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Shelf to Bathyal Bivalve and Scaphopod Mollusks Collected by the R/V *Wakataka-maru* from off the Pacific Coast of Northern Japan during the Years 2005–2007

Takashi Okutani[1], Hiroshi Saito[2] and Takuma Haga[3, 4]

[1] Japan Agency for Marine-Earth Science and Technology, 2–15 Natsushima-cho,Yokosuka, 237–0062 Japan
E-mail: okutani@jamstec.go.jp.
[2] Department of Zoology, National Museum of Nature and Science,
3–23–1 Hyakunin-cho, Shinjuku-ku, Tokyo 169–0073, Japan
E-mail: h-saito@kahaku.go.jp
[3] Department of Geology and Paleontology, National Museum of Nature and Science,
3–23–1 Hyakunin-cho, Shinjuku-ku, Tokyo 169–0073, Japan
[4] Department of Biological Sciences, Graduate School of Science, The University of Tokyo,
7–3–1 Hongo, Bunkyo-ku, Tokyo 113–0033, Japan
E-mail: haga@kahaku.go.jp.

Abstract: Examination of shelf to bathyal bivalve and scaphopod specimens collected by the R/V *Wakataka-maru* from the Pacific coast of northern Honshu, Japan in the years from 2005 to 2007 identified 89 species of bivalves and 6 species of scaphopods. Three species, *Acila castarensis* (Hinds, 1843), *Lyonsia arenosa tarasovi* Scarlato, 1981 and *Cardiomya lindbergi* are recorded for the first time from Japanese waters. Over all, 29 species (31%) are considered to be subarctic elements, 27 species (28%) live in the mixing water down south to the Sagami Bay region, 24 species (25%) seem to have the major stock in the warm-water areas, while the remaining 15 species (16%) are not subjected for classification of distribution type

Key words: taxonomy, Mollusca, Bivalvia, Scaphopoda, deep-sea, Japan

Introduction

Under the project conducted by the National Museum of Nature and Science, Tokyo, to elucidate deep-sea faunal diversity in Japanese waters, deep-sea samplings were repeatedly carried out in the Pacific coast of northern Honshu (from Joban to Sanriku Coasts) by the R/V *Wakataka-maru* of the Tohoku National Fisheries Research Institute, Fisheries Research Agency, using an otter trawl and a biological dredge during the years from 2005 to 2007. This report deals with taxonomy of bivalves and scaphopods sorted out from benthos samples.

Materials and Methods

Sampling sites and gears

The surveyed area covered from off Aomori Prefecture down to the south off Ibaraki Prefecture. Samplings were carried out at the stations on 12 latitudinal transect lines at depths from 150 to 1500 m (Fig. 1). The positive stations for otter trawl (7.8 m in mouth span) were 117 at depths between 151 m and 1515 m and for ORI dredge (1 m in mouth span) were 40 at depth between 146 and 1521 m.

Format

Taxon name (scientific and Japanese name: Jn), positive station number and the numbers of

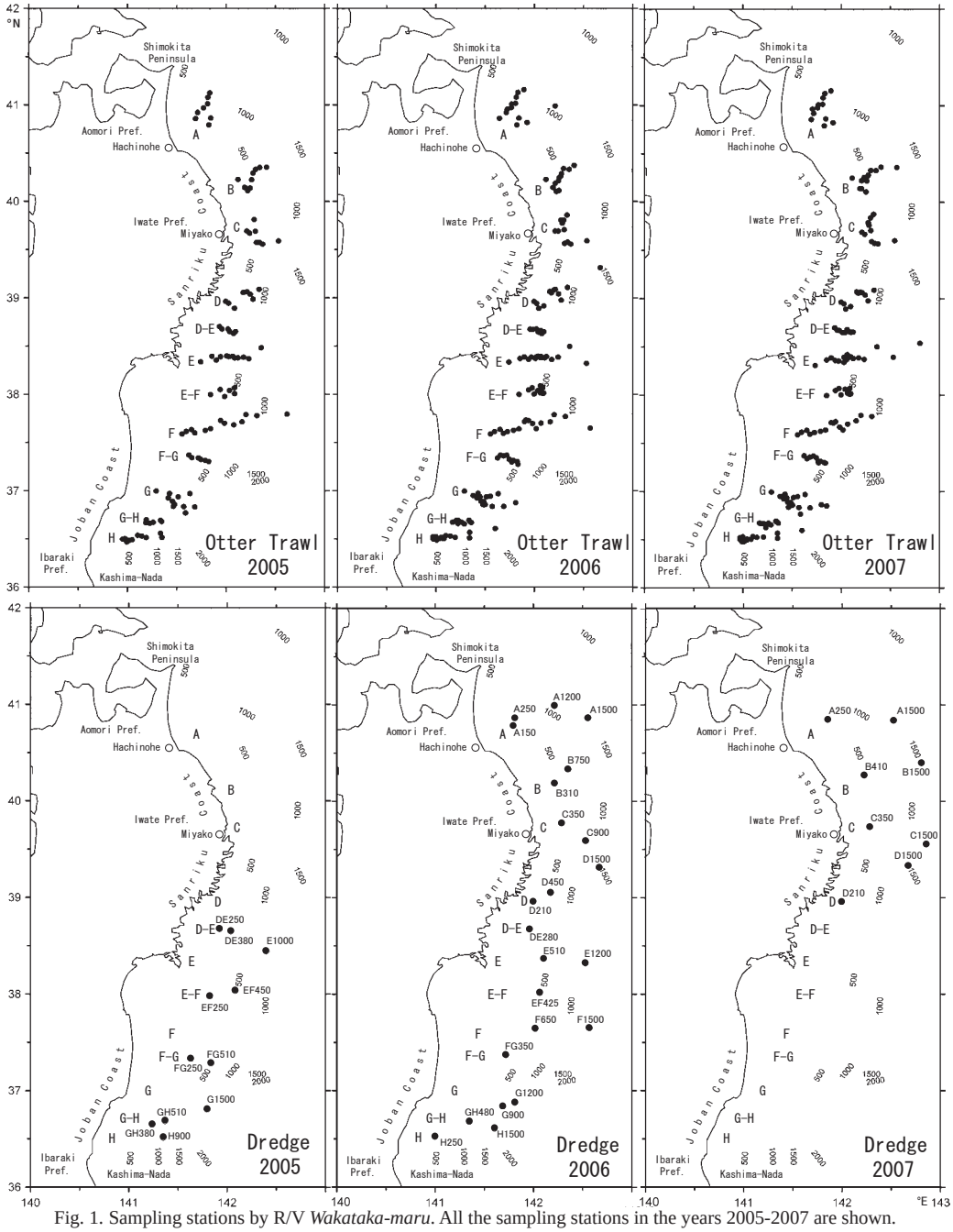

Fig. 1. Sampling stations by R/V *Wakataka-maru*. All the sampling stations in the years 2005-2007 are shown.

live-taken specimen are given under 'material examined'. The format of station number is composed of ship's code (WA for the R/V *Wakataka-maru*), year (e.g. 05 for 2005), transect symbol (A to H), and interposed ones between two adjoining transects indicate, e.g. DE, FE, FG, and GH), and designated tow depth. The letter D after the station number indicates the duplicated sampling at expected depth (= station number) by dredge. The exact positions and depths of tows are referable in Table 1. The number of live-taken specimens examined follow in parenthesis. Other abbreviations used in the text are as follows: SH, shell height; SL, shell length; PL, pallet length.

Table 1. List of stations cited in the text. OT, otter trawl; DG, dredge.

Station	Date	Gear	Position in	Position out	Depth (m)	Temp (˚C)
WA05-DE250D	19 November 2005	DG	38˚40.6′N, 141˚55.3′E	38˚40.2′N, 141˚55.2′E	249–249	–
WA05-DE380	19 November 2005	OT	38˚38.9′N, 142˚02.3′E	38˚40.5′N, 142˚02.4′E	376–377	3.2
WA05-DE380D	19 November 2005	DG	38˚39.1′N, 142˚02.2′E	38˚38.6′N, 142˚02.1′E	375–373	–
WA05-DE410	20 November 2005	OT	38˚39.3′N, 142˚03.4′E	38˚40.9′N, 142˚03.5′E	407–404	3.3
WA05-DE450	20 November 2005	OT	38˚37.7′N, 142˚04.5′E	38˚39.3′N, 142˚04.8′E	451–447	3.3
WA05-DE480	21 November 2005	OT	38˚39.0′N, 142˚05.8′E	38˚40.6′N, 142˚06.1′E	473–477	3.3
WA05-DE510	21 November 2005	OT	38˚39.0′N, 142˚07.3′E	38˚37.9′N, 142˚07.2′E	511–511	3.4
WA05-E450	25 October 2005	OT	38˚23.6′N, 142˚04.0′E	38˚25.2′N, 142˚03.7′E	448–452	3.9
WA05-E480	25 October 2005	OT	38˚22.6′N, 142˚05.3′E	38˚20.9′N, 142˚06.0′E	482–483	3.9
WA05-E900	26 October 2005	OT	38˚28.9′N, 142˚21.4′E	38˚29.7′N, 142˚21.6′E	900–904	3.1
WA05-E1000D	26 October 2005	DG	38˚26.7′N, 142˚23.8′E	38˚26.4′N, 142˚23.7′E	1005–1004	–
WA05-EF250D	17 November 2005	DG	37˚58.7′N, 141˚49.3′E	37˚59.0′N, 141˚49.4′E	259–253	–
WA05-EF450D	18 November 2005	DG	38˚02.2′N, 142˚04.8′E	38˚02.6′N, 142˚04.9′E	452–454	–
WA05-EF510	16 November 2005	OT	38˚00.8′N, 142˚05.7′E	38˚01.7′N, 142˚06.3′E	505–514	3.7
WA05-F480	27 October 2005	OT	37˚41.9′N, 141˚59.0′E	37˚40.2′N, 141˚59.0′E	484–480	4.4
WA05-F510	27 October 2005	OT	37˚39.4′N, 142˚01.2′E	37˚38.2′N, 142˚01.1′E	508–506	4.3
WA05-F650	28 October 2005	OT	37˚42.8′N, 142˚09.7′E	37˚43.9′N, 142˚09.2′E	652–649	3.8
WA05-F750	28 October 2005	OT	37˚47.4′N, 142˚12.2′E	37˚48.4′N, 142˚11.8′E	749–744	3.5
WA05-F900	28 October 2005	OT	37˚46.7′N, 142˚18.8′E	37˚45.7′N, 142˚19.1′E	900–904	3.3
WA05-FG250D	14 November 2005	DG	37˚19.9′N, 141˚37.7′E	37˚20.0′N, 141˚37.4′E	255–253	–
WA05-FG380	15 November 2005	OT	37˚19.5′N, 141˚44.6′E	37˚21.1′N, 141˚44.8′E	383–383	4.3
WA05-FG410	14 November 2005	OT	37˚18.9′N, 141˚45.8′E	37˚17.3′N, 141˚45.5′E	411–410	4.2
WA05-FG425	15 November 2005	OT	37˚19.6′N, 141˚46.5′E	37˚17.9′N, 141˚46.2′E	426–426	4.0
WA05-FG450	14 November 2005	OT	37˚18.8′N, 141˚47.2′E	37˚20.5′N, 141˚47.5′E	450–446	3.9
WA05-FG480	14 November 2005	OT	37˚18.1′N, 141˚49.4′E	37˚16.5′N, 141˚48.9′E	480–480	3.8
WA05-FG510D	15 November 2005	DG	37˚16.9′N, 141˚50.0′E	37˚17.3′N, 141˚50.2′E	516–515	–
WA05-G280	29 October 2005	OT	36˚55.4′N, 141˚24.9′E	36˚54.0′N, 141˚24.2′E	277–279	4.9
WA05-G350	3 November 2005	OT	36˚56.3′N, 141˚30.9′E	36˚58.0′N, 141˚31.5′E	373–356	4.0
WA05-G425	9 November 2005	OT	36˚53.2′N, 141˚29.2′E	36˚52.1′N, 141˚27.7′E	427–418	4.0
WA05-G450	9 November 2005	OT	36˚51.6′N, 141˚28.7′E	36˚52.8′N, 141˚30.0′E	454–448	4.0
WA05-G510	9 November 2005	OT	36˚51.6′N, 141˚30.3′E	36˚52.4′N, 141˚31.4′E	507–509	4.0
WA05-G650	9 November 2005	OT	36˚50.2′N, 141˚34.2′E	36˚50.9′N, 141˚35.2′E	644–650	3.7
WA05-G750	10 November 2005	OT	36˚46.2′N, 141˚35.4′E	36˚45.6′N, 141˚34.8′E	750–750	3.4
WA05-G900	10 November 2005	OT	36˚49.9′N, 141˚41.0′E	36˚49.3′N, 141˚40.5′E	901–901	3.2
WA05-G1500D	10 November 2005	DG	36˚48.4′N, 141˚47.7′E	36˚48.6′N, 141˚48.2′E	1498–1498	2.4
WA05-GH250	11 November 2005	OT	36˚41.9′N, 141˚11.4′E	36˚40.5′N, 141˚10.2′E	251–249	7.6
WA05-GH350	11 November 2005	OT	36˚39.7′N, 141˚13.5′E	36˚41.0′N, 141˚15.0′E	344–351	4.3
WA05-GH380	12 November 2005	OT	36˚40.4′N, 141˚15.6′E	36˚39.0′N, 141˚14.5′E	376–381	4.2
WA05-GH380D	12 November 2005	DG	36˚39.0′N, 141˚14.3′E	36˚39.3′N, 141˚14.6′E	378–373	–
WA05-GH425	13 November 2005	OT	36˚39.5′N, 141˚17.3′E	36˚40.9′N, 141˚18.3′E	425–422	4.0
WA05-GH450	13 November 2005	OT	36˚41.6′N, 141˚20.1′E	36˚40.2′N, 141˚19.0′E	454–452	4.1
WA05-GH480	13 November 2005	OT	36˚40.8′N, 141˚20.8′E	36˚42.3′N, 141˚21.6′E	482–479	4.1
WA05-GH510	11 November 2005	OT	36˚40.3′N, 141˚21.6′E	36˚41.3′N, 141˚22.2′E	509–511	4.1
WA05-GH510D	11 November 2005	DG	36˚41.1′N, 141˚22.0′E	36˚40.9′N, 141˚21.9′E	512–508	–
WA05-H150	30 October 2005	OT	36˚29.9′N, 140˚57.0′E	36˚31.3′N, 140˚58.1′E	154–156	10.9
WA05-H550	1 November 2005	OT	36˚31.8′N, 141˚08.7′E	36˚32.5′N, 141˚09.6′E	563–558	4.1
WA05-H900	2 November 2005	OT	36˚30.9′N, 141˚21.0′E	36˚30.4′N, 141˚20.3′E	900–899	3.2
WA06-A150D	9 October 2006	DG	40˚46.5′N, 141˚51.9′E	40˚46.5′N, 141˚52.2′E	146–147	–
WA06-A250D	10 October 2006	DG	40˚51.4′N, 141˚50.9′E	40˚51.3′N, 141˚51.1′E	267–266	–
WA06-A450	10 October 2006	OT	40˚58.3′N, 141˚45.9′E	40˚58.9′N, 141˚45.4′E	466–474	2.9
WA06-A900	12 October 2006	OT	41˚09.5′N, 141˚53.7′E	41˚09.2′N, 141˚53.8′E	883–882	2.9
WA06-A1200	12 October 2006	OT	40˚56.0′N, 142˚15.7′E	40˚55.8′N, 142˚16.1′E	1182–1188	–
WA06-A1200D	12 October 2006	DG	40˚59.3′N, 142˚12.7′E	40˚58.9′N, 142˚12.9′E	1202–1201	–
WA06-A1500D	12 October 2006	DG	40˚52.0′N, 142˚33.4′E	40˚51.6′N, 142˚33.8′E	1513–1512	–

Table 1. (Continued)

Station	Date	Gear	Position in	Position out	Depth (m)	Temp (˚C)
WA06-B310D	14 October 2006	DG	40˚09.9´N, 142˚13.2´E	40˚10.0´N, 142˚13.2´E	305–305	–
WA06-B750D	13 October 2006	DG	40˚21.8´N, 142˚20.2´E	40˚22.1´N, 142˚20.0´E	750–747	–
WA06-C350D	15 October 2006	DG	39˚48.9´N, 142˚17.1´E	39˚49.0´N, 142˚17.2´E	357–364	–
WA06-C450	16 October 2006	OT	39˚42.3´N, 142˚18.2´E	39˚40.7´N, 142˚17.7´E	482–454	3.0
WA06-C650	5 October 2006	OT	39˚34.6´N, 142˚20.3´E	39˚35.6´N, 142˚20.4´E	663–649	3.5
WA06-C900	5 October 2006	OT	39˚35.4´N, 142˚32.0´E	39˚36.1´N, 142˚32.8´E	893–909	2.8
WA06-D210D	19 October 2006	DG	38˚56.4´N, 141˚59.3´E	38˚56.2´N, 141˚59.2´E	213–214	–
WA06-D450D	17 October 2006	DG	39˚02.4´N, 142˚10.5´E	39˚02.7´N, 142˚10.6´E	460–460	–
WA06-D1500D	17 October 2006	DG	39˚18.7´N, 142˚40.2´E	39˚18.0´N, 142˚40.1´E	1521–1518	–
WA06-DE280D	23 November 2006	DG	38˚42.9´N, 141˚58.3´E	38˚43.1´N, 141˚58.4´E	284–285	–
WA06-DE380	23 November 2006	OT	38˚38.7´N, 142˚02.2´E	38˚40.4´N, 142˚02.4´E	376–378	3.2
WA06-DE425	23 November 2006	OT	38˚39.6´N, 142˚03.9´E	38˚40.9´N, 142˚04.3´E	421–424	3.2
WA06-DE480	23 November 2006	OT	38˚38.9´N, 142˚05.7´E	38˚39.8´N, 142˚05.9´E	476–476	3.4
WA06-E150	5 November 2006	OT	38˚20.0´N, 141˚44.5´E	38˚18.2´N, 141˚44.1´E	154–151	13.0
WA06-E380	4 November 2006	OT	38˚23.4´N, 142˚01.6´E	38˚21.9´N, 142˚02.3´E	377–382	3.3
WA06-E450	3 November 2006	OT	38˚23.5´N, 142˚04.0´E	38˚25.2´N, 142˚03.6´E	448–451	3.6
WA06-E480	3 November 2006	OT	38˚22.7´N, 142˚05.2´E	38˚21.2´N, 142˚05.9´E	480–484	3.4
WA06-E510	3 November 2006	OT	38˚22.6´N, 142˚06.3´E	38˚23.9´N, 142˚05.7´E	514–506	3.4
WA06-E510D	3 November 2006	DG	38˚23.8´N, 142˚05.6´E	38˚24.1´N, 142˚05.4´E	503–498	–
WA06-E900	2 November 2006	OT	38˚29.8´N, 142˚21.6´E	38˚29.1´N, 142˚21.5´E	905–908	2.8
WA06-E1200	2 November 2006	OT	38˚23.4´N, 142˚31.8´E	38˚23.8´N, 142˚31.9´E	1202–1206	–
WA06-E1200D	2 November 2006	DG	38˚19.3´N, 142˚31.7´E	38˚19.4´N, 142˚31.7´E	1214–1213	–
WA06-EF350	22 November 2006	OT	38˚00.2´N, 141˚59.9´E	37˚58.7´N, 141˚59.3´E	356–357	8.1
WA06-EF380	22 November 2006	OT	38˚02.3´N, 142˚02.1´E	38˚04.0´N, 142˚02.5´E	378–373	4.1
WA06-EF410	22 November 2006	OT	38˚05.3´N, 142˚03.7´E	38˚03.6´N, 142˚03.7´E	410–409	3.9
WA06-EF425D	21 November 2006	DG	38˚03.3´N, 142˚04.0´E	38˚03.1´N, 142˚04.1´E	420–424	–
WA06-EF450	22 November 2006	OT	38˚04.0´N, 142˚05.1´E	38˚02.6´N, 142˚05.0´E	450–453	3.8
WA06-E510	3 November 2006	OT	38˚22.6´N, 142˚06.3´E	38˚23.9´N, 142˚05.7´E	514–506	3.4
WA06-F310	29 October 2006	OT	37˚36.8´N, 141˚43.7´E	37˚36.1´N, 141˚43.6´E	313–309	4.1
WA06-F350	30 October 2006	OT	37˚37.6´N, 141˚47.3´E	37˚39.2´N, 141˚47.4´E	353–350	3.9
WA06-F450	30 October 2006	OT	37˚43.6´N, 141˚56.6´E	37˚45.2´N, 141˚56.4´E	450–450	3.4
WA06-F480	31 October 2006	OT	37˚41.7´N, 141˚59.0´E	37˚39.9´N, 141˚59.0´E	483–478	3.6
WA06-F510	31 October 2006	OT	37˚38.6´N, 142˚01.1´E	37˚39.8´N, 142˚01.4´E	503–511	3.8
WA06-F650	31 October 2006	OT	37˚42.9´N, 142˚09.7´E	37˚44.0´N, 142˚09.1´E	654–651	3.7
WA06-F650D	31 October 2006	OT	37˚44.9´N, 142˚08.5´E	37˚45.2´N, 142˚08.4´E	647–641	–
WA06-F750	1 November 2006	OT	37˚47.3´N, 142˚12.2´E	37˚48.1´N, 142˚12.0´E	749–747	3.4
WA06-F1500	1 November 2006	OT	37˚36.3´N, 142˚33.6´E	37˚36.0´N, 142˚33.5´E	1515–1513	–
WA06-F1500D-1	1 November 2006	DG	37˚34.6´N, 142˚33.5´E	37˚35.0´N, 142˚33.5´E	1511–1508	–
WA06-F1500D-2	1 November 2006	DG	37˚38.9´N, 142˚34.1´E	37˚39.4´N, 142˚34.3´E	1466–1471	–
WA06-FG250	19 November 2006	OT	37˚20.4´N, 141˚37.6´E	37˚21.9´N, 141˚37.5´E	255–252	6.8
WA06-FG280	19 November 2006	OT	37˚22.1´N, 141˚39.3´E	37˚20.4´N, 141˚39.1´E	278–277	5.6
WA06-FG350D	19 November 2006	OT	37˚22.8´N, 141˚43.2´E	37˚23.2´N, 141˚43.2´E	346–346	–
WA06-FG380	19 November 2006	OT	37˚19.5´N, 141˚44.6´E	37˚21.1´N, 141˚44.8´E	382–382	4.7
WA06-FG425	10 November 2006	OT	37˚17.8´N, 141˚46.2´E	37˚19.5´N, 141˚46.6´E	426–425	4.2
WA06-FG450	10 November 2006	OT	37˚18.8´N, 141˚47.2´E	37˚20.5´N, 141˚47.5´E	449–444	4.0
WA06-FG480	10 November 2006	OT	37˚18.2´N, 141˚49.5´E	37˚16.5´N, 141˚48.8´E	480–477	3.8
WA06-G210	26 October 2006	OT	36˚57.0´N, 141˚22.7´E	36˚58.4´N, 141˚23.8´E	210–208	8.9
WA06-G310	26 October 2006	OT	36˚56.2´N, 141˚26.9´E	36˚54.8´N, 141˚26.5´E	301–315	4.8
WA06-G425	27 October 2006	OT	36˚53.2´N, 141˚29.2´E	36˚52.1´N, 141˚27.6´E	428–420	5.0
WA06-G450	27 October 2006	OT	36˚51.5´N, 141˚28.6´E	36˚52.7´N, 141˚30.0´E	454–454	4.6
WA06-G480	28 October 2006	OT	36˚51.2´N, 141˚29.2´E	36˚50.0´N, 141˚27.7´E	481–483	4.5
WA06-G900D	11 November 2006	DG	36˚47.5´N, 141˚39.4´E	36˚47.3´N, 141˚39.1´E	925–920	–
WA06-GH350	16 November 2006	OT	36˚39.6´N, 141˚13.4´E	36˚40.8´N, 141˚14.8´E	345–352	4.6
WA06-GH380	16 November 2006	OT	36˚40.4´N, 141˚15.6´E	36˚38.9´N, 141˚14.5´E	377–381	4.7

Table 1. (Continued)

Station	Date	Gear	Position in	Position out	Depth (m)	Temp (˚C)
WA06-GH450	16 November 2006	OT	36˚41.6′N, 141˚20.1′E	36˚40.3′N, 141˚19.0′E	453-450	4.5
WA06-GH480	18 November 2006	OT	36˚40.7′N, 141˚20.8′E	36˚42.2′N, 141˚21.6′E	481-478	4.3
WA06-GH480D	18 November 2006	DG	36˚40.0′N, 141˚20.3′E	36˚39.8′N, 141˚20.0′E	483-478	–
WA06-H150	12 November 2006	OT	36˚31.3′N, 140˚58.2′E	36˚29.9′N, 140˚57.1′E	157-154	12.8
WA06-H250	12 November 2006	OT	36˚31.4′N, 140˚59.9′E	36˚29.8′N, 140˚58.8′E	243-246	8.5
WA06-H250D	12 November 2006	OT	36˚30.9′N, 140˚59.6′E	36˚31.1′N, 140˚59.8′E	248-248	–
WA06-H280	13 November 2006	OT	36˚30.8′N, 141˚00.2′E	36˚29.4′N, 140˚59.1′E	282-279	5.9
WA06-H310	12 November 2006	OT	36˚30.6′N, 141˚00.6′E	36˚29.1′N, 140˚59.5′E	309-310	5.5
WA06-H480	13 November 2006	OT	36˚32.1′N, 141˚06.0′E	36˚32.7′N, 141˚06.9′E	481-480	4.2
WA06-H510	14 November 2006	OT	36˚30.3′N, 141˚04.9′E	36˚31.1′N, 141˚05.9′E	508-510	3.9
WA06-H550	14 November 2006	OT	36˚31.8′N, 141˚08.7′E	36˚32.6′N, 141˚09.8′E	561-557	4.1
WA06-H650	14 November 2006	OT	36˚31.0′N, 141˚11.7′E	36˚31.7′N, 141˚12.7′E	659-646	3.8
WA06-H900	14 November 2006	OT	36˚30.6′N, 141˚20.5′E	36˚31.2′N, 141˚21.1′E	896-894	3.1
WA06-H1500	15 November 2006	OT	36˚36.1′N, 141˚36.1′E	36˚35.9′N, 141˚36.1′E	1478-1475	–
WA06-H1500D	15 November 2006	DG	36˚36.5′N, 141˚36.2′E	36˚36.7′N, 141˚36.1′E	1470-1450	–
WA07-A150	7 October 2007	OT	40˚47.5′N, 141˚49.6′E	40˚46.8′N, 141˚51.3′E	154-146	15.2
WA07-A250	6 October 2007	OT	40˚51.8′N, 141˚50.6′E	40˚50.5′N, 141˚51.9′E	273-258	5.4
WA07-A250D	6 October 2007	DG	40˚51.0′N, 141˚51.2′E	40˚50.9′N, 141˚51.5′E	258-258	–
WA07-A310	6 October 2007	OT	40˚49.4′N, 141˚55.0′E	40˚50.6′N, 141˚53.5′E	306-309	3.6
WA07-A350	7 October 2007	OT	40˚55.3′N, 141˚43.2′E	40˚55.2′N, 141˚44.7′E	360-359	–
WA07-A410	9 October 2007	OT	40˚57.9′N, 141˚42.5′E	40˚57.5′N, 141˚43.3′E	412-415	3.4
WA07-A450	9 October 2007	OT	40˚58.7′N, 141˚45.6′E	40˚58.3′N, 141˚46.1′E	471-468	3.4
WA07-A650	10 October 2007	OT	41˚04.9′N, 141˚48.9′E	41˚04.5′N, 141˚49.2′E	662-661	3.3
WA07-A1500D	11 October 2007	DG	40˚50.5′N, 142˚31.5′E	40˚50.2′N, 142˚31.1′E	1402-1377	–
WA07-B150	14 October 2007	OT	40˚15.0′N, 142˚06.6′E	40˚13.3′N, 142˚07.4′E	153-156	9.8
WA07-B310	13 October 2007	OT	40˚13.4′N, 142˚12.4′E	40˚11.7′N, 142˚12.8′E	309-307	3.5
WA07-B350	13 October 2007	OT	40˚06.4′N, 142˚15.1′E	40˚08.2′N, 142˚14.6′E	350-352	3.4
WA07-B410	13 October 2007	OT	40˚15.4′N, 142˚14.1′E	40˚13.7′N, 142˚14.6′E	420-412	3.4
WA07-B410D	13 October 2007	DG	40˚16.9′N, 142˚13.5′E	40˚17.1′N, 142˚13.5′E	416-416	–
WA07-B450	12 October 2007	OT	40˚13.2′N, 142˚15.7′E	40˚14.7′N, 142˚15.4′E	454-459	3.5
WA07-B1500D	12 October 2007	DG	40˚23.9′N, 142˚48.5′E	40˚23.9′N, 142˚48.2′E	1511-1514	–
WA07-C310	14 October 2007	OT	39˚47.3′N, 142˚16.4′E	39˚45.6′N, 142˚16.0′E	318-294	3.9
WA07-C350	15 October 2007	OT	39˚45.7′N, 142˚16.9′E	39˚47.4′N, 142˚17.0′E	358-358	3.9
WA07-C350D	15 October 2007	DG	39˚44.2′N, 142˚16.9′E	39˚44.4′N, 142˚16.9′E	355-354	–
WA07-C410	14 October 2007	OT	39˚50.3′N, 142˚17.9′E	39˚48.5′N, 142˚17.9′E	409-415	3.7
WA07-C450	17 October 2007	OT	39˚42.3′N, 142˚18.0′E	39˚40.6′N, 142˚17.7′E	467-458	3.7
WA07-C510	14 October 2007	OT	39˚52.5′N, 142˚19.8′E	39˚51.2′N, 142˚20.0′E	511-521	3.5
WA07-C750	16 October 2007	OT	39˚34.1′N, 142˚22.5′E	39˚33.5′N, 142˚22.3′E	748-749	3.4
WA07-C900	16 October 2007	OT	39˚36.1′N, 142˚32.7′E	39˚35.9′N, 142˚32.5′E	900-893	3.1
WA07-C1500D	16 October 2007	DG	39˚33.4′N, 142˚51.3′E	39˚33.6′N, 142˚53.3′E	1499-1480	–
WA07-D210	18 October 2007	OT	38˚57.8′N, 141˚59.9′E	38˚59.2′N, 142˚00.6′E	212-214	8.8
WA07-D210D	18 October 2007	DG	38˚57.4′N, 141˚59.7′E	38˚57.7′N, 141˚59.9′E	213-213	–
WA07-D350	18 October 2007	OT	38˚55.1′N, 142˚05.7′E	38˚53.5′N, 142˚05.2′E	354-351	5.0
WA07-D410	17 October 2007	OT	39˚04.2′N, 142˚09.5′E	39˚06.0′N, 142˚09.8′E	406-406	4.1
WA07-D510	17 October 2007	OT	39˚04.2′N, 142˚11.8′E	39˚05.3′N, 142˚12.0′E	505-513	3.6
WA07-D650	5 October 2007	OT	39˚02.3′N, 142˚14.7′E	39˚03.3′N, 142˚14.9′E	640-661	3.6
WA07-D900	5 October 2007	OT	39˚05.3′N, 142˚20.0′E	39˚06.0′N, 142˚20.1′E	898-905	3.2
WA07-DE250	23 November 2007	OT	38˚41.9′N, 141˚55.9′E	38˚40.5′N, 141˚55.5′E	251-252	11.0
WA07-F900	10 November 2007	OT	37˚46.7′N, 142˚18.7′E	37˚46.1′N, 142˚18.9′E	896-898	3.3
WA07-FG250	19 November 2007	OT	37˚22.3′N, 141˚37.3′E	37˚20.6′N, 141˚37.6′E	251-255	7.5

Taxonomic Account

Class BIVALVIA Linnaeus, 1758
Subclass Protobranchia Pelseneer, 1889
Order Solemyoida Dall, 1889
Family Solemyidae Gray, 1840

Acharax johnsoni (Dall, 1891) [Jn: Suehiro-kinutaregai] (Fig. 2A)

*Material examined.*WA07-C1500D (3).

*Remarks.*This species is associated with deep-sea seeps and carries chemoautosynthetic symbiont bacteria. However, there is a possibility that *Acharax* '*johnsoni*' is composed of diverse cryptic species.

Order Nuculoida Dall, 1889
Family Nucinellidae Vokes, 1956

Huxleyia sulcata (A. Admas, 1860) [Jn: Kibigaragai] (Fig. 2B)

*Material examined.*WA05-DE250D (7); WA05-FG250D (5); WA06-DE280D (7).

*Remarks.*The present finding may be a slight extension of geographical distribution range up north to the Sanriku Coast, as this species has been known from off Boso Peninsula, and southwards, in 50–200 m (Higo *et al.*, 1999). This species is well characterized by having lustrous surface and commarginal step-like lamellae along growth lines.

Family Nuculidae Gray, 1824

Leionucula tenuis (Montagu, 1808) [Jn: Kogurumigai] (Fig. 2C)

*Material examined.*WA05-DE250D (9); WA05-DE380D (87); WA05-DE410 (1); WA05-DE450 (1); WA05-DE480 (1); WA05-DE510 (1); WA05-E480 (2); WA05-EF250D (7); WA05-FG250D (10); WA05-FG510D (1); WA06-C450 (3); WA06-D450D (2); WA06-DE280D (71); WA06-DE380D (24); WA06-DE480 (2); WA06-E450 (1); WA06-E510D (30); WA06-EF425D (7); WA06-H480 (1); WA06-H550(1); WA07-A250D (2); WA07-A450 (1); WA07-A650 (1); WA07-B410D (1); WA07-C350D (1); WA07-D210D (2); WA07-DE250D (7); WA07-FG250D (4).

Leionucula cyrenoides (Kuroda, 1929) [Jn: Shijiminari-kurumigai] (Fig. 2D)

*Material examined.*WA05-FG250D (3); WA06-H250D (25); WA06-H480 (2); WA07-D210D (3).

*Remarks.*This species resembles the preceding species in profile, but the shell is more inflated and ornamented by irregular commarginal lamellae, but without radial lines in inter-lamellar spaces. Toba (2009) recorded this species from depths between 50 m and 2230 m off Iwate Prefecture.

Leionucula niponica (Smith, 1885) [Jn: Kurumigai = O-kurumigai] (Fig. 2E)

*Material examined.*WA05-DE250D (7); WA05-DE380D (7); WA05-E450 (1); WA05-EF250D (1); WA05-EF450D (2); WA05-F480 (1); WA05-FG250D (4); WA05-FG510D (9); WA06-A1200 (4); WA06-D450D (3); WA06-DE280D (5); WA06-DE380D (4); WA06-E380 (2); WA06-E480 (1); WA06-E510D (8); WA06-EF425D (7); WA06-F450 (1); WA06-F480 (1); WA06-F650D (1); WA06-FG350D (8); WA06-H250D (20); WA06-H480 (148); WA06-H550 (1);

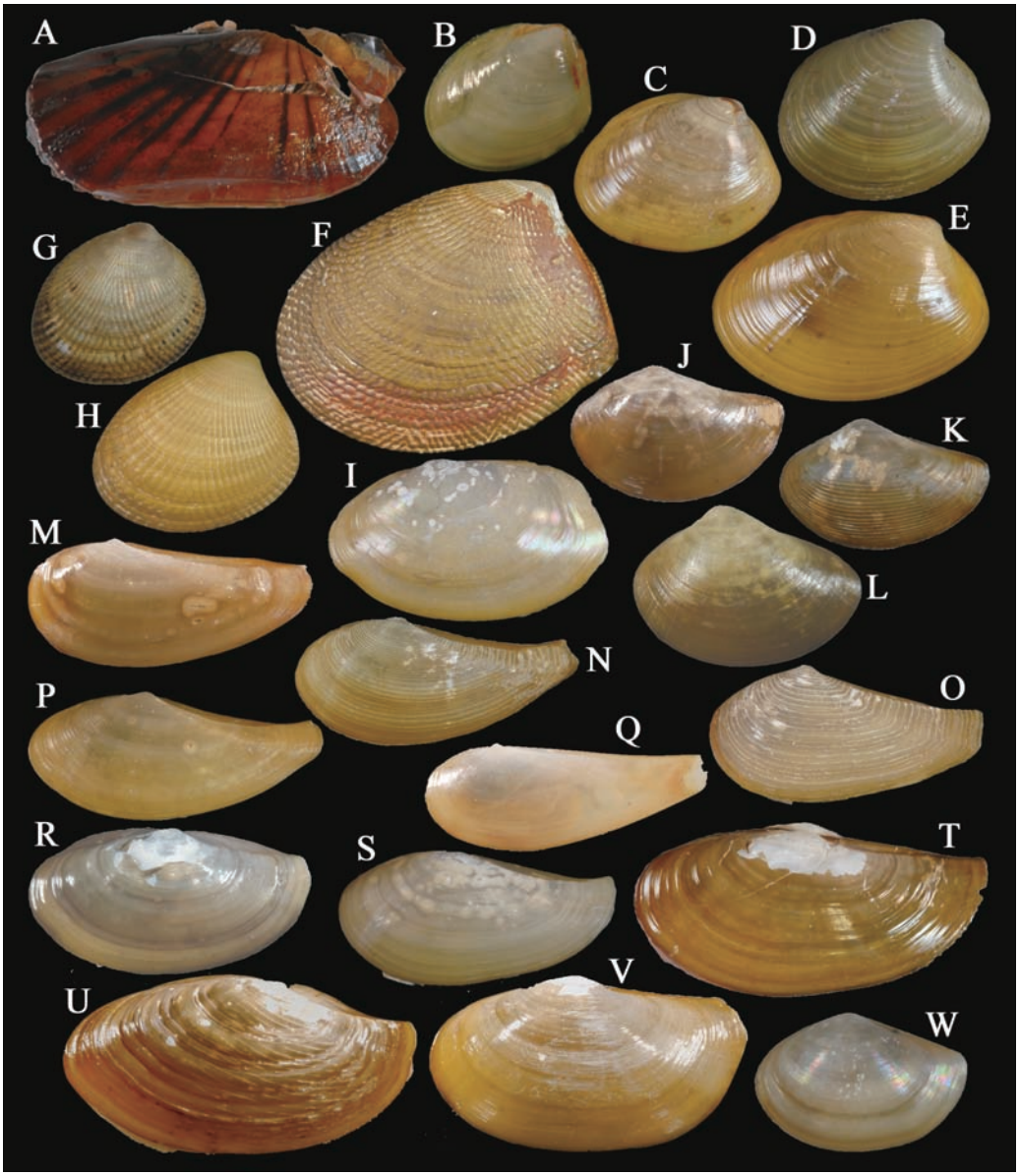

Fig. 2. Protobranchia. A, *Acharax johonsoni*, WA07-C1500D, SL 40.0 mm; B, *Huxleyia sulcata*, WA06-DE280D, SL 1.9 mm; C, *Leionucula tenuis*, WA05-DE380D, SL 12.6 mm; D, *Leionucula cyrenoides*, WA06-H480, SL 16.5 mm; E, *Leionucula niponica*, WA06-A1200, SL 30.5 mm; F, *Acila divaricata vigilia*, WA06-DE280D, SL 35.6 mm; G, *Truncacila minutoides*, WA07-D210D, SL 6.0 mm; H, *Truncacila castrensis*, WA06-F1500D, SL 12.8 mm; I, *Malletia* sp. cf *pacifica*, WA07-D900, SL 17.1 mm; J, *Neilonella soyoae*, WA06-F750, SL 10.8 mm; K, *Neilonella coix*, WA06-H250D, SL 9.4 mm; L, *Neillonella japonica*, WA06-F1500D, SL 8.6 mm; M, *Nuculana* (*Robaia*) *robai*, WA06-DE380D, SL 16.9 mm; N, *Nuculana* (*Thestyleda*) *kawamurai*, WA05-DE250D, SL 12.8 mm; O, *Nuculana* (*Thestyleda*) *sagamiensis*, WA06-A1200, SL 20.1 mm; P, *Nuculana ensiformis*, WA07-C350D, SL 15.8 mm; Q, *Nuculana* (*Tenuileda*) *ikebei*, WA06-H250D, SL 15.1 mm; R, *Yoldia kikuchii*, WA07-B410D, SL 12.4 mm; S, *Yoldia similis*, WA06-H250D, SL 21.0 mm; T, *Yoldia bartschi*, WA07-A450, SL 31.3 mm; U, *Yoldia* (*Cnesterium*) *johanni*, WA06-A150D, SL 28.2 mm; V, *Portlandia japonica*, WA06-F750, SL 24.7 mm; W, *Yoldiella philippiana*, WA06-DE480, SL 5.1 mm.

WA07-A450 (31); WA07-A650 (1); WA07-B410D (1); WA07-C510 (1); WA07-D210D (3); WA07-D510 (1); WA07-D900 (10).

Remarks.Leionucula niponica (Smith, 1885) was originally described from *Challenger* St. 232 in Sagami Bay, in 585 m depth, while *Leionucula mirifica* (Dall, 1907) from *Albatross* St. 5040 off south coast of Hokkaido, in 484 m depth. *L. mirifica* usually has larger, solid, and more inflated shell than *L. niponica*, and covered with dark olive periostracum. Rust-like deposits are frequently observed on umbonal and/or along the dorsal margin of the shell. It is distributed from off Hokkaido, down south to Sagami Bay in the bathyal zone (Okutani, 1962; Higo *et al*., 1999). However, in examining a large number of growth series of specimens, we are inclined to consider that *L. mirifica* is a gerontic stage of *L. niponica*, otherwise *L. mirifica* represents a cold-water morphotype of *L. niponica*. No decisive character is apparent to separate both through growth stages. Horikoshi *et al.* (1983) recorded *L.* "*mirifica*" from a depth of 620–640 m off Miyako, Iwate Prefecture.

Acila divaricata vigilia Schenck, 1936 [Jn: Karafuto-kiraragai] (Fig. 2F)

*Material examined.*WA05-DE250D (5); WA05-DE380 (6); WA05-DE380D (10); WA05-F650 (2); WA05-FG250D (1); WA06-DE280D (56); WA06-EF425D (1); WA06-F650D (1); WA06-F750 (2); WA06-FG350D (1); WA06-H250D (3); WA06-H480 (171); WA06-H510 (1); WA06-H550 (1); WA07-A450 (9); WA07-B410D (9); WA07-C350D (3); WA07-D210 (1).

*Remarks.*This is a northern subspecies of *Acila divaricata* population occurring northward from Choshi (Cape Inubo) in 160-500 m. The typical *A. divaricata divaricata* (Hinds, 1843) is distributed in Sagami Bay, southwestwards to the East China Sea, and western Japan Sea, in 50–500 m (Kurozumi and Tsuchida, 2000). This subspecies is characterized by thicker and more inflated shell, strong hinge plate, with rather ill-defined posterior flexure at the gerontic stage. Sometimes a rust-like substance covers the shell surface.

Acila minutoides Kuroda and Habe in Habe, 1958 [Jn: Tsubomi-kiraragai] (Fig. 2G)

*Material examined.*WA07-D210D (15); WA07-D900 (1).

Acila castrensis (Hinds, 1843) [Jn: Arasuka-kiraragai] (Fig. 2H)

*Material examined.*WA05-DE380D (1); WA06-F1500D (2); WA06-F1500D-2 (1); WA06-H1500D-2(2).

*Remarks.*According to Abbott (1974), it has been known from the Bering Sea, Alaska to Baja California, in 5–400 m. Higo *et al.* (1999) did not include this species in the Japanese fauna. The present discovery is a westward range extension of this species, and the first record from Japanese waters.

Family Malletiidae H. Adams and A. Adams, 1858

Malletia sp. cf. ***pacifica*** Dall, 1897 [New Jn: Konoha-sodegai] (Fig. 2I)

*Material examined.*WA05-F750 (1); WA06-B750D (1); WA06-E900 (1); WA06-E1200 (2); WA06-E1200D (1); WA06-H480 (19); WA06-H1500D (1); WA07-A650 (2); WA07-C900 (1); WA07-D900 (26).

*Remarks.*This species resembles *Malletia pacifica* Dall, 1897 which has been known from the Northeast Pacific from Alaska to California, in 400–2900 m (Coan *et al*., 2000), but has never been recorded from the Northwest Pacific.

Family Neilonellidae Schileyko, 1989

Neilonella soyoae Habe, 1958 [Jn: Soyo-hatomugi-sodegai] (Fig. 2J)

*Material examined.*WA05-EF450D (1); WA05-FG510D (8); WA05-GH380D (19); WA05-GH510 (22); WA06-DE280D (37); WA06-E510D (1); WA06-F750 (1); WA06-GH480D (58); WA06-H480 (many); WA06-H510 (4); WA06-H550 (1).

*Remarks.*Tsuchida (1985) stated that this species is replaced by a congener, *Neilonella japonica* Okutani, 1962 at around depths of 800–1000 m with a transitional zone. The present records support Tsuchida's statement: *Neilonella soyoae* was collected at the depths 250–750 m, while *N. japonica* from 1500 m.

Neilonella coix Habe, 1951 [Jn: Hatomugi-sodegai] (Fig. 2K)

*Material examined.*WA06-H480 (many); WA06-H150D (11); WA06-H250D (5); WA07-D210D (4).

Remarks.Neilonella coix Habe, 1951 was once synonymized with *Neilonella dubia* Prashad, 1932 from *Siboga* St. 52 in Indonesia (between Flores and Sumba Islands), in 959 m by Habe (1977). Prashad's species has rather strong commarginal riblets, but the present specimens have only weak growth lamellae in marginal area. Thus, we retained Habe's name.

Neilonella japonica Okutani, 1962 [Jn: Nippon-hatomugi-sodegai] (Fig. 2L)

*Material examined.*WA06-F1500D (6); WA06-H1500D (9).

*Remarks.*This species is abundant in bathyal depth in the Sagami Trough (Okutani 1962, 1966), but more recently this species has been recorded from off Kii Peninsula (Tsuchida, 1985) and Tosa Bay (Tsuchida, 1994).

Family Nuculanidae H. Adams and A. Adams, 1858

Nuculana* (*Robaia*) *robai (Kuroda, 1929) [Jn: Robai = Chiri-robai] (Fig. 2M)

*Material examined.*WA05-DE380D (9); WA06-DE280D (16); WA07-A450 (5); WA07-C350D (8).

Nuculana* (*Thestyleda*) *kawamurai Habe, 1961 [Kawamura-rôbai] (Fig. 2N)

*Material examined.*WA05-DE250D (19); WA05-DE380D (1); WA05-EF250D (1); WA05-EF450D (2); WA05-FG250D (11); WA05-FG425 (1); WA05-FG510D (3); WA05-G280 (1); WA05-GH380D (10); WA06-FG350D (1); WA06-GH480D (4); WA06-H480 (2); WA07-D210D (22).

*Remarks.*Habe (1961) initially placed this taxon as a subspecies of a circum-polar species, *Nuculana pernula* (Müller, 1771). However, the compressed shell with sharp commarginal riblets, and slightly upturned rostrum well characterize it in *Thestyleda* as a distinct species (Kurozumi and Tsuchida, 2000).

Nuculana* (*Thestyleda*) *sagamiensis Okutani, 1962 [Sagami-arabori-robai] (Fig. 2O)

*Material examined.*WA06-A1200 (3); WA06-F1500D (1); WA06-F1500D-2 (3); WA06-H1500D (4); WA07-D900 (24).

*Remarks.*This species has been known from Sagami Bay, in 700–1500 (Okutani, 1962, 1966) and Okhotsk Sea, in 307–1643 m (Scarlato, 1981).

Nuculana* (*Nuculana*) *ensiformis Scarlato, 1981 [New Jn: Tsuya-robai] (Fig. 2P)

*Material examined.*WA06-DE280D (2); WA07-C350D (1).

*Remarks.*This species has been known from the southern Kurile Islands, in 150–414 m. The present records extend its distributional range ca. 1000 km to the southwest.

Nuculana* (*Tenuileda*) *ikebei Suzuki and Kanehara, 1936 [Jn: Kagero-sodegai = ikebe-sodegai] (Fig. 2Q)

*Material examined.*WA05-DE380D (6); WA05-FG250D (3); WA05-GH380D (11); WA05-GH510D (4); WA06-DE280D (17); WA06-FG350D (8); WA06-GH480D (1); WA06-H250D (3); WA06-H480D (38).

*Remarks.*The occurrences of the Recent specimens have been reported from bathyal depths (700–1000 m) from the Sea of Kashima-Nada to Sagami and Suruga Bays (Okutani, 1962, 1966, 1968). The present discoveries extended its distribution range north to off the Sanriku Coast by ascending the habitat to shelf and slope, around 250–500 m.

Yoldia kikuchii Kuroda, 1929 [Jn: Naginata-sodegai] (Fig. 2R)

*Material examined.*WA05-DE380D (1); WA07-B410D (9); WA07-C350D (2).

Yoldia similis Kuroda and Habe in Habe, 1958 [Jn: Naga-sodegai] (Fig. 2S)

*Material examined.*WA06-H250D (58).

*Remarks.*The present specimen superficially resembles *Nuculana robai* (Kuroda, 1929), but it is distinguishable from the latter in having low umbo, dull coloration of periostracum, and lack of flexure within the posterior rostrum. Toba (2009) reported this spacies from off Otsuchi Bay, Iwate Prefecture, 64-150 m depth.

Yoldia bartschi Scarlato, 1981 [New Jn: Abra-sodegai] (Fig. 2T)

*Material examined.*WA07-A450 (2): WA07-B410D (1).

*Remarks.*This species was described from the Sea of Japan and Okhotsk Sea, in 15–900 m (Scarlato, 1981: 199). Habe and Ito (1965: 104, pl. 48, fig. 30) illustrated this species under the name of "*Yoldia amygdalea* (Valenciennes)" and elucidated distribution as Hokkaido and northwards.

Yoldia* (*Cnesterium*) *johanni Dall, 1958 [Jn: Ezo-sodegai] (Fig. 2U)

*Material examined.*WA06-A150D (2).

Portlandia japonica (Adams and Reeve, 1850) [Jn: Bekko-kiraragai] (Fig. 2V)

*Material examined.*WA05-DE380D (135); WA05-DE410 (2); WA05-DE450 (2); WA05-E480 (1); WA05-EF450D (1); WA06-A450 (1); WA06-A1500D (3); WA06-C450 (1); WA06-D450D (26); WA06-DE280D (3); WA06-DE425 (1); WA06-E450 (1); WA06-E480 (2); WA06-E510 (1); WA06-E510D (92); WA06-E1200D (2); WA06-EF425D (17); WA06-F750 (5); WA06-F1500D (6); WA06-F1500D-2 (9); WA06-H480 (1); WA06-H1500D (3); WA07-A450 (53); WA07-A650 (4); WA07-B1500 (3); WA07-C450 (1); WA07-D410 (2); WA07-D510 (1); WA07-D900 (9).

*Remarks.*Kuroda *et al.* (1971), Habe (1977) and Higo *et al.* (1999) all considered that this is a sublittoral to shelf species, such as in 20–300 m. But, the present survey clarified it that *Portlandia japonica* is extended down to bathyal depth of 1500 m. A congeneric species, *Portlandia lischkei* (Smith, 1885) is a consistent member of the bathyal community in Sagami Bay and southward, but did not occur in the present material.

Yoldiella philippiana (Nyst, 1844) [Jn: Kibi-sodegai] (Fig. 2W)

*Material examined.*WA05-DE250D (1); WA05-DE380D (3); WA05-FG250D (1); WA06-DE480 (1); WA06-E510D (1); WA06-EF410 (1); WA06-H480 (6); WA07-A450 (73).

Subclass Pteriomorphia Beurlen, 1944
Order Arcoida Stoliczka, 1871
Family Limopsidae Dall, 1895

Limopsis uwadokoi Oyama, 1951 [Jn: Mino-shirasunagai] (Fig. 3A)

*Material examined.*WA05-DE410 (2); WA05-DE450 (1); WA05-E900 (2); WA05-EF450D (3); WA05-F750 (1); WA05-F900 (5); WA05-FG380 (1); WA05-FG425 (4); WA05-FG450 (2); WA05-FG480 (1); WA05-G350 (1); WA05-G450 (2); WA05-G900 (3); WA05-GH450 (1); WA05-GH480 (1); WA05-GH510 (3); WA05-H900 (3); WA06-A150D (1); WA06-A250D (20); WA06-B750D (1); WA06-C350D (2); WA06-D450D (6); WA06-DE280D (1); WA06-DE380D (1); WA06-DE480 (1); WA06-E1200D (2); WA06-EF425D (1); WA06-F450 (1); WA06-F480 (1); WA06-F650 (1); WA06-F650D (2); WA06-F750 (2); WA06-F1500D (6); WA06-F1500D-2 (27); WA06-FG425 (2); WA06-FG450 (2); WA06-FG480 (2); WA06-G210 (1); WA06-G310 (1); WA06-G480 (1); WA06-G900D (4); WA06-GH450 (1); WA06-GH480 (1); WA06-GH480D (15); WA06-H250D (1); WA06-H480 (3); WA06-H550 (1); WA06-H650 (3); WA06-H900 (1); WA06-H1500D (1); WA07-A250D (131); WA07-A310 (2); WA07-A350 (1); WA07-A410 (1); WA07-B410D (11); WA07-C450 (1); WA07-C750 (1); WA07-C1500D (16); WA07-D900 (many); WA07-F900 (1).

*Remarks.*This species is well characterized in having thick periostracum with dense periostracal hairs. It is most probable that it represents a northern phenotype of *Limopsis belcheri* Adams and Reeve, 1850, which is common around the depth 100–800 m in off Boso Peninsula, southward to Shikoku and Kyushu and the western Japan Sea. Habe (1977) synonymized this species with *Limopsis tajimae* Sowerby, 1914 (= *L. belcheri*). *L. uwadokoi* is one of the most abundant bivalves living in shelf to bathyal zones in the Sea of Kashima-Nada (Okutani 1962; Horikoshi *et al*., 1983) northwards to the Sanriku Coast and the Pacific coast of Hokkaido. Scarlato (1981) recorded it also from the Sea of Okhotsk, in 235–500 m.

Crenulilimopsis oblonga (A. Adams, 1860) [Jn: Namijiwa-shirasunagai] **(**Fig. 3B)

*Material examined.*WA05-G1500D (2): WA06-A150D (4); WA06-F1500D (3); WA06-H1500D (11); WA07-A150 (1).

*Remarks.*This species seems to be rather common on shelf in this sea area, as S/S *Sôyô-maru* also collected this species from depths of 143 m, 152 m, and 172 m (Habe, 1958a). Toba (2009) recorded this species from off Otsuchi Bay, Iwate Prefecture, 52-150 m depth.

Family Glycymerididae Newton, 1916

Glycymeris yessoensis (Sowerby, 1889) [Jn: Ezo-tamakigai] (Fig. 3C)

*Material examined.*WA06-A150D (2).

Order Mytiloida Férussac, 1822
Family Mytilidae Rafinesque, 1815

Modiolus margaritaceus (Nomura and Hatai, 1940) [Jn: Mame-hibarigai] (Fig. 3D)

*Material examined.*WA06-E150 (5); WA07-A250D (8).

Fig. 3. Pteriomorphia. A, *Limopsis uwadokoi*, WA05-GH480, SL 27.6 mm; B, *Crenulilimopsis oblonga*, WA06-GH1500D, SL 12.0 mm; C, *Glycymeris yessoensis*, WA06-A150D, SL 15.0 mm; D, *Modiolus margaritaceus*, WA06E150, SL 13.6 mm; E, *Adipicola crypta*, WA05-F510, 14.3 mm; F, *Adipicola iwaotakii*, WA06-FG480, SL 8.0 mm; G, *Idasola japonica*, WA06-FG480, SL 16.9 mm; H, *Dacrydium vitreum*, WA06-DE280D, SL 4.1 mm; I, *Solamen spectabilis*, WA06-H250D, SL 11.0 mm; J, *Crenulla yokoyamai*, WA06-EF425D, SL 6.1 mm; K, *Crenella columbiana*, WA05-FG510D, SL 29.6 mm; L, *Musculus laevigatus*, WA07-A350, SL 14.0 mm; M, *Musculus minutus*, WA06-F1500D, SL 7.1 mm; N, *Musculus corrugatus* WA07-B410D, SL 17.2 mm; O, *Musculus cupreus*, WA07-B310, SL 8.4 mm; P, *Limatula vladiostokensis*, WA05-GH350, SL 6.3 mm; Q, *Chlamys* (*Chlamys*) *islandica*, WA07-B150, SL 40.0 mm; R, *Chlamys* (*Coralichlamys*) *jousseaumei*, WA06-H310, SL 15.1 mm; S, *Delectopecten randolphi*, WA06-H550, SL 29.6 mm; T, *Parvamussium alaskense*, WA06-B310D, SL 26.9 mm; U, *Monia macroschisma*, WA06-H150, SL 14.0 mm.

Adipicola crypta (Dall, Bartsch and Rehder, 1938) [Jn: Hoso-hirano-makura] (Fig. 3E)

*Material examined.*WA05-F510 (1).

*Remarks.*This species prefers to reducing environment, such as whale falls (Okutani *et al.*, 2003). It is not evident if there were organic remains at the trawling station where this specimen was collected.

Adipicola iwaotakii (Habe, 1958) [Jn: Ito-mayuigai] (Fig. 3F)

*Material examined.*WA05-GH380 (2); WA06-FG480 (1).

*Remarks.*Habe (1958a) reported that this species lives in holes of sunken timber bored by shipworms. A young specimen in the present material (WA06-FG480) is extremely slender having SL 8.0 mm or about 4 times SH. Habe (1961) claimed that the shell of *Adipicola iwaotakii* is sometimes not so elongated as indicated by the shape of borehole. The specimen from WA05-GH380 is SL 7.6 mm or about 3 times SH. The type specimen is SL 26 mm or 2.8 times SH. The congeneric species, *Adipicola pacifica* Dall, Bartsch and Rehder, 1938 is associated with whale fall (Tsuchida and Tabakotani, 1997; Okutani *et al.*, 2003), but not with sunken wood.

Idasola japonica Habe, 1976 [Jn: Kizamiba-mayuigai] (Fig. 3G)

*Material examined.*WA05-GH380 (4); WA06-EF450 (1); WA06-F510 (1); WA06-FG480 (98).

*Remarks.*This genus is characterized by having taxodont teeth behind the ligament. Habe (1976) emphasized that this species has periostracal hairs. A part of the present material also exhibits a hirsute appearance, but they are byssal hairs (Bottjer and Carter, 1980). This species has been found attached to sunken wood, and the present specimens were also collected from wood. A congeneric species *I. washintonia* Bernard, 1978 is associated with both sunken wood and whale fall (Dell, 1987; Smith, 1992).

Dacrydium vitreum (Möller, 1842) [Jn: Kitano-hibarigai] (Fig. 3H)

*Material examined.*WA05-DE250D (2); WA05-FG250D (1); WA06-DE280D (1); WA06-FG350D (1); WA06-GH480 (2); WA07-A450 (2); WA07-B410D (1); WA07-D900 (3).

*Remarks.*This is a circum-arctic species with wide bathymetrical range (in 5–4380 m: Scarlato, 1981).

Solamen spectabilis (A. Adams, 1862) [Jn: Kisagai-modoki] (Fig. 3I)

*Material examined.*WA05-H150 (1); WA06-H250D (1).

*Remarks.*This has been known as *Solamen diaphana* (Dall, 1908) or *Solamen saccosericata* Habe, 1951 (Jn: Kinubukuro). The depth range has been estimated as 50–870 m (Kurozumi, 2000).

Crenella yokoyamai Nomura, 1922 [Jn: Chigo-Kizamigai] (Fig. 3J)

*Material examined.*WA05-EF250D (1); WA06-DE280D (6); WA06-EF425D (1); WA06-F1500-2 (1); WA06-H480 (1); WA07-D210D (2); WA07-D900 (60).

Crenella columbiana Dall, 1897 [Jn: Hososuji-kizamigai] (Fig. 3K)

*Material examined.*WA05-FG510D (1).

*Remarks.*The present specimen has a more elongate shell, smaller umbo, and more angulate posterodorsal margin, which are different from hitherto figured specimens in the previous works such as Habe (1961) and Kurozumi (2000). However, there are delicate taxodont teeth on the hinge line indicating that this sample may represent considerable individual variability.

Musculus laevigatus (Gray, 1824) [Jn: Habutae-tamaegai] (Fig. 3L)

*Material examined.*WA07-A350 (2).

Musculus minutus Scarlato, 1960 [Jn: Kitano-kotamaegai] (Fig. 3M)

*Material examined.*WA05-DE380D (9); WA06-F1500D-2 (1); WA07-A250D (2); WA07-A450 (1); WA07-C350D (1); WA07-C1500D (1); WA07-D210D (4); WA07-D900 (19).

*Remarks.*This has been known from Komandorsky Island, at 126 m, Kurile Islands, in 13–380 m, Okhotsk Sea, at 72 m (Scarlato, 1960, 1981) and south to off Tohoku District, in 150–380 m (Kurozumi, 2000). The present occurrence seems to represent deepening of habitat towards southern locality.

Musculus corrugatus (Stimpson, 1851) [Jn: Chidori-tamaegai] (Fig. 3N)

*Material examined.*WA07-B410D (1).

*Remarks.*This species is widely distributed in circum-arctic areas, from 20 m to 264 m (Scarlato, 1981). Around the mainland Japan, Habe and Ito (1965) reported it from Hokkaido. This is the southernmost and the deepest record of this species.

Musculus cupreus (Gould, 1861) [Jn: Tamaegai] (Fig. 3O)

*Material examined.*WA07-B310 (1).

*Remarks.*The present depth record is deeper than previous records which ranged from intertidal to 150 m (Higo *et al.*, 1999)

Order Limoida Waller, 1978
Family Limidae Rafinesque, 1815

Limatula vladivostokensis (Scarlato, 1955) [Jn: Hime-yukibane] (Fig. 3P)

*Material examined.*WA05-EF250D (1); WA05-GH350 (2); WA05-GH380 (1); WA05-GH380D (many); WA05-GH425 (1); WA06-GH350 (1); WA06-GH480D (1); WA06-H250D (2); WA06-H480 (1); WA07-A250D (1).

*Remarks.*This species was originally described from the Primoriya Region, northern Japan Sea, but now it is known to range south to the western Japan Sea and to Kii Peninsula, on the Pacific coast of Honshu, at depths between 50 and 350 m (Higo *et al.*, 1999).

Order Pectinoida Adams and Adams, 1858
Family Pectinidae Rafinesque, 1815

Chlamys* (*Chlamys*) *islandica (Müller, 1776) [Jn: Orora-nishiki] (Fig. 3Q)

*Material examined.*WA07-B150 (1).

Chlamys* (*Coralichlamys*) *jousseaumei (Bavay, 1904) [Jn: Nikuiro-nadeshiko] (Fig. 3R)

*Material examined.*WA06-H310 (5); WA07-B150(2).

*Remarks.*This species has been known from off Boso Peninsula southward to Kyushu (Habe, 1977), and further south to the South China Sea (Higo *et al.*, 1999). The present occurrence is northern range extension up to the Sanriku Coast. Hayami (2000) placed this taxon in the subgenus *Veprichlamys*.

Delectopecten randolphi (Dall, 1897) [Jn: O-harinadeshiko] (Fig. 3S)

*Material examined.*WA05-FG480 (3); WA05-G650 (2); WA05-G750 (3); WA05-H550 (1); WA05-H900D (1); WA06-C650 (1); WA06-C900 (3); WA06-F650 (9); WA06-FG425 (1); WA06-H550 (1); WA07-C900 (3); WA07-D650 (1).

*Remarks.*The type locality of this scallop is Destruction Island, Washington. This is a circumsubarctic species extending south by deepening the habitat to Sagami Bay and off Miyake Island (Okutani, 1968), and further west to the East China Sea (Higo *et al*., 1999). A dense aggregation was occasionally observed in bathyal habitat by the underwater vehicle (Okutani, 2008).

Family Propeamussiidae Abbott, 1954

Parvamussium alaskense (Dall, 1871) [Jn: Arasuka-nishiki] (Fig. 3T)

*Material examined.*WA05-DE250D (2); WA05-G350 (1); WA05-GH350 (1); WA06-A250D (1); WA06-B310D (12); WA06-C350D (23); WA06-C450 (2); WA06-EF350 (1); WA06-F310 (1); WA06-GH350 (1); WA06-GH380 (1); WA07-A250 (4); WA07-A250D (4); WA07-A310 (7); WA07-B350 (28); WA07-B410 (1); WA07-C310 (many); WA07-C350 (54); WA07-C350D (1); WA07-C410 (10).

*Remarks.*The radial sculpture on the left valve is variable from nearly smooth to being ornamented by strong scales.

Family Anomiidae Rafinesque, 1815

Monia macroschisma (Deshayes, 1839) [Jn: Namimagashiwa-modoki] (Fig. 3U)

*Material examined.*WA06-H150 (1)

*Remarks.*The substratum to which this specimen attached is unknown. But, it is assumed that this was adherent to round pebble not to a pectinoid shell, as the present specimen has no false ribs but only delicately wrinkled radial sculptures.

Subclass Heterodonta Neumayr, 1884
Order Veneroida H. Adams and A. Adams, 1856
Family Lucinidae Fleming, 1828

Lucinoma yoshidai Habe, 1958 [Jn: Yoshida-tsukigai-modoki] (Fig. 4A)

*Material examined.*WA06-H250D (7).

*Remarks.*This species undergoes a remarkable transformation in outline with growth, but the identity of two small specimens (SL 6.0 and 6.8 mm) needs to be confirmed. *Lucinoma yoshidai* Habe, 1958 was originally described from S/S *Sôyô-maru* St. 495, off Shimane Prefecture, the Sea of Japan, at the depth of 146 m. Since then, this species has been known from the Sea of Kashima-Nada, southward to Sagami Bay, from shelf (around 100–200 m) down to bathyal depths (700–1000m) (Okutani and Hashimoto, 1997), occasionally within chemosynthesis-based community associated with seeps (Fujikura *et al*., 1996; Okutani, 2008).

Family Thyasiridae Dall, 1900

Thyasira tokunagai Kuroda and Habe in Habe, 1961 [Jn: Hanashigai] (Fig. 4B)

*Material examined.*WA05-DE380D (1); WA05-FG510D (17); WA06-E510D (38); WA06-FG350D (2); WA06-GH480D (2); WA06-H480 (9); WA07-B410D (3).

Remarks. This species has been known from southern Hokkaido and southwards, northeastern Honshu, the Sea of Japan, East China Sea, Yellow Sea and Bo-hai, in 5–300 m (Higo *et al*.,

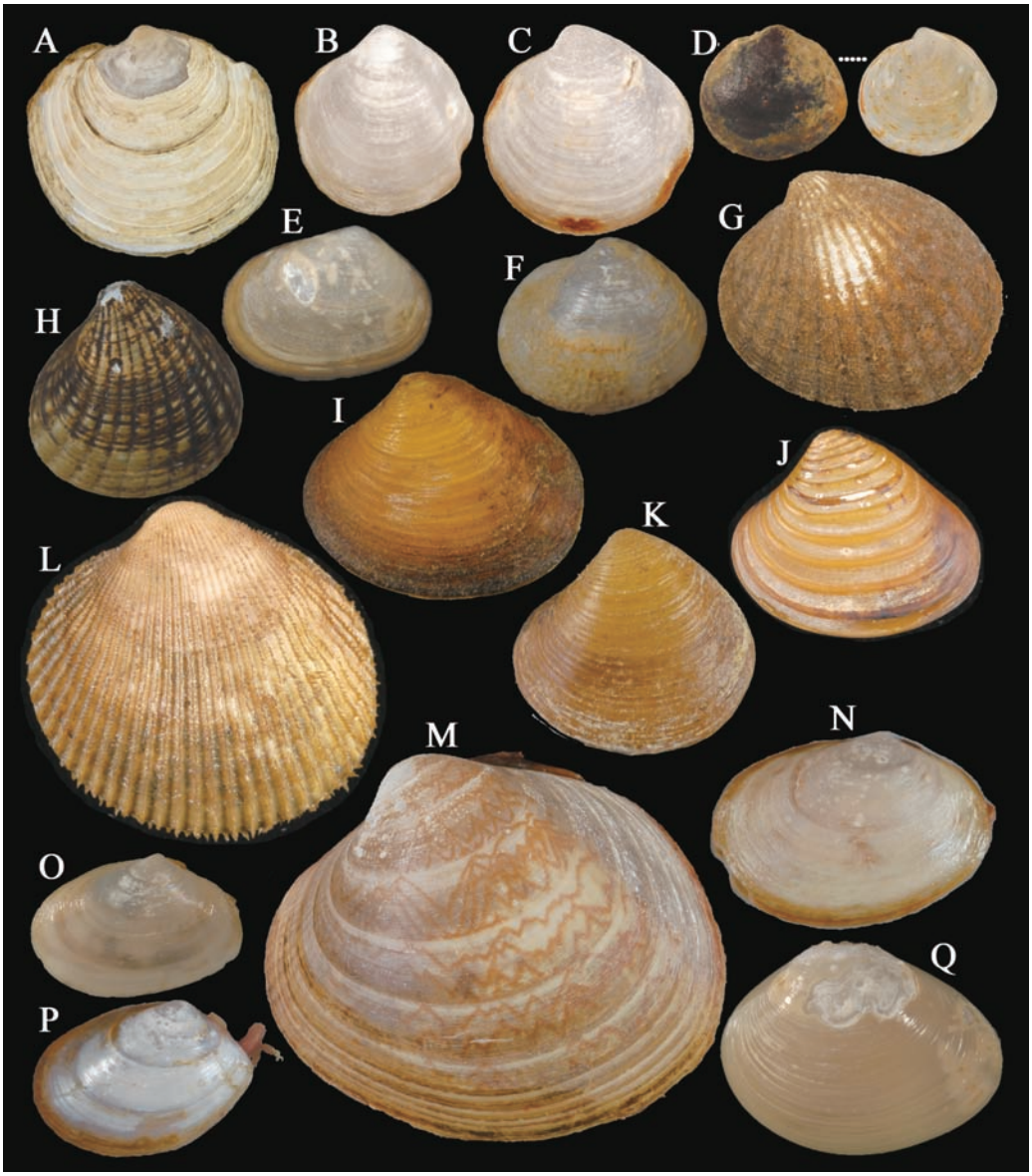

Fig. 4. Heterodonta: Veneroida. A, *Lucinoma yoshidai*, WA06-H250D, SL 19.8 mm; B, *Thyasira tokunagai*, WA06-E510D, SL 6.0 mm; C, *Thyasira* (*Maorithyas*) sp. aff. *kawamurai*, WA06-D450D, SL 10.0 mm; D, *Axinulus rubiginosa*, WA06-DE280D, SL 2.9 mm (left: shell covered by foreign deposit); E, *Mysella ventricosa*, WA07-D900, SL 5.2 mm; F, *Neaeromya*? sp., WA07-A450, SL 4.3 mm; G, *Cyclocardia ferruginea*, WA06-A150D, SL 20.6 mm; H, *Miodontiscus annakensis*, WA07-C350D, SL 5.8 mm; I, *Tridonta borealis*, WA06-DE380D, SL 22.6 mm; J, *Tridonta elliptica*, WA07-A250, SL 17.0 mm; K, *Tridonta bennetti*, WA06-A250D, SL 14.9 mm; L, *Clinocardium ciliatum*, WA07-A250D, SL 35.0 mm; M, *Serripes* (*Yagudinella*) *notabilis*, WA07-A350, SL 80.3 mm; N, *Macoma moesta*, WA07-A450, SL 19.8 mm; O, *Abrina* sp. a, WA06-F1500D, SL 11.4 mm; P, *Abrina* sp. b, WA07-B410D, SL 6.4 mm; Q, *Liocyma fluctuosa*, WA06-D450D, SL 10.3 mm.

1999; Toba, 2009).

Thyasira* (*Parathyasira*)** sp. aff. ***kawamurai Habe, 1951 (Fig. 4C)

*Material examined.*WA05-FG510D (3); WA06-D450D (1); WA06-E510D (1); WA06-F650D

(1); WA06-F1500D-2 (1); WA06-H250D (1); WA06-H480 (2); WA07-A450 (2); WA07-D900 (2).

*Remarks.*The present specimens are most probably identical with *Thyasira kawamurai* Habe, 1951 characterizing in having a single fold on postero-dorsal margin and a low central ridge. *T. kawamurai* has been known from Sagami Bay, westwards to Mie Prefecture (Higo *et al.*, 1999), and has larger size (the type specimen measures 12.5 mm SH, 12.1 mm SL). The present specimens still disagree in their smaller size (<10.4 mm SH), less pronounced beak, and smoothly round ventral margin. It is not certain at present if they represent a northern range extension of *T. kawamurai* or close but different species of *Parathyasira*.

Axinulus rubiginosa Okutani and Izumidate, 1992 [Jn: Sabitsuki-hanashigai] (Fig. 4D)

*Material examined.*WA05-DE250D (28); WA05-FG250D (61); WA06-DE280D (103); WA06-H480 (1); WA07-D900 (1).

*Remarks.*The shell surface of most of the specimens are encrusted by a rust-like substance like in *Thyasira* (*Mendicula*) *"ferruginea* (Locard, 1886)*"*, but has two knobs and posterior lateral tooth on hinge plate.

Family Lasaeidae Gray, 1842

Mysella ventricosa Scarlato, 1981 [New Jn: Haiiro-hanabiragai] (Fig. 4E)

*Material examined.*WA07-D900 (8).

*Remarks.*The present species has oval-subquadrate, thin shells, and weak posterior lateral tooth. The outline of shells and the features of hinge teeth are similar to those of *Mysella planata* (Krause, 1885), but the latter has solid shells. The present species has been known from northern part of the Sea of Japan, Okhotsk Sea and southern Kurile Islands, at depths from 30–400 m. This report extends the distributional range of this species ca. 1000 km south, and bathymetrical range down to 900 m.

Neaeromya? sp. (Fig. 4F)

*Material examined.*WA07-A450 (22).

*Remarks.*The present specimens have thick periostracum, single knob-like cardinal tooth in right valve, and edentulous left valve, which match the features of the genus *Neaeromya*. However, further studies are necessary to determine the species, and even the generic assignment.

Family Carditidae Fleming, 1828

Cyclocardia ferruginea (Clessin, 1888) [Jn: Kuromaru-fumigai] (Fig. 4G)

*Material examined.*WA05-DE380D (5); WA06-A150D (8); WA06-DE280D (1).

*Remarks.*This species has frequently been collected from the shelf (101–143 m) to bathyal zone (535 m) off the Sanriku Coast by the early expedition of the S/S *Sôyô-maru* (Habe, 1958b).

Miodontiscus annakensis (Oinomikado, 1938) [New Jn: Kazuune-mamefumigai] (Fig. 4H)

*Material examined.*WA07-B410 (13); WA07-B410D (many); WA07-C350D (9).

*Remarks.*Scarlato (1981) reported *Miodontiscus prolongatus* (Carpenter, 1864) and *Monodontiscus annakensis* (Oinomikado, 1938) from the Northwest Pacific, and separated them by the number of the radial ribs on the shell surface: 10–12 in the former, while 19–23 in the latter. However, Oinomikado (1938) counted 14–16 ribs for the type specimens, and the present specimens have 15–18 ribs. As Coan *et al*.(2000) claimed, further close comparison are needed to clarify their

identity.

Family Astartidae d'Orbigny, 1844

Tridonta borealis Schumacher, 1817 [Jn: Ezo-shiraogai] (Fig. 4I)

*Material examined.*WA05-DE380D (1); WA06-A250D (4); WA06-C350D (2); WA06-DE280D (4); WA07-A250D (17); WA07-B410 (1); WA07-B410D (114); WA07-C350D (23).

*Remarks.*This is one of the circum-boreal species distributed in the subarctic Pacific and Atlantic Oceans, and the Japan, Okhotsk and Bering Seas, in 5–390 m (Scarlato, 1981). Habe (1958b) recorded this species from depths of 219 m, 377 m and 535 m off the Sanriku Coast.

Tridonta elliptica (T. Brown, 1827) [Jn: Arasuka-shiraogai] (Fig. 4J)

*Material examined.*WA06-A250D (1); WA07-A250D (3); WA07-B410D (1): WA07-C350D (1).

*Remarks.*The collected area may be the southernmost limit of distribution of this species. All previous records are from the same area, from S/S *Sôyô-maru* St. 71 off the Shimokita Peninsula, in 444 m (Habe, 1958b), and also from off the same peninsula, in 80–600 m (Ishiyama, 1974).

Tridonta bennetti (Dall, 1903) [Jn: Koezo-shiraogai] (Fig. 4K)

*Material examined.*WA06-A250D (41); WA06-B310D (1); WA06-D450D (5); WA07-A250D (91); WA07-B410D (34); WA07-C350D (5).

*Remarks.*This species is characterized by inequilateral valves which have shorter posterior margin. However, considerable variations are found in the position of umbo, and the valve sculpture from nearly smooth to having fairly strong commarginal ribs.

Family Cardiidae Lamarck, 1809

Clinocardium ciliatum (Fabricius, 1780) [Jn: Kokera-ishikagegai] (Fig. 4L)

*Material examined.*WA06-A250D (3); WA07-A250D (7).

Serripes* (*Yagudinella*) *notabilis (Sowerby, 1915) [Jn: Arisotorigai] (Fig. 4M)

*Material examined.*WA07-A350 (1).

Family Tellinidae Blainville, 1814

Macoma moesta (Deshayes, 1855) [Jn: Sotoori-shiratori] (Fig. 4N)

Material examined. WA07-A450 (1); WA07-D900 (1).

Remarks. The present occurrence proved that this species lives much deeper habitat than past records (Scarlato, 1981; Tsuchida and Kurozumi, 1995).

Family Semelidae Stoliczka, 1870

Abrina sp. a (Fig. 4O)

*Material examined.*WA05-DE250D (24); WA05-DE380D (110); WA05-EF250D (20); WA05-EF450D (37); WA05-FG250D (15); WA05-FG450 (1); WA05-FG510D (9); WA05-GH380D (5); WA06-D210D (1); WA06-D450D (1); WA06-DE250D (1); WA06-DE280D (19); WA06-DE380D (1); WA06-E510D (12); WA06-EF410 (1); WA06-EF425D (28); WA06-F650D (2); WA06-F750D (1); WA06-F1500D (1); WA06-F1500D-2 (2); WA06-FG350D (19); WA06-

G900D (2); WA06-GH480D (5); WA06-H250D (10); WA06-H480 (14); WA06-H510 (2); WA07-A250D (1); WA07-A450 (3); WA07-B1500D (1); WA07-D210D (25); WA07-D900 (31).

*Remarks.*The present species superficially resembles *Bathytellina citrocarnea* Kuroda and Habe, 1958, but is assigned to the genus *Abrina* by having oblique, posteroventrally directed resilium on the hinge plate, and lack of lateral teeth. Among *Abrina* species in the Northwest Pacific, the present species resembles either *Abrina kinoshitai* Kuroda and Habe, 1958 or *Abrina scarlatoi* Kamenev, 2007, but differs from the former by having less inflated valves with a sub-truncate posterior end, and from the latter, by having smooth shell surface and bifid cardinal tooth. The present species may be an undescribed species, but further examinations including comparisons with type materials are needed for the correct identification.

Abrina sp. b (Fig. 4P)

*Material examined.*WA07-A350 (1); WA07-B410D (19); WA07-C350D (1); WA07-C1500D (1).

*Remarks.*This species resembles the preceding species, but differs by having more posteriorly positioned umbo, and acute posterior margin. This may be also an undescribed species.

Family Veneridae Rafinesque, 1815

Liocyma fluctuosa (Gould, 1841) [Jn: Ezo-hamaguri (= Aniwa-hamaguri)] (Fig. 4Q)

*Material examined.*WA06-D450D (2); WA07-C350D (3); WA07-B410D(81).

*Remarks.*Scarlato (1981) demonstrated wide variety of the shell morphology of this species, and synonymized many taxa. All the present specimens match the form ever called *Liocyma aniwana* by Dall (1907) by having thicker, and more inflated shells. Here, we follow Scarlato's treatment, but more detailed work on specimens from more diverse localities is necessary for elucidating infraspecific variabilities.

Order Myoida Goldfuss, 1820
Family Hiatellidae Gray, 1824

Hiatella orientalis (Yokoyama, 1920) [Jn: Kinumatoigai] (Fig. 5A)

*Material examined.*WA05-DE250D (1); WA05-EF510 (7); WA05-FG410 (1); WA05-FG450 (1); WA05-G450 (2); WA05-GH380 (3); WA06-DE280D (3); WA06-E150 (5); WA06-E380 (1); WA06-F350 (1); WA06-H280 (11); WA07-A250 (1); WA07-A250D (1); WA07-A450 (3).

Family Xylophagaidae Purchon, 1941

Xylophaga rikuzenica Taki and Habe, 1945 [Jn: Kikuigai] (Fig. 5B)

*Material examined.*WA05-GH250 (many).

Xylophaga sp. cf. ***gerda*** Turner, 1972 (Fig. 5C)

*Material examined.*WA06-FG480 (2)

*Remarks.*This species is referable to *Xylophaga gerda* Turner, 2002 collected from the Caribbean because of the presence of long siphon with equal siphon tips and by shell profile, particularly of the deep gape at the postero-ventral margin. *X. gerda* has the chitinous siphonal cone which covers distal end of the siphon, but two specimens in the present collection lack the structure. It is possible that this species originally has the siphonal cone.

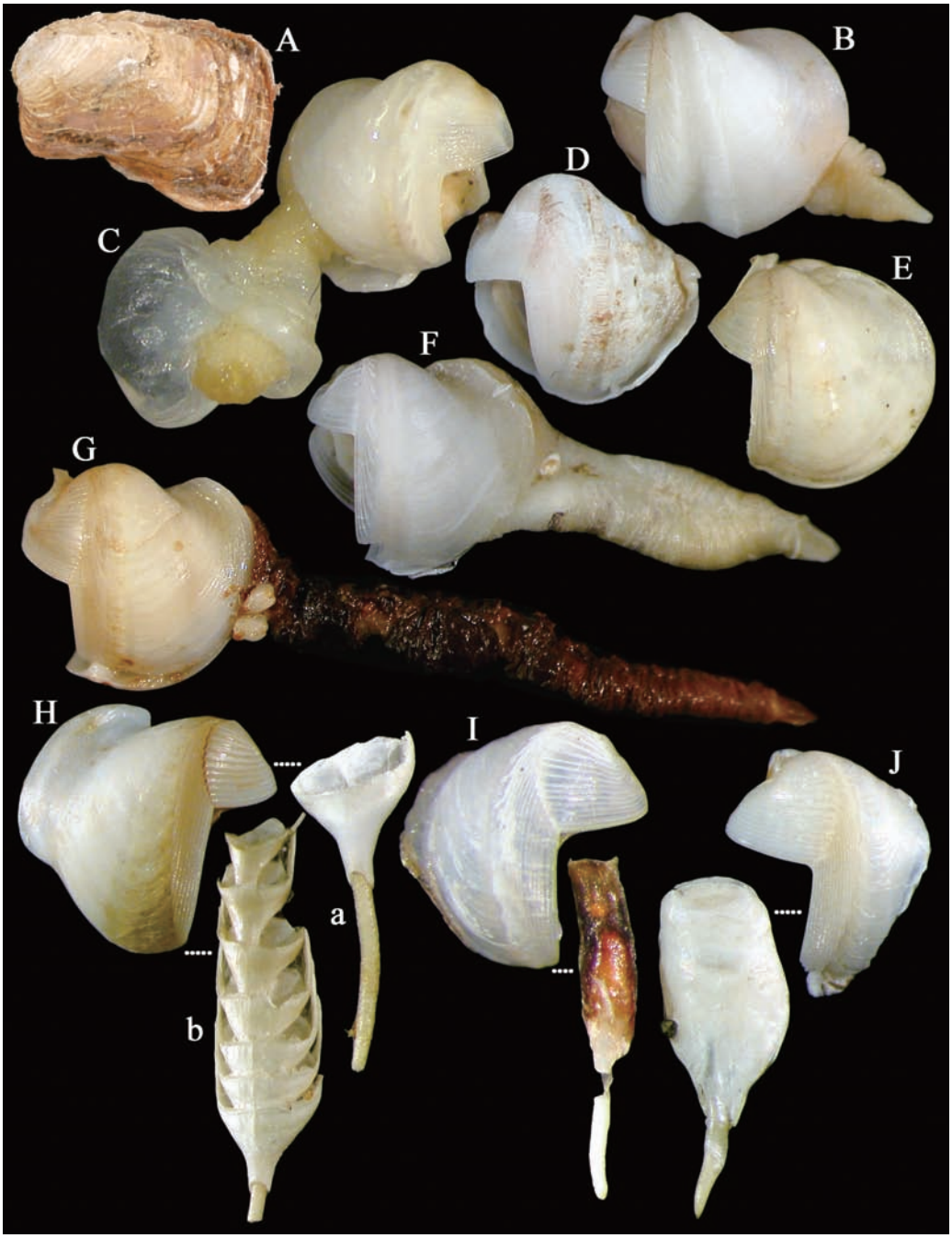

Fig. 5. Heterodonta: Myoida. A, *Hiatella orientalis*, WA06-E150, SL 20.9 mm; B, *Xylophaga rikuzenica*, WA05-GH250, SL 17.0 mm; C, *Xylophaga* sp. cf. *gerda*, WA06-FG480, SL 3 mm; D, *Xylophaga* sp. a, WA06-H480, SL 7.0 mm; E, *Xylophaga* sp. b, WA06-DE425, SL 4.6 mm; F, *Xylopholas* sp. cf. *altenai*, WA06-FG480, SL 4.0 mm; G, *Xylopholas* sp., WA06-EF450, SL 7.3 mm; H, *Bankia setacea*, WA05-GH250, SL 4.7 mm, PL ca. 6.5 mm (a); ca. 9.3 mm (b); I, *Lyrodus pedicellatus*, WA06-FG280, SL 1.4 mm, PL ca. 3.0 mm; J, *Psiloteredo megotara*, WA06-EF510, SL 3.4 mm, PL 5.8 mm. The shell and pallet were from the same individual, except Fig. 5J.

Xylophaga sp. a (Fig. 5D)

Material examined. WA06-H480 (1).

Remarks. A single specimen taken alive is complete, however, detailed allocation is difficult due to heavy corrosion of the shell surface and the stunted shell that probably deformed during development. This species is characterized by rough shell surface, prominent keel at the posterior portion of the disc and flat mesoplax.

Xylophaga sp. b (Fig. 5E)

*Material examined.*WA06-DE425 (2).

*Remarks.*Two empty, conjoined shells with complete mesoplax were collected. *Xylophaga muraokai* Turner, 2002 and *Xylophaga corona* Voight, 2007 both from the East Pacific are most similar, but this species is distinguishable from them by the more round shell, flat anterior reflection, and shallow mesoplax which is settled at an acute angle.

Xylopholas sp. cf. ***altenai*** Turner, 1972 (Fig. 5F)

*Material examined.*WA06-FG480 (7).

*Remarks.*The genus *Xylopholas* is characterized by having a pair of chitinous siphonal plates which covers the distal end of the siphon tips (Turner, 1972, 2002; Voight, 2007). Atlantic species, *Xylopholas altenai* Turner, 1972, is well referable, but the dorsal portion of the posterior slope is wider and elevated in this species. The small individuals are cuneiform and sporadically attach to the base of the siphon of the larger individual.

Xylopholas sp. (Fig. 5G)

*Material examined.*WA06-EF450 (2); WA06-G425 (1).

*Remarks.*This species is characterized by the large size, globular shell, and prosogyrate dorsal portion of the wide posterior slope, however, this species might be identical with the preceding species. More materials are needed to confirm its assignment.

Family Teredinidae Rafinesque, 1815

Bankia setacea (Tryon, 1863) [Jn: Kita-o-funakuimushi] (Fig. 5H)

*Material examined.*WA05-GH250 (5).

Lyrodus pedicellatus (Quatrefagus, 1849) [Jn: Yatsu-funakuimushi] (Fig. 5I)

*Material examined.*WA06-FG280 (1).

Psiloteredo megotara (Hanley, 1848) [Jn: Uchiwa-funakuimushi] (Fig. 5J)

*Material examined.*WA05-G425 (1); WA05-GH250 (10); WA06-DE425 (1); WA06-EF510 (5); WA06-FG250 (2); WA07-B450 (2).

*Remarks.*This species appears to have long been confused with *Nototeredo edax* (Headley, 1895) because the morphology of the pallet having the nail-like depression at the distal end is very similar in both species. However, the pallet of this species is blunt pentagonal which could be distinguished from that of *N. edax*. The dorsally projected, semicircular, large posterior slope is also characteristic to this species, although it often breaks in older individuals such as the specimen shown here (Fig. 5J). *Psiloteredo pentagonalis* Taki and Habe, 1945, which has been synonymized with *N. edax* (Turner, 1966; Habe, 1977), seems to be a synonymy of *P. megotara* referring the original description and the line drawing in Habe (1952: fig. 674). Examination of the type specimen of *P. pentagonalis* is needed to confirm its status, but the type material was not designated and

it has not been located to date.

Subclass Anomalodesmata Dall, 1889
Order Pholadomyoida Newell, 1965
Family Periplomatidae Dall, 1895

Periploma* (*Takashia*) *plane Ozaki, 1958 [Jn: Ryugu-hagoromo] (Fig. 6A)

*Material examined.*WA06-DE280D (1)

*Remarks.*The northern limit of its distribution has been thought to be off Choshi (Cape Inubo) (Higo *et al.*, 1999), but the present occurrence of a small specimen (12.8 mm SL) is a slight northern range extension of this species.

Family Thraciidae Stoliczka, 1870

Thracia kakumana Yokoyama, 1927 [Jn: Suemonogai] (Fig. 6B)

*Material examined.*WA05-DE250D (1); WA05-DE380D (6); WA05-EF250D (2); WA06-D210D (1); WA06-EF425D (1); WA06-FG350D (1); WA07-B410D (5); WA07-D210D (1).

Parvithracia* (*Pseudoasthenothaerus*) *lukini Kamenev, 2002 [New Jn: Rukin-suemonogai] (Fig. 6C)

Material examined. WA05-DE250D (6); WA05-G280 (1); WA07-A250D (3); WA07-D210D (4).

*Remarks.*This species has been recorded from the western Bering Sea to the Kurile Islands, as well as northern part of the Sea of Japan, at depths from 65–418 m (Kamenev, 2002). The present record indicates that the range is extended southwards to Joban Coast.

Parvithracia* (*Pseudoasthenothaerus*) *sirenkoi Kamenev, 2002 [New Jn: Musubi-suemonogai] (Fig. 6D)

*Material examined.*WA05-DE380D (5); WA05-EF450D (2); WA06-D450D (7); WA06-F1500-2 (1); WA06-F1500D (1); WA07-B410D (5); WA07-C1500D (1).

*Remarks.*This species was described from the southern Kurile Islands, and the southwestern Okhotsk Sea, at depths from 101–920 m (Kamenev, 2002). The present collection is the southern extension of the habitat.

Family Lyonsiidae Fischer, 1887

Lyonsia arenosa tarasovi Scarlato, 1981 [New Jn: Kitano-sazanamigai] (Fig. 6E)

*Material examined.*WA05-DE380D (1); WA07-A250D (4); WA07-D350 (1).

*Remarks.*This is the first record of this species from Japanese waters. According to Scarlato, (1981), it has been known from the Bering Sea and the northern Okhotsk Sea, at depths of 200–400 m. The present discovery is a southward range extension of this species, and a new addition to the Japanese fauna.

Family Verticordiidae Stoliczka, 1871

Halicardia nipponica Okutani, 1962 [Jn: Nippon-otohimegokorogai] (Fig. 6F)

*Material examined.*WA05-G750 (1); WA05-GH510D (1); WA06-H1500 (1); WA07-D900 (1).

*Remarks.*Before this species was described in 1962 from Sagami Bay, in 700–750 m depth, it had been recorded as “an unidentified bivalve” with an illustration in an internal report on trawl

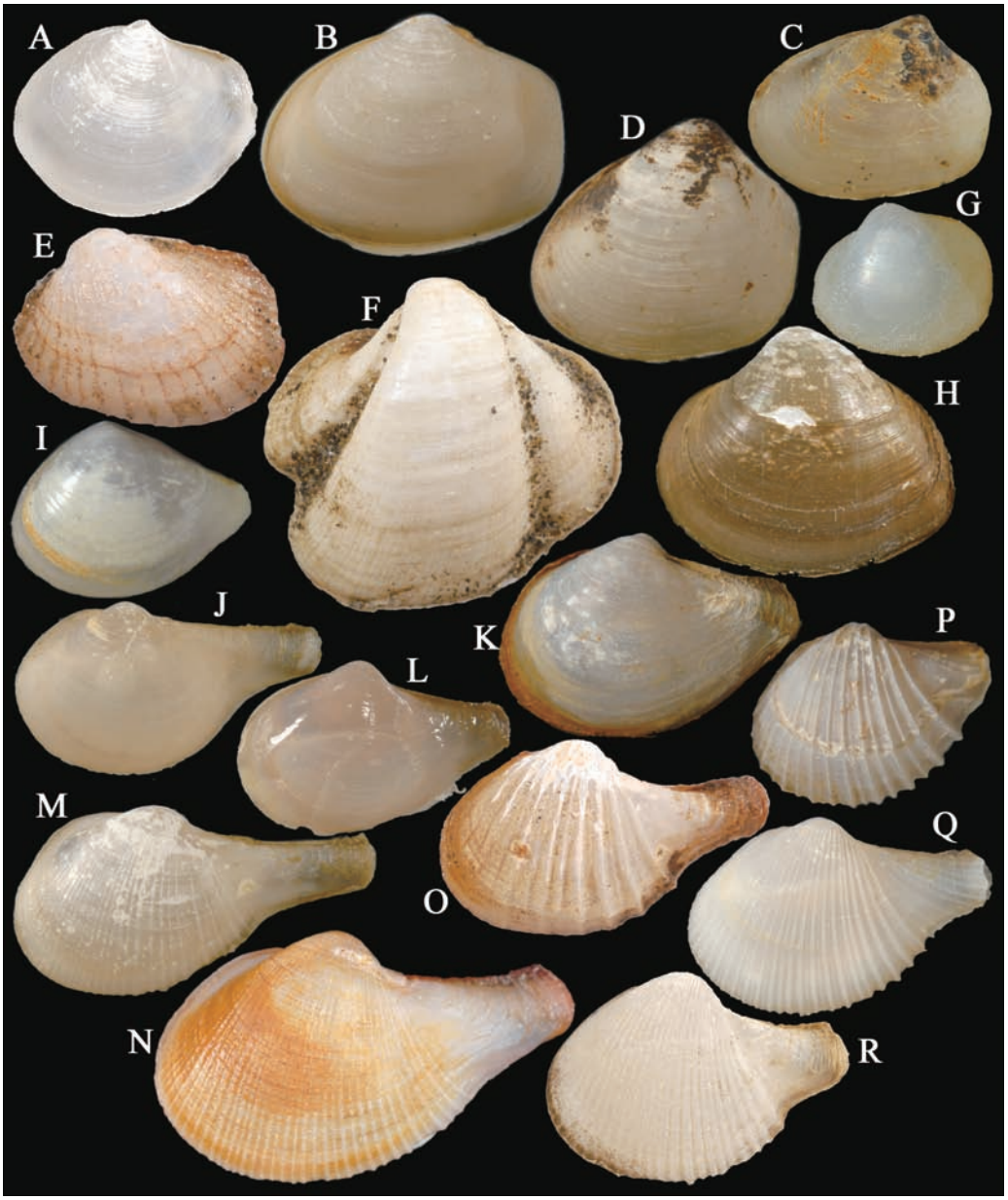

Fig. 6. Anomalodesmacea. A, *Periploma* (*Takashia*) *plane*, WA06-DE280D, SL 12.9 mm; B, *Thracia kakumana*, WA05-DE250D, SL 16.5 mm; C, *Parvithracia* (*Pseudoasthenothaerus*) *lukini*, WA05-DE250D, SL 7.3 mm; D, *Parvithracia* (*Pseudoasthenothaerus*) *sirenkoi*, WA06-F1500D, SL 7.4 mm; E, *Lyonsia arenosa tarasovi*, WA05-DE380D, SL 12.6 mm; F, *Halicardia nipponica*, WA05-G750, SL 32.4 mm; G, *Poromya* sp. WA07-D410, SL 4.8 mm; H, *Dermatomya tenuiconcha*, WA06-H480, SL 14.8 mm; I, *Pseudoneara semipellucida*, WA07-D900, SL 5.2 mm; J, *Cuspidaria mitis*, WA06-E1200D, SL 10.2 mm; K, *Cuspidaria obtusirostris*, WA06-F750, SL 12.7 mm; L, *Cuspidaria* sp., WA07-A1500D, SL 13.1 mm; M, *Cardiomya nipponica*, WA05-GH510, SL 13.3 mm; N, *Cardiomya behringensis*, WA06-A1500D, SL 15.9 mm; O, *Cardiomya kashimana*, WA05-EF450D, SL 16.3 mm; P, *Cardiomya lindbergi*, WA06-GH480D, SL 10.3 mm; Q, *Cardiomya* sp. a, WA07-C1500D, SL 10.6 mm; R, *Cardiomya* sp. b, WA07-A1500D, SL 15.6 mm.

surveys by the Tohoku Regional Fisheries Research Laboratory (1952) from off Kinkazan, in 600–800 m. Since then, this species has been collected from off Miyako (Horikoshi *et al*., 1983), the Sea of Kashima-Nada (Shikama, 1962; Okutani, 1966) , Suruga Bay (Ohta, 1983); off Miyake Island (Okutani, 1968), westward to Tosa Bay, within a bathymetrical range from 550 m to 1500 m (Okutani, 2000).

Family Poromyidae Dall, 1886

Poromya sp. (Fig. 6G)

*Material examined.*WA07-D410(1).

*Remarks.*Single juvenile specimen does not allow us to identify to species.

Dermatomya tenuiconcha (Dall, 1913) [Jn: Biwa-no-tane] (Fig. 6H)

*Material examined.*WA05-DE380D (9); WA05-EF450D (2); WA05-FG510D (1); WA05-GH380D (5); WA06-D480D (2); WA06-DE380D (2); WA06-EF350 (1); WA06-EF425D (1); WA06-G450 (1); WA06-GH450 (1); WA06-GH480D (1); WA06-H480 (15); WA07-D900 (2).

*Remarks.*Both *Dermatomya tenuiconcha soyoae* (Habe, 1952) from off Hachinohe (S/S *Sôyô-maru* St. 71, in 444 m), off Kuji (St. 62, in 631m), and off Kinkazan (St. 33, in 331 m), and *Dermatomya* (*tenuichoncha* Dall, 1913, var?) *sagamiensis* Okutani, 1962 from Sagami Bay (R/V *Soyo-maru* St. 2. in 700–750 m) are synonyms. Thus, this species is distributed from off Sanriku Coast south to Sagami Bay at depths around 300–1000 m. The type locality of this species is "deep water off Monterey Bay, California". It is not known at present, either *D. tenuiconcha* is an amphipacific species or its distribution range is continuous via the subarctic North Pacific.

Family Cuspidariidae Dall, 1886

Pseudoneara semipellucida (Kuroda, 1948) [Jn: Shakushigai-modoki] (Fig. 6I)

*Material examined.*WA07-D900 (6).

Cuspidaria mitis Prashad, 1932 [Jn: Yowa-shakushi] (Fig. 6J)

*Material examined.*WA06-E1200D (1); WA06-F1500D (1); WA06-H1500D (3); WA07-C1500D (1).

*Remarks.*This species which had been originally described from the Java Sea (*Siboga* St. 18, in 1018 m) was first discovered among bathyal fauna in Sagami Bay (Okutani, 1962). Since then, this species has been collected from off Miyake Island, in 600–1250 m, the Sea of Kashima-Nada, in 870 m (Okutani, 1968), and off the Sanriku Coast, 1585–1625 m (Horikoshi *et al*., 1983).

Cuspidaria obtusirostris Okutani, 1962 [Jn: Watazoko-shakushi] (Fig. 6K)

*Material examined.*WA07-A1500D (1).

*Remarks.*This species is characterized in having gradually tapering posterior part without a distinct step between shell body and rostrum, which is partially ornamented by wrinkled periostracum. This species has seldom been discovered from outside Sagami Bay since it was described.

Cuspidaria sp. (Fig. 6L)

*Material examined.*WA06-F750 (1); WA06-H480 (2).

*Remarks.*This species resembles the preceding species, but differs in a shorter rostrum which is well demarcated from rest of the shells by a weak ridge.

Cardiomya nipponica (Okutani, 1962) [Jn: Sekiguchi-hime-shakushi] (Fig. 6M)

*Material examined.*WA05-G510 (1); WA05-GH510D (1).

Cardiomya behringensis Leach, 1883 [Jn: Tengu-shakushi] (Fig. 6N)

*Material examined.*WA06-A900 (1); WA06-A1200D (1); WA06-A1500D (3); WA07-A450 (3).

*Remarks.*This is a cold-water species, which occasionally is found submerged underneath warm surface water and yields various phenotypes, such as *Cardiomya robiginosa* Okutani and Sakurai, 1964 in bathyal Sagami Bay, and *Cardiomya behringensis okutanii* Scarlato, 1981 in the Sea of Okhotsk. The clarification of *C. behringensis*-complex, probably using molecular method, is badly needed. Horikoshi *et al.* (1983) recorded this species from deeper stations, such as, 1585–1625 m, 1645–1655 m, and 2090–2120 m in this sea area in the collection of the R/V *Hakuho-maru*.

Cardiomya kashimana Okutani and Sakurai, 1964 [Jn: Ara-hime-shakushi] (Fig. 6O)

*Material examined.*WA05-DE380D (7); WA05-GH380D (2); WA06-GH480D (3); WA05-GH510D (2); WA06-D450D (5); WA06-H480 (7); WA07-B410D (6); WA07-C350D (1).

Cardiomya lindbergi Scarlato, 1972 [New Jn: Kitano-hime-shakushi] (Fig. 6P)

*Material examined.*WA06-EF380 (1); WA06-H480 (1); WA06-GH480 (2).

*Remarks.*The present species has sharper and more spaced radial ribs than *Cardiomya gouldiana* (Hinds, 1843). It is probable that this is a boreal phenotype of *C. gouldiana*-complex.

Cardiomya sp. a (Fig. 6Q)

*Material examined.*WA07-C1500D (2).

*Remarks.*This species is distinct by having fine, radial ribs developed on the whole shell surfaces. This may be an undescribed species.

Cardiomya sp. b (Fig. 6R)

*Material examined.*WA07-A1500D (2).

*Remarks.*The dense radial ribs on the shell of the present specimens resemble those of *Cardiomya sagamiana* Okutani and Sakurai, 1964 which has been known from Boso Peninsula to Kyushu, 10–200 m, but the latter has more elongate shells with longer rostrum. The smaller specimen (5.1 mm SL) has weak radial sculpture on the dorsal surface of rostrum, but it is obsolete in the larger specimen (15.6 mm SL).

Class SCAPHOPODA Keferstein 1862
Order Dentaliida Da Costa, 1778
Family Dentaliidae Gray, 1847

Striodentalium rhabdotum (Pilsbry, 1905) [Jn: Muchi-tsunogai] (Fig. 7A)

*Material examined.*WA05-DE250D (14); WA05-EF250D (7); WA05-FG250D (8); WA05-G1500D (5); WA05-GH510D (1); WA06-F1500D (12); WA06-F1500D-2 (34); WA06-FG350D (1); WA06-FG480 (1); WA06-GH480 (2); WA06-H250D (46); WA06-H1500D (9).

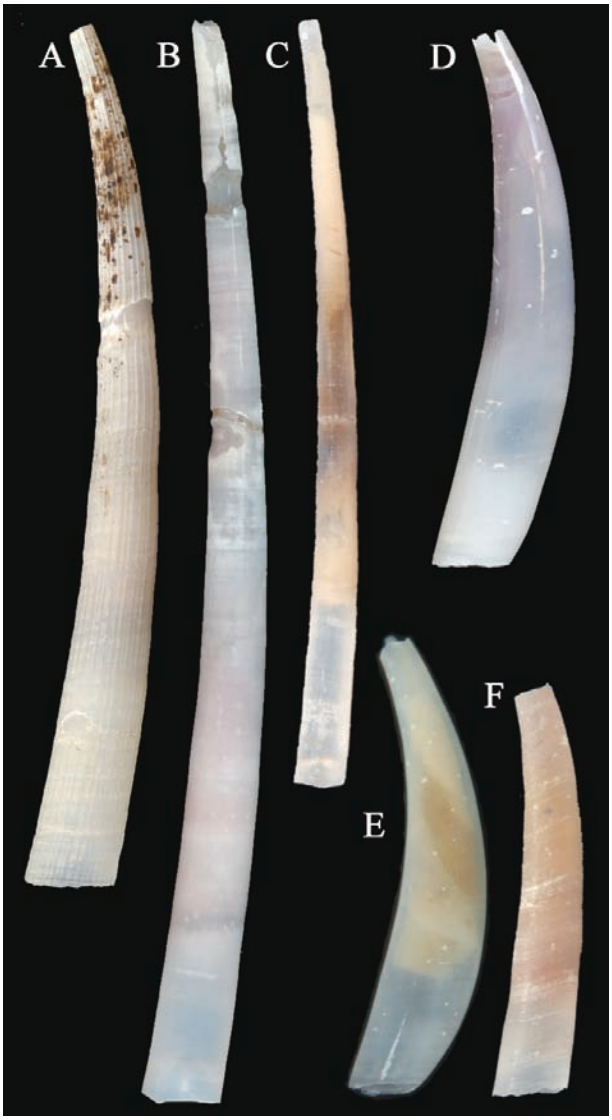

Fig. 7. Scaphopoda. A, *Striodentalium rhabdotum*, WA06-F1500D, SL 36.4 mm; B, *Laevidentalium toyamense*, WA07-A450, SL, 50.7 mm; C, *Laevidentalium* sp. aff. *sominium*, WA06-H1500D, SL 28.0 mm; D, *Polyschides sakuraii*, WA07-D900, SL 18.3 mm; E, *Gadila opportunus*, WA06-GH480D, SL 8.3 mm; F, *Siphonodentalium japonicum*, WA05-EF450D, SL 8.0 mm.

Family Laevidentaliidae Palmer, 1974

Laevidentalium toyamense (Kuroda and Kikuchi, 1933) [Jn: Toyama-tsunogai] (Fig.7B)

*Material examined.*WA05-DE380D (1); WA05-E1000D (6); WA05-EF250D (1); WA05-GH510D (1); WA06-B750D (1): WA06-E450 (1); WA06-E510D (7); WA06-E1200D (2); WA06-F650D (1); WA06-F750 (1); WA06-F1500 (1); WA06-F1500D-1 (1); WA06-F1500D-2 (9); WA06-G900D (1); WA06-H1500D (6); WA07-A450 (3); WA07-A650 (3).

Remarks.Laevidentalium toyamense (Kuroda and Kikuchi, 1933) is a large species attaining

85 mm in shell length (Okutani, 1964). The largest specimen among the present material measures 55 mm. Since this species had been originally described in 1933 from Toyama Bay facing the Sea of Japan, it was re-discovered from bathyal depths of 1190–1400 m in Sagami Bay (Okutani, 1964). The present occurrence indicates that this tusk shell is distributed in slope to bathyal zones in 380–1500 m off the Sanriku Coast. Horikoshi *et al.* (1983) also identified this species from a depth of 615–620 m off Isozaki, Iwate Prefecture (KH-69-02, St. 3).

Laevidentalium sp. aff. ***sominium*** Okutani, 1964 (Fig. 7C)

*Material examined.*WA05-G1500D (3); WA06-F1500D-2 (2); WA06-H1500D (4); WA07-B1500D (1); WA07-C1500D (1).

*Remarks.*The present species is comparable with *Laevidentalium sominium* Okutani, 1964 by having very narrow shell, but it is slightly curved in the former. All the specimens were collected from the depths around 1500 m.

Order Gadilida Starobogatov, 1974
Family Gadilidae Stoliczka, 1868

Polyschides sakuraii (Kuroda and Habe, 1961) [Jn: Sakurai-harabuto-tsunogai] (Fig. 7D)

*Material examined.*WA05-DE380D (30); WA05-EF450D (32); WA05-FG510D (9); WA06-B750D (8); WA06-C350D (1); WA06-D450D (4); WA06-DE380D (30); WA06-DE480 (1); WA06-E510D (52); WA06-EF425D (13); WA06-F650D (10); WA06-F750 (4); WA06-FG350D (6); WA06-G900D (1); WA06-H480 (73); WA06-H510 (1); WA07-A450 (162); WA07-A650 (18); WA07-B410 (33); WA07-D410 (2); WA07-D900 (many).

Gadila opportunus (Kuroda and Habe, 1961) [Jn: Harabuto-tsunogai] (Fig. 7E)

*Material examined.*WA06-GH480D (1).

*Remarks.*Horikoshi *et al.* (1983) also recorded this species from a depth of 615–620 m off Isozaki, Iwate Prefecture, concurrent with *Laevidentalium toyamense* (Kuroda and Kikuchi, 1933) at KH-69-02, St. 3.

Siphonodentalium japonicum Habe, 1963 [Jn: Nippon-kuchikire-tsunogai] (Fig. 7F)

*Material examined.*WA05-EF450D (3); WA05-FG250D (2).

Discussion

The geographical and bathymetrical coverages of the R/V *Wakataka-maru* survey are well known fishing grounds not only for bottom fishes but also pelagic fishes, because of high productivity of the mixing zone of both warm Kuroshio water and cold Oyashio water of subarctic origin (Kawai, 1955; Okutani and Chinzei, 1976). Thus, faunal and fishery resources investigations of this area have frequently been carried out by fisheries research institutions. However, the results have usually been appeared in internal reports of limited circulation (e.g. Tohoku Regional Fisheries Research Laboratory, 1952) and have seldom been made public.

The shallow water molluscan fauna on the coast of Kashima-Nada (almost the southern extremity of the present survey at about 35º 40´–36º 30´N) was reported by Harada *et al.* (1956) from the viewpoint of exploratory investigation on clam resources. Okutani (1957) reviwed the characteristics of molluscan fauna in the Sea of Kashima-Nada. Tsuchida and Kurozumi (1993, 1995, 1996) reported the shallow water molluscan fauna in Otsuchi Bay (about 38º 40´N; 3–152 m). Ishiyama (1974) published an annotated list of mollusks in this sea region utilizing the catches for

fishing ground investigation by the Tohoku Regional Fisheries Research Laboratory. More recently, Toba (2009) published monographic book on marine Mollusca of Iwate Prefecture.

Okutani (1982) analyzed the molluscan faunal succession on an oblique transect in the Sanriku Coast (about 37º to 38º N, from 900–970 m to 4680–4130 m). According to compilation of data from dredging surveys of shelf zone by the S/S *Sôyô-maru* during 1923–1930 by Horikoshi *et al.* (1982), more than 140 stations were investigated in the Sanriku and Joban Coasts (about 36º–41º N, 35–799 m depth) and the bivalves obtained therefrom have been partially reported in Habe (1958a, b). Subsequently, Horikoshi *et al.* (1983) published a faunal list of benthos collected during the R/V *Hakuho-maru* cruises (19 stations off the Sanriku Coast of KH-67-02, KH-67-05, KH-69-02, and KH-81-04, from 615–620m to 7420–7450 m). But, identification of bivalves and scaphopods in their list was still crude except a few being identified to species.

Thus, this paper may be the first comprehensive report of the taxonomic details of bivalve and scaphopod fauna in shelf, slope and bathyal zones of extensive sea area of the Pacific coast of northeastern Honshu (from Sanriku to Joban Coasts). The geographical coverage of the 2005–2007 surveys of the R/V *Wakataka-maru* was from 36º N up north to 41º N, and bathymetrical range was from 146 m down to 1521 m.

The sampling was not always very quantitative, but relative abundance (number of specimens) and frequency of occurrence (number of positive stations) may indicate the dominant species in this sea area and depth range. The dominant (or frequent) are: *Leionucula niponica, Limopsis uwadokoi, Abrina* sp. a, *Dermatomya tenuiconcha, Antalis rhabdotum* and *Polyschides sakuraii* among others indicating the dominance of muddy bottom dwellers. They also frequently occur (except *Abrina* sp. a) in shallower stations of the R/V *Hakuho-maru* (Horikoshi *et al*., 1983) and shallower sectors of the transect studied by Okutani (1982). Some species are also common with the catalogue of Horikoshi *et al*. (1983), such as, *Acila diavaricata vigilia*, *Leionucula "mirifica"*, *Limopsis uwadokoi*, *Halicardia nipponica*, *Laevidentalium toyamense*, *Gadila opportuna* etc. from depths of 615–640 m, and *Cuspidaria mitis* in 1585–1625 m. *Cardiomya behringensis* occurred from shallow depth (75 m by Tsuchida and Kurozumi, 1996) and also from 1645–1655 m and 2090–2120 m (Horikoshi *et al.*, 1983). This species was represented in the present material from the intermediate depths of 468–1402 m.

The newly discovered species from the surveyed area are *Truncacila castarensis*, *Nuculana ensiformis, Yoldia bartschi, Miodontiscus annakensis, Parvithracia lukini, P. sirenkoi, Lyonsia arenaria tarasovi* and *Cardiomya lindbergi*. The first species has hitherto been known from the Bering Sea to the Northeast Pacific. Coan *et al*. (2000) recorded it "off Kamchatka". Therefore, it is most probably that this is a circum-boreal (subarctic) species, rather than an "amphipacific" species. Most of these species have hitherto been known from the Bering Sea to the northern Okhotsk Sea. *Truncacila castarensis Lyonsia arenaria tarasovi* and *Cardiomya lindbergi* are new additions to Japanese bivalve fauna. Two species of *Parvithracia* described by Kamenev (2002) were originally recorded from the southern Kurile Islands. The present survey extended their distribution records southwardly to the Joban Coast.

Okutani (1972) previously found some subarctic elements among bathyal mollusca in Sagami Bay, and claimed that they were all transported by the Oyashio Undercurrent which penetrates into the Sagami Basin. Among the present material, a considerable number of species were found where northern limit has been thought to be Sagami Bay or off Boso Peninsula northward to Choshi (Cape Inubo at 35º 40´N). They are all depicted as "northern range extension" in the text, but it is difficult to ascertain whether (1) the mother population is occupying here and only a fraction is transported to the south with the cold undercurrent, or (2) the fraction of warm-water species stock is transported by strong Kuroshio Current and settled there. Okutani (1957) showed that the molluscan fauna in the Sea of Kashima-Nada is a mixture of warm-water elements (in shallow

zone) and cold-water species (towards deep), and Shikama (1955) postulated that some warm-water elements would be transported to the north drifting in warm current.

The present collection is naturally dominated by suspension-detritus feeders as sampling was made mainly on soft bottom. The occasional sunken timber yielded interesting fauna: the epibiotic *Idasola* and endobiotic Teredinidae and Xylophagaidae. The analysis of multispecies utilization of a single timber (or other type of organic remains) might be interesting from the viewpoint of not only food supply of bottom dwellers but also species dispersion through such an optimistic substratum.

Over all, the components of bivalves in the present collection comprised 89 species of 29 families, and scaphopods 6 species of 3 families. Among them, 29 species (31%) are considered to be the subarctic elements, 27 species (28%) live in the mixing water south to Sagami Bay area, 24 species (25%) comprise major stock in the warm-water areas, while the remaining 15 species (16%) are not subjected for classification of distribution type, because identification did not reach to species.

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