ALASKOTHYRIS NEW GENUS (FAMILY STRINGOCEPHILIDAE, SUBFAMILY RENSSELANDIINAE) FROM THE GIVETIAN (UPPER MIDDLE DEVONIAN) OF THE NORTHWESTERN BROOKS RANGE, NORTHERN ALASKA

ROBERT B. BLODGETT[1], VALERYI V. BARANOV[2] and VINCENT L. SANTUCCI[3]

[1]2821 Kingfisher Drive, Anchorage, AK 99502; -email: robertbblodgett@gmail.com
[2]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;
[3]National Park Service-Geologic Resources Division, 1201 Eye Street, NW (Room 1146), Washington, D.C. 20005,

Abstract—We describe a new genus and species of Middle Devonian (Givetian) brachiopod, *Alaskothyris frosti* n. gen., n. sp., found in Middle Devonian (Givetian) strata exposed near Nigtun Lake, Howard Pass 1:250,000 scale quadrangle, northwestern Alaska. The species occurs in a single monotaxic, coquinoid brachiopod accumulation within Noatak National Preserve. This rensselandiinid brachiopod is significant in that it represents only the fourth species of a Middle Devonian brachiopod ever described from the northwestern Alaska, an area with thick Devonian platform carbonate and siliciclastic-dominated strata successions. Despite the great areal extent of Devonian strata here, the area has had only limited paleontological study, and remains almost a *terra incognita* for Devonian fossils. The strata hosting the new brachiopod genus and species are part of the Arctic Alaska superterrane (Blodgett et al., 2002). Evaluation of the taxonomic diversity and character of the Devonian fauna found here is important in determining the paleogeographic origin of this superterrane and the paleobiogeography of the Bering Strait region separating northeast Russia and northwestern Alaska.

INTRODUCTION

In the present paper we establish a new genus and species of rensellandiinid brachiopod, *Alaskothyris frosti* n. gen., n. sp., which exhibits morphological similarities to the genus *Chascothyris*. The Alaskan occurrence is biogeographically significant in that similar related forms have previously been reported only from Eurasian strata of the Old World Realm. This occurrence gives further support for the Eurasian origin (most notably with Siberia) of some of Alaska's accreted terranes (Blodgett et al., 2002; Blodgett and Baranov 2014). In addition this new genus provides a glimpse into the poorly known Devonian brachiopod fauna of northern Alaska (belonging to the Arctic Alaska superterrane). Our recent studies (Blodgett and Dutro, 1992; Baranov and Blodgett, 2013; Boucot and Blodgett, 2003; and unpublished) indicate that northeast Russia and Alaska as a region was the locus of evolution of many new Givetian stringocephaloid brachiopod genera. It appears to represent a local faunistic center, with many of the new genera subsequently becoming more widespread.

Previous publications providing illustration and description of northern Alaskan Devonian brachiopods are limited to a few publications and include Sartenaer (1969), Blodgett et al., (1988), Blodgett and Dutro (1992), Popov et al., (1994), Baxter and Blodgett (1994), Dutro et al., (1994), Blodgett et al., (2002), Blodgett and Baranov (2012), and Baranov and Blodgett (2013).

LOCALITY INFORMATION AND STRATIGRAPHIC SETTING

In 1968 A.K. (Gus) Armstrong of the U.S. Geological Survey collected the brachiopod specimens described here from exposures in the western Brooks Range. The locality (USGS locality 8451-SD) is situated in the Howard Pass 1:250,000 scale quadrangle and was also the source of a single dipnoan fish tooth plate which was described as *Dipterus* sp. by Perkins (1971). In the preceding article it was noted that the collection included numerous specimens of the brachiopod *Stringocephalus* identified by J.T. Dutro, Jr. (identified by us here as *Alaskothyris frosti* n. gen., n. sp.). The locality data provided in the paper was that the specimens come "from a small hill on the east side of Howard Pass, approximately two miles southeast of Nigtun Lake (68°13'N, 156°50'W.)" (Perkins, 1971, p. 555). No formal stratigraphic nomenclature has been applied to the Devonian rocks in this part of the Howard Pass quadrangle. The brachiopod specimens described in this paper are deposited in the Department of Paleobiology, National Museum of Natural History (Smithsonian Institution), Washington, D.C.

SYSTEMATIC PALEONTOLOGY

Suborder Terebratulidina Waagen, 1883
Superfamily Stringocephaloidea King, 1850
Family Stringocephalidae King, 1850
Subfamily Rensselandiinae Cloud, 1942
Genus *Alaskothyris* n. gen.

Type species: *Alaskothyris frosti* n. gen., n. sp. from unnamed Middle Devonian (Givetian) strata exposed near Nigtun Lake, Howard Pass 1:250,000 scale quadrangle, northwestern Alaska.

Etymology: Combination of the geographic name Alaska and the Greek term "thyra" (meaning door). The name is in allusion to the externally similar related genus *Chascothyris* Holzapfel, 1895.

Diagnosis: Transverse rensselandiinid brachiopods similar externally to the genus *Chascothyris*, but differing in the presence of a prominent pedicle support structure in the ventral valve (see serial sections shown in Fig. 3A at 3.2 mm and succeeding anterior intervals, and in Fig. 3B from 2.5 mm and succeeding anterior intervals).

Occurrence: The new genus is presently known only from the single locality referenced above from near Nigtun Lake, Howard Pass 1:250,000 scale quadrangle, northwestern Alaska.

Comparison: The new genus differs from all other rensselandiinid genera (i.e., *Chascothyris*, *Newberria*) in its unique, highly distinctive pedicle support structure observed in the ventral valve. Such a feature is unknown in other rensselandiinid brachiopods. The most similar rensselandiinid genera in terms of their transverse exteriors are *Chascothyris* Holzapfel, 1895, *Elmaria* Nalivkin, 1947, and *Rensselandioidea* Yang, 1983. Externally the new genus most closely resembles *Chascothyris*, but is clearly distinguished by the brachial support structure (Figs. 3A, B) found in the ventral valve. The remaining rensselandiinid genera such as *Newberria* Hall in Whiteaves, 1891 and *Ectorensselandia* Johnson, 1973, and Cloud, 1942 differ externally in being much more elongate and not transverse. The genus *Subrensselandia* Cloud, 1942, recently separated from the Rensselandiinae and placed by Boucot and Blodgett (2003) into a new subfamily, Subrensselandiinae Boucot and Blodgett also differs by being more elongate and not transverse in shape.

***Alaskothyris frosti* n. sp.**
Figs. 1-5

Etymology: The new species is named in honor of Dr. Herbert C. Frost, National Park Service, Alaska Regional Director, Anchorage, Alaska, for his support to science, management and stewardship of National Park Service paleontological resources.

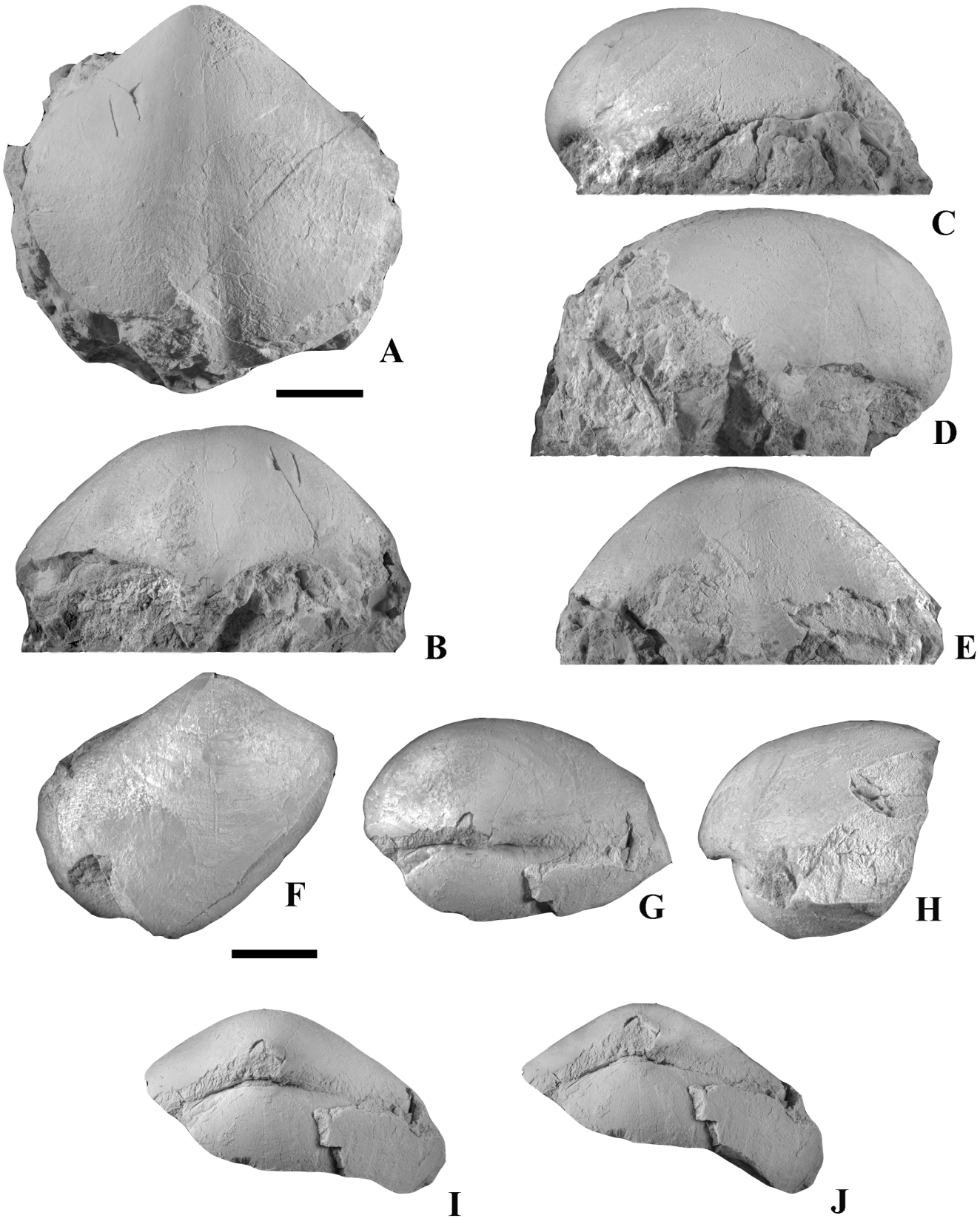

FIGURE 1. *Alaskothyris frosti* n. gen., n. sp., **A-E**, holotype, USNM 604946, in **A**, ventral, **B**, posterior, **C**, lateral, **D**, opposing lateral, and **E**, anterior views of ventral valve. **F-J**, paratype, USNM 604947, in **F**, ventral, **G**, posterior, **H**, oblique posterior, *I*, even more obliquely posterior (almost dorsal), and **J**, lateral views of an articulated specimen in which only the posterior-most portion is preserved. Scale bars = 1 cm.

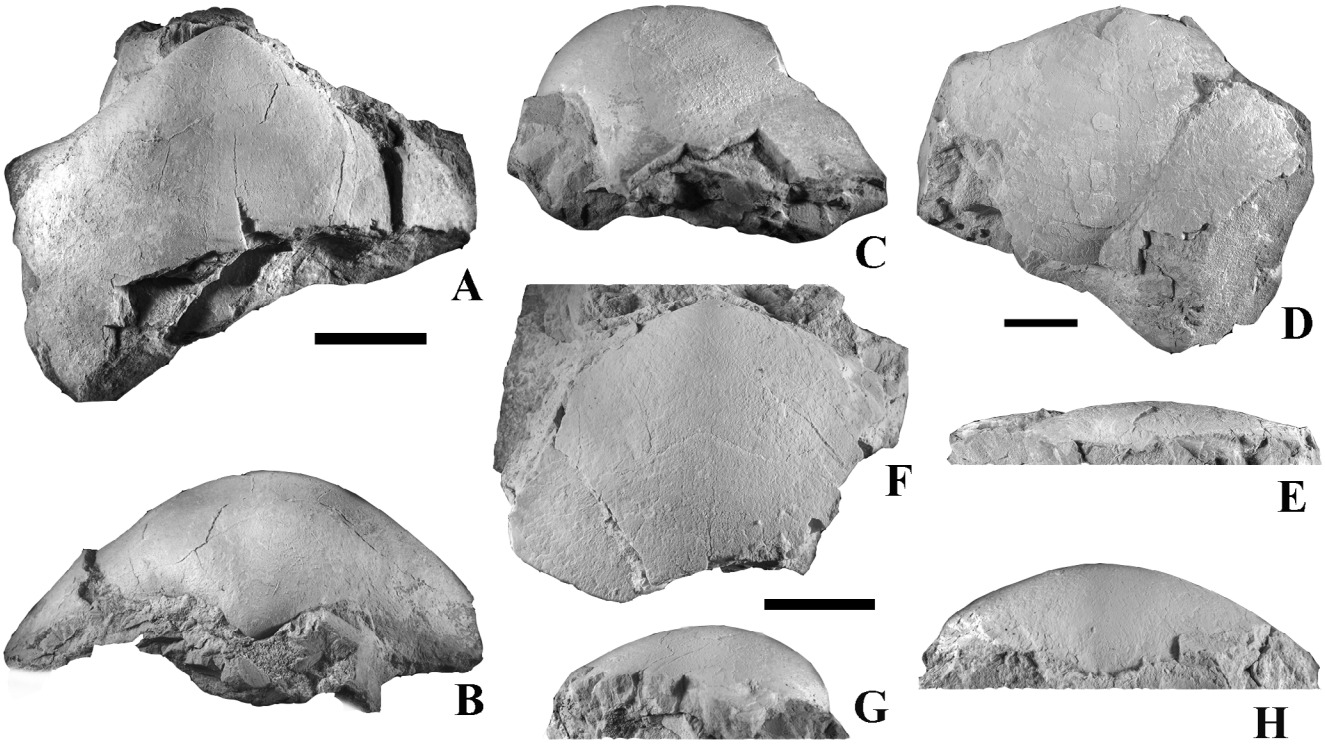

FIGURE 2. *Alaskothyris frosti* n. gen., n. sp., **A-C**, paratype, USNM 604948, in **A**, ventral, **B**, posterior, and **C**, lateral views of ventral valve. **D-E**, paratype, USNM 604949, in **D**, dorsal and **E**, posterior views of dorsal valve. **F-H**, paratype, USNM 604950, in **F**, dorsal, **G**, lateral, and **H**, posterior views of dorsal valve. Scale bars = 1 cm.

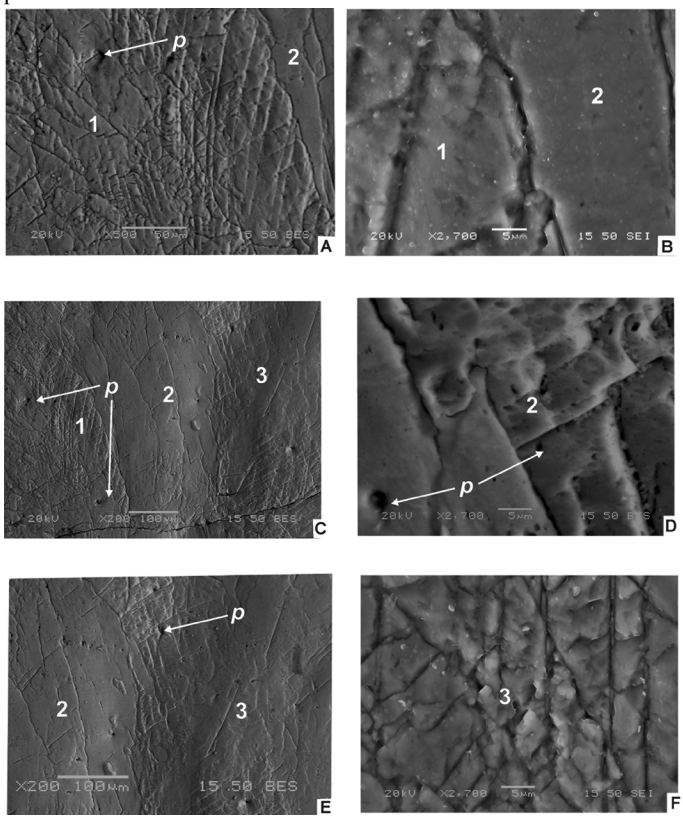

FIGURE 3. **A – F –** Microstructure of the ventral valve of *Alaskothyris frosti* n. gen., n.sp.**,** Holotype, USNM 604946. **A –** boundary between the outer (1) and middle (2) layers, **B –** microstructure of the outer (1) layer, **C –** boundaries between the middle (2) and inner layers, **D –** microstructure of the middle (2) layer, **E –** boundary between middle (2) and inner (3) layers, **F** – microstructure of the inner (3) layer; *p* – punctae. Scale bar given in each view.

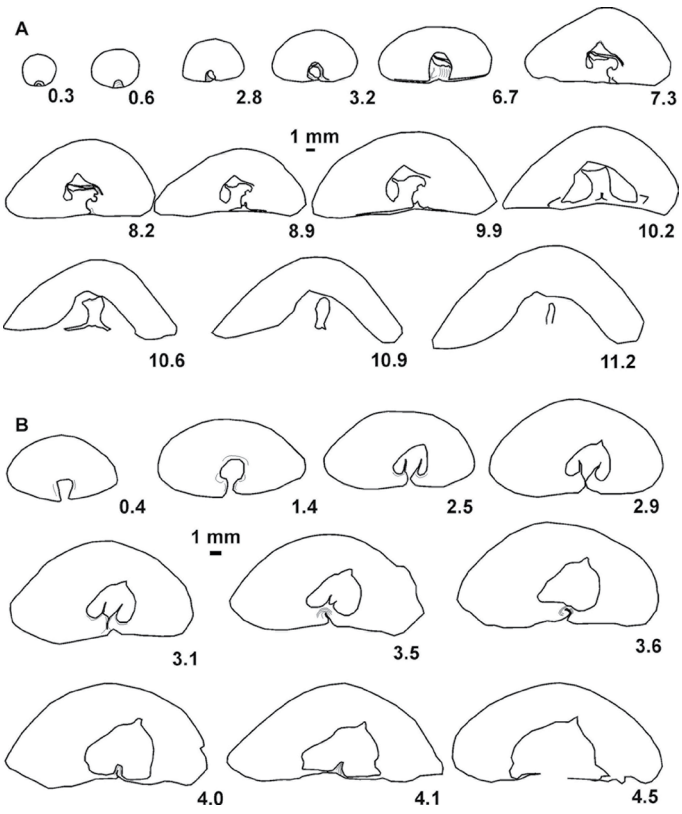

FIGURE 4. Selected transverse serial sections illustrating the internal structures of two ventral valves of *Alaskothyris frosti* n. gen., n. sp. **A**, Holotype, USNM 604946. **B**, paratype, USNM 604948.

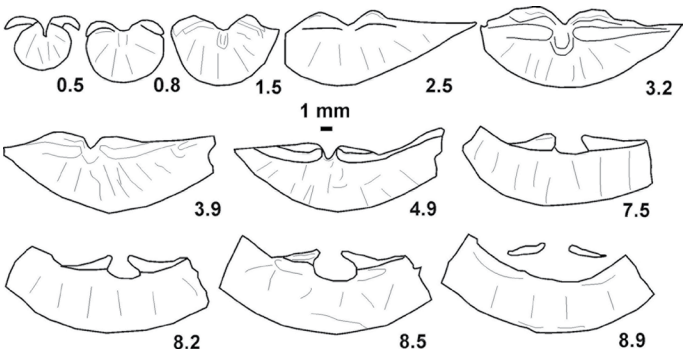

FIGURE 5. Selected transverse serial sections illustrating the internal structures of a dorsal valve of *Alaskothyris frosti* n. gen., n. sp. Paratype, USNM 604950.

Exterior: Subcircular smooth valves with a very weak, broad ventral sulcus in the ventral valve, no evidence of a fold in the dorsal valve. Shell ventribiconvex, ventral valve more convex than dorsal valve, greatest width of valves at mid-length, both ventral and dorsal valves evenly convex in posterior view. The ventral valve is slightly incurved with a short beak, the cardinal margin is terebratulid, character of delthyrium unknown. Punctae present in photomicrographs of microstructure (Figs. 3A, C, D, and E). Dimension of holotype (ventral valve), USNM 604946, length 44.4 mm, width 46.6 mm, and height 19.5 mm.

Ventral interior: Dental plates and ventral median septum absent. Visceral foramen perforated by the beak. In the umbonal portion of the beak is a pedicle support whose shape is extremely variable. This is the first time such a structure has been found in Paleozoic terebratulids. A pedicle support structure was earlier described in representatives of athyridids (genus *Didymothyris* Rubel and Modzalevskaya, 1967, p. 238; Modzalevskaya, 1985, p. 70 - 75; pl. XVI, figs. 6, 7), where its form is also characterized by great variability.

Dorsal interior: Discrete hinge plates**,** muscle field unknown**,** loop unknown. The base of the hinge plate in the apical part of the valve rests on its bottom and becomes weakly tilted laterally toward the anterior margin.

Microstructure: The microstructure of the dorsal valve consists of three layers: external, middle and internal (Figs. 3A-F). The external layer is formed by thin plates (fibers) of calcite having a thickness varying from 0.1 to 0.4 μm oriented at 30–40^0 to the middle layer, the latter having a thickness of 200 to 300 μm (Fig. 3B). The middle layer (prismatic) is formed by columns of calcite crystals oriented perpendicular to the surface of valve (Fig. 3D). The internal layer consists of a series of parallel plates with a thickness from 2 to 15 μm divided by very thin plates having a thickness less than 1 μm which are parallel the middle layer (Fig. 3F). All three layers are penetrated by punctae with a width ranging from 1 to 2.5 μm.

Types: Holotype, USNM 604946, ventral valve, Figure 1A-E, Figure 3A, Figure 5; paratype, USNM 604947, articulated specimen with only posterior part preserved, Figure 1F-I; paratype, USNM 604948, ventral valve, Figure 2A-C, Figure 3B; paratype, USNM 604949, dorsal valve, Figure 2D-E; paratype, USNM 604950, dorsal valve, Figure 2F-H, Figure 4.

Other material: In addition to the types listed above, there are numerous disarticulated shells in this monotaxic association, with evidence of anterior shell breakage shown by many specimens.

Paleoecology: The highly disarticulated nature of the Alaskan material, showing evidence of anterior shell breakage by many specimens, indicate a rough water environment similar to that commonly (but not always) present in the related genus *Stringocephalus.*

ACKNOWLEDGMENTS

We thank the National Park Service for providing funding that allowed Blodgett to locate this fossil collection in the holdings of the Department of Paleobiology, U.S. National Museum (Smithsonian Institution), Washington, D.C. The collection was formerly property of the Branch of Paleontology & Stratigraphy of the U.S. Geological Survey, but was transferred to the USNM after the disbanding of the P&S Branch following the 1995 Reduction-In-Force (RIF) in the USGS. We thank Kathy Hollis and Mark Florence, both of the Department of Paleobiology, U.S. National Museum, for arranging a loan of the collection for study. We also thank Peter E. Isaacson (University of Idaho, Moscow) and Howard R. Feldman (Division of Paleontology (Invertebrates), American Museum of Natural History, New York, N.Y.) for their helpful reviews of this manuscript. The work was partly supported by the Russian Fund of Basic Researches (grant 13-05-00520), Program of Presidium of the Russian Academy of Science No 23, Project No 23.1.

REFERENCES

Baranov, V.V., and Blodgett, R.B., 2013, The first stringocephalid brachiopods in the upper Givetian of Selennyakh Range (Northeast Asia) and their paleobiogeographical significance: Journal of Paleontology, v, 87 p. 297-311.

Baxter, M.E., and Blodgett, R.B., 1994, A new species of *Droharhynchia* from the lower Middle Devonian (Eifelian) of west-central Alaska: Journal of Paleontology, v. 68, p. 1235-1240.

Blodgett, R.B., and Baranov, V.V., 2012, Alaska Fossil of the Month – *Stringocephalus* and *Omolonia* (members of the brachiopod subfamily Stringocephalinae): Alaska Geology – Newsletter of the Alaska Geological Society, v. 42, no. 7, p. 6-9.

Blodgett, R.B., and Baranov, V.V., 2014, Devonian brachiopods from Alaska's accreted terranes and their paleobiogeographic relationships with faunas from Arctic regions of Eurasia and adjoining parts of Laurentia (western & Arctic North America): Geological Society of America, Abstracts with Programs, v. 46, no. 6, p. 785.

Blodgett, R.B., Boucot, A.J., and Koch, W.F. II, 1988, New occurrences of color patterns in Devonian articulate brachiopods: Journal of Paleontology, v. 62, p. 46–51.

Blodgett, R.B., and Dutro, J.T., Jr., 1992, *Stringocephalus* (Brachiopoda) from Middle Devonian (Givetian) rocks of the Baird Group, Western Brooks Range, Alaska, *in* Chaplin, J.R., and Barrick, J.E., eds., Special Papers in Paleontology and Stratigraphy: A Tribute to Thomas W. Amsden: Oklahoma Geological Survey Bulletin 145, p. 91–99.

Blodgett, R.B., Rohr, D.M., and Boucot, A.J., 2002, Paleozoic links among some Alaskan accreted terranes and Siberia based on megafossils, *in* Miller, E.L., Grantz, A., and Klemperer, S.L., eds., Tectonic Evolution of the Bering Shelf-Chukchi Sea-Arctic Margin and Adjacent Landmasses: Boulder, Colorado, Geological Society of America Special Paper 360, p. 273–290.

Boucot, A.J., and Blodgett, R.B., 2003, Oldest, smallest *Newberria* (Brachiopoda from the Eifelian (early Middle Devonian) of west-central Alaska: Neues Jahrbuch für Geologie, Paläontologie, Monatshefte*,* v. 2003, no. 2, p. 91–100.

Cloud, P.E., Jr., 1942, Terebratuloid Brachiopoda of the Silurian and Devonian: New York, Geological Society of America Special Paper 38, 182 p.

Dutro, J.T., Jr., Blodgett, R.B., and Mull, C.G., 1994, *Cyrtospirifer* from Upper Devonian rocks of the Endicott Group, west-central Brooks Range, Alaska: U.S. Geological Survey Bulletin 2107, p. 133-141

Holzapfel, E., 1895, Das obere Mitteldevon (Schichten mit *Stringocephalus burtini* und *Maeneceras terebratum*) im Rheinischen Gebirge: Koenigliche-Preussische geologische Landesanstalt, Abhandlungen, v, 16, p. 1-460.

Johnson, J.G., 1973, Some North American rensselandiid brachiopods, Part 2: Journal of Paleontology, v. 47, p. 1102-1107.

King, W., 1850, A monograph of the Permian fossils of England. London, Palaeontographical Society Monograph, v. 3, no. 1, 258 p.

Modzalevskaya, T.L., 1985, Brakhiopody Silura i Rannego Devona Evropeiskoi Chasti SSSR. Moscow, Nauka, 128 p.

Nalivkin, D.V. 1947. Klass brakhiopody. *in* D.V. Nalivkin, and Verber, V.N., eds., Atlas Rukovodiashchikh Form Iskopoemykh Fauni SSSR, Tom 3, Devonskaya Sistema: Leningrad, Vsesoyuznyi Nauchn-issledovatl'skii Geologicheskii Institut (VSEGEI), p. 63-134.

Perkins, P.L., 1971, The dipnoan fish *Dipterus* from the Middle Devonian (Givetian) of Alaska: Journal of Paleontology, v. 45, p. 554-555.

Popov, L.Y., Blodgett, R.B., and Anderson, A.V., 1994, The first occurrence of the genus *Bicarinatina* (Brachiopoda, Inarticulata) from the Middle Devonian in North America: Journal of Paleontology, v. 68, p. 1214-1218.

Rubel, M., and Modzalevskaya, T.L., 1967, Novye siluriiskie brachiopody semeistva Athyrididae: Izestiya. AN ESSR. Khimia. Geologiya, v. 16, 238-249.

Sartenaer, P., 1969, Late Upper Devonian (Famennian) rhynchonellid brachiopods from western Canada: Geological Survey of Canada Bulletin 169, 269 p.

Waagen, W.H., 1883, Salt Range Fossils. I. *Productus*-Limestone Fossils, p. 391–496. Calcutta, Geological Survey India, Memoirs, Palaeontologia Indica, Series 13, v. 4, no. 2, p. 391-546.

Whiteaves, J.F., 1891, Part IV. 5. The fossils of the Devonian rocks of the Mackenzie River basin: Contributions to Canadian Palaeontology, Volume 1, Geological Survey of Canada, p. 197–253.

Yang, De-li, 1983, Late Middle Devonian terebratulids of Xiangzhou, Guangxi: Bulletin of the Yichang Institute of Geology and Mineral Resources of the Chinese Academy of Geological Sciences, v. 7, 27-40.