
Article

***Ostrea awajiensis* sp. nov. (Mollusca : Bivalvia),
a new fossil oyster from the Tertiary Iwaya Formation
in Awaji Island, Hyogo Prefecture, Southwest Japan**

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Abstract

A new fossil oyster, *Ostrea awajiensis* sp. nov., is proposed herein based on the specimens collected from the Tertiary Iwaya Formation in Awaji Island, Hyogo Prefecture.

Key words: *Ostrea awajiensis* sp. nov., Iwaya Formation, Tertiary

Introduction

The Tertiary Iwaya Formation (Shikama, 1938) is sporadically distributed in the northern part of Awaji Island in Hyogo Prefecture, unconformably overlying the basement rocks mainly composed of Cretaceous granite (Fig. 1). The molluscan fossils from this formation have been studied by several geologists and paleontologists since Yamashita (1893) first reported the occurrence of marine molluscs. Itoigawa (1969, 1971, 1983) outlined the molluscan assemblages from the Iwaya Formation and Mizuno et al. (1990) remarked that the molluscs from the formation include common species to the Kadonosawa Fauna (Otuka, 1939), which is a tropical-subtropical molluscan fauna reported from the upper Lower-lower Middle Miocene in Japan. However, these studies were done based only on lists, with neither illustration nor description of species.

During the course of his examination of fossil molluscs from the Iwaya Formation, stored in the Museum of Nature and Human Activities, Hyogo (MNHAH), the present writer found specimens of a peculiar oyster among them. In this paper, the writer describes *Ostrea awajiensis* sp. nov. based on the specimens.

The supraspecific oyster classification used here follows that of Stenzel (1971), although it has subsequently been reviewed and somewhat modified by several malacologists (e.g. Torigoe, 1981 ; Harry, 1985).

Acknowledgments

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Systematic description

Family Ostreidae Rafinesque, 1815
Subfamily Ostreinae Rafinesque, 1815

Genus *Ostrea* Linné, 1758

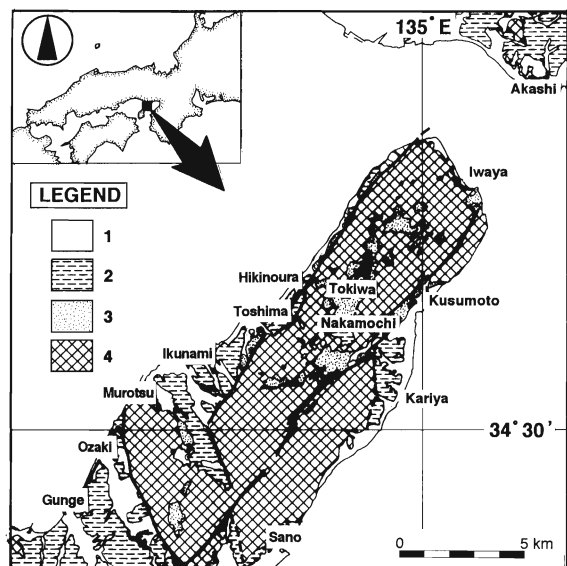


Fig. 1. Geologic map of the northern part of Awaji Island (compiled from Mizuno et al., 1990 and Hyogo Prefectural Government, 1996). The type locality of *Ostrea awajiensis* sp. nov. is marked as a black star. 1 : Alluvial and terrace deposits ; 2 : Plio-Pleistocene Osaka Group ; 3 : Iwaya Formation ; 4 : Pre-Tertiary basements.

Ostrea awajiensis sp. nov.

[Japanese name : Awaji Itabo-gaki]

Plate 1, 1a-c, 1c, 2a-b ;

Plate 2, 1a-b, 2a-b, 3a-b ;

Plate 3, 1a-b, 2a-b, 3a-b, 4a-b

Type specimen.—MNHAH Reg. No. D1-017813 (holotype), D1-017811, D1-017812, D1-017814, D1017815, D1-017816, D1-017817, D1-017818, D1017819, D1-017820, D1-017821, D1-017822, D1017823, D1-017824, D1-017825, D1-017826, D1017827, D1-017828, D1-017829, D1-017830, D1017831, D1-017832, D1-017833, D1-017834 (paratypes).

Type locality and formation.—About 1km northeast of Tokiwa, Hokudan Town, Tsuna County, Hyogo Prefecture (N34°33'39", 134°58'27"E), Iwaya Formation (Fig. 1).

Diagnosis.—Shell of moderate size, thick. Right valve with a broad ligamental area ; both dorsal margins with strong anachomata ; shell surface ornamented by rather broadly spaced growth lines and numerous, faint radial striations.

Description.—Shell moderate in size (maximum height less than 100mm ; maximum length about 90mm), thick, rather compressed, irregular in shape ; ventral margin not plicate.

Right valve subcircular to subtrapezoid or subtriangular in shape, compressed, inequilateral, prosocline except for subcircular individuals, higher than long generally (height / shell length 0.991 to 1.348, with most frequent ratio between 1.05 and 1.10) ; shell surface ornamented by fine, rather broadly spaced growth lines, and numerous, faint radial striations ; antero-dorsal margin weakly arched, nearly perpendicular against ligamental axis except for several subcircular specimens ; postero-dorsal margin long, nearly straight, oblique ; ligamental area broad (length of ligamental area / length ranging from 0.368 to 0.570), finely annulated ; resilifer weakly depressed, rather broad ; both dorsal margins with strong anachomata which are not becoming nodulous ; adductor muscle scar leniform, moderate to rather large, well impressed, situated at slightly posterior part of shell ; ventral margin thick, subtruncated.

Left valve subquadrate, as high as long, compressed ; shell surface lacking radial ribs ; both dorsal part produced laterally and piled concentrically at outside of commissure ; catachomata distinct ; umbonal cavity less developed.

Discussion.—A single left (lower) and 23 right (upper) valves were examined.

Rather compressed valves, right valve lacking any radial ribs and strong anachomata on the both dorsal margins of right valve, non-plicate ventral margin, a reniform adductor muscle scar, and less developed umbonal cavity on the left valve indicate that the present new species belongs to the genus *Ostrea* sense Stenzel (1971).

Strong anachomata on the right valve are one of the diagnostic characteristics of the present new species as opposed to other living and fossil *Ostrea* species hitherto reported.

Features of the left valve were not fully examined because only a single specimen with a worn ligamental area was obtained. Shell surface of the left valve lacks radial ribs probably because most part of this valve was attached to a hard substratum, and one is not able to regard it as a diagnostic characteristic of the present new species.

Ostrea awajiensis sp. nov. closely resembles *Ostrea eorivularis* Oyama and Mizuno, 1958, from the Paleogene Shitakara Formation of the Urahoro Group, Hokkaido. However, the present new species is distinguished from the latter species by having a thicker shell with stronger

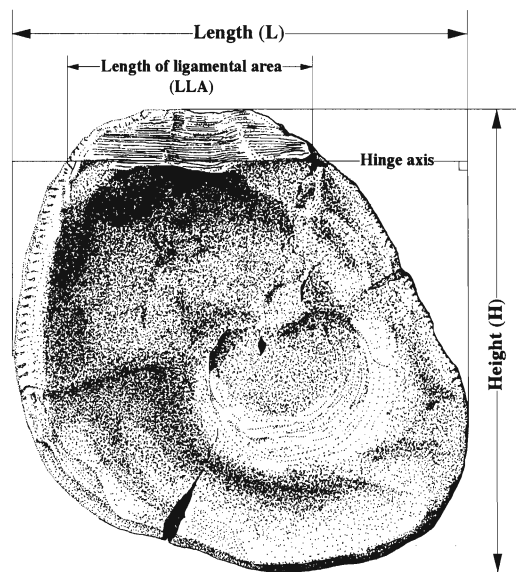


Fig. 2. Internal surface of the right valve of *Ostrea awajiensis* sp. nov. (holotype : MNHAH reg. no. D1017813) showing positions measured.

anachomata and a broader ligamental area. Honda (1989) regarded as *Ostrea yokoyamai* Kamada, 1962, from the Paleogene Iwaki Formation in Fukushima Prefecture is synonymous with *Ostrea eorivularis*.

Ostrea denselamellosa Lischke, a well-known living species in NW Pacific, is distinguished from the present species by having less developed chomata.

Ostrea itoigawai Taguchi, 1992, from the lower Middle Miocene Katsuta Group in Okayama Prefecture, differs from the present species in its smaller and thinner shell with less developed chomata.

Ostrea circumpicta Pilsbry, another living species, is easily distinguished from *Ostrea awajiensis* sp. nov. in having dichotomous radial ribs in both valves and densely piled growth squamae in the right valve.

Crassostrea sunakozakaensis Ogasawara, 1976, from the lower Middle Miocene Sunakozaka Formation in Ishikawa Prefecture, possesses a right valve similar in shape to that of the present new oyster. However, this species entirely lacks chomata on the dorsal margin. Although this species was regarded to belong to the genus *Ostrea* by Taguchi (1992), the present writer can not support his opinion based on the dorsal character.

Associated fauna.—*Chlamys* sp. (rare). Itoigawa (1983) defined the assemblage dominated by the present new oyster and associated by *Chlamys* sp. the “*Ostrea*” assemblage. He estimated that this assemblage is a representative of an uppermost to upper sublittoral, rocky bottom environment.

Distribution.—Known only from the Iwaya Formation. However, the Tertiary shell-limestone beds, which are composed mainly of oyster shells and have been correlated with the Iwaya Formation, are developed around the Seto Inland Sea (Itoigawa, 1969, 1971, 1983). Unfortunately, oysters from these shell-limestone beds have only been listed as either *Ostrea* sp. or “*Ostrea*” sp. (e.g. Ozaki, 1956 ; Saito, 1962 ; Itoigawa, 1969, 1971, 1983). It is expected that these oysters include the present new species, and thus, a taxonomic review for these fossil oysters is necessary to clarify the distribution.

Geologic age.—The geologic age of the Iwaya Formation bearing *Ostrea awajiensis* sp. nov. has been estimated to be late Early-early Middle Miocene on the basis of benthic foraminiferal and molluscan data. For example, Tai (1959) reported such benthic foraminiferal assemblage as the *Elphidium-Elphidiella-Cibicides* faunule from the formation, and correlated it with the *Miogypsina kotoi-Operculina complanata japonica* Zone of late Early-early Middle Miocene. Mizuno et al. (1990) and Ozaki et al. (1996) concurred with this opinion on the basis of the molluscs which are common to those from the “First Setouchi Miocene Series.”

On the other hand, the latest radiometric datings revealed that several Tertiary strata which had been included in the “Setouchi Miocene Series” are of Paleogene in age (Ozaki and Matsuura, 1988 ; Hayashi and Koshimizu, 1993 ; Ozaki et al., 1996). In particular, Ozaki and Matsuura (1988) and Ozaki et al. (1996) clarified that the Kobe Group (Shikama, 1938), which is broadly distributed in the Shirakawa and Sanda districts situated in the north of Awaji Island, is of Upper Eocene or Oligocene. Taking these radiometric ages into account, they insisted that the “Miocene” Iwaya Formation is excluded from the Paleogene Kobe Group. However, there has been neither planktonic microfossil age assignment nor radiometric dating for this formation. Consequently, the geologic age of the Iwaya Formation must be reviewed in the same chronological point of view.

Measurements.—Fig. 2, Table 1.

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Table 1. Measurements of *Ostrea awajiensis* sp. nov. See Fig. 2 for abbreviation of the positions measured.

MNHAH reg. no.	L (mm)	H (mm)	LLA (mm)	H/L	LLA / L	Valve
D1-017811 (paratype)	89.0	90.65	40.1	1.019	0.451	Left
D1-017812 (paratype)	86.1	91.5+	40.0	—	0.465	Right
D1-017813 (holotype)	69.2	68.55	36.25	0.991	0.524	Right
D1-017814 (paratype)	66.5	73.0	37.9	1.098	0.570	Right
D1-017815 (paratype)	67.6	75.8	28.1	1.121	0.416	Right
D1-017816 (paratype)	69.0	64.5	27.5	0.935	0.399	Right
D1-017817 (paratype)	72.2	74.25	about 30.3	1.028	about 0.42	Right
D1-017818 (paratype)	72.45	76.5	27.7	1.056	0.382	Right
D1-017819 (paratype)	57.8	58.05	23.7	1.004	0.41	Right
D1-017820 (paratype)	68.4+	71.5	—	—	—	Right
D1-017821 (paratype)	52.0	51.8	28.2	0.996	0.542	Right
D1-017822 (paratype)	88.8	86.7+	32.7	—	0.368	Right
D1-017823 (paratype)	67.6	91.1	—	1.348	—	Right
D1-017824 (paratype)	66.5	87.5	—	1.316	—	Right
D1-017825 (paratype)	56.0	61.9	—	1.105	—	Right
D1-017826 (paratype)	54.1	54.0	—	0.998	—	Right
D1-017827 (paratype)	60.1	64.8	about 33.4	1.078	about 0.56	Right
D1-017828 (paratype)	66.2	70.2	about 22.6	1.060	about 0.34	Right
D1-017829 (paratype)	53.3	57.9	24.8	1.086	0.465	Right
D1-017830 (paratype)	53.0	56.4	20.2	1.064	0.381	Right
D1-017831 (paratype)*	—	—	—	—	—	Right
D1-017832 (paratype)	54.2	63.9	—	1.179	—	Right
D1-017833 (paratype)*	—	—	—	—	—	Right
D1-017834 (paratype)*	—	—	—	—	—	Right

* : lacking ligamental area

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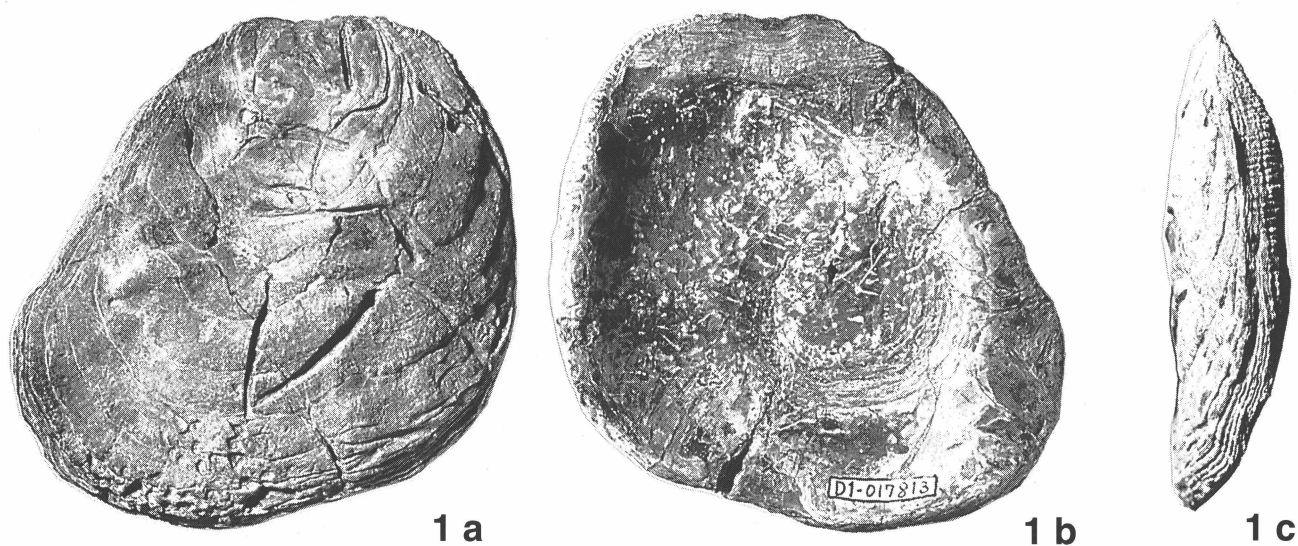


Plate 1. *Ostrea awajiensis* sp. nov.

1 a-c : Right valve MNHAH reg. no. D1-017813 (Holotype). 1a : External shell ; 1b : Internal shell ; 1c : Anterior view, showing especially development of chomata. **2a-b** : Right valve. MNHAH reg. D1-017812 (Paratype). 2a : External shell ; 2b : Internal shell. All figures in natural size.

Plate 2. *Ostrea awajiensis* sp. nov. (→)

1a-b. Right valve. MNHAH reg. no. D1-017814 (Paratype). 1a : External shell ; 1b : Internal shell. **2.** Left valve. MNHAH reg. no. D1-017811 (Paratype). Internal shell. **3a-b.** Right valve. MNHAH reg. no. D1-07815 (Paratype). 3a : External shell ; 3b : Internal shell. All figures in natural size.



1 a



1 b



2



3 a



3 b

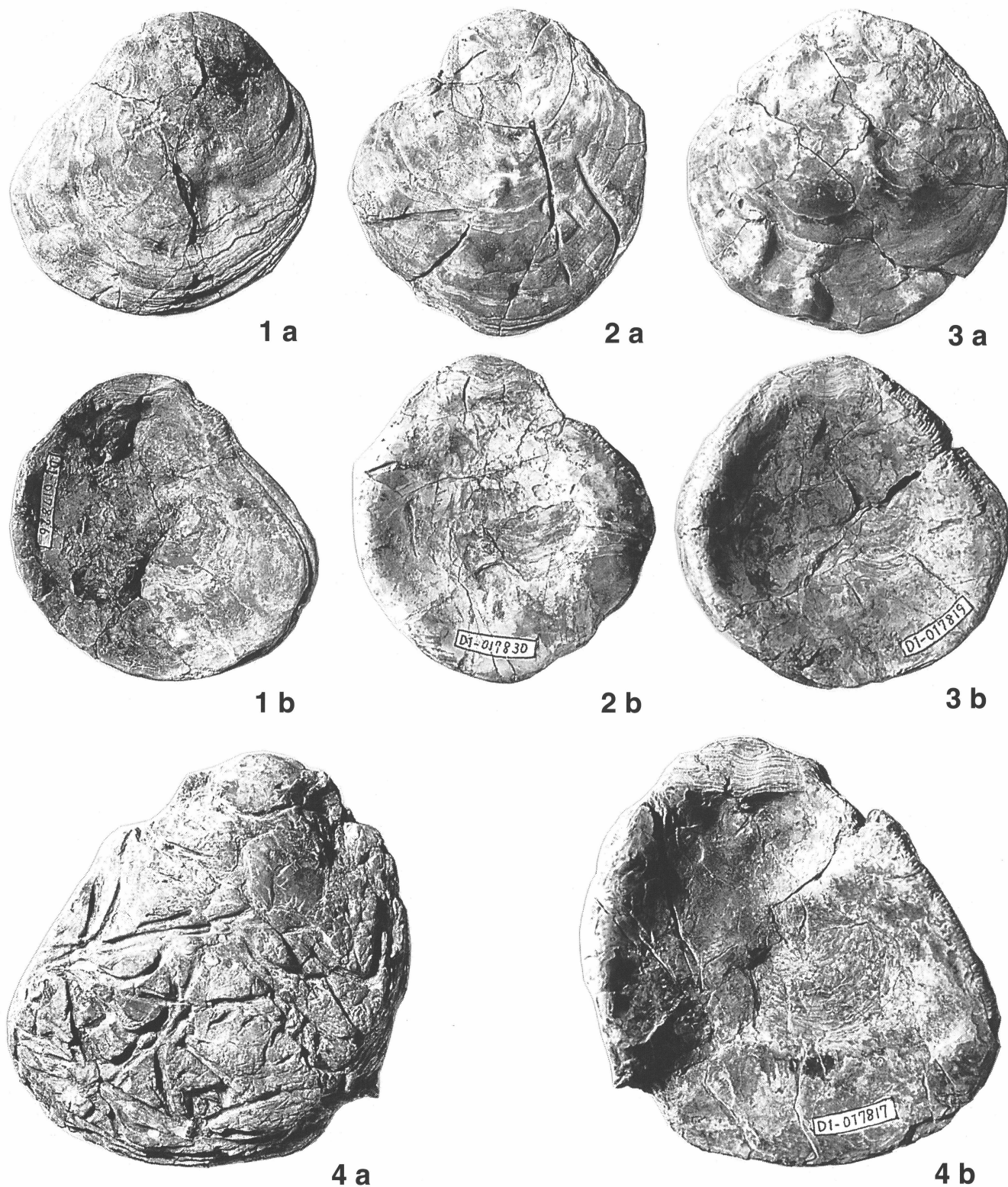


Plate 3. *Ostrea awajiensis* sp. nov.

1 a-b : Right valve. MNHAH reg. no. D1-017826 (Paratype). 1a : External shell ; 1b : Internal shell. **2a-b**. Right valve. MNHAH reg. no. D1-017830 (Paratype). 2a : External shell ; 2b : Internal shell. **3a-b**. Right valve. MNHAH reg. no. D1-017819 (Paratype). 3a : External shell ; 3b : Internal shell. **4a-b**. Right valve. MNHAH reg. no. D1-017817 (Paratype). 4a : External shell ; 4b : Internal shell. All figures in natural size.

Corrigendum

The editorial board would like to apologize for errors that occurred in this issue.

Nature and Human Activities, no. 3.

P. 2, Fig. 1. was printed incorrectly. The correct version appears below.

