

**A NEW SPECIES OF *VOLVATELLA* PEASE, 1860, FOUND
IN THE "CAULERPAN MICROFAUNA" IN THE PROVINCE
OF KII, MIDDLE JAPAN
(OPISTHOBANCHIA : SACOGLOSSA)¹⁾**

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With Text-figures 1-3 and Plates II-III

In the "caulerpan microfauna", so called by Burn (1966), which is a group of small animals especially inhabiting the caulerpan colonies and essentially feeding on these green algae, shelled sacoglossan opisthobranchs are systematically very interesting.

Gonor (1961) gave in a table all available records of shelled sacoglossan opisthobranchs which had ones been described by other researchers from various caulerpan species, when he showed the biology of *Lobiger serradifalci* (Calcara, 1840) collected from a mat of *Caulerpa prolifera* in the Harbor of Villefranche in September of 1960. Further, Burn (1966) described four species of shelled sacoglossan opisthobranchs, which were found in October of 1964 living on the green alga *Caulerpa racemosa*, var. *turbinata* growing on the coral reef near the southeast of Suva, Viti Levu, Fiji.

The present author also made an observation on the "caulerpan microfauna" at Cape Shionomisaki in the Province of Kii, Middle Japan in March of 1971 and found fourteen species of opisthobranch gastropods living on *Caulerpa brachypus* Harvey growing in the lower intertidal zone. They are:

1. A form of Cephalaspidea (probably a juvenile of *Hydatina* sp.)
2. *Philine* sp. (1)
3. *P.* sp. (2)
4. *Chelidonura fulvipunctata* Baba, 1938
5. *Gastropteron* sp. (probably a juvenile of *G. fuscum* Baba & Tokioka, 1965)
6. *Runcina* sp. (1)
7. *R.* sp. (2)
8. *Cylindrobulla japonica* Hamatani, 1969
9. *Volvatella* sp.
10. *Oxynoe viridis* (Pease, 1861)
11. *Lobiger (Lobiger) sagamiensis* Baba, 1952

1) Contributions from the Seto Marine Biological Laboratory, No. 565.

12. *Phyllobranchillus orientalis* (Kelaart, 1858)
13. *Hermaea dendritica* (Alder & Hancock, 1843)
14. A form of Tritoniidae

Of these, thirty-one specimens of *Volvatella* sp. were collected. All of them are seemingly conspecific and detailed examinations on them have revealed that the form represents clearly a new species, which is named *ayakii* in memory of Mr. Ayaki Y. Nakajima whose aid made the present author collect these specimens.

Hitherto, no species of *Volvatella* has been known from any part of Honshu Island of Japan; although only a single species, *V. vigourouxi* (Montrouzier, 1861), has been recorded from the Amami Islands south to Kyushu (Baba, 1966) and from Okinawa further south of the Amami Islands (Habe, 1946). So far as the present author is aware, the following ten species are generally recognized at present as valid members of the genus *Volvatella* Pease, 1860 (= *Arthessa* Evans, 1950).

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|---|-------------------------------|
| 1. <i>V. fragilis</i> Pease, 1860 | Hawaii |
| 2. <i>V. cumingii</i> (A. Adams, 1855) | Puerto St. Elena, W. Columbia |
| 3. <i>V. vigourouxi</i> (Montrouzier, 1861) | New Caledonia |
| 4. <i>V. candida</i> Pease, 1868 | Polynesia |
| 5. <i>V. pyriformis</i> Pease, 1868 | Society Is. |
| 6. <i>V. cincta</i> Nevill & Nevill, 1869 | Ceylon |
| 7. <i>V. laguncula</i> Sowerby, 1894 | Port Elizabeth |
| 8. <i>V. elioti</i> (Evans, 1950) | Zanzibar Is. |
| 9. <i>V. evansi</i> (Kay, 1961) | Hawaii |
| 10. <i>V. ficula</i> Burn, 1966 | Fiji |

Before going into the description, the author wants to express his hearty thanks to Mr. A. Y. Nakajima for his help in collecting the specimens and also to Dr. T. Tokioka of the Seto Marine Biological Laboratory for his kindness in reading the manuscript.

Volvatella ayakii sp. nov.

(Japanese name: Himetama-budoginu)

Holotype: Collected on March 28, 1971 on the green alga, *Caulerpa brachypus* Harvey, growing on the rocky substratum in the intertidal zone near the low water mark in the neighbourhood of Cape Shionomisaki, Kii, Middle Japan. The specimen was fixed by 4% formaldehyde and preserved in 70% ethanol, and it is now in the custody by the present author.

Paratypes: Paratypes Nos. 1 and 3-5 were collected together with the holotype. Paratype No. 2 was, however, collected on March 12, 1971 at the same locality and was dissected for the examinations of the radula, protoconch, spire and penis.

The measurements of the types are as follows:

Specimen number	Type number	Animal length, in an extended state	Shell length	Shell breadth
1	Holotype	—	6.2 mm	3.4 mm
2	Paratype 1	6.8 mm	5.0 mm	2.8 mm
3	Paratype 2	7.0 mm	5.0 mm	3.0 mm
4	Paratype 3	6.5 mm	4.5 mm	2.0 mm
5	Paratype 4	5.2 mm	4.5 mm	2.5 mm
6	Paratype 5	—	3.8 mm	2.0 mm

Other specimens: Among these specimens (Sp. Nos. 7–22), three specimens (Sp. Nos. 7–9) were fixed by Bouin's fluid in sea water and sectioned into horizontal series and Sp. Nos. 10 and 13 into transverse series for future internal morphological studies, while Sp. Nos. 16 and 17 were dissected for observations of radular teeth. The soft-body in nine specimens (Sp. Nos. 11, 12, 14, 15 and 18–22) was in an imperfect condition to be studied. Sp. Nos. 23–31 were collected as empty shells, of which Nos. 23–25 were almost perfect, while others (Sp. Nos. 26–31) were broken considerably.

Description: Living animals (Fig. 1; Pl. III, A–D) are whitish at a glance, as the soft-body of the animal extended out of the shell is milky white in colour, but specimens

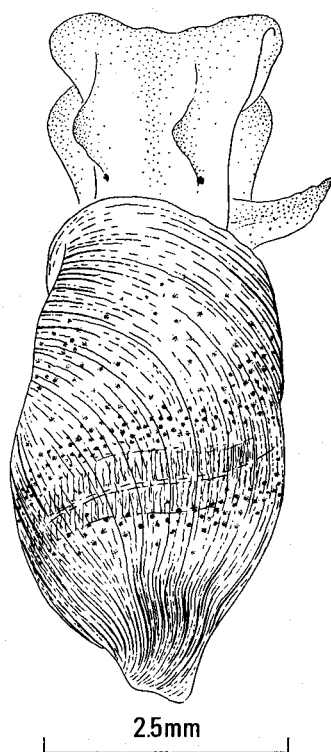


Fig. 1. *Volvatella ayakii* sp. nov.
Dorsal aspect of a living animal, Paratype No. 2 (Sp. No. 3).

preserved in alcohol (Pl. II, A–D) are yellowish orange. The soft-body can be involuted perfectly within the shell. A pair of rhinophore-like protuberances are visible on the head, though sometimes they may be only gentle inconspicuous elevations. Paired pure black eyes in the deep tissue are seen through the skin posterior and slightly external to the base of rhinophore-like protuberances. In contrast with *Clyindrobulla*, no furrow is definable in the median line of the head-shield. The lateral edge of the head-shield is enfolded deeply to the base of the penis between the head-shield and the foot to form a groove on the lateral side of the head. Eyes are seen clearly

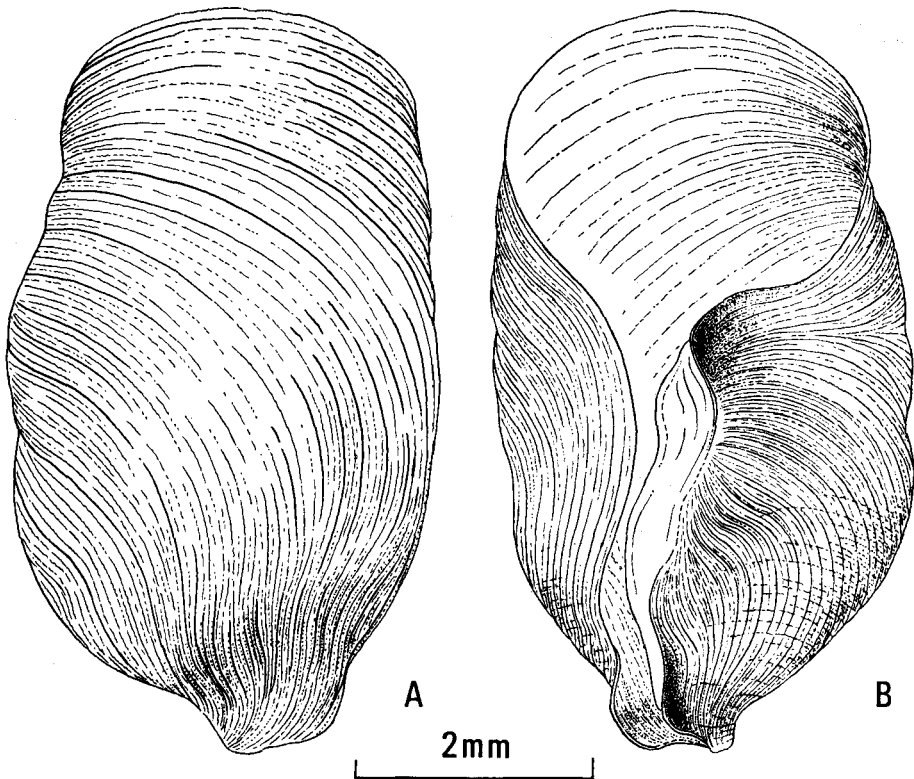


Fig. 2. *Volvatella ayakii* sp. nov. Empty shell of the holotype (Sp. No. 1).
A: dorsal side. B: ventral side.

through the body wall in this groove at about the anterior one-third, the external oviduct furrow is running under this groove from near the mouth to the female orifice. The foot is small and rounded at anterior and posterior ends, the anterior end is slightly broader than the posterior. The body is furnished with numerous white opaque dots over the whole part under the shell and especially densely along the anterior border of the head-shield, on rhinophore-like protuberances, on the dorsal side of foot-corners, at the posterior end of the foot, in the area posterior to the gill-belt, and sometimes

even on the penis, especially in its distal half. These white dots secrete copious white mucus at mechanical stimulation.

The shell (Fig. 2, A and B) is nearly ovoid in shape, very thin and flexible, but extremely fragile. It is calcareous, but covered with the membranous epidermis coloured straw. In *V. vigourouxi* the epidermis is coloured ashy yellow with fine growth lines of dark brown (see Baba, 1966) and evidently more deeply than in the present species. The body whorl is rounded and slightly swollen in the middle, but contracted near the posterior end to form a spout. The anterior half of the aperture is dilated roundly and about a half as high as the shell, while the posterior half becomes narrower and extends somewhat linearly to the spout forming a narrow slit. The spire is completely enveloped in the body whorl at about the posterior one-third of the shell length. The protoconch, which was born in the veliger stage, is retained on the spire. It is coiled sinistrally about 1-1/2 times and its type agrees with the "Shell-type 1" defined by Thompson (1961), which is corresponding to the "Types A & B" of Vestergaard and Thorson (1938).

Visceral organs are blackishly seen through the shell, because it is only slightly translucent. A belt of gill-folds is seen on the liver-mass extending from the right middle to the left posterior fourth of the shell. The gill of the present species is of a pectinate shape, the primitive type common to *Cylindrobulla* (see Marcus & Marcus, 1956), *Volvatella* (see Baba, 1966), *Lobiger* (see Hoffmann, 1940) and *Oxynoe* (see Eliot, 1906). The roof of the mantle cavity, to which the gill-folds are attached, corresponds to the tissue of the kidney.

The radular teeth (Fig. 3, A; Pl. III, E) are uniserial and of a typical sacoglossan style as in *Volvatella vigourouxi* (see Baba, 1966), *Cylindrobulla japonica* (see Hamatani, 1969) and *C. californica* (see Hamatani, 1971). The radula consists of 8 teeth in the ascending and 19 teeth and a pre-radular tooth in the descending series in Sp. No. 16, while about 10 teeth in the ascending and 15 and a pre-radular tooth in the descending series in Sp. No. 17. Each tooth (Fig. 3, B and C) is blade-shaped, with a slightly hooked apex and with a series of about 25 (on an average, more than 30 at the maximum and less than 20 at the minimum) somewhat slender denticles on each side of the blade which is broader in the present new species than in *Volvatella vigourouxi*. All these features rather resemble those in *Cylindrobulla japonica* and *C. californica*. The tooth is almost transparent, though it is tinged very faintly yellowish. The pre-radular tooth is lod-shaped as in *Cylindrobulla japonica* (see Hamatani, 1969) and *C. californica* (see Hamatani, 1971). In both *Volvatella vigourouxi* and *V. ficula* the pre-radular tooth has never been described.

No penial stylet is found at the tip of the penis, by this point the present species is distinguished from *V. vigourouxi*. The rectum is short and slightly curved; the anus is situated slightly anterior to the middle and slightly displaced to the right from the median line on the dorsal surface of the visceral mass. The nervous system is almost

the same as in *V. vigourouxi* (see Baba, 1966). Other details of the internal morphology will be given in a future paper.

Remarks: The shell of the present new species is very similar to that of *Volvatella cumingii* (A. Adams, 1855), but in the latter the body whorl is much more dilated round-

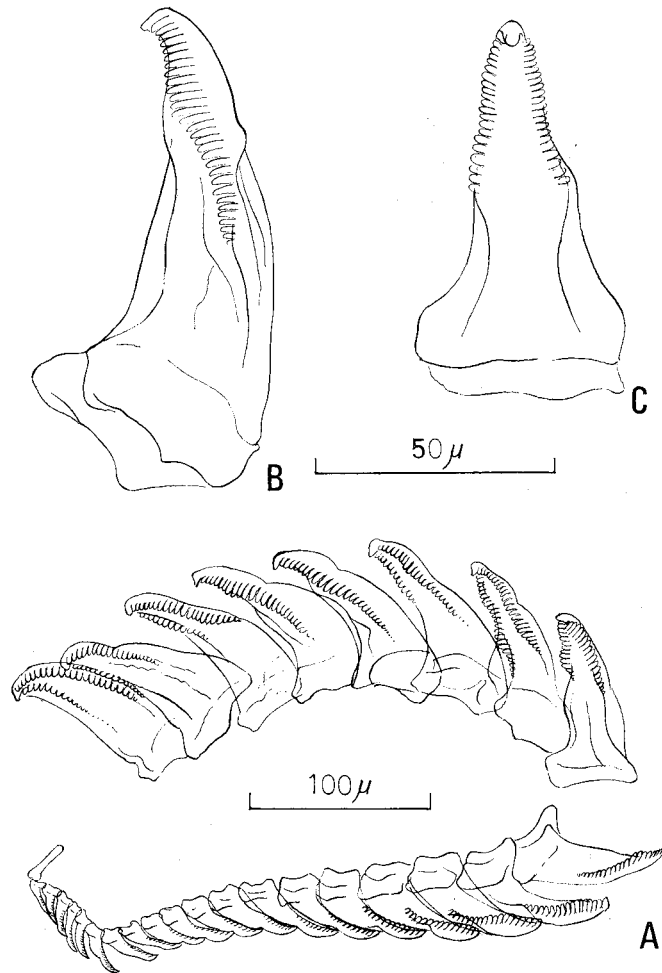


Fig. 3. *Volvatella ayakii* sp. nov.

- A: Radular teeth of Sp. No. 16.
 B: An effective-tooth from Sp. No. 16, lateral side.
 C: A tooth of the ascending series from Sp. No. 17, ventral side.

ly. *V. ficula* Burn, 1966 from Fiji is also closely allied to the present new species in the form and size of the shell and living animal body. However, in *V. ficula* the spout is slenderer than in the present new species. Especially, the soft-body of the present new species shows no sign of a narrow orange band along the anterior mantle margin,

which is very characteristic in *V. ficula*. In the general arrangement and morphology of radular teeth and respective tooth-blades, the present new species belongs to the group comprising *V. vigourouxi*, *Cylindrobulla japonica* and *C. californica*, as (1) the radula is of a uniserial sacoglossan type consisting of ascending and descending series, (2) each tooth has a series of slender denticles on each side, and (3) the tip of the tooth is hooked slightly. However, the present new species and the two species of *Cylindrobulla* are separated very distinctly from *V. vigourouxi*, as the lod-like pre-radular tooth is existing at the end of the descending series in the former, but never defined in the latter.

Summary

1. *Volvatella ayakii* sp. nov. described in this paper was collected from *Caulerpa* colonies growing in the lower intertidal zone at Cape Shionomisaki in the province of Kii, Middle Japan, together with *Cylindrobulla japonica* Hamatani, 1969 and some other opisthobranchs, forming the so-called "caulerpan microfauna".
2. *Volvatella ayakii* sp. nov. is defined mainly on the external appearance of living animal body and the morphology of the shell and radular teeth,
3. *Volvatella ayakii* sp. nov. resembles very closely *V. cumingii* (A. Adams, 1855) from W. Columbia in the shell morphology, but the body whorl is more swollen in the latter than in the former. The present new species is also very similar to *V. ficula* Burn, 1966 from Fiji in the appearance of living animal body, but the narrow orange band along the anterior mantle margin characteristic to the latter is quite missing in the former.
4. In features of radular teeth *Volvatella ayakii* sp. nov. belongs to the same group as one containing *V. vigourouxi* (Montrouzier, 1861), *Cylindrobulla japonica* Hamatani, 1969 and *C. californica* Hamatani, 1971, if the existence or absence of the lod-like pre-radular tooth can be of a minor significance.

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EXPLANATION OF PLATES II-III

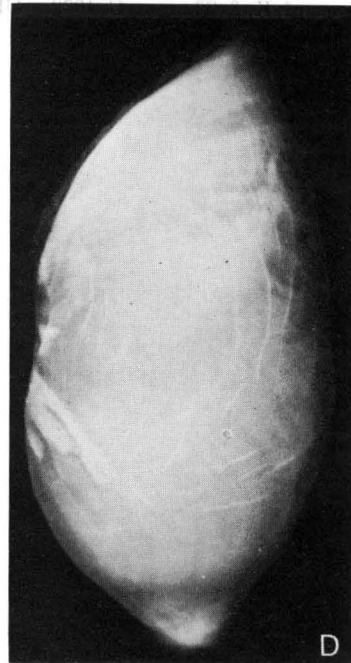
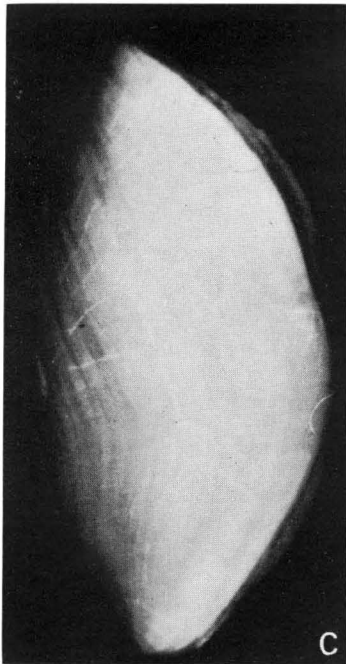
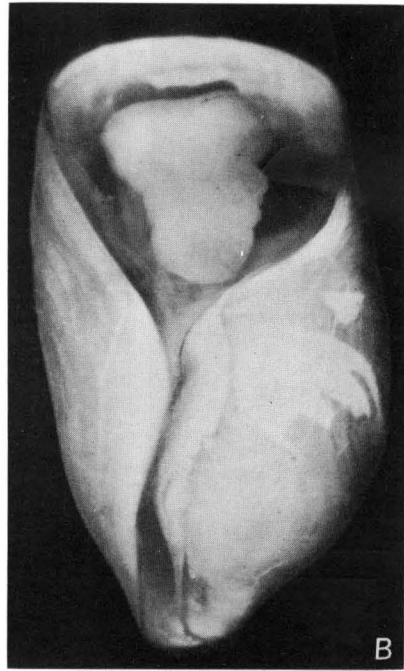
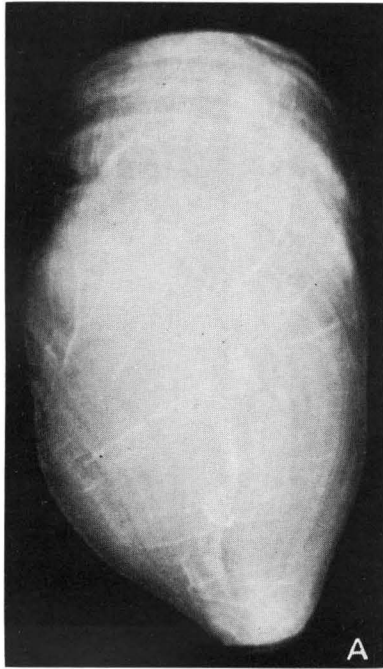
Plate II. *Volvatella ayakii* sp. nov. The holotype, preserved specimen.

Fig. A: Dorsal side. Fig. B: Ventral side. Fig. C: Right side. Fig. D: Left side.

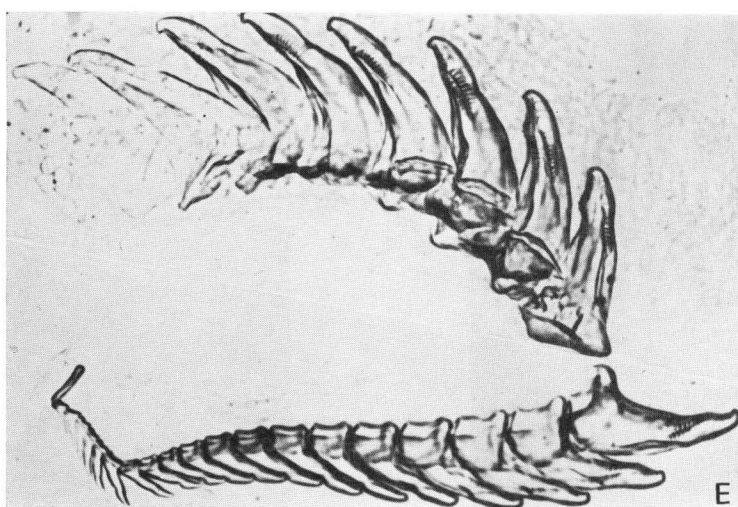
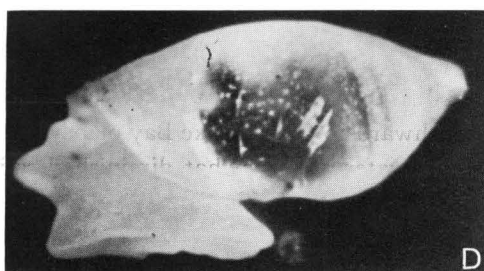
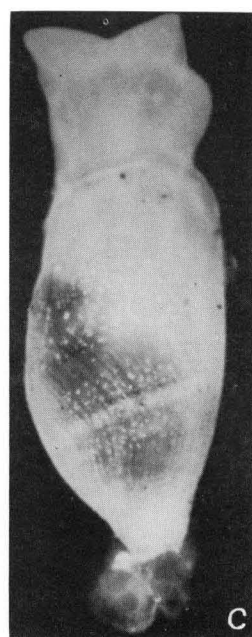
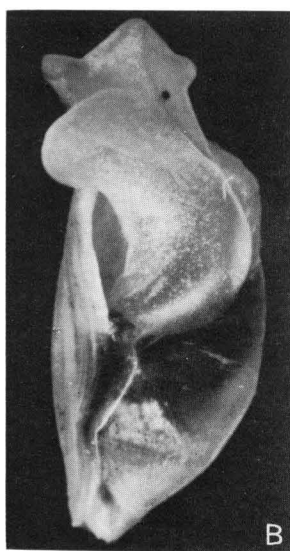
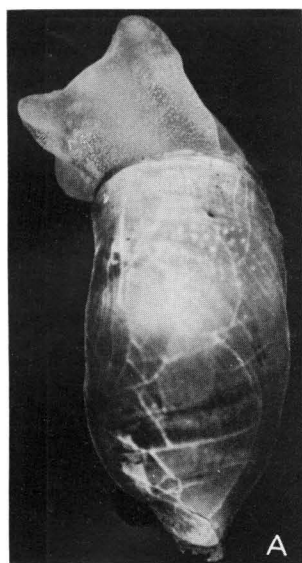
Plate III. *Volvatella ayakii* sp. nov.

Figs. A-D. Living specimens. A: Sp. No. 7, dorsal side. B: Sp. No. 9, ventral side. C: Sp. No. 9, showing white opaque secretion from the spout at mechanical stimulation. D: Sp. No. 9, left side in a slightly contracted state.

Fig. E. Radular teeth of Sp. No. 16, reproduced in Fig. 3 A.



I. HAMATANI: *A New Species of Volvatella from Middle Japan*



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