanese	indet.	indet.	indet.	Mentioned by Whalley, 1980
New Jersey	indet.	indet.	indet.	Mentioned by Grimaldi et al., 2002

Table 1: Summary of reported and known pseudoscorpions.

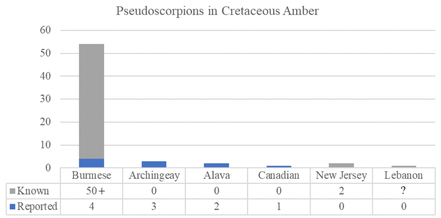

Figure 4: Comparison of pseudoscorpions described and those known and in collections

MAPS-001 Undescribed, Garypinidae?

AMNH-NJ:1130 Undescribed, Cheliferidae?

Materials & Methods

- Specimens were provided on loan by American Museum of Natural History (AMNH) and the Monmouth Amateur Paleontological Society (MAPS).
  - MAPS is a private collection, but the specimen is currently housed at the University of Kansas.
- NJ amber fractures easily and is highly susceptible to degradation (Nascimbene & Silverstein, 2000). Biscula et al. (2008) the amber darkens and fractures when exposure to heat and fluctuations in humidity. Thus, conservation is required.
  - Long-term conservation of Raritan amber requires embedding in high-quality epoxy (Grimaldi et al. 1989; Nascimbene & Silverstein, 2000).
  - AMNH-NJ:1130 was embedded in 2014 by Paul Nascimbene for conservation.
  - MAPS-001 was inadequately stored and needed conserving. The specimen was embedded in January 2019.
- Specimens were photographed used a Canon EOS 6D Mark II attached to a Leica M205C stereomicroscope.
- Images were aligned and stacked using Adobe Photoshop.

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