Additional *Gigantoproductus* species from the upper Visean-Namurian limestone of Kotaki, central Japan

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Abstract

A large productid brachiopod species, *Gigantoproductus aurita* (Bolkhovitinova, 1938), is described from the Tsuchikurazawa Limestone (upper Visean-Namurian), a large limestone block within a Permian accretionary complex of Kotaki, Itoigawa City, Niigata Prefecture, central Japan. This is the fourth described *Gigantoproductus* species from the Tsuchikurazawa Limestone. The range of *G. aurita* may extend to late Visean on the basis of the previous fossil records of the limestone.

Key words: Brachiopoda, Carboniferous, *Gigantoproductus*, Kotaki, Tsuchikurazawa Limestone.

Introduction

The Tsuchikurazawa Limestone (Takenouchi, 2005) is a large exotic limestone block within a Permian accretionary complex, the Kotaki Complex, distributed in and around the lower Tsuchikurazawa Valley, a tributary of the Kotakigawa River, Kotaki, Itoigawa City, Niigata Prefecture, central Japan (Fig. 1). The age of the Tsuchikurazawa Limestone is assigned to a late Visean-Namurian on the basis of smaller foraminifers (Nakazawa et al., 1998), corals (Kamiya and Niko, 1996; Niko and Yamagiwa, 1998), brachiopods (Tazawa, 2004; Ibaraki et al., 2008) and calcareous algae (Konishi, 1956). In the previous studies, the following three gigantoproductid species have been described from the Tsuchikurazawa Limestone:

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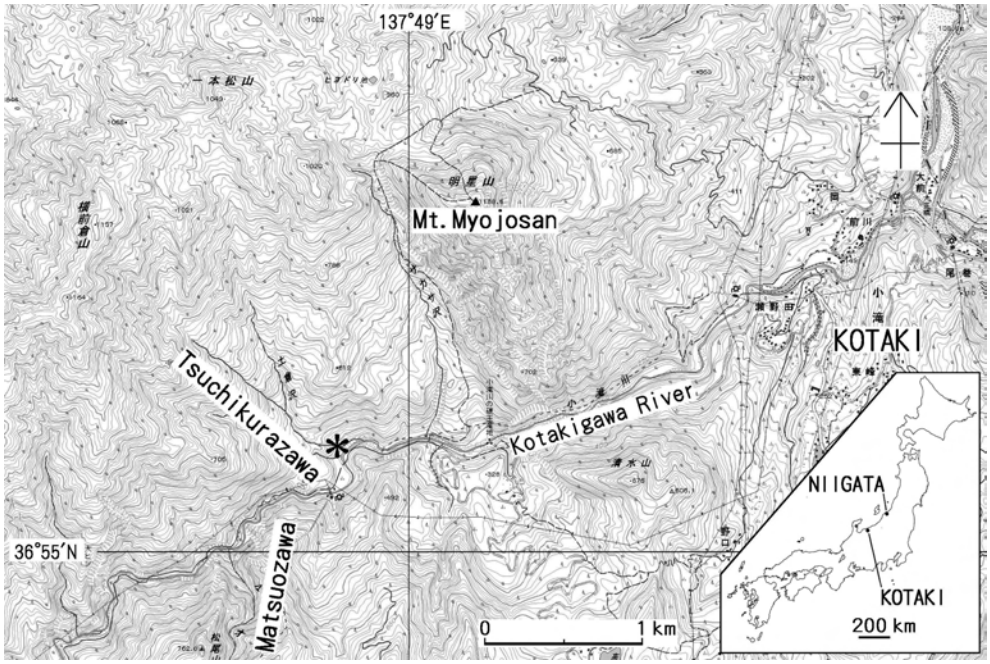

Fig. 1. Map showing the fossil locality (asterisk). Using the topographical maps of "Kotaki" and "Echigohiraiwa" scale 1:25,000 published by the Geographical Survey Institute of Japan.

Gigantoproductus sp. by Tazawa (2004), *Gigantoproductus tujucsuensis* Gladchenko and *Gigantoproductus meridionalis* Legrand-Blain by Ibaraki et al. (2008).

Brachiopod specimens now referred to *Gigantoproductus aurita* (Bolkhovitinova) were collected by the third author of the present paper (YN) from the Tsuchikurazawa Limestone at the lower stream of the Tsuchikurazawa Valley. This species is the fourth gigantoproductid, described from the Tsuchikurazawa Limestone. *G. aurita* is known from the middle Visean of the Moscow Basin (Bolkhovitinova, 1938) and central Kazakhstan (Litvinovich in Litvinovich et al., 1969). We consider that the range of *G. aurita* extend to late Visean on the basis of the previous fossil records of the Tsuchikurazawa Limestone.

The brachiopod specimens treated in this study are registered and housed in the Fossa Magna Museum, Itoigawa City, central Japan.

Systematic descriptions

(by YI and JT)

Order Productida Sarytcheva and Sokolskaya, 1959

Suborder Productidina Waagen, 1883

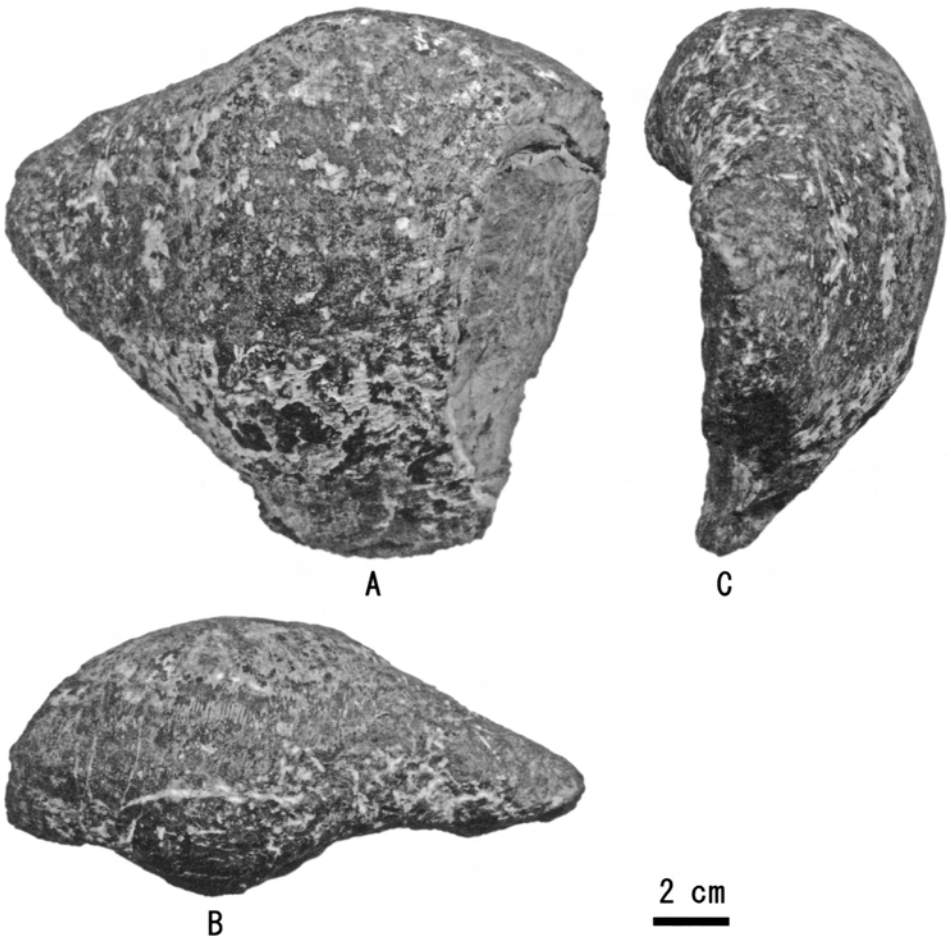

Fig. 2. *Gigantoproductus aurita* (Bolkhovitinova, 1938), ventral valve specimen, from the lower Tsuchikurazawa Valley, FMM1780, A: ventral view, B: lateral view, C: posterior view.

Superfamily Linoproductoidea Stehli, 1954
Family Monticuliferidae Muir-Wood and Cooper, 1960
Subfamily Gigantoproductinae Muir-Wood and Cooper, 1960
Tribe Gigantoproductini Muir-Wood and Cooper, 1960
Genus *Gigantoproductus* Prentice, 1950

Type species.—*Productus giganteus* Sowerby, 1822.

Gigantoproductus aurita (Bolkhovitinova, 1938)
Figs. 2A-2C, 3A-3C

Gigantella tulensis aurita Bolkhovitinova, 1938, p. 215, pl. 3, figs. 4-5.
Gigantoproductus tulensis aurita (Bolkhovitinova): Litvinovich in Litvinovich et al., 1969, p. 176, pl. 17, figs. 1a, 1b.

Material.—Two specimens, two ventral valves, FMM1780, 1781.

Description.—Shell large for genus, slightly transverse subelliptical in outline, with greatest width at hinge; length 86 mm+, width 185 mm+ in the larger specimen (FMM1781); length 73 mm, width 155 mm in the smaller one (FMM1780). Ventral valve strongly and evenly convex in anterior profile, but strongly and unevenly inflated in lateral profile, most convex at umbonal region, nearly flat at anterior half of valve; umbo large, inflated, greatly projected beyond hinge and strongly incurved; ears large, blunt, trigonal in shape, and not clearly demarkated from flanks; flanks gently inclined; sulcus absent. External surface of ventral valve ornamented with numerous costae; costae slightly flexuous, numbering 9-10 in 10 mm at about midvalve; 4-5 weak concentric rugae occurred around umbo; no fluting; spines and spine bases absent or not preserved. Shell layer 12 mm thick for posterior portion of ventral valve, 1.0-1.2 mm for nearly anterior margin of ventral valve.

Remarks.—The specimens from Kotaki are referred to *Gigantoproductus aurita* Bolkhovitinova (1938, p. 215, pl. 3, figs. 4-5), originally described from the middle Visean (Tulsky Horizon) of the Moscow Basin, and subsequently described by Litvinovich (in Litvinovich et al., 1969, p. 176, pl. 17, figs. 1a, 1b) from the middle Visean (Yagovkinsky Horizon) of central Kazakhstan in size, shape and external ornament of ventral valve, especially its slightly transverse outline, large triangular-shaped ears and relatively coarse costae on the ventral valve.

Previously described gigantoproductids from the Tsuchikurazawa Limestone, *Gigantoproductus* sp. (Tazawa, 2004, p. 415, fig. 2.1) is easily distinguished from *G. aurita* in having fluting on the ventral valve; *Gigantoproductus tujucsuensis* Gladchenko by Ibaraki et al. (2008, p. 58, figs. 3A-3C, 4) differs in its strongly and evenly convex ventral valve; and *Gigantoproductus meridionalis* Legrand-Blain by Ibaraki et al. (2008, p. 61, figs. 5A-5C, 6) differs in its much finer costae on the ventral valve.

Gigantoproductus tulensis Bolkhovitinova, described or figured from the middle Visean of the Moscow Basin, differs from *Gigantoproductus aurita* by its smaller size, more steep flanks, and finer costae on the ventral valve (see Pattison, 1981, p. 9, pl. 1, fig. 1.3; pl. 9, fig. 9.15).

Gigantoproductus okensis Sarytcheva (1928, p.41, pl. 5, figs. 4a, 4b), described from the upper Visean of the Moscow Basin, somewhat resembles the present species in its large size and strongly convex umbo, but differs in having fluting and finer costae on the ventral valve.

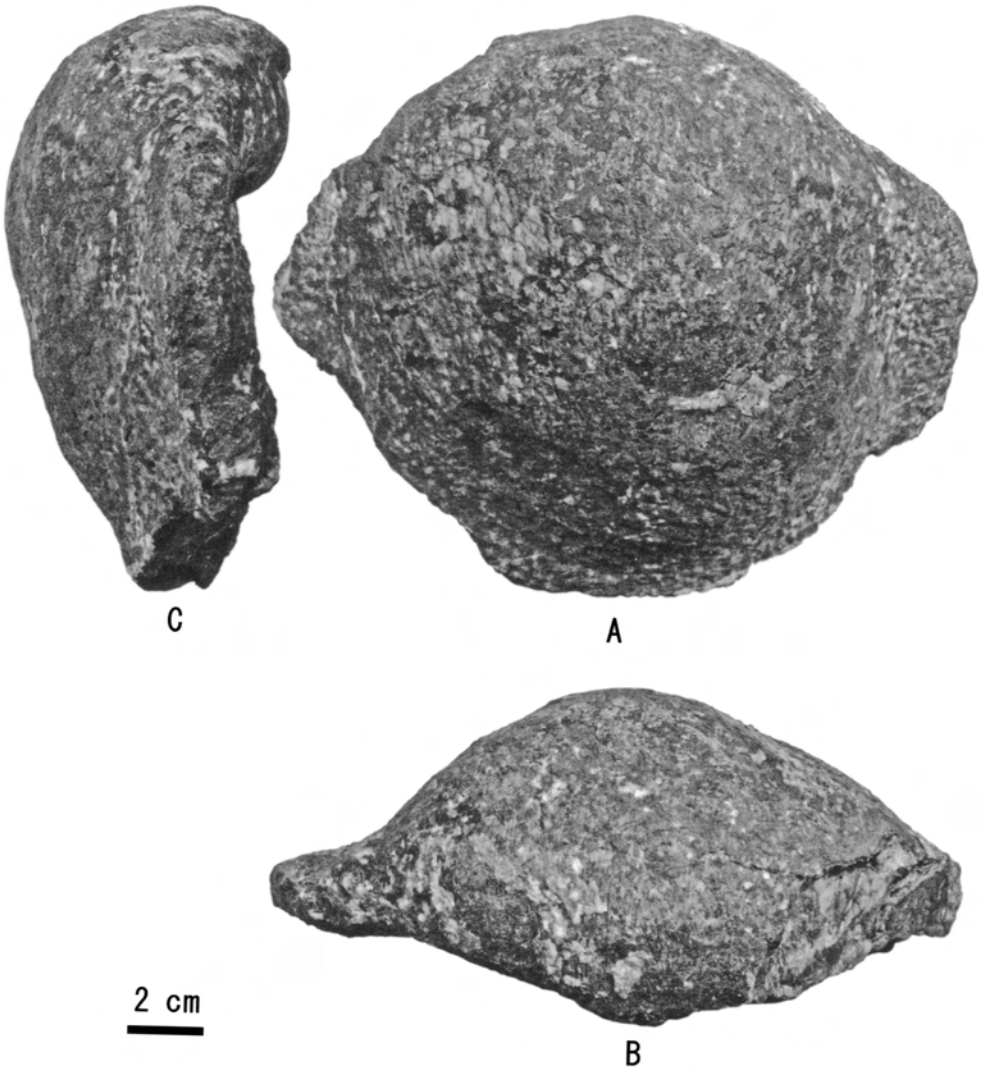

Fig. 3. *Gigantoproductus aurita* (Bolkhovitinova, 1938), ventral valve specimen, from the lower Tsuchikurazawa Valley, FMM1781, A: ventral view, B: lateral view, C: posterior view.

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