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Nota científica/Scientific note

FIRST RECORD OF *OPHTHALMOPLAX BRASILIANA* (MAURY, 1930) (CRUSTACEA, DECAPODA, BRACHYURA) FROM THE UPPER CRETACEOUS (CAMPANIAN) OF THE POTIGUAR BASIN, NORTHEAST OF BRAZIL

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ABSTRACT – This paper documents the occurrence of *Ophthalmoplax brasiliana*, the first fossil crab in the Potiguar Basin based on an adult male specimen collected in the outcrop of the Jandaíra Formation (Campanian). The material was obtained from the carbonatic layers of the Upper Cretaceous near the city of Apodi, west of the State of Rio Grande do Norte. This is probably the oldest record of this species in the Americas and a contribution to the knowledge of the paleobiogeography of this taxonomic group.

Key words: Macropipidae, Portunoidea, Jandaíra Formation.

INTRODUCTION

The collection and description of decapod crustaceans from the Cretaceous of Brazil have increased in recent decades (Martins-Neto, 1987, 2001; Martins-Neto & Mezzalira, 1991; Maisey & Carvalho, 1995; Santana *et al*., 2013; Pinheiro *et al*., 2014) and provide valuable information on the evolution and distribution of these organisms in this period.

In Brazil, decapod occurrences have been recorded for the following formations: Riachuelo (*Brazilomunida brasiliensis* Martins-Neto, 2001; *Maurimia sergipensis* Martins-Neto, 2001; *Archaeopus rathbunae* Beurlen, 1965), Santana (*Beurlenia araripensis* Martins-Neto & Mezzalira, 1991; *Araripecarcinus ferreirai* Martins-Neto, 1987; *Paleomattea deliciosa* Maisey & Carvalho, 1995; *Kellnerius jamacaruensis* Santana, *et al*., 2013; *Araripenaeus timidus* Pinheiro *et al*., 2014), Marizal (*Palaemon bahiensis* Roxo, 1940; *Atyoida roxoi* Beurlen, 1950), and Itamaracá (*Callianassa* sp.) for the Lower Cretaceous. Beberibe (*Callianassa beberibae* Beurlen, 1962) and Gramame [*Ophthalmoplax brasiliana* (Maury, 1930) in Beurlen, 1958; *Paleoxanthopsis cretacea* (Rathbun, 1902) in Beurlen, 1958; *Callianassa mottai* Beurlen, 1962; *Callianassa massarandubae* Beurlen, 1962] for the Upper Cretaceous, all collected in sedimentary basins in northeastern Brazil (Martins-Neto, 2005).

The occurrence of fossil crustaceans for the Jandaíra Formation was restricted to conchostracans and ostracods. However, Martins-Neto (2005) stated that the Cretaceous outcrops of the Potiguar Basin could potentially reveal the existence of fossils of decapods. Thus, here we record the presence of *Ophthalmoplax brasiliana* (Maury, 1930) in the Jandaíra Formation. This is the first occurrence of a fossil decapod in the Potiguar Basin.

GEOLOGICAL SETTING

The studied fossil specimen was collected in the region near the municipality of Apodi, State of Rio Grande do Norte, Brazil (Figure 1).

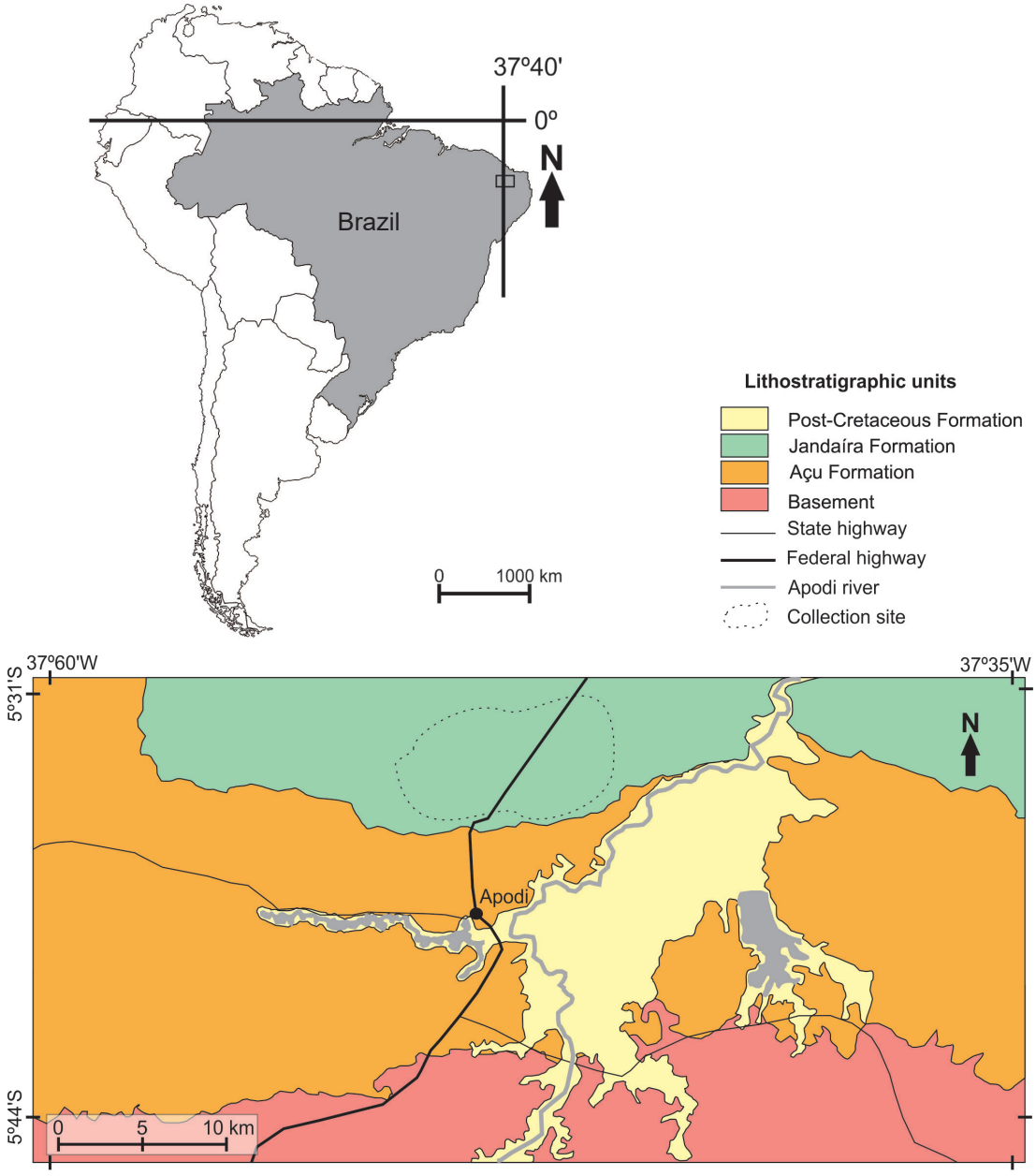

Figure 1. Location map of the collection area in Potiguar Basin, State of Rio Grande do Norte, Brazil.

The sample was obtained from an outcrop of the Jandaíra Formation belonging to the Apodi Group of the Potiguar Sedimentary Basin, which emerged from the fracturing of the supercontinent Gondwana (Cainelli & Mohriak, 1999). This area is located in the northernmost region of northeast Brazil. It is a rift basin that was formed in the Early Jurassic during the separation of the South American and the African plates. Its origin is linked to the formation of the South Atlantic Ocean and related to a series of intracontinental Neocomian basins that make up the rift zone system of northeastern Brazil (Matos, 1992). These rift systems are covered by Cretaceous and Paleogene sediments.

The Jandaíra Formation is a sediment sequence of the Turonian–lower Campanian stages characterised by the predominance of marine carbonates formed in shallow and agitated water environments (Tibana & Terra, 1981; Souza-Lima *et al*., 2007). Its composition is a mixture of calcarenites and bioclastic calcilutites that range from light grey to yellow in colour and exhibit evaporites at the base layer. Near the city of Apodi, where the studied specimen was obtained, an analysis of the limestone showed low dolomite content and the absence of clay and sand. This last feature could indicate that the area near the coast was flat without rugged terrain, or the predominance of a semi-arid climate that prevented the formation of large rivers to carry the matter from continental weathering (Beurlen, 1967). The occurrence of benthic foraminifera and green algae, and the presence of roots and contraction cracks are characteristics that point to a tidal flat environment, although a shallow platform predominated in some places

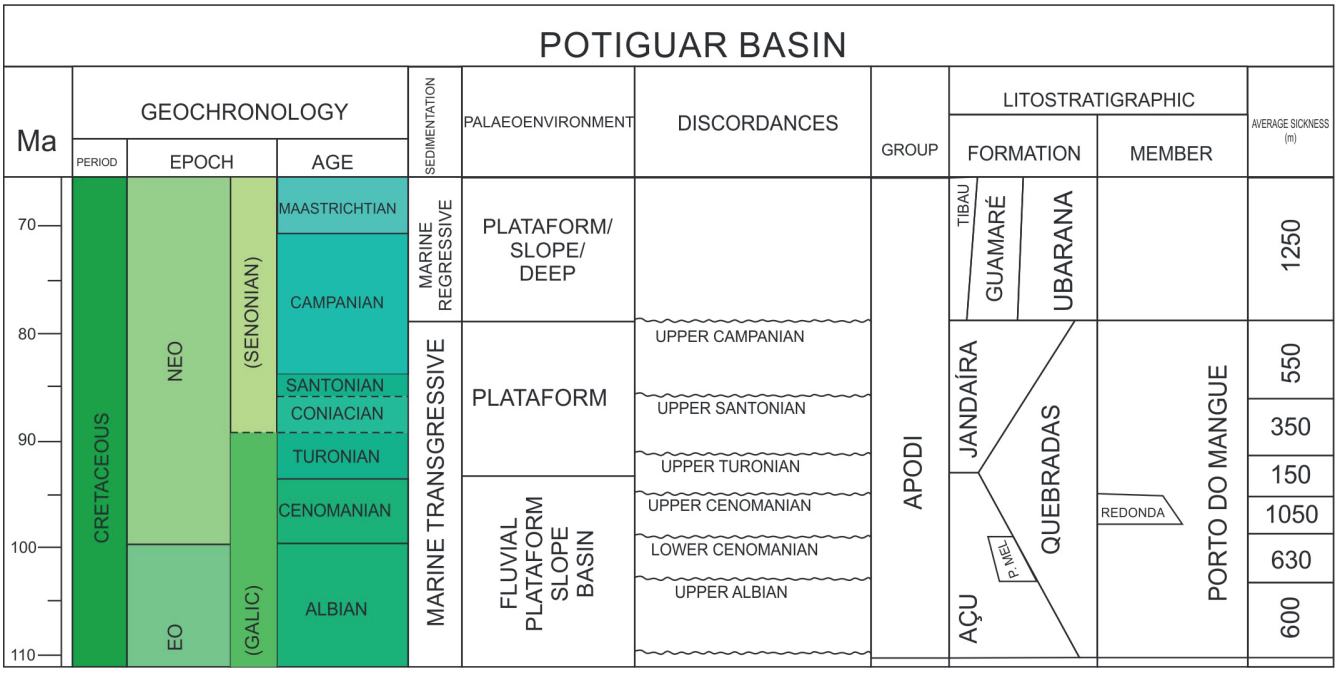

Figure 2. Cretaceous stratigraphic chart of Potiguar Basin (modified from Pessoa-Neto *et al.,* 2007).

(Cassab, 2003). Beurlen (1961, 1964, 1967) subdivided the Jandaíra Formation into a lower part, of Turonian age, restricted to the Chapada do Apodi, of the Vale do Rio Açu westward to its western boundaries in Ceará, and an upper part, with sediments of the Campanian–Maastrichtian, with a gap between them, corresponding to a regressive phase (Figure 2).

Córdoba *et al*. (1996) studied the carbonates of the southwestern rim of the Potiguar Basin, in the region near the city of Apodi. They defined a depositional model of a tidal flat system integrating the supratidal, mesotidal and infratidal zones in the paleophysiography of the bay. According to the authors, the faciological relationships and low biotic diversity indicate the existence of conditions that restricted marine life in the area.

In the Jandaíra Formation, molluscs and echinoids are the most abundant and diversified macrofossils. In addition to these invertebrates, there are records in the literature of foraminifera, bryozoans, corals, polychaetes and conchostracans, and fragments of other crustaceans (Lana & Carvalho, 2002; Cassab, 2003). There are also records of trace fossils of invertebrates and some fossils of vertebrates, including at least three species of fish and a turtle (Cassab, 2003; Machado & Brito, 2006). Plant records include the charred remains of plants, some leaves attributed to dicots, and trace fossils throughout the formation. When analysed in their totality, the fossils preserved in the limestone of the Jandaíra Formation are quite diverse. However, local low species diversity was also noted, with a predominance of one or two species for each outcrop (Cassab, 2003). As for the taphonomy, autochthonous deposits with individuals presented in life position predominate in the tidal flat facies and the lagoon facies (Cassab, 2003).

SYSTEMATIC PALEONTOLOGY

Subphylum CRUSTACEA Brünnich, 1772
Order DECAPODA Latreille, 1802
Suborder PLEOCYEMATA Burkenroad, 1963
Infraorder BRACHYURA Latreille, 1802
Superfamily PORTUNOIDEA Rafinesque, 1815
Family MACROPIPIDAE Stephenson & Campbell, 1960

Ophthalmoplax Rathbun, 1935

Ophthalmoplax brasiliana (Maury, 1930)
(Figure 3)

Material examined. One (01) specimen, Laboratório de Paleontologia da Universidade Regional do Cariri (**URCA**), LPU n. 1505 (Figure 3).

Description (based on the collected specimen). Carapace medium to large; subhexagonal in shape; slightly wider than long; widest at anterior third; spines not visible; orbits long, eyestalk calcification not preserved; anterior margin approximately 90 percent maximum carapace width, slightly sinuous; outer orbital spine not visible; cuticle granulose; anterolateral margin nearly straight, nearly half the maximum carapace length; posterolateral margin about half maximum carapace length; posterior margin rimmed, straight; dorsal carapace marked by transverse ridges and slight grooves; sharp transverse ridge in proximal portion of mesogastric process; protogastric process downturned on distal portion; mesogastric region subpentagonal; meta and urogastric regions undifferentiated; cardiac region subtrapezoidal; intestinal region subtriangular; hepatic

region with a median tubercle; mesobranchial region with weak transverse ridge and stout tubercle on lateral margin; metabranchial region with strong but short transverse ridge, posterior edge bounded by short and deep branchiocardiac groove; cervical and branchiocardiac grooves impressed; sternum wide; sternites 1 and 2 fused, triangular; suture present between sternites 2 and 3; sternite 3 transversely rhombic, notches on posterolateral margins; sternite 4 subtrapezoidal, lateral margins concave, rimmed, notches on posterolateral margins, episternal projection reaching posterior margin of sternite 5; sternite 5 subrectangular, notch on posterolateral margins ; sternites 6 and 7 subrectangular, without notches; sternite 8 small, visible on ventral view; male abdomen narrow, triangular, widest at level of somite 3; appendages not preserved; male pleon narrow, triangular, widest at level of somite 3; telson subtriangular, elongate, nearly as long as length of sternite 4, posterior margin concave at median portion; somite 6 subrectangular elongate, as long as sternites 5 and 6, one-third wider than telson but similar length (13.60/13.63 mm, respectively), posterior margin concave at mid portion, strong but narrow transverse ridge on central portion; somite 5 subtrapezoidal slightly wider at its base but shorter (8.36 mm) than somite 6; somite 4 subrectangular, approximately one-third wider and shorter than somite 5, somite 3 median transverse ridge larger than the width of that of somite 4, posterior margin invisible; somites 3-5 not fused; somites 2 and 1 not entirely preserved; coxa of Pereopod 1 semicircular with posterior process.

Remarks. Vega *et al*. (2013) distinguishes two different morphometric patterns of *Ophthalmoplax brasiliana* specimens based upon their dorsal carapace measurements: medium specimens = 30–52 mm carapace length/35–61 mm carapace width; large specimens = 44–120 mm carapace length/50–123 mm carapace width. Our specimen is a "large specimen", with the following measurements: 71.90 mm carapace length; 69.39 mm carapace width. Other measurements (all in mm): Width telson base = 10.39; length telson = 13.60; length somite 6 = 13.63; width somite 6 = 12.02; length somite 5 = 8.36; width somite 5 = 12.95; length somite 4 = 7.38; width somite 4 = 16.40; width somite 3 = 24.11; length sternite 1-2 = 6.57; length sternite 3 = 5.68; length sternite 4 = 14.35; length sternite 5 = 7.91; length sternite 6 = 8.99; length sternite 7 = 11.24; length sternite 8 = 5.77.

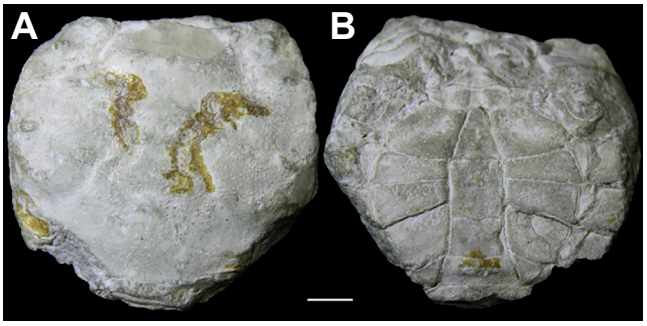

Figure 3. A, dorsal and **B**, ventral views of *Ophthalmoplax brasiliana* (Maury, 1930) (LPU 1505) from Potiguar Basin, Brazil. Scale bar = 10 mm.

DISCUSSION

The genus *Ophthalmoplax* have been recorded from the Upper Cretaceous on the East Coast of North America (Rathbun, 1935; Stenzel, 1952; Vega & Feldmann, 1991 as their junior synonymous *Mascaranada* and by their senior synonymous (Schweitzer *et al*., 2007; Vega *et al*., 2007) and in South America (Colombia, Venezuela, and Brazil) (Maury, 1930 as junior synonymous *Zanthopsis*; in Beurlen, 1958, 1965 as junior synonymous *Archaeopus*; and by their senior synonymous in Feldmann & Villamil, 2002; Souza Lima *et al*., 2003; Aguilera *et al*., 2010). This genus is also known for the African Upper Cretaceous (Campanian), in Morocco (Ossó-Morales *et al*., 2010). However, all stratigraphic occurrences of *Ophthalmoplax brasiliana* in America match the stratigraphic units of the Maastrichtian (Vega *et al*., 2013).

Schweitzer *et al*. (2007) primarily used differences in form and degree of development of regions of the dorsal surface of the carapace to recognize the following species of *Ophthalmoplax*: *O. stephensoni* Rathbun, 1935; *O. brasiliana* (Maury, 1930); *O. comancheensis* Rathbun, 1935; *O. triambonatus* Feldmann & Villamil, 2002; and the questionable *O. spinosus* Feldmann *et al*. (1999). According to Karasawa *et al*. (2008), *Ophthalmoplax* belongs to Macropipidae, although some features should be discussed in future reviews on the systematic placement of this genus (Ossó-Morales *et al*., 2010).

More recently, Vega *et al*. (2013), in a study on the variation in morphology and size of fossil species of Portunoidea, reviewed 76 occurrences of *Ophthalmoplax* from the Maastrichtian of the Americas and recommended the inclusion of all of them in the senior synonym *Ophthalmoplax brasiliana* (Maury, 1930).

The Maastrichtian specimens of the genus were described on more complete specimens, while *Ophthalmoplax comanchensis* was based on isolated movable fingers and a fixed finger. In this species the occlusal teeth are more numerous and massive, all inconsistent with the hypodigm of *O. brasiliana* (Vega *et al*., 2013). Based on the stratigraphic occurrence of *O. comancheensis* in the Albian deposits in Texas, Feldmann & Schweitzer (2006) considered the possible origin of the genus in the Early Cretaceous.

In Brazil, *Ophthalmoplax brasiliana* was only recorded in two localities of the Pernambuco-Paraiba Basin, Gramame Formation, interpreted as a shallow marine environment and ranging between middle to late Maastrichtian (Souza-Lima *et al*., 2003). For the Potiguar Basin, this is the first occurrence of a fossil crab. Martins-Neto (2005), in a review on the Brazilian paleoarthropod fauna, state that the Potiguar Basin is a promising region in relation to the presence of fossil decapod crustaceans of the Cretaceous. The record of *O. brasiliana* in deposits in the Jandaíra Formation (Campanian) is probably the oldest record of this species

in sedimentary basins in the Americas. This record also confirms the suggestion of Ossó-Morales *et al*. (2010) on the rapid dispersion of the group from the origin in Africa and westward across the Proto-Atlantic. In America, this dispersion probably started in the Potiguar basin region southward (until the Gramame Formation) and northward to the East Coast of North America.

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