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Early Albian (Early Cretaceous) douvilleiceratid ammonites from Haida Gwaii, British Columbia, Canada

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Abstract.—The early Albian to mid-Albian cosmopolitan genus *Douvilleiceras* is represented in the Haida Gwaii archipelago of western British Columbia by five species, *D. mammillatum* (Schlotheim), *D. offarcinatum* (White), *D. scabrosum* Casey, *D. spiniferum* (Whiteaves), and *D.* aff. *spiniferum* (Whiteaves). Specimens of one of these taxa, *D. spiniferum*, are particularly abundant on Haida Gwaii and the species is discussed with respect to its morphological variability and ontogenetic development. The important morphological features for taxonomic criteria of the genus *Douvilleiceras* are the mode of tuberculation, the pattern of ribbing, and the proportions of the shell in the middle growth stage.

Introduction

The Cretaceous succession of the Haida Gwaii archipelago (formerly Queen Charlotte Islands) of western British Columbia, Canada, includes numerous abundant and well-preserved molluscan faunas, particularly in the Haida Formation, making this one of the best localities to study ammonite faunas of the North Pacific faunal province. The Haida Formation contains a number of important Albian ammonite taxa recognized elsewhere in the Pacific region and in some cases globally, including the genus *Douvilleiceras* and the species *Anagaudryceras filicinctum* (Whiteaves, 1876), "*Anahoplitoides*" [= *Pochialayniceras* Alabushev and Alabusheva (1988)] *yakounensis* (Whiteaves, 1900), *Arcthoplites* (*Lemuroceras*) *linaensis* McLearn, 1972, *Brewericeras hulenense* (Anderson, 1938), *Calliphylloceras nizinanum* Imlay, 1960, *Cleoniceras* (*Grycia*) *perezianum* (Whiteaves, 1876), and *Parasilesites laperousianum* (Whiteaves, 1876). Among these, "*A.*" *yakounensis*, *C.* (*G.*) *perezianum*, and *A.* (*L.*) *linaensis* are all very interesting in representing typical Boreal faunal elements. The early Albian ammonite fauna of Haida Gwaii is thus a mixture of Tethyan and Boreal components in a broad sense and this mixed fauna has been called the North Pacific Fauna by Jeletzky (1977).

Based on numbers of specimens collected over the past 140 years, ammonites of the genus *Douvilleiceras* form one of the most abundant and distinctive ammonite genera characteristic of the early Albian faunas of Haida Gwaii. The douvilleiceratids from the Haida Formation, particularly in the Maude Island section found in Skidegate Inlet, have been studied systematically by Whiteaves (1876) and McLearn (1972), who both recognized only one distinct species, *Douvilleiceras spiniferum* (Whiteaves, 1876). Using an expanded set of morphological criteria, however, as well as large populations of specimens unavailable to the previous workers, we recognize five species within the genus *Douvilleiceras* in the Albian strata of Haida Gwaii.

Since Casey (1961) established the first modern biostratigraphic framework for the Albian, the European and Tethyan Albian ammonite zonations have been closely studied by numerous workers (e.g., Owen, 1988, 1999, 2007; Hoedemaeker et al., 1990; Reboulet et al., 2011) and, consequently, *Douvilleiceras mammillatum* has been recognized as an important zonal marker. As shown by Casey (1962), douvilleiceratid species are particularly abundant in the *mammillatum* Zone, the upper part of the lower Albian, of northwestern Europe. On a global scale, the stratigraphic range of douvilleiceratid ammonites is restricted to the interval from the *Leymeriella* (*L.*) *tardefurcata* Zone (*L. acuticostata* Subzone) (Kennedy and Kollmann, 1979; Bréhéret et al., 1986; Owen, 1999) to the *Lyelliceras lyelli* Subzone of the *Hoplites dentatus* Zone (Owen, 1971; Destombes, 1979), indicating the lower part of the lower Albian to the lower part of the middle Albian.

Geological setting

Highly fossiliferous strata of Albian-Turonian age crop out along the shores of Bearskin Bay in central Skidegate Inlet, Haida Gwaii, British Columbia (Fig. 1). These Cretaceous strata, referred to the Queen Charlotte Group (Sutherland Brown, 1968; Haggart, 1991), are well exposed along the south shore of Graham Island adjacent to the town of Queen Charlotte City, as well as along the shores of Lina, Maude, and other

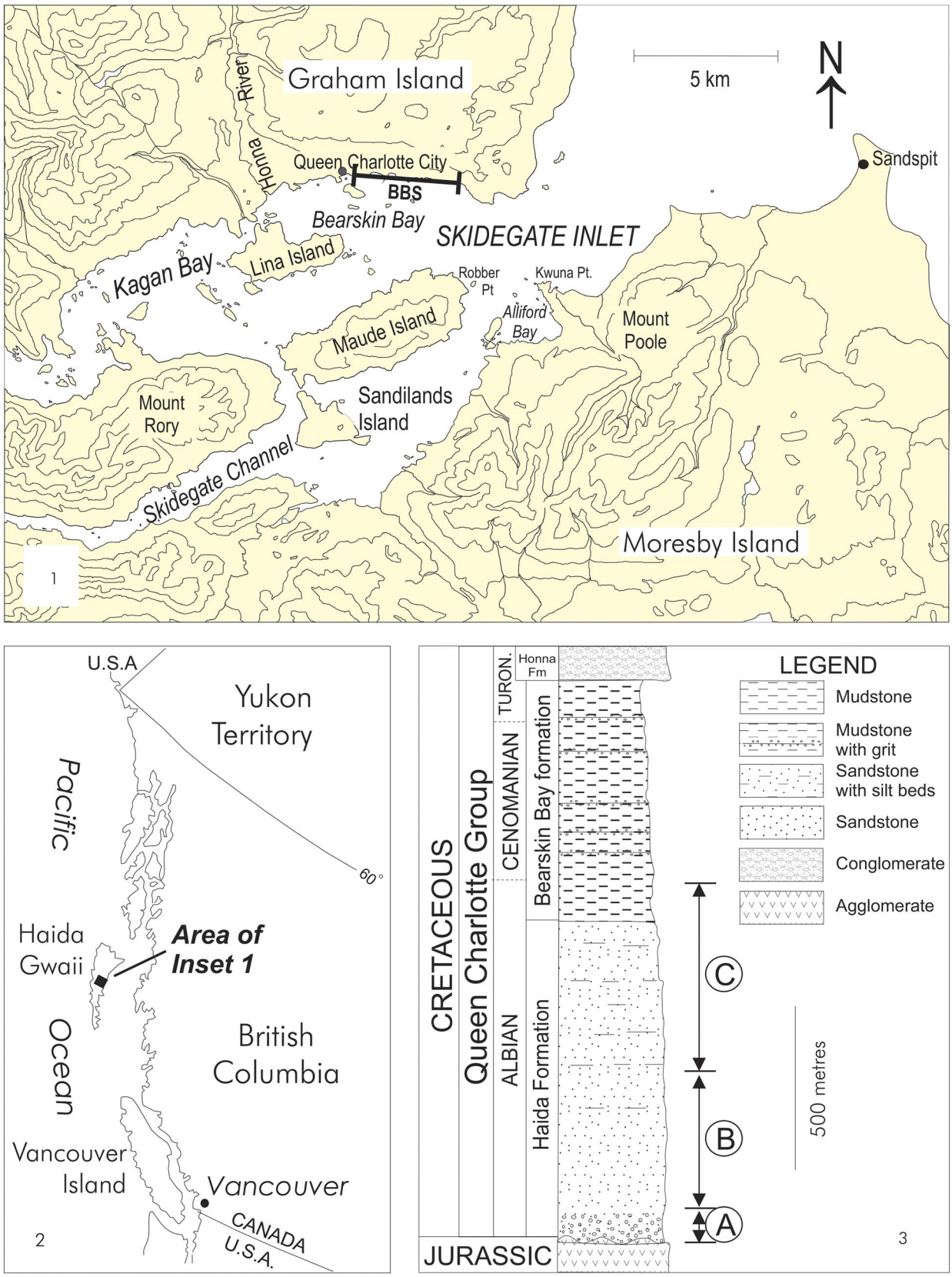

Figure 1. (**1, 2**) Location map of Haida Gwaii (formerly Queen Charlotte Islands), British Columbia, showing location of the Albian-Turonian succession preserved in Bearskin Bay, Skidegate Inlet (BBS; illustrated in inset **3**). Circled letters in (**3**) indicate stratigraphic ranges of Albian fossil zones: A = *Brewericeras hulenense* Zone; B = *Cleoniceras* (*Grycia*) *perezianum* Zone; C = *Mortoniceras – Desmoceras* (*Pseudouhligella*) *dawsoni* Zone.

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islands in Bearskin Bay (Haggart, 2004). The Albian section at Bearskin Bay is perhaps one of the best biostratigraphic reference sections for the Albian stage within the North Pacific region.

Lowermost Cretaceous strata exposed at Bearskin Bay consist primarily of conglomerate, sandstone, and alternating sandstone and siltstone. Collectively, these strata comprise the Haida Formation of the Queen Charlotte Group, and range in age from late early Albian to early late Albian (McLearn, 1972; Haggart, 1986, 1991). The Haida Formation grades upward into muddy siltstone and silty mudstone and shale of the informal Bearskin Bay formation, which ranges in age from late late Albian to late early Turonian (Haggart, 1986, 2004) (Fig. 1.3). The Bearskin Bay formation is in turn overlain, apparently conformably, by the poorly-fossiliferous Honna Formation (Haggart, 1991).

In addition to its relatively complete succession and simple structure, the Haida Formation displays an abundant and diverse molluscan fauna, including ammonites, bivalves, and gastropods. A basic biostratigraphic framework for the formation was established by McLearn (1972) and Jeletzky (1977), who recognized four local ammonite zones within the formation on Haida Gwaii. In ascending stratigraphic order these are: (1) the *Leconteites lecontei* Zone (= *Leymeriella* (*L.*) *tardefurcata* Zone in ammonite standard zonation of Reboulet et al., 2011, lower lower Albian); (2) the *Brewericeras hulenense* Zone (= *Douvilleiceras mammillatum* Zone, upper lower Albian); (3) the *Cleoniceras* (*Grycia*) *perezianum* Zone (= *Hoplites dentatus* ~ *Euhoplites lautus* zones, middle Albian); and (4) the *Mortoniceras* - *Desmoceras* (*Pseudouhligella*) *dawsoni* Zone (*Dipoloceras cristatum* ~ *Arrhaphoceras briacensis* zones, upper Albian). The Haida Formation at Skidegate Inlet, however, lacks the basal Albian *Leconteites lecontei* Zone (Fig. 1.3).

Douvilleiceras spiniferum (Whiteaves) is found commonly within a limited geographical and stratigraphical range in the upper lower Albian *Brewericeras hulenense* Zone on Lina and Maude islands (Fig. 1.2), and the northern part of Moresby Island (McLearn, 1972). In addition to *D. spiniferum*, we recognize several additional species of the genus *Douvilleiceras* from Haida Gwaii. All of these douvilleiceratids were obtained from calcareous concretions rich with the ammonite *Brewericeras hulenense* (Anderson, 1938) and plant fragments.

Systematic paleontology

Institutional abbreviations.—BM = Natural History Museum, London; GSC = Geological Survey of Canada, Ottawa; GSM = Geological Survey Museum, London.

Dimensions.—All measurements are given in millimeters. The following abbreviations are used for morphological features: D = specimen diameter; B = whorl breadth; H = whorl height; U = umbilical width; NR = number of ribs per whorl; NT = number of tubercles on each rib.

Sutural terminology.—Sutural terminology follows the usage of Wedekind (1916) as augmented by Kullmann and Wiedmann (1970), Wiedmann and Kullmann (1981), and Korn et al. (2003): I = internal lobe; U = umbilical lobe; A = lateral lobe; E = external lobe.

Order Ammonoidea Zittel, 1884
Suborder Ancyloceratina Wiedmann, 1966
Superfamily Douvilleiceratoidea Parona and Bonarelli, 1897
Family Douvilleiceratidae Parona and Bonarelli, 1897
Subfamily Douvilleiceratinae Parona and Bonarelli, 1897
Genus *Douvilleiceras* de Grossouvre, 1894

Douvilleiceras mammillatum (Schlotheim, 1813)
Figures 2, 3

1962 *Douvilleiceras mammillatum*; Casey, p. 265, pl. 40, fig. 4, pl. 41, figs. 4a–b, pl. 42, figs. 6, 9a–b, 10a–b, text-figs. 94, 102a–b [with synonymy].
1962 *Douvilleiceras mammillatum* var. *aequinodum*; Casey, p. 271, pl. 40, fig. 5, pl. 41, figs. 5–7, pl. 42, figs. 10a–b, text-figs. 94a–c, 95a–b, 102d, 103a–b.
1962 *Douvilleiceras mammillatum* var. *praecox*; Casey, p. 272, pl. 41, figs. 8a–b, text-figs. 94d–e, 102c.
1962 *Douvilleiceras monile*; Casey, p. 284, pl. 41, figs. 2a–b, pl. 42, fig. 5, text-fig. 102e.
1963 *Douvilleiceras mammillatum*; Collignon, p. 109, pl. 283, figs. 1238–1239, 1241, pl. 284, fig. 1242.
? 1963 *Douvilleiceras albense*; Collignon, p. 112, pl. 284, fig. 1243.
1969 *Douvilleiceras mammillatum*; Obata, p. 172–174, pl. 19, figs. 3, 5.
1972 *Douvilleiceras spiniferum*; McLearn, p. 62 (pars), pl. 10, figs. 3A–C.
1979 *Douvilleiceras mammillatum mammillatum*; Destombes, p. 69, pl. 4–21, fig. 1.
1979 *Douvilleiceras mammillatum* var. *aequinodum*; Destombes, p. 71, pl. 4–4, fig. 1, pl. 4–5, fig. 2, pl. 4–21, fig. 2.
1979 *Douvilleiceras mammillatum* var. *praecox*; Destombes, p. 71, pl. 4–21, fig. 3.
1979 *Douvilleiceras perchoisense*; Destombes, p. 72, pl. 4–4, figs. 2a, b.
1983 *Douvilleiceras aequinodum*; Weidich *et al*., p. 566, pl. 2, fig. 6.
1990 *Douvilleiceras mammillatum*; Marcinowski and Wiedmann, p. 51, pl. 7, figs. 5, 6.
? 2005 *Douvilleiceras* cf. *mammillatum*; Myczyński and Iturralde-Vinent, p. 792, figs. 3–9, 5.1, 2, 3.
2005 *Douvilleiceras mammillatum*; Prins, p. 31, CP46.
2008 *Douvilleiceras mammillatum aequinodum*; Latil, p. 257, pl. 2, figs. 4, 5.
2010 *Douvilleiceras mammillatum*; Courville and Lebrun, p. 28, pl. 1, figs. E, F.
2010 *Douvilleiceras monile*; Courville and Lebrun, p. 28, pl. 2, fig. R, pl. 6, fig. A.

Type.—Neotype, BM C12491, designated by Casey (1962, pl. 41, figs. 4a-b, text-fig. 102a), Folkestone Beds, main *mammillatum* bed, Copt Point, Folkestone, Kent (Coll. F. G. H. Price).

Description.—The coiling is moderately involute and the umbilicus is moderately wide, with U/D = 0.35. The whorl is depressed (Fig. 3). Multituberculate ribs on the outer whorl are rectiradiate and separated by interspaces a little wider

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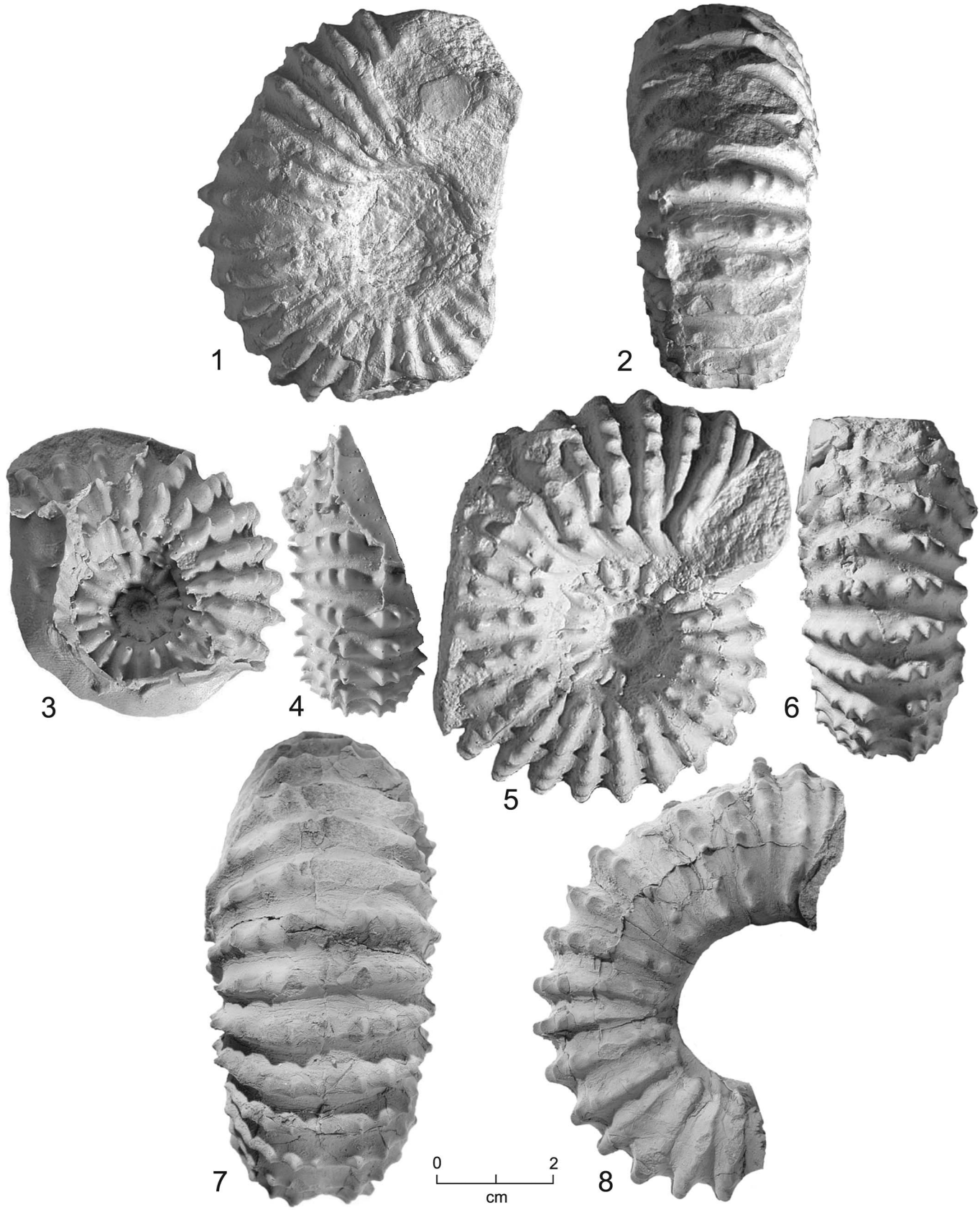

Figure 2. *Douvilleiceras mammillatum* (Schlotheim, 1813). (**1, 2**) GSC No. 21239, GSC Loc. 7598, lateral and ventral views of plaster cast. (**3–8**) GSC No. 10657, GSC Loc. C-303724; (**3, 4**) right lateral and ventral views of composite latex peel and plaster cast derived from external mold; (**5, 6**) left lateral and ventral views of composite plaster cast derived from external mold; (**7, 8**) ventral and left lateral views of actual specimen. All specimens coated with ammonium chloride.

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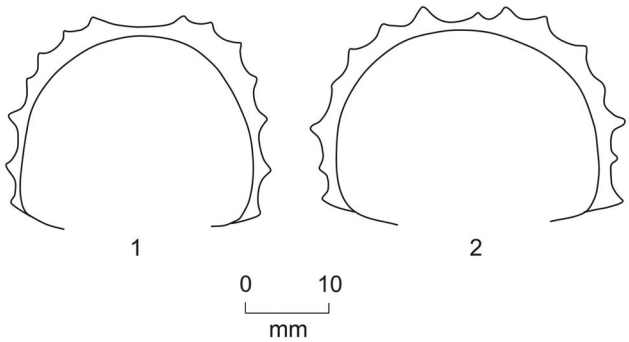

Figure 3. Whorl sections of *Douvilleiceras mammillatum* (Schlotheim) from Haida Gwaii. (1), GSC No. 21239, GSC Loc. 7598. (2), GSC No. 10657, GSC Loc. C-303724.

Table 1. Dimensions of specimens of *Douvilleiceras mammillatum* (Schlotheim, 1813) from Haida Gwaii, British Columbia

Specimen	D	H	B	B/H	U	U/D	NR	NT
GSC No. 10657	79.6	29.8	(36.8)	(1.23)	27.8	0.35	26	7+1*
GSC No. 21239	(70.0)	(29.2)	(33.0)	(1.13)	-	-	14x2	7+1*

All measurements in millimeters.
Measurements in parentheses are approximate.
*Indicating an additional row on each side of the venter.

than the ribs themselves. There are occasional intercalated ribs on the outer whorl of GSC No. 10657. The ribs number 26 per whorl on the outer whorl of GSC No. 10657. This specimen has eight rows of tubercles on each rib on the body chamber, but the inner row of ventrolateral tubercles on the left side of the shell is fainter than the other rows. This specimen shows an ontogenetic change in the number of tubercles on the outer whorl: six at less than approximately 50 mm in diameter, seven at approximately 50–70 mm, and eight at over 70 mm diameter.

Dimensions.—See Table 1.

Material.—GSC No. 10657, from a sandy calcareous concretion collected at GSC Loc. C-303724. The specimen consists of approximately two-thirds of a whorl of an intermediate-sized individual, as well as the very well-preserved internal mold of the remainder of the whorl. A composite plaster cast-latex rubber mold recreates the full specimen of GSC No. 10657. Another specimen, GSC No. 21239 (figured previously as *D. spiniferum* (Whiteaves) by McLearn, 1972, pl. 10, figs. 3a–c; illustrated herein in Fig. 2.1, 2), comes from GSC Loc. 7598.

Occurrence.—Whereas this species is found rarely in the lower part of the Haida Formation in Skidegate Inlet, it is widely distributed in the upper lower Albian (the *mammillatum* Zone) of the Mediterranean region.

Remarks.—The shell ornamentation of GSC No. 10657 (Fig. 2.3–2.8), such as mode of tuberculation and ribbing, is similar to the neotype specimen of *D. mammillatum*, illustrated by Casey (1962, pl. 41, figs. 5a–b), from southeast England. The present specimen, however, has a more slender whorl compared with the neotype.

GSC No. 21239 (Fig. 2.1, 2.2), figured by McLearn (1972, pl. 10, figs. 3a–c) as a specimen of *D. spiniferum*, has eight rows of tubercles on the outer whorl in middle growth stage, including an additional row on each side of the venter that is not seen in typical examples of the species, and fine and delicate tuberculation and fine ribbing on the outer whorl; consequently, this specimen appears to fall outside of the range of morphological variation for *D. spiniferum*. It is closely similar to a specimen illustrated by Casey (1962, p. 272, text-figs. 94–d, e) as *D. mammillatum* var. *praecox*, and we herein include it within material assigned to *D. mammillatum*.

Douvilleiceras spiniferum (Whiteaves, 1876)
Figures 4–9

1876 *Ammonites stoliczkanus* var. *spiniferus*; Whiteaves, p. 24, pl. 3, fig. 3, pl. 4, fig.1.
1900 *Acanthoceras spiniferum*; Whiteaves, p. 273, pl. 35, figs. 2, 3, 3a, text-fig. 14.
?1938 *Douvilleiceras restitutum*; Anderson, p. 175, pl. 54, fig. 2.
1962 *Douvilleiceras leightonense* var. *pringlei*; Casey, p. 277, pl. 41, figs. 3a–b, text-fig. 102j.
1967 *Douvilleiceras charshangense*; Mirzoyev, p. 54, pl. 7, figs. 1–5.
1972 *Douvilleiceras spiniferum*; McLearn, p. 62, pl. 10, figs. 1–3, pl. 11, figs. 1–2.
1972 *Douvilleiceras* sp. b; McLearn, p. 67, pl. 13, figs. 1A–B, pl. 26, fig. 1.
1979 *Douvilleiceras tarapacaense*; Etayo-Serna, p. 54, pl. 7, fig. 5, pl. 8, figs. 2, 6.

Types.—GSC No. 5014b, the lectotype selected by McLearn (1972) and illustrated by Whiteaves (1876, pl. 3, fig. 3; McLearn, 1972, pl. 11, figs. 1A–C; illustrated herein in Fig. 4), from Skidegate Inlet, west of Alliford Bay, exact locality not recorded (Coll. J. Richardson, 1872). GSC No. 5014a, a paralectotype also figured by Whiteaves (1876, pl. 4, fig. 1; McLearn, 1972, pl. 10, figs. 1A–C), was collected from the same locality.

Ontogenetic description.—The ontogenetic development in the relatively early stage of *D. spiniferum* (less than 35 mm in shell diameter) has been studied on selected specimens (GSC No. 10708 and GSC No. 10711) from Maude Island. The protoconch appears roughly ellipsoidal in shape. A clear primary constriction exists at approximately 0.9 mm diameter. The shell surface before the primary constriction is smooth, without any trace of ribs or tubercles on the whorl. After the primary constriction, a faint lateral tubercle, or possible spine, begins to appear on the mid-flanks. These tubercles number eight per whorl at approximately 2.5 mm of shell diameter (Fig. 5.1). The whorl at this stage is greatly depressed, the height being much smaller than the width, and the whorl section is trapezoidal in form. The ontogenetic changes in the whorl section after about 1.5 mm in shell diameter are shown in Figure 5.2.

At approximately 4.2 mm in diameter, faint and numerous ribs appear on the venter, lacking tubercles. They appear to be

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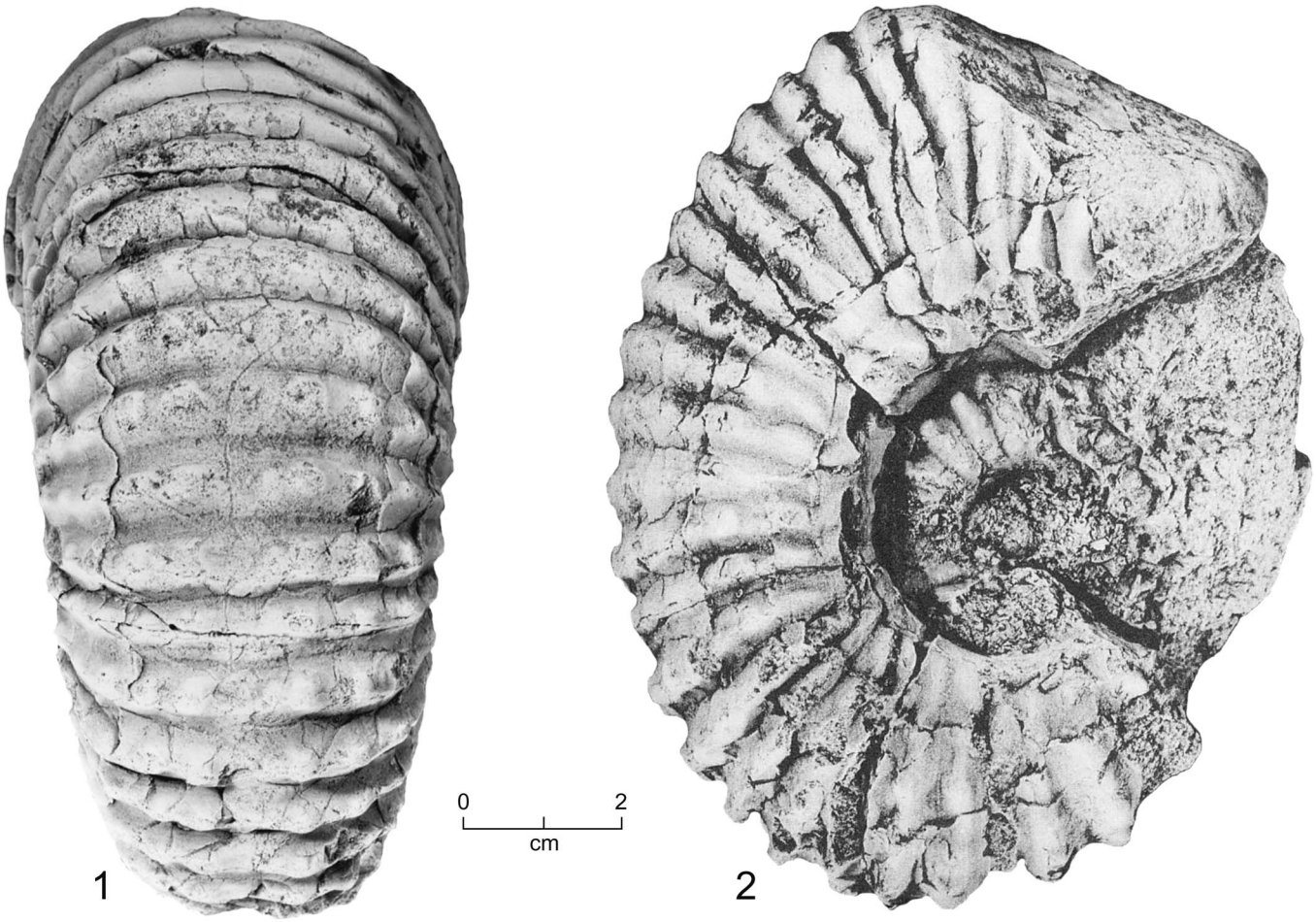

Figure 4. Lectotype of *Douvilleiceras spiniferum* (Whiteaves, 1876), GSC No. 5014b, Skidegate Inlet, west of Alliford Bay, exact locality not recorded (Coll. J. Richardson, 1872). (**1**) ventral, and (**2**) left lateral views of plaster cast of lectotype, coated with ammonium chloride.

irregular in strength. The first ventrolateral tubercle appears at about 6.2 mm in diameter as a faint conical elevation on the ventrolateral part of the ribs. At the same stage, the lateral tubercles are represented by a long spine. With further growth, the ventrolateral elevation becomes gradually higher, and then forms a distinct tubercle at approximately 7.5 mm in diameter, although it is not yet clavate. At approximately 11.5 mm in diameter, the third row of tubercles appears ventrolaterally to the second row of tubercles, and the ribs between the first ventrolateral tubercles have disappeared or become quite faint. In this stage, the first ventrolateral tubercles appear to be clavate. The first umbilical tubercles, forming the fourth row, develop along the umbilical margin at approximately 14.5 mm in diameter. At 22 mm in diameter, the third ventrolateral tubercle forms ventrolaterally to the second ventral tubercle (Fig. 6.1). Finally, at approximately 43 mm in diameter, a faint spinose tubercle appears between the lateral tubercle and the umbilical one. Regarding such ontogenetic changes as appearance or disappearance of tubercles and ribs, the present species shows great variation between individuals (Fig. 5.2, 5.3).

The sutural elements of *D. spiniferum* at middle growth stage are of typical *Douvilleiceras* form, characterized by fairly deep and narrow external and lateral lobes, and a broad and somewhat rounded first lateral saddle (E/A) (Fig. 7.2). The suture line of the extremely early growth stage is, unfortunately, not observed. At D $\approx$ 1–2 mm, however, the suture is expressed as EAUI, while at D >2.5 mm it is expressed as EAU_2U_1I, as shown in Figure 7.1. The suture of the later growth stage is given as EAU_2U_1I (Korn et al., 2003). The pattern of ontogenetic change of the suture line of *D. spiniferum* is closely similar to that of *D. "charshangense"* figured by Mirzoyev (1967, p. 56, fig. 2).

Occurrence.—This species is common in the lower part of the Haida Formation, particularly in the *Brewericeras hulenense* Zone (= *mammillatum* Zone) on Maude Island, and particularly in the *Leymeriella* (*L.*) *tardefurcata* and *D. mammillatum* zones, the lower Albian of the Lower Greensand of southern England.

Material.—A large number of additional GSC specimens were obtained from calcareous concretions collected at GSC Loc. C-300855, whereas a few other specimens were collected from GSC localities 7591a, C-304101, C-304102, and GSC C-304103. All of these latter four localities are in the lower part of the Haida Formation.

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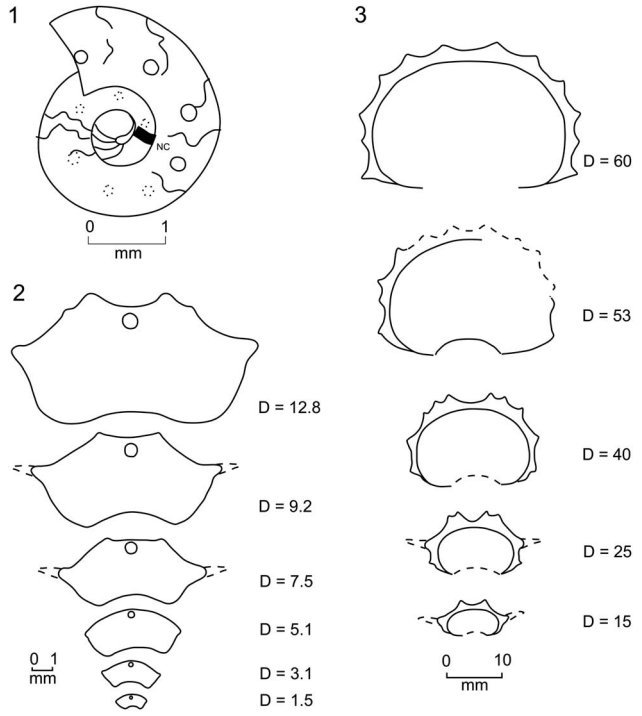

Figure 5. **(1)** Shell ornamentation of *Douvilleiceras spiniferum* (Whiteaves) in early growth stage. GSC No. 10708, GSC Loc. C-300855. NC = primary constriction. (**2, 3**) Ontogenetic changes in the whorl section of *Douvilleiceras spiniferum* (Whiteaves) in (**2**) early growth stage (GSC No. 10708, GSC Loc. C-300855), and (**3**) early to middle growth stage (GSC No. 10711, GSC Loc. 48572).

Dimensions.—See Table 2.

Variation.—*Douvilleiceras spiniferum* from Maude Island exhibits a very wide range of morphological variation, particularly in the number and mode of tubercles, and the shape of the whorl section. The species is generally characterized by six rows of tubercles on each flank, and occasionally seven at diameters greater than approximately 60 mm (Fig. 8). As pointed out by McLearn (1972, p. 65), the appearance of an additional row of tubercles immediately adjacent to the first ventrolateral tubercles on either side, or rarely both sides, of the venter is rare, but noted. If this additional row becomes as large as the first ventrolateral tubercles, it becomes difficult to distinguish *D. spiniferum* from some European species, such as *D. mammillatum* (Schlotheim) and *D. leightonense* Casey. A rare example from Maude Island, GSC No. 10706 (Fig. 9.1, 9.2), shows nine rows of tubercles on each rib at 110 mm diameter; these rows are composed of fairly faint, node-like tubercles, and are not clavate on the ventrolateral part. This specimen shows typical features of *D. spiniferum* on the inner whorl, however: it has three rows of tubercles in the ventrolateral region at about 55 mm diameter. The specimen GSC No. 10704 has six rows of tubercles at 26.3 mm diameter and is the smallest example in our material showing six rows of tubercles. GSC No. 5014b, the lectotype of *D. spiniferum* figured by McLearn (1972, pl. 11, figs. 1A–C; Fig. 4 herein), is unique in his material. This specimen shows different extent of tuberculation on each side: there are seven rows of tubercles on the right side of the shell, but only six rows on the left side (Fig. 8.4). This specimen appears to represent an intermediate morphological form between American *D. spiniferum* and European *D. leightonense*. Such difference in ornamentation between the right and left sides of the shell, seen as a rare example in *D. spiniferum*, is noted occasionally in other ornate ammonites, for example *Lyelliceras ulrichi* Knechtel from the middle Albian (Obata et al., 1975).

Regarding the mode of tuberculation, the present species is characterized by strong tubercles on each rib, compared with *D. mammillatum* discussed above. Several interesting specimens in our material, including GSC No. 10662 and GSC No. 10747, have extremely strong ventrolateral tubercles and coarse ribs in the middle growth stage (D ≈ 40–50 mm) (Figs. 6.12–6.14, 8.1). These ventrolateral tubercles are massive and form spiral ridges. In addition, the ventral sulcus is wide and deep, but not U-shaped in outline. These specimens appear to resemble a specimen of

Table 2. Dimensions of specimens of *Douvilleiceras spiniferum* (Whiteaves, 1876) from Haida Gwaii, British Columbia

Specimen	D	H	B	B/H	U	U/D	NR	NT
GSC No. 10658	(110)	45.3	60.4	1.33	36.3	(0.33)	22x2	6
GSC No. 10659	(126)	51.0	-	-	41.3	0.33	31	7
GSC No. 10660	75.6	29.5	41.6	1.41	27.7	0.37	24	6
GSC No. 10661	(66.2)	20.4	35.3	1.73	24.8	(0.37)	13x2	6+1*
GSC No. 10662	-	27.3	-	-	-	-	10x2	6
GSC No. 10663	64.0	26.3	37.8	1.44	21.4	0.33	18	6
GSC No. 10664	37.3	15.1	-	-	12.7	0.34	18	5
GSC No. 10665	25.8	10.7	-	-	8.5	0.33	-	-
GSC No. 10666	-	26.7	-	-	-	-	18	6
GSC No. 10667	60.1	24.8	(29.2)	(1.18)	20.4	0.34	21	6
GSC No. 10668	50.7	21.7	29.0	1.34	17.1	0.34	18	5
GSC No. 10669	47.9	18.1	30.0	1.66	16.2	0.34	22	6
GSC No. 10670	48.3	21.2	28.8	1.36	14.9	0.31	20	6
GSC No. 10671	44.3	17.9	26.8	1.50	13.5	0.30	16	6
GSC No. 10672	44.8	(17.7)	(29.2)	(1.65)	14.9	0.33	21	6
GSC No. 10673	49.0	20.3	29.2	1.44	15.0	0.31	18	6
GSC No. 10674	43.6	17.5	(11.6x2)	(1.33)	14.5	0.33	20	5
GSC No. 10675	45.6	18.9	27.8	1.47	15.0	0.33	21	6
GSC No. 10676	-	18.5	(27.0)	(1.46)	15.7	-	-	5
GSC No. 10677	32.0	11.5	20.4	1.77	11.6	0.36	18	5
GSC No. 10678	36.1	15.1	19.1	1.26	11.3	0.31	18	5
GSC No. 10679	36.5	14.3	23.0	1.61	12.1	0.33	24	5
GSC No. 10680	34.4	14.1	18.5	1.31	10.6	0.31	23	5
GSC No. 10681	32.0	12.2	18.8	1.54	11.8	0.37	17	5
GSC No. 10682	29.6	10.9	18.1	1.66	10.4	0.34	20	5
GSC No. 10683	(38.7)	(14.5)	(27.5)	(1.90)	13.6	(0.35)	-	5
GSC No. 10684	28.3	9.9	19.2	1.94	10.0	0.35	16	5
GSC No. 10685	(28.6)	11.8	18.6	1.58	9.9	(0.35)	15	5
GSC No. 10686	24.4	10.4	(15.0)	(1.44)	6.7	0.27	18	4
GSC No. 10687	28.8	11.3	(10.0x2)	(1.77)	9.1	0.32	20	4
GSC No. 10688	(20.0)	(7.7)	12.7	(1.65)	6.6	(0.33)	-	4
GSC No. 10689	24.7	10.3	(13.8)	(1.34)	7.8	0.32	(14)	4
GSC No. 10690	24.3	(12.0)	-	-	7.4	0.30	-	-
GSC No. 10691	13.0	5.2	7.9	1.52	4.3	0.33	-	-
GSC No. 10692	22.2	8.6	14.3	1.66	7.4	0.33	17	4
GSC No. 10693	23.9	9.2	14.9	1.62	7.8	0.33	22	4
GSC No. 10694	22.4	9.6	14.1	1.47	6.7	0.30	13	5
GSC No. 10695	21.5	9.2	13.5	1.47	6.7	0.31	17	4
GSC No. 10696	18.8	7.4	12.9	1.74	6.2	0.33	(16)	4
GSC No. 10697	20.3	9.3	11.8	1.27	6.2	0.31	16	4
GSC No. 10698	18.4	7.3	13.2	1.81	5.4	0.29	14	4
GSC No. 10699	18.0	7.8	11.7	1.50	5.9	0.33	14	4
GSC No. 10700	19.3	7.9	12.0	1.52	6.4	0.33	17	4
GSC No. 10701	20.1	8.4	13.3	1.58	6.6	0.33	14	-
GSC No. 10702	19.5	8.6	(12.2)	(1.42)	5.8	0.30	-	4
GSC No. 10703	34.0	14.4	21.0	1.46	10.9	0.32	-	5
GSC No. 10704	26.3	13.3	17.1	1.29	9.1	0.35	-	6
GSC No. 10705	-	15.4	23.3	1.51	-	-	-	6
GSC No. 10706	(115.6)	51.3	(55.6)	(1.08)	33.4	(0.29)	36	9
GSC No. 10707	(127.0)	(53.1)	-	-	40.0	(0.31)	(39)	-
GSC No. 10708	19.1	7.4	13.4	1.81	6.5	0.34	17	4

All measurements in millimeters.
Measurements in parentheses are approximate.
*Indicating an additional row on each side of the venter.

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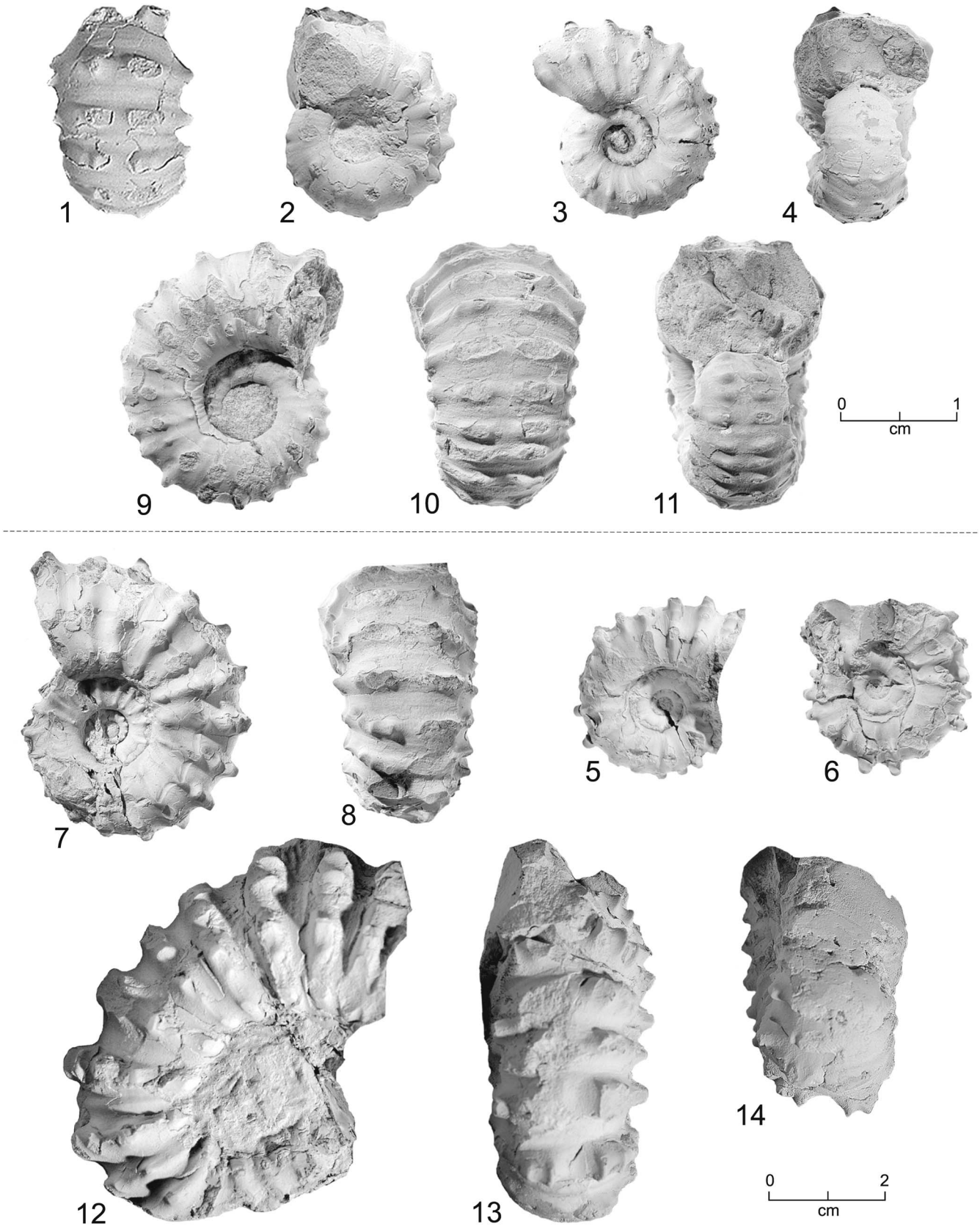

Figure 6. *Douvilleiceras spiniferum* (Whiteaves, 1876). (**1, 2**) GSC No. 10700, GSC Loc. C-300855, ventral and right lateral views. (**3, 4**) GSC No. 10702, GSC Loc. C-300855, right lateral and dorsal views. (**5-7**) GSC No. 10693, GSC Loc. C-300855, left lateral, ventral, and dorsal views. (**8, 9**) GSC No. 10670, GSC Loc. C-300855, right lateral and ventral views. (**10, 11**) GSC No. 10677, GSC Loc. C-300855, left lateral and right lateral views. (**12-14**) GSC No. 10662, GSC Loc. C-300855, left lateral, ventral, and dorsal views. All specimens coated with ammonium chloride.

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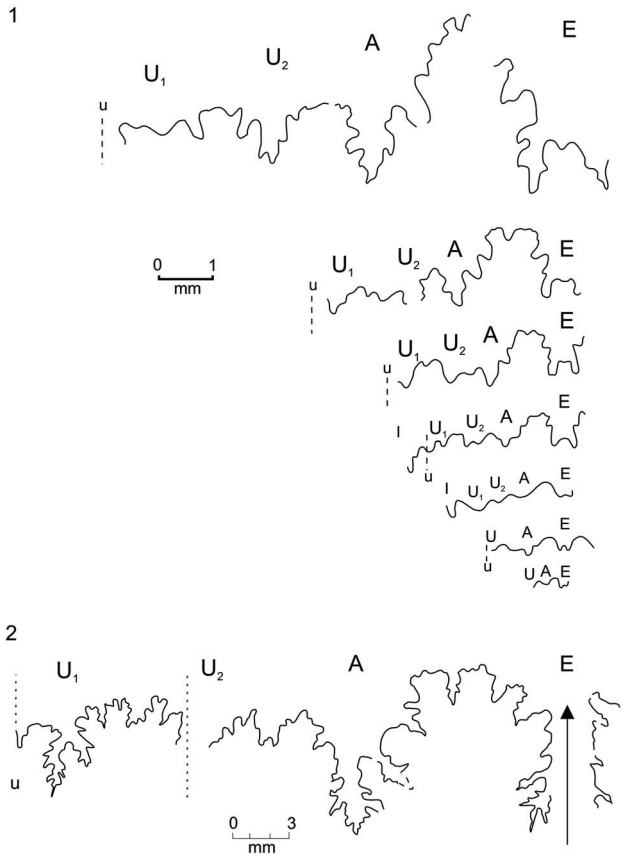

Figure 7. Suture line of *Douvilleiceras spiniferum* (Whiteaves) from Haida Gwaii. (**1**) Ontogenetic changes in suture line in early growth stage, GSC No. 10711, GSC Loc. 48572. (**2**) Suture line at middle growth stage, shell diameter approximately 40 mm, GSC No. 10708, GSC Loc. C-300855. Sutural nomenclature after Wedekind (1916), as augmented by Korn et al. (2003).

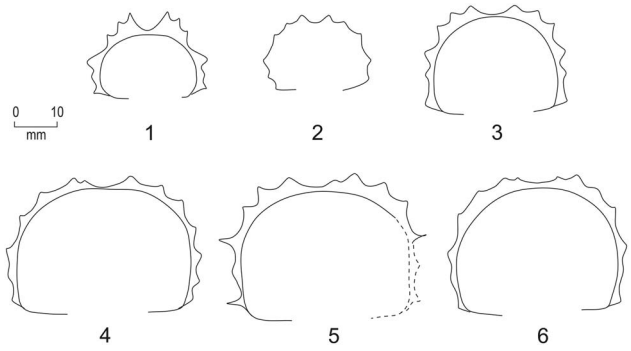

Figure 8. Whorl sections of *Douvilleiceras spiniferum* (Whiteaves) in middle growth stage. (**1**) GSC No. 10747, GSC Loc. 7591a. (**2**) GSC No. 10711, GSC Loc. 48572. (**3**) GSC No. 21240, collected from talus at Bush Island, Skidegate Inlet (unassigned locality). (**4**) GSC No. 5014b, Skidegate Inlet, west of Alliford Bay, exact locality not recorded (Coll. J. Richardson, 1872). (**5**) GSC No. 10746, GSC Loc. C-196887. (**6**) GSC No. 5014a, Skidegate Inlet, west of Alliford Bay, exact locality not recorded (Coll. J. Richardson, 1872).

D. orbignyi Hyatt figured by Casey (1962, pl. 40, fig. 6), which has the weakest ornamentation among specimens referred to *D. orbignyi*. The Canadian specimens differ distinctly from others of *D. orbignyi*, however, in having three clavate tubercles in their ventrolateral region. Therefore, they are probably extreme variants of *D. spiniferum*.

Remarks.—The morphological characters of this species have been described by Whiteaves (1900, p. 273), and also re-examined by McLearn (1972, p. 62). McLearn described the morphology of several specimens of *D. spiniferum*, including the lectotypes of the species, and also discussed its variation and affinities. Based on the large amount of material available, McLearn (1972, p. 63) recognized one broad species-group of *Douvilleiceras* from the Haida Formation, viz. *D. spiniferum*, and two extreme variants or possible new species within this group, viz. *Douvilleiceras* sp. a and *Douvilleiceras* sp. b. Many of these specimens are poorly preserved, however, and consist of less than half a whorl.

As pointed out by McLearn (1972, p. 66), *Douvilleiceras restitutum* Anderson (1938, p. 175, pl. 54, fig. 2), from Shasta County in northern California, is closely similar to the present species, particularly in the numbers of ribs and rows of tubercles. The holotype of *D. restitutum* has a large shell being 153 mm in diameter, and non-tuberculate ribs above a diameter of 90 mm. Although the extent of variation in Anderson's species has not been described, it appears to fall readily within the range of *D. spiniferum* in having similar morphological features on the outer whorl of the full-grown shell. A number of the specimens of *Douvilleiceras charshangense* from the *D. mammillatum* Zone of the Gissar Range in central Asia figured by Mirzoyev (1967, pl. 7, figs. 1–5) are considered here to fall closely within the range of variation shown by *D. spiniferum*, as described above. The holotype of *D. charshangense*, No. 116/300 (Mirzoyev, 1967, p. 54, fig. 1, pl. 7, figs. 1–4), is quite similar to *D. spiniferum* in the shape of its whorl section and in showing six distinct rows of tubercles with three ventrolateral clavi. *D. spiniferum* also resembles *D. leightonense* var. *pringlei* Casey (1962, p. 277, pl. 41, figs. 3a-b, text-fig. 102j) from the *Leymeriella* (*L.*) *tardefurcata* and *D. mammillatum* zones of the Lower Greensand, particularly in having six rows of tubercles, coarser ribs, and similar whorl section. *D. leightonense* var. *pringlei* appears to fall readily within the range of variation of the present species.

Douvilleiceras offarcinatum (White, 1887)

Figure 10.3–10.5

1887 *Ammonites offarcinatus*; White, p. 219, pl. 23, figs. 3–4.
1938 *Douvilleiceras aurarium*; Anderson, p. 175, pl. 53, fig. 1.
? 1940 *Douvilleiceras offarcinatum*; Scott, p. 1011, pl. 58, figs. 4–5.
? 1974 *Douvilleiceras* sp. cf. *D. offarcinatum*; Young, p. 188, pl. 1, fig. 2, pl. 4, figs. 5, 10, pl. 5, figs. 5, 6, pl. 7, fig. 3.
? 1979 *Douvilleiceras abozagloi*; Etayo-Serna, p. 55, pl. 8, fig. 7.

Types.—White (1887, p. 219, pl. 23, figs. 3–4) illustrated two original specimens from the old wharf (Trapiche das Pedras Velho), Bom Jardim, Sergipe Province. They were probably obtained from the Riachuelo Formation, Sergipe Group, in Brazil.

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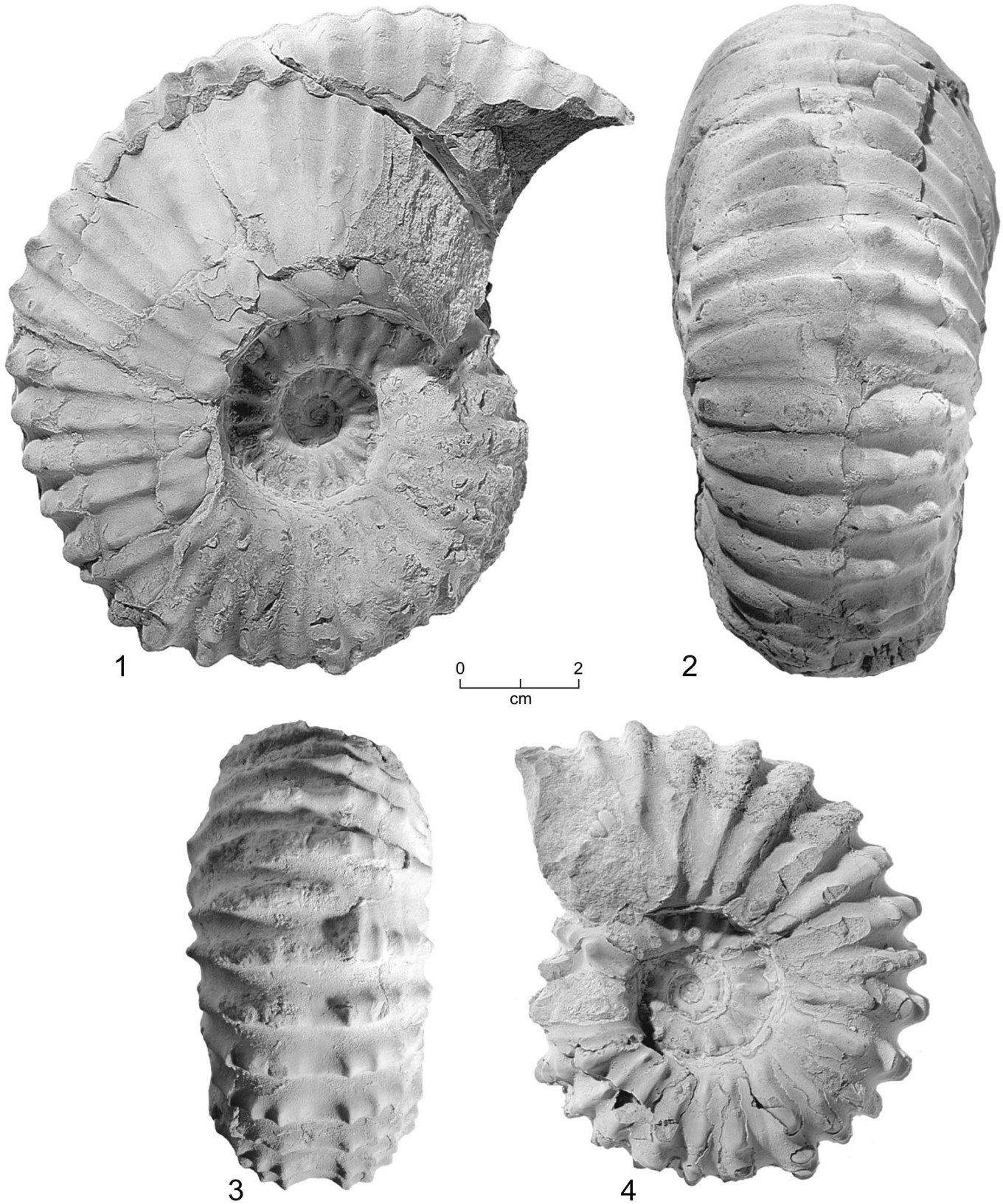

Figure 9. *Douvilleiceras spiniferum* (Whiteaves, 1876). (**1, 2**) GSC No. 10706, GSC Loc. C-300855, left lateral and ventral views. (**3, 4**) GSC No. 10660, GSC Loc. C-300855, ventral and right lateral views. Both specimens coated with ammonium chloride.

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Table 3. Dimensions of specimens of *Douvilleiceras offarcinatum* (White, 1887) from Haida Gwaii, British Columbia

Specimen	D	H	B	B/H	U	U/D	NR	NT
GSC No. 10709	57.1	22.6	30.1	1.33	19.8	0.35	21	5

All measurements in millimeters.

Description.—The specimen GSC No. 10709 is approximately 57 mm in diameter. The specimen has rectiradiate to very gently rursiradiate ribs and lacks intercalated ribs on the outer whorl. Ribs number 21 per whorl. On the outer whorl there are five rows of tubercles on each rib, consisting of three clavate tubercles in the ventrolateral region, a bullate or spinose lateral tubercle, and an umbilical tubercle, as shown in Figure 10.5. The medial ventral sulcus is wide.

Dimensions.—See Table 3.

Material.—A single specimen, GSC No. 10709, obtained from a sandy calcareous concretion at GSC Loc. C-304101, Haida Formation.

Occurrence.—This species is known from the upper lower Albian, the *mammillatum* Zone of the lower part of the Haida Formation in Canada, the Cuchillo Formation in Texas, and Sergipe Province in Brazil.

Remarks.—The morphological characters of this specimen are closely similar to those of the holotype of *D. aurarium* Anderson (1938, p. 175, pl. 53, fig. 1) from Shasta County, northern California. It is difficult to distinguish *D. aurarium* from *D. offarcinatum* (White, 1887) from Brazil, particularly in the mode and number of tubercles on both examples. Our specimen is somewhat similar to *D. spiniferum*; a distinct difference between them, however, is that our example of *D. offarcinatum* shows no intermediate tubercle between the lateral and umbilical tubercles, even in the middle growth stage at 57 mm in diameter. Because the intermediate tubercles in *D. spiniferum* are already present on the flanks at this growth stage, the characteristic tuberculation of this specimen thus appears to fall outside the range of variation of *D. spiniferum*.

Douvilleiceras scabrosum Casey, 1962

Figures 10.1, 10.2, 11

? 1841 *Ammonites mammillaris*; d'Orbigny, p. 249, pl. 72, fig. 5.
1962 *Douvilleiceras scabrosum*; Casey, p. 278, pl. 40, figs. 1–3, pl. 42, figs. 2a-b, text-figs. 102f, 103i.
1972 *Douvilleiceras* sp. a; McLearn, p. 67, pl. 12, figs. 1A, B.

Types.—The holotype, BM C69861, illustrated by Casey (1962, pl. 40, figs. 1a-b, text-fig. 102f), from Folkstone Beds, *mammillatum* Zone Bed, Chrismill Bridge (M20 Motorway), Eyhorne Street, Kent (Coll. H. G. Owen); paratypes GSM 107909 (Casey, 1962, pl. 40, figs. 2a-b), GSM 70424 (Casey, 1962, pl. 40, figs. 3a-b, text-fig. 103i), GSM 107913 (Casey, 1962, pl. 42, figs. 2a-b), Folkestone Beds, main *mammillatum* bed, Copt Point, Folkestone, Kent (Coll. R. Casey), GSM Zn940 from the Folkestone Beds, the *puzosianus* Subzone, Sandling Junction, and BM C54304 from Machéroménil, Ardennes.

Table 4. Dimensions of specimens of *Douvilleiceras scabrosum* Casey, 1962 from Haida Gwaii, British Columbia

Specimen	D	H	B	B/H	U	U/D	NR	NT
GSC No. 21241*	139.0	54.8	-	-	46.5	0.33	38	7 + 1**

Notes
All measurements in millimeters.
*Measurements taken from plaster cast.
**Indicating an additional row on each side of the venter.

Dimensions.—See Table 4.

Material.—A single specimen, GSC No. 21241, described and illustrated by McLearn (1972, p. 67, pl. 12, figs. 1A-B; illustrated herein in Fig. 10.1, 2) as *Douvilleiceras* sp. a, is from GSC Loc. 7594.

Occurrence.—This species is known from the *mammillatum* Zone of the lower part of the Haida Formation in Canada and the Lower Greensand of southern England and France.

Remarks.—This specimen was identified by McLearn (1972, p. 67, pl. 12, figs. 1A-B) as *Douvilleiceras* sp. a. McLearn described the features of this specimen, giving comparisons with two other species of *Douvilleiceras*, *D. spiniferum* and *D. scabrosum*. McLearn concluded that the specimen either represents an extreme variant of *D. spiniferum* or a new species. We re-examined the specimen GSC No. 21241. The ribs are unequal in strength and rarely intercalated on the outer whorl. The tuberculation is represented by four distinct clavate tubercles in the ventrolateral region, a strong lateral spinose tubercle, a faint intermediate node-like tubercle, and a bullate umbilical one (Fig. 11.1). Based on the composition of these tubercles, this specimen falls distinctly outside of the range of variation of *D. spiniferum*.

The morphological features of this specimen, particularly the mode of tuberculation, the number of rows of tubercles on each side, and the mode of ribbing, are closely similar to those of the paratype of *D. scabrosum* Casey, GSM 107909 (Casey, 1962, p. 278, pl. 40, figs. 2a-b), from the *mammillatum* Zone of England. The Canadian specimen has somewhat weaker ribs than the paratype of *D. scabrosum*, and the initial appearance of the intermediate tubercles in this specimen is somewhat later than in the holotype and paratypes of *D. scabrosum*. It does appear, however, to fall within the relatively wide variation of *D. scabrosum*. According to Casey (1962, p. 278), *D. scabrosum* differs from *D. mammillatum* in having irregular and coarse ribbing and a wide ventral sulcus. In addition, the number of rows of tubercles on each side is seven, although the holotype specimen exhibits an additional row of tubercles on each side of the venter (Casey, 1962, p. 285, text-fig. 102f).

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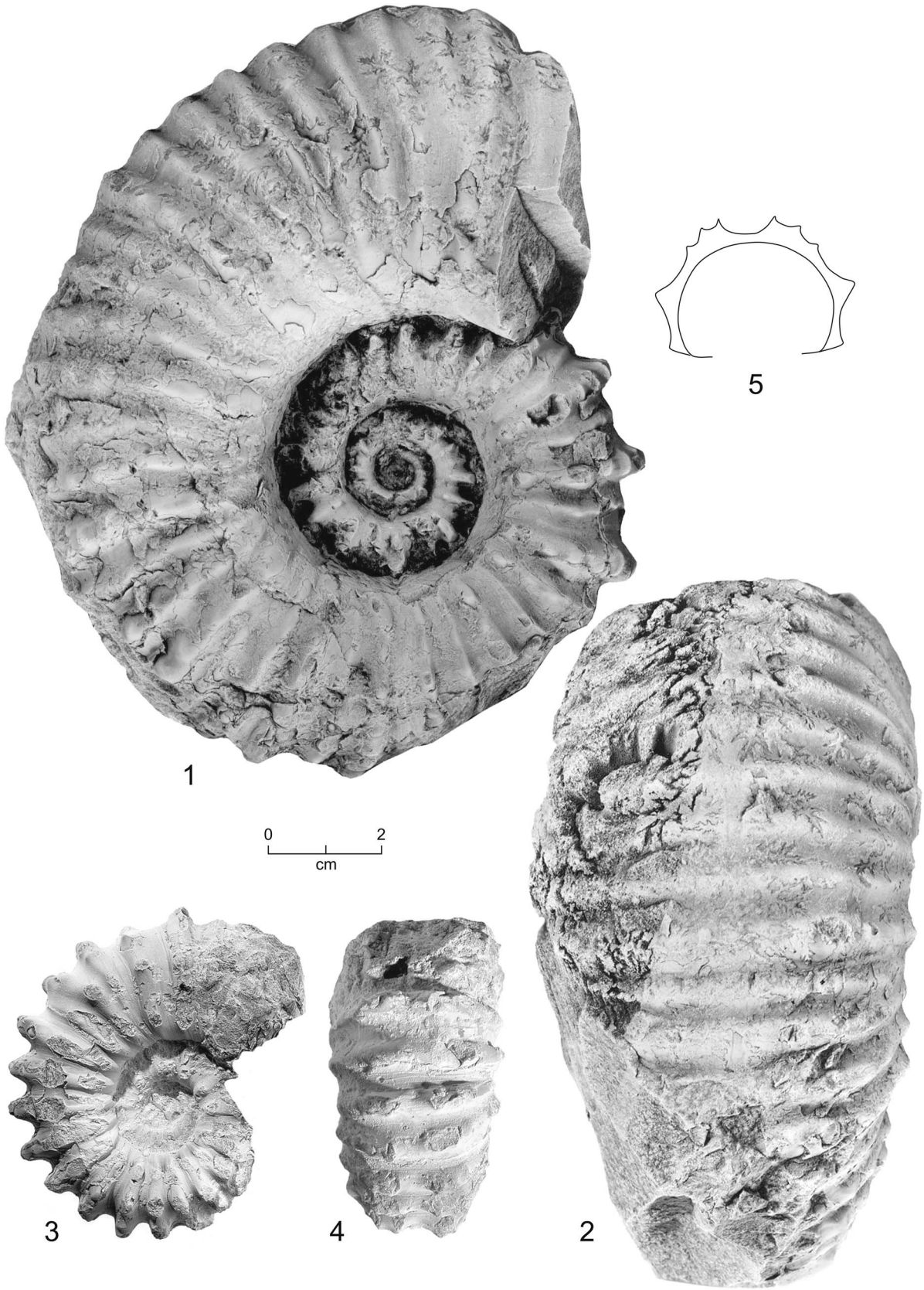

Figure 10. **(1, 2)** *Douvilleiceras scabrosum* Casey, 1962, GSC No. 21241, GSC Loc. 7594, left lateral and ventral views. (**3–5**) *Douvilleiceras offarcinatum* (White, 1887), GSC No. 10709, GSC Loc. C-304101, left lateral and ventral views, and whorl section. Both specimens coated with ammonium chloride.

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Douvilleiceras aff. *spiniferum* (Whiteaves, 1876)

Figure 12

Description.—Although the specimen has a secondarily deformed body-chamber shell, the ornamentation on the septate part of the whorl is well-preserved. The shell is of the middle growth stage, ca. 67.8 mm in diameter, evolute and widely umbilicate. The whorl is depressed (B/H = 1.34). The whorl section is polygonal along the costa, with maximum thickness at the mid-flank. Ribs on the outer whorl are rectiradiate across the middle and outer parts of the flank, but rursiradiate on the umbilical margin; they number twenty-two on the outer whorl, and are coarse and separated by interspaces wider than the ribs themselves. There are six rows of tubercles on the body chamber at about 67 mm diameter. Three ventral tubercles are clavate, forming somewhat distinct spiral ridges. On the septate part of the whorl greater than 40 mm diameter, the lateral and umbilical tubercles are faint or lacking, and the ribs on the inner half-whorl are fused to form a wing-like feature, rather than distinct tubercles (Fig. 12.3). The ventral sulcus is wide and deep, but not U-shaped in outline. The suture line is well-preserved on the septate portion of the whorl (Fig. 12.4). The external (E) and lateral (A) lobes are relatively narrow and deep, and the first lateral (E/A) and umbilical (A/U_1) saddles are broad. The character of the suture is a typical douvilleiceratid.

Dimensions.—See Table 5.

Material.—A single specimen, GSC No. 10710, was collected by M. Futakami from a calcareous concretion at GSC Loc. C-300855.

Occurrence.—The specimen was obtained from the lower member of the Haida Formation. Its stratigraphic position is assigned to the upper part of the lower Albian, the *mammillatum* zone.

Remarks.—The specimen is characterized by an extended rib which forms a wing-like feature on the inner half-whorl of the middle growth stage. Due to the presence of this extended rib on the flanks, the umbilical tubercle has disappeared, and the lateral tubercle becomes faint or disappears altogether. The specimen is unique, particularly in the shape of its costal section, and differs from all other species of *Douvilleiceras* in this feature. The specimen is similar to *D. spiniferum* (Whiteaves) in the mode of the ventrolateral clavate tubercles, which exhibit the great range of variation described above. The specimen differs from typical *D. spiniferum*, however, in having the unique, extended rib on the inner half-whorl on the middle growth stage. In addition, the ribs on this species are sharper than those of *D. spiniferum*. This specimen may represent an extreme variant of *D. spiniferum*, possibly a malformed shell of that species, or possibly a new species altogether.

Table 5. Dimensions of specimens of *Douvilleiceras* aff. *spiniferum* (Whiteaves) from Haida Gwaii, British Columbia

Specimen	D	H	B	B/H	U	U/D	NR	NT
GSC No. 10710	(67.8)	-	-	-	25.1	(0.37)	22	(6)
GSC No. 10710 (-90°)	56.0	21.6	29.0	1.34	19.1	0.34	20	4

All measurements in millimeters.
Measurements in parentheses are approximate.

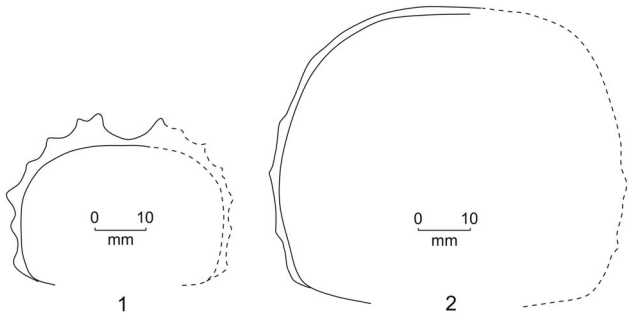

Figure 11. Whorl sections of *Douvilleiceras scabrosum* Casey from Haida Gwaii. GSC No. 21241, GSC Loc. 7594, at approximately 75 mm in shell diameter (**1**) and at approximately 127 mm in shell diameter (**2**).

Discussion

Ammonites assigned to the genus *Douvilleiceras* are characterized by the presence of a ventral sulcus and multituberculate ribs in the early and middle growth stages. The tuberculation consists of five to ten rows of tubercles on each rib in the middle growth stage, about 50 or 60 mm to 100 mm in shell diameter. The tubercles are variable in morphology and position; typically they consist of umbilical bullae or spinose nodes, lateral spinose nodes, and ventrolateral clavi, often with numerous intermediate tubercles. The umbilical and lateral tubercles form the bases of spines, which were probably broken off from the shell during post-mortem processes. The rather depressed whorl is polygonal in cross-section.

In late growth stage, generally over 100 to ~150 mm in shell diameter, the ventral sulcus and ventrolateral tubercles become gradually fainter with growth and finally disappear altogether. The non-tuberculate ribs on the outer whorl of the full-grown shell are more numerous than the tuberculate ones in the middle growth stage. The whorl has a nearly circular cross-section, and maintains faint tubercles on the umbilical margin. The largest shells of the genus known to us include an example assigned to *Douvilleiceras* sp. cf. *leightonense* (Casey, 1962, p. 276, text-fig. 97) from southeast England, which is about 440 mm in diameter (approximately 650 mm in estimated shell diameter), and also another example assigned to *D. clementinum* (Courville and Lebrun, 2010, p. 27, fig. 12) from Troyes (Aube) in the Paris basin which is over 800 mm in diameter. These specimens exhibit weak tuberculation only in the umbilical region and the ribs are also faint, weakening on the latest preserved part of the whorl to the extent the flanks are almost smooth. The simplified suture line is characterized by fairly deep and narrow external and lateral lobes, and a broad and somewhat rounded first lateral saddle.

Previously-described species of *Douvilleiceras* exhibit various morphological features in the middle growth stage of their ontogenetic sequences. We consider the mode of tuberculation and ribbing in the middle growth stage, as well as the general shell proportions, as the key morphological criteria

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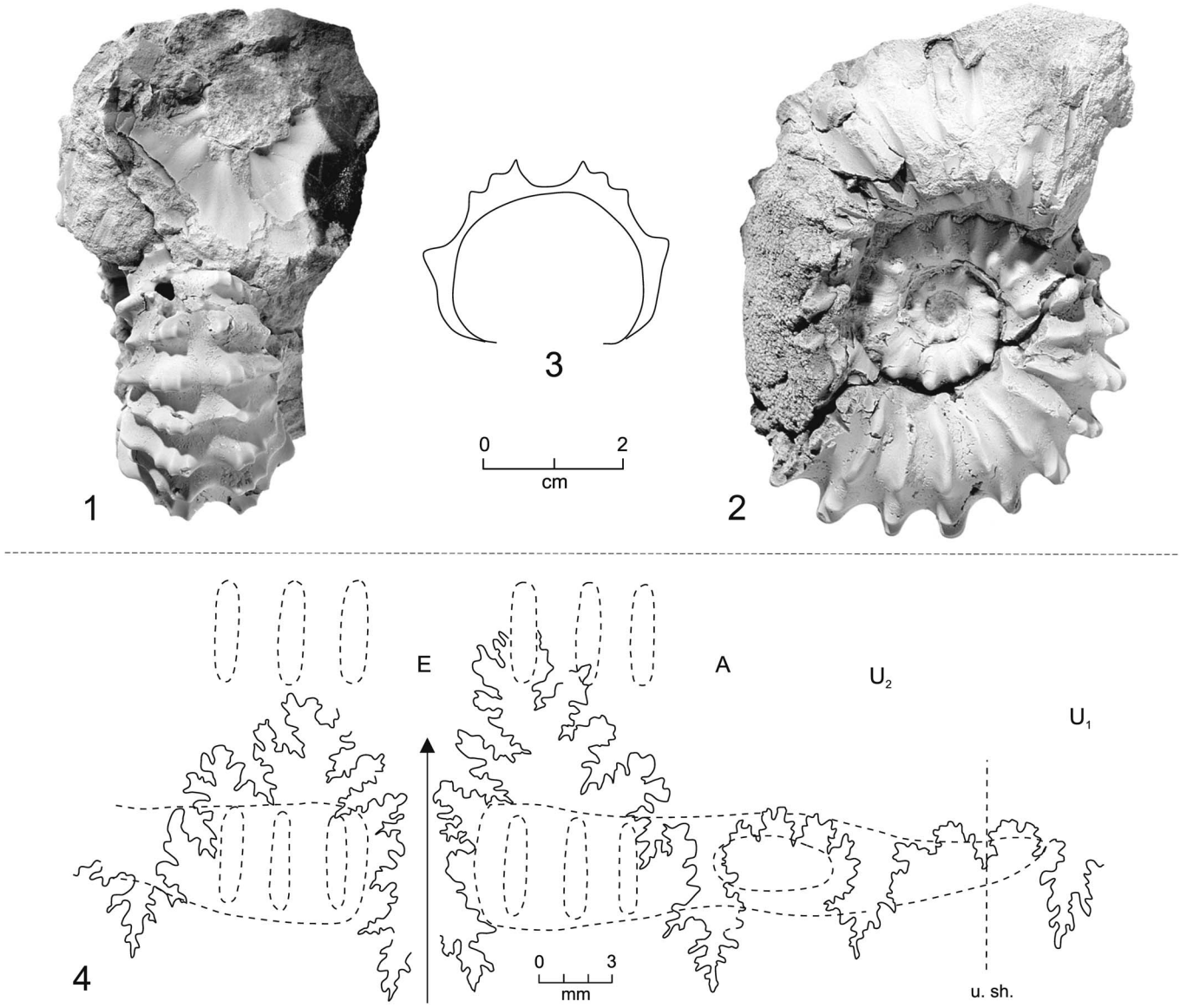

Figure 12. *Douvilleiceras* aff. *spiniferum* (Whiteaves, 1876) from Haida Gwaii, GSC No. 10710, GSC Loc. C-300855. (**1, 2**) Dorsal and left lateral views, coated with ammonium chloride. (**3**) Whorl section. (**4**) Suture line. Scale bar = 3 mm. Small dashed ellipses denote nodes; larger irregular dashed features denote ribs.

to be used in differentiating species of *Douvilleiceras*. The ventrolateral ornamentation that characterizes the middle growth stage is particularly diagnostic, as Casey (1962) has noted. The morphological features in early and late growth stages of this genus are similar to those of the late Aptian genus *Cheloniceras*. For this reason, identification of a species or a genus of *Douvilleiceras* based on the morphological features of the early or late growth stage alone is often problematic.

Conclusions

The rich Cretaceous faunas of the Haida Gwaii archipelago of British Columbia contain an abundance of ammonite taxa and serve as a reference for Albian faunas of the northeast Pacific region. Specimens of the cosmopolitan genus *Douvilleiceras* form a significant component of the late early Albian faunas of Haida Gwaii and have traditionally been assigned to a single species, *Douvilleiceras spiniferum* (Whiteaves, 1876). We recognize five from the Albian strata of Haida Gwaii, which are *Douvilleiceras mammillatum* (Schlotheim), *D. offarcinatum* (White), *D. scabrosum* Casey, *D. spiniferum* (Whiteaves), and *D.* aff. *spiniferum* (Whiteaves). Among these, *D. spiniferum* is particularly abundant, with many specimens exhibiting well-preserved shell. This population thus provides a comprehensive understanding of the ontogenetic development of the early growth-stage of *D. spiniferum*, as well as the successive ontogenetic changes in the species' whorl shape, its ornamentation and suture line, and its overall morphological variation, which is substantial. The stratigraphic position of *Douvilleiceras* faunas on Haida Gwaii are within the *Brewericeras hulenense* Zone (= *mammillatum* Zone) of the upper lower Albian in Canada, equivalent with the *Leymeriella* (*L.*) *tardefurcata* and

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D. mammillatum zones of the lower to upper lower Albian in England.

Douvilleiceras populations of Haida Gwaii demonstrate that species of the genus are characterized by appreciable morphological variation, particularly with respect to the shape of the whorl and the pattern of ribbing and tuberculation. Morphological variation is most accentuated in the middle growth stage, approximately 50 or 60 mm to 100 mm in shell diameter, with earlier and later growth-stages showing less distinctive features. The most useful criteria for differentiating species within the genus *Douvilleiceras* are the mode of tuberculation and ribbing, as well as overall shell proportions, of the middle growth stage.

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Appendix A. Fossil Locality Data

GSC Loc. 7591a. 103F/01 map-area, UTM Zone 8, 697125E, 5900850N. Skidegate Inlet, Maude Island, north shore, east section, east side of Contact Bay; small cave separates agglomerates from base of Haida Formation; float. Coll. F. H. McLearn, 1921, Field # Q.H.D.8. Haida Formation.

GSC Loc. 7594. 103F/01 map-area, UTM Zone 8, 697925E, 5900900N. Skidegate Inlet, Maude Island, north shore, east section; in place. Coll. F. H. McLearn, 1921, Field # Q.H.D.14. Haida Formation.

GSC Loc. 7598. 103F/01 map-area, UTM Zone 8, 693775E, 5901350N. Skidegate Inlet, Lina Island, south shore, a large ledge along shore below McLellan house, west; in place. Coll. F. H. McLearn, 07/08/1921, Field # Q.H.E.3. Haida Formation.

GSC Loc. 7613a. 103F/01 map-area, UTM Zone 8, 700125E, 5900100N. Skidegate Inlet, northerly [Bush Island] of two islets in Alliford Bay between Transit Island and Kwuna Point; float. Coll. F. H. McLearn, 08/09/1921, Field # Q.H.P.2. Haida Formation.

GSC Loc. 48572. 103F/01 map-area, 53° 13.25'N, 132° 2.00'W. Skidegate Inlet, Maude Island. Coll. A. Sutherland Brown, 1961, Field # ASB-61-295. Haida Formation.

GSC Loc. C-196887. 103G/04 map-area, Zone 9, 300900E, 5897850N. Northern Moresby Island, along logging road; in place. Coll. J. W. Haggart, 07/17/1991, Field # HFB-91-273. Haida Formation.

GSC Loc. C-300855. 103F/01 map-area, UTM Zone 8, 697900E, 5900775N. Skidegate Inlet, northeast shore of Maude Island; in place. Coll. J. W. Haggart, 07/21/1993, Field # HFB-93-631 and M. Futakami, 09/11/1997. Haida Formation.

GSC Loc. C-303724. 103G/04 map-area, UTM Zone 9, 300650E, 5897850N. Northern Moresby Island, small cliff along north side of logging road; in place. Coll. J.W. Haggart, 07/17/1991, Field # HFB-91-271. Haida Formation.

GSC Loc. C-304101. 103G/04 map-area, UTM Zone 9, 300650E, 5897850N. Northern Moresby Island, small cliff along north side of logging road; in place. Coll. M. Futakami, 05/16/1997. Haida Formation.

GSC Loc. C-304102. 103F/01 map-area, UTM Zone 8, 697950E, 5900725N. Skidegate Inlet, Robber Point, northeast shore of Maude Island; in place. Coll. M. Futakami, 09/11/1997. Haida Formation.

GSC Loc. C-304103. 103F/01 map area, UTM Zone 8, 697640E, 5900800N. Skidegate Inlet, Maude Island, north shore; in place. Coll. M. Futakami, 10/04/1997. Haida Formation.