

A new cyclodorippid crab, *Berglundus bretoni* n. gen., n. sp. (Decapoda, Cyclodorippidae), from the Northeastern Pacific, USA

Un nuevo cangrejo ciclodorípido, Berglundus bretoni n. gen., n. sp. (Decapoda, Cyclodorippidae), del noreste del Pacífico, EUA

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ABSTRACT

A new cyclodorippid crab, *Berglundus bretoni* n. gen., n. sp. (Cyclodorippidae Ortmann, 1892) from the Astoria Formation (early to middle Miocene) of Washington State is herein described. It represents the fourth genus of cyclodorippids in North America, keeping the stratigraphic range and the palaeogeographic distribution of the Cyclodorippidae unchanged.

Keywords: Crustacea, Cyclodorippoidea, Miocene, taxonomy, Washington State, USA.

RESUMEN

Un nuevo cangrejo ciclodorípido, Berglundus bretoni n. gen., n. sp. (Cyclodorippidae Ortmann, 1892) de la Formación Astoria (Mioceno temprano a medio) del Estado de Washington, es descrito aquí. Este es el cuarto género de ciclodorípidos en Norteamérica, manteniendo el alcance estratigráfico y paleobiogeográfico intactos.

Palabras clave: Crustacea, Cyclodorippoidea, Mioceno, taxonomía, Washington, EUA.

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1. Introduction

According to Guinot *et al.* (2013) the Section Cyclodorippoida Ahyong, Lai, Sharkey, Colgan and Ng, 2007 includes 231 species within 46 genera, most of them extant. The fossil record of Cyclodorippoidae (Cyclodorippinae and Xeinostominae) is very scarce, restricted to only 4 genera with 10 species respectively (Schweitzer *et al.*, 2017). Bishop (1983) described *Hillius youngi* Bishop, 1983 from the Early Cretaceous (Albian) of Texas (USA). Feldmann *et al.* (2011) reported *Miotymolus quadratus* Feldmann, Schweitzer, Casadio and Griffin, 2011 from the Miocene of Tierra del Fuego (Argentina). *Tymolus* Stimpson, 1858 is the best-known genus of the family with a widespread palaeogeographic distribution including 7 species from the Miocene to Pliocene of Alaska, Washington State, and Oregon (USA) and Japan (for complete list see Nyborg and Garassino, 2020). Finally, Schweitzer (2001) reported *Xeinostoma antiqua* Schweitzer, 2001 from the late Eocene (Priabonian) of Washington State (USA).

Subject of this note is the description of *Berglundus* n. gen. from the Astoria Formation (early to middle Miocene) of Washington State (USA), representing the fourth genus of cyclodorippids from North America. Based upon this new report, the stratigraphic range and palaeogeographic distribution of the Cyclodorippidae remains unchanged.

2. Geological setting

The Astoria Formation is widely distributed in southwestern Washington, with outcrops along the Columbia River, especially between the old townsite of Knappton on the west and Altoona to the east, outcrops along the Naselle River, and Salmon Creek, near the town of Naselle, and in southwestern Washington in the Montesano and Willapa Hills area (*e.g.*, Weaver, 1937; Wolfe and Mckee, 1968, 1972; Wells, 1979, 1989; Logan, 1987; Walsh *et al.*, 1987). This unit is part of a sequence of early to middle Miocene, terrestrial

and marine beds of conglomerate, sandstone, and siltstone, exposed in the southwestern-most portion of Washington State, and tentatively correlated with the Astoria Formation of Oregon based upon faunal contents, stratigraphic position, and lithologic characteristics (*e.g.*, Rau, 1948; Snavely *et al.*, 1978; Wolfe and Mckee, 1972; Walsh *et al.*, 1987). The Astoria Formation of Washington locally interfingers with the Grande Ronde Basalt and the Wanapun Basalt of the Columbia River Basalt Group, which have been dated near the early-middle Miocene boundary (Walsh *et al.*, 1987). Fossils within the Astoria Formation of Washington State appear to represent that part of the unit below these basalt flows, placing the fossil crabs described herein most likely within the early Miocene. Age control is also based upon mineral isotope composition (Wolfe and Mckee, 1972), the biostratigraphical distribution of molluscs (Etherington, 1931; Moore and Addicott, 1987), and Foraminifera (Rau, 1948). Although the fossil decapod crustacean faunas suggest a similarity in depositional environments and past workers have believed that rocks assigned to the Astoria Formation in Oregon and those in Washington State to be contemporaneous, there is a marked difference in fossil decapod crustacean faunas from the Astoria Formation of Oregon and Washington State, with only one genus, *Mursia* Leach in Desmarest, 1822, found in both States (Nyborg, 2002).

All of the specimens, except for one, as described herein, were collected from sandy-siltstone exposures on a west-facing road cut along Pigeon Point, along the north shore of the Columbia River, near the town of Altoona, Washington State (USA) (Figure 1). Weaver (1937) was the first to map the area of the Grays River Quadrangle that contains the Pigeon Point area. Wolfe and Mckee (1968) gave a detailed map of the area correlating the outcrops at Pigeon Point with the Astoria Formation. Berglund and Goedert (1992) were the first to describe a fossil crab *Anisospinos wahkiakumensis* (Berglund and Goedert, 1992) from this locality, providing faunal details of the locality and surrounding outcrops. Two other fossil crabs have also been described from this locality,

Lophomastix altoonaensis Nyborg and Vega, 2008 and *Macrocheira columbiaensis* Nyborg, Nyborg, Garassino and Vega, 2016.

One additional specimen was collected from the stream gravels of Salmon Creek interpreted to have been derived from the Astoria Formation (Wolfe and Mckee, 1972) near the town of Naselle, Washington State, USA, in the NW1/4, NE1/4, T10N, R9W of the Knappton Quadrangle, Washington State-Oregon 7.5 minute series topographic map. *Munida branti* Nyborg and Garassino, 2015 is the only other fossil crab described from this locality.

Abbreviations: *L1*, length of carapace; *W1*, width of carapace; *W2*, frontal width; *W3*, fronto-orbital width; *W4*, posterior width.

3. Systematic palaeontology

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

Superfamily Cyclodorippoidea Ortmann, 1892

Family Cyclodorippidae Ortmann, 1892

Subfamily Cyclodorippinae Ortmann, 1892

Genus *Berglundus* nov.

Diagnosis: Carapace subcircular and gently convex in both direction; rostrum tridentate,

densely granular, axially depressed, ending into two small, sharp, triangular teeth forward directed; regions well defined and strongly inflated with 14 tubercles; anterolateral margin fringed with minute granules; smooth posterolateral margins.

Etymology: after Ross Berglund, deceased, who donated the studied specimens. Gender: masculine.

Type species: *Berglundus bretoni* n. gen., n. sp. by monotypy.

Discussion: Tavares (1993: 264) reported two families, Cyclodorippidae Ortmann, 1892 and Cymonomidae Bouvier, 1897, which are distinguished from each other by the difference in carapace outline and for the presence or absence of orbits.

Later, Tavares (1998) described the new family Phyllotymolinidae, including three extant genera. Finally Frantescu (2014) described the new family Quadratoplanidae, including just one sole genus from the Early Cretaceous (Albian) of Texas (USA). Although the studied specimens do not preserve ventral parts, useful diagnostic characters in the systematics of the Cyclodorippoidea, they can be assigned to the Cyclodorippidae for the subcircular carapace, the presence of orbits, and well-defined and inflated carapace regions. Indeed, we exclude their belonging to the Cymonomidae having subsquare carapace and absence of orbits.



Figure 1 Map drawing showing the approximate locality (X) where *Berglundus bretoni* n. gen., n. sp. was collected.

The carapace regions scarcely defined and inflated distinguish the Phyllotymolinidae from the studied specimens. Finally, the rectangular outline of the carapace and the flat and moderately developed carapace regions also distinguish the studied specimens from the Quadratoplanidae.

Based upon Schweitzer *et al.* (2017) the Cyclodorippinae includes three genera: *Hillius* Bishop, 1983 (fossil); *Miotymolus* Feldmann, Schweitzer, Casadio and Griffin, 2011 (fossil); and *Tymolus* Stimpson, 1858 (extant and fossil).

The tridentate rostrum, ending in two small, sharp, triangular teeth and the carapace regions strongly inflated with 14 tubercles distinguish the studied specimens from *Hillius* having a wide front and carapace regions not inflated and scarcely tuberculate (except protogastric and cardiac regions with one and two tubercles respectively); and from *Miotymolus* having a bifid rostrum and inflated carapace regions without tubercles.

The studied specimens share with *Tymolus* the granulate and inflated carapace regions with tubercles in some fossil species, like *T. bottemilleri* Nyborg and Garassino, 2020 or *T. collinsi* Nyborg and Garassino, 2020, and well marked by deep grooves. However, the tridentate rostrum, ending in two small, sharp, triangular teeth distinguishes the studied specimens from *Tymolus* having a bifid rostrum.

The shape of the rostrum of the studied specimens is unique among the fossil genera of the Cyclodorippinae, although the distinct rostral shape, as proven by some extant genera of the subfamily, such as *Coricodus* A. Milne-Edwards, 1880, *Clythrocerus* A. Milne-Edwards and Bouvier, 1899, and *Deilocerus* Tavares, 1993, include species having a highly variable rostral shape (Goeke and Heard, 1984; Tavares, 1993).

In conclusion, we justify the description of the new genus *Berglundus* for tridentate rostrum and the inflated carapaces regions with 14 tubercles, which are unique among the representatives of the Cyclodorippidae.

Berglundus bretoni n. gen., n. sp.
(Figures 2 and 3)

Diagnosis: As for the genus.

Etymology: after Gerard Breton (1944-2019) for his important contribution to the knowledge of Cenozoic fossil crabs.

Type material: Holotype UWBM IP 97181, and paratypes UWBM IP 97182-97193 (UWBM IP = The Burke Museum of Natural History and Culture, Invertebrate Paleontology Collections, University of Washington, Seattle, Washington State, USA).

Geological age: early to middle Miocene, Astoria Formation.

Measurements: (in mm) Holotype UWBM IP 97181, $L1 = 10.2$, $W1 = 10.2$, $W2 = 1.1$, $W3 = 2.7$, $W4 = 5.8$. Paratype UWBM IP 97185, $L1 =$ approximately 10.9, $W1 = 11.1$, $W2 = 1.8$, $W3 = 4.4$. Paratype UWBM IP 97186, $L1 =$ approximately 12.8, $W1 = 12.8$, $W2 = 2.5$, $W3 = 5.0$, $W4 = 7.1$. Remainder of paratype specimens only partially preserved.

Occurrence: The holotype UWBM IP 97181 and paratypes UWBM IP 97182-97192 were collected from concretions along Pigeon Point, along the north shore of the Columbia River, near the town of Altoona, Washington State (Figure 1). Paratype UWBM IP 97193 was collected from a concretion as float along Salmon Creek, near the town of Naselle. Specimen UWBM IP 97193 is only partially preserved, however dorsal carapace regions match that of the other specimens collected at Pigeon Point.

Description: Carapace subcircular, weakly vaulted transversely and longitudinally, length about 96 percent maximum carapace width; regions strongly inflated, delineated by deep grooves; carapace surface granular, almost pustulose on tubercles and frontal region, remainder of surface smooth; rostrum tridentate, densely granular, axially depressed, ending in two small, sharp, triangular spines directed forward (see Figure 2E: spine 3); pair of spines on either side, rounded, triangular, sharp, laterally directed, separated from medial spines by shallow U-shaped notch (see Figure 2E: spine 2); inner-orbital spines large, rounded, inflated, separated from adjacent spines by a deep U-shaped notch (see Figure 2E:

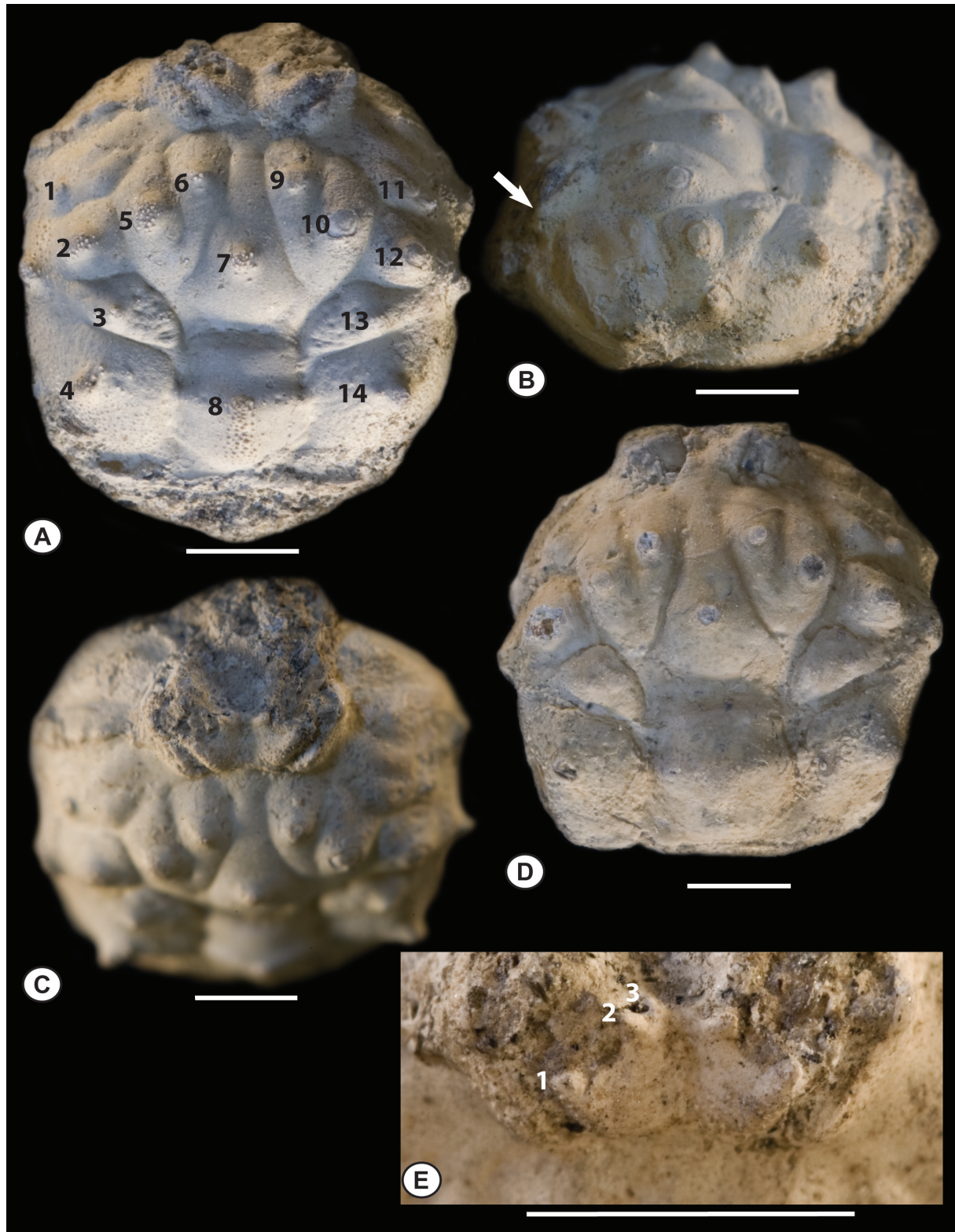


Figure 2 *Berglundus bretoni* n. gen., n. sp., A) Holotype, UWBM IP 97181, general view of carapace dorsal surface. Numbers 1-14 represent placement of the fourteen carapace tubercles. B) Holotype, UWBM IP 97181, right-lateral view of carapace. Arrow indicates outer-orbital spine. C) Holotype, UWBM IP 97181, close-up view of rostrum. D) Paratype UWBM IP 97185, general view of carapace dorsal surface. E) Holotype, UWBM IP 97181, close-up view of rostrum with numbers indicating the three spines of the rostrum. Scale bar equals 5 mm.

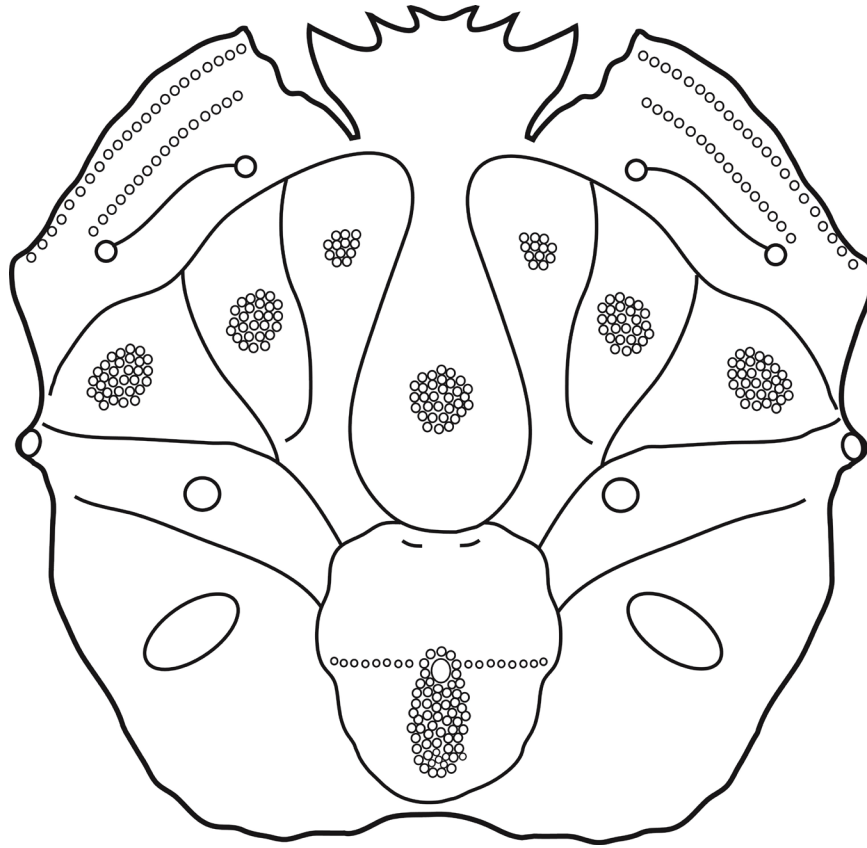


Figure 3 Idealized line drawings of *Berglundus bretoni* n. gen., n. sp. discussed herein. Line drawing not drawn to scale.

cle; small posterior portion with small, rounded tubercle; epigastric region transversely depressed, poorly defined; groove extends transversely, ending at base of outer-orbital spine; protogastric region longitudinally inflated, weakly triangular rounded, divided in half by a shallow, narrow, longitudinal groove, directed axially; protogastric region with one rounded, anterior tubercle and one posterior tubercle slightly larger than anterior one; triangular-shaped mesogastric region, narrow anteriorly, wider posteriorly with an axially median rounded tubercle; smooth depressed metagastric region with two deep gastric pits; rectangular urogastric region inflated only about half as much as other axial regions, defined by posterior depression and anterior and lateral grooves; rounded, weakly sub-pentagonal cardiac region; anterior transversely ridged with one median tubercle axially situated on anterior margin of region; granules on and axi-

ally of cardiac tubercle; intestinal region strongly reduced, not well differentiated; epibranchial region divided in two parts by deep groove; anterior separated by deep cervical groove; posterior by deep, narrow branchiocardiac groove; anterior portion quadrate, strongly inflated, with one large, rounded, median tubercle; triangular-shaped posterior portion, strongly inflated with one median tubercle; mesobranchial region with one median tubercle; smooth metabranchial region; sternum and appendages not preserved.

4. Conclusion

The fossil record of the Cyclodorippidae includes four genera *Hillius* Bishop, 1983 (fossil), *Miotymolus* Feldmann, Schweitzer, Casadio and Griffin, 2011 (fossil), *Tymolus* Stimpson, 1858 (fossil and extant), and *Xeinostoma* Stebbing, 1920 (fossil and extant) reported from the Early Cretaceous (Albian) to the Miocene of North and South America and Japan, suggesting that the cyclodorippids had an amphitropical distribution in the Miocene and the origin of the family most likely predated that time (Feldmann *et al.*, 2011). Based upon Tavares (1993, 1996) the Cyclodorippidae presently has a broad geographic range extending from northern Japan through the Indian Ocean and south to Tasmania in the Indo-West Pacific region and from the United States to northern Brazil. The extant representatives of the family in the Indo-West Pacific have usually a small-sized body (Davie, 2002; Poore, 2004) living at depths ranging from 90-1200 m. and typically inhabit soft, sandy, and muddy substrates (Davie, 2002). Fossil cyclodorippids reported from the Miocene of Japan, Alaska, and Washington State (Imiazumi, 1952; Takeda and Tomida, 1984; Conkle *et al.*, 2006; Nyborg and Garassino, 2020) and assigned to *Tymolus* are larger than the extant forms. Schweitzer (2001) described *Xeinostoma antiqua* from the late Eocene of Washington State based upon one incomplete sole specimen, which is as small as the extant representatives of the genus.

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