

New nephropid lobster (Decapoda: Astacidea) from the late Campanian of California; extending the range of Pacific coastal fossil lobster occurrences

Nueva langosta nefrópida (Decapoda: Astacidea) del Campaniano tardío de California; ampliando el alcance del registro de langostas fósiles en la costa del Pacífico

LSID urn:lsid:zoobank.org:pub:219D9751-2793-4430-9AA6-C9FC5E2053C0

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ABSTRACT

Two well preserved specimens of nephropid lobster from the Late Cretaceous (late Campanian) Point Loma Formation in San Diego County, California, form the basis of description of a new species of *Hoploparia*. The occurrence represents the southernmost fossil record of macrurus along the Pacific coast of North America and it is only the third fossil lobster from California.

Keywords: Cretaceous, Nephropoidea, Nephropidae, *Hoploparia*.

RESUMEN

Dos especímenes bien conservados de langosta de nefrópidos, de la Formación Point Loma del Cretácico Tardío (Campaniano tardío) en el condado de San Diego, California, forman la base para la descripción de una nueva especie de *Hoploparia*. Este acontecimiento representa el registro fósil de macrurus en el extremo sur a lo largo de la costa del Pacífico de América del Norte, y se trata de la tercera langosta fósil de California.

Palabras clave: Cretácico, Nephropoidea, Nephropidae, *Hoploparia*.

How to cite this article:

Feldmann, R.M., Schweitzer, C. E., 2021, New nephropid lobster (Decapoda: Astacidea) from the late Campanian of California; extending the range of Pacific coastal fossil lobster occurrences: Boletín de la Sociedad Geológica Mexicana, 73 (3), A241220. <http://dx.doi.org/10.18268/BSGM2021v73n3a241220>

Manuscript received: August 2, 2020

Corrected manuscript received: August 26, 2020

Manuscript accepted: August 30, 2020

Peer Reviewing under the responsibility of Universidad Nacional Autónoma de México.

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1. Introduction

The fossil decapod fauna of the west coast of North America is dominated by anomurans and brachyurans. Macrurans, the lobsters and their relatives (Table 1), are far less common and less diverse. The preponderance of their occurrences is in the north, in Washington and Alaska, USA, and in British Columbia, Canada. Previously, a single species, *Hoploparia shastensis* (Rathbun, 1929) was recorded in California. The sole specimen of that species was collected in Shasta County near the Oregon border. *Enoploclytia trisulcata* (Schweitzer and Feldmann, 2001) was reported from the Cenomanian Antelope Shale in Colusa County, also in northern California. Thus, the discovery of specimens of nephropid lobsters in San Diego County, the southernmost county in the state, significantly extends the southern range of Pacific coast lobsters and adds a new species of *Hoploparia* to the North American decapod fossil fauna.

Prior to this work, two brachyurans were recorded from the Point Loma Formation near Carlsbad, San Diego County (Bishop, 1988). *Xandarocarcinus sternbergi* (Rathbun, 1926) and *Icriocarcinus xestos* (Bishop, 1988), were collected from the same locality as the new species of lobster described herein. The specimens documenting these species were collected from an 800 ft. (244 m) road cut during excavation of the extension of College Boulevard in 1986 and 1987. The excavation exposed 90 ft. (27.5 m) of Cretaceous mudstone and shale containing abundant molluscs, the decapods, other invertebrates, vertebrates, and plants (Deméré, 1987), donated by the Koll Construction Company.

The purpose of the present work is to describe a new species of nephropid decapod crustacean from the Late Cretaceous of North America and to add to the vagrant benthic predator/scavenger fauna within the Point Loma Formation.

2. Methods

Specimens were prepared by the staff of the San Diego Natural History Museum, Department of Paleontology. Photographic illustrations were prepared using a Nikon D3100 camera with an AF-S

micro Nikkor 60 mm lens. Contrast and brightness were optimized in Adobe Photoshop CC2018. Abbreviations for morphological features of the cephalothorax follow Holthuis (1974). SDSNH denotes the San Diego Natural History Museum, San Diego, California, USA.

3. Systematic paleontology

Order Decapoda Latreille, 1802
 Infraorder Astacidea Latreille, 1802
 Superfamily Nephropoidea Dana, 1852
 Family Nephropidae Dana, 1852
Hoploparia M'Coy, 1849

Type species. *Astacus longimanus* Sowerby, 1826, by subsequent designation of Rathbun (1926).

Included species. See Schweitzer *et al.*, 2010, plus *H. bretoni* new species; *H. nasilowensis* Fraaije *et al.*, 2018.

Discussion. Tshudy *et al.* (2018) summarized work done on *Hoploparia* and other nephropid genera. They suggested that although the range of variation among species currently assigned to *Hoploparia* is wide, there is no obvious way to subdivide the genus. Thus, they, and we, maintain the genus as currently construed.

Hoploparia bretoni n. sp.

Figures 1, 2

LSID urn:lsid:zoobank.org:pub:219D9751-2793-4430-9AA6-C9FC5E2053C0

Etymology. The trivial name honors the late Gérard Breton, who contributed much to the paleontology of France, and to that of decapod crustaceans.

Types. Holotype, SDSNH 34151, and paratype, SDSNH 34152, deposited in the San Diego Natural History Museum, San Diego, California, USA.

Locality and stratigraphic position. The specimens were collected at SDSNH locality 3405, latitude 33.139519, longitude -117.283928, Carlsbad, San Diego County, California, USGS 1:24000 San Luis Rey, California topographic

Table 1. North American Pacific coast lobsters and their occurrences. E, e, early; L, l, late; M, m, middle.

Generic placement	Species	Authority	Age	Formation	Location
Infraorder Polychelida Scholtz and Richter, 1995					
Family Eryonidae de Haan, 1841					
<i>Wrangelleryon</i>		Feldmann, Schweitzer & Haggart, 2013			
<i>Wrangelleryon</i>	<i>perates</i>	Feldmann, Schweitzer & Haggart, 2013	Early Jurassic, Hettangian	Sandilands Formation	British Columbia, Canada
Palaeopentacheilidae Ah Yong, 2009					
Palaeopentacheles					
<i>Palaeopentacheles?</i>	<i>starri</i>	Schweitzer and Feldmann, 2001	Oligocene	Makah Formation	Washington, USA
Infraorder Achelata Scholtz & Richter, 1995					
Palinuridae Latreille, 1802					
<i>Linuparus</i>		White, 1847			
<i>Linuparus</i>	<i>canadensis</i>	Whiteaves, 1885	e. Campanian	Nanaimo Group Pender Formation	Vancouver & Hornby islands, BC, Canada
<i>Linuparus</i>	<i>vancouverensis</i>	Whiteaves, 1895	e. Campanian	Nanaimo Group, Pender Formation	Vancouver & Hornby islands, BC, Canada
Scyllaridae Latreille, 1825					
<i>Scyllarella</i>		Rathbun, 1935			
<i>Scyllarella</i>	<i>manlevi</i>	Feldmann & Schweitzer, 2017	Eocene	Lookingglass Formation	Oregon
Infraorder Glypheidea Winckler, 1881					
Erymidae Van Straelen, 1925					
<i>Enoploclytia</i>		M'Coy, 1849			
<i>Enoploclytia</i>	<i>minor</i>	Woodward, 1900 (Schweitzer & Feldmann, 2001)	L. Cretaceous (l. Campanian – e. Maastrichtian)	Spray Formation?	Hornby Island, BC, Canada
<i>Enoploclytia</i>	<i>trisulcata</i>	(Schweitzer & Feldmann, 2001)	L. Cretaceous (Cenomanian)	Antelope Shale	California, USA
<i>Pustulina</i>		Quenstedt, 1857			
<i>Pustulina</i>	<i>dawsoni</i>	(Woodward, 1900)	L. Cretaceous (l. Campanian – e. Maastrichtian)	Spray Formation?	Hornby Island, BC, Canada
<i>Stenodactylina</i>		Beurlen, 1928			
<i>Stenodactylina</i>	<i>walkerae</i>	(Feldmann & Haggart, 2008)	M. Jurassic (e. Bajocian – e. Callovian)	Smithers Formation	British Columbia, Canada
<i>Stenodactylina</i>	<i>beardi</i>	Feldmann, Schweitzer & Haggart, 2020	L. Cretaceous (l. Santonian – e. Campanian)	Haslam Formation	Vancouver Island, BC, Canada
Chimaerastacidae Amati et al., 2004					
<i>Chimaerastacus</i>		Amati, Feldmann & Zonneveld, 2004			
<i>Chimaerastacus</i>	<i>pacifluvialis</i>	Amati, Feldmann & Zonneveld, 2004	Middle Triassic (Ladinian-Carnian)		British Columbia, Canada
Glypheidae					
<i>Glyphea</i>		Von Meyer, 1835			
<i>Glyphea</i>	sp.	Whiteaves, 1903	Cretaceous	Nanaimo	Vancouver Island, BC, Canada
<i>Trachysoma</i>		Bell, 1858			
<i>Trachysoma</i>	<i>micheleae</i>	(Schweitzer & Feldmann, 2001)	Eocene (Lutetian)	Aldwell Formation	Washington, USA
Mecochiridae Van Straelen, 1925					
<i>Meyeria</i>		M'Coy, 1849			
<i>Meyeria?</i>	<i>harveyi</i>	Woodward, 1900	U. Cretaceous	----	Hornby Island, BC Canada
Astacidea					
<i>Hoploparia</i>		M'Coy, 1849			
<i>Hoploparia</i>	<i>bennetti</i>	Woodward, 1900	Late Cretaceous		British Columbia, Canada
<i>Hoploparia</i>	<i>horrida</i>	Schweitzer, Feldmann, Fam, Hessin, Hetrick, Nyborg, & Ross, 2003	e. Campanian	Pender Formation	Vancouver Island, BC Canada
<i>Hoploparia</i>	<i>riddlensis</i>	Feldmann, 1974	Hauterevian	Days Creek Formation	Oregon
<i>Hoploparia</i>	<i>shastensis</i>	Rathbun, 1929	L. Cretaceous	Chico Formation	California
<i>Hoploparia</i>	<i>tshudyi</i>	Schweitzer & Feldmann, 2001	l. Albian	Moonshine Formation	Wrangell Mts., Alaska USA
<i>Palaeonephrops</i>		Mertin, 1941			
<i>Palaeonephrops</i>	<i>ornatus</i>	(Whiteaves, 1887)	Late Cretaceous		British Columbia, Canada

map (Deméré, 1987). The locality exposes the Point Loma Formation in the Rosario Group, late Campanian in age. The matrix surrounding the specimens is a fossiliferous mudstone supporting sand size fragments of molluscs arrayed in what appear to be crude bedding surfaces. The lobsters are preserved within the matrix with no evidence of concretions.

Diagnosis. *Hoploparia* with well-developed cervical and postcervical grooves and faint branchiocardiac groove; with accessory intercervical and sellar grooves. Carapace ornamentation grades from granular to scabrous in cephalic region to nearly smooth in branchial region. Pleura and terga not separated by a crest.

Description. Moderate size for genus; dorsal margin straight with axial line; posterior margin weakly sinuous; ventral margin smoothly convex with deepest point in posterior half. Total carapace length including rostrum, 56.0 mm; length from base of orbit to posterior margin, 39.2 mm; length from base of orbit to where postcervical groove crosses midline, 20.4 mm; carapace height 25.7 mm measured at postcervical groove. Rostrum long, sulcate, curved downward proximally and upward distally. Rostral carina (R) strongly developed at least to mid-length where rostrum is broken. Rostral termination a sharp upward directed spine; lateral tooth (3) situated near terminus. Cephalic region finely granular anteriorly, becoming finely scabrous between cervical and postcervical grooves. Branchial region bearing a few granules. Orbital carina (O) distinct; orbit deepest ventrally. Supraorbital carina (P) smooth or with diminutive spines. Postorbital spine (8) short, prominent. Antennal carina (A) broad with sharp crest.

Cervical groove (e-e') deeply impressed, bounded posteriorly by row of coarse granules; extending from mid-height of carapace, curving ventrally into deep antennal groove (b) which bifurcates anteriorly into short, straight element and longer dorsally curved segment terminating at antennal carina (A). Inferior groove (i) deeply impressed, not extending to ventral margin. Postcervical groove (c) deeply impressed at midlength,

shallow crossing midline, and obscure ventrally. Intercervical groove (c') subtle, most prominent near postcervical groove. Sellar groove (s) deep, concave forward. Branchiocardiac groove (a) diverges from postcervical groove becoming obscure posteriorly. Posteromarginal carina (PM) and groove (p.m.) strongly developed, terminating at posteroventral corner.

Pleon with six somites present; telson and uropods not preserved. Overall surface of pleon smooth. Pleonite 1 length 5.5 mm, measured along midline of paratype. Pleonites 2 and 3 length 7.1 mm; pleonite 4 length 8.6 mm, pleonite 5 length 7.2 mm, pleonite 6 length about 10.4 mm. Pleuron 2 reniform with anterior lobe larger than posterior lobe. Pleura 3-5 cordate with short, sharp spine on posterior ventral corner.

Basal article of antenna stout, longer than high. Parts of basal articles of right and left chelipeds preserved. Right merus broadens distally, smooth. Carpus stout, slightly higher than long; two spines along midheight of outer surface. Propodus ovoid in cross-section, broken. Merus and carpus of left cheliped crushed, incomplete. Propodus broadens distally, compressed in cross-section, weakly sulcate along lower edge of outer surface.

Discussion. The species is represented by two specimens, the holotype, SDSNH 34151, consisting of an articulated cephalothorax and pleon as well as proximal elements of the chelipeds, and the paratype, SDSNH 34152, an isolated pleon comprising six pleonites but absent the telson and uropods. The pleon on both specimens is strongly flexed suggesting a condition of rigor, which in turn may suggest that the specimens are remains of corpses in which the muscles of the pleon are present. Strong flexure of the pleon results as the anterior oblique muscles contract upon death. These muscles form the major muscle mass in the pleon; the dorsal pleonal muscles, which are responsible for extending the pleon, are weaker (Feldmann and Schweitzer, 2010).

The cuticle on the holotype is strongly fractured in the branchial region and on the pleon, whereas that of the paratype is intact. In the posteroventral portion of the branchial region on the holotype,



Figure 1 *Hoploparia bretoni* n. sp. A-C, holotype, SDSNH 34151, A, right lateral view of carapace, pleon, and right cheliped; B, closeup of carapace with morphology labeled; C, dorsal view of cephalothorax and rostrum. D-E, paratype SDSNH 34152, D, dorsal view of pleon, E, right lateral view of pleon. Scale bars = 1 cm. Abbreviations: a = branchiocardiac groove, A = antennal carina, b = antennal groove, c = postcervical groove; c' = intercervical groove, e-e' = cervical groove, i = inferior groove, o = orbit, P = supraorbital carina, PM = postermarginal carina, p.m. = postmarginal groove, R = rostrum, 3 = lateral rostral spine, 8 = post-orbital spine.

the exocuticle surface is generally dense whereas the surface of the endocuticle exhibits a fine reticulate pattern (Figure 2). The surface of the mold of the interior of the cuticle is granular.

Placement of this new species in *Hoploparia* is confirmed by its having a typical nephropid form and exhibiting a long rostrum with suprarostreal spines, the subdorsal carina, well developed cervical and postcervical grooves, and a faint branchio-cardiac groove (Feldmann *et al.*, 2016). The new species is distinguished from the previously known species by possessing a pattern of carapace ornamentation of fine granules grading into a scabrous field in the cephalic region and a smooth branchial surface. A sellar groove is prominent and the intercervical groove, although present, is subtle. Although nearly all species of *Hoploparia* have a

well-developed demarcation between the tergum and pleuron, none is present on the new species. The pleuron of the second pleonite is typically bounded by a crest; such feature is not present on the new species. Thus, the combination of features supports assignment to a new species. The genus is one of the most speciose of the lobster taxa, with 67 species (Schweitzer *et al.*, 2010) ranging from Berriasian (Early Cretaceous) to Miocene.

4. Discussion

The extensive list of taxa collected from locality 3405 is dominated by molluscs, including in order of abundance, bivalves, gastropods, and cephalopods; an echinoid and four brachiopod valves represent the remaining invertebrates (Deméré,



Figure 2 Cuticular layers of *Hoploparia bretoni* n. sp., holotype, SDSNH 34151, right posterolateral area. Scale bar = 1 cm.

1987). Two shark vertebrae and a single hadrosaur tooth represent the only vertebrate remains. The shark as well as the cephalopods and some of the gastropods comprise the predatory members of the assemblage other than the decapods. The brachyurans and *Hoploparia bretoni* n. sp. represent a trophic position of mobile predators/scavengers that are underrepresented in the Point Loma Formation. The generally well-preserved remains of the decapods suggests that other members of the group may be anticipated when additional exposures are available.

Acknowledgements

Specimens forming the basis for this study as well as the detailed locality register documenting the locality were provided by T. Deméré, Curator of Paleontology of the Department of Paleontology, San Diego Natural History Museum in San Diego, California, USA. The paper benefited from a review by G. Schweigert, SMNS, Germany.

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