903. TAXONOMIC AND PALEozoOGEOGRAPHIC SIGNIFICANCE
OF CENOZOIC HUNCH-BACK LIKE VENERIDS

PART 1. GIGANTOCALLISTA, GEN. NOV. (MOLLUSCA : BIVALVIA),
A NEW ENDEMIC VENERID GENUS FROM THE PlioCENE
TATSUNOKUCHI FORMATION, SENDAI CITY,
MIYAGI PREFECTURE, NORTHEASTERN JAPAN

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Abstract. A new genus of hunch-back like Bivalvia, Gigantocallista, is proposed and
Pitar sendaica Nomura is designated as the type-species. The genus is monotypic and may
have evolved from the Miocene genus Neogenella. Gigantocallista sendaica occurs only in
the Pliocene Tatsunokuchi Formation, and may reflect localized zoogeographic or paleocological conditions within the Pliocene Paleo-Sendai Bay.

Key words. Hunch-back like shell, Gigantocallista, Tatsunokuchi Formation, Tatsu-
nokuchi Fauna, Pliocene.

Introduction

The extraordinary group of Pitar (Hayasaka and Uozumi, 1954), or “the so-called
Tertiary Pitar” (Iwasaki, 1963) is a venerid with an unusually thick hunch-back like
shell. In Japan, Pitar okadana (Yokoyama), P. itoi Makiyama, P. hokkaidoensis
Nomura, and P. sendaica Nomura have been included in this above-mentioned “Pitar”
group (Iwasaki, 1963). This group of Pitar has long been well known from Miocene and
Pliocene deposits of Japan, Korea, Sakhalin and Kamchatka. Particular attention has
been paid to this type of Pitar because of its biostratigraphic value as well as its unusual
morphology (Makiyama, 1926, 1936; Yokoyama, 1932; Nomura, 1935, 1938, 1940;
Slodkewitsch, 1938; Nomura and Hatai, 1936, 1937; Uozumi, 1953, 1962; Hayasaka

et al., 1968, 1972; Itoigawa, et al., 1974; Itoigawa et al., 1981a,b; Amano, 1983,
1986; Gladenkov, 1984; Menner, 1984).

Though this type of venerid has long been included in Pitar, its dentition is clearly
different from Pitar Römer (Iwasaki, 1963). The taxonomic position of this venerid has
not been settled to many authors yet, who either include the above-mentioned “Pitar”
species in Römer’s Pitar, or in Pseudamiantis Kuroda (1933). Krishtofovich (1955, fide
Zhidkova et al., 1968) proposed Neogenella as a subgenus of Pitar Römer and some
authors included this type of “Pitar” in his subgenus. But as already mentioned by
Iwasaki (1963), its dentition is not of Pitar-type, so this type of “Pitar” should not be
included in the genus Pitar.

These so-called Pitar species are biogeographically significant. They and their allied
species are known only in eastern Asia, although significant changes in their geographic distribution have occurred during the Neogene. In Miocene time they inhabited Korea, Honshu, Hokkaido, Sakhalin and western Kamchatka, but in Pliocene time they were confined only to Sendai Basin (Takagi, 1987, 1989 MS).

The present writer was recently given the opportunity to re-examine the extraordinary group of Pitar from the Miocene and the Pliocene deposits of various localities in Hokkaido, Honshu, Korea, and western Kamchatka. He proposed a new genus, Gigantocallista, based upon Pitar sendaiaca Nomura (1938) and included Miocene species, P. okadana, P.itoi, and P. hokkaidoensis in the genus Neogenella Krish-tofovich.

In this paper, the writer discusses the taxonomic and paleozoogeographic positions of the new genus Gigantocallista. The taxonomic and paleozoogeographic problems of Neogenella will be discussed in another paper.

**Systematic description**

Order Veneroida H. and A. Adams, 1858
Superfamily Veneracea Rafinesque, 1815
Family Veneridae Rafinesque, 1815
Genus Gigantocallista Takagi, gen. nov.

*Type species.*—Pitar sendaiaca Nomura, 1938, by original designation. Pliocene Tatsunokuchi Formation, Sendai, Miyagi Prefecture, Japan.

*Diagnosis.*—Hunch-back like Callista-type genus with high and strong hinge plate, peculiar cardinals and laterals; Neogenella-like cardinals in right valve and A-shape strong cardinals of (2a)-(2b), and remarkably large and heavy lateral in left valve.

*Description.*—Shell large, test thick, trigonalovate, strongly inflated; lunule wide, cordate, obscurely impressed; escutcheon indistinct; sculpture consisting of incremental growth lines and very weak radial striae; hinge plate high, thick; hinge of right valve consisting of 2 indistinct anterior lateral lamellae (A1 and AIII) flanking a deep socket, and strong 3 cardinals, the anterior (3a) and middle (1) ones almost perpendicular to hinge margin, the middle (1) one heavy, the anterior (3a) one short, the posterior (3b) one bifid, anterior lateral lamellae (A1) and (AIII) indistinct; a-bivalve and flanking a deep A-shape, anterior lateral (AII) heavy, conical, and bifid, the base of (AII) extending toward beak.

The type species of Gigantocallista, G. sendaiaca exhibits dimorphism in anterior lateral (AII); most of specimens have large thickened and strongly inflated anterior lateral AII (A-type), but one specimen, large but thinner than A-type and distinctly bifid one (B-type).
lial sinus deep; ventral margin smooth.

Comparison.—*Gigantocallista*, gen. nov. differs from all other venerid genera in possessing a high and strong hinge plate, and peculiar cardinals and laterals; *Neogenella*-like cardinals in right valve, Δ-shaped strong cardinals of (2a)–(2b), and a remarkably large and heavy lateral in the left valve (Figure 1). Above mentioned dentition of *Gigantocallista* is dissimilar to that of *Pitar*, but of *Callista*.

*Callista* Poli (1791, *fide* Cox *et al.*, 1969) resembles the present genus by having Δ-shaped cardinals of (2a)–(2b) and beak-side stretched AII in the left valve, which are common characters of the subfamily *Callistinae* Nordsieck (1969; *fide* Cox *et al.*, 1969). However, the present genus differs from *Callista* in possessing a thin and less inflated shell, a lower and thinner hinge plate, and a smaller and thinner anterior lateral in the left valve.

Nomura (1938) applied the genus *Pitar* Römer (1857) to his new species *sendaiaca*, designated as *Gigantocallista* herein, because its teeth arrangement is of *Pitar* and its large and heavy shell may be placed in *Megapartaria*. However, at that time, he had only worn and imperfect specimens to examine. However, *Pitar* differs from *Gigantocallista* in possessing a low and thin hinge plate, bridged cardinals of (2a)–(2b) that are almost parallel to the hinge margin anterior lateral in the left valve. The subgenera of *Pitar*, *Pitarina* Jukes-Browne (1913, *fide* Cox *et al.*, 1969), *Lamelliconcha* Dall (1902) and *Hyphantomosoma* Dall (1902), have similar dentition, but differ from *Gigantocallista*.

*Hysterochoncha* Dall (1902) and *Costel-lipitar* Habe (1951) also have *Pitar*-type dentition as mentioned above except for their posterior cardinal in left valve and can be easily distinguished from *Gigantocallista* by having low and thin hinge plate, and bridged cardinals of (2a)–(2b).

Nomura (1938) also discussed the relation of *Pitar sendaiaca* with *Megapartaria* Grant and Gale (1931), and *Amiantis* Carpenter (1864, *fide* Grant and Gale, 1931). However, *Megapartaria*, which was raised from the subgenus of *Pitar* to generic rank by Hertlein and Grant (1972), differs from the present genus in possessing a thinner shell, a low and thinner hinge plate, bridged cardinals of (2a)–(2b), and a thinner anterior lateral in the left valve.

*Amiantis* resembles *Gigantocallista* in having large and heavy shell, but differs from the latter in possessing a low and thin hinge plate, a thin and short (3a) cardinal in its right valve, bridged cardinals of (2a)–(2b) and an isolated long anterior lateral in the left valve, that is almost parallel to hinge margin.

*Macrocallista* Meek (1876 *fide* Grant and Gale, 1931; Korobkov, 1954) resembles *Gigantocallista* in having a large shell and Δ-shaped cardinals of (2a)–(2b) in the left valve, but differs from the latter in possessing a thin and elongated shell, a low and thin hinge plate, and a thin anterior lateral in the left valve.

*Ezocallista* Kamada (1962) resembles the present genus in having a large shell, and Δ-shaped cardinals of (2a)–(2b) in its left valve, but differs from *Gigantocallista* in possessing independent cardinals of (2a) and (2b), and a thin anterior lateral in its left valve.

*Saxidomus* Conrad (1897, *fide* Grant and Gale, 1931) resembles the present genus in having rather distinct concentric lines on its surface, and Δ-shaped cardinals of (2a)–(2b) in the left valve, but differs from *Gigantocallista* in possessing a thin shell, a low and thin hinge plate, and an anterior denticle joined to (3a) cardinal in its right valve.

*Pseudamiantis* Kuroda (Kuroda, 1933; Iwasaki, 1963; Habe, 1977) resembles the present genus in having a large shell and similar dentition in the right valve. Chizenzi and Iwasaki (1967) applied the generic name *Pseudamiantis* Kuroda (1933), without description or remarks, to the type-species of the present genus and some authors followed.
them (e.g., Chinzei, 1978; Masuda, 1986; Matsui, 1988). But *Pseudamiantis* differs from *Gigantocallista* in possessing low and thinner hinge plate, bridged cardinals of (2a)–(2b), isolated (= not joined to nymph) (4b) cardinal in the left valve, distinct radial threads on the surface, and a thinner shell (Figure 7–5).

*Neogenella* Krishtofovich (1955, *fide* Zhidkova *et al.*, 1968) resembles *Gigantocallista* in having a high and thick hinge plate and a thick hunch-like shell. Amano (1983) included the type-species of the present genus in *Neogenella*, but it differs from the present genus in possessing bridged cardinals of (2a)–(2b) in the left valve, and large middle cardinals (1) and short anterior (3a) one in the right valve (Figures 6–5a—b and Figure 7–6).

*Gigantocallista* is represented only by the Pliocene *G. sendaiaca* (Nomura) from the Tatsunokuchi Formation in Miyagi Prefecture and may be restricted to the Pliocene Paleo-Sendai Bay (Chinzei and Iwasaki, 1967; Masuda and Ogasawara, 1981). From the peculiar hunch-back like shell, high and thick hinge plate, and similar dentition except for anterior and middle cardinals in left valve, *Gigantocallista* may have evolved from the Miocene *Neogenella*. The relation of both genera with the taxonomic problem of

![Figure 2. Measurement of Gigantocallista sendaiaca.](image)

<table>
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<tr>
<th>No.</th>
<th>Loc.</th>
<th>Meg. No.</th>
<th>Length</th>
<th>Height</th>
<th>Depth</th>
<th>B.P.</th>
<th>Ds.</th>
<th>H/L%</th>
<th>D/H%*2</th>
<th>BP/L%</th>
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<td>36.4</td>
<td>31.9</td>
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</table>
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*Neogenella* will be discussed in another paper.

**Gigantocallista sendaica**
(Nomura, 1938)

Figures 6-1—4b; 7-1—4

*Pitar sendaica* Nomura, 1938, p. 258, pl. 35(3), figs. 1–3, 10a–b.

*Pitar sendaica monstrosa* Nomura, 1938, p. 259, pl. 35(3), figs. 8a–b, 9a–b.

**Remarks**: The present writer re-examined the specimens of this species from the Tatsunokuchi Formation including Nomura’s type specimens in the Saito Ho-on Kai Museum. Measured specimens are not

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**Figure 3.** Relation between height/length and length of *Gigantocallista sendaica* (Nomura). H/L %: height/length %; 1: specimens from Gōroku Cliff, Sendai City; 2: specimens from Sendai City (locality unknown); 3: specimens from Chūō 5-chome, Sendai City; 4: type-specimen of *Pitar sendaica monstrosa* Nomura.

**Figure 4.** Relation between depth/height and height of *Gigantocallista sendaica* (Nomura). D/H %: depth/height %; symbols are the same as in Figure 3.
so many because most of materials at hand are imperfect. Statistically useful measured data, therefore, will be needed for discussing the strict variation of this species. Examining all material at hand, the writer recognized a variation of height/length ranging from 81% to 95% (Figure 3), and a variation of depth/height ranging from 32% to 44% (Figure 4). Generally speaking, the most common proportion is about 80–88% in the former, and in the latter, 32–38%, both being observed in both immature and adult shells. The present species exhibits dimorphism in the anterior lateral of the left valve (Figure 1). Most specimens have an A-type lateral, which is large, thickened and strongly inflated. But one specimen has a B-type lateral, which is large, but thinner than the A-type, and distinctly bifid. The B-type lateral may be abnormal form of this species.

Nomura (1938) described *Pitar sendaiaca monstrosa* based on specimens from the same locality as *Pitar sendaiaca*, and noted that this subspecies can be distinguished from *sendaiaca* (s.s) by “having more inflated valves, beaks placed slightly more anteriorly with a more convex, or somewhat hump-back curvature along the postero-dorsal border”. But the type specimens of Nomura’s *P. sendaiaca* (s.s) have more inflated shells (42.3–44.3% in depth/height) than those of *P. sendaiaca monstrosa* (41%), and the proportion of beak point/length of *Gigantocallista sendaiaca* from the Tatsunokuchi Formation grades continuously from 27.9% to 36.3% (Figure 5). Since they occur form the same place and can not be divided from each other by morphological characters, Nomura’s *P. sendaiaca monstrosa* may be considered herein to be a junior synonym of *P. sendaiaca* (s.s). Similar

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**Figures 6-1 — 4b.** *Gigantocallista sendaiaca* (Nomura) 1-3, hinge area of left valve, 1: U.H. Reg. No. 31006, ×1.35; 2: U.H. Reg. No. 31007, ×1; 3: U.H. Reg. No. 31008, ×1; 4a — b: dorsal (4a) and right (4b) views, Prof. Masuda’s collection in Miyagi University of Education, ×1; 1 — 3, Tatsunokuchi Formation, Chūō 5 chôme, Sendai City; 4, Tatsunokuchi Formation, Gōroku Cliff, Sendai City. 5a — b, *Neogenella okadana* (Yokoyama), interior and exterior views of left valve, for comparison, U.H. Reg. No. 31011, ×1, Tachikaraushinanai Formation, Utanobori-chou, northern Hokkaido.
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morphological variation is observed in its related species *Neogenella okadana* (Yokoyama). Over 80 specimens of this species are measured and examined, the writer recognized that some old large specimens of *Neogenella okadana* tend to have more inflated or somewhat hump-back curvature along the postero-dorsal border, in general. This species from the type locality has large varietal form and ranges from typical hunch-back like *N. okadana* form to low convex even including *N. hokkaidoensis* form. The variation and its relation to geological and geographical distributions of this species will be discussed in another paper.

**Geologic and paleozoogeographic distribution of *Gigantocallista***

The hunch-back like shells of the Miocene *Neogenella* species and Pliocene *Gigantocallista sendaiaca*, may be closely related to each other genetically and ecologically. Many distinctive morphological characters are shared by these species and they also show a remarkably crowded occurrence in coarse-grained sandstone. Based on associated fossils and substrate, they evidently lived on shallow, sandy, and level bottoms (Chinzei and Iwasaki, 1967). In Miocene time, *Neogenella* was distributed widely in eastern Asia, including Korea, Honshu, Hokkaido, Sakhalin, and western Kamchatka. During late Middle to Late Miocene time, *Neogenella* lived in Hokkaido, Sakhalin and western Kamchatka, but not to the south in Honshu and Korea. During this period, the Wakkana and Atsunai-Togeshita Faunas occupied in those northern areas. It seems that this faunas lived in water which was cool-temperate, but still slightly warm, because they were associated with intermingled cool and warm elements (Uozumi, 1962; Zhidkova *et al.*, 1968; Amano, 1983, 1986; Gladenkov, 1984; Menner, 1984).

Another hunch-back like venerid, *Gigantocallista*, was restricted geologically and geographically to the Pliocene Tatsunokuchi Fauna in the “Paleo-Sendai Bay” (Chinzei and Iwasaki, 1967; Masuda and Ogawara, 1981). Though the Tatsunokuchi Fauna has been recognized to be composed of cool water elements, this fauna also includes some warm water elements such as *Trachycardium goro-kuense*, *Mereotrix paramereotrix*, *Anisocorbula venusta*, and *Neverita kirtianiana* (Nomura, 1938). Since this fauna is composed of intermingled cool and warm elements, the Tatsunokuchi Fauna seems to have lived in water that was cool-temperate, but still somewhat warm.

In Pliocene time, the Takikawa-Honbetsu Fauna lived in Hokkaido, Sakhalin and Kamchatka, but not in the Miyagi Prefecture and its south. It seems that this fauna lived within cool-water currents, similar to those of the present day along the Pacific coast of eastern Hokkaido (Uozumi, 1962; Takagi, 1982; Uozumi *et al.*, 1986). In addition, *Dosinia tomi kwensis* Takagi, one of the characteristic species of the Takikawa-Honbetsu Fauna, was distributed in Aomori, Hokkaido, and southern Sakhalin, but not in the Sendai Basin and further south (Takagi, 1986; Uozumi *et al.*, 1986).

The Tatsunokuchi and the Kakegawa Faunas were intermingled in the southern area of Sendai (= the Ishiguma Formation of

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Futaba and Tomioka Formation of Hirono, Futaba-gun, Fukushima Prefecture. In these mixed fauna, *Fortipecten takahashii* (Yokoyama) or *F. kenyoshiensis* Chinzei, and cool-water elements, such as *Puncturella nobilis*, *Ariadnaria insignis*, *Turritella fortillirata*, *Velutina plicatilis cryptospira*, *Cryptonatica janthostoma*, *Nucella lamellosa*, *Nucella lapillus*, *Neptunea arthritica*, *Japelion pericochlon*, *Aulacofusus periscleridus*, *Obestoma simplex*, *Acisra ochotensis*, *Glycymeris yessoensis*, *Limatula vladivostokensis*, and *Spisula polynyma* are associated with warm Kakegawa faunal elements (e.g., *Suchium giganteum* yamamotoi, *Neritera didyma*, *Adusta onyx*, *Sydaphera spengleriata*, *Turritella ikebei*, *Glycymeris* cf. *nakamurae*, *Chlamys miurensis*, *Chlamys satoi*, *Cryptodilus vesicullosus*, *Nemocardium samaran-gae*, and *Anisocoruba venusta*) (Hayasaka and Hangai, 1966; Masuda and Ogasawara, 1981; O’Hara and Nemoto, 1988; Noda, Kikuchi and Nikaio, 1989). Though it contains cool-water elements, this fauna of the Ishiguma and Tomioka Formations seemed to live in warm-temperate habitat, warmer than that of the Tatsunokuchi Fauna and the Takikawa-Honbetsu Fauna (Hayasaka and Hangai, 1966; Takahashi, 1986; Noda, Kikuchi and Nikaio, 1989).

Though this fauna includes *Fortipecten*, the molluscan fauna of the Ishiguma and Tomioka Formations is more similar to the southern Kakegawa Fauna than to the Tatsunokuchi and Takikawa-Honbetsu Formas.


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venerid specimens from the Tatsunokuchi Formation in Sendai.

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Toshio Takagi


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the Upper Miocene and Pliocene, Sakhalin.  
Acad. Sci., USSR, Siberian Section, p. 1-176,  
pls. 1-50. (in Russian)

---, Vevz, V.E., Ilyina, A.P., Krishtofovich, L.V.,  

Tatsunokuchi 竜ノ口, Sendai 仙台, Miyagi 宮城, Wakkanai 雅内, Atsunai-Togeshita 厚内一帯下, Takikawa-Honbetsu 澀川 - 本別, Aomori 青森, Hokkaido 北海道, Ishiguma 石熊, Futaba 双葉, Fukushima 福島, Kakegawa 指川, Ikeda 池田, Obihiro 帯広, Utanobori 歌登, Poroshin 構新, Numata 沼田, Oiwaie 追分, Iwamizawa 岩見沢。

Gigantocallista, 宮城県仙台市の鮮新世竜ノ口層 Veneridae 科 (二枚貝綱) の一新属：本邦の中中新世および鮮新世より産する特異な形態をもついわゆる Pitar 属に含められてきた貝化石の検討を行い、宮城県仙台市の竜ノ口層から産する Pitar sendaica Nomura をもとに新属 Gigantocallista を提唱する。本属は著しく大型で鋭く膨らんだ厚い殻、重厚な鋭板、独特の鋭歯等で特徴づけられる。Gigantocallista は、その形態的特徴（特に鋭板、鋭歯）が中新世に広く産する Neogenella 属に良く類似し、前者は後者から派生したことが強く示唆される。また、本属の分布は鮮新世のいわゆる古仙台湾に限られることや、共産する貝類化石も本属と同様の時代的、地理的分布を示すものが著しく多いことから、Gigantocallista は、鮮新世の竜ノ口動物群の地理的・環境的な特異性を示すものと考えられる。高木俊男