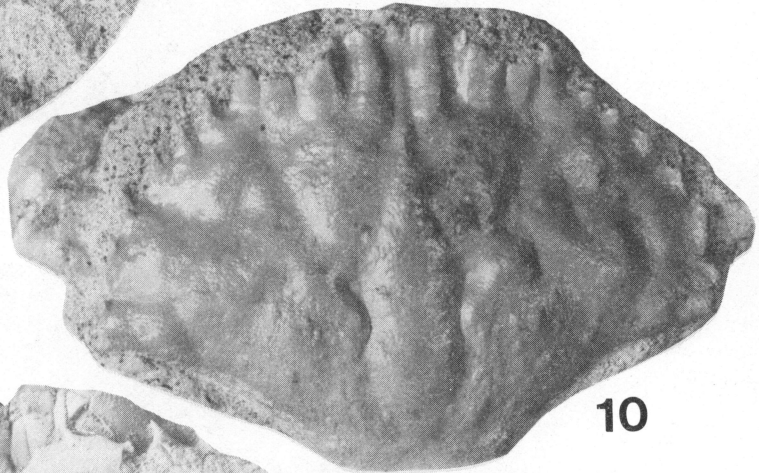




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14

laterally directed. Cross-sections at bases of teeth 1 through 7 elliptical, at tips circular; tooth 8 circular from base to tip. All anterolateral teeth separated to their bases, edges finely granulate; outer margins of teeth 1 through 7 straight; between teeth are deep rounded sinuses, shallowest between teeth 3 and 4, deepest between teeth 6, 7, and 8. No teeth or carinae on posterior or posterolateral margins.

Carapace surface moderately to sharply differentiated into elevated regions. Gastric, cardiac, and branchial regions moderately inflated; mesogastric, urogastric, and cardiac regions weakly demarcated; epibranchial region and anterior end of elongated branchial lobes prominently swollen; metabranchial region with small node. Interregional furrows well defined; 3 prominent furrows project posteriorly from sinuses in frontal margin; in mesobranchial and gastrocardiac regions furrows very deeply incised. Entire surface of carapace covered with dense network of fine granules; a few large granules scattered over surface of mesogastric and metagastric regions; several large tubercles on metabranchial and mesobranchial regions.

Abdomen of male composed of 6 somites: somites 1 through 4 shortest; 1 through 3 approximately equal in width; sides of somite 3 narrowing anteriorly, 4 and 5 nearly parallel, those of somite 6 converging to a sharp tip.

Walking legs: meri long, thin, nearly equal in length, locally thickened at distal ends near articulation with carpus; carpus of last walking leg long, upper margin very convex, lower concave, distal end subtriangular in cross-section. Carpus, and parts distal to the merus, appear to have been posteriorly directed.

Chelipeds equal; manus long, high distally, upper and lower margins strongly convergent proximally, outer surface gently convex longitudinally, strongly convex vertically, vertical cross-section through hand narrowly diamond-shaped, elongate vertically. Outer surface of hand carinate; upper margin (carina 1) thin and blade-like with 3 sharp, distally-inclined spines equally spaced between distal angle and upper articulation with carpus; largest spine at distal angle, smallest spine low and weakly defined near articulation. Outer-upper surface convex, coarsely granulate to scabrous near upper margin, coarsely reticulate closer to the median. Three

inconspicuous carinae on this surface indicated by alignments of decorative features approximately equally spaced; an irregular longitudinal row of large granule groupings (carina 2) immediately below the upper margin; 2 uneven rows formed by aligned sections of the reticulate pattern (carinae 3 and 4), converging distally, nearly meeting at articulation. Carina 5 a well defined ridge on the median, extending full length of hand; carina 6 is a prominent raised and broadly rounded rim along lower margin extending from lower articulation with carpus to tip of fixed finger. Surface between carinae 5 and 6 relatively smooth. Inner surface of manus concave longitudinally, convex vertically, with a prominent carina along the median; surface with scattering of fine granules. Length of merus approximately that of manus, width at mid-length approximately twice that at articulation with ischium. Upper surface of carpus bordered by narrow band of granules beginning near upper articulation with manus and extending distally to base of large, sharp, distally directed spine at upper distal angle; at inner angle, a much shorter spine. Subparallel to proximal half of upper surface on ridge, 2 or 3 short longitudinal carinae with several transverse ridges; entire area finely granulate. Large, sharp, conical tubercle located adjacent to upper articulation, one of four tubercles forming an irregular diagonal carina.

Fixed fingers acutely triangular in shape; inner surface smooth, gently concave longitudinally; outer surface with 2 narrow, longitudinal grooves, dividing finger into 2 low ridges, one bordering lower margin of finger, the uppermost separated from bases of cutting teeth by narrow, shallow groove. Four or 5 large, oval, setal pits; several small, circular depressions along bases of cutting teeth; tip of each tooth darkened. Both left- and right-hand fixed fingers have 11 cutting teeth, differing slightly in size and position. Right-hand fixed finger with teeth 1, 2, 3, 5, 6, 8, 9, and 11 small, subequal, with some darkening on each; teeth 4, 7, and 10 large, size increasing distally, 50–75% of each tooth darkened; teeth 4 and 7 subacute; tooth 10 very long, narrow, acute. Left-hand fixed finger with teeth 1, 2, 3, 4, 6, 7, 9, and 11 small, subequal in size, with some darkening on each; teeth 5, 8, and 10 large, size increasing distally, 50–75% of each tooth darkened; teeth 5 and 8 subacute; tooth 10 very long, narrow, acute.

Figures 8–14. *Cancer wahkiakumensis*, new species.

- Fig. 8. Paratype, UWBM 74403: right merus and carpus of fifth leg, x 1.75
 Fig. 9. Paratype, USNM 448194: left cheliped, outer view, x 2.75
 Fig. 10. Paratype, USNM 448194: carapace, dorsal view, x 2.8
 Fig. 11. Paratype, LACMIP 8286: left cheliped, outer view, x 1.5
 Fig. 12. Paratype, LACMIP 8285: carapace, front view, x 1
 Fig. 13. Paratype, USNM 448194: carapace, front view, x 2.4
 Fig. 14. Paratype, UWBM 74403: chelipeds, outer view, x 1.6

Movable fingers thin; upper margin very highly arched, highest section approximately at mid-length, proximal one-third nearly at right angle to distal one-third. Three long, distally inclined spines equally spaced along middle one-third of upper margin; proximal spine largest, distal spine smallest. Outer surface slightly convex longitudinally and transversely; granules scattered along crest between spines; punctae small, densest on upper one-third, scarce near toothline; several setal pits along baseline of teeth; tip of each finger darkened. Both left- and right-hand fingers with 8 cutting teeth, some variation in tooth size and location. Right-hand finger with first tooth large, conical, inclined toward articulation with hand, half of tip darkened; teeth 2, 3, and 4 small; tooth 5 large, acute; teeth 6, 7, and 8 long, occlusal surfaces nearly flat, thin, ridge-like. Distal one-fifth of occlusal surface without teeth. Left-hand

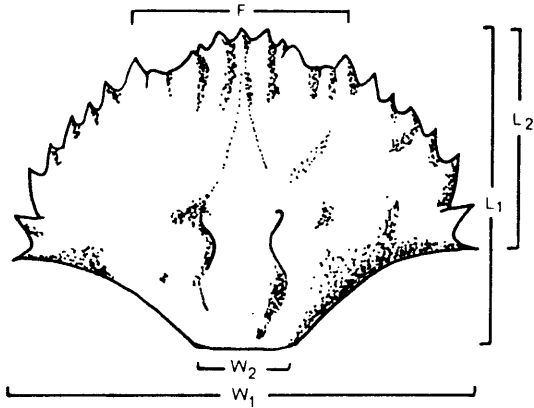


Figure 15. *Cancer wahkiakumensis*, new species: reconstruction of carapace showing location and orientation for measurements in table 2.

Table 2

Carapace measurements (in mm) for *Cancer wahkiakumensis* n. sp. (See fig. 15 for location and orientation of measurements.)

Specimen	W/1	L/1	F	W/2	L/2
UWBM 74400	62.3	40.7	24.3	17.0	27.0
USNM 448194	30.0	20.7	14.0	8.8	14.1
LACMIP 8289	45.6	33.0	17.6	9.8	22.0
LACMIP 8290		21.0	13.5	8.0	14.0

finger with teeth 1 through 5 small, with some darkening on each; tooth 6 large, acute, one-half of tip darkened; teeth 7 and 8 low, elongate; distal one-fifth of occlusal surface ridge-like, without teeth.

Measurements (in mm)

Carapace measurements are listed in table 2; their orientation and location are shown in figure 15. Cheliped measurements (table 3) were made at locations specified by Nations (1975: fig. 3). Several selected pairs of cheliped measurements have been combined as ratios in table 4 following the system used by Nations (1975: 8).

Etymology

The new species is named for Wahkiakum County, Washington, wherein the holotype was collected.

Material

HOLOTYPE: UWBM 74400 (locality UWBM B5497). PARATYPES: UWBM 74401, 74402 (locality UWBM B5498); UWBM 74403, 74404, 74405, 74406 (locality UWBM B5500); USNM 448194 (locality UWBM B5499), USNM 448195 (locality UWBM B5500); LACMIP 8284, 8285, 8286 (locality LACMIP 5848), LACMIP 8289, 8290 (locality LACMIP 5848), LACMIP 8291 (locality LACMIP 5847). PLASTOHOLOTYPE: LACMIP 8282, USNM 448496. PLASTOPARATYPE: LACMIP 8283 (cast of USNM 448194). Referred specimens, UWBM 74407 (locality UWBM B5497), UWBM 74408 (locality UWBM B5500), LACMIP 8287 (locality LACMIP 12218), LACMIP 8288, 8292 (locality LACMIP 5864), LACMIP 8293 (locality LACMIP 5848).

Occurrence

Type locality, UWBM B5497, Astoria Formation (Unit II), Wahkiakum County, Washington. Unit I (Naselle unit), UWBM locality B5498 (=LACMIP loc. 12218), LACMIP loc. 5847, LACMIP loc. 5864, all in Pacific County, Washington; Unit II, UWBM localities B5499, and B5500 (=LACMIP loc. 5848) in Wahkiakum

County. Precise locality descriptions are available upon request to the appropriate institution.

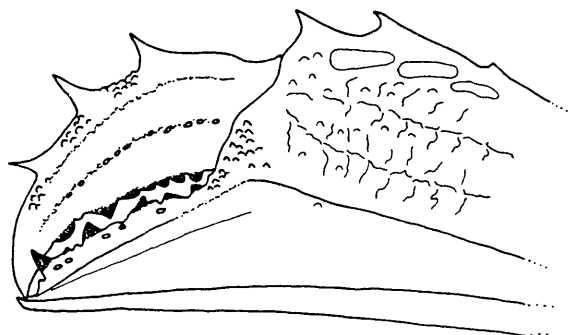


Figure 16. *Cancer wahkiakumensis*, new species: reconstruction of left chela (articulation with carpus not shown).

Table 3
Cheliped measurements (in mm) for *Cancer wahkiakumensis*, n. sp.

Specimen	Manus		Fixed Finger			Movable Finger	
	Lu	Hm	Lf	Hf	Lmf	Hmf	
UWBM 74403	20.2L	15.0L	12.6L	6.3L, 6.2R	17.6L	5.4L	
UWBM 74404		15.7R	11.7R	5.8R			
LACMIP 8286		12.5L		5.0L		4.2L	
UWBM 74406			16.0R	8.0R			
USNM 448194	10.5L	8.3L	6.2L	3.4L	9.0L	3.0L	

Lu – Length, upper margin of manus; Hm – height of manus; Lf – length, fixed finger; Hf – Height, fixed finger; Lmf – length, movable finger; Hmf – height, movable finger; L – left; R – right.

Table 4
Cheliped ratios (follows Nations 1975). (See Table 3 for key to abbreviations.)

Specimen	Lu/Hm	Hf/Hm	Hf/Lf	Hmf/Lmf
UWBM 74403 (L)	1.347	0.420	0.500	0.307
UWBM 74404 (R)		0.369	0.496	
LACMIP 8286 (R)		0.400		
UWBM 74406 (R)		0.500		
USNM 448194 (L)	1.265	0.409	0.548	0.330
Average (L)	1.306	0.414	0.524	0.318
(R)		0.423	0.496	

Discussion

The new crab, *Cancer wahkiakumensis*, is superficially similar to species within the family Portunidae in having a carapace with eight anterolateral teeth and lacking posterolateral protuberances and carinae; however, some characters diagnostic of Portunidae (e.g., branchial ridging and swimming legs) are absent. The new taxon resembles more closely the family Cancridae, especially species of the genus *Cancer*, in the shape and spination of the carapace and chelipeds, the shape of the anterolateral teeth, and the shape and dentition of the front; however, the carapace differs from that of all other species of *Cancer* (in which the carapace is known) by lacking posterolateral teeth and carinae, and by having only eight anterolateral teeth.

The chelipeds of all previously described species of *Cancer* have mani with six or seven longitudinal carinae on the outer surface (Nations 1975). The mani of *C. wahkiakumensis* have six carinae (fig. 16), although carinae 2, 3, and 4 are represented by inconspicuous rows of decorative elements, best preserved on paratype UWBM 74403, and faintly discernible on paratype USNM 448194.

Nations (1975) reviewed the genus *Cancer*, including all known Recent species and all extinct species from western North and South America, and recognized four subgenera: *Cancer*, *Glebocarcinus*, *Metacarcinus*, and *Romaleon*. The carapace of *Cancer wahkiakumensis* lacks the ornate areolation and strong differentiation of regions possessed by species of the subgenus *Glebocarcinus*. Species of the subgenera *Cancer* and *Metacarcinus* have ovate carapaces with truncate anterolateral teeth, whereas the carapace of *C. wahkiakumensis* is suboctagonal with sharp-tipped, forward pointing anterolateral teeth. Based primarily on carapace morphology, *C. wahkiakumensis* appears to be most closely related to species of the

subgenus *Romaleon*.

Of the ten species of the subgenus *Romaleon* recognized by Nations (1975), *Cancer wahkiakumensis* most closely resembles *C. gibbosulus* Rathbun, 1898; *C. branneri* Rathbun, 1926; and *C. dereki* Nations, 1975. *Cancer gibbosulus* is a Recent species which lives along the coasts of Japan and China in the western Pacific Ocean; *C. branneri* ranges

from Pliocene in California to Recent in the eastern North Pacific Ocean from California to Alaska; and *C. dereki* is known only from middle Miocene-age rocks in California. All three have an anterolateral tooth shape and orientation that is similar to that of *C. wahkiakumensis*, but they differ from *C. wahkiakumensis* by having an alternation in tooth size in which the odd-numbered teeth are larger, and the even-numbered ones are smaller. The last anterolateral tooth of *C. branneri* is directed anteriorly, not transversely outward as in *C. gibbosulus*, *C. dereki*, and *C. wahkiakumensis*. The deep furrows extending posteriorly from the sinuses in the anterior margin of the carapace of *C. wahkiakumensis* are comparable to those of *C. dereki*, to a lesser degree to those of *C. gibbosulus*, and even less to those of *C. branneri*. For both *C. wahkiakumensis* and *C. dereki*, outline and areolation of the carapace, and shape and orientation of the anterolateral teeth, are similar; however, decoration along tooth margins of *C. wahkiakumensis* is a fine granulation instead of spinules. The carapace width of both species is widest between the tips of the teeth at the posterolateral angles. The carapace of *C. wahkiakumensis* differs from that of all other species of *Romaleon* in being much less ovate in outline. The carapace of *C. yanceyi* Nations, 1975, is unknown and the species is based on two fossil mani. The manus of *C. yanceyi* is short, with seven carinae on the outer surface, whereas that of *C. wahkiakumensis* is long, with six carinae on the outer surface.

Although *Cancer wahkiakumensis* possesses several unique characters that are not shared by any other known species of *Cancer*, these are not considered sufficient at this time to justify the naming of a new genus. The discovery of better preserved and more complete specimens, as well as the description of other new taxa from western North America (see Feldmann, Tucker, and Berglund 1991), may indicate the need for recognition of a new genus.

Except for an undescribed species of *Cancer* from the late Eocene Hoko River Formation (Feldmann, Tucker, and Berglund 1991), *Cancer wahkiakumensis* is the earliest record of the genus *Cancer* in the eastern Pacific Ocean; all other species of *Cancer* are middle Miocene age or younger (Nations 1975). Because it is known only from rocks within one small Miocene-age embayment, *C. wahkiakumensis* may have been endemic to that embayment.

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