Early Anisian (Middle Triassic) ammonoid biostratigraphy of northeastern British Columbia

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Key words: Ammonoids, Early Anisian, Middle Triassic, British Columbia

ABSTRACT

The Early Anisian ammonoid sequence of the Toad Formation in northeastern British Columbia has been subdivided into the Mulleri Zone and Caurus Zone by Tozer (1994a), with further distinction of Subzones 1 and 2 within the Caurus Zone. Gymnites procerus Tozer, Caurusites ordtardi n. sp., Stenopoanoconites sp. indet., and Usurrites muskwa McLeArn are here reported for the first time from Caurus Subzone 1. Another distinct fauna characterized by Pararchoceritoceras americanum (McLeArn) was thought to be of Early Anisian age but its stratigraphic position in relation to other Anisian faunas was so far unknown. Two new localities yielding this distinctive fauna have now been found. It appears that the fauna occurs in beds near the Early-Middle Anisian boundary, above Subzone 1 of the Early Anisian Caurus Zone and below the early Middle Anisian Haugei Zone. Besides Pararchoceritoceras americanum (McLeArn), diagnostic species for this fauna include Bradyia cameranoense n. gen. n. sp., Columboceras inflatum n. gen. n. sp., Stenopaanoconites normale (McLeArn), and Columbiscyclus nucleatus Tozer. Pararchoceritoceras is exclusively Early Anisian. Also, the associated species Gromberga tetes Tozer, Stenophylites kindti (McLeArn), and Usurrites muskwa McLeArn range up from the Caurus Subzone 1 into the P. americanum Beds. Among the genera of the P. americanum fauna, only Bradyia, Stenopaanoconites and Usurrites range up into the Middle Anisian. The newly documented suprataxonomic relationships and the faunal content indicate a latest Early Anisian allocration of this fauna. Similarities between the P. americanum Beds and Caurus Subzone 2 are not great, and their mutual suprataxonomic relationships remain unknown. However, the P. americanum Beds of British Columbia provide a distinct assemblage which shows strong affinities with another newly discovered latest Early Anisian fauna in the Favret Formation of northwestern Nevada (Bucher, unpubl. data). This suggests that a higher resolution in the correlations between the mid- and low-paleolatitude plate-boundary records of the North American Cordillera can be achieved for ammonoid faunas of Early Anisian age.

1. Introduction

The Toad Formation in the Rocky Mountain Foothills of northeastern British Columbia has yielded a wealth of Middle Triassic ammonoids, on which Silberling & Tozer (1968) and Tozer (1967, 1982) based the North American mid-paleolatitude, plate-boundary standard succession. Anisian ammonoid faunas from the Tetsa River Valley (northeastern British Columbia) were first made known by McLeArn (1946a, 1946b, 1948, 1969) and McLeArn & Kindie (1950). The geology of the Tetsa
River Valley and adjoining areas has been mapped by Pelletier (1959). Later reports on the Triassic geology and biostratigraphy of the area are in Pelletier (1960, 1961, 1963), Tozer (1967), and Taylor & Stott (1973). This standard has been revised recently and updated by Tozer (1994a) in a comprehensive biostratigraphic and taxonomic treatment of the Triassic ammonoids from Canada. New Early, Middle, and Late Anisian collections and biostratigraphic data were obtained by the writer from the Toad Formation of the Tetsa River Valley (Figure 1). This paper deals only with the Early Anisian material. The Middle and Late Anisian will be treated separately.
2. Early Anisian biostratigraphy

Following the biostratigraphic zonation established by Bucher (1989) for the low-paleolatitude Early Anisian record in Nevada, the biostratigraphic subdivisions of this stage in northeastern British Columbia have been subsequently updated by Tozer (1994a). Tozer recognizes two zones: Mulleri and Caurus, the latter being subdivided into Caurus Subzone 1 and Caurus Subzone 2 (see Figure 2). However, McLean (1946, 1948, 1969) described another distinct, but stratigraphically isolated fauna characterized by Paracrocodyliformes amercianum (McLean) at GSC loc. 10732 (southern tip of Cameron Hill, see Figure 1). Since McLean's discovery, this unique fauna has never been duplicated, and its stratigraphic position with respect to other Anisian ammonoid assemblages has remained unknown. Our new field investigations have now further documented McLean's fauna in two sections: Cameron Hill 2 and Mile Post 375 East (see Figure 1). At Cameron Hill 2, the P. americanum fauna (loc. C.209951) occurs 3.9 m below the base of the Middle Anisian Hagei Zone (loc. C.209953). At Mile Post 375 East, the P. americanum fauna (loc. C.209952) is found 4.6 m below the Hagei Zone (loc. C.209954) and about 12 m above the type locality of Subzone 1 of the Caurus Zone (GSC loc. 68203). The section at Mile Post 375 East is the most complete Early Anisian succession known from northeastern British Columbia. There, the Mulleri Zone (GSC loc. 68226), Caurus Subzone 1 (GSC loc. 68203), and the P. americanum fauna (loc. C.209952) are documented in sequence. Unfortunately, the Caurus Subzone 2 fauna is not known from this section.

The P. americanum fauna at Cameron Hill 2 (loc. C.209951) also comprises Braddyia cameronense n. gen. n. sp., Grambergia tetaensis McLEAN, Columbiculites maclearni TOZER, Stenophyllites kindlei (McLEAN), and Ussurites muskwa McLEAN. The P. americanum fauna at Mile Post 375 East (loc. C.209952) also includes Braddyia cameronense n. gen. n. sp., Columbiculites inflatum n. gen. n. sp., Grambergia tetaensis McLEAN, Stenophyllites kindlei (McLEAN), and Ussurites muskwa McLEAN. The fauna at McLean's original locality (GSC loc. 10732, McLean 1969, p. 8), as revised by Tozer (1994a), includes Paracrocodyliformes americanum (McLEAN), Grambergia tetaensis McLEAN, Columbiculites maclearni TOZER, Stenophyllites kindlei (McLEAN), and Ussurites muskwa McLEAN.
The diagnostic ammonoid association for this fauna includes: *Parachordiceras americanum*, *Stenopopanoceras normale*, *Columbianites macleanii*, *Bradyia cameronense*, and *Columbianites inflatum*. Representatives of *Greenlandites kummel*, *Lenotropites popov*, *Pearlandites kummel*, and *Caucasites shevryev*, which are well represented in the Mulleri and Caurus zones from both Nevada and northeastern British Columbia, are not known from this fauna. *Columbianites* is apparently restricted to this fauna, whereas *Bradyia* ranges into younger beds, being in the Middle Anisian of Nevada ("*Acrochordiceras* coyoense Bucher from Constricetus Subzone of the Hyatti Zone, see Bucher 1992). In the Toad Formation, *Caucasites* (*C. mulleri* Tozer) and *Gymnites procerus* Tozer were previously only known from the Mulleri Zone. *Caucasites archeri* n. sp., *Gymnites procerus* Tozer, and *Usurites muskwa* McLearn are recorded for the first time from the Caurus Zone (Subzone 1) at GSC loc. 68203. Figure 2 provides a summary of the biostratigraphic distribution of Early Anisian ammonoids from northeastern British Columbia as presently known.

Superpositional relationships documented from the sections at Cameron Hill 2 and Mile Post 375 East as well as faunal content confer a latest Early Anisian age to the *P. americanum* Beds. However, McLearn (1969, p.12) described one specimen of *P. americanum* from Liard River (GSC loc. 10660). Occurrences at this locality were described by Tozer (1994a), with a succession from Caurus Subzone 1 to Subzone 2, followed by the Middle Anisian Hagei Zone. Unfortunately, the position of *P. americanum* in relation to the Caurus subzones remains unknown. In Teta River Valley (Cameron Hill 2 and Mile Post 375 East), Caurus Subzone 1 is so far not documented. The stratigraphic relationship of the *P. americanum* Beds with respect to Caurus Subzone 2 thus remains uncertain, as suggested in Figure 2.

In the Teta River Valley, a tectonic culmination consisting of Paleozoic rocks (see SW corner of Figure 1) apparently separates two groups of facies within Anisian strata of the Toad Formation. West of the culmination, Anisian strata are predominantly shaly and contain pavements of phosphatic ammonoids. East of the tectonic culmination, correlative rocks consist of interbedded sandstone, siltstone, silty limestone, occasional limestone concretions, and shale. There, ammonoid occurrences do not show any sign of condensation. Furthermore, the detailed lithostratigraphic sequence appears to be laterally consistent in the eastern facies belt, with abundant marker beds. For instance, the horizon yielding the *P. americanum* fauna provides a conspicuous marker which consists of widely spaced (up to 15 m apart), black silty limestone nodules containing a maximum diameter of about 90 cm. In the studied area, the apparently rapid transition between the eastern facies belt and the deeper-water western facies belt suggests that a west-facing paleotopographic break existed along the future emplacement of the tectonic culmination.

The *P. americanum* Beds have no exact counterpart in the low-paleolatitude sequence of Nevada as established by Bucher (1989, Table 2), nor do they correlate well with the Siberian Tardus Zone (Dagys, 1988) whose *Lenotropites-Czekanowskities-Arctohungarites* association suggests a post-Caurus and pre-Middle Anisian age (see further discussion in Bucher, 1989; 960). However, another newly discovered latest Early Anisian fauna in the Favret Formation of Nevada (loc. HB 544 & 545, McCoy–Wildhorse mines area, Pershing County) resembles the Canadian *P. americanum* fauna, including *Bradyia*, *Grambergia*, and *Columbianites* associated with typical low-paleolatitude taxa such as *Silberlingites* and earliest representatives of *Balatonites* (Bucher, unpubl. data). The stratigraphic position of this assemblage is unfortunately not known with respect to the Early Anisian sequence as established from the Prida Formation in northern Humboldt Range. Nevertheless, the new occurrence from Nevada suggests that the faunal assemblage provisionally referred to as *P. americanum* Beds in northeastern British Columbia has a significant potential for correlation between the mid- and low-paleolatitude records of the North American Cordillera.

All the taxa known from the *P. americanum* Beds are illustrated in Plate 1 with the exception of *Stenopopanoceras normale* (McLearn) whose unique occurrence is at locality GSC 10732 (see Tozer, 1994a). Systematic descriptions include new taxa as well as emended descriptions for some others.

3. Systematic descriptions

Conventions. Locality numbers with GSC prefix, e.g., GSC 10732, are in the Catalogue of the Geological Survey of Ottawa. Numbers prefixed C-, e.g., C-209951, are in the Catalogue of the Institute of Sedimentary and Petroleum Geology in Calgary. Occurrences of taxa described hereafter include the number of specimens obtained from each locality. For example, C-209951 (2) means that two specimens were identified from loc. C-209951. Whorl height (H), whorl width (W), and umbilical diameter (U) are expressed as percentages of the shell diameter. The systematic descriptions follow the classification of Tozer (1981). The definition and classification of the outer shell features termed megaspira are in Bucher & Guex (1990).

Order *Ceratiida* Hyatt, 1884
Superfamily *Megaphyllitaceae* Mojsisovics, 1896
Family *Parapopanoceratidae* Tozer, 1971
Genus *Stenopopanoceras* Popov, 1961
Type species: *Stenopopanoceras mirabile* Popov, 1961

*Stenopopanoceras* sp. indet.
Pl. 1, Fig. 25–26

Description. A single small immature specimen was obtained from the Caurus Zone. Outline of last volution initially semicircular, ventor becomes blunt and angular on end of last, volution. Coiling egressive.

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280 H. Bucher
**Pararochodiceras americanum** (McLEARN), 1946

Pl. 1, Fig. 1–4

**Acrochordiceras (Pararochodiceras) americanum** McLEARN, 1946a, p. 16; McLEARN, 1946b, p. 3, PL 5, fig. 1; McLEARN, 1948, p. 25, PL 5, fig. 1; McLEARN, 1969, p. 12, PL 1, figs. 1–3; Tozer, 1967, p. 23, 77 (only); Tozer, 1994a, p. 111, PL 42, figs. 1–3.


**Description.** Inner whorls rounded, slightly depressed, with coarse and rursiradiate plicate ribbing on flanks but fading on the low arched venter. Ribs typically single when between two consecutive megaspirae. Paired ribs associated with megaspirae and conspicuous lateral parabolic on inner whorls. Umbilical shoulder indistinct, with flanks grading into the gently rounded umbilical wall. On outer whorls, loss of parabolic nodes concomitant with migration of branching point on lower flanks. Paired ribs gradually become predominant and progressively change into sinuous trajectory. While at early ontogenetic stage costation is more prominent on lower flanks, it becomes comparatively stronger on the upper flanks and venter at larger shell diameters. The whorl section also acquires a subquadrate outline, with development of rounded umbilical and ventral shoulders. Mature body chamber imperfectly known, but apparently characterized by a decreasing number of branching ribs. At D = 38 mm (pleistotype GSC 101812), H = 33 mm, W = 33 mm, and U = 46%. Largest size estimated at about 5 cm in diameter. Suture line incompletely known but ceratitic, for pleistotype GSC 101813 shows smooth saddles.

**Discussion.** Among the localities from which McLearn (1969) reported *P. americanum*, GSC loc. 10660 on the Llano River poses a problem. With the exception of *P. americanum*, this lot of ammonoids collected by E. D. Kindel typically represents a Caurus Zone assemblage. A first alternative is that this locality encompasses more than one bed, because *P. americanum* has never been recorded from any other Caurus Zone assemblage. Although less likely, another alternative is that this locality would indicate the earliest stratigraphic occurrence of *P. americanum*. Because Caurus Subzone 2 and *P. americanum* Beds have never been documented in stratigraphic succession, a formal separation of these two faunas is still uncertain as shown in Figure 2.

"**Pararochodiceras americanum**" was also originally recorded from GSC loc. 68226 (Mulleri Zone, Mile Post 375 East) by Tozer (1967, p. 69), but based on distinctive morphological grounds, this occurrence is now separated from *P. americanum* by Tozer (1994a) and has been renamed as *P. benderi*.


Family **Acrochordiceratidae** ARTHABER, 1911

Genus **Acrochordiceras** SPATH, 1934

Type species: **Acrochordiceras anodosa** WELTER, 1915

**Superfamily Ceratitaceae** MOJISOVICS, 1879

Family **Longobardiidae** SPATH, 1951

Subfamily **Longobardiniinae** SPATH, 1951

Genus **Grambergia** POPOV, 1961

Type species: **Grambergia taianiensis** POPOV, 1961

**Grambergia taianiensis** McLEARN, 1969

Pl. 1, Fig. 27–34; Text-fig. 3

**Grambergia taianiensis** McLEARN, 1969, p. 36, PL 7, figs. 1–5; Tozer, 1994a, p. 101, PL 43, figs. 3–4, PL 44, figs. 3–4, 10.

**Description.** Innermost whorls evolute, venter smooth and rounded, lateral folds of variable strength. Venter gradually becomes blunt and angular at about 7 mm in diameter. Faint, wavy rursiradiate folds on lower two thirds of flanks gradually fade away. Umbilicus very small or nearly occluded. Venter raises into a true keel at about 14 mm in diameter, and becomes acute at a size of 30–40 mm. Whorl section becomes lanceolate with very small but open umbilicus. On outer shell only, up to 5 barely visible spiral lines occasionally occur on outermost fourth of flanks. Growth lines typically biconvex, with a first broad shallow sinus on lower flanks and a second, much shorter sinus on outer flanks. Largest, complete and mature specimen 88 mm in diameter. Mature body chamber approximately two thirds of a whorl. At D = 57 mm, H = 59%, W = 21%, and U = 3%. Suture line with lateral lobe deeper than first umbilical lobe.

**Occurrence.** Loc. C-209951 (5), GSC loc. 10732 (6), Cameron Hill; C-209952 (5), Mile Post 375 East; *Pararochodiceras americanum* Beds, Toad Formation, northeastern British Columbia. Occurrences from the Mulleri and Caurus zones listed in Tozer (1994a).

Family **Acrochordiceratidae** ARTHABER, 1911

Genus **Acrochordiceras** SPATH, 1934

Type species: **Acrochordiceras anodosa** WELTER, 1915

**Discussion.** This specimen can be assigned to **Stenopopanoceras** with some confidence on account of its early egressive coiling and angular venter, but it is too incomplete for identification at the species level.

**Occurrence.** GSC loc. 68203 (1), Mile Post 375 East, Caurus Zone (Subzone 1), Toad Formation, northeastern British Columbia.
Diagnosis. Depressed, somewhat inflated, moderately evolve, and finely ribbed acrochordiceratid without tuberculation.

Description. Venter broad, with semi-circular outline, indistinct flanks limited by high and convex umbilical wall. Up to about 1 cm in diameter, the holotype shows parabolic megaspirae, but without elevation at the emplacement of the parabolic segment. Plicate ribbing dense and fine, straight or slightly prospiradate, with only a few ribs branching below mid-line of flanks. No elevation occurs at branching point. Ribs gradually attain their greater strength on venter. At D = 21 mm (holotype of type species), H = 40%, W = 63%, and U = 26%. Suture line not known.

Etymology. Genus name derived from the Province of British Columbia.

Discussion. Conch shape of Columboceras invites comparison with Pseudacrochordiceras, a genus name introduced by Tozer (1994b) for the late Spatham Acrochordiceras inyoense Smith (1914). However, the distinction at the genus level is based on the absence of any suggestion of tuberculation. Columboceras also differs from Paracrochordiceras and Acrochordiceras by its depressed shape and absence of tuberculation.

Columboceras inflatum n. sp.
Pl. 1, Fig. 5–6

Diagnosis and Description. As for the genus.

Etymology. Refers to the inflated whorl shape.


Genus Bradyia n. gen.
Type species: Bradyia cameronense n. sp.

Diagnosis. Small to medium-sized, non-tuberculated acrochordiceratid with constrictions and subducted plicate ribbing. Conch evolve, with either rounded or somewhat depressed whorl section. Length of body chamber at least of three forths of a whorl. Suture line subammonitic, with deeply indented and broad lateral lobe.

Etymology. Genus named for David Brady, Unionville (Nevada).

Composition of the genus. Bradyia cameronense n. sp., Bradyia coyotense (Bucher).

Discussion. Distinction from both Paracrochordiceras (Early Anisian) and Acrochordiceras (Middle Anisian) is based on the combined absence of tubercles and presence of constrictions. The new genus is the only known acrochordiceratid that possesses constrictions. The subammonitic suture line of Bradyia is closely similar to that of Acrochordiceras and differs only in having a broader first umbilical saddle. Phylogenetically, Bradyia is interpreted as a separate offshoot of the earlier Early Anisian paracrochordiceratid stock, from which Acrochordiceras also evolved around the Early-Middle Anisian boundary.

Remarks. From the Middle Anisian sequence of Nevada, "Acrochordiceras" coyotense was described by Bucher (1992, p. 152, Pl. 6, figs. 1721) from the Constrictus Subzone of the Hyatti Zone. This species is here assigned to Bradyia. Plicate ribbing and constrictions are characters commonly shared by at least some Anisian representatives of Balatonitidae (e.g., Gipsburgites, see Bucher, 1992, p. 154, Pl., figs. 611) and Acrochordiceratidae (e.g., Bradyia n. gen.), suggesting close phylogenetic relationships at the family level. Biostratigraphic constraints suggest that Acrochordiceratidae may have branched off from Balatonitidae during the Spatham (Bucher, unpubl. data).

Occurrence. Latest Early Anisian (P. americanum Beds), Toad Formation, northeastern British Columbia; earliest Middle Anisian (Hyatti Zone, Constrictus Subzone), Fossil Hill Member of the Prida Formation, Nevada.

Bradyia cameronense n. sp.
Pl. 1, Fig. 35; Text-fig. 4

Diagnosis. Small-sized, evolve Bradyia with rounded whorl section and subdued ribbing.

Description. Shell shape evolve with rounded whorl section. The holotype has 12 shallow constrictions on the ultimate volution. Plicate ribs bordering the prospiradate constrictions invariably have a greater strength than intervening ribs. Umbilical margin well defined and first rounded, then becoming higher and convex. At D = 26.5 mm (holotype), H = 31%, W = 39%, and U = 45%.

Etymology. Species named derived from Cameron Hill.

Discussion. Distinguished from B. coyotense (Bucher) by its more serpentine shape, weaker ribbing, and more numerous constrictions.

Occurrence. Loc. C-209951 (1), Cameron Hill; C-209952 (2), Mile Post 375 East, Paracrochordiceras americanum Beds, Toad Formation, northeastern British Columbia.
Superfamily *Psychitaceae* Moisiosovics, 1882
Family *Ischitidae* Spatii, 1951
Genus *Columbusculites* Tozer, 1994a
Type species: *Columbusculites maclearni* Tozer, 1994a

*Columbusculites maclearni* Tozer, 1994a
Pl. 1, Fig. 19–24

*Emended description.* Medium-sized ischitid with permanently occluded umbilicus and smooth outer shell. Intraspecific variation expressed by about 50% variation of the shell width. Growth lines straight on inner flanks, gently rursiradiate on outer flanks, and sinus-shaped on venter. Occurrence of constrictions highly variable, from none to up to five per half-whorl. On phragmocone, constrictions visible on both inner mold and outer shell. On mature body chamber, constrictions only visible on inner mold, not on outer shell. Outer shell of mature body chamber with occasional crinkled megastriae and wrinkle layer on dorsal side. Spiral lines occur on inner mold of mature body chamber. Broad peristomal collar on final aperture. Length of mature body chamber about four-thirds of a whorl. Suture line ammonitic with finely frilled and elongated elements (see Tozer, 1994a, fig. 32).

*Discussion.* As a monospecific genus, *Columbusculites* is distinguished from all representatives of *Ischitites* Moisiosovics (Early and Middle Anisian age) and *Nevadisculites* Bucher (Middle Anisian age) by its permanently occluded umbilicus and rursiradiate growth lines. Although the presence of constrictions very variable in *Columbusculites*, this character is shared with *Ischitites*, but not with *Nevadisculites* (see Bucher, 1988, p. 744). On the other hand, the suture line of *Columbusculites* compares more closely with that of *Nevadisculites* (see Bucher 1988, fig. 16) than with that of *Ischitites* (see Silberling & Nichols, 1982, fig. 26).

*Occurrence.* Loc. C-209951 (6), GSC 10732 (2), Cameron Hill 2 Paracordiscus americani Beds, Toad Formation, northeastern British Columbia.

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Superfamily *Pinacocerataceae* Moisiosovics, 1879
Family *Gymnitiaceae* Waagen, 1895
Subfamily *Japonitiidae* Tozer, 1971
Genus *Caucasites* Shevrev, 1968
Type species: *Caucasites evolutus* Shevrev, 1968

*Caucasites orchardi* n. sp.
Pl. 1, Fig. 17, 18; Text-fig. 5

*Diagnosis.* Cadicone, somewhat compressed *Caucasites* with megastriae on outer shell.

*Description.* Flanks slightly convex and converging, venter narrowly rounded. Whorl section becomes subfastigate as whorl height increases. Umbilical shoulder narrowly rounded, with progressively higher and slightly convex umbilical wall. Shell surface smooth, with prorsiradiate striae. Last whorl of phragmocone bears four megastriae showing deep U or V-shaped ventral sinuses imparting an irregular lateral outline to the siphonal line. Some bundling of growth striae results from intersection by megastriae. Remains of the flattened body chamber which were removed during preparation indicate a length of at least seven eighths of a whorl. At D = 36 mm (end of phragmocone), H = 37%, W = 42%, and U = 35%. Suture line ammonitic, conforming to that of the genus. Lateral saddle massive and less elongated than the first external saddle. Lateral saddles forming a somewhat retracted suspensory lobe.

*Etymology.* Species named for Michael J. Orchard, Geological Survey of Canada (Vancouver).

*Discussion.* Among all of the representatives of *Caucasites*, presence of megastriae and the slightly retracted outline of the suspensory lobe are distinctive characters of *C. orchardi* n. sp. Tighter coiling is an additional difference with *C. mulleri* Tozer (Mulleri Zone of northeastern British Columbia), *C. evolutus* Shevrev, and *C. inflatus* Shevrev. A more compressed whorl section allied with a more subfastigate venter also permit distinction from *C. nicholisi* Bucher. Although intraspecific variation of *C. orchardi* n. sp. cannot be assessed, its general shell shape more closely resembles that of compressed variants of *C. nicholisi* from the Mulleri Zone of Nevada (Bucher, 1989, p. 980).

*Occurrence.* GSC loc. 68203 (1), Caurus Zone, Subzone 1, Mile Post 375 East, Toad Formation, northeastern British Columbia.

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Fig. 5. Suture line of *Caucasites orchardi* n. sp. Holotype, GSC 101820, loc. GSC 08203, Caurus Zone, Subzone 1, x 6.
Order Phylloceratida ZITTEL, 1884
Superfamily Ussuritaceae HYATT, 1900
Family Palaeophyllitidae POPOV, 1958
Genus Stenophyllites TOZER, 1994a
Type species: Leiophyllites kindlei MCLEARN, 1946.

**Stenophyllites kindlei** (MCLEARN, 1946)
Pl. 1, Fig. 1316; Text-fig 6

** Leiophyllites? kindlei** MCLEARN, 1946a, p. 10; Appendix II, p. 1, Pl. 2, fig. 4; MCLEARN, 1948, p. 12, Pl. 2, fig. 4.

** Leiophyllites kindlei** MCLEARN, TOZER, 1967, p. 23, 71; MCLEARN, 1969, p. 55, Pl. 1, fig. 9.

**Stenophyllites kindlei** (MCLEARN), TOZER, 1994a, p. 269, Pl. 46, figs. 46.

**Description.** Evolute, extremely platycone, and smooth Stenophyllites. Venter rounded and umbilical margin very low but steep. At D = 34 mm, H = 41%, W = 15%, and U = 32%. Suture line with finely indented lobes, and flanks of saddles crenulated. Ventral lobe wide, first umbilical lobe deeper than lateral lobe.

**Discussion.** Comparison of the specimens from the *P. americanum* Beds does not show any significant difference with older representatives from the Caurus Zone.

**Occurrence.** Loc. C-209951 (3), Cameron Hill 2; GSC 10732 (12), Cameron Hill; Loc. C-209952 (6), Mile Post 375 East; Paracrochordiceras americanum Beds, Toad Formation, northeastern British Columbia. Occurrences from the Caurus Zone in the Toad Formation listed in Tozer (1994a).

Family Ussuritidae HYATT, 1900
Genus Ussurites HYATT, 1900
Type species. Monophyllites sichoticus DIENER, 1895

**Ussurites muskwa** MCLEARN, 1946
Pl. 1, Fig. 11-12, Text-fig 7


**Description.** Ussurites with megastraiae associated with spirally elongated marginal auriculoids occurring up to a shell diameter of about 3 cm. Striation slightly prorsiradiate, with some bundling on the flanks resulting from their intersection with megastraiae. Megastraiae also impart a polygonal outline to the umbilicus on innermost whorls. Transition to outer whors enhanced by gradual transformation from a subquadrangular, somewhat rounded whorl section to a much higher, subrectangular shape with concomitant accentuation of umbilical shoulders. Irregularly distributed wavy ribs still persist and are superimposed on the striation on flanks but do not cross the uniformly arched venter. The largest known specimen is about 9 cm in diameter (see MCLEARN, 1969, Pl. 13, fig. 2). At D = 54 mm, H = 39%, W = 26%, and U = 35%. Suture line conforms with original illustration of MCLEARN (1969, fig. 28).

**Discussion.** Distinguished from *U. cameroni* MCLEARN of Upper Anisian age (Deleeni Zone from northeastern British Columbia) by a less complexly subdivided first lateral lobe, presence of wavy folds, an ontogenetically more extended marginal tuberculation, and an apparently smaller size; from *U. dawleyi* BUCHER (Caurus Zone from Nevada) by absence of well-defined ribbing on inner whorls. The range of *U. cameroni* is also here newly extended to the Caurus Zone (Subzone 1).

**Occurrence.** GSC loc. 68203 (1), Caurus Subzone 1, Mile Post 375 East. Loc. C-209951 (3), Cameron Hill 2; Loc. C-209952 (2), Mile Post 375 East; Paracrochordiceras americanum Beds; Early Anisian, Toad Formation, northeastern British Columbia.

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Fig. 1–4. *Paracrochordiceras americanum* McLEARN, *Paracrochordiceras americanum* Beds, loc. C-209951; 1–2, plesiotype, GSC 101812; 3–4, plesiotype, GSC 101813.

Fig. 5–6. *Colubmoceras inflatum* n. gen. n. sp., *Paracrochordiceras americanum* Beds, holotype, GSC 101814, loc. C-209952.

Fig. 7–10. *Bradyia cameronense* n. gen. n. sp., *Paracrochordiceras americanum* Beds; 7–8, plesiotype, GSC 101815, loc. C-209952; 9–10, holotype, GSC 101816, loc. C-209951.

Fig. 11–12. *Usuratismus muskwa* McLEARN, *Paracrochordiceras americanum* Beds, loc. C-209951, plesiotype, GSC 101817.

Fig. 13–16. *Sonophyllites kleinii* (McLEARN), *Paracrochordiceras americanum* Beds; 13–14, plesiotype, GSC 101818, loc. C-209951; 15–16, plesiotype, GSC 101819, loc. C-209952.

Fig. 17–18. *Caucasites orchardi* n. sp., Caurus Zone, Subzone 1, GSC loc. 68203, holotype, GSC 101820. Flattened body chamber removed.


Fig. 25–26. *Sienopanoceras* sp. indet., Caurus Zone, Subzone 1, GSC loc. 68203, plesiotype, GSC 101824.
