Gigantoproductus (Carboniferous Brachiopoda) from Kotaki, Itoigawa City, Niigata Prefecture, central Japan

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Abstract

Two species of large productid brachiopods, *Gigantoproductus tujucsuensis* Gladchenko, 1955 and *Gigantoproductus meridionalis* Legrand-Blain, 1973 are described from the Tsuchikurazawa Limestone of Kotaki, Itoigawa City, central Japan. These gigantoproductids indicate a Namurian age for the limestone.

Key words: Brachiopoda, central Japan, *Gigantoproductus*, Kotaki, Namurian, Tsuchikurazawa Limestone.

Introduction

The Tsuchikurazawa Limestone (Nakazawa et al., 1998; Takenouchi, 2005), an exotic limestone block in the Permian Kotaki Complex (Kawai and Takeuchi, 2001) is found as floats in the lower Tsuchikurazawa Valley, a tributary of the Kotakigawa River, Kotaki, Itoigawa City, Niigata Prefecture, central Japan (Figs. 1, 2). The limestone is black in colour, in contrast to the white to light grey colour of the Lower Carboniferous to Middle Permian Omi Limestone (Tazawa et al., 2002), and contains various fossils including calcareous algae, crinoids, rugose corals, tabulate corals and brachiopods.

Konishi (1956) described 5 species of calcareous algae from the Tsuchikurazawa Limestone, noting a close relationship to the calcareous algae from the Lower Carboniferous Kakisako

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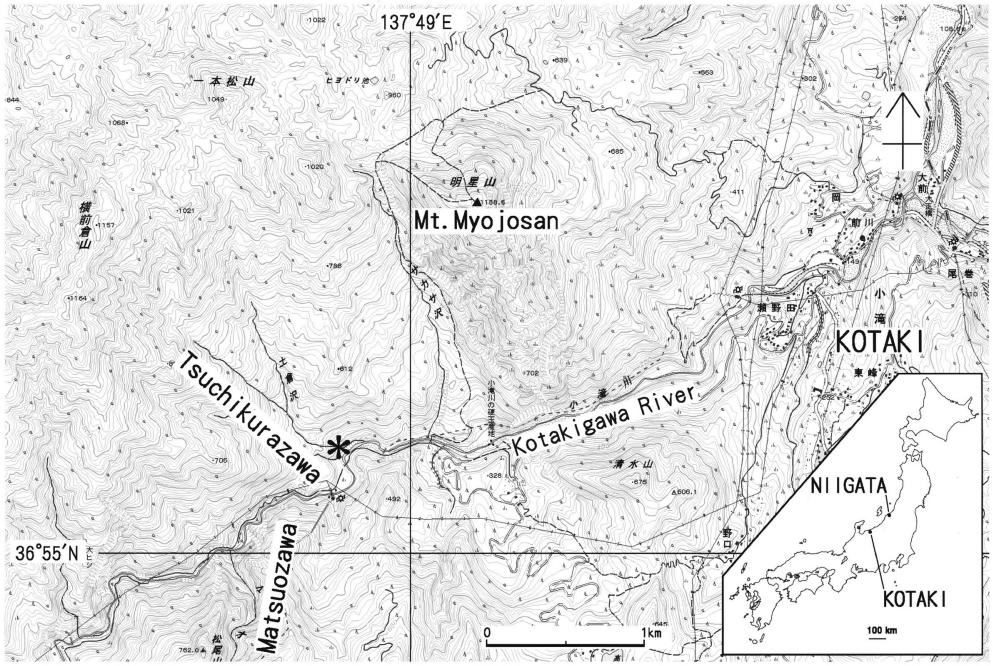

Fig. 1. Map showing the fossil locality (asterisk). Using the topographical maps of "Kotaki" and "Echigohiraiwa" scale 1:25,000 published by the Geographical Survey Institute of Japan.

Formation of the Kurosegawa Belt and the Lower Carboniferous Ichinotani Formation of the Hida Gaien Belt. Tazawa et al. (1984) reported some Middle Permian radiolarians from shale of "non-calcareous Palaeozoic strata" in the Kotakigawa River and the Mushikawa River, about 5 km NNE of the Tsuchikurazawa Valley, being the first to confirm the presence of a Permian accretionary complex in this area. Kamiya and Niko (1996) described a tabulate coral *Syringopora* sp. from this limestone and noted that this genus has never been described from the Omi Limestone. Niko and Yamagiwa (1998) described 10 species of corals, including *Lithostrotion* (*Lithostrotion*) *decipiens* (M'Coy), *L.* (*Siphonodendron*) *kamiyai* Niko and Yamagiwa, *Diphyphyllum* sp. from the Tsuchikurazawa Limestone, and pointed out that these corals closely resembled those from the Ichinotani Formation of Fukuji in the Hida Gaien Belt. Tazawa (2004) described two brachiopod species, *Gigantoproductus* sp. and *Echinoconchella* sp., from the Tsuchikurazawa Limestone, and mentioned that (1) the limestone originated from the lowest part of the Ichinotani Formation or corresponding limestone of the Hida Gaien Belt, and (2) the Permian accretionary complex including the Tsuchikurazawa Limestone was formed within the subduction zone bordering eastern margin of North China.

We (KS and YN) recently collected two brachiopod specimens from the Tsuchikurazawa Limestone. The specimens, ventral valves of large productoids, strongly convexed and ornamented with numerous fine costae, are safely assigned to the genus *Gigantoproductus*

Fig. 2. Wide view of the Tsuchikurazawa Valley (above) and some limestone floats at the lower Tsuchikurazawa Valley (below).

Prentice, 1950. In this paper, we (YI and JT) describe the specimens as the following two species: *Gigantoproductus tujucsuensis* Gladchenko, 1955, from the Lower Namurian of northern Kirgizia; and *Gigantoproductus meridionalis* Legrand-Blain, 1973, from the Namurian of Algeria. The occurrence of the gigantoproductoids from the Tsuchikurazawa Limestone supports the opinion of Tazawa (2004), the age of this limestone is considered to be Late Visean to Moscovian. The brachiopod specimens described herein are registered and housed in the Fossa Magna Museum, Itoigawa, Japan.

Systematic descriptions

Order Procuctida Sarytcheva and Sokolskaya, 1959
Suborder Productidina Waagen, 1883
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 tujucsuensis Gladchenko, 1955
Figs. 3A-3C, 4

Productus (Gigantoproductus) tujucsuensis Gladchenko, 1955, p. 20, pl. 10, fig. 2; pl. 11, figs. 1a, 1b; pl. 12, figs. 2a, 2b; pl. 13, figs. 1, 2.
Gigantoproductus tujucsuensis Gladchenko: Galitskaja, 1977, p. 143, pl. 61, fig. 1.

Material.—One specimen, a ventral valve, FMM1733.

Description.—Shell very large for genus, transversely semicircular in outline, with greatest width at hinge; length 90 mm, width about 160 mm. Ventral valve strongly convex, inflated evenly in lateral and anterior profiles; umbo large, inflated, projected beyond hinge and strongly incurved; ears large, enrolled, and well separated from flanks; sulcus absent. External surface of ventral valve ornamented with numerous costae; costae often irregular on trail, numbering 10-12 in 10 mm at about midvalve; several weak rugae on both of posterior part of ventral valve and ears; no fluting; spines or spine bases absent or not preserved. Shell thickness about 5-6 mm for anterior of ventral valve, and up to 9 mm for posterior of ventral valve. Interior of ventral valve not observed.

Remarks.—This specimen is referred to *Gigantoproductus tujucsuensis* Gladchenko, 1955, originally described from the lower Namurian of the Tujucsu River area, northern

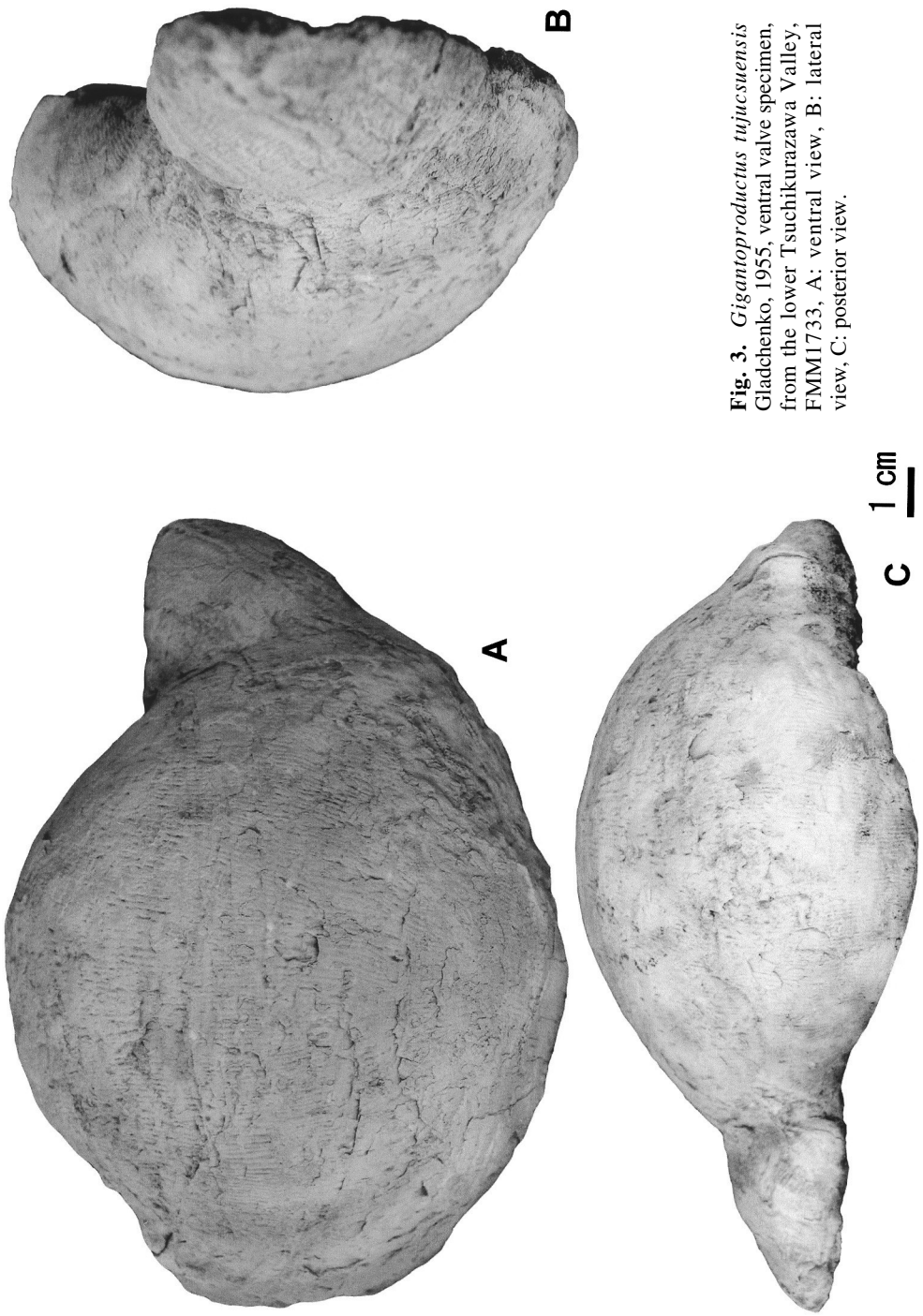

Fig. 3. *Gigantoproductus tujucsuensis* Gladchenko, 1955, ventral valve specimen, from the lower Tsuchikurazawa Valley, FMM1733, A: ventral view, B: lateral view, C: posterior view.

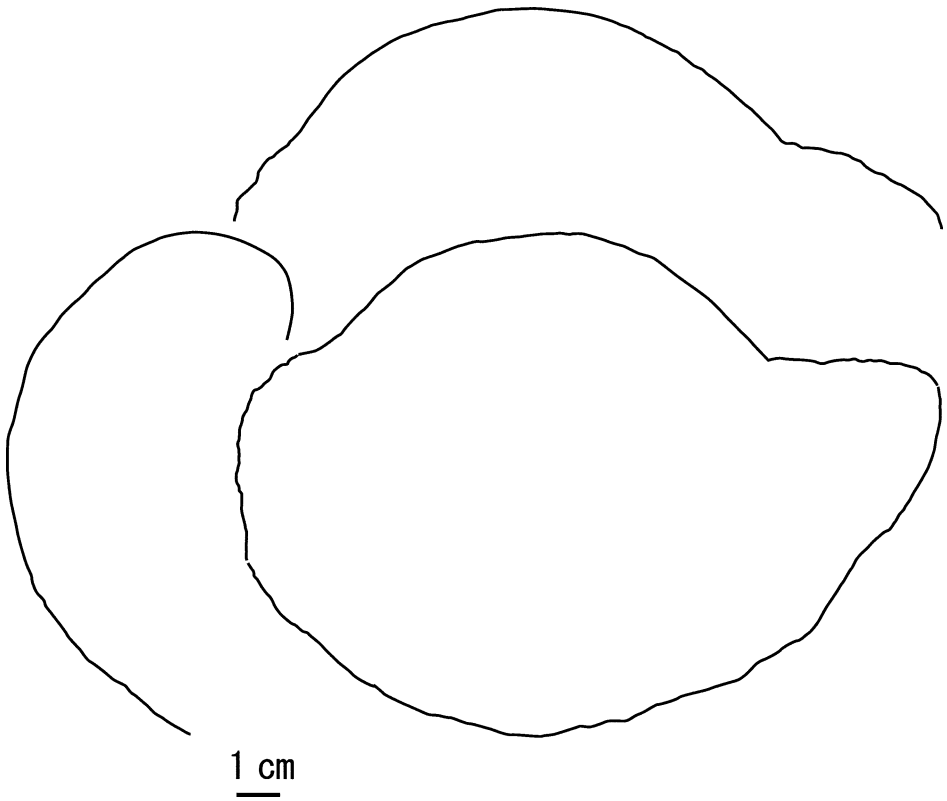

Fig. 4. *Gigantoproductus tujucsuensis* Gladchenko, 1955, outline, lateral profile and anterior profile of ventral valve (FMM1733).

Kirgizia in size, shape and external ornament of ventral valve, in particular its large size, transverse outline, large ears well separated from flanks, and lacking of fluting.

Productus (*Gigantella*) *striato-sulcatus* var. *semiglobosa* Paeckelmann (1931, p. 246, pl. 24, figs. 1a-1c), from the Lower Carboniferous of Schlesien, Germany, is somewhat similar to *Gigantoproductus tujucsuensis* in its transverse, strongly convex ventral valve without fluting, but it differs in its smaller ventral valve with small ears.

Gigantoproductus sp. (Tazawa and Kato, 1986, p. 386, pl. 78, fig. 7), from the lowest part of the Ichinotani Formation (Upper Visean) of Fukuji, Hida Gaien Belt, is clearly distinguished from *G. tujucsuensis* by its much smaller, less transverse ventral valve with shallow sulcus.

Gigantoproductus sp. (Tazaza, 2004, p. 415, fig. 2.1), from the Tsuchikurazawa Limestone of the same locality in the Tsuchikurazawa Valley, Kotaki, differs from *G. tujucsuensis* in its smaller, less convex ventral valve, having shallow sulcus and coarser costae.

Distribution.—Lower Namurian of northern Kirgizia and central Japan (Kotaki).

Gigantoproductus meridionalis Legrand-Blain, 1973
Figs. 5A-5C; 6

Productus - Gigantoproductus -giganteus Martin: Pareyn, 1961, p. 201, pl. 24, fig. 3.
Gigantoproductus meridionalis Legrand-Blain, 1973, p. 147, pl. 4, figs. 4-6; text-fig. 3h; Legrand-Blain, 1987, p. 166, pl. 1, figs. 2, 3, 5, 6; pl. 2, figs. 3, 4; text-fig. 4a.

Material.—One specimen, a ventral valve, FMM1732.

Description.—Shell very large for genus, transversely semicircular in outline, widest at hinge; length 90 mm, width about 160 mm. Ventral valve strongly convex, inflated evenly in lateral profile, but moderately flat on midvalve in anterior profile; umbo large, wide, inflated, strongly projecting beyond hinge, and strongly incurved; ears moderately large, not clearly separated from flanks; flanks steep in anterior profile; sulcus absent. External surface of ventral valve ornamented with numerous costae; costae regularly developed, although often irregular on trail, numbering 14-15 in 10 mm at about midvalve; rugae very weak on posterior part of ventral valve and ears, 7-8 rugae on venter; some narrow irregular fluting on anterior part of ventral valve; spines or spine bases not observed. Shell thickness about 5–6 mm for anterior of ventral valve, up to 9 mm for posterior of ventral valve. Internal structures of ventral valve not observed.

Remarks.—This specimen is referred to *Gigantoproductus meridionalis* Legrand-Blain, 1973, originally described from the middle part of the Ouarkziz Formation (Lower Namurian, after Legrand-Blain, 1987) of north Tindorf, El Guelmouna Formation (Namurian) of Saoura, and the Berga Formation (Namurian) of central Sahara, northwest Algeria in its large, transverse and strongly convex ventral valve, with projected umbo, flattend midvalve and narrow, irregular fluting.

Gigantoproductus tujucsuensis Gladchenko, 1955, as described above, resembles *Gigantoproductus meridionalis* in its large, transverse ventral valve, but the Russian species differs in its large ears, clearly demarcated from flanks.

Distribution.—Namurian of Algeria and central Japan (Kotaki).

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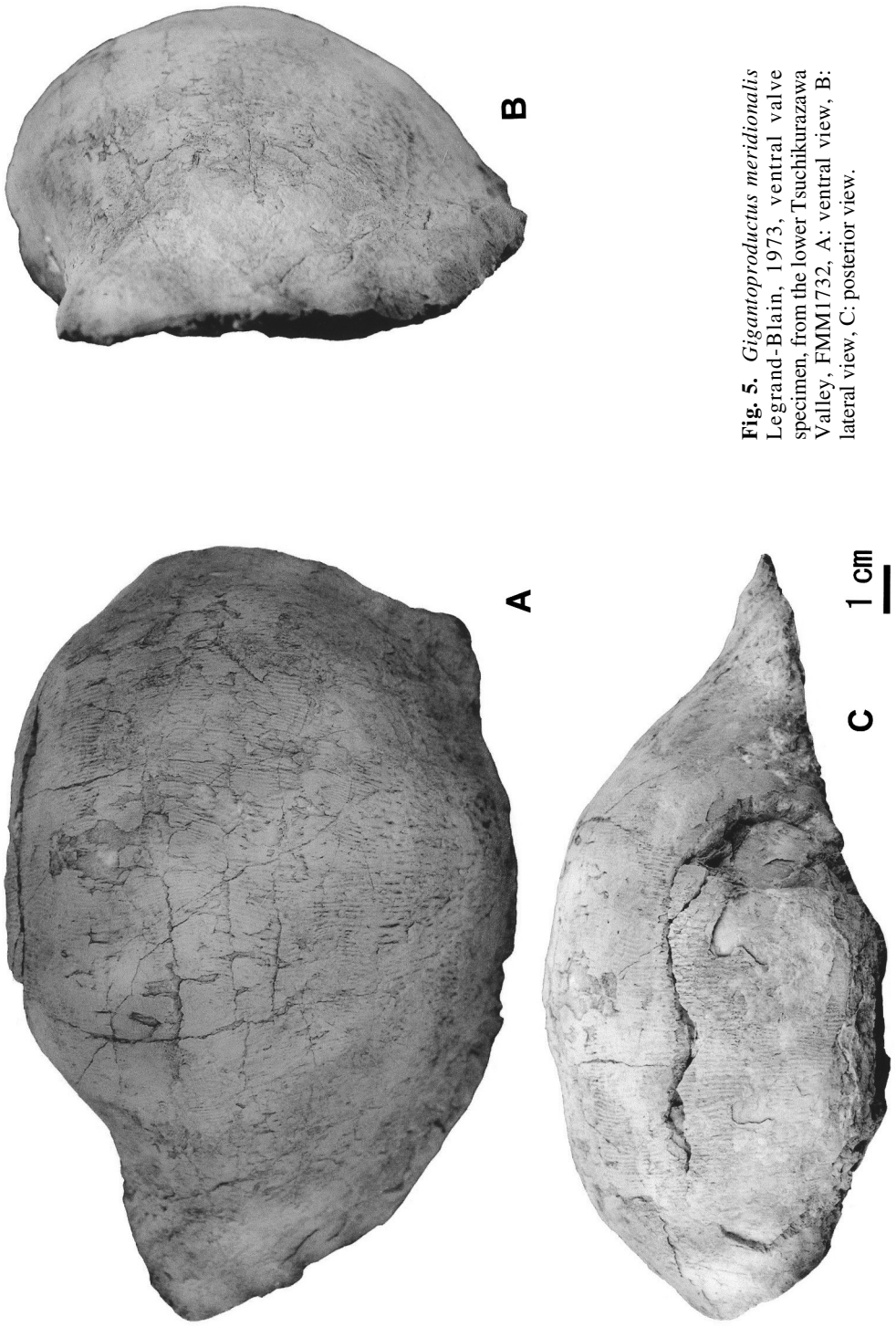

Fig. 5. *Gigantoproductus meridionalis* Legrand-Blain, 1973, ventral valve specimen, from the lower Tsuchikurazawa Valley, FMM1732, A: ventral view, B: lateral view, C: posterior view.

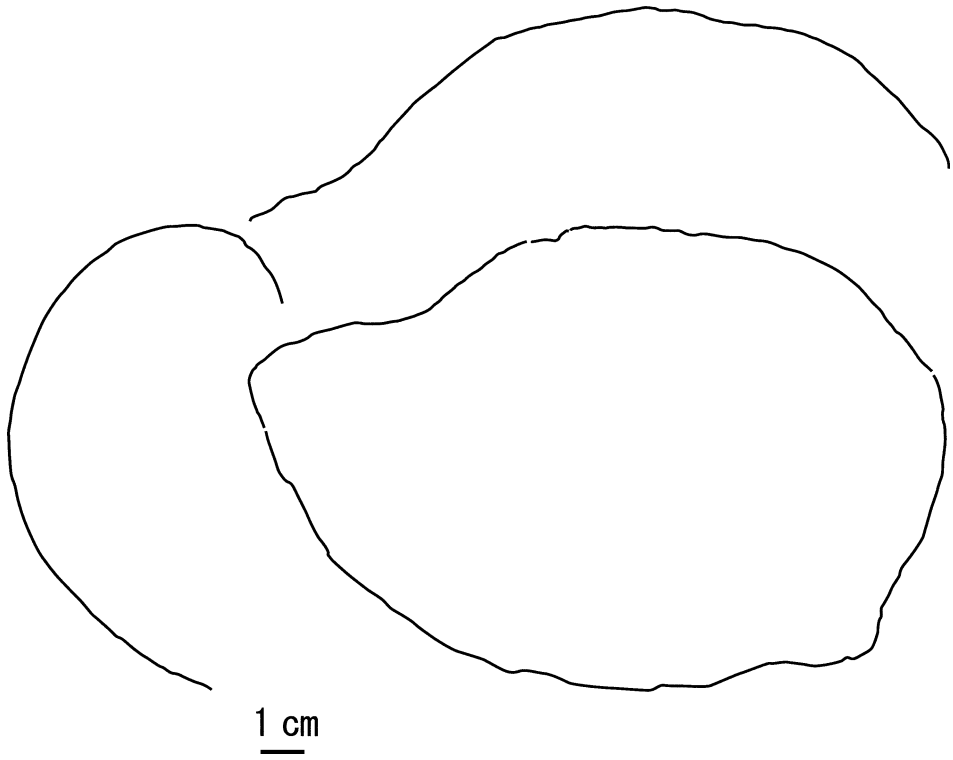

Fig. 6. *Gigantoproductus meridionalis* Legrand-Blain, 1973, outline, lateral profile and anterior profile of ventral valve (FMM1732).

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