

# A new subspecies of *Chlamys lioica* (Dall) from the Pliocene Shigarami Formation developed in the environs of Nagano City, central Japan

Kazutaka Amano\* and Shigeru Karasawa\*\*

長野市近郊に発達する鮮新統柵層より産出したカミオニシキガイ属の一新亜種

天野和孝・唐沢 茂

## (要 旨)

長野県上水内郡戸隠村荒倉山キャンプ場付近の鮮新統柵層から産出したカミオニシキガイ属の新亜種 *Chlamys (Chlamys) lioica shigaramiensis* を記載, 報告した。

本亜種は中型で, 薄い殻をもち, 比較的扁平で, ほぼ左右等殻, 殻頂角は約85度である。右殻の殻表には, 腹縁と前後端付近に, 66本の弱い放射状脈を刻む。右殻の前耳には5本の明らかな放射肋を刻み, 足糸包帯 (byssal fasciole) はやや狭く, 足糸湾入は広く浅い。右殻の後耳はごく小さく, 三角形で, 4本の明らかな溝をもつ。足糸櫛歯は短く, 4本の弱い櫛歯から成る。左殻の殻表も多くの弱い放射脈を除き平滑。左殻の前耳は三角形で, 5本の明らかな放射肋を刻み, 足糸湾入は広く, 浅い。左殻の後耳は不明。右殻の蝶番は顕著な主関節と深い弾帯窩を伴う。内腹縁は弱く刻まれる。

本亜種は, 殻形, 殻表彫刻, 耳の形態と彫刻からアラスカの鮮新統より知られる *Chlamys (Chlamys) lioica* (Dall) に類似するが, アラスカの種より耳が小さく, 足糸櫛歯が少なく, 足糸包帯が狭い点で異なる。

## I Introduction

The Neogene deposits are well exposed in the environs of Nagano City. These deposits are stratigraphically subdivided into the Aoki, Ogawa, Shigarami and Sarumaru formations from the lower to upper (Yano and Murayama, 1976). Among them, the Shigarami Formation yields abundant molluscan fossils known as the Shimonireki fauna (Tomizawa, 1958) or the Shigarami fauna (Akiyama, 1962).

Up to this time, a total of four species of *Chlamys* are known from the Shigarami Formation; *Chlamys (Chlamys) tanakai* Akiyama, *Ch. (Ch.) daishakaensis* Masuda and

\* Department of Geoscience, Joetsu University of Education, Yamayashiki-cho, Joetsu, 943.  
上越教育大学地学教室。

\*\* Nagano City Museum, Koshimada-cho, Nagano, 381-11. 長野市立博物館。

Sawada, *Ch. (Ch.) cosibensis* (Yokoyama) and *Ch. (Ch.) foeda* (Yokoyama) (Masuda, 1962, 1986). Besides these species, a new subspecies of *Chlamys* was obtained from this formation. This new form is much allied to *Chlamys lioica* (Dall) described and known only from the Pliocene deposits in Alaska. Therefore, it is important to describe this new *Chlamys* and the relationship between *Chlamys lioica* and the Shigarami species.

## II Locality, stratigraphic horizon and age of a new *Chlamys*

The fossil locality of a new *Chlamys* is a road-side cliff at about 500m south of the

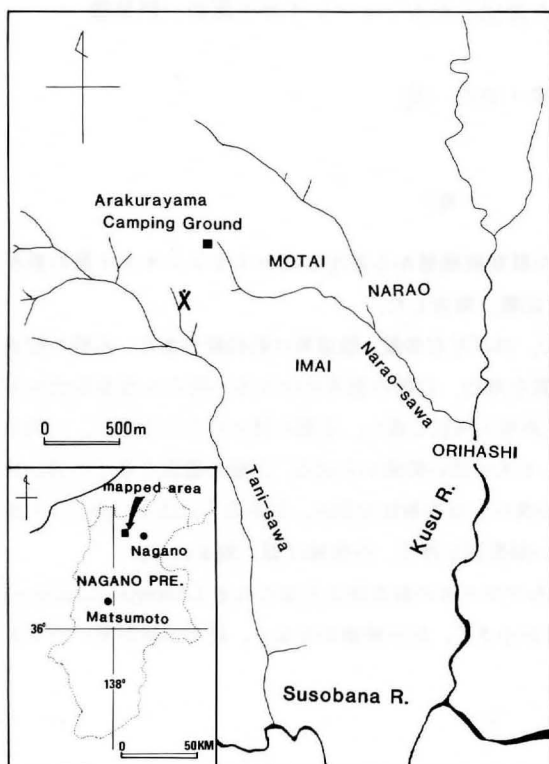


Fig. 1. Locality of *Chlamys lioica shigaramiensis*, n. subsp. X . . . fossil locality.

図1. 新亜種 *Chlamys lioica shigaramiensis* の産地。  
X . . . 化石産地。

Arakurayama camping ground near Motai (Fig. 1). At this locality, the following sequence of strata is observed in ascending order ; tuff breccia (25m+), volcanic conglomerate (1m), medium- to coarse-grained tuffaceous sandstone (40m), poorly sorted and fine-grained tuffaceous sandstone including granules (7m), coarse-

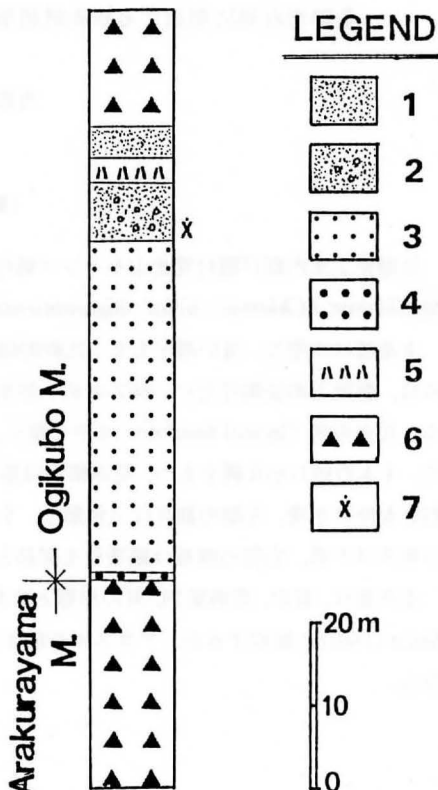


Fig. 2. Columnar section of the locality of *Chlamys lioica shigaramiensis*, n. subsp., 1. fine-grained sandstone, 2. fine-grained sandstone including granules, 3. medium to coarse-grained sandstone, 4. volcanic conglomerate, 5. tuff, 6. tuff breccia, 7. fossils.

図2. 新亜種 *Chlamys lioica shigaramiensis* の産地の地質柱状図； 1. 細粒砂岩， 2. 細礫を含む細粒砂岩， 3. 中粒～粗粒砂岩， 4. 火山円礫岩， 5. 凝灰岩， 6. 凝灰角礫岩， 7. 化石。

grained white tuff (3m), fine-grained sandstone (4m) and tuff breccia (13.5m), as shown in Fig. 2. Many disarticulated specimens of mollusks were obtained from the poorly sorted fine-grained sandstone just below the white tuff.

According to Yano and Murayama (1976), the Shigarami Formation is subdivided into the following three members from the lower to upper; namely, Takafu Mudstone, Arakurayama Pyroclastics, and Ogikubo Sandstone and Mudstone Members. The new subspecies of *Chlamys* occurs from the lowest part of the Ogikubo Member of Yano and Murayama (1976). This locality is also located near the boundary between the Arakurayama and the Ogikubo members, judging from the geological map of Suzuki (1938), Tomizawa (1953), Takeshita *et al.* (1960) and Yano (1981).

Recently, the uppermost part of the Ogikubo Member was assigned to Late Pliocene (about 3 Ma) based on the planktonic foraminifers (Tsuchi, 1985 MS). The Ogawa Formation overlain by the Shigarami yields the Late Miocene molluscan fauna (Kanno and Tomizawa, 1959). Moreover, the Susobana Tuff Member of the Ogawa Formation (Kanno and Tomizawa, 1959) was assigned to Late Miocene (7.5 Ma) based on the fission track dating (Yamagishi *et al.*, 1984 MS). Therefore, the geologic age of the locality of the new *Chlamys* seems to be of Early Pliocene.

### III Fossil occurrence and paleoenvironment

From the locality of the new *Chlamys*, nineteen species of mollusks and one brachiopod species were identified as shown in Table 1. The molluscan fauna consists of eighteen bivalves and one gastropod.

Most specimens of bivalves are disarticulated as aforementioned, though *Solamen spectabilis* and *Fulvia* sp., and some species such as *Mizuhopecten* sp. and *Crassostrea* ? sp. occur as fragments. However, bivalve specimens are not so abraded and the fine sculpture of *Chlamys tanakai* is well preserved (Pl. 4, fig. 8).

From a view point of the lithofacies and the specific composition, the mollusks from this locality can be compared with the *Patinopecten-Chlamys* assemblage (Chinzei and Iwasaki, 1967). According to Chinzei (1963), the pectinid assemblages with brachiopod are commonly found in the coarse-grained sandstone in association with off-shore type faunae. His statement is also applied to the associated fauna of the new *Chlamys*. Namely, as shown in Table 1, *Chlamys lioica shigaramiensis*, n. subsp. is associated with a few deep water species such as *Nuculana yokoyamai arai* and *Astarte alaskensis*. The data mentioned above indicate that the fossil-bearing layer of the new *Chlamys* was deposited in the off-shore environment.

Table 1. Associated species with the new subspecies of *Chlamys*.

表1. カミオニシキガイ属の新亜種の随伴種

---

<i>Nuculana (Thestyleda) yokoyamai arai</i> Habe .....	Pl. 4, fig. 5.
<i>Arca boucardi</i> Jousseaume	
<i>Barbatia</i> ? sp.	
<i>Glycymeris</i> sp.	
<i>Modiolus</i> sp.	
<i>Solamen spectabilis</i> (A. Adams)	
<i>Chlamys (Chlamys) tanakai</i> Akiyama .....	Pl. 4, figs. 2, 8.
<i>Ch. (Ch.) cosibensis</i> (Yokoyama)	
<i>Ch.</i> sp.	
<i>Mizuhopecten</i> sp.	
<i>Crassostrea</i> ? sp.	
<i>Astarte (Tridonta) alaskensis</i> Dall .....	Pl. 4, fig. 12.
<i>Felaniella usta</i> (Gould)	
<i>Chama</i> ? sp.	
<i>Papyridea kurodai</i> Hatai and Nisiyama	
<i>Fulvia</i> sp.	
<i>Spisula (Mactromeris) grayana</i> (Yokoyama)	
<i>Tectura (Niveotectura) sigaramiensis</i> (Makiyama)	
Trochidae gen. et sp. indet.	
<i>Coptothyris</i> sp. ....	Pl. 4, fig. 6.

---

#### IV Description of the new subspecies

Family Pectinidae

Subfamily Chlamiinae

Genus *Chlamys* (Röding, 1798)

Subgenus *Chlamys* s. s.

*Chlamys (Chlamys) lioica shigaramiensis*, n. subsp.

(Pl. 4, figs. 1, 3-4, 7, 9-11, 13)

Type specimens : Holotype, JUE\*\*\* no. 15037, Paratypes, JUE nos. 15038-15041. (JUE\*\*\*=abbreviation of the specimens catalogued in the Department of Geoscience, Joetsu University of Education).

*Description* : Seventeen specimens are examined. Shell moderate in size, thin, rather compressed, higher than long, subequilateral except for auricles, subequivalve ; apical angle about 85°. Surface of right valve smooth except for 66 obsolete radial threads near ventral margin, anterior and posterior sides. Anterior auricle of right valve moderate in size, sculptured by 5 distinct radial ribs ; byssal fasciole rather narrow ; byssal notch rather wide. Posterior auricle of right valve very small, triangular, with 4 distinct grooves. Ctenolium short, consisting of 4 weak denticles. Surface of left valve also smooth except for many obsolete radial threads. Anterior auricle of left valve triangular, ornamented with 5 distinct radial ribs ; byssal sinus rather wide and shallow. Posterior auricle of left

valve broken. Hinge of right valve with conspicuous cardinal crura and deep resilial pit. Inner ventral margin weakly crenulated.

*Measurements (in mm) :*

Specimens	Length	Height	Hinge length
JUE no. 15037	40.2	43.8	14.8
" 15038	33.0	38.5	14.4

*Remarks :* *Chlamys lioica* was originally described by Dall (1907) from the Pliocene Nome beach deposit in Alaska. Dall (1920) stated that "no further specimens of this very distinct species have come to hand". Grant and Gale (1931) suggested that the present species may be a monstrosity of *Chlamys islandica* (Müller). Subsequently, the type specimen was redrawn by MacNeil *et al.* (1943). MacNeil (1967) described this species from the Yakataga Formation near Malaspina district in the southern Alaska and pointed out the similarity of this species to *Pecten tigrinus* var. *laevis* figured by Wood (1851) from the Coralline Crag (Late Pliocene) in England.

The Shigarami specimens are included in *Chlamys lioica* (Dall) because it has smooth shell surface except for faint radial threads, suborbicular shape, and distinct radial ribs on the auricle. However, the Shigarami specimens are slightly different from the typical species by having smaller auricles, less numerous denticles of ctenolium, and narrower byssal fasciole than the latter.

Up to this time, there was no record of *Chlamys lioica* from the Pliocene deposits in Kamchatka, Sakhalin, Kurile Islands and Hokkaido. Therefore, considering the morphological differences and the geographic separation between the Shigarami and the Alaska specimens, the author propose a new subspecies based on the Shigarami specimens.

The present subspecies is allied to *Chlamys kumanodoensis* Masuda from the Miocene Moniwa Formation in having numerous faint and fine radial ribs. However, the former differs from the latter by having more faint radial ribs, deeper byssal sinus and smaller auricles of left valve.

The new subspecies is distinguished from any species of *Placopecten* Verrill and *Nipponopecten* Masuda by having subequivalve, small apical angle, distinct radial ribs on the auricle, and byssal sinus of left valve which are all characteristics of the genus *Chlamys*.

The present subspecies distinctly differs from *Chlamys islandicas* (Müller) by having smooth shell surface except for obsolete radial threads. The morphological features of the present subspecies are stable. Therefore, the present authors do not agree with the opinion of Grant and Gale (1931). *Chlamys lioica* is an independent species.

*Type locality :* Road-side cliff at about 500m south of the Arakurayama Camping Ground, near Motai, Togakushi-mura, Kamiminochi-gun, Nagano Prefecture.

*Distribution :* Pliocene Shigarami Formation in Nagano Prefecture and Pliocene Tomikura

Formation in Niigata Prefecture.

### Acknowledgment

The authors wish to express their deep appreciation to Professor Saburo Kanno, Department of Geoscience, Joetsu University of Education for his careful reading of the manuscript.

### References

- Akiyama, M. (1962), Studies on the phylogeny of *Patinopecten* in Japan. *Sci. Rep., Tokyo Kyoiku Daigaku, Sec. C*, 8 (74), 63-122.
- Chinzei, K. (1963), Notes on historical change of Neogene molluscan assemblages in Northeast Japan. *Fossils*, no. 5, 20-26 (in Japanese).
- and Iwasaki, Y. (1967), Paleoecology of shallow sea molluscan fauna in the Neogene deposits of Northeast Honshu, Japan. *Trans. Proc. Palaeont. Soc. Japan, N.S.*, no. 67, 93-113.
- Dall, W. H. (1907), On climatic conditions at Nome, Alaska, during the Pliocene, and on a new species of *Pecten* from the Nome gold-bearing gravels. *Amer. Jour. Sci., Ser. 4*, 23 (138), 457-458.
- (1920), Pliocene and Pleistocene fossils from the Arctic coast of Alaska and the auriferous beaches of Nome, Norton Sound, Alaska. *U. S. Geol. Surv. Prof. Pap.*, 125-C, 23-37.
- Grant, U. S. and Gale, H. R. (1931), Catalogue of the marine Pliocene and Pleistocene Mollusca of California. *Mem. San Diego Soc. Nat.*, 1, 1-1046.
- Kanno, S. and Tomizawa, T. (1959), Fossil molluscan fauna from the environs of the Zenkoji hot-springs, Nagano Prefecture. *Trans. Proc. Palaeont. Soc. Japan, N.S.*, no. 33, 9-14.
- MacNeil, F.S. (1967), Cenozoic pectinids of Alaska, Iceland, and other northern regions. *U.S. Geol. Surv. Prof. Pap.*, 553, 1-57.
- , Mertie, J. B. and Pilsbry, H.A. (1943), Marine invertebrate faunas of the buried beaches near Nome, Alaska. *Jour. Paleont.*, 17 (1), 69-96.
- Masuda, K. (1962), Tertiary Pectinidae of Japan. *Sci. Rep., Tohoku Univ., 2nd Ser.*, 33 (2), 117-238.
- (1986), Historical change of the Neogene molluscan fauna of Japan with special reference to pectinids. In, Noda, H. et al. eds., Faunal characteristics of Japanese Cenozoic molluscs. *Monogr. Mizunami Fossil Mus.*, no. 6, 1-21, pls. 1-3 (in Japanese with English abstract).
- Suzuki, T. (1938), Explanation of the topography and geology of the Nagano Oil-field, Nagano Prefecture. 46p. *Geol. Surv. Japan* (in Japanese).
- Takeshita, H., Saito, Y. and Momose, K. (1960), Paleomagnetisms and volcanic geology of the Shigarami Formation. *Earth Sci.*, no. 49, 26-35 (in Japanese).
- Tomizawa, T. (1953), On the stratigraphy and geological structure of the Susobana-kawa region

- in the northern part of Nagano Prefecture. *Jour. Geol. Soc. Japan*, **59** (699), 552-560 (in Japanese).
- (1958), Studies on fossils from the Kami-Minochi district, Nagano Prefecture, in T. and Y. Yagi, *Geology of Kami-Minochi-gun.* 317-347 (in Japanese).
- Tsuchi, R. (1985, MS), Geologic age and characteristics of the Omma-Manganzian fauna. *Community characteristics of the Neogene mollusks in Japan by Noda (ed.)*, 13-14 (in Japanese).
- Yamagishi, I., Okimizu, T. and Yokoyama, H. (1984 MS), Fission-track age of the Neogene System of the Northern Fossa Magna Region (Part I). *Abstract of the 91st Annual Meeting of the Geological Society of Japan*, 148 (in Japanese).
- Yano, T. (1981), Partial unconformity in the Pliocene strata of the Shigarami area, northern Nagano Prefecture. *Jour. Geol. Soc. Japan*, **87** (1), 35-46 (in Japanese).
- and Murayama, S. (1976), Stratigraphy and geologic structure around Mt. Arakurayama in northern Nagano Prefecture. *Mem. Geol. Soc. Japan*, no. 13, 159-173 (in Japanese).
- Wood, S. V. (1851), Bivalves, pt. 2, no. 1 of the Crag Mollusca. *Palaeontogr. Soc. London, Mon.*, **4**, 1-150.

Plate 4

Figs. 1, 3-4, 7, 9-11, 13. *Chlamys (Chlamys) lioica shigaramiensis*, n. subsp., fig. 1,  $\times 1.2$ , JUE no. 15042 ; fig. 3,  $\times 1.2$ , JUE no. 15043 ; fig. 4,  $\times 1.5$ , JUE no. 15040 (Paratype) ; fig. 7,  $\times 1.2$ , JUE no. 15044 ; fig. 9,  $\times 1.2$ , JUE no. 15041 (Paratype) ; fig. 10,  $\times 1.2$ , JUE no. 15039 (Paratype) ; fig. 11,  $\times 1.2$ , JUE no. 15037 (Holotype) ; fig. 13,  $\times 1.2$ , JUE no. 15038 (Paratype).

Figs. 2, 8. *Chlamys (Chlamys) tanakai* Akiyama, fig. 2,  $\times 1$ , JUE no. 15046 ; fig. 8,  $\times 1.5$ , JUE no. 15047.

Fig. 5. *Nuculana (Thestyleda) yokoyamai arai* Habe,  $\times 2$ , JUE no. 15045.

Fig. 6. *Coptothyris* sp.,  $\times 1.2$ , JUE no. 15049.

Fig. 12. *Astarte (Tridonta) ataskensis* Dall,  $\times 1.2$ , JUE no. 15048.



