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A New Species of Chimney-Building *Penitella* from the Gulf of Alaska (Bivalvia: Pholadidae)

by

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Abstract. *Penitella* ***hopkinsi*** sp. nov., from the Gulf of Alaska, differs from other species in the genus by its blunt and thickened posterior margin that inserts against the base of a chimney of agglutinated sediment (unique in the genus), by the shape of the mesoplax, and by details of the umbonal reflection and dorsal extension of the callum. Anatomy is unknown. Late Pleistocene records of the species range from the Seward Peninsula, Alaska, to Point Arena, California.

INTRODUCTION

Recent efforts to identify several enigmatic species of *Penitella* Valenciennes, 1846, from both the northeastern and northwestern Pacific revealed that a number of nomenclatural and taxonomic problems in the genus still need to be resolved (KENNEDY, 1985). Here we describe a new species of *Penitella* from the Gulf of Alaska region based on well-preserved modern (Recent) specimens collected by Armentrout in 1975 from the south end of Wingham Island. The specimens came from the modern intertidal marine abrasion platform that had been uplifted about 2.8 m during tectonic events associated with the 27 March 1964 Good Friday earthquake in Alaska (PLAFKER, 1969 [1970]: pl. 1; PLAFKER, 1974). Poorly preserved specimens (shells only) of this species previously had been cited as *Penitella kamakurensis* (Yokoyama, 1922), a Japanese species name that can now be dropped from eastern Pacific faunal lists. Descriptive terminology follows that of KENNEDY (1974a: 11–13, fig. 2).

The following institutional abbreviations are used: AMNH, American Museum of Natural History, New York; CAS, California Academy of Sciences, San Francisco; LACM and LACMIP, Natural History Museum of Los Angeles County, Los Angeles (LACMIP, Invertebrate Paleontology; LACM, Invertebrate Zoology [Malacology]); MCZ, Museum of Comparative Zoology, Cambridge; NMC, National Museum of Natural Sciences, Ottawa; NSMT, National Science Museum, Tokyo; SBMNH, Santa Barbara Museum of Natural History, Santa Barbara; UCLA, University of California, Los Angeles (collections at LACM); UCMP, University of California Museum of Paleontology, Berkeley; USGS, U.S. Geological Survey, Menlo Park (M) and Washington; USNM, U.S. National Museum of Natural History, Washington.

DESCRIPTION

Family PHOLADIDAE Lamarck, 1809

Subfamily MARTESIINAE Grant & Gale, 1931

Genus *Penitella* Valenciennes, 1846

Type species: *Penitella conradi* Valenciennes, 1846, by subsequent designation (GRANT & GALE, 1931:433).

Penitella ***hopkinsi*** Kennedy & Armentrout, sp. nov.

(Figures 1–13)

Pholadidea penita (Conrad): MacNeil *in* MACNEIL *et al.*, 1943:73, 75, 94, pl. 16, figs. 4–6. [Not *Pholas penita* Conrad, 1837.]

Penitella kamakurensis (Yokoyama): KENNEDY, 1974a:48 (in part), fig. 60; (Alaska records only); KENNEDY, 1974b: 22 (in part; Alaska records only); BERNARD, 1983:61 (in part; eastern Pacific records only). [Not *Jouannetia kamakurensis* Yokoyama, 1922.]
Penitella kamakurensis of authors: KENNEDY, 1985:13.

Diagnosis: Medium-sized species of *Penitella,* adult length to about 4.5 cm. Posterior margin in adult shell blunt and thickened where it inserts against base of chimney (unique in *Penitella*). Siphonoplax lacking. Umbonal reflection not wide, loosely overlaps anterior slope, not tightly appressed as in *P. penita.* Callum complete, dorsal extension narrow, not lobate even in thick-shelled specimens. Mesoplax somewhat variable in shape, generally subrectangular, with medial constriction, bluntly pointed posteriorly, and with rounded, "swept-back" wings. Periostracum along commissure just posterior to mesoplax with small, opposing calcified patches; thin and light colored on disc and posterior slope. Anatomy unknown.

Penitella penita (Conrad, 1837) differs in its acutely pointed mesoplax, usually tightly appressed umbonal reflection, and flaplike siphonoplax; *P. conradi* Valenciennes, 1846, differs in its smaller size, rounded mesoplax, lobate and tightly appressed umbonal reflection, roughened muscle scars, cupped siphonoplax, and habit of boring into *Haliotis* shells; *P. fitchi* Turner, 1955, differs in its rounded mesoplax, tightly appressed umbonal reflection, shortened (reduced) anterodorsal margin, partial (incomplete) callum, and leafy periostracal siphonoplax; *P. turnerae* Evans & Fisher, 1966, differs in its large size, appressed umbonal reflection that is upturned at anterior end, and lack of a marginal periostracal band posteriorly; and *P. richardsoni* Kennedy, 1989, differs in its free, not appressed, umbonal reflection, and narrow dorsal extension of the callum.

Description: Adult shell medium sized for genus, reaching 5.5 cm in length (fossil, LACMIP loc. 11741), but rarely exceeding 4.5 cm; most adult shells are 3.5 to 4.5 cm in length. Elongate pear-shaped in overall appearance, more bulbous anteriorly, conically constricted posteriorly, with relatively straight dorsal and ventral margins. Immature specimens beaked, widely gaping anteriorly, closed by complete callum in adult; rounded and closed posteriorly. Posterior margin of adult shell blunt, where it inserts against base of chimney, thickened by buildup of periostracum from within. Siphonoplax lacking. Chimney of agglutinated sediment similar to that of *Parapholas californica* (Conrad, 1837); apertural opening circular in outline, basal opening bilaterally compressed with rimmed depressions on either side, where thickened end of shell inserts against base of chimney.

Anterior slope sculptured by close-set, upturned, undulating, concentric ridges, and radial "ribs" formed by aligned undulations of the ridges. Umbonal-ventral sulcus prominent, marked by angular junction of concentric ridges of anterior slope and growth lines on disc. Disc and posterior slope sculptured with concentric growth lines and obscure, narrow, rounded ridges.

Umbones prominent, located near anterior third of shell. Umbonal reflection not wide, loosely overlaps anterior slope, not tightly appressed as in *Penitella penita,* barely raised at anterior-most point. Callum complete, usually smooth, but sometimes with radiating furrows that correspond to undulations of the concentric ridges along the anterior margin, barely protruding anterior to beaks. Dorsal extension of callum narrow, not widely lobate in thick-shelled specimens, but may have greater height than lateral extent to compensate.

Mesoplax transverse, situated dorsally above and just posterior to umbones, somewhat more variable in shape than in some species, generally subrectangular, with medial constriction and rounded, "swept-back" lateral wings. Posterior end bluntly pointed, may be directed ventrally or posteriorly, but lacks sharpened appearance of that of *Penitella penita.* Ventrally, there may be a pocketlike fold posteriorly, which differs from the simple ridge found on the underside of the *P. penita* mesoplax.

Umbonal-ventral ridge low, not paticularly prominent in actively boring specimens, inconspicuous in adults. Muscle scars visible, smooth to barely roughened. Ventral muscle scar long, narrow, overlaps umbonal-ventral ridge. Posterior muscle scar elongate-oval in outline. Pallial sinus moderately broad, extends to or just beyond umbonal-ventral ridge. Apophyses somewhat irregular and blade-like, with flattened extremity, rotated somewhat from long axis of shell, wider ventrally, protruding at angle slightly anterior to that of umbonal-ventral ridge.

Periostracum on disc and posterior slope thin, light colored; thicker and dark brown around commissure, particularly at posterior extremity, and with small opposing calcified patches just posterior to mesoplax in adult specimens. Periostracal attachment scars may be present inside siphonal opening. Anatomy unknown.

Holotype: LACM 2387, from LACM sta. 75-582, Wingham Island, Alaska (type locality), coll. J. M. Armentrout, 1975. Dimensions: length, 41 mm; height, ca. 24 mm.

Paratypes: All from type locality unless otherwise indicated: AMNH 232083a, b (1 specimen and chimney). CAS 065057–065059 (3 specimens; Figures 10, 12, 13), 065060–065062 (3 chimneys; Figures 2–4). LACMIP 7864 (1 specimen) from LACMIP loc. 4816, Pleistocene, Point Arena, California (coll. G. L. Kennedy, 1974). LACM 2388a–c (3 specimens; Figures 5, 7, 9), 2388d–g (4 specimens with disassociated mesoplaxes), 2388h–k (4 specimens lacking mesoplaxes), 2388l–q (6 chimneys); LACM 2389a, b (2 specimens) from LACM sta. 65-180, Hinchinbrook Island, Alaska (coll. Rae Baxter, 1965). MCZ 297050a–c (1 specimen and 2 chimneys), 297064a, b (2 specimens), 297065 (chimney; Figure 1). NMC 92790 (1 specimen and chimney). NSMT Mo64636 (1 specimen and chimney). SBMNH 34961 (1 specimen). UCMP 38213 (1 specimen). USNM 859331, 859332 (2 right valves; Figure 6 [859331]) from USGS loc. M1627, Chi-

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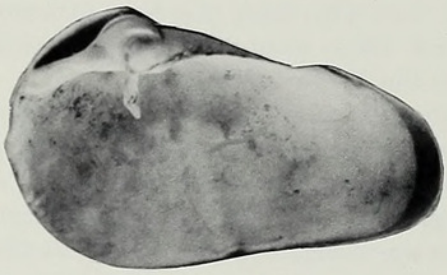

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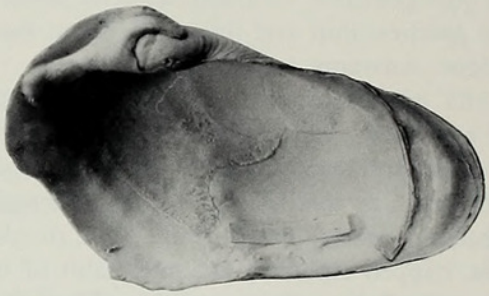

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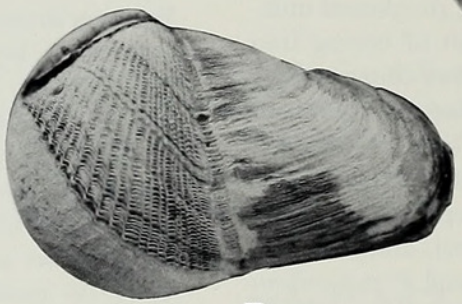

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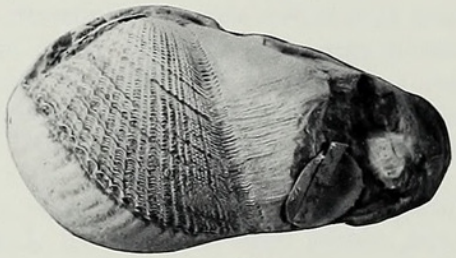

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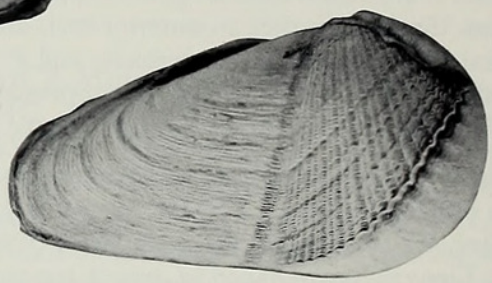

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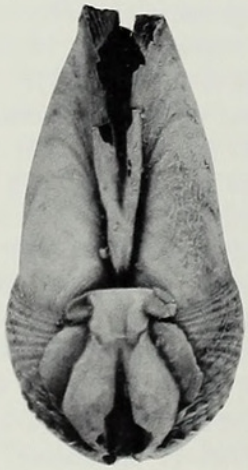

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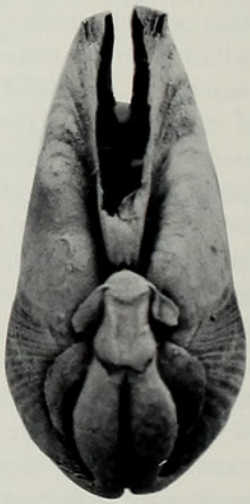

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rikof Island, Alaska (coll. unknown); USNM 859333 (1 specimen without mesoplax) from USGS loc. M3852, Middleton Island, Alaska (coll. George Plafker, 1968).

One unnumbered paratype and chimney remain in the collection of the junior author. Additional specimens cited below, mostly Pleistocene fossils, are specifically excluded from consideration as type material.

Type locality: LACM sta. 75-582. Southeast margin of modern emergent marine abrasion platform on southwest-facing southern end of Wingham Island, mouth of Controller Bay, Gulf of Alaska, Alaska (59°59′28.2″N, 144°22′36″W). Collected by John M. Armentrout, 16 July 1975. Association: holotype and 23 paratypes collected with nine *Penitella penita* (Conrad, 1837).

Modern distribution: ALASKA: Gulf of Alaska: Wingham Island (LACM sta. 75-582; type locality); Chirikof Island (USGS loc. M1627); Hinchinbrook Island (LACM sta. 65-180); Kayak Island (UCLA 35107); Middleton Island (USGS loc. M3852).

Fossil record: Neogene(?), Pleistocene.

NEOGENE(?): ALASKA: South end of Wingham Island, LACMIP Loc. 11741.

PLEISTOCENE: ALASKA: Second Beach, Peluk Creek, near Nome, Seward Peninsula, USGS locs. 3752 (MACNEIL, *et al.*, 1943:75, as *Pholadidea penita*), and 3751 (both KENNEDY, 1974a:48, as *Penitella kamakurensis*). South end of Wingham Island, USGS loc. 15864 (KENNEDY, 1974a: 48, as *Penitella kamakurensis* from "Yakutat Bay").

OREGON: Whiskey Run Terrace, north of Bandon at Fivemile Point, LACMIP loc. 3950 (KENNEDY, 1974a:47, 79, as *Penitella gabbii*; KENNEDY, 1978:387 (table 62), 504, as *Penitella* sp. cf. *P. gabbii*).

CALIFORNIA: Point Arena, near lighthouse, LACMIP locs. 4816 (KENNEDY, 1978:175 [table 11], as *Penitella* sp. indet.), and 10770.

Etymology: We are pleased to name this Alaskan species for David M. Hopkins, in recognition of his contributions to our understanding of the Quaternary history of Alaska, and of Beringia in particular.

Remarks: The first published record of this species was that of MacNeil (*in* MACNEIL *et al.*, 1943), who attributed several worn valves from the "Pliocene" [=Pleistocene] of the Seward Peninsula, Alaska, to *Pholadidea penita*. KENNEDY (1974a, b) recognized that these, and several Recent valves from the Gulf of Alaska, were specifically distinct, and introduced into eastern Pacific literature the Japanese species name *Penitella kamakurensis*. The fossil specimens were poorly preserved, only one possessed a mesoplax, and none was associated with the characteristic chimney. The thickened posterior margin was not particularly apparent on any of the existing specimens, modern or fossil.

The unusual nature of this chimney-building species was recognized only several years later, when the authors attempted to identify several well-preserved, but enigmatic specimens collected by Armentrout in 1975 in the Gulf of Alaska. Comparison of these specimens with those previously assigned to *Penitella kamakurensis* revealed them to be identical, and incorrectly assigned to *P. kamakurensis* as presently understood (see comments on Japanese species of *Penitella* in KENNEDY, 1989).

Penitella ***hopkinsi*** is separated from all other eastern Pacific species of *Penitella* by the chimney of agglutinated sediment, the blunt and thickened posterior extremity of the valves (which insert against the base of the chimney), by the shape of the mesoplax, by details of the umbonal reflection and dorsal extension of the callum, and by the small calcified patches in the periostracum just posterior to the mesoplax in adult specimens. Chimneys of agglutinated sediment and/or fecal material previously had been known only in *Parapholas* Conrad, 1848, and *Aspidopholas* Fischer, 1887, in the Martesiinae, and in *Xylophaga* Turton, 1822, in the Xylophagainae (TURNER, 1955; KNUDSEN, 1961; KENNEDY, 1974a).

Incomplete or poorly preserved specimens of *Penitella* ***hopkinsi*** may be confused with either *P. penita* (Conrad), or *P. richardsoni* Kennedy (=*P. gabbii* of authors, not Tryon, 1863, which is a Japanese species). The umbonal reflection of *P.* ***hopkinsi*** only loosely overlaps the anterior slope, and thus could be interpreted as an aberrant *P. richardsoni*, which normally has a freer and more open dorsal reflection, or with an aberrant *P. penita*, which normally has a more tightly appressed umbonal reflection. The mesoplax of *P.* ***hopkinsi*** is also somewhat intermediate in form between that of *P. penita* and *P. richardsoni* and could be confused with either species.

←

Explanation of Figures 1 to 13

Figures 1–13. *Penitella* ***hopkinsi*** Kennedy & Armentrout, sp. nov.; all from type locality (Wingham Island, Alaska) unless otherwise indicated. Figures 1–4: MCZ 297065 and CAS 065060–065062, one apertural, two lateral, and one basal view of four siphonal chimneys; ×1.25. Figure 5: paratype, LACM 2388a, right valve; length 38 mm. Figure 6: paratype, USNM 859331, right valve, from Chirikof Island, Alaska (USGS loc. M1627); length 44 mm. Figure 7: paratype, LACM 2388b, left valve; length 40 mm. Figure 8: hypotype, USNM 189802, left valve of paired specimen, Pleistocene, from Wingham Island, Alaska (USGS loc. 15864); length 51 mm. Figure 9: paratype, LACM 2388c, right valve of paired specimen; length 41 mm. Figures 10–13: dorsal views of four paired specimens. Figure 10: paratype, CAS 065057; length 33.6 mm. Figure 11: holotype, LACM 2387; length 41 mm. Figure 12: paratype, CAS 065058; length 41 mm. Figure 13: paratype, CAS 065059; length 43 mm.

Specimens that closely resemble Gulf of Alaska specimens of *Penitella* ***hopkinsi*** are present in the U.S. National Museum of Natural History collections from the eastern USSR: Aniwa Bay (Zaliv Aniva) (USNM 404319) on the south end of Sakhalin, just north of Hokkaido, Japan, and from Bering Island (USNM 210780), presumably Ostrov Beringa in the Komandorskiye Ostrova, between Kamchatka and the westernmost of the Aleutian Islands, Alaska. Because of slight morphological differences between the northeastern and northwestern Pacific populations, the lack of any intervening records, and the lack of (known) chimneys associated with the western Pacific specimens, the two populations are treated as distinct for the time being. Further study of western Pacific *Penitella* species may clarify the systematic relationships of the two.

Previous citations of *Penitella kamakurensis* in Alaska (KENNEDY, 1974a, b) were based on published figures of *P. kamakurensis* of authors, not YOKOYAMA (1922), and which actually represent an undescribed species (KENNEDY, 1985, 1989) that is characterized by its rounded mesoplax, tightly appressed umbonal reflection, partial (incomplete) callum, and reduced leafy periostracal fringe on its posterior margin. Morphologically it is most similar to the eastern Pacific *P. fitchi* Turner.

Fossil records of *Penitella* ***hopkinsi*** encompass a greater geographic extent than the known modern range of the species (Gulf of Alaska), which, however, may be greater than indicated here. The largest collection of fossils is from the southern end of Wingham Island (LACMIP loc. 11741), from the marine abrasion platform uplifted at the time of the 1964 Alaska earthquake. These are probably of Neogene age, but could possibly be as young as Pleistocene, and be contemporaneous with those from Quaternary deposits overlying the marine terrace on the southeastern spur of the island (USGS loc. 15864) (see MARTIN 1908:46, pl. 5; MILLER, 1961:sheet 1). A specimen from the latter locality was figured by KENNEDY, (1974a:fig. 60) as *P. kamakurensis* from "Yakutat Bay," and is refigured here (Figure 8). Most of the specimens from LACMIP loc. 11741 are not well preserved, but a few show traces of the diagnostic chimney.

The remaining Pleistocene specimens all represent extralimital records. The northernmost specimens are from the Second Beach deposits near Nome, Alaska (MACNEIL *et al.,* 1943). The Second Beach deposits contain a number of extralimital southern (*i.e.,* warmer-water) species, and are correlated to the peak of the last interglacial period about 125,000 yr BP (substage 5e of the marine oxygen isotope record; D. M. Hopkins, pers. commun., 1988), when marine waters were slightly warmer (at least seasonally) than they are today. The southern records are from the Whiskey Run Terrace near Bandon, on the southern Oregon coast, and at Point Arena, on the northern California coast. The faunas at both of these localities contain a number of extralimital northern (*i.e.,* cooler-water) species, and have been correlated to a minor sea-level high stand that occurred about 82,000 yr BP (substage 5a of the marine oxygen isotope record; KENNEDY, 1978 and KENNEDY *et al.,* 1982), when marine waters were slightly cooler than they are today.

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