

Redescription of three syringothyridid brachiopod species from the lower Carboniferous of the South Kitakami Belt, Japan

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Abstract

In this paper three syringothyridid species, originally described by Minato (1951) from the lower Carboniferous Arisu Formation of the South Kitakami Belt, northeastern Japan, are revised and redescribed based on the type specimens. The species are *Syringothyris texta* (Hall, 1857) (= *Syringothyris transversa* Minato, 1951), *Pseudosyrinx jumonjiensis* (Minato, 1951) (= *Syringothyris jumonjiensis* Minato, 1951) and *Asyrinxia nipponotrigonalis* (Minato, 1951) (= *Fusella nipponotrigonalis* Minato, 1951).

Key words: Brachiopoda, Carboniferous, redescription, South Kitakami Belt, syringothyridid.

Introduction

Syringothyridid brachiopods are antitropical genera distributed mainly in the Boreal and Gondwanan regions in the early Carboniferous. In the lower Carboniferous of the South Kitakami Belt, northeastern Japan, the syringothyridids (*Syringothyris*, *Pseudosyrinx* and *Asyrinxia*) form important stratigraphical marker horizon of the middle part of the Arisu Formation (= D₀ Zone of Minato et al., 1953, 1979). However, the systematics of the syringothyridid species have been insufficient.

In the present study, I redescribe three species of the syringothyridids from the middle part of the Arisu Formation (correlated with the lower Viséan, by Tazawa and Iryu, 2018) of the Yokota and Shimoarisu areas in the South Kitakami Belt based on the type specimens,

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which are housed in the Hokkaido University Museum, Sapporo. The species are *Syringothyris transversa* Minato, 1951, *Syringothyris jumonjiensis* Minato, 1951 and *Fusella nipponotrigonalis* Minato, 1951. These species are now revised as *Syringothyris texta* (Hall, 1857), *Pseudosyrinx jumonjiensis* (Minato, 1951) and *Asyrinxia nipponotrigonalis* (Minato, 1951), respectively.

Systematic descriptions

Order Spiriferinida Ivanova, 1972

Suborder Spiriferinidina Ivanova, 1972

Superfamily Syringothyridoidea Fredericks, 1926

Family Syringothyrididae Fredericks, 1926

Subfamily Syringothyridinae Fredericks, 1926

Genus *Syringothyris* Winchell, 1863

Type species.—*Syringothyris tyba* Winchell, 1863.

Syringothyris texta (Hall, 1857)

Fig. 1.1

Spirifer textus Hall, 1857, p. 169.

Syringothyris textus (Hall). Weller, 1914, p. 399, pl. 69, figs. 6–9; pl. 70, figs. 1–4; pl. 71, figs. 1, 2.

Syringothyris transversa Minato, 1951, p. 377, pl. 5, fig. 1; Minato, 1952, p. 167, pl. 11, fig. 5 only; Minato et al., 1979, pl. 21, fig. 11; Tazawa, 2002, fig. 7.6; Tazawa, 2006, p. 134, figs. 7.1, 7.2.

Material.—One specimen from the middle part of the Arisu Formation of Nashirozawa in the Shimoarisu area, internal mould of a conjoined shell, with external mould of the ventral interarea, UHR16925 (holotype).

Description.—Shell large in size for genus, transversely subtriangular in outline, cardinal extremities slightly mucronate; length about 50 mm, width about 84 mm in the holotype (UHR16925). Ventral valve gently convex in lateral profile; interarea moderately high and slightly concave, with a narrow triangular delthyrium, having a delthyrian angle 35°; a syrinx present; sulcus wide and deep. Dorsal valve gently convex in both lateral and anterior profiles; fold wide and high. External surface of both valves ornamented with numerous simple costae on lateral slopes, but nearly smooth on sulcus and fold; costae numbering 3–4 in 10 mm at anterior margin of dorsal valve; microornament of fine concentric growth lines on entire valve. Ventral interior with a pair of strong diverging dental plates and a large rounded and radially striated muscle scars in posterior portion of

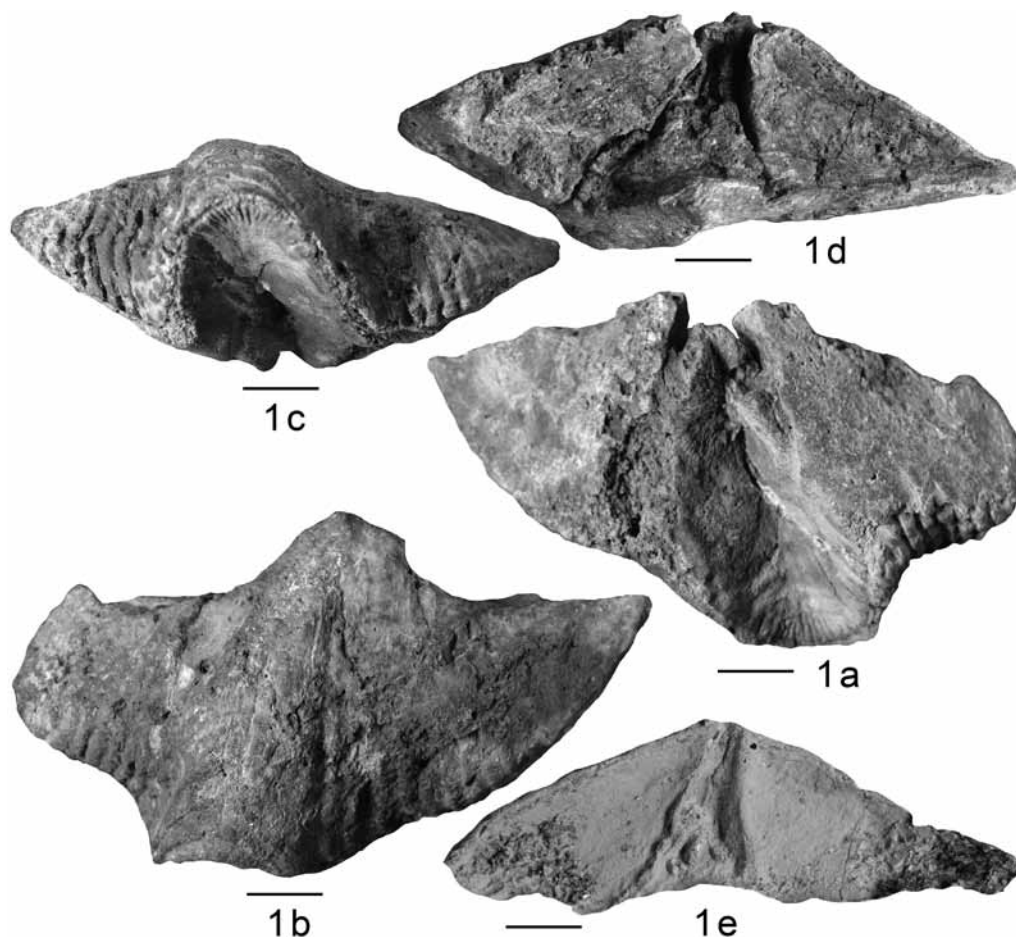


Fig. 1. 1, *Syringothyris texta* (Hall); 1a, 1b, 1c, 1d, ventral, dorsal, anterior and posterior views of internal mould of conjoined shell, UHR16925 (holotype); 1e, external cast of ventral interarea of the conjoined shell. Scale bars represent 1 cm.

valve. Interior of dorsal valve not well preserved.

Remarks.—This specimen was described by Minato (1951, p. 377) as the holotype of *Syringothyris transversa* Minato, 1951. But the Kitakami species is considered to be a junior synonym of *Syringothyris texta* (Hall, 1857), redescribed by Weller (1914, p. 399, pl. 69, figs. 6–9; pl. 70, figs. 1–4; pl. 71, figs. 1, 2) from the Keokuk Limestone of Missouri and the Knobstone Formation of Indiana, in the large, transverse shell and relatively low and slightly concave ventral interarea with a syrinx in the delthyrium. *Syringothyris altaica* Tolmatchoff (1924, p. 162, 555, pl. 8, figs. 9–11; pl. 9, fig. 1), from the upper Tournaisian of the Kuznetsk Basin, central Russia, differs from *S. texta* in having blunt cardinal extremities.

Distribution.—Lower Visean: northeastern Japan (Shimoarisu and Yokota in the South Kitakami Belt) and USA (Missouri and Indiana).

Subfamily Permasyrinxinae Waterhouse, 1986

Genus *Pseudosyrinx* Weller, 1914

Type species.—*Pseudosyrinx missouriensis* Weller, 1914.

Pseudosyrinx jumonjiensis (Minato, 1951)

Fig. 2.1

Syringothyris jumonjiensis Minato, 1951, p. 376, pl. 2, fig. 1; Minato et al., 1979, pl. 21, fig. 12.

Material.—One specimen from the middle part of the Arisu Formation of the Shimoarisu area, external mould of a dorsal valve with interarea of the ventral valve, UHR15995 (holotype).

Description.—Shell large in size for genus, transversely rhombus in outline, with mucronate cardinal extremities; length 62 mm, width 97 mm in the holotype (UHR15995). Ventral interarea very high and flat; delthyrium narrow with delthyrial angle about 20°; syrinx absent. Dorsal valve gently convex in both lateral and anterior profiles; fold moderately broad and high, smooth; lateral slopes ornamented with numerous simple rounded costae, numbering 6–7 in 10 mm at anterior margin of valve; microornament consisting of concentric growth lines.

Remarks.—This specimen was described by Minato (1951, p. 376) as the holotype of *Syringothyris jumonjiensis* Minato, 1951. But the genus of the Kitakami species should be replaced to *Pseudosyrinx*, for the presence of high, flat ventral interarea and the lacking of syrinx in the delthyrium. The present species most resembles *Pseudosyrinx missouriensis* Weller (1914, p. 406, pl. 65, figs. 5–9; pl. 66, figs. 11–13) from the Burlington Limestone of the Mississippi Valley in general shape, but the American species is smaller in size. *Pseudosyrinx sampsoni* (Weller, 1909, p. 311, pl. 14, fig. 4), from the Fern Glen Formation of Missouri, is also a large-sized *Pseudosyrinx* species, but differs from *P. jumonjiensis* in having fewer and stronger costae on the dorsal valve.

Distribution.—Lower Visean: northeastern Japan (Yokota and Shimoarisu in the South Kitakami Belt).

Genus *Asyrinxia* Campbell, 1957

Type species.—*Spirifera lata* M' Coy, 1847.

Asyrinxia nipponotrigonalis (Minato, 1951)

Figs. 3.1, 3.2

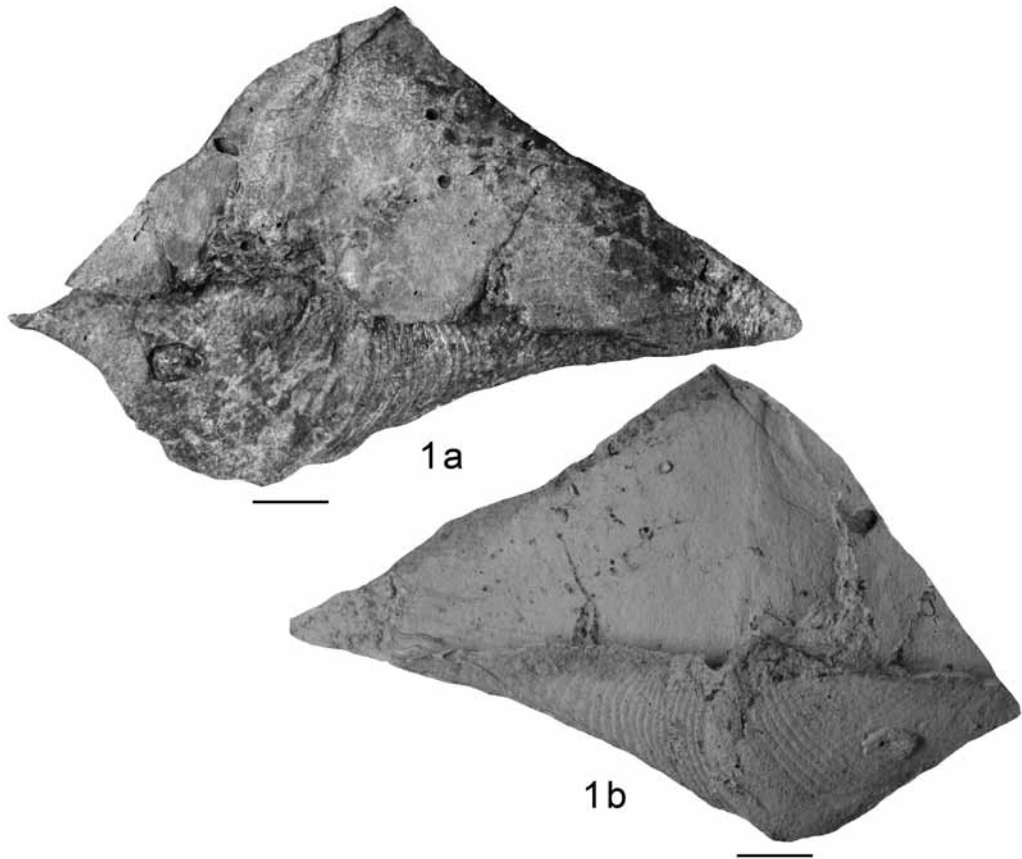


Fig. 2. 1. *Pseudosyrinx jumonjiensis* (Minato); 1a, 1b, external mould and external latex cast of conjoined shell, UHR15995 (holotype). Scale bars represent 1 cm.

Fusella nipponotrigonalis Minato, 1951, p. 372, pl. 2, fig. 5; Minato, 1952, p. 160, pl. 5, fig. 1; pl. 6, fig. 6; pl. 11, fig. 3; Minato et al., 1979, pl. 22, fig. 4.

Fusella nipponotrigonalis var. *minor* Minato, 1952, p. 160, pl. 6, fig. 3.

Asyrinxia sp. Tazawa, 1981, p. 74, pl. 5, fig. 14.

Material.—Two specimens from the middle part of the Arisu Formation of the Otsubosawa Valley, Yokota: (1) internal moulds of a conjoined shell, UHR16018 (holotype); and (2) external and internal moulds of a dorsal valve, UHR16016.

Description.—Shell medium in size for genus, transversely subtrigonal in outline, cardinal extremities slightly mucronate, ventral interarea moderately high and concave, without syrinx; length about 34 mm, width about 98 mm in the holotype (UHR16018). Dorsal valve gently convex in lateral profile; fold broad and moderately high, having no costae; lateral slopes ornamented with numerous simple rounded costae, numbering 4–5 in 10 mm at

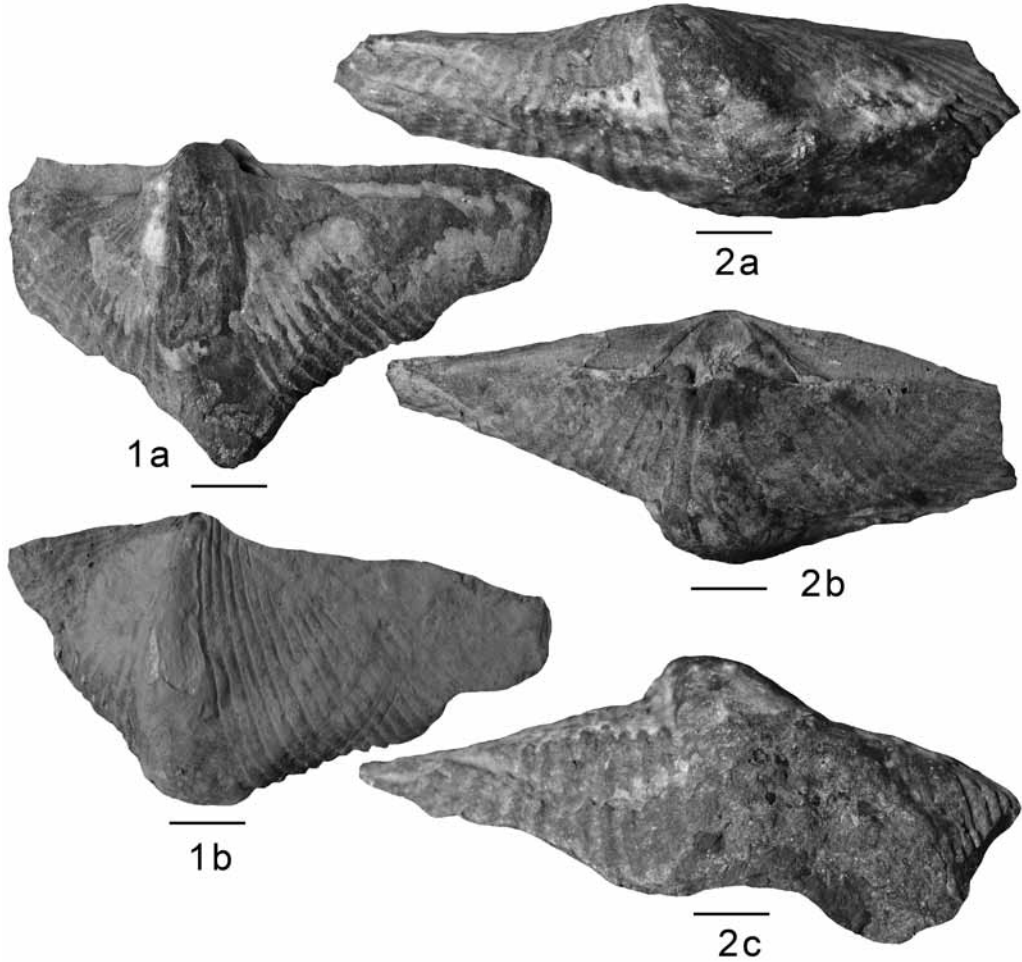


Fig. 3. 1, 2, *Asyrinxia nipponotrigonalis* (Minato); 1a, 1b, internal mould and external latex cast of dorsal valve, UHR16016; 2a, 2b, 2c, dorsal, posterior and anterior views of internal mould of conjoined shell, UHR16018 (holotype). Scale bars represent 1 cm.

anterior margin; microornament of concentric growth lines on entire valve. Internal structures of dorsal valve not well preserved.

Remarks.—These specimens were described by Minato (1951, p. 372) as the type specimens of *Fusella nipponotrigonalis* Minato, 1951. However, as suggested by Campbell (1957, p. 83–84), the Kitakami species is assigned to the genus *Asyrinxia*, in the large size and in having moderately high, concave ventral interarea, and lacking syrinx. Two syringothyridid species from the lower Carboniferous of the South Kitakami Belt, *Fusella nipponotrigonalis* var. *minor* Minato (1952, p. 160, pl. 6, fig. 3) from the Jumonji and Maide series (middle and upper parts of the Arisu Formation) of the Yokota area and *Asyrinxia* sp. in Tazawa (1981, p. 74, pl. 5, fig. 14) from the Karoyama Formation (upper Visean) of the Nisawa area, are considered to be junior synonyms of the present species. The type species,

Asyrinxia lata (M'Coy, 1857), redescribed by Campbell (1957, p. 81, pl. 16, figs. 1–9) from the middle Visean of Babbinboon, New South Wales, eastern Australia, differs from *A. nipponotrigonalis* by the more transverse outline.

Distribution.—Lower–upper Visean: northeastern Japan (Yokota, Shimoarisu and Nisawa in the South Kitakami Belt).

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