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Uppermost Jurassic (Tithonian) to Lower Cretaceous (Valanginian) section at Grassy Island, west coast Vancouver Island, British Columbia

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INTRODUCTION

Grassy Island consists of a small archipelago of low islets located off the west coast of Vancouver Island south of Kyuquot Sound (ca. Lat. 49°55.48' N, Long. 127°15.18' W; UTM zone 9U, 625400E, 5531500N; NTS 92E/14; Fig. 1). The stratigraphic section preserved at Grassy Island (Fig. 2) contains a near-complete succession of Tithonian (*i.e.*, Portlandian *sensu stricto*) and Berriasian to mid-Valanginian sedimentary strata, with only the upper Tithonian stage mostly or completely missing (Jeletzky, 1965). The section is by far the most representative of such rocks known in the western Canadian Cordillera, more complete than the Harrison Lake section published by Crickmay (1962) and richly fossiliferous throughout. The outstanding importance of the section for establishing the zonal sequence of upper Upper Jurassic and lower Lower Cretaceous index fossils of the western Canadian Cordillera was emphasized by Jeletzky in numerous reports (Jeletzky, 1950, 1965, 1984).

Dolmage (1921) collected fossils from One Tree Island (now known as Clark Island), adjacent to Grassy Island, and the strata there were briefly noted and assigned by Bancroft (1937) to the "Cowichan Formation (One Tree island)." The stratigraphic sections on Grassy Island and adjacent Clark Island were subsequently

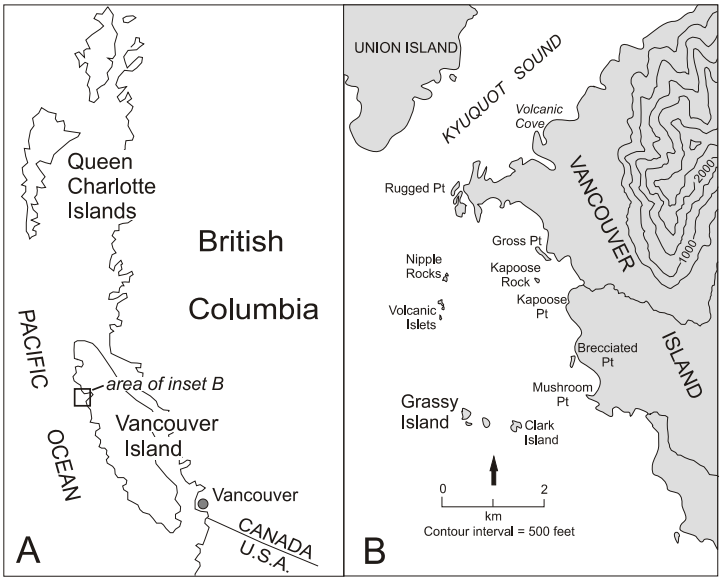

Figure 1. Location map of Grassy Island area, west coast Vancouver Island, British Columbia.

[1] Deceased 1988

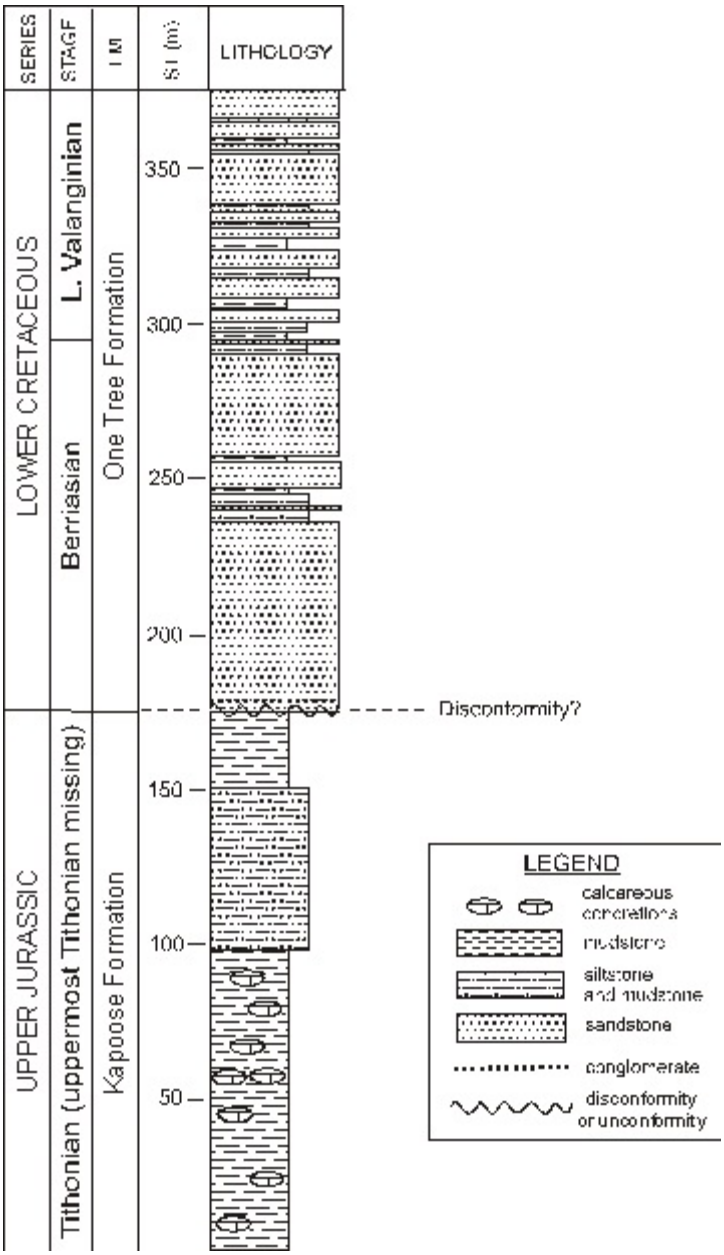

Figure 2. Generalized stratigraphy of the Kyuquot Group, Grassy Island, British Columbia. FM = Formation; ST = Stratigraphic Thickness.

studied in more detail by Jeletzky in 1949, 1950, 1951, and 1952 during the course of geological mapping (Jeletzky, 1950, 1965). Jeletzky (1950, 1965) recognized that the Grassy Island section included a lower, fine-grained unit which he assigned (1965) to his "Division B" of the Upper Jurassic, in addition to the stratigraphically-higher, coarse-grained clastics of Early Cretaceous age originally noted by Bancroft (1937). Jeletzky (1950, p. 38) noted that Bancroft had assigned the Lower Cretaceous beds of Clark and Grassy islands to the "One Tree formation," but eschewed this usage in favour of "Lower Cretaceous Sedimentary Rocks," which he subdivided into three members. (Haggart and Grey have subsequently found these members difficult to recognize in the field and thus do not include them in the stratigraphic section of the island [Fig. 2].) Subsequently, Muller *et al.* (1981) assigned the fine-grained strata of the lower part of the section to their Kapoose Formation and the coarser strata of the upper part of the section to their One Tree Formation, both forming the Jura-Cretaceous Kyuquot Group (Muller *et al.*, 1981).

The section on Grassy Island includes virtually the full thickness of the One Tree Formation, and somewhat less than half of the Kapoose Formation, the base of that unit not found on the island. Fossil collections from Grassy Island indicate that the One Tree Formation on the island ranges in age from early Berriasian to mid-Valanginian, while the Kapoose Formation ranges from early Tithonian (*i.e.*, Portlandian) to late Tithonian. A disconformity is inferred to separate the two formations on the island, spanning the latest Tithonian [age assignments are based on the standard *Buchia* zonal succession

established by Jeletzky (1965); Haggart and Grey note that minor changes to the age distribution of some buchiid zones may be merited, e.g. as suggested by Bralower (1990) and Bralower *et al.* (1990) based on work in northern California, but do not incorporate them here pending verification of their applicability to the western Canada succession.]

Jeletzky measured the stratigraphic section on Grassy Island in 1949, 1951, and 1952, making approximately 265 stratigraphically-assigned fossil collections during the course of his work. These fossil collections are presently held in the collections of the Geological Survey of Canada in Vancouver, British Columbia. Fossils in the collections consist mostly of buchiid bivalves, numbering many tens of thousands of specimens. Collections were made *in situ* throughout the section at intervals from a few centimetres to a few decimetres.

The summary stratigraphic section of the Grassy Island succession presented below is based primarily on Jeletzky's copious field notes and description, augmented by information compiled by Haggart and Grey, based on their visits to Grassy Island as well as review of Jeletzky's original fossil collections. In addition to presenting a detailed description of the lithological units present on Grassy Island, the section provides the stratigraphic context for fossil materials illustrated by Jeletzky in his publications (see above). Geological Survey of Canada (GSC) fossil collections are noted in the section as **GSC Loc. xxxx** (generally with original field number included) while individual illustrated type specimens are noted as **GSC No. xxxx**. Fossil identifications given are mostly those of Jeletzky, verified by Grey and Haggart and with some additional identifications provided by them. Within each collection, identified taxa are listed in their approximate order of abundance. Some taxonomic revisions of buchiid species described herein are based on the recent publications of Grey *et al.* (in press a, b) and interested readers are encouraged to review those publications for details.

Jeletzky's original description of the section recognized 204 stratigraphic units that he referred to as 'beds.' It is Haggart and Grey's assessment, however, that many of these 'beds' represent amalgamations of multiple sedimentological beds; hence we have changed the 'bed' designation to stratigraphic 'unit.' Jeletzky originally measured the section in inches and feet (standard system); his measurements have been converted to metric. The thickness and lithological composition of many stratigraphic units vary significantly over short lateral distances. The more significant of these are commented upon in the unit descriptions and reflected in the maximum and minimum thicknesses given for the units. A previously-published summary stratigraphic log of the section (Jeletzky, 1965, Fig. 4) arbitrarily uses the minimum thicknesses measured. The tops and bases of all paleontological zones and those of the "overlap beds" between them are the same as those given in the 1965 report of Jeletzky.

A number of faults exist in the stratigraphic section, the most important ones are noted below.

None of these faults appears to result in displacement of more than a few metres of the succession as they are not accompanied by abrupt changes in the associated *Buchia* faunas. In addition, it is possible in nearly all cases to trace individual beds across the offsetting faults.

ACKNOWLEDGMENTS

Grey and Haggart are deeply indebted to the late George Jeletzky (deceased 1988), who undertook measurement and description of the Grassy Island section, as well as collection of the hundreds of thousands of fossil specimens from the island that are resident in the collections of the Geological Survey of Canada. This contribution utilizes his section description, stratigraphic measurements, and taxonomic assignments greatly.

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GRASSY ISLAND STRATIGRAPHIC SECTION

(Measured from base up)

The stratigraphic section is measured along the upper intertidal bench forming the west side of Grassy Island. The base of the measured section is concealed beneath the sea at mid-low tide at the northern end of the main body of the island and begins at UTM zone 9U 625570E 5531670N (NAD83). References to geographic features are presented throughout the section (in parentheses) to help subsequent workers identify units on the ground.

Unit	Unit Description	Thickness (m)	Total Thickness Above Base (m)

UPPER JURASSIC
Kapoose Formation
Tithonian (*i.e.*, uppermost Portlandian *sensu stricto*)
Buchia columbiana Zone (formerly *Buchia* cf. *blanfordiana* Zone)

1		13.7-17.5	13.7-17.5

(Lowermost part of unit is exposed only on the northernmost point of the island north of the last big crevice passable at mid-low tide.)

Mudstone, contains several interbeds and rows of concretions of impure, grey, cryptocrystalline limestone.

Fossils from the lowermost 5.2-7.9 m of the unit (**GSC Loc. 19002**; Field No. 52a, 1949; Field No. 52a.1, 1950) include:

Buchia columbiana Grey *et al.*, 2007b (formerly *Buchia* cf. *blanfordiana*)

Fossils collected about 5.2 m higher than lot 52a.1, immediately north of the above-mentioned crevice (**GSC Loc. 18992**; Field No. 52a.2) include:

Buchia columbiana

Fossils collected 2.6-3.2 m higher in the succession than lot 52a.2 and 1.2-1.8 m south of the above-mentioned crevice (**GSC Loc. 19027**; Field No. 52a.3) include:

Buchia columbiana.

2		22.4-23.3	36.1-40.8

(A major fault trending north-south along the west side of the main body of Grassy Island crosses Unit 2; it is accompanied by a badly faulted, 0.6-1.2 m-thick felsic dyke.)

Mudstone, locally silty, interbedded with rows of concretionary limestone; locally grading into shale.

A triple bed of limestone 2.6-3.2 m thick and approximately 1.8-2.1 m above the base of unit consists of dark grey concretionary limestone layers (each about 15-30 cm thick) separated by 1.8-2.1 m-thick layers of dark grey to bluish-grey shale with dispersed smaller limestone concretions. Fossils from these beds (**GSC Loc. 19001**; Field No. 52b.1) include:

Buchia columbiana; and
belemnite, indet.

Fossils from 5.2 m-thick sequence of beds immediately overlying bed 52b.1 (**GSC Loc. 19029**; Field No. 52b.2) include:

Buchia columbiana; and
phylloceratid(?) ammonite, indet.

Unit	Unit Description	Thickness (m)	Total Thickness Above Base (m)

Fossils from the next 5.2 m-thick interval (**GSC Loc. 18991**; Field No. 52b.3) include:
Buchia columbiana.

The top of this interval is marked by a thick, marked, double or triple bed of yellowish-weathering, concretionary limestone or calcareous shale; only two or three rows of smaller concretions at the top and base of this interval are fossiliferous and they account for the majority of the fossils collected; the next 2.6 m are badly faulted and actually represent a thickness of about 7.6 m; fossils from the lower 3.6 m of this interval (**GSC Loc. 18988**; Field No. 52b.4) are mostly from two or three persistent layers of concretionary limestone 3.0-3.6 m above the top of interval 52b.3 and include:
Buchia columbiana.

Fossils from the upper 3.6-4.0 m of the same interval (**GSC Loc. 19026**; Field No. 52b.6) include:
Buchia columbiana.

3		~13.2	49.3-54.0

Mudstone, locally silty, with interbeds and concretions of limestone.

Fossils from throughout unit (**GSC Loc. 18477**; Field No. 52c) include:
Buchia columbiana; and
Phylloceras cf. *subplicatum* Burckhardt.

4		~9.1	58.4-63.1

Mudstone, locally silty; contains interbeds or rows of concretions of grey, cryptocrystalline, impure limestone containing well-preserved *Buchia* and ammonites; top and base of unit contain two persistent, 45-60 cm-thick beds of resistant limestone which stand out in relief from the flat, middle part of the unit; a 1.0-2.5 cm-thick layer of greyish-green, fine-grained sandstone noted near base of unit.

Fossils from throughout the unit (**GSC Loc. 18374**; Field No. 52d) include:
Buchia columbiana; and
Phylloceras ex gr. *reticulatum* Burckhardt; and
Phylloceras cf. *subplicatum*.

5		9.2	67.6-72.3

(The upper limestone bed in this unit, discussed below, strikes approximately into the northern end [west side] of the flat-topped central hill of the island.)

Mudstone, silty to sandy; base marked by a prominent limestone bed forming the top of unit 4; top marked by a prominent bed of merging, loaf-like limestone concretions 30-45 cm-thick; *Buchia* distributed singly or in small clusters throughout unit.

Fossils from throughout unit (**GSC Loc. 18415**; Field No. 52e) include:
Buchia columbiana; and
Acroteuthis(?) sp.

6		~18.3-24.4	85.9-96.7

Mudstone, silty to sandy, with concretionary limestone beds; base marked by a 30-45 cm-thick bed of grey, impure concretionary limestone which forms the top part of unit 5, top marked by a 15-30 cm-thick layer of similar limestone; similar limestone interbeds noted at irregular intervals throughout unit have yielded the bulk of the fossils collected, as those fossils noted in the intervening mudstone are nearly always crushed and flattened; *Buchia* are mostly scattered throughout the unit singly or in small groups; their clusters and

Unit	Unit Description	Thickness (m)	Total Thickness Above Base (m)

lenses are rare and restricted to the middle part of the unit where they may rarely be 12-25 cm long and 5-8 cm thick.

Fossils from the lower third of the unit (**GSC Loc. 18342.l**; Field No. 52f.lower) include:
Buchia columbiana; and
Phylloceras cf. *subplicatum*.

Fossils from the middle third of the unit (**GSC Loc. 18342m**; Field No. 52f.middle) include:
Buchia columbiana.

Fossils from the upper third of the unit (**GSC Loc. 18342u**; Field No. 52f.upper) include:
Buchia columbiana; and
Acroteuthis sp.

Additional fossils (**GSC Loc. 18413**; Field No. 52f) were collected from throughout the unit (collection missing).

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7 ~10.1-13.1 96.0-109.8

Shale, medium to ash-grey, bluish-tinged, silty and calcareous, lithologically similar to underlying shale and mudstone units; base marked by a row of grey, yellowish-grey-weathering limestone concretions forming the top of underlying unit 6; the top is marked by a 1.2-1.5 m-thick limestone bed (as at the base) and is situated at the base of a pronounced 3.0-3.6 m-high rocky bench formed by an east-west trending fault; some concretions of limestone and thin interbeds of mudstone noted scattered throughout the unit.

Fossils from throughout the unit (**GSC Loc. 18366**; Field No. 52g) include:
Buchia columbiana;
Acroteuthis cf. *impressa* (Gabb); and
Phylloceras sp. indet.

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8 6.1-10.7 102.1-120.5

(Forms a pronounced E-W–trending ridge crossing the western tidal shelf of the main body of Grassy Island, the first such ridge encountered. The base of unit is on north side of this ridge.)

Mudstone, greyish-green, sandy, medium-hard; interbedded with thinly bedded, fine-grained, greyish-green sandstone; mudstone prevails at the top and bottom of the unit while sandstone predominates in the middle 3.0-4.5 m; limestone concretions and interbeds noted throughout the unit; several concretionary limestone layers 12-15 cm-thick and mudstone layers 5-8 cm-thick are abundant with whole *Buchia* shells and fragments; some ammonites and belemnites are associated with *Buchia* in these interbeds.

Fossils from throughout the unit (**GSC Loc. 18401**; Field No. 52h) include:
Buchia columbiana; and
belemnite, indet.

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9 18.3-19.8 120.4-140.3

Mudstone, dark grey, dense, poorly-sorted, grades into silty shale and contains some layers of very fine-grained, silty sandstone with abundant *Buchia*; fossils are rare elsewhere, except for one or two very limey mudstone layers near the upper boundary which are very rich in *Buchia*; the top of the unit is marked by 3 or 4 layers of grey concretionary limestone each 10-60 cm thick; farther down, the unit is almost devoid of concretions and/or layers of limestone.

Fossils from the upper 4.6-5.5 m (**GSC Loc. 18460.u**; Field No. 52i.upper) include:

Unit	Unit Description	Thickness (m)	Total Thickness Above Base (m)

Buchia columbiana.

Fossils from the remainder of the unit (**GSC Loc. 18460**; Field No. 52i) include:
Buchia columbiana.

10		19.8-21.3	140.2-161.6

Mudstone, dark grey, dense, sandier than underlying units and contains more glauconite; base of unit is marked by the uppermost of three or four limestone layers forming the top of unit 9, upper margin of unit is marked by a pronounced crevice trending east-west and probably representing a fault; numerous rows of small, spherical or irregularly shaped concretions of impure limestone observed throughout unit but no persistent limestone beds seen; unit 10 subdivided into three, approximately equally thick beds, 6.0-7.5 m-thick, for the purpose of fossil collecting.

Fossils were collected from three intervals within the unit: the lower 6.0-7.5 m (Field No. 52j.lower); the middle 6.0-7.5 m (Field No. 52j.middle); and the upper 6.0-7.5 m (Field No. 52j.upper); the original segregation of these collections has subsequently been lost and all have been assumed under **GSC Loc. 18402**. Fossils from this lot include:
Buchia columbiana; and
Acroteuthis sp.

11		~7.6-9.1	147.8-170.7

Silty mudstone, locally sandy, grey to dark grey, reddish-tinged, medium-hard, capped by a 6-10 cm-thick continuous bed of concretionary limestone; this limestone bed noted 3.5-4.0 m north from the base of a steep, east-west trending bench where the Jurassic-Cretaceous contact is exposed; two or three rows of impure limestone concretions, surrounded by mudstone matrix, noted in the bed.

Fossils from throughout the unit (**GSC Loc. 18369**; Field No. 52k) include:
Buchia columbiana.

12		~3.4-4.0	151.2-174.7

Silty mudstone, as in unit 11.

Fossils from the unit (**GSC Loc. 18489**; Field No. 52l) include:
Cylindroteuthis sp.

13		~0.6-0.8	151.8-175.5

Concretionary limestone, grey, impure, persistent across the outcrop.

Fossils from throughout the unit (**GSC Loc. 18367**; Field No. 52m) include only:
Buchia columbiana, typical forms and variants (**GSC No. 16577**, Jeletzky, 1965, pl. 2, figs. 2A, B; **GSC No. 16578**, Jeletzky, 1965, pl. 2, figs. 3A-C; **GSC No. 16579**, Jeletzky, 1965, pl. 2, figs. 4A-C; **GSC No. 16584**, Jeletzky, 1965, pl. 3, figs. 5A-C; **GSC No. 17517**, Jeletzky, 1965, pl. 22, figs. 2A-E).

14		~1.0-1.4	152.8-176.9

(Units 14-17 are exposed on the prominent north-facing cliff face in the middle of the west side of Grassy Island proper. The top of this cliff face is cut by a prominent notch just west of a steep, grass-covered ridge leading up the higher part of the island to the east.)

Silty mudstone, grey, reddish-tinged, locally sand; interbed of concretionary limestone 30-45 cm thick noted 60-75 cm above base; it is then capped by 5-15 cm of mudstone.

Unit	Unit Description	Thickness (m)	Total Thickness Above Base (m)

The *Buchia* fauna is uniform throughout the unit; unlike occurrences of younger *Buchia* stratigraphically higher in the section, *B. columbiana* at this level are mostly noted as single specimens scattered throughout the thickness; fossils from a loose boulder 10.5 m northeast of the unit and presumably derived from it (**GSC Loc. 18459**; Field No. 52n.1) include only:

Buchia columbiana.

Fossils from throughout the unit (**GSC Loc. 18384**; Field No. 52.n) include:

Buchia columbiana (**GSC No. 16585**, Jeletzky, 1965, pl. 3, figs. 6A-C);

poorly preserved ammonite resembling *Substeueroceras stantoni* Anderson 1945 (**GSC No. 16580**, Jeletzky, 1965, pl. 2, fig. 5);

poorly preserved ammonite resembling *Gymnodiscoceras* Spath 1925 (**GSC No. 16583**, Jeletzky, 1965, pl. 2, figs. 9A, B); and

Cylindroteuthis aff. *obeliscoides* Pavlow & Lamplugh 1892 (**GSC No. 16582**, Jeletzky, 1965, pl. 2, figs. 8A, B).

LOWER CRETACEOUS
One Tree Formation
Lower Berriasian
Buchia okensis Zone

15		~2.4-3.0	155.2-179.9

Sandstone, medium- to coarse-grained, light grey to yellowish-green, glauconite-bearing, very calcareous throughout; thin pebble conglomerate found locally; layers poor in *Buchia* are interbedded with thin layers rich in *Buchia* shells; contact with unit 14 is uneven and knife-edge sharp, presumably an erosional disconformity; fossils indicate that most or all of the upper Tithonian is missing at this contact (Jeletzky, 1965, p. 65).

Fossils from the basal 8-10 cm, immediately above the contact with unit 14 (**GSC Loc. 18397**; Field No. 52o.1), include:

Buchia okensis (Pavlow 1907) *forma typica* (**GSC No. 17451**, Jeletzky, 1965, pl. 4, figs. 3A-C);

B. okensis var. *canadiana* (Crickmay 1930) (**GSC No. 17453**, Jeletzky, 1965, pl. 4, figs. 19A-D);

B. uncitoides (Pavlow 1907) *sensu lato* (**GSC No. 17446**, Jeletzky, 1965, pl. 4, figs. 13A-D);

B. uncitoides (Pavlow 1907) var. (**GSC No. 17436**, Jeletzky, 1965, pl. 4, figs. 2A-D);

B. cf. *uncitoides* (Pavlow 1907) *sensu lato* (**GSC No. 17440**, Jeletzky, 1965, pl. 4, figs. 7A-C);

B. okensis (Pavlow 1907) var. *subokensis* (Pavlow 1907) (**GSC No. 17445**, Jeletzky, 1965, pl. 4, figs. 12A-D; **GSC No. 17448**, Jeletzky, 1965, pl. 4, figs. 15A-D; **GSC No. 17457**, Jeletzky, 1965, pl. 4, figs. 23A-D);

B. okensis (Pavlow 1907) aff. var. *subokensis* (Pavlow 1907) (**GSC No. 17441**, Jeletzky, 1965, pl. 4, figs. 8A-D); and

B. aff. *fischeriana* (d'Orbigny 1845) *sensu lato* (**GSC No. 17447**, Jeletzky, 1965, pl. 4, figs. 14A-D).

Fossils from a 30 cm-thick layer 1.8-2.1 m above the base of the unit and 60-90 cm below the top of the unit (**GSC Loc. 18382**; Field No. 52o.2) include:

Buchia okensis (Pavlow 1907) *forma typica* (**GSC No. 17437**, Jeletzky, 1965, pl. 4, figs. 4A-D; **GSC No. 17439**, Jeletzky, 1965, pl. 4, figs. 6A-D);

B. okensis (Pavlow 1907) *sensu lato* (**GSC No. 17452**, Jeletzky, 1965, pl. 4, figs. 18A-C; *non* fig 18D = **GSC No. 17444**);

Unit	Unit Description	Thickness (m)	Total Thickness Above Base (m)

B. okensis (Pavlow 1907) *sensu lato* var. (**GSC No. 17455**, Jeletzky, 1965, pl. 4, figs. 21A-D; **GSC No. 17456**, Jeletzky, 1965, pl. 4, figs. 22A-D);
B. okensis (Pavlow 1907) var. *subokensis* (Pavlow 1907) (**GSC No. 17438**, Jeletzky, 1965, pl. 4, figs. 5A-D);
B. aff. *okensis* (Pavlow 1907) var. *subokensis* (Pavlow 1907) (**GSC No. 17442**, Jeletzky, 1965, pl. 4, figs. 9A-C; **GSC No. 17458**, Jeletzky, 1965, pl. 4, figs. 24A-D);
B. okensis var. *canadiana* (Crickmay 1930) (**GSC No. 17435**, Jeletzky, 1965, pl. 4, figs. 1A-D; **GSC No. 17454**, Jeletzky, 1965, pl. 4, figs. 20A-D); and
B. aff. *terebratuloides* (Lahusen 1888) *sensu lato* (**GSC No. 17450**, Jeletzky, 1965, pl. 4, figs. 17A-D).

Fossils from the uppermost 15 cm of the unit (**GSC Loc. 18403**; Field No. 52o.3; this fossil lot was collected 7.5 m to the west of the main line of section where the sandstone begins to pinch out, as the top of the unit is unfossiliferous in the section itself) include:
Buchia okensis forma typica.

Fossils collected from throughout the unit as **GSC Loc. 18364** (Field No. 52o) include:
Buchia okensis var. *subokensis* (Pavlow 1907);
B. okensis aff. var. *subokensis* (Pavlow 1907); and
B. aff. *uncitoides* (Pavlow 1907) *sensu lato*.

16 — 0.02-0.05 — 155.2-180.0

Pebble conglomerate, grades into medium- to coarse-grained, gritty and pebbly sandstone; calcareous to very calcareous; matrix is often coquina-like, with abundant broken and complete *Buchia* shells; pebbles are mostly locally derived.

Fossils from this conglomerate and from the lowermost 45-75 cm of unit 17 (represented largely by the coquinoid sandstone) (**GSC Loc. 18365**; Field No. 52p) include:
Buchia okensis (Pavlow 1907) *sensu lato* (**GSC No. 16589**, Jeletzky, 1965, pl. 5, figs. 2A, B);
Buchia okensis (Pavlow 1907) *sensu lato* var. (**GSC No. 16591**, Jeletzky, 1965, pl. 5, figs. 4A, B); and
B. okensis (Pavlow 1907) var. *canadiana* (Crickmay 1930) (**GSC No. 16594**, Jeletzky, 1965, pl. 5, figs. 7A, B).

17 — 1.2-1.8 — 156.4-181.8

Sandstone, fine- to medium-grained, greenish-grey, calcareous, thinly bedded; grades into fragmental, impure coquinoid sandstone; fossils (mostly *Buchia*) are mostly concentrated in 7-15 cm-thick coquina layers separated by poorly fossiliferous, less calcareous sandstone.

Fossils from a 5-8 cm thick shell layer at 0.9-1.1 m above the top of the basal coquinoid sandstone from which fossil lot 52p was collected and 30-45 cm below the top of the unit (**GSC Loc. 18493**; Field No. 52q) include:
Buchia uncitoides; and
B. okensis.

Fossils from the upper 15 cm of the unit (**GSC Loc. 18398**; Field No. 52r) include:
Buchia okensis.

18 — ~3.3-3.6 — 159.7-185.4

Sandstone, fine-grained, green, calcareous; this interval contains four or five 1.0-8.0 cm-thick, lenses filled with *Buchia*, alternating with nearly barren sandstone; some of the lenses contain only small *Buchia*

Unit	Unit Description	Thickness (m)	Total Thickness Above Base (m)

uncitoides sensu lato while others contain large *B. okensis sensu lato* and *B. uncitoides* (Pavlow) var. *spasskenskoides* (Crickmay); the alternation of larger shells with smaller ones seems to noted repeatedly in this and underlying units of the section.

(In this interval there is no drastic change of *Buchia* fauna but a gradual decrease of shell size and replacement of *B. okensis sensu lato* by *B. uncitoides* upwards from one bed to another.)

Fossils from the basal 15-45 cm of the unit (**GSC Loc. 19322**; Field No. 52r.1) include:
Buchia uncitoides; and
B. okensis.

Fossils from a 10-12 cm-thick bed of similar sandstone immediately overlying that from which lot No. 52r.1 was collected (this bed contains two 1-4 cm-thick lenses rich in *Buchia*) (**GSC Loc. 19362**; Field No. 52r.2) include:
Buchia uncitoides; and
B. okensis.

Fossils from the next 1.5-1.8 m (**GSC Loc. 19281;** Field No. 52r.3) include:
Buchia uncitoides; and
B. okensis.

The upper part of the unit consists of a less calcareous sandstone rich in *Buchia*; large and sparsely-ribbed variant of *B. okensis sensu lato* are all but absent in this bed, the fauna of which consists of *B. uncitoides sensu lato*, *B. okensis* var. *subokensis* (Pavlow) and transitional forms between the two. The higher part of the unit contains few fossils and was not collected. Fossils from a 45 cm-thick bed situated 45 cm above the top of the 52r.3 layer (**GSC Loc. 19364**; Field No. 52r.4) include:
Buchia uncitoides; and
B. okensis.

19		~0.8	160.5-186.2

Sandstone, fine-grained, greenish-grey, hard; rich in *Buchia*.

Fossils from throughout the unit (**GSC Loc. 19349**; Field No. 52r.5) include:
Buchia uncitoides; and
B. okensis.

20		~4.6-5.5	165.1-191.6

(The top of this unit coincides with the base of the northern slope of a pronounced gully bisecting the southwestern ridge of Grassy Island; the bottom of the gully is covered with sandstone debris.)

Sandstone, fine-grained, greenish-grey to yellowish-green, partly coquina-like; relatively poor in fossils.

GSC Loc. 19358 (Field No. 52r.6) collected from the lowermost 8-10 cm of the unit, consisting of impure, calcareous coquina sandstone with abundant *Dentalium* sp. indet.; its fossils include:
B. aff. *fischeriana* (d'Orbigny 1945) var. *stremouhovi* (Pavlow 1907); and
Buchia okensis.

GSC Loc. 19347 (Field No. 52r.7) collected from a 12-15 cm-thick layer of greenish-grey sandstone immediately above that which produced lot 52r.7; its fossils include:
Buchia uncitoides; and
B. okensis.

Unit	Unit Description	Thickness (m)	Total Thickness Above Base (m)

GSC Loc. 18368 (Field No. 52s) collected from the top 30-60 cm of the unit at the base of the northern slope of the first gully of the main body, where softer and harder sandstone beds interfinger; its fossils include:

Buchia aff. *fischeriana* (d'Orbigny 1945) var. *stremouhovi* (Pavlow 1907) (**GSC No. 17473**, Jeletzky, 1965, pl. 7, figs. 6A-D).

21 — 2.5-3.2 — 167.6-194.8

Sandstone, fine- to coarse-grained, grey, slightly calcareous, coquina-like; contains a 10-12 cm-thick layer filled with *Buchia* at its top; large *Astarte*? sp. indet. appear here for the first time; large broad and flat *B. okensis sensu lato* noted only rarely in this layer; fossils collected from this layer (**GSC Loc. 19298**; Field No. 52s.1) include:

Buchia okensis (Pavlow 1907) *forma typica*.

22 — ~5.8-7.3 — 173.4-202.2

(The upper 3.5-4.5 m of the unit occupy the northern wall of the first hogback immediately south of the bottom of the first gully described above; this part of the unit consists of dense, fine-grained, yellowish-grey to bluish-grey sandstone mostly very poor in fossils.)

Sandstone, mostly fine-grained, dense; mostly poor in fossils.

The lower 2.1-2.7 m of this unit occupy the bottom of the first gully; this part of the unit consists of yellowish-grey sandstone; a 5-8 cm-thick layer abundant with large *Buchia* noted 60-70 cm above its base; fossils from this layer (**GSC Loc. 19334**; Field No. 52s.2) include:

Buchia okensis (Pavlow 1907) *sensu lato*;
B. uncitoides (Pavlow 1907) *sensu lato*;
B. okensis var. *canadiana* (Crickmay 1930);
B. okensis aff. var. *canadiana* (Crickmay 1930);
B. okensis var. *subokensis* (Pavlow 1907);
B. okensis aff. var. *subokensis* (Crickmay 1930);
B. uncitoides var. *spasskenskoides* (Crickmay 1930); and
a transitional form between *B. volgensis* -like var. of *B. okensis sensu lato*.

Fossils from a 10-15 cm-thick layer of bluish-grey sandstone rich in *Buchia* from about 2.0-2.4 m above layer 52s.2 (**GSC Loc. 19302**; Field No. 52s.3) include:

Buchia okensis.

About 1.2-1.3 m above layer 52s.3, **GSC Loc. 19337** (Field No. 52s.4) was collected from an 8 cm-thick layer of greenish-grey sandstone containing dispersed *Buchia* shells; this lot includes:

Buchia uncitoides; and
B. okensis.

About 2.0 m above layer 52s.4, **GSC Loc. 19326** (Field No. 52s.5) was collected from a 22 cm-thick layer of grey sandstone full of shells and large shale fragments; it includes two thin layers of very calcareous sandstone with abundant *Dentalium* sp. indet. and *Buchia* shells noted in thin layers both above and below the *Dentalium* shells; casts of belemnites also noted in this layer; the layer appears to be pronouncedly lenticular and to pinch out along strike; the fauna of this layer includes:

Buchia uncitoides.

23 — ~7.6 — 181.0-209.8

(This unit forms the top of the hogback situated between the more northerly first gully described above and the second gully from the north that bisects the southwest ridge of the main body of

Unit	Unit Description	Thickness (m)	Total Thickness Above Base (m)

Grassy Island.)

Sandstone, fine-grained, grey, hard and dense (quartzite-like in places); mostly poor in fossils or even barren of them.

A 45 cm-thick bed of hard, bluish-grey, thinly bedded laminated sandstone is noted 4.6 m above the base of the unit; this layer is fairly rich in *Buchia* and other fossils which are noted largely in thin layers but are also present in the well-sorted sandstone between these coquina-like layers; large *B. okensis sensu lato* noted in one of the layers only and are mostly fragmentary or broken in pieces; smaller *Buchia* noted everywhere and are well preserved; *Buchia* are mostly segregated from all other fossils; fossils from this part of the unit (**GSC Loc. 19289**; Field No. 52s.6) include:

Buchia uncitoides; and
B. okensis.

Higher, the unit is generally fossiliferous throughout; fossils from the 30-45 cm-thick bed of brownish-grey to green sandstone noted 45-90 cm above bed 52s.6 (**GSC Loc. 19357**; Field No. 52s.7; this level is on the southern side of the hogback, 0.9-1.2 m below its top) include:

two specimens of large *B. okensis sensu lato*; younger specimens are more common;
the majority of *Buchia* belong to *B.* ex gr. *uncitoides sensu lato*.

Fossils from a 8 cm-thick layer of dark greenish-grey sandstone with abundant *Buchia* and a 15 cm-thick layer of lighter-coloured, less fossiliferous sandstone overlying the underlying layer (**GSC Loc. 19356**; Field No. 52s.8; the unit 52s.8 occupies the southern base of the hogback) include:

Buchia uncitoides; and
B. okensis (large *B. okensis sensu lato* seem to be absent in this unit).

24		~1.6-1.8	182.6-211.6

Sandstone, fine-grained, greenish-blue, calcareous; *Buchia* and other fossils abundant in the uppermost 20-25 cm, elsewhere poor in fossils.

Fossils from the topmost 20-25 cm (**GSC Loc. 19309**; Field No. 52s.9) include:

Buchia okensis (Pavlow 1907) *sensu lato* (**GSC No. 17471**, Jeletzky, 1965, pl. 7, figs. 4A-D);
Buchia okensis (Pavlow 1907) *sensu lato* var. (**GSC No. 17469**, Jeletzky, 1965, pl. 7, figs. 2A-D);
Buchia okensis (Pavlow 1907) var. *subokensis* (Pavlow 1907) (**GSC No. 17474**, Jeletzky, 1965, pl. 7, figs. 7A-D); and
B. uncitoides (Pavlow 1907) var. *spasskenskoides* (Crickmay 1930) (**GSC No. 17481**, Jeletzky, 1965, pl. 7, figs. 14A-D).

25		0.23-0.25	182.8-211.8

Sandstone, fine-grained, bluish-grey, massive; relatively poor in fossils but contains some *B. okensis sensu lato* which seldom reach large size.

Fossils from throughout the unit (**GSC Loc. 19327**; Field No. 52s.10) include:

Buchia okensis (Pavlow 1907) *sensu lato*; and
Buchia okensis (Pavlow 1907) var. *subokensis* (Pavlow 1907).

26		~1.5-1.7	184.3-213.5

Sandstone, fine-grained, greenish-grey, massive; almost barren of fossils except for a few immature *Buchia uncitoides* (Pavlow 1907) *sensu lato*; none collected.

27		0.36-0.43	184.7-213.9

Unit	Unit Description	Thickness (m)	Total Thickness Above Base (m)

Sandstone, fine-grained, grey, calcareous.

Buchia abundant in the lower 18-20 cm of the unit; the fauna of this layer (**GSC Loc. 19346**; Field No. 52s.11a) includes:

Buchia okensis (Pavlow 1907) *sensu lato* var. (**GSC No. 17468**, Jeletzky, 1965, pl. 7, figs. 1A-D); and

Buchia aff. *uncitoides* (Pavlow 1907) *sensu lato* (**GSC No. 17472**, Jeletzky, 1965, pl. 7, figs. 5A-C).

The upper 10-12 cm of the unit contain clusters and scattered, solitary specimens of *Buchia*; two or three separate, thin layers tightly packed with *Buchia* also noted; large, sparsely-ribbed *B.* ex gr. *okensis* predominate in this part of the unit and reach larger dimensions than in the overlying units; fossils from this part of the unit (except for its topmost 8-10 cm) (**GSC Loc. 19316**; Field No. 52s.11b) include:

Buchia okensis (Pavlow 1907) var. *canadiana* (Crickmay 1930) (**GSC No. 17470**, Jeletzky, 1965, pl. 7, figs. 3A-D); and

Buchia okensis (Pavlow 1907) *sensu lato* var. (**GSC No. 17519**, Jeletzky, 1965, pl. 22, figs. 4A-D).

Another layer immediately above the last, 8-10 cm thick and with abundant *Buchia*, marks the top of the unit; its fauna (**GSC Loc. 19314**; Field No. 52s.11c) includes:

Buchia aff. *uncitoides* (Pavlow 1907) *sensu lato* (**GSC No. 17478**, Jeletzky, 1965, pl. 7, figs. 11A-C); and

Buchia uncitoides (Pavlow 1907) var. *spasskenskoides* (Crickmay 1930) (**GSC No. 17479**, Jeletzky, 1965, pl. 7, figs. 12A-C).

28 ~0.46-0.61 185.2-214.5

Sandstone, as in unit 27; solitary *Buchia* noted scattered throughout; two thin layers 2-8 cm thick packed tight with *Buchia* noted in the unit; *Buchia* fauna remains the same throughout the unit, with the large, sparsely-ribbed *B.* ex gr. *okensis* predominant.

Fossils from throughout the unit (**GSC Loc. 19274**; Field No. 52s.12) include:

Buchia uncitoides; and

B. okensis.

29 0.30-0.46 185.5-215.0

Sandstone, fine-grained, bluish-grey; two layers rich in *Buchia* noted in the middle 8-10 cm; the lower of these is rich in slender and small *B.* ex gr. *uncitoides sensu lato*, while the upper one contains larger and coarsely-ribbed *B.* ex gr. *okensis*; fossils from both layers (**GSC Loc. 19333**; Field No. 52s.13) include:

Buchia uncitoides; and

B. okensis.

30 1.7-1.8 187.2-216.8

Sandstone, fine-grained, dark greyish-green, massive.

The lower 1.2 m contain only a few immature *Buchia* cf. *uncitoides* (Pavlow) *sensu lato*; none collected.

The upper 45-60 cm of the unit is rich in large *Buchia* in its lower 10-12 cm; fossils from this interval (**GSC Loc. 19353**; Field No. 52s.14a) include:

Buchia okensis.

The topmost 4 cm of the unit is packed tight with large *Buchia*; fossils from this layer (**GSC Loc. 19324**;

Unit	Unit Description	Thickness (m)	Total Thickness Above Base (m)
	Field No. 52s.14b) include: *Buchia uncitoides*; and *B. okensis*.		
31	Sandstone, fine-grained, yellowish-green; poor in fossils, none collected.	~0.30-0.46	187.5-217.2
32	(This unit can be followed for about 100 metres east of a major north-south trending fault crossing the west part of the main body of Grassy Island.) Sandstone, fine-grained, dark grey, somewhat calcareous, surface differentially weathered; lithologically distinctive and laterally persistent; abundant with various fossils for the most part. Fossils from the basal 15-18 cm (**GSC Loc. 19348**; Field No. 52s.15) include: *Buchia uncitoides*. The middle 15 cm are almost unfossiliferous and were not collected. Fossils from the upper 2-5 cm (with abundant *Buchia*) (**GSC Loc. 19335**; Field No. 52s.15a) include: *Buchia uncitoides*. Both fossil lots lack *Buchia okensis* and are dominated by small *Buchia* forms.	0.33-0.38	187.8-217.6
33	Sandstone, fine-grained, grey; the lower 10-15 cm are almost barren of fossils; the upper 8-10 cm are rich in small and large *Buchia*; fossils from this layer (**GSC Loc. 19325**; Field No. 52s.16) include: *Buchia uncitoides*; and *B. okensis*.	0.18-0.23	188.0-217.9
34	Sandstone, fine-grained, grey; the lower 35-40 cm are almost unfossiliferous, the upper 2-5 cm are packed tight with small, possibly immature *Buchia*, forming a coquina; fossils from this top layer (**GSC Loc. 19311**; Field No. 52s.17) include: *Buchia uncitoides*; and *B. okensis*.	0.38-0.46	188.4-218.3
35	Sandstone, fine-grained, grey, largely unfossiliferous except for a centimetre-thick layer at the top which includes a concretion-like lens with abundant *Buchia*; fossils from this layer (**GSC Loc. 19312**; Field No. 52s.18) include: *Buchia uncitoides*; and *B. okensis*.	0.30-0.33	188.7-218.7
36	Sandstone, fine-grained, grey; consists of alternating layers of fossiliferous and unfossiliferous rock. The lowermost 60 cm of the unit are almost barren of fossils and were not collected; strata about 15-20 cm above this interval are very rich in large *Buchia*; this layer also contains some large, thick-shelled bivalves; fossils (**GSC Loc. 19283**; Field No. 52s.19a) include: *Buchia uncitoides*; and	1.3-1.6	190.0-220.3

Unit	Unit Description	Thickness (m)	Total Thickness Above Base (m)

B. okensis.

The next higher 45-60 cm are packed tight with various fossils; fossils from the lower 15-18 cm of this interval (**GSC Loc. 19329**; Field No. 52s.20a) include:
Buchia uncitoides; and
B. okensis.

The overlying 10-15 cm are less fossiliferous and were not collected.

The middle 20-20 cm of the unit were not collected. Fossils from the remaining, upper part of the unit (**GSC Loc. 19359**; Field No. 52s.20b) include:
Buchia uncitoides;
B. okensis; and
Acroteuthis sp. cf. *impressa* (Gabb).

37		0.13-0.15	190.1-220.4

Sandstone, fine-grained, grey; contains a few, very thin layers (fraction of a centimetre only) containing *Buchia*; fossils from these layers (**GSC Loc. 19363**; Field No. 52s.21) include:
Buchia uncitoides.

38		1.4	191.5-221.8

(This unit forms the lower part of the southern wall of the second gully described above.)

Sandstone, mostly fine-grained, greenish-grey, massive, nearly barren of fossils; a few *Buchia* collected (**GSC Loc. 19313**; Field No. 52s.22); the top is marked by a row of loaf-like concretions of dark green, calcareous sandstone persistent along the strike; fossils include:
Buchia okensis.

39		~0.9-1.1	192.4-222.9

Sandstone, as in unit 38. Almost barren of fossils except for a 2-8 cm-thick layer at the top where a few lenses are packed tight with mostly small *Buchia*; fossils from this top layer (**GSC Loc. 19351**; Field No. 52s.23) include:
Buchia uncitoides; and
B. okensis.

40		0.5-0.6	192.9-223.5

Sandstone, fine-grained, green, calcareous; includes a very persistent layer with abundant *Buchia* which are found with both valves intact in nearly all cases.

Fossils from throughout the unit (**GSC Loc. 19355**; Field No. 52s.24) include:
Buchia uncitoides; and
B. okensis.

41		0.53-0.56	193.4-224.1

(This unit forms the upper third of the steep southern wall of the second gully described above.)

Sandstone, fine-grained, brownish-grey.

The lower 35 cm of the unit are poor in *Buchia*; fossils from this level (**GSC Loc. 19339**; Field No. 52s.25a) include:
Buchia uncitoides; and

Unit	Unit Description	Thickness (m)	Total Thickness Above Base (m)
	B. okensis. The upper 18-20 cm of the unit are packed tight with *Buchia*; fossils from this level (**GSC Loc. 19288**; Field No. 52s.25b) include: *Buchia uncitoides*; and *B. okensis*.		
42	Sandstone, fine-grained, yellowish-grey. The lower 45-50 cm of the unit are poor in *Buchia*; fossils collected (**GSC Loc. 19342**; Field No. 52s.26a) include: *Buchia uncitoides*; and *B. okensis*. An 8-12 cm-thick layer in the upper part of the unit is rich in *Buchia*; fossils from this layer (**GSC Loc. 19345**; Field No. 52s.26b) include: *Buchia okensis*.	0.53-0.64	194.0-224.7
43	Sandstone, fine-grained, yellowish-grey; the lower 60 cm is almost barren of fossils and was not collected. The upper 30 cm of the unit is rich in *Buchia*; fossils from this part of the unit (**GSC Loc. 19290**; Field No. 52s.27) include: *Buchia uncitoides*; and *B. okensis*.	0.9	194.9-225.6
	(Units 44, 45, and 46 form the uppermost part of the south wall of the second gully from the north described above; the hogback formed in the ridge south of the second gully is less pronounced than the first hogback to the north; a secondary depression at the north end of this second hogback, about 1.8-2.1 m deep, is just south of the top of unit 46; south of this secondary depression, another crest atop the second hogback is formed by units 49, 50, and 51; this crest overhangs the north side of the third gully from the north that bisects the southwest ridgeline of Grassy Island.)		
44	Sandstone, fine- to coarse-grained, grey; the top of the unit (2-12 cm thick) consists of thinly bedded, fine-grained sandstone; the base is marked by a minor erosional boundary and the upper contact with unit 45 is uneven and hardened; poor in *Buchia* except in a 2-5 cm-thick layer near the top; fossils from this layer (**GSC Loc. 19350**; Field No. 52s.28) include: *Buchia uncitoides*; and *B. okensis*.	~0.3-0.5	195.2-226.1
45	Sandstone, coarse-grained, grey, with a few dispersed fine pebbles; a 2-5 cm-thick basal conglomerate separates it from unit 44; very rich in *Buchia*; some belemnites also noted. Fossils from throughout the unit, including the basal conglomerate (**GSC Loc. 19310**; Field No. 52s.29), include: *Buchia uncitoides*; and *B. okensis*.	0.13-0.15	195.3-226.3

Unit	Unit Description	Thickness (m)	Total Thickness Above Base (m)
46	Sandstone, fine-grained, grey, calcareous; packed tight with *Buchia*; some ammonites also noted. Fossils from throughout the unit (**GSC Loc. 19294**; Field No. 52s.30) include: *Buchia uncitoides*; *B. okensis*; and ammonite, juvenile, possible lytoceratid.	0.15	195.4-226.4
47	Sandstone, fine-grained, grey; rich in the same *Buchia* throughout its thickness. Fossils collected from throughout the unit (**GSC Loc. 19336**; Field No. 52s.31) include: *Buchia uncitoides*.	~1.1	196.5-227.5
48	Sandstone, very fine-grained, grey, weathers rust-brown, soft and friable; grades into siltstone; poor in fossils, no collection made.	0.20-0.25	196.7-227.8
49	(This unit forms the crest of the southern side of the second hogback.) Sandstone, fine-grained, greenish-grey to green, thinly bedded, contains lenses of darker coloured, thinly bedded sandstone; mostly poor in fossils. Fossils from the basal 10-12 cm of the unit (**GSC Loc. 19332**; Field No. 52s.32) include: *Buchia uncitoides*; and *B. okensis*. A *Buchia*-bearing layer 1-8 cm thick at ca. 1.2 m above the base of the unit (**GSC Loc. 19323**; Field No. 52s.33) includes: *Buchia uncitoides*; and *B. okensis*.	~1.8	198.5-229.6
50	(This unit persists right across the island and in its eastern half forms the southern wall of the second hogback.) Sandstone, coarse-grained, greenish-grey to grey, calcareous, contains dispersed grit and pebbles; in places the contact with unit 49 is very sharp and suggestive of an erosional disconformity; elsewhere, however, it is more gradational; packed tight with *Buchia* and other fossils. Fossils from throughout the unit (**GSC Loc. 19286**; Field No. 52s.34) include: *Buchia uncitoides*.	0.08-0.13	198.6-229.7
51	Sandstone, as in unit 50; contains two or three layers 10-15 cm thick, each very rich in *Buchia*; the *Buchia* forms are the same in all three layers. Fossils from the upper layer (**GSC Loc. 19330**; Field No. 52s.35) include: *Buchia uncitoides*.	0.8-0.9	199.4-230.6

Unit	Unit Description	Thickness (m)	Total Thickness Above Base (m)
52	Sandstone, fine-grained, greenish-grey, thinly bedded; barren of fossils except for a few immature *Buchia uncitoides sensu lato*; none collected.	~0.4	199.8-231.0
53	Sandstone, fine-grained, dark grey, speckled; practically barren of fossils except for the lower 2-5 cm which carry some *Buchia*; fossils from this layer (**GSC Loc. 19340**; Field No. 52s.36) include: *Buchia uncitoides*.	0.28-0.30	200.1-231.3
54	Sandstone, fine-grained, grey, thinly bedded, weathering "pillow-like"; the upper part of the unit is abundant with the same *Buchia* as those present in its lower part, but none collected. The lowermost 8-10 cm of the unit are filled with *Buchia*; fossils from this part of the unit (**GSC Loc. 19287**; Field No. 52s.37) include: *Buchia uncitoides*; and *B. okensis*.	0.25-0.28	200.3-231.6
55	Sandstone, fine-grained, brownish-yellow to greenish-grey, hard, some inclusions of calcareous sandstone; generally poor in fossils but contains *Buchia*-bearing layers at several levels. Fossils from 15-30 cm above the base of the unit (**GSC Loc. 19306**; Field No. 52s.38) include: *Buchia uncitoides*. Fossils from 0.9-1.1 m above the base of the unit (**GSC Loc. 19305**; Field No. 52s.39) include: *Buchia okensis* (Pavlow 1907) *sensu lato* (**GSC No. 17487**, Jeletzky, 1965, pl. 8, figs. 6A-D) *Buchia okensis* (Pavlow 1907) *sensu lato* var. (**GSC No. 17482**, Jeletzky, 1965, pl. 8, figs. 1A-D; **GSC No. 17484**, Jeletzky, 1965, pl. 8, figs. 3A-D; **GSC No. 17485**, Jeletzky, 1965, pl. 8, figs. 4A-D; **GSC No. 17500**, Jeletzky, 1965, pl. 9, figs. 7A-D; **GSC No. 17501**, Jeletzky, 1965, pl. 9, figs. 8A-D); *B.* aff. *okensis* (Pavlow 1907) *sensu lato* (**GSC No. 17483**, Jeletzky, 1965, pl. 8, figs. 2A-D; **GSC No. 17486**, Jeletzky, 1965, pl. 8, figs. 5A-D; **GSC No. 17488**, Jeletzky, 1965, pl. 8, figs. 7A-D); *B. uncitoides* (Pavlow 1907) *sensu lato* var. (**GSC No. 17498**, Jeletzky, 1965, pl. 9, figs. 5A-D; **GSC No. 17502**, Jeletzky, 1965, pl. 9, figs. 9A-D; **GSC No. 17503**, Jeletzky, 1965, pl. 9, figs. 10A-D; **GSC No. 17504**, Jeletzky, 1965, pl. 9, figs. 11A-D; **GSC No. 17505**, Jeletzky, 1965, pl. 9, figs. 12A-D; **GSC No. 17508**, Jeletzky, 1965, pl. 9, figs. 15A-E; **GSC No. 17510**, Jeletzky, 1965, pl. 9, figs. 17A-D; **GSC No. 17514**, Jeletzky, 1965, pl. 9, figs. 21A-E; **GSC No. 17516**, Jeletzky, 1965, pl. 9, figs. 23A-D) *B. uncitoides* var. *catamorpha* (Crickmay 1930) (**GSC No. 17506**, Jeletzky, 1965, pl. 9, figs. 13A-D; **GSC No. 17511**, Jeletzky, 1965, pl. 9, figs. 18A-D); *B. uncitoides* var. *acutistriata* (Crickmay 1930) (**GSC No. 17495**, Jeletzky, 1965, pl. 9, figs. 2A-D; **GSC No. 17507**, Jeletzky, 1965, pl. 9, figs. 14A-E; **GSC No. 17512**, Jeletzky, 1965, pl. 9, figs. 19A-D; **GSC No. 17513**, Jeletzky, 1965, pl. 9, figs. 20A-E); *B. uncitoides* var. *spasskenskoides* (Crickmay 1930) (**GSC No. 17491**, Jeletzky, 1965, pl. 8, figs. 10A-D; **GSC No. 17492**, Jeletzky, 1965, pl. 8, figs. 11A-D; **GSC No. 17493**, Jeletzky, 1965, pl. 8, figs. 12A-D; **GSC No. 17494**, Jeletzky, 1965, pl. 9, figs. 1A-D; **GSC No. 17496**, Jeletzky, 1965, pl. 9, figs. 3A-D; **GSC No. 17497**, Jeletzky, 1965, pl. 9, figs. 4A-D; **GSC No. 17499**, Jeletzky, 1965, pl. 9, figs. 6A-D; **GSC No. 17509**, Jeletzky, 1965, pl. 9, figs. 16A-D; **GSC No. 17515**, Jeletzky, 1965, pl. 9, figs. 22A-D); and	6.7	207.0-238.0

Unit	Unit Description	Thickness (m)	Total Thickness Above Base (m)

B. aff. *uncitoides* var. *spasskenskoides* (Crickmay 1930) (**GSC No. 17489**, Jeletzky, 1965, pl. 8, figs. 8A-D; **GSC No. 17490**, Jeletzky, 1965, pl. 8, figs. 9A-D).

Fossils from an 8-10 cm-thick layer with abundant *Buchia* at 1.5-1.7 m above the base of the unit (**GSC Loc. 19315**; Field No. 52s.40) include:

Buchia uncitoides.

Fossils from an 8-12 cm-thick layer of brownish-yellow to greenish-yellow, fine-grained sandstone tightly packed with *Buchia* at 2.5-2.6 m above the base of the unit (**GSC Loc. 19307**; Field No. 52s.41) include:

Buchia uncitoides.

Fossils from a 12-15 cm-thick layer tightly packed with *Buchia* at 3.0 m above the base of the unit (**GSC Loc. 19328**; Field No. 52s.42) include:

Buchia uncitoides; and
possible lytoceratid(?) ammonite, indet.

The interval 3.2-4.3 m above the base of the unit is poor in fossils and was not collected.

Fossils from another sandstone bed rich in large *Buchia* shells at 4.3-4.4 m above the base of the section (**GSC Loc. 19285**; Field No. 52s.43) include:

Buchia uncitoides.

Fossils from an 8 cm-thick sandstone layer similar to the underlying beds and rich in *Buchia* at 4.7 m above the base of the unit (**GSC Loc. 19354**; Field No. 52s.44) include:

Buchia uncitoides; and
B. okensis.

Fossils from some small sandstone lenses in the middle of the interval 4.7-5.6 m above the base of the unit (**GSC Loc. 19338**; Field No. 52s.45) include:

Buchia uncitoides.

Fossils from the interval 5.6-5.9 m above the base of the unit (**GSC Loc. 19284**; Field No. 52s.46) include:

Buchia uncitoides (Pavlow 1907) var. *spasskenskoides* (Crickmay 1930) (**GSC No. 16600**, Jeletzky, 1965, pl. 10, figs. 3A, B; **GSC No. 16605**, Jeletzky, 1965, pl. 10, figs. 10A, B);
B. okensis; and
lytoceratid(?) ammonite, indet.

Buchia uncitoides Zone

The base of the *Buchia uncitoides* Zone proper begins above the level of GSC Loc. 19305 (Field No. 52s.39), with GSC Loc. 19315 (Field No. 52s.40) assigned to its base; the underlying part of unit 55 is thus assigned to the topmost part of the "overlap beds" between the *Buchia okensis* and *Buchia uncitoides* zones.

56		~3.0	210.0-241.0

Sandstone, coarse-grained, darker than that of unit 55, poorly-sorted, generally more calcareous; separated from unit 55 by an erosional disconformity; a few dispersed pebbles and grit noted in the basal few centimetres but do not form a basal conglomerate; the upper part contains numerous lenses of more brownish-green, calcareous sandstone with differentially weathered surface; fossils abundant throughout the

Unit	Unit Description	Thickness (m)	Total Thickness Above Base (m)

thickness.

Fossils from the basal 90 cm (**GSC Loc. 19282**; Field No. 52s.47) include:
Spiticeras (*Spiticeras*) sp. indet. juven. **(GSC No. 16609**, Jeletzky, 1965, pl. 11, fig. 3).

Fossils from the interval 0.9-1.8 m above the base of the unit (**GSC Loc. 19304**; Field No. 52s.48) include:
Buchia uncitoides; and
Lytoceras sp.

Fossils from the upper 1.2 m of the unit (**GSC Loc. 19291**; Field No. 52s.49) include:
Buchia uncitoides.

57		~0.8	210.8-241.8

Sandstone, fine-grained, greenish-grey; barren of fossils except for two layers rich in *Buchia*.

Fossils from a 1-2 cm-thick layer at the base of the unit (**GSC Loc. 19361** Field No. 52s.50) include:
Buchia uncitoides.

Fossils from the 8-12 cm-thick layer capping the unit (**GSC Loc. 19317**; Field No. 52s.51) include:
Buchia uncitoides.

58		1.2	212.0-243.0

Sandstone, fine-grained, greenish-grey, contains numerous concretions of lighter-coloured, calcareous sandstone; mostly barren of fossils but containing two thin layers rich in small *Buchia uncitoides* (Pavlow) *sensu lato*; none collected.

59		0.30-0.46	212.3-243.4

Sandstone, fine-grained, brown, calcareous; calcareous cement is distributed irregularly; persistent laterally across the island and rich in fossils.

Fossils from throughout the unit (**GSC Loc. 19344**; Field No. 52s.52) include:
Buchia uncitoides; and
Phylloceras cf. *onoense* Stanton.

60		0.28-0.30	212.6-243.7

Sandstone, fine-grained, greenish-yellow, massive; almost barren of fossils except for occasional *Acroteuthis* sp. indet. and *Buchia uncitoides* (Pavlow) *sensu lato*; none collected.

61		1.8	214.4-245.5

(This unit occupies the bottom of the wide depression [fourth gully] from the north that bisects the southwest ridge of Grassy Island and separates the third and fourth [southernmost] hogbacks; the top of this unit is marked by a 8-10 cm-thick bed of bluish-grey to greenish-grey siltstone.)

Sandstone, as in unit 58; concretions rich in fossils locally.

Fossils from concretions in the lower 90 cm of the unit (**GSC Loc. 19293**; Field No. 52s.53a) include:
Spiticeras (*Spiticeras*) sp. indet. juvenile [possibly young representative of *S.* (*S.*) *scriptus* (Strachey 1965)];
S. (*S.*) cf. *scriptus* (Strachey 1965);
S. (*S.*) cf. *mojsvari* Uhlig 1903; and
lytoceratid ammonite, indet.

Unit	Unit Description	Thickness (m)	Total Thickness Above Base (m)
	Fossils from the upper 90 cm of the unit (**GSC Loc. 19301**; Field No. 52s.53b) include: *B*. ex gr. *volgensis* (small examples); *Lytoceras* sp. cf. *batesi* (Trask); and *Phylloceras* sp.		
62		~0.15-0.25	214.6-245.8
	Sandstone, fine-grained, greenish-grey, concretionary, hard; rich in *Buchia*. Fossils collected from throughout the unit as **GSC Loc. 19308** (Field No. 52s.54) include: *Buchia uncitoides*.		
63		1.5-1.8	216.1-247.6
	Sandstone, fine-grained, greenish-yellow, massive; barren of fossils for the most part but includes thin layers rich in *Buchia* at several levels. From 1.1-1.2 m above base, two layers about one centimetre thick (**GSC Loc. 19341**; Field No. 52s.55;) yielded: *Buchia* ex gr. *keyserlingi-volgensis*. About 1.5 m above the base of the unit another 8-10 cm-thick layer with abundant *Buchia* (**GSC Loc. 19352**; Field No. 52s.56) yielded: *Buchia uncitoides*.		
63a		0.8-0.9	216.9-248.5
	Sandstone, fine-grained, brownish-green, calcareous, concretionary; locally rich with *Buchia* and other bivalves; fossils noted largely in clusters or concretion-like bodies of more calcareous, lighter coloured coquinoid sandstone; lithology and fossil content vary along strike. Fossils from throughout the unit (**GSC Loc. 19297**; Field No. 52s.57) include: phylloceratid ammonite, gen. et sp. indet. (**GSC No. 16617**, Jeletzky, 1965, pl. 12, figs. 3A, B); and *Lytoceras* sp. cf. *batesi* (Trask).		
64		1.8-2.0	218.7-250.5
	Sandstone, fine-grained, brownish-green, with a few calcareous lenses and concretions; fossils relatively scarce except in a few lenses and concretions and in some thin layers irregularly distributed throughout the unit. Fossils from throughout the unit (**GSC Locs. 19831** and **19331**; Field No. 52s.58) include: *Buchia uncitoides*; and lytoceratid ammonite, indet.		
	(All of the underlying part of the section was measured along the west side of the main body of Grassy Island. The beds forming the steep southern side of the main body of Grassy Island can be traced eastward across a 100 metre-wide sea channel [a fault zone] to the northern end of a rocky islet southeast of the main body of Grassy Island. The section is resumed at the north end of this rocky islet and is measured to southward across the rocky islet.)		
65		1.8-2.1	220.5-252.6
	(Forms a pronounced hogback at the northern end of the rocky islet.)		

Unit	Unit Description	Thickness (m)	Total Thickness Above Base (m)

Sandstone, fine-grained, brownish-yellow, calcareous, partly differentially weathered and honeycombed on the surface; fossils abundant throughout but the majority are concentrated in irregularly shaped cluster- and concretion-like bodies distributed irregularly throughout its thickness.

Fossils from the lowermost 60-90 cm of the unit (**GSC Loc. 19343**; Field No. 52t.a) include:
Buchia uncitoides.

The upper 30-45 cm of the unit are packed tight with *Buchia*; fossils from this part of the unit in three different places (**GSC locs. 20054**; Field No. 52t.1; also **GSC Locs. 19360** and **20667**) include:
Buchia uncitoides;
Phylloceras cf. *onoense* Stanton;
Lytoceras cf. *batesi* (Trask); and
Spiticeras (*Spiticeras*) cf. *mojsvari* Uhlig 1903 (**GSC No. 16619**, Jeletzky, 1965, pl. 12, fig. 5).

Fossils collected in 1949 from throughout the unit on the southern end of the main body of Grassy Island (**GSC Loc. 18380**; Field No. 52t) include:
Buchia uncitoides;
Phylloceras cf. *onoense*; and
Lytoceras cf. *batesi*.

66		~0.3	220.8-252.9

Sandstone, brownish-grey to dark brown, soft, calcareous; rich in *Buchia* and other bivalves.

Fossils from throughout the unit (**GSC Loc. 20653**; Field No. 52t.2) include:
Buchia uncitoides.

67		0.8-0.9	221.6-253.8

Sandstone, fine- to medium-grained, dark grey to greenish-grey, sometimes calcareous; at the middle of the unit an ~15 cm-thick layer of softer, dark grey, laminated sandstone noted; at the base a 5-30 cm-thick bed of somewhat soft, calcareous, laminated sandstone noted, separating units 67 and 66; some *Buchia* noted locally.

Fossils from throughout the unit (**GSC Loc. 20047**; Field No. 52t.3) include:
Buchia uncitoides.

68		~1.5	223.1-255.3

(Completely covered by water in a deep crevice crossing the the rocky islet.)

69		~1.2	224.3-256.5

Sandstone, fine-grained, brownish-grey, resistant; contains clusters and lenses of *Buchia* and other fossils; subdivided into beds 15-30 cm thick; fossils are poorly preserved and comparatively rare, even in the clusters and lenses.

Fossils from throughout the unit (**GSC Loc. 20657**; Field No. 52t.4) include:
Buchia uncitoides.

70		~0.2	224.5-256.7

Silstsone, ash- to dark grey, sandy, grades locally into shale; surface exhibits a peculiar square- to pentagon-like weathering; barren of fossils.

71		3.7	228.2-260.4

Unit	Unit Description	Thickness (m)	Total Thickness Above Base (m)

Sandstone, fine-grained, clay-rich, brownish-grey to buff, somewhat calcareous; interbedded with a similar sandy siltstone in layers and beds from 2-30 cm thick throughout most of the unit's thickness; mostly poor in fossils but locally contains a few lenses and layers with abundant *Buchia* and other bivalves; some ammonites and belemnites also noted; ferruginous lenses and layers noted throughout unit.

Fossils from the lower 1.2 m of the unit (**GSC Loc. 20670**; Field No. 52t.5) include:
Buchia uncitoides; and
ammonite, indet.

Fossils from the middle 1.2 m of the unit (**GSC Loc. 20663**; Field No. 52t.6) include:
Buchia uncitoides; and
B. ex gr. *keyserlingi*.

Fossils from the upper 1.2 m of the unit (**GSC Loc. 20625**; Field No. 52t.7) include:
Buchia uncitoides.

72 — 0.6 — 228.8-261.0

(Forms the bottom of a 2.4-3.0 m-deep crevice that crosses the southeastern part of the rocky islet.)

Siltstone, dark grey to brownish-grey, partly laminated, sandy; interbedded with thin layers and laminae of superficially similar, fine-grained sandstone, somewhat soft; apparently barren of fossils.

73 — 0.6 — 229.4-261.6

(Forms the steep southern slope of the crevice discussed just above.)

Sandstone, fine-grained, dark grey, weathers brownish-grey, locally calcareous, soft; numerous, irregularly shaped, shaly concretions, 5-8 cm in diameter, weathering light grey to white grey, are dispersed throughout the thickness; at the upper boundary these concretions occur as lenses of sub-rounded pebbles together with numerous *Buchia* and other shells; lower boundary is sharply marked by a layer of shell fragments and grit; fossils noted either dispersed singly throughout unit or forming accumulations in concretions; in the west part of the islet, the sandstone is coarser and the fossils more plentiful; in the middle of the islet, the above lenses grade into a regular pebble conglomerate 25-30 cm thick; in the east part of the islet, the top of the unit is barren of conglomerate and fossils.

Fossils from the above described lenses of pebble conglomerate in the middle part of the unit (**GSC Loc. 20669**; Field No. 52u.1a) include:
Buchia uncitoides.

Fossils from throughout the unit on both sides of the islet (**GSC Loc. 20652**; Field No. 52u.1) include:
Buchia uncitoides; and
Lytoceras sp.

74 — ~1.2 — 230.6-262.8

(Forms the upper part of the southern slope of the crevice discussed just above and the crest of a small, secondary hogback above it on the south.)

Sandstone, fine-grained, dark grey, weathers brownish-grey, locally calcareous, without siltstone interbeds; locally honeycombed on the surface, grades into unit 75; lower boundary is sharp wherever conglomerate is present in unit 73; the upper 30 cm or so is largely honeycombed on the surface and weathers lighter brown; it contains concretion-like clusters of calcareous sandstone with abundant fossils including *Buchia*, ammonites, and belemnites.

Unit	Unit Description	Thickness (m)	Total Thickness Above Base (m)

Fossils from throughout the unit (**GSC Loc. 20627**; Field No. 52u.2) include:
Buchia uncitoides; and
lytoceratid ammonite, indet.; and
Acroteuthis sp.

75		0.9	231.5-263.7

Sandstone, much as in unit 74, but more calcareous and clay-rich and locally grading into sandy siltstone; rare calcareous lenses with abundant *Buchia* and small, whitish-weathering concretions noted locally; except for the above lenses; single fossils noted dispersed sparsely throughout the unit or in small, dispersed clusters.

Fossils from throughout the unit (**GSC Loc. 20689**; Field No. 52u.3) include:
Buchia uncitoides; and
B. ex gr. *keyserlingi*.

76		0.9	232.4-264.6

Sandstone, fine-grained, dark grey, weathers brownish-grey, locally calcareous, very soft; interbedded with ash-grey to brownish-grey, sandy shale; lower boundary is marked by two persistent 1-3 cm-thick layers of sandy siltstone weathering whitish-grey; these layers are separated by an equally thin layer of sandstone, weathering brownish-green; forms a depression between units 75 and 77; almost barren of fossils, none collected.

77		~0.6	233.0-265.2

Sandstone, fine-grained, clay-rich, ash-grey to bluish-grey when fresh, weathers greenish to brownish grey, hard, fairly dense and resistant; fossils noted singly or in small clusters scattered in the unit.

Only a few fossils collected from throughout the unit (**GSC Loc. 20668**; Field No. 52v.1), including:
Buchia uncitoides (small specimens); and
Phylloceras sp. indet.

78		2.4	235.4-267.6

Alternating grey sandy shale and siltstone with almost equal amount of fine-grained, clay-rich, light grey sandstone in layers from 2-8 cm thick; about 1.2 m above base a layer of loaf-like, calcareous concretions rich in *Buchia* noted; below this layer the rock is not rich in fossils; another row of such concretions rich in *Buchia* noted about 25 cm above the first concretionary layer.

Fossils from the lower 1.2 m of the unit, including the first concretionary layer (**GSC Loc. 20069**; Field No. 52v.2) include:
Buchia uncitoides (Pavlow 1907) var. (**GSC No. 16606**, Jeletzky, 1965, pl. 10, figs. 14A-C).

Fossils from the upper 1.2 m (**GSC Loc. 20690**; Field No. 52v.3) include:
B.uncitoides sensu lato (**GSC No. 16604**, Jeletzky, 1965, pl. 10, figs. 9A-C); and
lytoceratid ammonite, indet.

79		~1.2-1.4	236.6-269.0

Sandstone, fine-grained, clay-rich, greenish-grey; top marked by a generally persistent layer of sandy siltstone weathering lighter grey and with numerous small burrows filled with cream-coloured siltstone; *Buchia* dispersed evenly throughout or form isolated thin lenses and clusters.

Fossils from throughout the unit (**GSC Loc. 20660**; Field No. 52v.4) include:

Unit	Unit Description	Thickness (m)	Total Thickness Above Base (m)
	Buchia uncitoides; and *B*. ex gr. *keyserlingi*.		
80	(On the east side of the central spit of the rocky islet, formed of shells and shell fragments, the unit is bordered by a deep crevice formed in about 30 cm of soft, sandy shale.) Siltstone, grey, sandy; often grades into very fine-grained, very silty sandstone; abundant concretions and lenses of harder siltstone both irregularly dispersed and in regular rows at 30 cm-thick intervals; *Buchia* are regularly dispersed throughout the unit but form some clusters of shells in concretions locally. Fossils from the lower 1.2 m of the unit (**GSC Loc. 20691**; Field No. 52v.5) include: *Buchia uncitoides*; and *B*. ex gr. *keyserlingi*. Fossils from the upper 0.9-1.1 m of the unit (**GSC Loc. 20666** Field No. 52v.6) include: *Buchia uncitoides*; and *B*. ex gr. *keyserlingi*.	~2.1-2.3	238.7-271.3
81	(This unit is only distinguishable on the east side of the rocky islet; on the west side it seems to be replaced laterally by the upper part of unit 80, or it may pinch out.) Sandstone, medium-grained, dark grey, calcareous, hard, the surface is differentially weathered; boundary with unit 80 is sharp and uneven, with lenses of tightly packed *Buchia* shells noted in places directly above the contact; rich and locally abundant with *Buchia* throughout. Fossils from throughout the unit (**GSC Loc. 20695**; Field No. 52v.7) include: *Buchia uncitoides*; and *Lytoceras* cf. *batesi*.	~0.5	239.2-271.8
82	(Unit is exposed only locally in the bottom of a deep, 0.9-1.5 m-wide crevice separating units 83 and 81 on the east side of the rocky islet; it appears to be mostly faulted out on the west side of the islet.) Shale, dark grey, sandy, soft; interbedded with friable, fine-grained dark grey sandstone; only a few *Buchia* similar to those noted in the underlying and overlying units have been seen, none collected.	0.9-1.5	240.1-273.3
83	Sandstone, coarse-grained, pebbly and gritty, grey, calcareous; abundant with *Buchia* and mostly coquinoid; strongly variable laterally in its lithology and thickness; irregular, lens-like interbeds of pebble conglomerate noted locally and tend to thicken westward. Fossils from the basal, 8-10 cm-thick conglomerate on the west side of the islet, where the unit is 1.5 m thick (**GSC Loc. 20664**; Field No. 52w.1) include: *Acroteuthis* sp.; and *Spiticeras* (*Groebericeras*) sp. indet.? (**GSC No. 16613**, Jeletzky, 1965, pl. 11, fig. 7)'. Fossils collected on the east side of the islet where the unit is 45 cm thick (**GSC Locs. 20169** and **20694**;	0.5-1.5	240.6-274.8

Unit	Unit Description	Thickness (m)	Total Thickness Above Base (m)

Field No. 52w.2) include:
Buchia uncitoides (Pavlow 1907) var. *catamorpha* (Crickmay 1930) (**GSC No. 16614**, Jeletzky, 1965, pl. 11, figs. 8A, B); and
Lytoceras cf. *batesi*.

84 ~0.9 241.5-275.7

Sandstone, fine-grained, light grey, calcareous, hard; grades into unit 83; carries irregular lenses and thin, lenticular layers rich in or abundant with *Buchia*; otherwise only a few isolated *Buchia* shells noted locally; the uppermost 15-20 cm are abundant with *Buchia* and form a bed of coquina-like sandstone.

Fossils from throughout the unit on the east side of the islet (**GSC Loc. 20067**; Field No. 52w.3) include:
Buchia uncitoides.

On the western margin of the islet this bed grades laterally into a 7.5 m-thick bed of sandstone with coquina-sandstone interbeds. Fossils from the topmost 3 m of the 7.5 m-thick sandstone bed here (**GSC Loc. 20655**; Field No. 52w.suppl.) include:
belemnites, indet.;
Lytoceras cf. *batesi*; and
a large *Neocomites sensu lato* sp. nov.?

85 1.2-1.4 242.7-277.1

(Forms a pronounced hogback on the east side of the rocky islet.)

Sandstone, fine-grained, bluish-grey, weathers brownish-grey; contains numerous lenses and clusters of fossils; in such places it is calcareous and coquina-like; the whole unit locally grades into a coquina-like sandy limestone or very limey sandstone.

Fossils from the lower 60 cm of the unit (**GSC Loc. 20644**; Field No. 52w.4) include:
Neocomites sensu lato sp. indet. (**GSC No. 16612**, Jeletzky, 1965, pl. 11, figs. 6A-C).

Fossils from the upper 60-75 cm of the unit (**GSC Loc. 20659**; Field No. 52w.5) include:
Buchia uncitoides

86 ~0.6 243.3-277.7

(Forms the southern base of the hogback described immediately above.)

Sandstone, fine-grained, light grey, weathers brownish-grey, hard; no fossils seen.

87 0.5 243.8-278.2

(Exposed locally along the bottom of a narrow trough between units 86 and 88.)

Sandstone, fine-grained, light grey, weathers brownish-grey, hard; no fossils seen.

88 ~0.8 244.6-279.0

Sandstone, as in unit 87; fairly rich in *Buchia* throughout and abundant with them in the upper 30 cm.

Fossils from throughout the unit (**GSC Loc. 20693**; Field No. 52w.6) include:
Buchia uncitoides.

89 ~0.6 245.2-279.6

Shale, bluish-grey, sandy, grades into similar siltstone; noted in thin layers 2.5-8 cm thick; a 2.5-5 cm-thick

Unit	Unit Description	Thickness (m)	Total Thickness Above Base (m)
	layer abundant with *Buchia* (coquina-like) noted 8-10 cm below the top. Fossils from throughout the unit (**GSC Loc. 20662**; Field No. 52w.7) include: *Buchia uncitoides*.		
90		~1.2-1.4	246.4-281.0
	Sandstone, medium-grained, bluish-grey, weathers dark brown, calcareous, surface differentially weathered in part; *Buchia* noted commonly throughout the unit but nowhere very abundant or well preserved. Fossils from throughout the unit (**GSC Loc. 20665**; Field No. 52w.8) include: *Buchia uncitoides*; and belemnite, indet.		
91		0.6	247.0-281.6
	Sandstone, medium-grained, bluish-grey when fresh, weathers light brown, very calcareous, resistant; also contains lenses and layers of fine-grained, soft sandstone; fossils found mostly as clusters. Fossils from throughout the unit (**GSC Loc. 20658**; Field No. 52w.9) include: *Buchia terebratuloides*; and *B. uncitoides*.		
92		1.2-1.4	248.2-283.0
	Sandstone, as in unit 91, but weathers brown; noted in layers and units from 8-25 cm thick, alternating with equally thick layers and beds of less resistant, finer grained, clay-rich sandstone or sandy, bluish-grey shale; the latter forms the basal 15-20 cm of the unit; fossils are only abundant locally, forming lenses and clusters; elsewhere they are rare, even in the interbeds of very calcareous sandstone. Fossils from throughout the unit (**GSC Loc. 20672**; Field No. 52w.10) include: *Buchia uncitoides*.		
93		0.6-0.8	248.8-283.8
	Sandstone, medium-grained, bluish-grey when fresh, weathers brownish-green, massive, calcareous; fossils scarce, none collected; top cut off by fault striking N40°W to N60°W.		
94		~0.3-0.5	249.1-284.3
	Calcareous sandstone, light grey, abundant with *Buchia* to the extent of being a coquina; base concealed for 30-60 cm; this unit appears to be faulted out all along the eastern part of the hogback. Fossils from throughout the unit (**GSC Loc. 20656**; Field No. 52x.1) include: *Berriasella* (*Protacanthodiscus*) sp. nov. aff. *B.* (*P.*) *micheicus* (Bogoslovsky 1897); and *Lytoceras* cf. *batesi*.		
95		1.1-1.2	250.2-285.5
	Sandstone, fine- to coarse-grained, grey; a few lenses of fine grit noted in the upper part; grades into the overlying unit; a few, well-rounded pebbles of volcanic rock found at the base of the assumed continuation of this unit on the eastern side of the islet; numerous *Buchia* noted throughout the thickness, scattered or forming clusters; some ammonoid fragments found; belemnoid guards and *Lytoceras* sp. indet. in the upper part. Fossils from throughout the unit (**GSC Loc. 20671** Field No. 52x.2) include: *Buchia uncitoides*;		

Unit	Unit Description	Thickness (m)	Total Thickness Above Base (m)
	Lytoceras sp.; and belemnite, indet.		
96	Grit and sandstone, fine- to coarse-grained, dark grey, weathers brownish-grey, contains numerous layers and lenses of fine pebble conglomerate which appear to be locally derived; no pebbles of igneous origin observed; the unit is capped by a 30-45 cm-thick bed of soft, fine- to coarse-grained, clay-rich sandstone which forms a deep crevice between units 96 and 97; unit is locally rich in belemnoids; *Buchia* noted mostly in lenses, clusters, and impersistent, lenticular layers; a few ammonite fragments found. The lithology of this unit is different on the western and eastern parts of the islet. Fossils from the lower 90 cm of the unit (**GSC Loc. 20692**; Field No. 52x.3) include: *Buchia uncitoides*; and *Acroteuthis* sp. Fossils from the upper 0.9-1.2 m of the unit (**GSC Loc. 20646**; Field No. 52x.4) include: *Buchia uncitoides*; and lytoceratid ammonite, indet.	1.8-2.1	252.0-287.6
97	(Faulting has made recognition of this unit difficult on the east side of the rocky islet.) Sandstone, fine-grained, grey, very calcareous, coquina-like; *Buchia* abundant throughout most of thickness. Fossils from throughout the unit (**GSC Locs. 20661** and **20673**; Field No. 52y.1) include: *Buchia uncitoides*; *Lytoceras* cf. *batesi*; and belemnite, indet.	~0.3	252.3-287.9
98	(Forms the entire crest and the larger upper part of the steep southern face of the southern hogback of the rocky islet, situated southeast of the main body of the island.) Sandstone, medium- to coarse-grained, dark grey when fresh, weathers greyish-brown, strongly calcareous; surface honeycombed in places; the rock appears to be concretionary in structure; fossils generally restricted to rust-coloured, calcareous lenses which are abundant with them; large *Lytoceras* spp. indet. are common in these lenses, otherwise unit is poor in fossils; upper boundary is ill-defined. Fossils from the lower 90 cm of the unit (**GSC Loc. 20654**; Field No. 52.y.2) include: *Buchia uncitoides* (Pavlow 1907) *sensu lato*; *B. uncitoides* (Pavlow 1907) var. *acutistriata* (Crickmay 1930); and *Lytoceras* cf. *batesi*. Fossils from the upper 0.9-1.2 m of the unit (**GSC Loc. 20642**; Field No. 52.y3) include: *Buchia uncitoides*; *Lytoceras* cf. *batesi* (fragments); and belemnites, indet.	1.8-2.1	254.1-290.0
99	(Deep channel filled with sea water, completely covered along strike. This is the first water-filled	4.6-4.9	258.7-294.9

Unit	Unit Description	Thickness (m)	Total Thickness Above Base (m)
	trough encountered on the tidal flat of the rocky islet proceeding southward from the north end of the islet.)		
100	(Crossing the deep channel described above, access is obtained to the "southern rocky fringe," *i.e.*, the intertidal platform immediately east of the south end of the main Grassy Island proper; this platform is cut by several deep water-filled channels which break the platform into a number of isolated, small islets.) Silty sandstone, fine-grained, bluish-grey, weathers greenish-grey; fossils rare. Fossils from the uppermost 30 cm of the unit (**GSC Loc. 20574**; Field No. 74.5a) include: *Buchia uncitoides*.	~1.5-1.8	260.2-296.7
101	Sandstone, medium- to coarse-grained, grey to greenish-grey, calcareous; calcareous concretions 2-8 cm long and 1-3 cm thick noted scattered throughout and form a generally persistent layer at the top of the unit; *Buchia* shells are scarce. Fossils from throughout the unit (**GSC Loc. 20621** Field No. 74.5b) include: *Buchia uncitoides*.	0.20-0.30	260.4-297.0
102	Silty sandstone, fine-grained, bluish-grey when fresh, weathers greenish-grey; abundant with *Buchia* throughout its thickness; ammonites and belemnites noted as well; the upper boundary is marked by a laterally discontinuous 5-10 cm-thick layer of grit and fine pebble conglomerate with fragments of belemnites. Fossils from throughout the unit (**GSC Loc. 20057** Field No. 74.5c) include: *Buchia uncitoides*; and	0.5-0.6	260.9-297.6
103	Silty sandstone, as in unit 102, but barren of fossils.	0.6-0.8	261.5-298.4
104	Silty sandstone, as in unit 102; poor in *Buchia*. Combined fossils from units 104 and 105 (**GSC Loc. 20053**; Field No. 74.5d) include: *Buchia uncitoides*.	~0.4	261.9-298.8
105	Siltstone, light grey, grades into shale; poor in fossils.	~0.6	262.5-299.4
106	(Unit is relatively resistant and stands out in the northern face of the first hogback encountered moving southward across the southern rocky fringe.) Shale, light grey, slightly sandy; rich in *Buchia* and other fossils. Fossils from the lower 45 cm of the unit (**GSC Loc. 20027**; Field No. 74.5e) include: *Buchia uncitoides*.	~0.6-0.8	263.1-300.2

Unit	Unit Description	Thickness (m)	Total Thickness Above Base (m)

Fossils from the upper 15-30 cm of the unit (**GSC Loc. 20568**; Field No. 74.5f) include:
Buchia uncitoides.

107 ~0.9 264.0-301.1

Silty sandstone, fine- to medium-grained, greenish-grey; grades into siltstone in places; calcareous and thinly bedded in places; overlies unit 106 with a sharp contact.

The middle 30 cm of the unit is barren of fossils. Fossils from the lower 30 cm of the unit (**GSC Loc. 20631**; Field No. 74.5g) include:
Buchia uncitoides.

Fossils from the upper 30 cm of the unit (**GSC Loc. 20632**; Field No. 74.5h) include:
Buchia uncitoides.

108 ~3.4 267.4-304.5

(Forms the crest of the first, northernmost, hogback of the southern rocky fringe encountered traversing southwards.)

Shale, greenish-grey to bluish-grey, massive; locally grades into siltstone; for the most part, fossils (mainly *Buchia*) noted sporadically, singly or in clusters and not abundant; a few more-or-less persistent layers are, however, abundant with *Buchia*.

Fossils from the basal 45 cm of the unit (**GSC Loc. 20567**; Field No. 74.5i) include:
Buchia uncitoides.

Fossils from the interval 45-90 cm above base of the unit (**GSC Loc. 20617**; Field No. 74.5i.1) include:
Buchia uncitoides.

Fossils from the interval 0.9-1.3 m above the base of the unit (**GSC Loc. 20576**; Field No. 74.51.2) include:
Buchia uncitoides.

Fossils from the interval 1.3-2.0 m above the base of the unit (**GSC Loc. 20628**; Field No. 74.5i.3) include:
Buchia uncitoides.

Fossils from the interval 2.0-2.9 m above the base of the unit (**GSC Loc. 20629**; Field No. 74.5i.4) include:
Buchia uncitoides.

Fossils from the interval 2.9-3.4 m above the base of the unit (**GSC Loc. 20573**; Field No. 74.51.5) include:
Buchia uncitoides.

109 ~0.6 268.0-305.1

Shale, greenish-grey to bluish-grey, massive; numerous lenses of fine-grained, greenish-brown to green, partly calcareous sandstone; numerous lenses are abundant with *Buchia*.

Fossils from throughout the unit (**GSC Loc. 20616**; Field No. 74.5k) include:
Buchia uncitoides.

110 ~0.3 268.3-305.4

Shale, dark grey, weathers brownish-grey, hard, partly calcareous; upper surface uneven; numerous lighter coloured vertical burrows 0.5-1.0 cm thick and 2-5 cm long; the unit is somewhat persistent and distinctive, it can be followed along strike across the rocky fringe; rich in *Buchia* and large *Lytoceras* sp. indet.

Unit	Unit Description	Thickness (m)	Total Thickness Above Base (m)
	Fossils from throughout the unit (**GSC Loc. 20048**; Field No. 74.51) include: *Buchia uncitoides*; and *Lytoceras* cf. *batesi*.		
111	Sandstone, fine-grained, dark grey to greenish-grey; contains irregular layers and lenses of hard, dark grey silty shale; fossils scarce, except in shale lenses. Fossils from the unit (**GSC Loc. 20026**; Field No. 74.5m) include: *Buchia uncitoides*.	~0.3	268.6-305.7
112	Siltstone, brown to greenish-brown, sandy, grades into fine-grained silty sandstone; the upper part of the unit is more finely grained than its lower part; *Buchia* abundant in the middle 25 cm; fossils scarce in the upper and lower parts of the unit. Fossils from throughout the unit (**GSC Loc. 20049**; Field No. 74.5n) include: *Buchia uncitoides*.	0.5-0.6	269.1-306.3
113	Shale, dark grey to bluish-grey, weathers brownish-grey to dark grey; grades into similar siltstone; clusters and layers of shale with abundant *Buchia* noted at various levels; elsewhere, *Buchia* noted singly or in small groups; living chamber of a large *Lytoceras* sp. indet. was found 45 cm from the top. Fossils from the basal 35-45 cm of the unit (**GSC Loc. 20034**; Field No. 74.5p.1) include: *Buchia uncitoides*. Fossils from the interval 45-90 cm above the base of the unit (**GSC Loc. 20565**; Field No. 74.5p.2) include: *Buchia uncitoides*. Fossils from the interval 0.9-1.8 m above the base of the unit (**GSC Loc. 20712**; Field No. 74.5p.3) include: *Buchia uncitoides*.	1.8-2.0	270.9-308.3
114	Shale, dark grey to bluish-grey, calcareous; *Buchia* abundant throughout; the upper 12-15 cm are rich in fragments and complete guards of belemnites, too fragile to be collected. Fossils from throughout the unit (**GSC Loc. 20030**; Field No. 74.5q) include: *Buchia uncitoides*.; *Acroteuthis*(?) sp.; and *Lytoceras* sp.	0.5	271.4-308.8
115	Sandstone, medium-grained, greenish-grey to dark green; barren of fossils except for a few poor belemnoid fragments, no collection made.	0.08-0.13	271.4-308.9
116	Sandstone, fine-grained, dark grey, weathers light grey, calcareous; grades upward into a similar sandy siltstone or shale including a few irregular and lenticular, thin layers of the above-mentioned sandstone; a row of whitish-yellow weathering, calcareous concretions noted near the top; upper boundary sharp.	~0.8	272.2-309.7

Unit	Unit Description	Thickness (m)	Total Thickness Above Base (m)
	Fossils from the lower 45 cm of the unit (**GSC Loc. 20052**; Field No. 74.5q.1) include: *Buchia uncitoides*.		
117		0.08-0.18	272.3-309.9
	Sandstone, fine-grained, bluish-grey to greenish-grey, strongly calcareous and honeycombed on the surface; locally filled with fossils.		
	Fossils from the unit (**GSC Loc. 20563**; Field No. 74.5q.2) include: *Buchia uncitoides*.		
118		0.10-0.15	272.4-310.0
	Shale, dark grey, weathers light grey, calcareous; rare *Buchia* noted at the boundary between this unit and unit 119.		
119		0.08-0.20	272.5-310.2
	Sandstone, fine-grained, light bluish-grey, weathers dark grey with brownish tinge.		
	Fossils from units 119 and 118 combined (**GSC Loc. 20706**; Field No. 74.5q.3) include: *Buchia uncitoides*.		
120		0.3	272.8-310.5
	Shale, bluish-grey, massive; loaf-like to irregularly shaped, yellow-weathering concretions of calcareous shale 15-35 cm long and 12-20 cm thick noted at various levels; grades into the underlying unit but the top is marked by a 5-10 cm-thick bed of fissile, laminated shale; few clusters of *Buchia*.		
	Fossils from throughout the unit (**GSC Loc. 20566**; Field No. 74.5q.4) include: *Buchia uncitoides*.		
121		0.5	273.3-311.0
	Shale, as in unit 120; fossils are restricted to concretions.		
	Fossils from the entire unit (**GSC Loc. 20028**; Field No. 74.5r) include: *Buchia uncitoides*.		
122		0.36	273.7-311.4
	Sandstone, fine-grained, brownish-grey to greenish-grey; fossils (mainly *Buchia*) rare in the lower 15 cm but fill up the rock in the upper 10-15 cm.		
	Fossils from throughout the unit (**GSC Loc. 20615**; Field No. 74.5r.1) include: *Buchia uncitoides*.		
123		0.15	273.8-311.6
	Shale, dark grey, soft, somewhat fissile; no fossils found.		
124		0.20-0.25	274.0-311.8
	Sandstone, fine-grained, grey, hard; *Buchia* abundant in the middle 10-12 cm.		
	Fossils from throughout the unit (**GSC Loc. 20072**; Field No. 74.5r.2) include: *Buchia uncitoides*.		

Unit	Unit Description	Thickness (m)	Total Thickness Above Base (m)
125	Siltstone, dark grey, soft, with rare *Buchia* shells; capped by a 10-12 cm-thick bed of harder siltstone rich in *Buchia*. Fossils from throughout the unit (**GSC Loc. 20634**; Field No. 74.5r.3) include: *Buchia uncitoides*.	0.25-0.30	274.3-312.1
126	Shale, dark grey, soft; no fossils found.	~0.5	274.8-312.6
127	Siltstone, light grey, soft; capped by a 5-8 cm-thick bed of hard, resistant, dark grey sandstone; *Buchia* shells are rare, no collection made.	0.5	275.3-313.1
128	Interbedded shale and siltstone as in units 126 and 127; a few thin beds and lenses of dark grey sandstone noted in places; fossils very rare or absent, no collection made.	2.7-3.0	278.0-316.1
129	Sandstone, fine-grained, hard, grey, calcareous, lens-like, pinches out within 15 metres west and east of the section proper; cut by many minor faults and deformed locally into a halfmoon shape by several faults of north-south strike; *Buchia* abundant. Fossils from throughout the unit (**GSC Loc. 20569**; Field No. 74.5r.4) include: *Buchia uncitoides*.	0.1-1.2	278.1-317.3
130	Shale, dark grey, soft; separated from unit 128 by the sandstone lens of unit 129; wherever unit 129 is absent, unit 130 cannot be differentiated from unit 128, except on the absence of fossils. No fossils found.	~0.9-1.2	279.0-318.5
131	Siltstone, dark grey to grey, partly calcareous; grades into clay-rich, fine-grained sandstone. A 5-10 cm-thick layer of grey, medium-grained sandstone with abundant *Buchia* is noted about 20 cm above base of the unit . Fossils from this layer (**GSC Loc. 20620** Field No. 74.5s) include: *Buchia uncitoides*.	0.8-0.9	279.8-319.4
132	Sandstone, fine-grained, greenish-grey to grey, calcareous; *Buchia* abundant. Fossils from the lowermost 20 cm of the unit (**GSC Loc. 20071**; Field No. 74.5s.l) include: *Buchia uncitoides*. Fossils from the interval 30-45 cm above the base of the unit (**GSC Loc. 20168**; Field No. 74.5s.2) include: *Buchia keyserlingi* (Lahusen 1888) var. *visingensis* (Sokolov 1908) (**GSC No. 16599**, Jeletzky, 1965 pl. 10, figs. 1A-C; **GSC No. 16607**, Jeletzky, 1965, pl. 11, figs. 1A, B; **GSC No. 16616**, Jeletzky, 1965, pl. 12, figs. 1A-C); and *B. keyserlingi* (Lahusen 1888) var. *sibirica* (Sokolov 1908) (**GSC No. 16611**, Jeletzky, 1965, pl. 11, figs. 5A-C). Fossils from the top 45 cm of the unit (**GSC Loc. 20029**; Field No. 74.5s.3) include:	1.4	281.2-320.8

Unit	Unit Description	Thickness (m)	Total Thickness Above Base (m)
	Buchia uncitoides.		
133		2.6-2.7	283.8-323.5
	(This unit forms the southern margin of the trough located at the northern base of the second hogback encountered traversing southward across the southern rocky fringe; it is intruded by a dark grey, felsic vertical dyke 15-45 cm thick and striking N20°W to N30°W.) Shale, dark grey, sandy, grades into sandy siltstone with minor beds of farder, dark grey, fine-grained sandstone to several cm thick; poor in *Buchia*. Fossils from throughout the unit (**GSC Loc. 20633**; Field No. 74.5s.4) include: *Buchia uncitoides*.		
	<u>*Buchia tolmatschowi* Zone</u>		
134		0.30-0.37	284.1-323.9
	Unit 134 is placed at the base of the *Buchia tolmatschowi* Zone. Sandstone, fine-grained, greenish-grey; contains layers and clusters of softer, lighter coloured, clay-rich sandstone grading into siltstone; the greenish-grey sandstone is abundant with *Buchia* while the softer sandstone is poor in fossils. Fossils from throughout the unit (**GSC Loc. 20630**; Field No. 74.5t) include: *Buchia tolmatschowi*; and *B. uncitoides*.		
135		~0.49-0.55	284.6-324.4
	Shale, dark bluish-grey when fresh, weathers light yellowish-grey, fairly resistant; *Buchia* noted as single, dispersed specimens; capped by 5-8 cm of hard, resistant, brownish-grey, fine-grained, clay-rich sandstone rich in *Buchia*. Fossils from throughout the unit (**GSC Loc. 20572**; Field No. 74.5u) include: *Buchia uncitoides*.		
136		1.4-1.5	286.0-325.9
	Shale, similar to that of unit 135, but less resistant and softer; *Buchia* noted in single dispersed specimens or in small clusters; some layers are somewhat sandy. Fossils from the lower 60 cm of the unit (**GSC Loc. 20032**; Field No. 74.5v) include: *Buchia uncitoides*. Fossils from the upper 60-90 cm of the unit (**GSC Loc. 20575**; Field No. 74.5v.1) include: *Buchia tolmatschowi*; and *B. uncitoides*.		
137		1.7-1.8	287.7-327.7
	(Forms the upper part of the northern side of the second hogback described above.) Shale, as in unit 135; becomes sandy upward and grades into sandy siltstone in the uppermost few cm; in the lower 1.0-1.2 m *Buchia* noted as single dispersed specimens or in well-spaced clusters, thin lenses, and		

Unit	Unit Description	Thickness (m)	Total Thickness Above Base (m)

layers, their number gradually increases upward; in the upper 0.3-0.45 m *Buchia* begin to fill out the rock; this condition is transitional to that observed in unit 138.

Fossils from the lower 30-60 cm of the unit (**GSC Loc. 20571**; Field No. 74.5w.1) include:
Buchia uncitoides.

Fossils from the middle 75 cm of the unit (**GSC Loc. 20564**; Field No. 74.5w.2) include:
Buchia uncitoides.

Fossils from the upper 45-60 cm of the unit (**GSC Loc. 20570**; Field No. 74.5w.3) include:
Buchia uncitoides.

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138 — 0.3-0.6 — 288.0-328.3

(Forms the crest of the second hogback described above.)

Siltstone, dark-grey to greenish-grey, sandy, resistant; and with abundant *Buchia*; capped by a 5 cm-thick layer of calcareous, medium-grained sandstone, light grey when fresh, weathering blackish-grey, which is poor in fossils.

Fossil lot **GSC Loc. 18381** (Field No. 74.4) is from this uppermost bed and includes:
Buchia uncitoides.

Fossils from throughout the unit (**GSC Loc. 20557**; Field No. 74.4a) include:
Buchia.uncitoides.

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139 — 0.5 — 288.5-328.8

(Forms a crevice between units 138 and 140.)

Siltstone, greenish-grey to dark grey, sandy, soft, laminated in part, may grade into sandy shale; the basal 10-15 cm consist of harder siltstone; the amount of sand increases in the uppermost 10 cm and the rock becomes a gritty, calcareous sandstone full of *Buchia* fragments and fragmentary belemnite guards; this layer represents a transition to unit 140; otherwise very poor in fossils.

Fossils from throughout the unit (**GSC Loc. 20023**; Field No. 74.4b) include:
Buchia uncitoides.

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140 — 0.6 — 289.1-329.4

(Forms the upper part of the southern face of the second hogback described above.)

Grit, dull green to greyish-green; interbedded with layers of coarse-grained, partly calcareous sandstone; the lower 12-15 cm, partly overlapping with unit 139, are the coarsest and carry some dispersed pebbles 0.5-1.0 cm in diameter; some layers are rich in *Buchia*, fragments of *Buchia* shells and shell detritus.

Fossils from throughout the unit (**GSC Loc. 20591**; Field No. 74.4c) include:
Buchia tolmatschowi; and
B. uncitoides.

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141 — 0.6 — 289.7-330.0

(For 200 metres along strike unit 141 forms the precipitous middle part of the southern face of the second hogback of the southern rocky fringe, 1.2-1.8 metres high.)

Unit	Unit Description	Thickness (m)	Total Thickness Above Base (m)

Sandstone, dark grey when fresh, weathers speckled yellowish-grey, gritty in the lower part but grades upward into clay-rich sandstone and then into sandy shale, strongly calcareous; *Buchia* shells locally fill the rock, grading into a coquinoid. The unit grades downward into unit 140, the number of *Buchia* shells decreasing downward as the amount of grit increases.

Fossils from throughout the unit (**GSC Loc. 20021**; Field No. 74.4d) include:
Buchia tolmatschowi; and
B. uncitoides.

142 — 0.5 — 290.2-330.5

(Unit forms a depression in the steep southern face of the second hogback between resistant units 141 and 143.)

Sandstone, grey, very silty, calcareous, grades laterally into similar siltstone; rich in but not abundant with *Buchia*.

Fossils from throughout the unit (**GSC Loc. 20717**; Field No. 74.4e) include:
Buchia tolmatschowi; and
B. uncitoides.

143 — ~0.8 — 291.0-331.3

(Unit is strongly resistant and forms a secondary hogback 1.2-1.8 m high all along the southern face of the second hogback of the southern rocky fringe.)

Limestone, grey, sandy and silty, grades into calcareous sandstone; *Buchia* abundant throughout; about 15 cm above base a thin layer of medium-grained, calcareous sandstone full of *Buchia* shells and shell fragments is found.

Fossils from throughout the unit (**GSC Loc. 20022**; Field No. 74.4f) include:
Buchia tolmatschowi; and
B. uncitoides.

144 — 0.8 — 291.8-332.1

Siltstone, grey, sandy, partly calcareous, grades into silty, calcareous, fine-grained sandstone; poor in fossils in the lower 50-60 cm and rich in *Buchia* in the upper 20-25 cm.

Fossils from the upper 20-25 cm of the unit (**GSC Loc. 20590**; Field No. 74.4g [= 74.3f.3]) include:
Buchia tolmatschowi; and
B. uncitoides.

145 — ~0.3 — 292.1-332.4

Siltstone, dark grey, sandy, calcareous, very rich in *Buchia*.

Fossils from throughout the unit (**GSC Loc. 20603**; Field No. 74.4h) include:
Buchia tolmatschowi; and
B. uncitoides.

146 — 0.0-0.30 — 292.1-332.7

Sandstone, coarse-grained to gritty, dark grey to greenish-grey, irregular and discontinuous; very poor in fossils; no collection made.

Unit	Unit Description	Thickness (m)	Total Thickness Above Base (m)
147	(Forms the bottom of a 2.4-3.0 m-wide trough filled with water even during the lowest tide. This trough is the second water-filled trough noted on the tidal flat of the southern rocky fringe, traversing from the north.) Friable shale, ash to dark grey, partly sandy; the top 60-90 cm are sandy, calcareous and light grey; mostly poorly exposed; poor in fossils, no collection made.	2.4-3.0	294.5-335.7
148	(Forms a dyke-like wall 1.2-1.8 m high all along the lowermost part of the upper northern slope immediately south of the trough occupied by unit 147.) Siltstone, dark grey, sandy, calcareous; capped by a layer of dark grey, calcareous grit 5-10 cm thick; very rich in *Buchia*. Fossils from throughout the unit (**GSC Loc. 20696**; Field No. 74.4i) include: *Buchia tolmatschowi*; and *B. uncitoides*.	0.15-0.25	294.6-336.0
149	(Exposed only on the bottom of a 1.2-1.8 m-deep crevice between the dyke-like protruding units 148 and 150.) Shale, dark grey to greenish-grey, sandy, contains dispersed grit, capped by a thin layer of calcareous grit containing some *Buchia* indistinguishable from those noted in the adjacent beds; no collection made.	0.25-0.30	294.9-336.3
150	Siltstone, ash-grey, sandy, grades into sandy shale in the middle 0.45-0.60 m; the basal 10-15 cm consist of calcareous, sandy siltstone with layers and lenses of calcareous sandstone and grit with abundant *Buchia*. Fossils from the basal part of the unit (**GSC Loc. 20711**; Field No. 74.4j.1) include: *Buchia tolmatschowi*; and *B. uncitoides*. The middle 60-75 cm of the unit is poor in *Buchia* except for a few pockets and lenses abundant with them. The topmost 15-20 cm consist of silty, calcareous, fine- to medium-grained sandstone with clusters and thin lenses of calcareous grit; lenses and irregular, impersistent beds with abundant *Buchia* noted locally in this topmost layer. Fossils from this uppermost part of the unit collected as **GSC Loc. 20070** (Field No. 74.4j.2) and include: *Buchia uncitoides*.	1.0	295.9-337.3
151	Sandstone, very fine-grained and silty, grey, grades into sandy siltstone; the bed is lenticular and discontinuous; fossils generally rare and noted singly or in clusters throughout the unit. Fossils (**GSC Loc. 20721**; Field No. 74.4k) include: *Buchia tolmatschowi*; and *B. uncitoides*.	2.1-2.4	298.0-339.7
152		0.13-0.15	298.1-339.8

Unit	Unit Description	Thickness (m)	Total Thickness Above Base (m)
	Sandstone, very fine-grained, silty; grey, grades into the overlying and underlying beds; *Buchia* abundant. Fossils from throughout the unit (**GSC Loc. 20554**; Field No. 74.41) include: *Buchia tolmatschowi*; and *B. uncitoides*.		
153		1.4-1.5	299.5-341.3
	Sandstone, as in unit 152, but grading into sandy shale. Fossils rare and noted singly or in clusters. Fossils from throughout the unit (**GSC Loc. 20598**; Field No. 74.4m) include: *Buchia tolmatschowi*.		
154		0.08-0.15	299.6-341.5
	(Forms the more northerly and smaller of two secondary hogbacks overlooking the recessed fault zone described below under unit 157.) Sandstone, as in unit 152, but even less continuous; forms a row of lenses with abundant *Buchia*. Fossils from throughout the unit (**GSC Loc. 20641**; Field No. 74.4n) include: *Buchia tolmatschowi*; and *B. uncitoides*.		
155		0.6	300.2-342.1
	Sandstone, as in unit 152, but completely barren of fossils.		
156		0.13-0.18	300.3-342.2
	Sandstone, as in unit 151; *Buchia* abundant. Fossils from throughout the unit (**GSC Loc. 20728**; Field No. 74.4o) include: *Buchia tolmatschowi*; and *B. uncitoides*.		
157		4.6-5.2	304.9-347.4
	(Forms the northern part of the same depression as unit 158; strongly disturbed by faults so the nature of both boundaries is uncertain.) Siltstone, dark to ash-grey, generally massive, grades into similar shale; rare fossils noted in small clusters or singly, but the unit is rich in fossils locally. Fossils from throughout the unit (**GSC Loc. 20637**; Field No. 74.4p) include: *Buchia tolmatschowi*; and *B. uncitoides*.		
158		0.8-1.1	305.7-348.6
	Shale, ash- to dark grey, partly sandy, weathers into small pieces; almost barren of fossils except for a few solitary specimens of *Buchia tolmatschowi* (Sokolov) *sensu lato* entirely similar to those noted in the overlying and underlying units; no collection made.		
159		1.4-1.5	307.1-350.1
	(Forms the bottom of a secondary depression between two hogbacks.)		

Unit	Unit Description	Thickness (m)	Total Thickness Above Base (m)
	Shale, dark to ash-grey, weathers brownish, generally sandy, grades into siltstone; upper and lower boundaries are ill-defined and apparently gradational; base cut off by a fault(s) striking S60°W to N60°W, although no faunal change is apparent between units 158 and 159; rich in solitary specimens or clusters of *Buchia*. Fossils from the lower 0.60 m of the unit (**GSC Loc. 20702**; Field No. 74.3a) include: *Buchia tolmatschowi*; and *B. uncitoides*. Fossils from the upper 0.75-0.90 m of the unit (**GSC Loc. 20602**; Field No. 74.3b) include: *Buchia tolmatschowi*; and *B. uncitoides*.		
160	Sandstone, very fine-grained, clay-rich, light to ash-grey when fresh, weathers brownish-grey, grades into sandy siltstone; *Buchia* noted in rows of solitary specimens or as rows of small clusters (3 to 10 specimens each). Fossils from the lower 0.45-0.60 m of the unit (**GSC Loc. 20594**; Field No. 74.3c) include: *Buchia tolmatschowi*; and *B. uncitoides*. Fossils from the upper 0.60-0.75 m of the unit (**GSC Loc. 20588**; Field No. 74.3d) include: *Buchia tolmatschowi*; and *B. uncitoides*.	1.2-1.4	308.3-351.4
161	Sandstone, as in unit 160, but richer in rows of specimens and clusters of large *Buchia*. Fossils from throughout the unit (**GSC Loc. 20599**; Field No. 74.3e) include: *Buchia tolmatschowi*; and *B. uncitoides*.	~0.5-0.6	308.8-352.0
162	Sandstone, similar to that of unit 160, but weathering more brownish and apparently less silty; the upper 1.20 m represented mostly by sandy siltstone capped by a somewhat persistent layer with abundant *Buchia*; the rest of the unit is not particularly rich in fossils. Fossils from the lower 0.60 m of the unit (**GSC Loc. 20718**; Field No. 74.3f.1) include: *Buchia tolmatschowi.* Fossils from the interval 0.75-0.90 m above the base of the unit (**GSC Loc. 20699**; Field No. 74.3f.2) include: *Buchia tolmatschowi.* Fossils from the upper 1.20 m of the unit (**GSC Loc. 20590**; Field No. 74.3f.3) include: *Buchia tolmatschowi*; and *B. uncitoides*.	2.6-2.7	311.4-354.8
163	Sandy siltstone, ash- to dark-grey; top and bottom of the unit are marked by thin layers of fissile shale;	~0.9	312.3-355.6

Unit	Unit Description	Thickness (m)	Total Thickness Above Base (m)

dispersed solitary specimens or small clusters of *Buchia* noted throughout; fossils generally rare.

Fossils from throughout the unit (**GSC Loc. 20045**; Field No. 74.3g) include:
Buchia tolmatschowi.

164 ~0.9 313.2-356.6

Sandy siltstone, much as unit 163 but more sandy; fossils mostly rare.

Fossils from throughout the unit (**GSC Loc. 10716**; Field No. 74.3h) include:
Buchia tolmatschowi.

165 1.2-1.4 314.4-358.0

(Locally forms a small hogback in the middle of a rocky flat about 20 metres wide. This flat noted between the base of unit 157 and the secondary hogback formed of units 173 to 177 inclusive [see below], its top is marked by a 8.0-25.0 cm-thick bed of coarser grained, darker sandstone which can be followed for a considerable distance along strike.)

Sandstone as that of unit 166, but richer in *Buchia*.

Fossils from throughout the unit (**GSC Loc. 20593**; Field No. 74.3i) include:
Buchia tolmatschowi; and
B. uncitoides.

166 1.2-1.5 315.6-359.4

(Contact with unit 165 concealed.)

Sandstone, fine-grained, dark to greenish-grey; rich in but not abundant with *Buchia*.

Fossils from throughout the unit (**GSC Loc. 20556**; Field No. 74.3j) include:
Buchia tolmatschowi.

167 0.1-0.6 315.7-360.0

Sandstone, medium-grained, dark brown to dark brownish-green, strongly lenticular but can be followed practically all across the southern rocky fringe; some 50 metres from the western end of the fringe it thickens quickly from 5 cm to 0.60 m over distance of 3.0-5.0 m; this thickness is maintained for about 30 metres along strike, then thins again to 5 cm; a 5.0-10.0 cm diameter granitoid pebble was found in the thickened part of the unit; *Buchia* abundant throughout.

Fossils from throughout the unit (**GSC Loc. 20704**; Field No. 74.3k) include:
Buchia tolmatschowi; and
B. uncitoides.

168 1.8-2.0 317.5-362.0

Sandstone, dark grey to greenish-grey, very fine-grained, generally silty and grades locally into very sandy siltstone; fossils generally rare.

Fossils from the lower 0.90 m of the unit (**GSC Loc. 20697**; Field No. 74.31) include:
Buchia tolmatschowi.

Fossils from the upper 1.10 m of the unit (**GSC Loc. 20638**; Field No. 74.3m) include:
Buchia tolmatschowi; and

Unit	Unit Description	Thickness (m)	Total Thickness Above Base (m)

polyptychitid(?) ammonite, indet.

At one place in the upper part of the unit an accumulation of coalified organic debris *ca.* 15 cm in diameter was found, containing a peculiar fauna and flora and a calcareous concretion carrying *Tollia* (*Tollia*) cf. *mutabilis* (Stanton) *sensu lato* (**GSC Loc. 20638**). In this part of the unit *Buchia* locally form clusters or rows of individual specimens but not lenses or layers.

169 ~2.4 319.9-364.4

Siltstone, dark grey to greenish-grey when fresh, weathers brownish, calcareous in places; in the upper 25 cm or so grades into fine- to medium-grained, clay-rich, calcareous sandstone, partly honeycombed on the surface, which is generally continuous along outcrop; *Buchia* noted in rows of individual specimens, clusters, or strings, but do not form large lenses or tightly packed layers except in the sandstone forming the top part of the unit.

Fossils from the lower 1.20 m of the unit (**GSC Loc. 20708**; Field No. 74.3n) include:

Buchia tolmatschowi.

Fossils from the upper 1.20 m of the unit (**GSC Loc. 20020**; Field No. 74.3p) include:

Tollia (*Tollia*) *mutabilis* (Stanton 1995) *sensu lato* (**GSC No. 16635**, Jeletzky, 1965, pl. 15, figs. 2A-D; **GSC No. 16638**, pl. 15, figs. 8A-D)

T. (*T.*) *mutabilis* (Stanton 1995) var. *tehamaensis* (Anderson 1938) (**GSC No. 16637**, Jeletzky, 1965, pl. 15, figs. 6A, B);

T. (*T.*) *mutabilis* (Stanton 1995) var. *burgeri* (Anderson 1938) (**GSC No. 16639**, Jeletzky, 1965, pl. 15, fig. 9);

Buchia tolmatschowi (Sokolov 1908) *forma typica* (**GSC No. 16636**, Jeletzky, 1965, pl. 15, figs. 4A-C); and

B. tolmatschowi (Sokolov 1908) var. *americana* (Sokolov 1908) (**GSC No. 16640**, Jeletzky, 1965, pl. 15, figs. 10A-D; **GSC No. 16641**, Jeletzky, 1965, pl. 15, figs. 11A-C).

Buchia pacifica Zone

170 0.13-0.20 320.0-364.6

(Unit 170 is arbitrarily considered to be the basal bed of the *Buchia pacifica* Zone but its *Buchia* and ammonite fauna is transitional in character from that of the *Buchia tolmatschowi* Zone.)

Sandstone, fine- to medium-grained, light grey, calcareous; *Buchia* abundant.

Buchia pacifica sensu lato fauna from throughout the unit (**GSC Loc. 20601**; Field No. 74.3q) has, on the whole, the same character as that of stratigraphically-higher units 171 and 173; however, it has a lesser percentage of typical representatives of *B. pacifica* and a somewhat greater percentage of forms indistinguishable from *B. tolmatschowi* var. *americana* and *forma typica* than the lots 20710 and 20705.

Other than *Buchia*, this fauna includes:

a single fragment of *Neocomites* (*Parandiceras*) cf. *rota* Spath;

a few fragmentary specimens of craspeditid ammonites apparently closely related to *Tollia* (*Tollia*) *mutabilis sensu lato*;

Phylloceras (*sensu lato*) sp. indet.; and

poor casts of small bivalves as in unit 171.

171 ~0.36 320.4-365.0

Unit	Unit Description	Thickness (m)	Total Thickness Above Base (m)
	Sandstone, light grey, calcareous and strongly honeycombed on the surface in the upper 0.25 m; fine-grained in lower 15 cm but becoming progressively coarser upward; except for the lowermost 15 cm, *Buchia* are abundant throughout; they are tightly packed in the uppermost 10-15 cm all along the outcrop; the basal 15 cm of fine-grained sandstone is poor in fossils. *Buchia pacifica* fauna from the upper 0.25 m (**GSC Loc. 20705**; Field No. 74.3r) has the same character as that of the unit 173 (GSC Loc. 20710). In addition to *Buchia*, this fauna includes numerous casts of small (immature?) *Astarte*-, *Arctica*-, and *Lima* (*Limea*)-like bivalves scattered in the matrix surrounding *Buchia* shells.		
172	(This unit forms a deep crevice 0.9-1.2 m deep between adjacent, more resistant beds along strike.) Shale, dark grey, sandy, very soft, laminated; exposed in only a few places; no fossils noted.	0.30-0.80	320.7-365.8
173	Sandstone, light greenish-grey, somewhat calcareous; with dispersed pebbles. Fossils collected in 1949 were labeled 74.2 (**GSC Loc. 18371**); additional fossils were collected in 1951 (**GSC Loc. 20710**; also labeled Field No. 74.2). *Buchia pacifica sensu lato* fauna from throughout the unit is dominated by the elongate and densely to indistinctly-ribbed forms, many of which are transitional to *B. tolmatschowi sensu lato*; typical representatives of the species are in the minority. Some fairly typical representatives of *B. tolmatschowi sensu lato* noted. Otherwise, only a solitary specimen of *Acroteuthis* sp. indet. noted.	0.5-0.6	321.2-366.4
174	Pebble conglomerate, brownish-grey, fine (pebbles under 1.0 cm predominate); lenses of coarser pebble conglomerate as well as grit and poorly-sorted gritty, brownish sandstone; sandstone is mostly thin-bedded; lens-like parts of the unit are abundant with *Buchia pacifica sensu lato* while elsewhere the rock is virtually barren of fossils; grades into underlying and overlying units. *Buchia* fauna from throughout the unit (**GSC Loc. 20722**; Field No. 74.2a) is the same as that noted in overlying units 180 and 181. Otherwise, only rare casts of small *Astarte*-, *Lima* (*Limea*)-, and *Arctica*-like bivalves noted.	0.9-1.2	322.1-367.6
175	Sandstone, light brownish-grey, poorly-sorted, partly gritty, calcareous, with irregularly distributed lenses and clusters of *Buchia*. *Buchia pacifica sensu lato* fauna from throughout the unit (**GSC Loc. 20727**; Field No. 74.2b) is the same as that noted in units 180 and 181. A single specimen of *Neocomites* (*Parandiceras*) cf. *rota* (Spath 1925) was found inside a large *B. pacifica* valve. Other fossils include rare casts of small (immature?) *Astarte*- and *Arctica*-like bivalves.	0.7-0.8	322.8-368.4
176	Sandstone, as in unit 173; *Buchia* abundant throughout. Fauna from throughout the unit (**GSC Loc. 20713**; Field No. 74.2c) is exactly the same as that of the upper 0.60-0.90 m of unit 177 (lot no. 20065), and includes *Buchia pacifica sensu lato* and *B. tolmaschowi sensu lato* (rare). Other fossils include very rare casts of *Lima* (*Limea*) ex gr. *blakei* Cox, small *Astarte*-like bivalves, and rare, immature representatives of *Inoceramus* aff. *scotti* Anderson 1945.	~0.8	323.6-369.2

Unit	Unit Description	Thickness (m)	Total Thickness Above Base (m)
177	Sandstone, coarse-grained, partly gritty, dark grey to greenish-grey; includes irregular lenses and layers of light brownish-grey sandstone; mostly abundant with *Buchia* but upper part is locally almost barren of fossils; poor ammonites noted locally in the upper part; becomes progressively finer and more brownish-coloured upward and grades into overlying unit 178. *Buchia pacifica sensu lato* fauna from the lower 0.60 m of the unit (**GSC Loc. 20600**; Field No. 74.2d) is the same as in units 180 and 181. *Buchia pacifica* fauna from the upper 0.60-0.90 m of the unit (**GSC Loc. 20065**; Field No. 72.2e) consists almost exclusively of large to very large representatives of the species. Most are typical forms but forms with extremely widely-spaced concentric ribs (Jeletzky, 1965, pl. XVI, figs. 9-10) are also common. Hardly any transitional forms to *B. tolmatschowi sensu lato* are noted.	1.2-1.5	324.8-370.7
	(Units 173 to 177 inclusive form a pronounced "dyke-like" secondary hogback about 1.20-1.50 m high on its northern side and 2.10-2.40 m high on its southern side. This secondary hogback is situated between the third trough (filled with water except at low tide) in the south and the rocky flat about 19 metres wide in the north; both sides are precipitous.) (The beds of the above-mentioned secondary hogback (see below) are not persistent along strike. Even conglomerate unit 174 is replaced locally by either a coarse grit with thin layers of fine conglomerate or by a coarser pebble conglomerate with minor interbeds of more fine-grained strata.)		
178	(This unit forms the bottom of the third trough and the adjacent lower part of the southern slope of a secondary hogback.) Sandstone, fine-grained, greenish-brown to greenish-grey, dark when fresh, lighter when weathered, well-sorted, somewhat calcareous; rich in, but not abundant with *Buchia* in the lower 0.6 m; higher, *Buchia* become progressively scarcer and are very rare in the top 0.9-1.2 m of the unit; the rock has a massive appearance where it is poor in fossils (especially in the upper 1.2-1.5 m). The *Buchia* fauna from the lower 1.0 m of the unit (**GSC Loc. 20597**; Field No. 74.2f) is the same as that of units 181 and 180. *Buchia* fauna from the upper 1.0-1.2 m of the unit (**GSC Loc. 20592**; Field No. 74.2g) includes: rare examples of *B. tolmatschowi sensu lato* like that noted in the lower 1.2 m of unit 179 (lot. No. 20589); and juvenile representatives of *Inoceramus* aff. *scotti* Anderson 1945.	~2.1-2.4	326.9-373.1
179	Silty sandstone, fine-grained, and sandy siltstone, greenish-grey to light-grey, sometimes speckled, calcareous, relatively soft and massive; poor in fossils; *Buchia* shells scattered sparsely throughout. Fauna from the lower 1.20 m of the unit (**GSC Loc. 20589**; Field No. 74.2h) is the same as in units 180 and 181, except that the elongate and densely-ribbed variants of *B. pacifica sensu lato* are again more common. *Buchia* fauna from the upper 1.80-2.10 m of the unit (**GSC Loc. 20066**; Field No. 74.2i) is exactly the same as that of units 180 and 181; it also includes a solitary specimen of a juvenile bivalve of *Inoceramus* aff.	~3.0-3.4	329.9-376.5

Unit	Unit Description	Thickness (m)	Total Thickness Above Base (m)
	scotti Anderson 1945.		
	(Unit 179, and in places unit 178 as well, form the bottom of the third trough. The southern side of this trough is everywhere separated from the third hogback by a deep, 1.5-1.8 metre-wide crevice filled with water, and across the general strike; this crevice does not offer any outcrops.)		
180	(Outcrops poor and intermittent, with the base nowhere exposed; forms a precipitous wall 1.2-2.4 m high.) Sandstone, fine- to medium-grained, brownish- to greenish-grey, calcareous; very poor in fossils except at the visible top where a thin layer is abundant with *Buchia*. Fossils from throughout the unit (**GSC Loc. 20703**; Field No. 74.2j) are exactly the same as in unit 181.	1.5-1.8	331.4-378.3
181	Sandstone, fine- to medium-grained, brownish- or greenish-grey, calcareous; *Buchia* abundant. Fossils from throughout the unit (**GSC Loc. 20640**; Field No. 74.2k) include: numerous, small to large, predominantly typical representatives of *B. pacifica sensu lato* (elongate variants are scarce and densely-ribbed); transitional forms to *B. tolmatschowi sensu lato* almost absent; and rare casts of *Arctica*- and *Astarte*-like bivalves.	0.13-0.30	331.5-378.6
182	Siltstone, ash-grey to dark grey, very sandy, calcareous; weathers brownish-grey. *Buchia* noted quite commonly throughout unit but do not fill out the rock. Fossils from throughout the unit (**GSC Loc. 20707**; Field No. 74.21) include: numerous small to large representatives of *B. pacifica forma typica* and var; however, typical representatives of the species are somewhat less common than in overlying beds while elongate, densely-ribbed variants and transitional forms to *B. tolmatschowi sensu lato* are somewhat more so.	1.1-1.2	332.6-379.8
183	Sandstone, fine-grained, clay-rich, brownish-grey; *Buchia* common throughout in rows or scattered individual specimens, or clusters of specimens; they do not fill out the rock except in the upper part of the unit where they are abundant in two layers, each 2-5 cm thick. Fossils from throughout the unit (**GSC Loc. 20723**; Field No. 74.2m) include: mostly the same forms of *B. pacifica sensu lato* as those noted in lots nos. 20024 and 20555; however, the elongate, densely-ribbed variants of the species and transitional forms to *B. tolmatschowi sensu lato* are less common than in units 184-185.	1.1-1.2	333.7-381.0
184	Sandstone, fine-grained, clay-rich, brownish-grey; *Buchia* abundant, forming a coquinoid-like accumulation. Fossils from throughout the unit (**GSC Loc. 20555**; Field No. 74.2n) include: the same forms of *B. pacifica sensu lato* as noted in lot no. 20024; elongate, densely-ribbed variants of the species and transitional forms to *B. tolmatschowi sensu lato* are as	0.25	334.0-381.3

Unit	Unit Description	Thickness (m)	Total Thickness Above Base (m)
	common as in unit 185.		
185		0.9-1.1	334.9-382.4
	Sandstone, fine-grained, clay-rich, dark grey, calcareous; grades gradually into sandy shale in upper 0.5 m and thence into overlying unit 186; *Buchia* abundant throughout. Fossils from throughout the unit (**GSC Loc. 20024**; Field No. 74.2o) include: numerous, small to very large, mostly typical representatives of *B. pacifica sensu lato*; however, elongate, densely-ribbed variants of the species are more common here than in overlying beds; some forms are transitional to *B. tolmatschowi sensu lato*.		
186		0.5	335.4-382.9
	Shale, ash- to dark grey, massive, locally sandy; interfingers with similarly coloured but laminated sandy or pure shale; *Buchia* abundant throughout. Fossils from throughout the unit (**GSC Loc. 20700**; Field No. 74.2p) include: numerous, small to very large, mostly typical, representatives of *B. pacifica sensu lato* - strongly elongate variants are rare and forms transitional to *B. tolmatschowi sensu lato* almost absent.		
187		0.4	335.8-383.3
	(All underlying units, including unit 180, form a shoulder on the northern slope of the third hogback of the rocky fringe, above which the central part of the hogback towers wall-like.) Shale, ash-grey, interfingered with dark green to dark grey, medium-grained sandstone; *Buchia* abundant in the upper 15-18 cm, in layers 2-5 cm thick and standing out in some relief; elsewhere, *Buchia* dispersed in the shale but also noted quite commonly in the sandstone. Fossils from throughout the unit (**GSC Loc. 20720**; Field No. 74.2q) include: numerous and mostly large to very large, predominantly typical representatives of *B. pacifica sensu lato*; elongate variants of *B. pacifica sensu lato* (fairly common); and some transitional forms from *B. pacifica* to *B. tolmatschowi sensu lato*.		
188		0.5-0.6	336.3-383.9
	Shale, bluish-grey, sandy, grades into siltstone; rich in, but not abundant with, *Buchia*, which are dispersed throughout thickness and form a coquinoid layer 10-12 cm thick at about the middle of the upper 0.3 m of the unit. Fossils from throughout the unit (**GSC Loc. 20714**; Field No. 74.2r) include: same *Buchia pacifica* forms as in the collections 20055 and 20046; and very rare transitional forms to *B. tolmatschowi sensu lato*.		
189		0.2-0.3	336.5-384.2
	(Forms the base of an extensive coquinoid of *Buchia*, the top of which is represented by unit 197 on the southern side of the third hogback.) Shale, brownish-grey, sandy, calcareous, hard; *Buchia* abundant throughout; mostly forms the lowermost part of the northern side of the central, “dyke”-like part of the third hogback. Fossils from throughout the unit (**GSC Loc. 20719**; Field No. 74.2s) include:		

Unit	Unit Description	Thickness (m)	Total Thickness Above Base (m)

numerous and mostly large, predominantly typical representatives of *B. pacifica sensu stricto* and *B. pacifica* var. (**GSC No. 16643**, Jeletzky, 1965, Pl. 16, figs. 2A-D; **GSC No. 16645**, Jeletzky, 1965, Pl. 16, figs. 4A-C; **GSC No. 16650**, Jeletzky, 1965, Pl. 16, figs. 9A-D; **GSC No. 16651**, Jeletzky, 1965, Pl. 16, figs. 10A-C; **GSC No. 16652**, Jeletzky, 1965, Pl. 19, figs. 3A-C; **GSC No. 16653**, Jeletzky, 1965, Pl. 19, figs. 4A-C; **GSC No. 16655**, Jeletzky, 1965, Pl. 19, figs. 8A, B); and
very few transitional forms to *B. tolmatschowi sensu lato*.

190 ~0.6 337.1-384.8

Siltstone, dark grey, sandy, weathers greenish-grey; *Buchia* abundant but less crowded than in adjacent units.

Fossils from throughout the unit (**GSC Loc. 20046**; Field No. 74.2t) include:
the same forms of *Buchia pacifica sensu lato* as in the lot 20055;
very rare representatives of *B. tolmatschowi sensu lato*;
transitional forms between *B. tolmatschowi* and *B. pacifica*;
rare casts of arcid-, *Astarte*-, and *Arctica*-like bivalves; and
rare *Acroteuthis* n. sp. A (*e.g.* Jeletzky, 1965, pl. XVIII, figs. 4, 5).

191 0.13-0.18 337.2-384.9

(Protrudes somewhat above the adjoining beds in the central part of the third hogback.)

Shale, brownish-grey, sandy, calcareous, hard; matrix in places grades into calcareous sandstone; *Buchia* abundant throughout.

Fossils from throughout the unit (**GSC Loc. 20055**; Field No. 74.2u) include:
the same forms of *Buchia pacifica sensu lato* as in the lot 20068 (large to very large representatives predominate);
very rare *B. tolmatschowi sensu lato*; and
transitional forms between *B. pacifica* and *B. tolmatschowi*.

192 0.6 337.7-385.5

Sandstone, grey, calcareous; coarse and gritty near top but gradually fining downward into calcareous, sandy siltstone in the lower 0.2 m; small, dispersed pebbles about 0.3 cm in diameter noted at top of unit.

Fossils from throughout the unit (**GSC Loc. 20726**; Field No. 74.2v) include:
the same forms of *Buchia pacifica sensu lato* as in lots 20725 and 20068;
very rare transitional forms to *B. tolmatschowi sensu lato*; and
a single specimen of a *Turbo*-like gastropod.

193 1.2-1.5 338.9-387.0

(Forms the northern part of the flat top of the central, “dyke-like” part of the third hogback.)

Sandstone, dark grey, gritty, calcareous; lenses and thin layers of coarse grit and abundant floating small (*ca.* to 0.5 cm) angular pebbles of volcanic? rock noted throughout; larger pebbles found less commonly in unit (as well as in overlying units); grit is locally reduced in the lower 0.6-0.9 m to regular, 5-10 cm-thick layers intercalated with similarly thick layers of calcareous sandstone; the upper 0.4-0.75 m are composed of grit all along the outcrop; *Buchia* abundant throughout.

Fossils from the lower 0.60-0.75 m of the unit (**GSC Loc. 20725**; Field No. 74.2w) include:
the same forms of *Buchia pacifica sensu lato* as in lots 20043 and 18372; and

Unit	Unit Description	Thickness (m)	Total Thickness Above Base (m)

rare casts of *Pecten* (*sensu lato*)- and *Arctica*-like bivalves.

Fossils from the upper 0.45-0.60 m of the unit (**GSC Loc. 20068**; Field No. 74.2x) include:
the same forms of *Buchia pacifica sensu lato* as in lots 20043, 18372 and 20725;
several specimens of *B. tolmatschowi sensu lato*;
Solemya? sp. indet. (solitary cast); and
very rare casts of *Arctica*-like bivalves (immature).

194 ~0.3 339.2-387.3

(Forms the southern part and edge of the flat top of the third hogback.)

Sandstone, fine-grained, clay-rich, grey, calcareous, often grades into coquinoid sandstone; common coarse sand and grit; grades into overlying and underlying gritty units; differs from adjacent beds in its lighter weathering colour and irregularly honeycombed and dissolved surface; tightly packed with *Buchia* throughout.

Fossils from throughout the unit (**GSC Locs. 20043** and **18372**; Field No. 74.1b) include:
Buchia pacifica Jeletzky 1965 (**GSC No. 16644**, Jeletzky, 1965, Pl. 16, figs. 3A-C; **GSC No. 16648**, Jeletzky, 1965, Pl. 16, figs. 7A, B) (these are the same forms of *Buchia pacifica* as in the lots 20044 and 20701; the ratio of transitional forms to *B. tolmatschowi sensu lato* is about the same as in lot 20701.

195 1.7-1.8 340.9-389.1

(Forms the uppermost part of the southern slope of the third hogback overlooking the ocean and is 7.0-8.5 m above low tide level.)

Grit, greenish-grey, somewhat calcareous, with numerous dispersed small pebbles up to 10 cm diameter; thin layers and lenses (2-8 cm thick) of fine pebble conglomerate noted locally; irregular, discontinuous lenses of sandy to gritty coquinoid, 2-12 cm thick and abundant with *Buchia*, noted at intervals throughout.

Fossils from the lower 0.60 m of the unit (**GSC Loc. 20056**; Field No. 74.1b.1) include:
the same forms of *Buchia pacifica* Jeletzky 1965 *sensu lato* as in unit 196 but with greater percentage of large specimens; and
rare casts of *Arctica*- and *Astarte*-like bivalves.

Fossils from the middle 0.60 m of the unit (**GSC Loc. 20044**; Field No. 74.1b.2) include:
numerous *Buchia pacifica* Jeletzky 1965 *forma typica* and var. (large, typical representatives predominate); and
rare transitional forms to *B. tolmatschowi sensu lato*.

Fossils from the upper 0.45-60 m of the unit (**GSC Loc. 20701**; Field No. 74.1b.3) include:
same forms of *B. pacifica* as in the lot 20044 associated with somewhat more numerous transitional forms to *B. tolmatschowi sensu lato*.

196 0.6 341.5-389.7

Coquina limestone, light grey, hard, impure; strongly arenaceous and gritty in lower 0.15 m; tightly packed with large *Buchia* throughout; dispersed grit particles and small pebbles noted commonly throughout thickness but definitely less common in upper 0.15 m of unit, which contains a great amount of sand and silt; surface strongly differentially-weathered; a thin (2-5 cm) layer of strongly calcareous siltstone noteds at boundary with overlying unit 197.

Unit	Unit Description	Thickness (m)	Total Thickness Above Base (m)
	Fossils from throughout the unit (**GSC Loc. 20626**; Field No. 74.1b.4) include: numerous small- to medium-sized (immature?) *Buchia pacifica* Jeletzky 1965 *sensu lato* (elongate forms predominate and some are transitional to *Buchia tolmatschowi* Sokolov 1908 *sensu lato*); and *Buchia* aff. *tolmaschowi* (rare)		
197	Limestone, light grey, impure, very sandy; *Buchia* abundant throughout. Fossils from throughout the unit (**GSC Loc. 20553**; Field No. 74.1a.6) include: numerous large representatives of *Buchia pacifica* Jeletzky 1965 *forma typica*; numerous large representatives of *Buchia pacifica* Jeletzky 1965 var.; *B*. aff. *tolmaschowi* (rare); and *Lima* (*Limea*?) sp. indet. (a few poor fragments).	0.6-0.8	342.1-390.5
198	Sandstone, brownish-grey to rust-coloured, very coarse, gritty, partly calcareous; grades locally into grit; strings of solitary specimens of *Buchia* noted throughout. Fossils from throughout the unit (**GSC Loc. 20698**; Field No. 74.1a.5) include: numerous but mostly small- to medium-sized forms of *Buchia pacifica* Jeletzky 1965; rare *B. tolmatschowi* Sokolov 1908 and transitional forms to *Buchia pacifica*; and *Lima* (*Limea*) sp. indet. (single specimen).	1.4-1.5	343.5-392.0
199	(Deep crevice extending along the southern slope of the third hogback; represents the site of weak rock largely removed by erosion and inaccessible due to coverage by the sea.)	0.3	343.8-392.3
200	Sandstone, medium-grained, light grey, very calcareous; *Buchia* abundant throughout. Fossils from throughout the unit (**GSC Loc. 20724**; Field No. 74.1a.4) include: numerous *Buchia pacifica* Jeletzky 1965 *forma typica*; numerous *Buchia pacifica* Jeletzky 1965 var.; very rare *Buchia* aff. *tolmatschowi* Sokolov 1908; *Astarte*-like bivalves (very rare); and wood fragments.	~0.6	344.4-392.9
201	Sandstone, coarse-grained and gritty, dark to light grey, mostly calcareous; *Buchia* abundant throughout. Fossils from throughout the unit (**GSC Loc. 20025**; Field No.74.1a.3) include: numerous *Buchia pacifica* Jeletzky 1965 *forma typica*; *Buchia pacifica* Jeletzky 1965 var. (**GSC No. 16654**, Jeletzky, 1965, Pl. 19, figs. 6A-C); *B*. aff. *tolmaschowi* (rare); indeterminate bivalves (rare); and *Epitoneum*-like gastropod (one specimen).	~1.2	345.6-394.1
202	(Forms the lower, wall-like, precipitous part of the southern slope of the third hogback, dropping down to the water's level over most parts of the southwestern shoreline of the southern rocky fringe of Grassy	1.8	347.4-396.0

Unit	Unit Description	Thickness (m)	Total Thickness Above Base (m)

Island; the promontory that exposes units 203 and 204 is found in the middle part of this shoreline.)

Grit, greenish-grey, very calcareous, with dispersed small pebbles; a few scattered lenses of *Buchia*.

Fossils from the lower 0.3 m of the unit (**GSC Loc. 20063**; Field No. 74.1a.2) include:
numerous *Buchia pacifica* Jeletzky 1965 *forma typica*;
numerous *Buchia pacifica* Jeletzky 1965 var.;
rare *Buchia* aff. *tolmatschowi* Sokolow 1908; and
rare *Dentalium*? sp. indet.

Fossils from the upper 0.3 m of the unit (**GSC Loc. 20709**; Field No. 74.1a) include:
numerous *Buchia pacifica* Jeletzky 1965 *forma typica*;
numerous *Buchia pacifica* Jeletzky 1965 var.; and
indeterminate plant fragments and pieces of fossil wood.

203		2.0-2.4	349.4-398.3

(Very poorly exposed in the trough between the more resistant units 202 and 204.)

Sandstone, coarse-grained, light grey, very calcareous; almost barren of fossils, no collection made.

204		0.6-0.9	350.0-399.2

(The unit is exposed only on a small promontory of the southern shoreline of the rocky fringe of Grassy Island, it forms a low hogback on the outer edge of this promontory; top concealed beneath the sea.)

Sandstone, fine-grained, light grey, very calcareous; *Buchia* abundant throughout.

Fossils from throughout the unit (**GSC Locs. 18393** and **20715**; Field No. 74.1a) include:
Buchia pacifica Jeletzky 1965 *forma typica* (**GSC No. 16649**, Jeletzky, 1965, Pl. 16, figs. 8A-C); and
Buchia pacifica Jeletzky 1965 var.

Top of section covered by sea