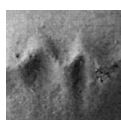


Gonella, a new genus and first color patterned terebratulidine brachiopod from the Lower Devonian of Northeast Asia

VALERYI V. BARANOV & ROBERT B. BLODGETT



The terebratulidine *Gonella boucoti* gen. et sp. nov. is described from Pragian and Emsian strata of the Selennyakh Range (Northeast Asia). Color patterns are found in both valves, consisting of six radial, dark reddish-brown color bands which begin at the beak, and uniformly expand anteriorly to the anterior margins of the valves. The latter feature, in combination with the character of accompanying megafauna, clearly testify to the presence of a tropical-subtropical climate for this region. • Key words: color pattern, new genus, Terebratulidina, Lower Devonian, Northeast Asia.

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Valeryi V. Baranov, Institute of Diamond and Precious Metals Geology, Yakutsk Research Center, Siberian Division, Russian Academy of Sciences, pr. Lenina 39, Yakutsk, 677980, Sakha Republic (Yakutia), Russia; vbaranov@diamond.ysn.ru • Robert B. Blodgett, Consulting Geologist, 2821 Kingfisher Drive, Anchorage, Alaska 99502, U.S.A.; robertbblodgett@yahoo.com

The systematic structure of Early Devonian brachiopods of Northeast Asia is most fully documented in “The Atlas of Devonian brachiopods of Northeast Russia” (Alekseeva *et al.* 1996). The only terebratulids described in this work were of Middle Devonian age. Early Devonian terebratulids were until now unknown in Northeast Asia. The new genus described here, *Gonella* with the type species *G. boucoti* sp. nov., is found in the Upper Nelitchen Subformation (*pireneae* Zone) and the lowermost Krivoi Creek Formation (*inversus* Zone) of the Selennyakh Range (Fig. 1). The Nelitchen Formation and Krivoi Creek Formation were established by Alkhovik & Baranov (1974, 2001). *G. boucoti* sp. nov. is found in shallow shelf brachiopod associations together with *Taimyrrhynchus taimyricus* (Nikiforova) (Upper Pragian) or with *Pseudouncinulus grossus* (Baranov) (Lower Emsian) and represent BA2 or BA3 benthic assemblages (Boucot 1975). The ancestor of *Gonella* is *Nordothyris* Modzalevskaya, 2007 which is widely distributed in the Lochkovian strata of Novaya Zemlya (Modzalevskaya 2007).

Remarks on color patterns in Devonian brachiopods and in *Gonella* gen. nov.

Color patterns have been observed and documented in over 80 species of Paleozoic articulate brachiopods (see

listings in Blodgett *et al.* 1983, 1988; Sun *et al.* 1999), with 45 species of those documented being of Devonian age. The oldest instances of color patterns in brachiopods are found in the Early Devonian, occurrences being especially notable in eurythyridinid terebratuloids of the mid-Early Devonian (Pragian) in the Oriskany Sandstone and equivalent strata in eastern North America (Murphy 1972; Blodgett *et al.* 1983, 1988). Baliński (2010) recently documented the oldest (Lochkovian; early Early Devonian) occurrence of color patterned brachiopods in the strophomenid *Plectodonta* sp. from Podolia (Ukraine). This occurrence is the only Lochkovian record and first report of color patterns in Devonian Strophomenida. It is of special interest in that the pattern consists of irregularly distributed spots restricted to the ventral valve, indicative of protective camouflage, as well as indicating that the convex ventral valve was positioned upwards with respect to the substrate (Baliński 2010). Other Early Devonian (but post-Lochkovian) occurrences of color patterned brachiopods include Boucot & Johnson (1968), Kříž & Lukeš (1974), and Johnson (1975, 1986). Singh (1979) reported the occurrence of original color in both valves of an inarticulate brachiopod, *Lingula* (*Pseudolingula*?) *cinnamomensis* Hall & Whitfield, from the Upper Ordovician of Kentucky. This report of preserved color (also noted in Kobluk & Mapes 1989) is restricted to the

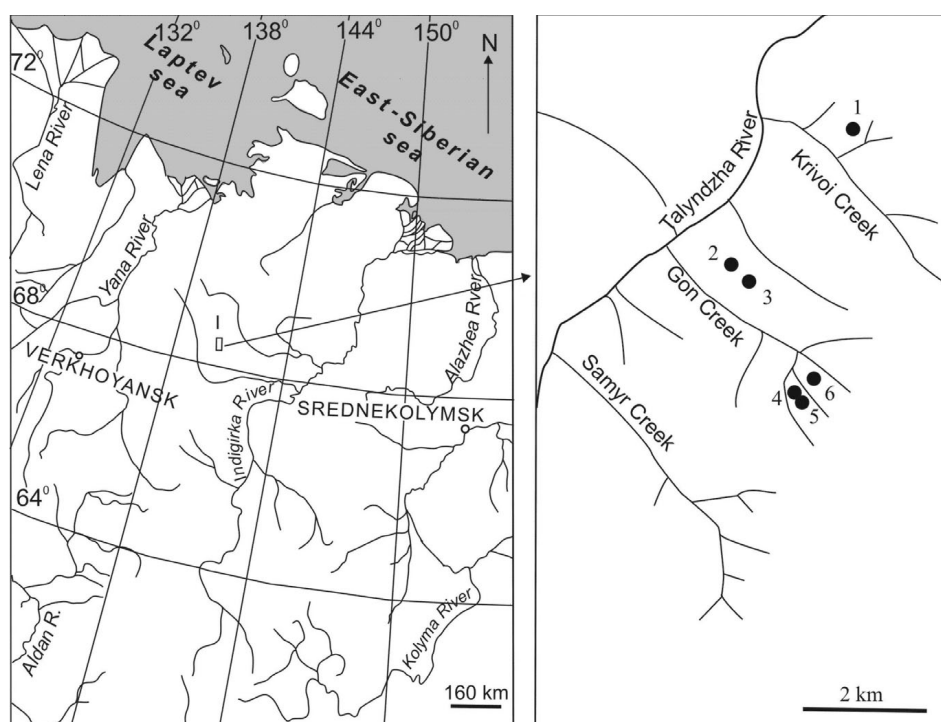


Figure 1. Index map of Northeast Asia showing the location from which the terebratulidines described in this paper were collected: I, Talyndzha River, Selennyakh Range, Northeast Asia, Russia; 1–6 – sample: 1 – 286(2), 2 – 262a, 3 – 262(1), 4 – 270(1), C-35, 5 – 270(2), 6 – 318(1).

periostracum, but does not represent a color pattern in any form.

The greatest number of color pattern records in Devonian articulate brachiopods are found amongst the Terebratulida (accounting for well over half the records), with lesser reports stemming from the Rhynchonellida and Athyrididina, and as mentioned above, only one instance in the Strophomenida. Color patterns found in articulate brachiopods come in an array of differing types (see Baliński 2010, fig. 3 for illustrations) ranging from radial bands, to concentric bands, irregular bands, spots, and even combinations thereof. Noting the presence of color patterns in fossil invertebrates is important in that can provide valuable information on paleoecologic, paleobiogeographic, and taxonomic issues (Blodgett *et al.* 1988, Baliński 2010). Blodgett *et al.* (1988) indicated that the consistency of a single pair of radial color bands in the dorsal valve of eurythyridinid terebratuloids should be included in the diagnosis of at least part of the subfamily Eurythyridinae. Color patterns were noted by Nicol (1967) to be conspicuously absent from bivalves in the modern Polar regions of the world, a condition which also typifies other invertebrate groups found at higher, cooler latitudes. Blodgett *et al.* (1988) suggested that this same pattern held true for Devonian marine invertebrates, with all color-pattern occurrences being limited to either the Old World Realm or Eastern Americas Realm of Boucot (1975) and Boucot & Blodgett (2001), corresponding to tropical-subtropical and warm-temperate belts, respectively. No color patterned invertebrates were noted as occurring in Devon-

ian strata of the Malvinokaffric Realm, which was situated in cool-water, high latitudes of the Southern Hemisphere. The occurrence of color patterns in *Gonella* gen. nov. represents the first documentation of color patterns in Lower Devonian brachiopods from Northeast Asia and provides further evidence of the warm water, tropical or subtropical conditions which likewise characterized the Old World Realm faunas of this region.

Color patterns have been observed in five specimens out of a total of fifty two specimens assigned to *Gonella boucoti* gen. et sp. nov. The color patterns are found on both valves and consist of six radial, dark reddish-brown color bands which begin at the beak, uniformly expanding anteriorly and extending to the anterior margins of the valves.

Systematic palaeontology

Repository. – The brachiopods described in this paper are deposited in the Geology Museum of the Institute of Diamond and Precious Metals Geology (GM IDPMG), Yakutsk, Sakha Republic (Yakutia), Yakutsk, Russia, collection N 203.

Order Terebratulida Waagen, 1883

Suborder Terebratulidina Waagen, 1883

Superfamily Megathyridoidea Schuchert & LeVene, 1929

Family Menganterididae Schuchert & LeVene, 1929

Subfamily Mutationellinae Cloud, 1942

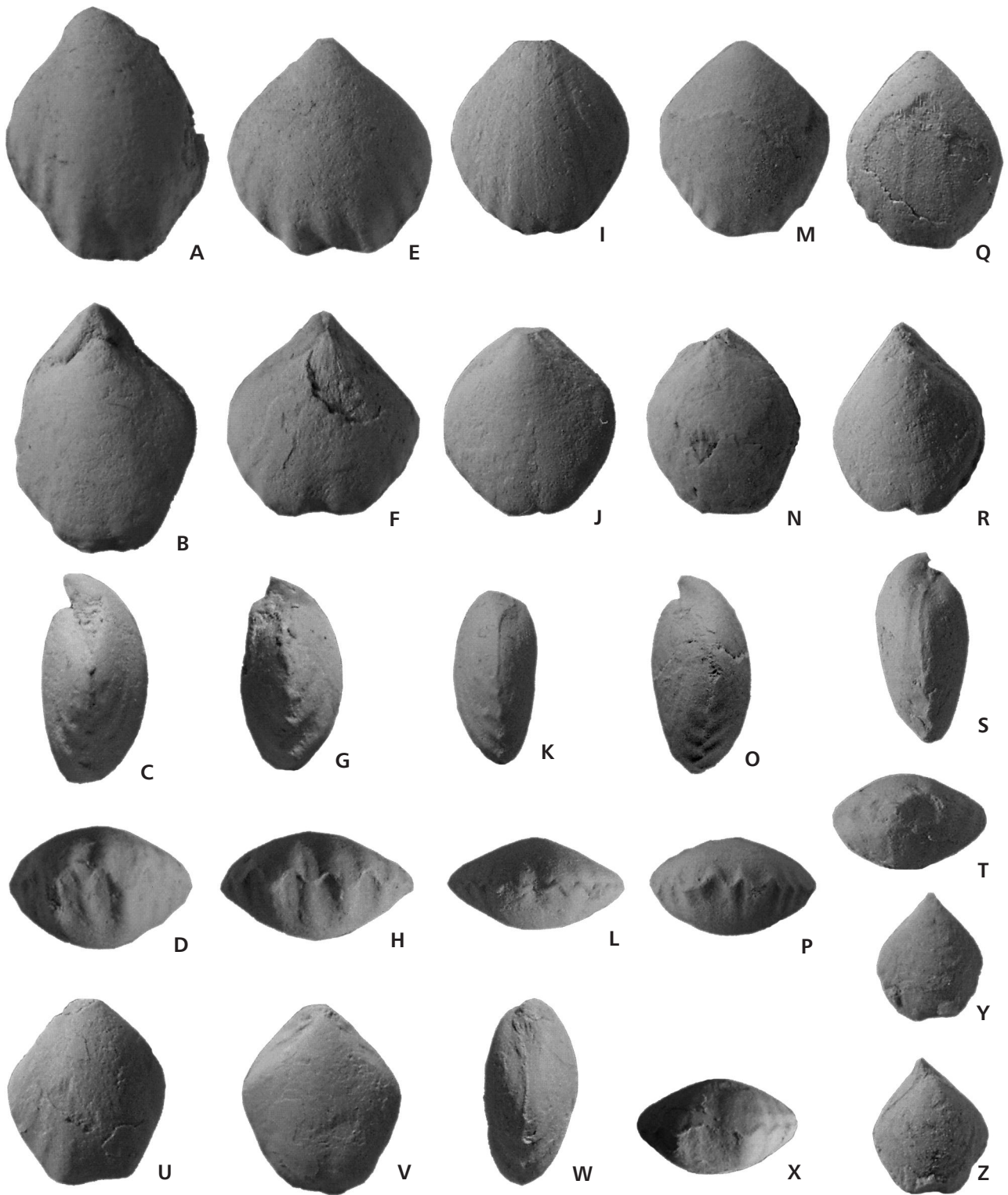


Figure 2. *Gonella boucoti* gen. et sp. nov. • A–D – pedicle, brachial, lateral, and anterior views of holotype, GM IDPMG 1/203, $\times 4.6$. • E–T – pedicle, brachial, lateral, and anterior views of paratypes: E–H – GM IDPMG 2/203, $\times 4.6$; I–L – GM IDPMG 3/203, $\times 3.8$; Q–T – GM IDPMG 4/203, $\times 4.1$. • Y, Z – pedicle and brachial views of paratype GM IDPMG 5/203, $\times 4.1$; Upper Nelitchen Subformation, Galkinskay Regional Stage, Talyndzha River, Nelitchen-Lednikovyi-Krivoi section, sample 270(1), Selennyakh Range, Northeast Asia, Russia; M–P – pedicle, brachial, lateral, and anterior views of paratype GM IDPMG 6/203, $\times 3.6$; Upper Nelitchen Subformation, Galkinskay Regional Stage, Talyndzha River, Nelitchen-Lednikovyi-Krivoi section, sample 270(2), Selennyakh Range, Northeast Asia, Russia. • U–X – pedicle, brachial, lateral, and anterior views of paratype GM IDPMG 7/203, $\times 3.8$; Upper Nelitchen Subformation, Galkinskay Regional Stage, Talyndzha River, section Gon, sample 262a, Selennyakh Range, Northeast Asia, Russia.

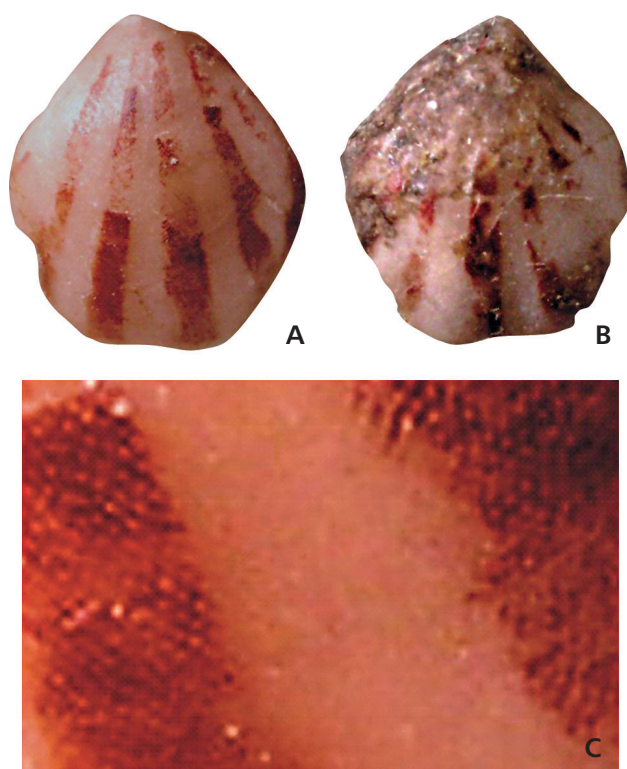


Figure 3. *Gonella boucoti* gen. et sp. nov. • A, B – color pattern on pedicle and brachial valves, paratype GM IDPMG 8/203, × 5.7. • C – punctate pedicle valve, paratype GM IDPMG 8/203, × 37; Upper Nelitchen Subformation, Galkinskay Regional Stage, Talyndzha River, Gon section, sample 262a, Selennyakh Range, Northeast Asia, Russia.

Genus *Gonella* gen. nov.

Type species. – *Gonella boucoti* gen. et sp. nov., from the upper Pragian (middle Early Devonian) of Selennyakh Range, Northeast Asia, Russia.

Etymology. – The genus is named for Gon Creek in the Selennyakh Range, Northeast Asia.

Diagnosis. – Shell small, elongate, subpentagonal with intraplicate anterior commissure and costae developed only at anterior margin of larger specimens; a fold with a median costa is present on the ventral valve; on the dorsal valve is present a corresponding depression; shell densely punctate; dental plates thin and short; dorsal cardinal plate has a U-shaped form and is perforated by a foramen; crura joined to socket ridges; loop centronelliform extending anteriorly with short vertical lamina; on both valves vascular markings are manifested by two central canals (Fig. 4A–C), which begin at the beak, and diverge as two thin canals situated one of each side of the valve.

Comparison. – *Gonella* differs from the majority of genera in the subfamily Mutationellinae in the character of the external ornament of the shell. Three genera from this subfamily are close to the new genus *Gonella* in the character of ribbing on the shell: *Cydimia* Chatterton, 1973, *Micidus* Chatterton, 1973, and *Barbarothyris* Wang & Rong, 1986. *Gonella* differs from *Cydimia* in having costae developed only at the anterior margin, and in the absence of a septum and septalium; from *Micidus* it differs in having costae developed only at the anterior margin, and in having a dorsal cardinal plate with a U-shaped form and loop with vertical lamina; from *Barbarothyris* it differs in having a subpentagonal shell with intraplicate anterior commissure, costae developed only at the anterior margin, a fold on the ventral valve, a depression at the anterior margin of the dorsal valve and form of loop. In addition, it differs from its presumed ancestral genus *Nordothyris* T. Modzalevskaya, 2007, in having an intraplicate anterior commissure, costae developed only at the anterior margin, and thin dental plates.

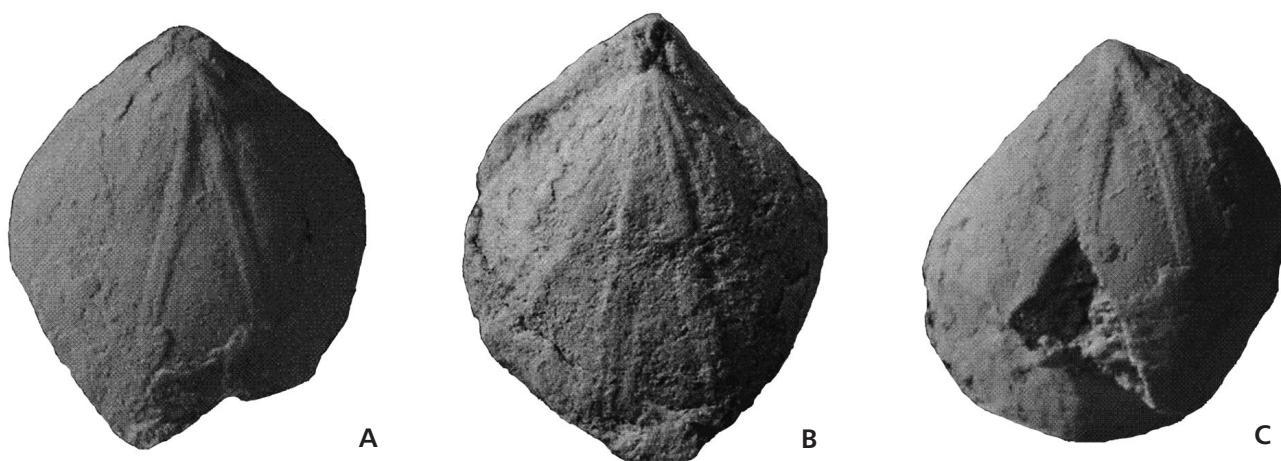


Figure 4. *Gonella boucoti* gen. et sp. nov. • A – vascular markings on brachial valve, paratype GM IDPMG 9/203, × 5.3; Upper Nelitchen Subformation, Galkinskay Regional Stage, Talyndzha River, Nelitchen-Lednikovyi-Krivoi section, sample 270(1), Selennyakh Range, Northeast Asia, Russia. • B, C – vascular markings on pedicle and brachial valves, paratype GM IDPMG 10/203, × 4.8; Upper Nelitchen Subformation, Galkinskay Regional Stage, Talyndzha River, Krivoi section, sample, 286(2), Selennyakh Range, Northeast Asia, Russia.

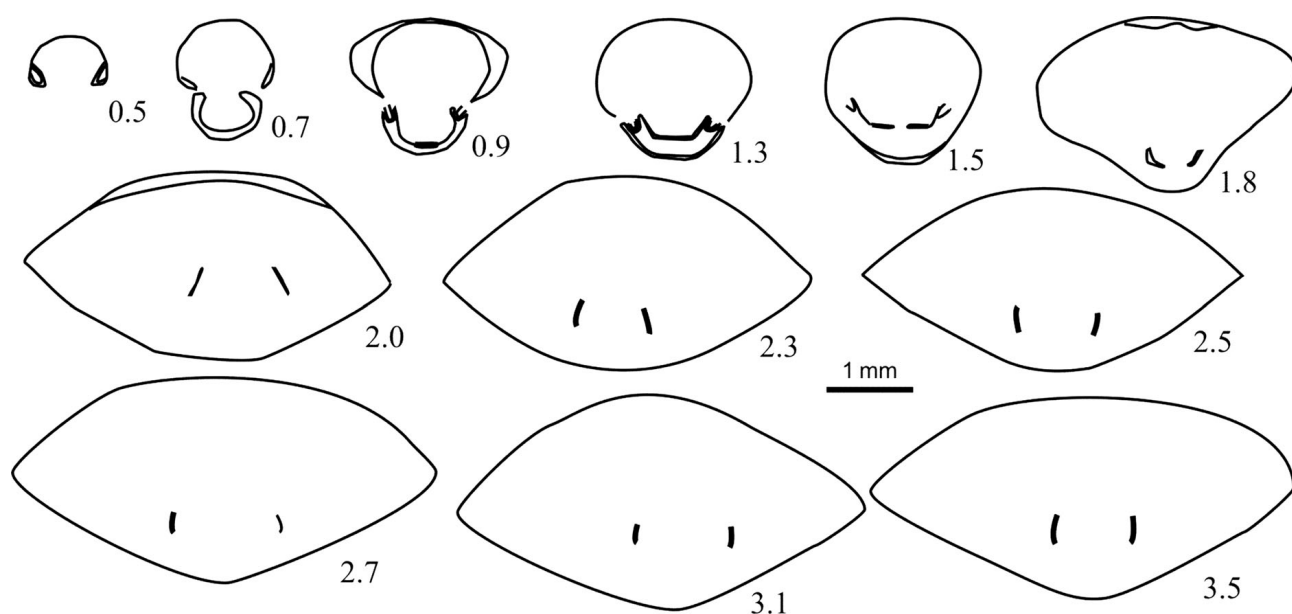


Figure 5. Selected transverse serial sections illustrating the internal structures in *Gonella boucoti* gen. et sp. nov., GM IDPMG 15/203, Lower Devonian, Upper Pragian, Upper Nelitchen Subformation, Selennyakh Range, Northeast Asia, Russia; distances were measured in mm from the posterior end of the shell. Scale bar represents 1 mm; original length 7.8 mm.

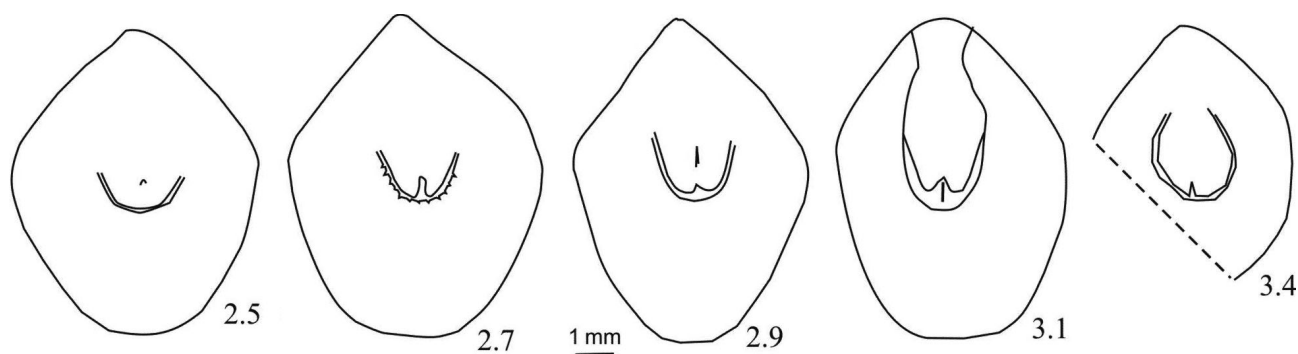


Figure 6. *Gonella boucoti* gen. et sp. nov. Drawings of serial sections through GM IDPMG 16/203 oriented subparallel to the plane of commissure with the brachial valve towards the top of the plaster mold; Lower Devonian, Upper Pragian, Upper Nelitchen Subformation, Selennyakh Range, Northeast Asia, Russia; distances were measured in mm from the posterior end of the shell. Scale bar represents 1 mm; original thickness 7.5 mm.

Species assigned. – Only the type species is known.

***Gonella boucoti* sp. nov.**

Figures 2A–Z, 3A–C, 4A–C, 5–7

Diagnosis. – Because monotypy, see that of genus.

Etymology. – In honor of Dr. A.J. Boucot, Professor of Zoology and Geology at Oregon State University, Corvallis, Oregon.

Material examined. – Six conjoined valves from sample 286(2), section Krivoi; twelve conjoined valves from sample 262a and 262(1), section Gon-1; forty two conjoined valves from samples 270(1), C-35, 270(2), 318(1), section

Nelitchen-Lednykovyi-Krivoi (Alkhovik & Baranov 2001, figs 12–14), Selennyakh Range, Talyndzha River (Fig. 1); Upper Nelitchen Subformation or lowermost Krivoi Creek Formation.

Measurements (in mm). – Length, 9.1–5.1; width, 7.6–4.0; thickness 5.2–2.7.

Types. – Holotype, GM IDPMG 1/203, Fig. 2A–D; paratype A, GM IDPMG 2/203, Fig. 2E–H; paratype B, GM IDPMG 3/203, Fig. 2I–L; paratype C, GM IDPMG 6/203, Fig. 2M–P; paratype D, GM IDPMG 4/203, Fig. 2Q–T; paratype E, GM IDPMG 5/203, Fig. 2Y, Z; paratype F, GM IDPMG 7/203, Fig. 2U–X; paratype G, GM IDPMG 8/203, Fig. 3A–C; paratype H, GM IDPMG 9/203, Fig. 4A; paratype I, GM IDPMG 10/203, Fig. 4B, C.

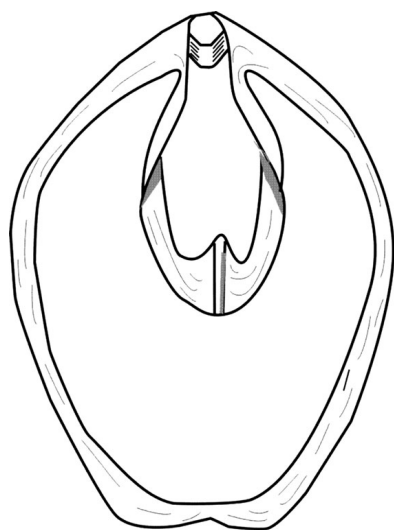


Figure 7. *Gonella boucoti* gen. et sp. nov. Reconstruction of brachidium based on serial sections (Figs 5, 6), showing the unsupported cardinal plate and brachidium.

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