

# *Strophatrypa*, a new genus of Brachiopoda (Atrypidae), from upper Silurian strata of the Alexander terrane, Southeast Alaska

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The atrypid brachiopod *Strophatrypa skaflestadi* gen. et sp. nov. occurs in unnamed upper Silurian strata exposed near the town of Hoonah on northeast Chichagof Island, Southeast Alaska. The new genus represents the first strophic atrypoid with many characters otherwise similar to those of the Atrypidae. Although this genus is known from only a single bed at one Alaskan locality, its unique morphology is worth noting in anticipation that similar forms may be discovered elsewhere in the Alexander terrane, or especially somewhere in Siberia where other taxa restricted to the Silurian of the Alexander terrane are shared. This paper represents a further contribution to our limited knowledge of the Silurian brachiopods of the Alexander terrane of Southeast Alaska. • Key words: Brachiopoda, late Silurian, new genus, Alexander terrane, Southeast Alaska, U.S.A., palaeoecology, slope facies, palaeogeography.

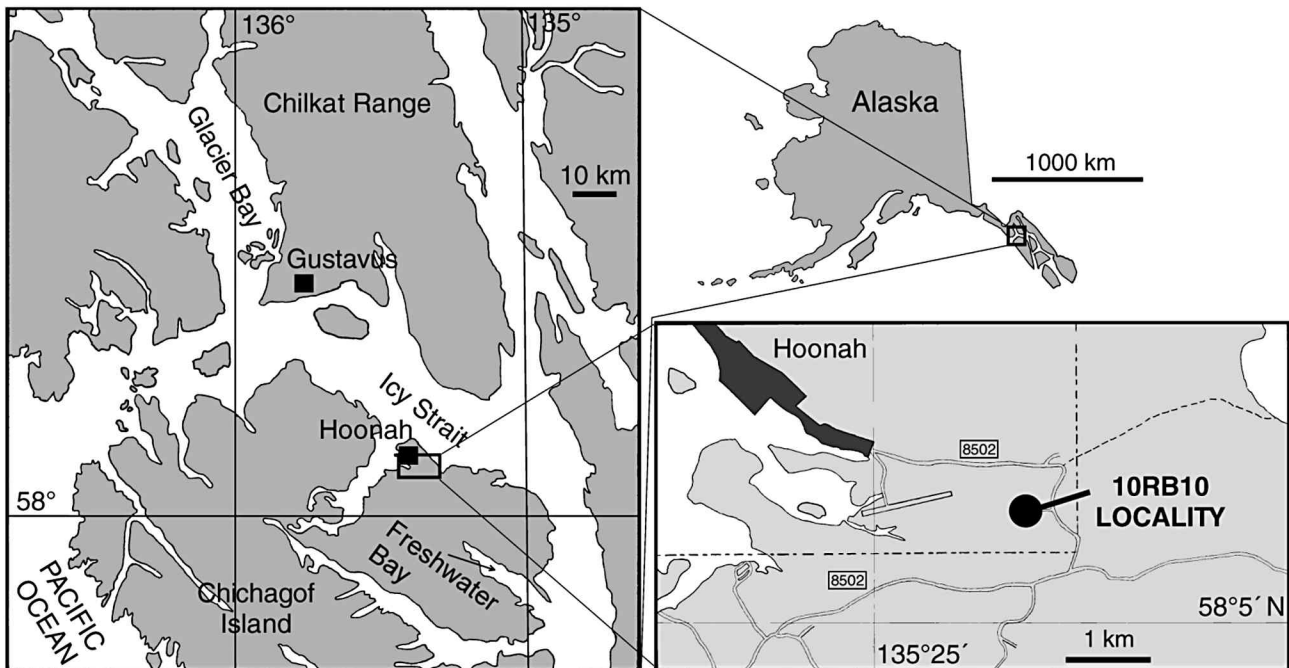
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The present paper describes a new brachiopod genus and species, *Strophatrypa skaflestadi*, found in an unnamed Silurian unit of mixed siliciclastics and limestones exposed in and around the town of Hoonah, situated on the northeast part of Chichagof Island. It was discovered and collected by R.B. Blodgett, D.M. Rohr, and J. E. Skaflestad on July 30, 2010 in the north side of a small quarry (Fig. 1) about 1 km east of Hoonah Airport runway on Chichagof Island, south-eastern Alaska, U.S.A. (locality 10RB10 – Latitude 58°05.716' N, Longitude 135°23.152' W). The quarry is reached by a small short road leading from the west from Forest Service Road 8052, the main road leaving and heading south of the town of Hoonah. The quarry is situated in the NW1/4 of the SE1/4 of section 35, T. 43 S., R. 62 E., Juneau A-5 1:63,360 scale quadrangle (Map edition 1994). The source quarry exposes two separate stratigraphic intervals: a lower greenish-gray, medium-bedded siltstone interval which forms the base of the quarry, and an upper limestone interval which forms cliffs on the south and west side of the quarry. The fossil-rich part (field locality 10RB10) of the siltstone beds is exposed on the north side of quarry (near NE end of quarry). The siltstone beds near the fossil locality strike N-S and dip steeply

70–75° to the west. This rich shelly fauna consists primarily of brachiopods along with a lesser amount of gastropods and bivalves (see Kříž *et al.* 2011 for description of the bivalves from this horizon). The fossiliferous zone which yielded this fauna was the only easily visible fossil-rich part of the siltstone beds exposed in the quarry. The age of this fossil horizon was indicated to be late Wenlock or early Ludlow according to the associated bivalve fauna (Kříž *et al.* 2011). The brachiopod fauna found here indicates only a generalized late Silurian age, and occurs primarily as disarticulated external and internal moulds extracted from siltstones. A limestone sample collected by D.M. Rohr in 2010 from the overlying limestone interval in the quarry was submitted to Ladislav Slavík (Praha, Czech Republic) who acidized the sample to extract conodonts. Unfortunately the sample proved to be barren. A sample of siltstone from the brachiopod-rich horizon was also unsuccessfully examined for chitinozoans by Viiu Nestor (Tallinn, Estonia).

This paper represents a further contribution to our limited knowledge of the Silurian brachiopods of the Alexander terrane of Southeast Alaska. Previous works dealing with Silurian brachiopods of this terrane include Kirk



**Figure 1.** Location of the field locality 10RB10, East of Hoonah Airport, Latitude 58°05.716' N, Longitude 135°23.152' W, Chichagof Island, Southeast Alaska, U.S.A. (from Kříž *et al.* 2011).

(1922, 1925, 1926), Kirk & Amsden (1952), and Savage (1989) on faunas found to the south on the western side of Prince of Wales Island and its westerly adjoining smaller islands. These faunas are from shallow-water platform carbonate facies rocks and are richly endowed with large pentameroid brachiopods [*i.e.*, *Kirkidium*, *Brooksina*, *Harpidium*, and *Cymbidium*]. The Chichagof Island brachiopod fauna represents a deeper-water, upper slope facies with a somewhat differing fauna, notably lacking in large pentameroids.

### Geological setting

Palaeozoic rocks are exposed throughout much of the north-east part of Chichagof Island of Southeast Alaska, however, little is known of its Palaeozoic fauna and flora. The only publications providing formal descriptions of Palaeozoic fossils are two papers on Silurian bivalves. Kirk (1927a) who described and illustrated *Pycinodesma benjamini* (Kirk), under the genus name *Pycinodesma*, which he later changed (Kirk 1927b) to *Pycinodesma* upon learning that the genus name was pre-occupied. This particular species was found in exposures of the type section of the Kennel Creek Limestone on the southern side of Freshwater Bay (Fig. 1). The other paper, Kříž *et al.* (2011), described a new bivalve community (*Goniophora thula-Mytilarca boucoti* Community) composed of 9 species from the same locality as *Strophatrypa*.

Geologic maps covering all or parts of Chichagof Island include Lathram *et al.* (1958), Lathram *et al.* (1959), Loney *et al.* (1963a), Loney *et al.* (1963b) and Karl (1999). Much of the basic stratigraphic nomenclature for this part of the island was established by Loney *et al.* (1963b). On the geologic map of northeast Chichagof Island of Karl (1999), the area including the quarry from which this collection was made was shown as being part of the Devonian age Cedar Cove Formation. Our field study indicated that many of the rocks exposed in the immediate area of Hoonah do not belong to the Cedar Cove Formation as indicated on the map of Karl (1999), but rather belong to a new unnamed mixed siliciclastic/limestone lithostratigraphic unit bearing late Silurian age fauna, probably forming a shelf-to-basin transitional lithofacies which lay to the north of late Silurian carbonate platform rocks of the Kennel Creek Limestone (Rohr *et al.* 2011). The Kennel Creek Limestone was established by Loney *et al.* (1963b), who considered it to be Middle Devonian in age. The only significant fossils found in the latter unit are the bivalve *Pycinodesma* and amphiporid stromatoporoids. More recent studies in Southeast Alaska clearly indicate that *Pycinodesma* is of late Silurian age, as originally indicated by Kirk (1927a, b), and the Kennel Creek is now recognized to be late Silurian in age.

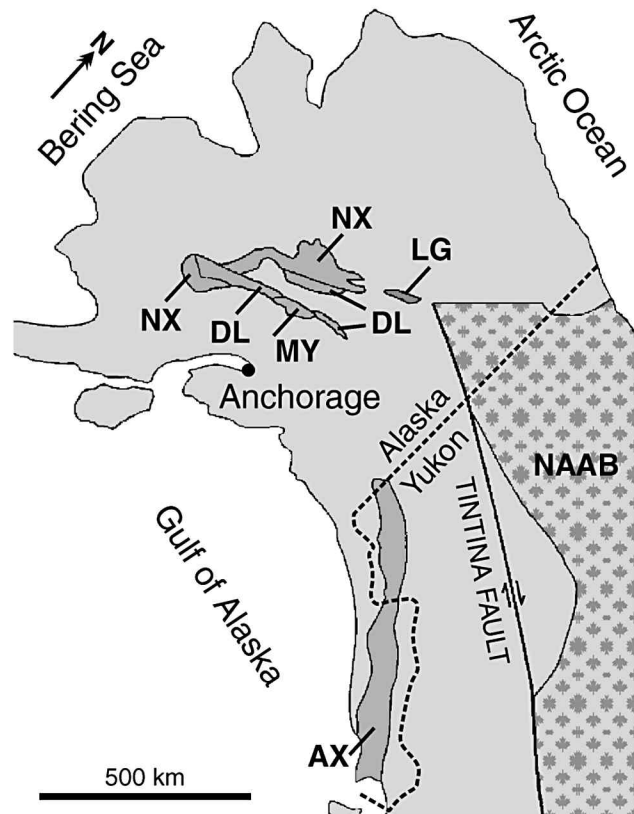
Carbonate platform facies of the Kennel Creek Limestone, as mentioned above, are well exposed to the south of Hoonah, most notably in and around Freshwater Bay. One of the nearest Kennel Creek quarry exposures to our

bivalve locality contained cyanobacterial reefal mound buildups, similar to those found in coeval platform edge rocks exposed throughout much of the Alexander terrane (Fig. 2) of Southeast Alaska and the Farewell terrane of southwestern Alaska (Clough & Blodgett 1988, Rigby *et al.* 1994), as well as in the Urals.

Palaeozoic strata of northeast Chichagof Island belong to the Alexander terrane (Fig. 2), a major tectonic element in Southeast Alaska, northwestern British Columbia, and southwestern Yukon Territory. This terrane along with many other terranes forms an accretionary complex of allochthonous terranes which characterize much of the Western Cordillera of North America. The Alexander terrane was one of first terranes to be recognized in western North America (Berg *et al.* 1972, Jones *et al.* 1972). Recent palaeobiogeographic studies indicate that the Alexander terrane has a fauna most similar to Siberia (Blodgett *et al.* 2002, 2003, 2010; Pedder 2006), notably its eastern portion. This terrane most likely originated as a rifted block of the eastern Siberian palaeocontinent, probably breaking away in the latter part of the Devonian (Blodgett *et al.* 2010).

Silurian shelly faunas of the Alexander terrane are distinctly different from those found along the western margin of cratonic North America. These differences are especially borne out by the gastropods (Rohr & Blodgett 2003, 2008; Rohr *et al.* 2003, 2008), brachiopods (Blodgett & Boucot 2009; Blodgett *et al.* 2002, 2010) and calcareous sponges (Rigby *et al.* 1994) found in Silurian strata of Alexander terrane. Summary data on the palaeobiogeographic affinities of the major Siluro-Devonian megafossil groups found in the Alexander terrane can be found in Blodgett *et al.* (2010). This latter study clearly shows the strongest palaeobiogeographic affinities are consistently found to be with the Siberian palaeocontinent. On-going studies of the Silurian brachiopods (by A.J. Boucot & R.B. Blodgett) and bivalves (by J. Kříž) will presumably throw additional light on this issue.

The fossil horizon containing *Strophatrypa skaflestadi* gen. et sp. nov. is a tan-weathering, greenish-gray, medium-bedded calcareous siltstone. Fine-sand to silt-sized grains of angular quartz, plagioclase and chert, minor detrital mica and glauconite are present. The fauna of this locality consists of a rich shelly benthos, especially brachiopods, but secondarily followed by bivalves and gastropods. Cephalopods are rare, favositid tabulate corals are also present, but form only a very minor component. Brachiopods retain shell microstructure, and they show little evidence of micritized rims indicating deposition below the photic zone (Flügel 2004). The brachiopods from this horizon were for the most part disarticulated, with the exception of a minority of the isorthids and *Strophatrypa skaflestadi* gen. et sp. nov. which remain articulated. The high degree of



**Figure 2.** Tectonostratigraphic terranes and component subterrane in Alaska. Abbreviations: AX – Alexander terrane; LG – Livengood terrane; Subterrane of the Farewell terrane: DL – Dillinger; MY – Mystic; NX – Nixon Fork. NAAB – North American autochthonous basement (after Blodgett *et al.* 2010).

disarticulation suggests a moderately high-energy setting, consistent with our interpretation of moderate transport (but not for great distances) on an inclined shelf to slope transition.

### Systematic palaeontology

- Order Atrypida Rzhonsnitskaya, 1960
- Suborder Atrypidina Moore, 1952
- Superfamily Atrypoidea Gill, 1871
- Family Atrypidae Gill, 1871
- Subfamily Atrypinae Gill, 1871

### Genus *Strophatrypa* gen. nov.

*Type species.* – *Strophatrypa skaflestadi* gen. et sp. nov. from unnamed upper Silurian strata south of the town of Hoonah, northeast Chichagof Island. The type specimens of *Strophatrypa skaflestadi* gen. et sp. nov., UAMES 14463–14476, are deposited at the University of Alaska Museum Earth Science Collection, Fairbanks.

*Etymology.* – Named to emphasize the strophic interareas, unusual for atrypoid brachiopods.

*Diagnosis.* – Atrypids with costellae that branch only at concentric growth lines, muscle field in both valves unimpressed, relatively small for the Family, and unique in having very narrow interareas in both valves, extending laterally almost to the maximum width.

*Occurrence.* – The new genus is known only from the Hoonah quarry locality, and as far as we know is restricted to the Alexander terrane of Southeast Alaska.

*Description.* – Impunctate, small to medium-size, unequally biconvex shells, with the dorsal valve less convex than the gently convex ventral valve, anterior commissure uniplicate, shells laterally elongate with rounded anterior and lateral margins, semicircular outline, greatest width near midlength, relatively broad, costellate dorsal sulcus and correspondingly broad, costellate ventral fold that have a regular change in slope into the lateral portions of the shells, ornamentation consists of well-marked concentric growth lines crossed by costellae that bifurcate at the first prominent growth line followed by additional bifurcations at more anterior growth lines. Form of deltidial region uncertain.

Ventral valve has two stout laterally broadening hinge teeth with an unimpressed muscle field. The external costellae are well marked interiorly. The dorsal valve has laterally directed, crenulated dental sockets, and a smooth area for diductor attachment, with an unimpressed muscle field, and anterior impressions of the external costellae. Spiralia and jugum unknown.

*Comparison.* – Lacks the comb-like ctenophoridium of *Atrypa sensu strictu*. Lacks any trace of dental lamellae, and has a wide, straight hinge line. Lacks the strongly impressed muscle fields present in most members of the Family. Differs from *Dehelicteria* by possession of prominent, concentric growth lamellae combined with coarser costellae. Has a strophic hinge line in contrast to *Omnutakhelina*, as well as marked growth lines. Has a strophic hinge line and marked, concentric growth lines in contrast to *Gotatrypa*, as well as marked fold and sulcus and much lower level of valve convexity.

*Discussion.* – Although this shell is known from only a single bed at one Alaskan locality its unique morphology is worth noting in the hope that similar forms will turn up elsewhere, especially somewhere in Siberia where other taxa restricted to the Silurian of the Alexander terrane are shared. No shells of this type are known from the late Silurian limestones and clastic rocks of Prince of Wales and Heceta Islands, suggesting that the Hoonah occurrence represents a different environment.

### *Strophatrypa skaflestadi* sp. nov.

Figures 3A–Q, 4A–J

*Etymology.* – Named in honor of Jeff E. Skaflestad of Hoonah, Alaska, who ably guided Blodgett & Rohr to the Hoonah quarry locality and other geological sites on the northeast part of Chichagof Island.

*Diagnosis and description.* – Because of monotypy, see that of genus.

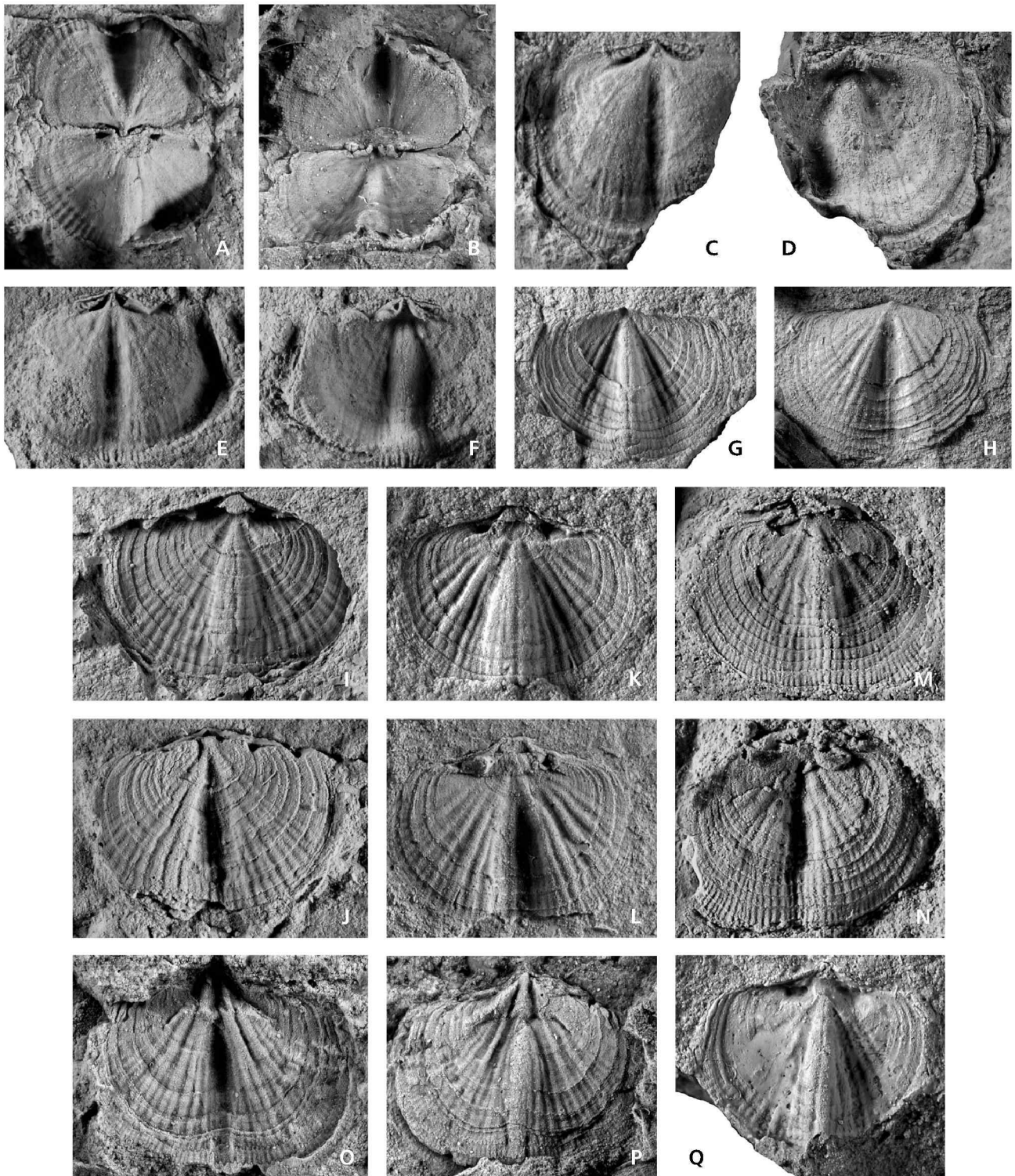
*Material.* – 48 dorsal valves, 36 ventral valves, 4 articulated specimens.

*Types.* – Holotype, UAMES 14463, Fig. 3A, B; paratype, UAMES 14464, Fig. 3C, D; paratype, UAMES 14465, Fig. 3E, F; paratype, UAMES 14466, Fig. 3G, H; paratype, UAMES 14467, Fig. 3I, J; paratype, UAMES 14468, Fig. 3K, L; paratype, UAMES 14469, Fig. 3M, N; paratype, UAMES 14470, Fig. 3O, P; paratype, UAMES 14471, Fig. 3Q; paratype, UAMES 14472, Fig. 4A, B; paratype, UAMES 14473, Fig. 4C, D; paratype, UAMES 14474, Fig. 4E, F; paratype, UAMES 14475, Fig. 4G, H; paratype, UAMES 14476, Fig. 4I, J.

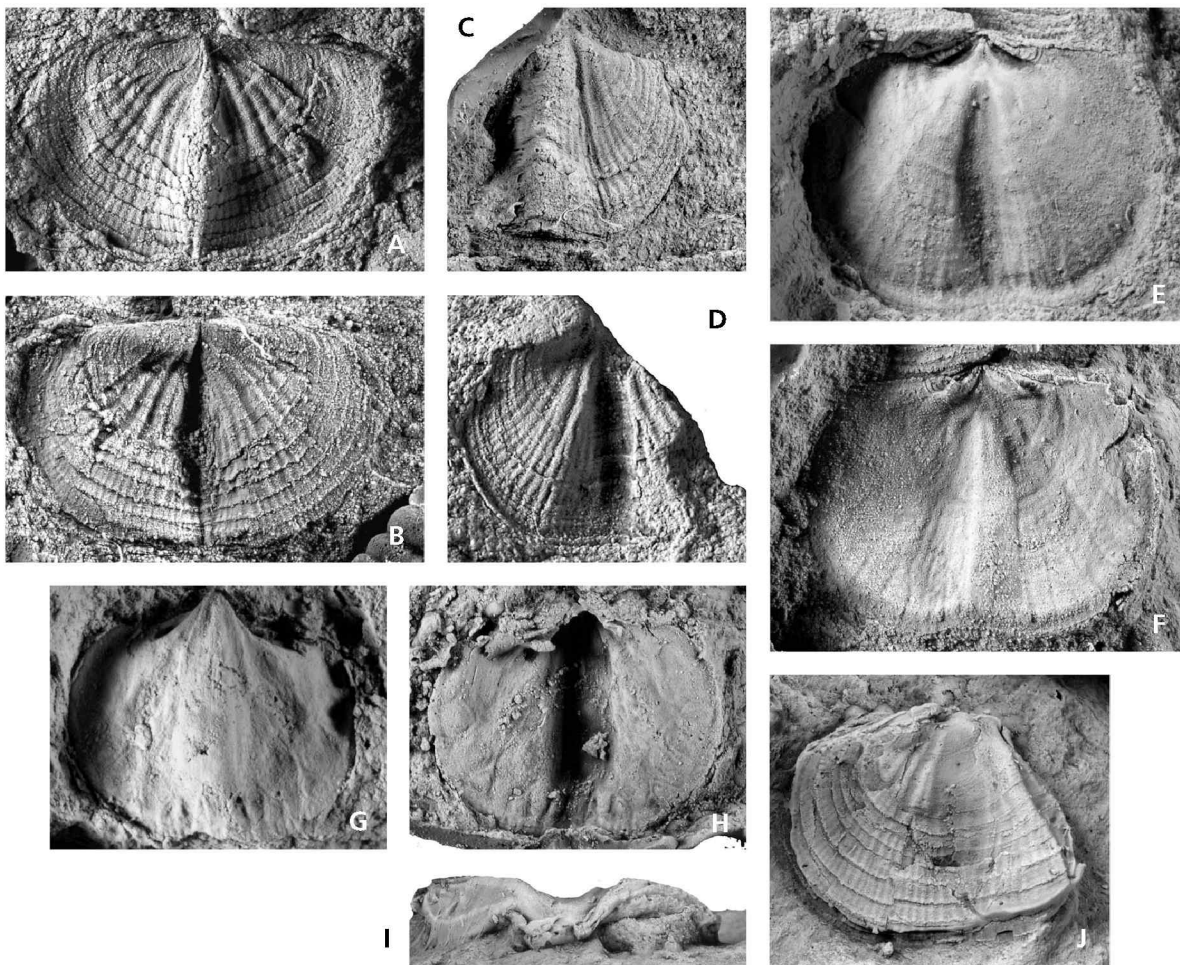
*Associated fauna.* – The Hoonah late Silurian fauna is a relatively moderate diversity fauna with a dominance of brachiopods to be described subsequently [additional to *Strophatrypa* there are the following in moderate abundance: *Howellella*, *Mesoleptostrophia*, *Isorthis (Arcualla)*, *Morinorhynchus*, “*Atrypa*”, together with a few valves of a pholidostrophid similar to *Eopholidostrophia*, several specimens of a gypidulid, a single specimen

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**Figure 3.** *Strophatrypa skaflestadi* gen. et sp. nov. • A, B – holotype, conjoined valve interiors (impression A, rubber replica B) showing the sulcate dorsal valve and the ventral fold; note the laterally directed dental sockets and the strophic hinge line, UAMES 14463, × 7. • C, D – paratype, dorsal valve interior (impression C, rubber replica D) showing the well developed sulcus, laterally directed, crenulate dental sockets, absence of well impressed muscle field, semicircular outline and impression anteriorly of costellae, UAMES 14464, × 6. • E, F – paratype, dorsal valve interior (impression E, rubber replica F), showing the sulcus, laterally directed, crenulate dental sockets, non-impressed muscle area, impression anteriorly of costellae, and semicircular outline, UAMES 14465, × 6. • G, H – paratype, dorsal valve exterior (impression G, rubber replica H), showing smooth transition from sulcus to lateral portion of shell, laterally extended, narrow, strophic hingeline, non-lamellose growth lines, and costellae unbranched posteriorly that bifurcate at more



anterior growth lines, UAMES 14466,  $\times 6$ . • I, J – paratype, dorsal view of conjoined valve interiors (impression I, rubber replica J), showing sulcus and costellae branching at growth lines; note semicircular outline, UAMES 14467,  $\times 6$ . • K, L – paratype, dorsal view of conjoined valve interiors (impression K, rubber replica L), showing strophic outline, semicircular lateral and anterior margins, UAMES 14468,  $\times 6$ . • M, N – paratype, dorsal view of conjoined valve interiors (impression M, rubber replica N), showing costellae branching at non-lamellose growth lines, UAMES 14469,  $\times 6$ . • O, P – paratype, dorsal view of interior (impression O, rubber replica P), showing strophic posterior and semicircular outline, with sulcus and costellae branching at growth line, UAMES 14470,  $\times 6$ . • Q – paratype, dorsal view of of impression, showing strophic posterior outline, semicircular lateral and anterior outline, and impression of costellae, UAMES 14471,  $\times 6$ .



**Figure 4.** *Strophatrypa skaflestadi* gen. et sp. nov. • A, B – paratype, dorsal view of exterior (impression A, rubber replica B), showing strophic posterior and semicircular lateral and anterior margins, sulcus, and costellae branching at growth lines, UAMES 14472, × 6. • C, D – paratype, dorsal view of exterior (rubber replica C, impression D), showing sulcus and costellae that branch at growth lines, UAMES 14473, × 6. • E, F – paratype, dorsal view of interior (impression E, rubber replica F) showing laterally directed, crenulated dental sockets, sulcus, strophic posterior outline and semicircular lateral and anterior outline, with impression of costellae, UAMES 14474, × 6. • G, H – paratype, impression of ventral interior (impression G, rubber replica H) showing antero-laterally directed hinge teeth, and lack of a well developed muscle impression, UAMES 14475, × 6. • I, J – paratype, rubber replica of dorsal valve interior (I – posterior view, J – dorsal view) showing dental sockets, costellae and semicircular lateral and anterior margins, UAMES 14476, × 6.

of a probable *Cyrtia*, and a single specimen of an unidentified athyroid], a moderate abundance of *Bivalvia* (Kříž *et al.* 2011), a moderate number of gastropods, rare cephalopods, several fragments of a favioid, and a few higher land plants fragments under study by Dianne Edwards.

### Acknowledgements

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