

Pseudonecrocarcinus eichhorni* n. sp. (Brachyura, Raninoidea, Paranecrocarcinidae) from the Late Cretaceous (Coniacian) of Montana (USA)**Pseudonecrocarcinus eichhorni* n. sp. (Brachyura, Raninoidea, Paranecrocarcinidae) del Cretácico tardío (Coniaciano) de Montana (EUA)**Torrey Nyborg¹, Alessandro Garassino¹, Gianni Pasini², Francisco J. Vega^{3,*}¹ Department of Earth and Biological Sciences, Loma Linda University, Loma Linda, CA 92350, USA.² Via Alessandro Volta 16, 22070 Appiano Gentile (Como), Italy.³ Instituto de Geología, Universidad Nacional Autónoma de México, Ciudad Universitaria, Coyoacán, CDMX, 04510, Mexico.* Corresponding author: (F.J. Vega) veguer@unam.mx**ABSTRACT**

The new species, *Pseudonecrocarcinus eichhorni* (Paranecrocarcinidae Fraaije, Van Bakel, Jagt and Artal, 2008) from the Late Cretaceous (Coniacian) of Montana is herein described. This new species represents the second report for the genus from the Late Cretaceous of USA.

Keywords: Crustacea, Decapoda, taxonomy, Late Cretaceous, Montana, Western Interior sea-way, USA.

RESUMEN

La especie nueva *Pseudonecrocarcinus eichhorni* (Paranecrocarcinidae Fraaije, Van Bakel, Jagt and Artal, 2008) del Cretácico Tardío (Coniaciano) de Montana es descrita aquí. Ésta nueva especie representa el segundo reporte para el género, del Cretácico Tardío de los EUA.

Palabras clave: Crustacea, Decapoda, taxonomía, Cretácico Tardío, Montana, Mar Interior Oeste, EUA.

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1. Introduction

The Family Paranecrocarcinidae Fraaije, Van Bakel, Jagt and Artal, 2008 shows a North Atlantic-Western Tethyan distribution based upon the fossil record known to date. Indeed, earliest reports of representatives of paranecrocarcinid crabs have been recorded on both sides of the North Atlantic, and new occurrences have been reported through western Asia into Africa from the Late Cretaceous (see Schweitzer *et al.*, 2016: fig. 13).

Subject of this paper is the description of a new species of paranecrocarcinid crab from the Late Cretaceous (late Coniacian) of Montana, representing the second record of the Paranecrocarcinidae from the Late Cretaceous of USA.

2. Geological setting

The sole specimen was found as talus at the base of a large (approximately 35 meter) vertical cut bank exposure at Mud Creek, west-central Montana (Figure 1). The most thorough work on these deposits was published by Cobban *et al.* (2005). They measured a section in the NW-NE and SW-NE section 11, T6N, R17E, Wheatland County, along the south side of Mud Creek on the Shawmut Anticline southeast of Harlowtown, Montana (Cobban *et al.*, 2005). Their measured section and subsequent other measured sections and correlations match the locality where the specimen described herein was collected. The exposure consists of dark-gray clayey shale interbedded with 1-2 meter thick sandstone beds. Approximately 11 meters from the base of the exposure is a bed that forms a prominent south-dipping bench that correlates to the MacGowan bed (Cobban *et al.*, 2005). The MacGowan bed forms a distinctive concretionary bed interpreted as having formed during a relative sea-level lowstand event of the Cretaceous Western Interior seaway and has been correlated as a sequence boundary within the marine section traced over much of west-central Montana and western Alberta (Cobban *et al.*,

1959, 2005).

The MacGowan bed lies disconformably on middle or lowermost upper Coniacian strata, and is overlain by mid to uppermost Coniacian beds (refer to Cobban *et al.*, 2005 for more detailed stratigraphy). Fossiliferous limestone and dolostone concretions occur throughout this section. Since the specimen described herein was collected as talus at the bottom of the exposure, the exact locality cannot be pin-pointed; however the exposure as measured and correlated by Cobban *et al.* (2005) is from the Coniacian, based on the occurrence of the MacGowan bed in the sequence and biostratigraphically constrained inoceramid bivalves and ammonites collected at this locality and similar lithologic localities within west-central Montana (Cobban *et al.*, 2005). This is the first fossil crab reported from these deposits.

3. Systematic palaeontology

Infraorder Brachyura Latreille, 1802

Section Raninoidea Ahyong, Lai, Sharkey, Colgan and Ng, 2007

Superfamily Necrocarinoidea Förster, 1968

Family Paranecrocarcinidae Fraaije, Van Bakel, Jagt and Artal, 2008

Genus *Pseudonecrocarcinus* Förster, 1968

Type species: *Necrocarcinus quadriscissus* Noetling, 1881, by monotypy [Late Cretaceous (Maastrichtian), The Netherlands].

Other fossil species: *Pseudonecrocarcinus bis-cissus* Wright and Collins (1972), Late Cretaceous (Cenomanian), UK; *P. digitatus* (Wright and Collins, 1972), Late Cretaceous (Cenomanian), UK; *P. eichhorni* n. sp. (herein); *P. foersteri* (Wright and Collins, 1972), Late Cretaceous (Cenomanian), UK; *P. gamma* (Roberts, 1962), Late Cretaceous (Cenomanian), USA; *P. graysonensis* (Rathbun, 1935), Early Cretaceous (Albian), USA; *P. milbournei* Collins, 2010, Late Cretaceous (Cenomanian), Nigeria; *P. moseleyi* (Stenzel, 1945), Early Cretaceous (Albian),

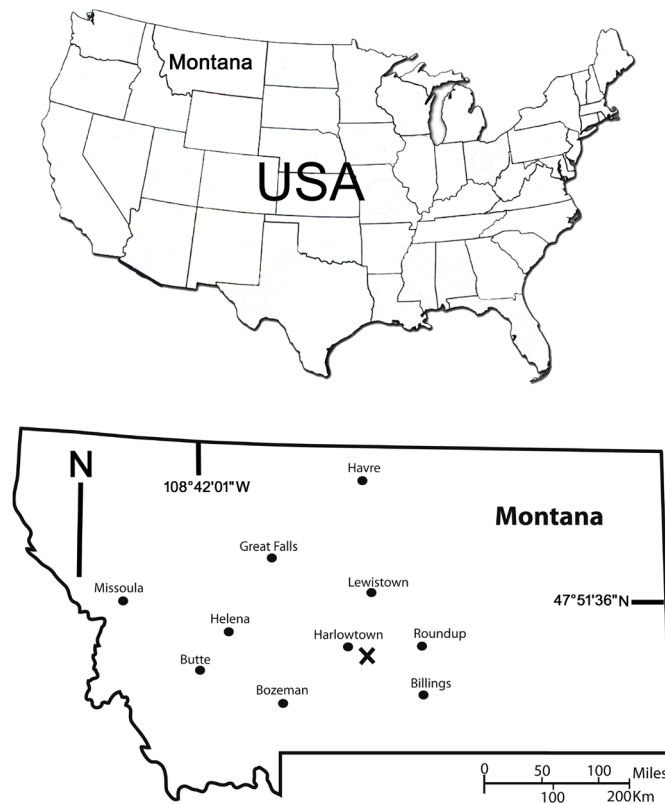


Figure 1 Generalized map of Montana State, USA showing major towns and location, marked by a X, where the specimen of *Pseudoneocarcinus eichhorni* n. sp. was collected.

USA; *P. pusillus* (Breton and Collins, 2011), Late Cretaceous (Cenomanian), France; *P. scotti* (Stenzel, 1945), Early Cretaceous (Albian), USA; *P. vanbirgeleni* Fraaije, 2002, Late Cretaceous (Maastriichtian), The Netherlands.

Pseudoneocarcinus eichhorni n. sp.

Figures 2A and 2B

Diagnosis: Suboval carapace wider than long, uniformly covered with granules; carapace with large swellings on gastric, cardiac, and branchial regions; anterolateral margin with nine spines; posterolateral margin with one spine followed by smaller granulations decreasing posteriorly; one pair of postrostral slits.

Etymology: The species is named in honour of Connie Eichhorn who has collected numerous fossils in Montana, many of which have been published in the scientific literature.

Holotype: UWBM IP 114701 (UWBM IP = The Burke Museum of Natural History and Culture, Invertebrate Paleontology Collections, University of Washington, Seattle, Washington State, USA).

Type locality: Bank exposure at Mud Creek, west-central Montana.

Material and measurements: One complete carapace in dorsal view (UWBM IP 114701 – carapace length: 16 mm; carapace width: 19 mm).

Description: Suboval carapace wider than long, weakly vaulted longitudinally, moderately flattened transversally; regions well defined; rostrum weakly projecting beyond orbits; postrostral region with two parallel longitudinal elongate slits, each ending in a distinct pit posteriorly forming a medial rounded elongate rim; front slightly downturned distally; frontal margin poorly preserved; rounded orbits forwardly directed; anterolateral

margin rounded, convex with nine triangular protruding spines (including epibranchial tooth), slightly increasing in size posteriorly; posterolateral margin nearly straight, fringed with small spines, decreasing in size posteriorly; posterior margin slightly concave medially; dorsal carapace covered by granules uniformly arranged, larger on the metabranchial and intestinal regions; short deep branchiocardiac grooves, delimiting cardiac region; smooth epigastric region slightly depressed; postorbital region inflated frontally; postorbital and

hepatic regions finely granulate, slightly depressed; hepatic region with one small tubercle near the lower of anterolateral margin; inflated protogastric regions with two distinct rounded equal tubercles; mesogastric region with two rounded stout tubercles, the anterior one larger; metagastric region with two deep gastric pits; cardiac region separated by gastric regions by wide depressed urogastric region; cardiac region rounded, inflated, with two equal tubercles ranged transversally; branchial regions moderately expanded laterally, convex, inflated,

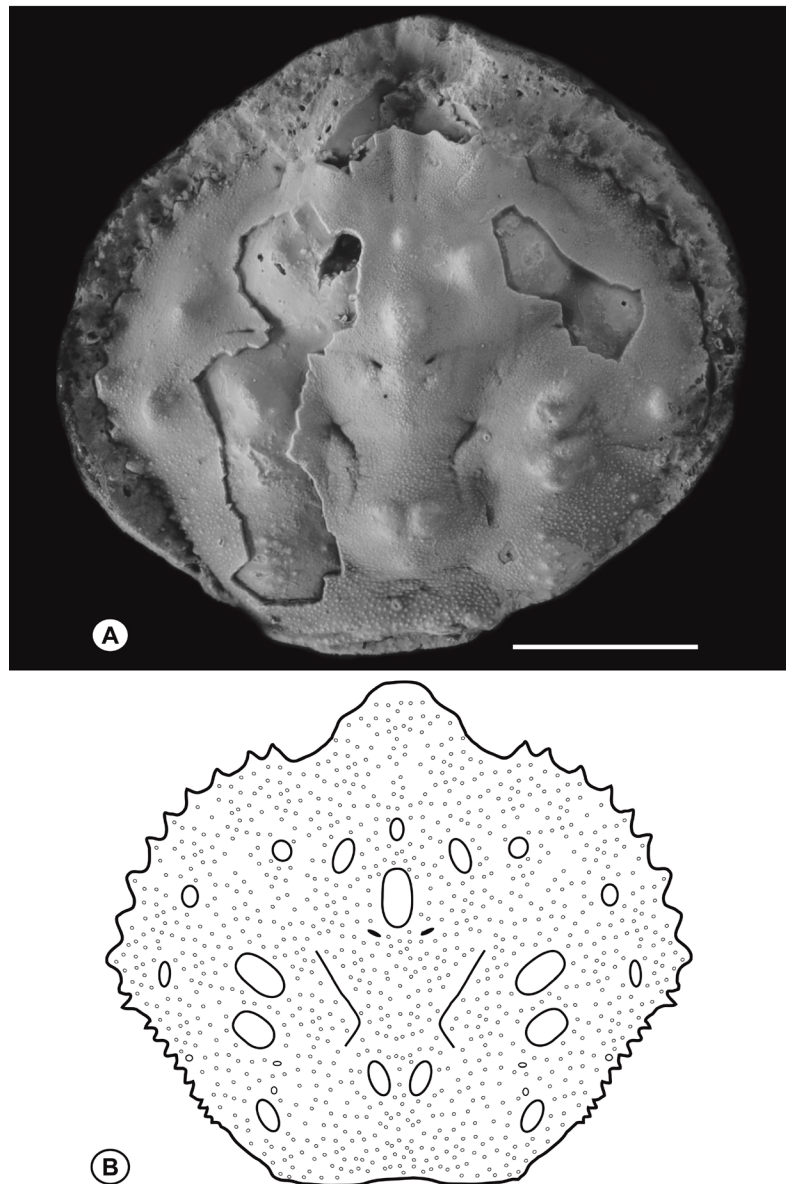


Figure 2 *Pseudonecrocarcinus eichhorni* n. sp., holotype UWBM IP 114701. A - Dorsal view. Scale bar equals 5 mm. B - Idealized line drawing of carapace.

with rounded protuberances; epibranchial region with one tubercle; mesobranchial region with two contiguous tubercles ranged longitudinally, the anterior one slightly smaller; metabranchial region with one stout tubercle; flat, short, and granulate intestinal region.

4. Discussion

Based upon the close review of the Necrocarinoidea Förster, 1968 by Schweitzer *et al.* (2016), the subfamily Paranecrocarininae Fraaije, Van Bakel, Jagt and Artal, 2008, was elevated to the rank of family, including three genera: *Paranecrocarinus* Van Straelen, 1936; *Protonecrocarinus* Förster, 1968; and *Pseudonecrocarinus* Förster, 1968. As reported by Schweitzer *et al.* (2016: 344, Tab. A2), this family is divided into two major clades: the first represented by *Paranecrocarinus* with four species (*P. balla* Van Bakel, Guinot, Artal, Fraaije and Jagt, 2012; *P. hexagonalis*, Van Straelen, 1936; *P. libanoticus* Förster, 1968, and *P. mozambiquensis* Förster, 1970) having just one tubercle on the protogastric region, and the second represented by the genera *Paranecrocarinus* and *Pseudonecrocarinus* which share only one character, the presence of one tubercle on the epibranchial region between the cervical and secondary grooves. The main characters for each genus have been confirmed by Schweitzer *et al.*, (2018: 12-14).

We can exclude the belonging of the studied specimen to *Paranecrocarinus* in having two aligned tubercles in the protogastric region.

We can rule out the belonging of the studied specimen to *Protonecrocarinus* including currently two species, *P. ovalis* (Stenzel, 1945) from the Early Cretaceous (Albian) of Texas (USA) and *P. tuberosus* Schweitzer, Feldmann, Kues and Bridge, 2017 from the Late Cretaceous (Turonian) of New Mexico (USA). The moderately flattened carapace, lacking of large swellings, the postrostral region with two parallel longitudinal elongate slits (*vs.* no slits in *P. ovalis* and *P. tuberosus*), the anterolateral margin with continuous and equal spines (*vs.* unequal spines separated by a notch in *P. ovalis*; equal spines and one

larger spine in *P. tuberosus*), and the cardiac region with two equal tubercles (*vs.* one tubercle in *P. ovalis* and *P. tuberosus*) exclude the belonging of the studied specimen to *Protonecrocarinus*.

We assign the studied specimen to *Pseudonecrocarinus* in having granular carapace, with regions ornamented with large tubercles, anterolateral margins with numerous spines, posterolateral margin fringed with several small spines, and epibranchial region with one tubercle between the cervical and secondary grooves.

Based upon the list of the species of *Pseudonecrocarinus* provided by Schweitzer *et al.*, (2016: 362) four species are reported to date from the Early and Late Cretaceous of USA: *P. gamma*, *P. graysonensis*, *P. moseleyi*, and *P. scotti*.

Pseudonecrocarinus graysonensis (= *Necrocarinus graysonensis*) was described by Rathbun (1935: 45) from one sole incomplete carapace from the Early Cretaceous (Albian) of Texas (USA). The anterolateral margin with five spines and the cardiac region with one tubercle, distinguish this species from *P. eichhorni* n. sp.

Pseudonecrocarinus moseleyi (= *Necrocarinus moseleyi*) was described by Stenzel (1945: 441) from one incomplete carapace from the Early Cretaceous (Albian) of Texas (USA). The anterolateral margin with eight tiny tubercles, of which six occur anterior to the hepatic notch, three small tubercles grouped together with the high epibranchial tubercle, and smooth cardiac region distinguish this species from *P. eichhorni* n. sp.

Pseudonecrocarinus scotti (= *Necrocarinus scotti*) was described by Stenzel (1945: 445) from one complete carapace from the Early Cretaceous (Albian) of Texas (USA). The rostrum and the carapace with 17 swellings distinguish this species from *P. eichhorni* n. sp.

Pseudonecrocarinus gamma (= *Paranecrocarinus gamma*) was described by Roberts (1962: 182) from one incomplete carapace from the Late Cretaceous (Campanian) of New Jersey (USA). The anterolateral margin with four spines, the posterolateral margin with three spines, and the urogastric region with one median tubercle distinguish this species from *P. eichhorni* n. sp.

5. Conclusion

Based upon the new species, the fossil record of *Pseudonecrocarcinus* Förster, 1968 includes to date 12 species, restricted from the Early Cretaceous (Albian) to Late Cretaceous (Maastrichtian). *Pseudonecrocarcinus eichhorni* n. sp. represents the second report for the genus from the Late Cretaceous of USA.

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