

REVISION OF SOME POLYDORIDS (POLYCHAETA:
SPIONIDAE) DESCRIBED AND RECORDED
FROM BRITISH COLUMBIA BY EDITH
AND CYRIL BERKELEY

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Abstract.—An examination of some spionid polychaetes from the collections of the late Edith and Cyril Berkeley from British Columbia resulted in the following revisions: (1) *Polydora caeca* var. *magna* E. Berkeley, 1927, *P. magna*: Berkeley and Berkeley (1936), *P. socialis plena* Berkeley and Berkeley, 1936 and *P. caeca*: Berkeley and Berkeley (1936) are synonymized with *P. socialis* (Schmarda, 1861); (2) *P. cardalia* E. Berkeley, 1927 is redescribed; (3) *P. (Boccardia) natrix* (*sensu* Berkeley and Berkeley, 1936) is redescribed as *Boccardia pugettensis* n. sp. The different forms of specialized posterior notosetae, found among some species of the polydorid complex, are discussed.

The late Edith and Cyril Berkeley, either singly or jointly, published more than 50 papers dealing with the polychaete fauna of western North America (Pettibone, 1967:19-21; Arai, 1971). Their 2 faunal treatments (Berkeley and Berkeley, 1948; 1952) were the major source of information for the identification of Canadian Pacific polychaetes for many years. The bulk of their collections, including most of the types, are now lodged in the Smithsonian Institution (Pettibone, 1967). The Berkeleys described or recorded approximately 25 species of spionid polychaetes from British Columbian waters. Several species have been revised or commented upon by Pettibone (1962), Woodwick (1963a; b), Blake (1966; 1971), Foster (1971), Blake and Woodwick (1972) and Banse (1972).

The following spionid species from British Columbia are included in this report:

Polydora socialis (Schmarda, 1861).

Includes: *P. caeca* var. *magna* E. Berkeley, 1927.

P. magna: Berkeley and Berkeley (1936).

P. socialis plena Berkeley and Berkeley, 1936.

P. caeca: Berkeley and Berkeley (1936). [*Not* Oersted, 1843.]

Polydora cardalia E. Berkeley, 1927.

Boccardia pugettensis, new species.

Includes: *P. (Boccardia) natrix*: Berkeley and Berkeley (1936). [*Not* Söderström, 1920.]

Specimens from the Smithsonian Institution (USNM), including the Berkeley collection, were loaned by Marian H. Pettibone and Meredith L. Jones. Additional comparative materials were provided by the late Katharine D. Hobson, British Columbia Provincial Museum (BCPM), Kristian Fauchald and Karen Green of the Allan Hancock Foundation (AHF), Dusty Chivers, California Academy of Sciences (CAS) and Lars Orrhage, Swedish Museum of Natural History, Stockholm (SMNH). I am grateful to all of the above-named individuals for their assistance and to William J. Light for reading and commenting on this paper.

Polydora socialis (Schmarda, 1861)

Leucodore socialis Schmarda, 1861:64, figs. a–c, pl. 26:fig. 209.

Polydora caeca var. *magna* E. Berkeley, 1927:419.—Pettibone, 1967:11 [New Synonymy].

Polydora magna: Berkeley and Berkeley, 1936:473; 1952:21 [New Synonymy].

Polydora socialis plena Berkeley and Berkeley, 1936:468–469; 1952:22.—Pettibone, 1967:11. *Fide* Blake, 1971.

Polydora caeca: Berkeley and Berkeley, 1936:469; 1952:20–21, *not* figs. 36–37, taken from Fauvel, 1927. [*Not* Oersted, 1843 *sensu* Fauvel, 1927 and authors.]

Polydora socialis: Hartman, 1941:310–311, pl. 48, figs. 41–42; 1969:147.—Blake, 1971:20–23, figs. 13–14 [Synonymy]; 1975:215, figs. 237–238.—Light, 1977:71; 1978:179–181, fig. 180a–l.—Blake and Kudenov, 1978:248–250, fig. 38d–e.

Polydora plena: Foster, 1971:24–25, figs. 22–29. *Fide* Light, 1977.

Material examined.—CANADA: British Columbia, Departure Bay, Nanaimo District, clean sand beach, littoral, 1 May 1935, coll. E. and C. Berkeley, holotype (USNM 32705) and 22 paratypes (USNM 32704) of *Polydora socialis plena*. Nanaimo, low tide, coll. E. and C. Berkeley, holotype of *Polydora caeca magna* (USNM 32710). West coast of Vancouver Island, 137 m, 15 May 1934, coll. E. and C. Berkeley, from walls of *Nicomache lumbricalis* tubes (Maldanidae), 7 specimens identified as *Polydora caeca* (USNM 36737). Cordova Bay, Vancouver Island, intertidal, sand, 27 July 1973, coll. B. Turner, 5 specimens (BCPM 973.151.4N).—CALIFORNIA: San Francisco Bay, San Bruno, seaplane harbor channel marker “1,” 4 m, coll. F. Nichols, 10 specimens (CAS 000779). Numerous additional specimens from Tomales Bay and Morro Bay, author’s collections.

Remarks.—*Polydora caeca magna* E. Berkeley and *P. caeca* (*sensu* Berkeley and Berkeley, 1936) are here referred to *P. socialis*. The synonymy of *P. socialis plena* Berkeley and Berkeley, 1936 with *P. socialis sensu stricto* proposed by Blake (1971) is reconfirmed. The specimens examined

agree in all significant details with the descriptions of *P. socialis* presented by Blake (1971) and Light (1978). The holotype of *P. caeca magna* is about 100 mm long and its caruncle extends posteriorly for 12 setigers. The great body length and long caruncle were cited as the primary characters distinguishing this species from *P. caeca* (E. Berkeley, 1927; Berkeley and Berkeley, 1936). Caruncle length, however, appears to be size-dependent in *P. socialis*. The caruncle lengths of New England specimens of *P. socialis* vary from 5–9 setigers, with those specimens having the longest caruncles also having a greater body length, up to 55 mm (Blake, 1971; also unpublished data). It is likely that specimens having even greater body lengths, such as seen in the holotype of *P. caeca magna*, would also have longer caruncles. Berkeley and Berkeley (1936; 1952) noted that their specimens identified as *P. caeca* had awl-shaped dorsal setae in posterior notopodia, while the types of *P. magna* had very sharp, slender capillaries with narrow wings. I have examined the posterior notopodial setae of the Berkeleys' specimens and others from British Columbia very carefully and in no instance have awl-shaped spines (these usually considered to be acicular) been observed. Instead, most posterior notopodia bear 7–8 long and 5–6 short, nearly smooth capillary setae, with occasional notopodia lacking most or all of the short capillaries. The short capillaries, rather than being acicular spines, are of the same thickness as the longer capillaries and appear to represent merely stages in the emergence, growth and replacement of the longer capillaries. These short capillaries are called "needlelike" by Light (1978), but an examination of his San Francisco Bay specimens indicates that they also appear to be replacement setae for the longer capillaries. Thick acicular spines have been noted in the posterior notopodia of specimens of *P. caeca* from Europe (Blake, unpublished data). In those specimens, however, the spines are thicker than the accompanying capillaries. In *P. socialis*, the major spines of setiger 5 are generally straight, not falcate, and have a weakly developed subterminal boss or enlargement. These spines are similar in specimens from British Columbia, California and New England. The hooded hooks lack a manubrium and have a reduced angle between the 2 teeth and a large angle between the main fang and shaft. A reduction of the apical tooth occurs in posterior neuropodia in some New England specimens (Blake, 1971) and in some San Francisco Bay specimens (Light, 1978; Blake, personal observation), but was not observed on the specimens from British Columbia. This variability does not appear to be taxonomically significant. The pygidia of British Columbian specimens are very similar to those figured by Blake (1971) in having a large ventral lobe and 2 small dorsal ones. A gizzard-like structure (Blake, 1971) occurs at the level of setigers 16–18 in all specimens examined.

Polydora socialis is a widespread and probably cosmopolitan species. The

small differences observed between widely separated populations do not exceed the expected genetic variability for such eurytopic forms.

Distribution.—East and west coasts of North America; Gulf of Mexico; Chile; Falkland Islands; Australia.

Polydora cardalia E. Berkeley, 1927

Figs. 1, 2

Polydora cardalia E. Berkeley, 1927:418–419, pl. I, fig. 14.—Berkeley and Berkeley, 1952:21, figs. 38–39.—Pettibone, 1967:11.

Material examined.—CANADA: British Columbia, Nanaimo, Cardale Point, 6 July 1921, dredged off Round Island, 19 Aug. 1920, False Narrows, 20 May 1920, Rocky Bay, 16 May 1920, 21 paratypes (USNM 32708).

Description.—A large species, up to 35 mm long and 1.5 mm wide for about 160 segments; reported up to 140 mm long and 2 mm wide for 400 segments (Berkeley, 1927). Body dark brown in alcohol, with small transverse pigment bands on some anterior segments.

Prostomium deeply incised on anterior margin, forming 2 divergent lobes (Fig. 1A); caruncle extending posteriorly to middle or end of setiger 5; no occipital tentacle; 2 pairs of eyes, anterior pair cup-shaped and laterally positioned, posterior pair oval and medially positioned. Peristomium broad; palps long, reaching posteriorly for about 20 setigers.

Setiger 1 well-developed; notopodium with small fascicle of capillary notosetae and broad, leaflike postsetal lamella (Fig. 1A); neuropodium with fascicle of long capillary neurosetae and broad, elliptical postsetal lamella. Setigers 2, 3, 4, 6 and subsequent setigers with large spreading fascicles of unilimbate capillary notosetae arranged in 2 tiers, those of anterior tier being shorter than those of posterior tier; with broad notopodial postsetal lamellae on setigers 2–4 (Fig. 1A); notopodia in posterior region with 5–7 long, slender capillaries and 13–18 thin, needlelike capillaries (Fig. 1E). Neuropodia of setigers 2, 3, 4 and 6 with capillaries similar to those of notopodia; beginning on setiger 7, neuropodium with 5–6 bidentate hooded hooks accompanied by 2–3 slender capillaries in superior position; hooks with reduced angle between teeth and wide angle between main fang and shaft, without constriction on shaft, and with fine serrations on margin of hood opening (Fig. 1B).

Modified setiger 5 with dorsal fascicle of numerous, fimbriated geniculate setae, a curved row of 12 or more major spines alternating with bilimbate companion setae (Fig. 1C, D, 2), and a ventral fascicle of unilimbate capillaries; major spines simple, lacking accessory structures, subterminal enlargement poorly developed, but each spine with numerous fine, scratch-like etchings in subterminal location when viewed at 1000× (Fig. 2).

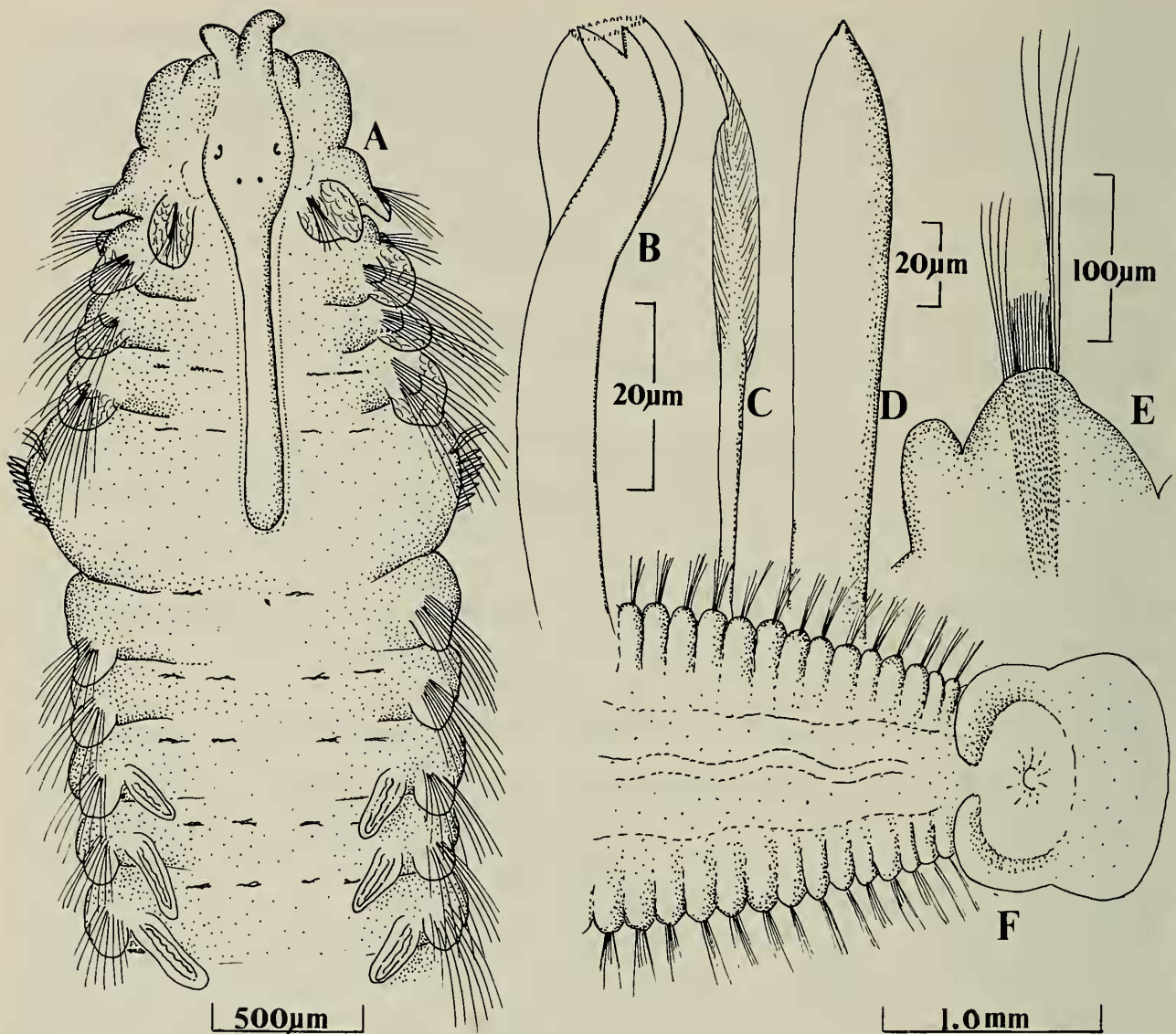


Fig. 1. *Polydora cardalia* (paratype, USNM 32708): A, Anterior end in dorsal view, palps missing; B, Hooded hook; C, Companion seta from setiger 5; D, Major spine from setiger 5; E, Posterior notopodium in dorsal view; F, Posterior end and pygidium in dorsal view.

Branchiae from setiger 8, continuing to near posterior end. Pygidium 3-lobed in paratypes, but reported as 3- or 4-lobed by Berkeley (1927). Gizzard-like structure present at level of setigers 14–16.

Remarks.—*Polydora cardalia* appears to be transitional between *P. socialis* and *P. flava* in the development of fine needlelike posterior notosetae. In *P. socialis*, short capillaries are few in number and are believed to represent developing replacement setae for the longer capillaries (see above). In *P. cardalia*, there are up to 18 thin capillaries projecting up to one-fourth of the distance from the notopodium to the tips of the longer capillaries; they are consistent on each segment and do not appear to be replacement setae. In *P. flava*, the needles form dense packets barely protruding above the cuticle (Fauvel, 1927; Blake and Kudenov, 1978). The subterminal enlargements of the major spines on setiger 5 of *P. cardalia* are reduced, but

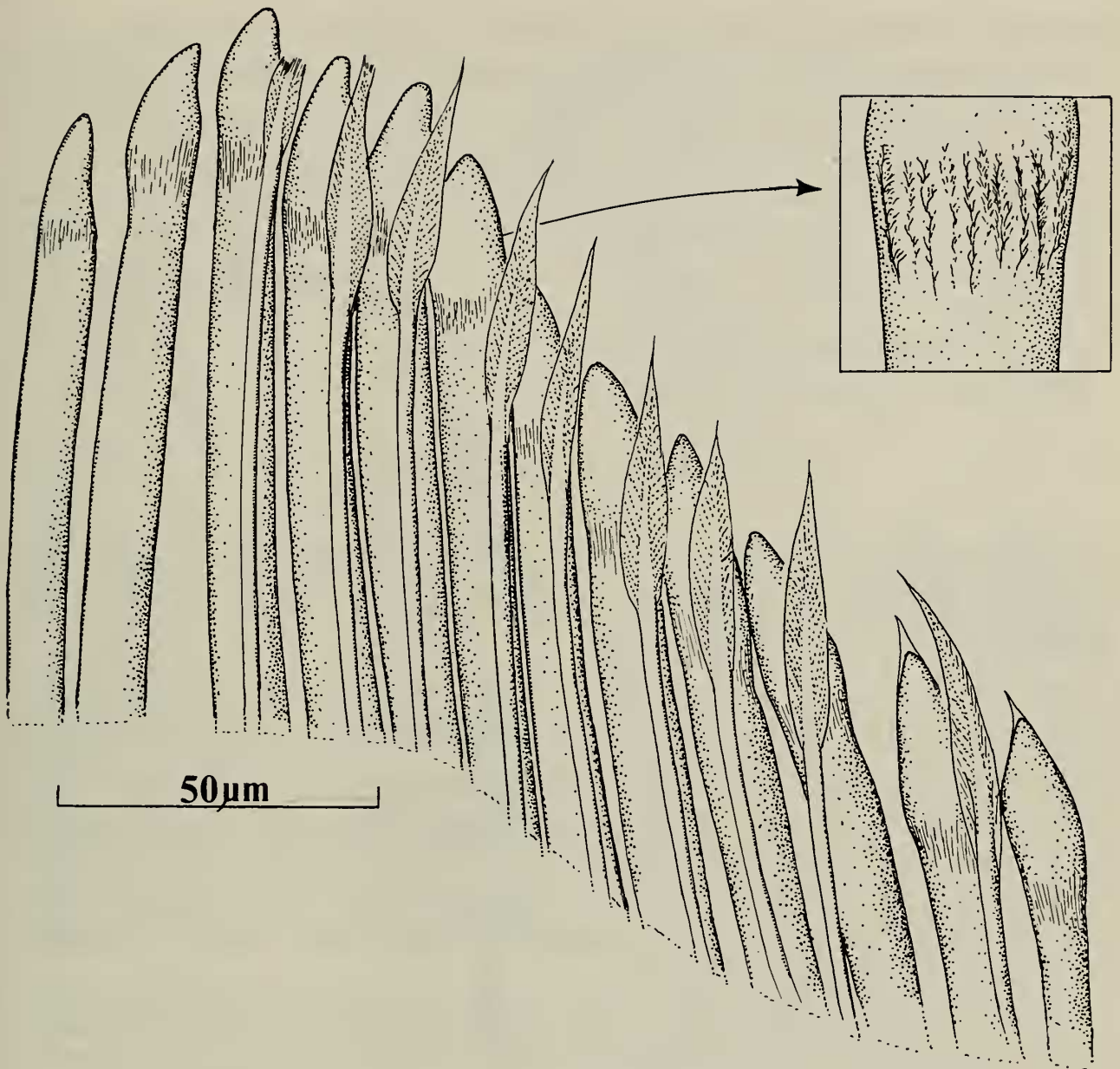


Fig. 2. *Polydora cardalia* (paratype, USNM 32708): Fascicle of major spines and companion setae from setiger 5, with inset [not to scale] showing form of subterminal etchings on spines.

the fine, scratchlike, subterminal etchings are unusual. Such markings have not previously been reported from the major spines of polydorids. *Polydora socialis* has 3–7 emergent spines on setiger 5 (Light, 1978; Blake, 1971, Fig. 14b), *P. flava* has 5–6 such spines (Mesnil, 1896) and *P. cardalia* has 12 or more. *P. cardalia* is further unusual in having exceptionally large, flattened, glandular postsetal lamellae in the anterior notopodia. These lamellae on setiger 1 are so large that they overlap nearly one-half of the length of setiger 2. In *P. socialis*, the same structures are much smaller, more elliptical, and although often flattened, are never glandular and do not extend beyond the limits of setiger 1.

Polydora cardalia may occur off southern California. Two specimens

from the BLM Outer Continental Shelf Survey (334–337 m), deposited in the Allan Hancock Foundation, were examined. Both are posteriorly incomplete, but agree in other respects with *P. cardalia*, including the form of the anterior notopodia. Unfortunately, the type-specimens of *P. neocardalia* Hartman, 1961 could not be located among the collections of the Allan Hancock Foundation, precluding any determination of its status. Light (1978) suggested that *P. neocardalia* might be the same as *P. socialis*, but until the types can be located and studied, the status of *P. neocardalia* and the BLM specimens remains uncertain.

Distribution.—British Columbia.

Boccardia pugettensis, new species

Fig. 3

Polydora (Boccardia) natrix: Berkeley and Berkeley, 1936:472; 1952:18, not Fig. 28, taken from Söderström (1920).—Banse, Hobson and Nichols, 1968:538. [Not Söderström, 1920.]

Material examined.—CANADA: British Columbia, Mudge Island, 16 June 1927, coll. E. and C. Berkeley, holotype (USNM 57479) and 2 paratypes (USNM 39567). Clayoquot, 4 June 1946, coll. E. F. Ricketts, sand flats, 1 paratype (USNM 39565). Nanoose Bay, 6 May 1965, coll. D. Ellis, 30 m, sand-silt, 5 paratypes (BCPM 42).—WASHINGTON: Puget Sound, 47°44'31"N; 122°32'41"W, Sta. 4, 29 April 1963, coll. U. Lie, 12 m, 3 paratypes (USNM 37017–9). Ballard, Seattle, 29 June 1946, coll. M. H. Pettibone, 3 paratypes (USNM 45193).

Description.—A large species, up to 25 mm long and 2.5 mm wide for 65 setigers. Color: light tan to dark brown in alcohol, with some brown pigment on prostomium and anterior setigers; small paired black spots on dorsum of some specimens.

Prostomium incised, forming 2 distinct lobes, with caruncle continuing to posterior margin of setiger 2 (Fig. 3A); no occipital tentacle; 2 pairs of eyes, anterior pair more widely spaced and cup-shaped; posterior pair oval. Palps thick, extending posteriorly for 8–9 setigers.

Setiger 1 smaller than subsequent setigers, but with well-developed noto- and neuropodia, each bearing fascicles of capillary setae. Notopodia of setigers 2, 3, 4, 6 and subsequent setigers with prominent fascicles of unilimbate capillaries arranged in 3 tiers: first tier with short, thick setae, second, with setae gradually elongating, third, with setae longest and thinnest; notopodia of far posterior setigers with 4–5 long capillaries and 2–3 short, pointed spines (Fig. 3I, J). Neurosetae of setigers 2, 3, 4 and 6 in 3-tiered fascicles similar to notosetae; beginning on setiger 7, neuropodium with 5–6 bidentate hooded hooks accompanied by 7–8 inferior unilimbate capillaries, capillaries reduced to 2–4 in middle and posterior setigers; hooks ex-

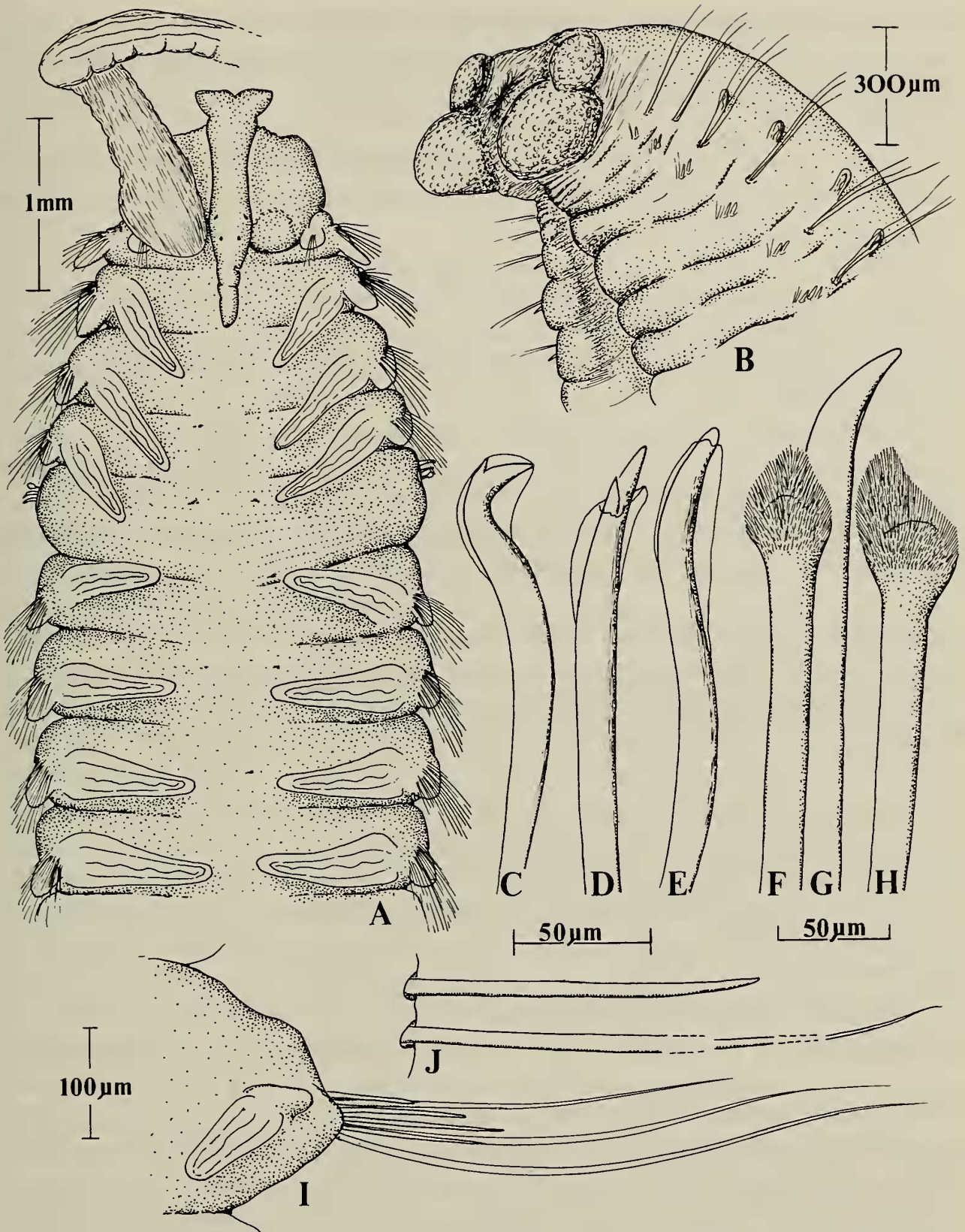


Fig. 3. *Boccardia pugettensis* (paratype, USNM 39567): A, Anterior end in dorsal view, base of left palp only shown; B, Posterior end in ventrolateral view; C, Hooded hook from anterior neuropodium; D, E, Hooded hooks from far posterior neuropodium; F, H, Bristle-topped spines from setiger 5; G, Falcate major spine from setiger 5; I, Notopodium from far posterior segment in dorsal view; J, Notopodial spine and capillary seta from same.

hibiting wide angle between teeth in anterior and middle setigers (Fig. 3C), this angle reduced in posterior setigers of largest specimens (Fig. 3D), with apical tooth sometimes being entirely lost (Fig. 3E), and hood frequently torn off.

Setiger 5 with ventral fascicle of unilimbate capillaries; major spines of 2 types: (1) simple falcate (Fig. 3G); (2) bristle-topped with bristles arising well below expanded tip (Fig. 3F, H).

Branchiae on setigers 2, 3, 4, 6 and subsequent segments (Fig. 3A) to end of body, reaching full size by setigers 10–12, where their tips meet middorsally. Pygidium reduced, much smaller than prepygidial segments, with 4 rounded, glandular lobes, dorsal pair being distinctly smaller than ventral pair (Fig. 3B).

Remarks.—The type-specimens of *Boccardia pugettensis* were previously referred to *Polydora (Boccardia) natrix* (Söderström) by Berkeley and Berkeley (1936; 1952), and, with doubt, by Banse *et al.* (1968). *B. pugettensis* agrees with *B. natrix* in having notosetae on setiger 1, an incised prostomium and general similarities in the structure of the major spines of setiger 5. However, a comparison of the holotype of *Polydora natrix* (SMNH 530) from southern South America, along with new material of the same from off Argentina with the specimens from British Columbia and Washington indicate that 2 distinct species are involved. *B. pugettensis* has posterior notopodial spines; the hooded hooks in the posterior segments show a reduced angle between the teeth, sometimes with a complete loss of the apical tooth; the expanded ends of the bristle-topped spines of setiger 5 are completely covered by bristles; and the pygidium consists of 4 small glandular lobes. In *B. natrix*, on the other hand, notopodial spines are lacking, the hooded hooks maintain a constant angle between the teeth throughout the body, the expanded ends of the bristle-topped spines of setiger 5 have 2 distinct smooth bosses and the large disclike pygidium is divided into 4 lobes. More detailed comments on the morphology of *B. natrix* will be included in a study of South American spionids (Blake, in preparation). *B. pugettensis* appears to be most closely related to *B. basilaria* Hartman, 1961 from southern California. In *B. basilaria*, the posterior notopodial spines are heavier than in *B. pugettensis*, the posterior hooded hooks are falcate and always lose the apical tooth and the pygidium consists of 2 ventral lappets. Moreover, *B. basilaria* has short anterior branchiae, basally fused to the postsetal lamellae, with those of setigers 2–4 barely extending one-fourth of the distance to the dorsal midline. *B. pugettensis*, on the other hand, has longer anterior branchiae, not fused basally to the notopodial lamellae, with those of setigers 2–4 extending across the dorsum to near the midline. *B. basilaria* was incompletely described by Hartman (1961). These comparative comments, based upon an examination of the type-material of

B. basilaria (AHF Poly 0637), should serve as an emendation until a more complete description can be prepared.

The posterior spines of *B. pugettensis*, although pointed and subequal in diameter, do not appear to be replacement setae for the long capillaries since they do not end in capillary tips.

Distribution.—British Columbia; Washington. In shallow subtidal and intertidal sand substrata.

Discussion

As is evident in the preceding section, there is considerable confusion among different investigators in the interpretation of the notosetae of the posterior setigers in species of the *Polydora*-complex. In an effort to clarify some of this confusion, a summary of the different forms of posterior notosetae found in these species is presented below.

1. Simple fascicles of long and short capillaries, subequal in diameter basally, with or without limbations; the shorter capillaries are developing replacement setae for the longer capillaries. Examples: *P. socialis* (this paper); *P. websteri* (Blake, 1971).

2. Long and short capillaries as in (1), with an additional group of short, very thin pointed setae. The latter setae are termed "needlelike" and occur as a group of 15 or more distinct setae as in *P. cardalia* (this paper) or in a dense flattened packet as in *P. flava* and *P. latispinosa* (see Blake and Kudenov, 1978).

3. Long and short capillaries as in (1) with additional short, acicular spines which are not capillary tipped. These spines are usually, but not always, thicker than the accompanying capillaries. Examples: *P. caeca* (see Fauvel, 1927); *P. aciculata* (see Blake and Kudenov, 1978).

4. Group of thickened acicular spines, sometimes arranged in a cone or rosette; spines either pointed (awl-shaped) or blunt, with accompanying capillaries usually lacking. Examples: awl-shaped spines—*P. caulleryi* and *P. quadrilobata* (see Blake, 1971); long pointed spines—*Tripolydora spinosa* (see Woodwick, 1964).

5. Capillaries accompanied by 1 or 2 giant, recurved boat hooks, sometimes with additional, thickened acicular spines. Examples: *P. hoplura* (see Fauvel, 1927; Blake and Kudenov, 1978); *P. colonia* (see Blake, 1971); *Boccardiella hamata* (see Blake, 1966); *B. ligerica* (see Blake and Woodwick, 1971; Light, 1978); *B. bihamata* (see Blake and Kudenov, 1978).

Most of the confusion arises with the first 3 setal arrangements indicated above. The presence of short capillaries among the longer ones has often been interpreted to mean that "needles" or "short spines" are present. Such setae, however, may be merely developing replacements for the longer capillaries. One way to check is to examine several sequential segments.

If the short setae are lacking on some segments or are highly variable in number relative to the longer capillaries, this suggests a variable replacement pattern among the capillaries. True posterior spines or needles will normally be consistent in number and arrangement over several segments.

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