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FOSSILS FROM HARRISON LAKE AREA, BRITISH COLUMBIA

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Illustrations

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INTRODUCTION

This report contains a brief account of the palæontological materials acquired during a geological study of the country adjacent to Harrison lake, British Columbia; made for the Geological Survey, by the writer, during the summers of the years 1924 and 1926. The writer had no assistant in 1924. In 1926 he was ably assisted by James R. Pollock.

The writer is indebted to Mr. J. Forsyth of the Provincial Library at Victoria, to Mr. C. Brakenridge, City Engineer of Vancouver, and to Mr. L. A. Agassiz, of Agassiz, for courtesies extended to him and information freely given during the course of the work. He is especially indebted to Professor J. P. Smith for invaluable advice freely given on many occasions.

The area under consideration lies in the heart of the southern extremity of the Coast range of British Columbia. Its southern boundary is Fraser river. The other boundaries are controlled by the distance possible to cover in one-day trips from the shores of the lake and river. Harrison lake lies in a large, fiord-like valley adjoining the Fraser on its north side. It is 1 to 4 miles wide and 38 miles long; its general trend is south-south-east. Its mean surface level is 30 feet above mean sea-level. It is fed at its north end by the turbulent waters of Lillooet river, and drained from its west side near the south end by the slow-moving Harrison river. Lillooet river and Harrison lake occupy one large valley which joins the Fraser valley at right angles. South of the lake the drainage is obstructed by moraines, so that the lake is drained through a narrow side valley which has been so modified that it now carries the entire overflow of the lake. Numerous streams, of the size referred to in the west as "creeks," enter the lake along its shores, at steep gradients.

The topography is entirely mountainous except for the small areas of flat land forming the bottoms of the larger valleys. In the southern half of the district the relief averages 4,000 feet (maximum 5,100), and though the slopes are steep the peaks are rounded. In the northern, the relief is about 5,500 feet (maximum 7,500); the slopes are steep; the peaks, sharp; mountain glaciers abound. A thick forest composed mainly of Douglas fir, western hemlock, and western red cedar covers all the land, except excessively steep slopes and "cleared" areas, up to an altitude of 4,000 feet. Above this the trees are much dwarfed, and few survive above 5,000 feet.

The shores of Harrison lake are principally low, rocky cliffs. Beaches form a very small proportion of the whole. The lake is deep, averaging over 100 fathoms throughout most of its length; however, at the south end

it has been silted up so that very slight depths (such as 3 fathoms) are encountered nearly midway across. The bottom is covered with fine silt containing some vegetable matter. In late winter and early spring the water is clear; during the rest of the year it is turbid, though never so foul as to be unfit to drink. The surface level has a maximum range of variation of about 7 feet. It is lowest in late winter and early spring, highest about midsummer, falls all summer, attaining a second minimum about the end of August, but rises to a second though inferior maximum in the autumn. The first minimum is due to the fact that at this time of the year precipitation takes the form of snow and so does not reach the lake; the first maximum is caused by the sudden melting of this snow in the early summer. The second minimum is due to depletion of the supply of snow water and lack of rain at this season, and the second maximum is the result of autumn rains.

The southernmost part of the district is traversed by the Canadian Pacific railway. A good road provides communication with Harrison Hot Springs at the south end of Harrison lake. Communication up and down the lake is effected entirely by boats.

Very little was known of the geology of this district at the time the investigation was commenced. No areal mapping had been done except around Agassiz, where the geology was known only in a very general way. The first reference to the geology of the district was made in the Director's Report,¹ Geological Survey, Canada, in 1888. It stated simply that the older Cretaceous rocks were extensively developed in Harrison Lake district. In the following year proof of this statement appeared, in the announcement that Amos Bowman had in 1882 collected *Aucella mosquensis* var. *concentrica* Fischer from several localities on Harrison lake.² In the same year Dawson³ listed the localities of the hot springs—St. Alice' well at the south end of the lake, and St. Agnes' well 5 miles beyond the north end. The following year Hoffmann⁴ gave analyses of the waters from the two springs, which compose St. Alice' well. In 1895 Stanton⁵ reported that the *Aucellae* from Harrison lake belonged to the species *A. crassicollis* Keyserling.

Since these early contributions Harrison lake has scarcely been mentioned in the literature. There is no information of any importance except Bowen's reports on his reconnaissance of 1912 in which he barely touched the south end of Harrison lake, but provided a route map of the country about Agassiz.⁶ Bowen discerned a fossiliferous sedimentary series, of which he gives a section, underlying the country around Agassiz. In his "Columnar Sections"⁷ he called this the Agassiz series of Palæozoic age, but in his summary report⁸ he used no name for it, but said it was of Lower Cretaceous or Jurassic age. He noticed that these rocks are intruded by a

¹Selwyn, A. R. C.: Geol. Surv., Canada, Ann. Rept., vol. III (1888).

²Whiteaves, J. F.: Geol. Surv., Canada, Cont. to Can. Pal., vol. I, pt. 2, No. 4 (1889).

³Dawson, G. M.: "The Mineral Wealth of British Columbia"; Geol. Surv., Canada, Ann. Rept., vol. III (1889).

⁴Hoffmann, G. C.: "Chemical Contributions to the Geology of Canada"; Geol. Surv., Canada, Ann. Rept., vol. IV (1890).

⁵Stanton, T. W.: "The Fauna of the Knoxville Beds"; U.S. Geol. Surv., Bull. 133 (1895).

⁶Route-map between Lytton and Agassiz; Route-map between Agassiz and Vancouver; Geol. Surv., Canada, Guide Book No. 8, pt. II (1913).

⁷Columnar Sections. N. L. Bowen, In the Coast Range. Camsell, C.: Geol. Surv., Canada, Guide Book No. 8, pt. II (1913).

⁸Bowen, N. L.: "A Geological Reconnaissance of the Fraser River Valley from Lytton to Vancouver, British Columbia"; Geol. Surv., Canada, Sum. Rept. 1912 (1914).

large mass of granite; he mentions the quartz-porphyry on the railway west of Agassiz, which he regarded as of Lower Cretaceous (?) age, and with an unconformable relation toward the Agassiz series. The age of the Agassiz series is Upper Jurassic. The quartz porphyry flows, mentioned by Bowen, are part of the Porphyrite series, and are of Middle Jurassic age.

Harrison Lake valley has been produced by erosion of disordered sedimentary series of great thickness accompanied by several masses of plutonic rocks. The long axis of the lake is located mainly on what is believed to be the site of a great overthrust. This fault dips steeply to the east; Carboniferous and Triassic rocks to the east of it are thrust over Jurassic and Cretaceous rocks to the west. This great fault, which extends beyond the limits of the area, is single throughout most of its length, but in the middle part of Harrison lake it is divided into several subparallel and oblique faults between which are wedges of rock of the nature of schuppen. These are well illustrated by the structure of the peninsula, and that of Long island. In these two areas the surface is composed of narrow selvages of Jurassic and Cretaceous sediments, bearing their characteristic fossils, and all dipping to the east yet alternating with one another in a perfectly bewildering fashion. Such an arrangement could not possibly be the result of peculiarities of deposition, and could have been formed only by a succession of thrust faults. Throughout most of the zone the rocks have been considerably crushed.

The oldest rocks lying to the east of the thrust fault are dark grey argillites with massive limestone lenses bearing Pennsylvanian fossils. These crop out over the west flank of Bear mountain, at the south end of the area. They dip steeply to the east, being bounded on the west by the thrust fault, and to the east by an overlying thick accumulation of sediments, mostly argillites but with some beds of pyroclastics. This series borders the thrust fault on the east from Trout Lake creek to Fifteenmile creek and makes up all the mountains between these creeks. The sediments dip uniformly steeply to the east (or a few degrees north of east). They are considerably crushed, in some places even to the state of foliation. So far they have yielded no fossils, but it is suspected that they are of Triassic age. The total thickness has not been determined, but is estimated at 14,000 or 15,000 feet.

Overlying the supposedly Triassic series and, therefore, succeeding them to the north and east, is a thick formation of crushed greenstones of volcanic origin. This formation occupies most of the country east of Harrison lake. These rocks have been considerably crushed and are more or less schistose throughout, but apart from this there is a great resemblance as regards thicknesses and details of lithology and succession between these rocks and Jurassic rocks lying to the west of Harrison lake, but no fossils have been obtained from the greenstones lying east of the lake.

The oldest rocks west of the great thrust occur in a small patch on the west shore of the lake immediately south of Camp cove. They consist of some 3,000 feet of sediments, mostly argillites with some tuffs and a conglomerate bed. The conglomerate contains besides other things, pebbles of the fossiliferous Pennsylvanian limestones. The series has yielded no fossils of its own date; it belongs between the top of the Pennsylvanian and the base of the Middle Jurassic. These rocks lie in the centre of a short

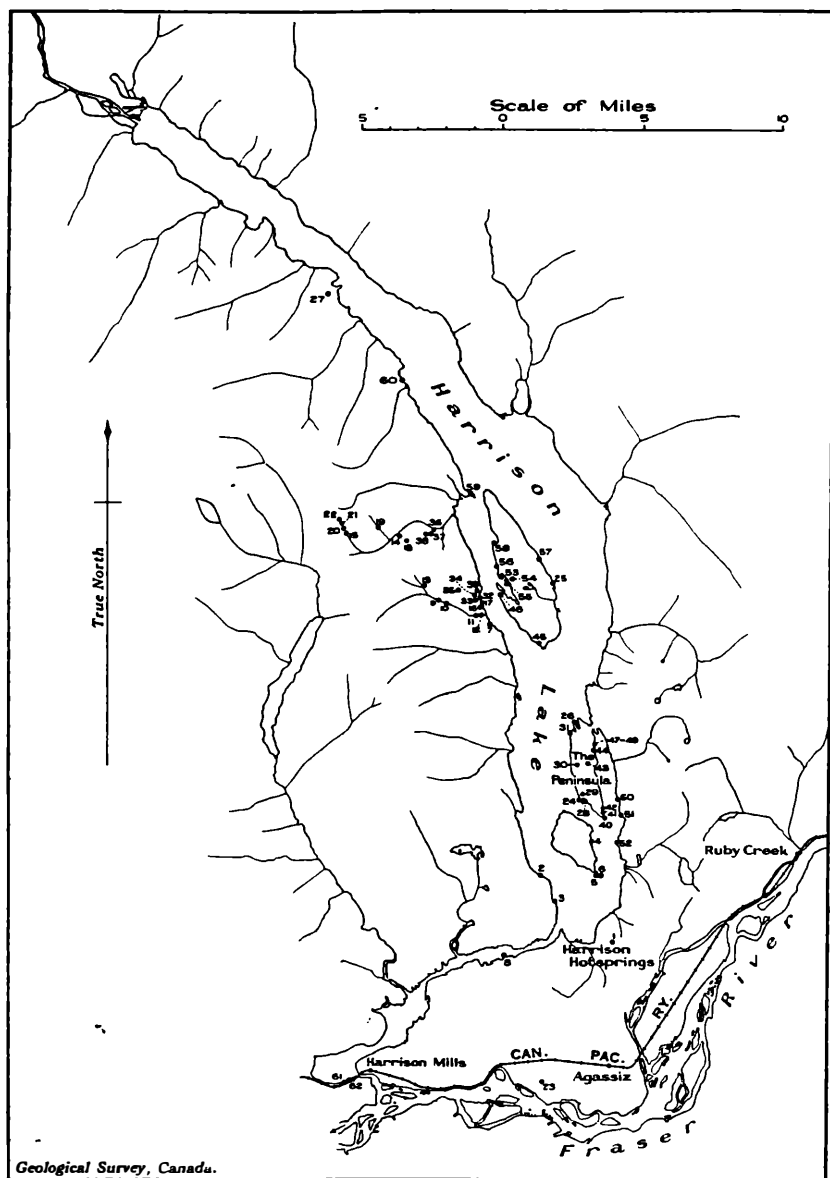


Figure 1. Index map showing positions of fossiliferous localities in the vicinity of Harrison lake, southwest British Columbia. Numbers correspond with those used in text.

anticline, and are surrounded by a thick accumulation of tuffs, agglomerates, and flows, which cover a very considerable area west of Harrison lake and occupy most of Echo island. The total thickness is about 9,000 feet. Fossils were obtained from a band of aqueous sediments in the lower part of the formation (locality No. 3, See Figure 1) and also from higher horizons. These show the volcanic assemblage to be of Middle Jurassic age.

To the north, near Deer creek, to the east on Echo island, and to the south on Harrison river, the volcanics are overlain conformably by well-stratified tuffs. These have an average thickness of 2,700 feet. Only a few fossils were found in them and none of these is indicative of exact dates. However, the formation is overlain conformably by dark grey argillites, the upper part of which yielded excellent fossils of early Upper Jurassic age. This deposit of argillite, which is about 2,400 feet thick, is well exposed from the mouth of Deer creek across the hills to the northwest, through the valley of Mysterious creek, and into the Chehalis Creek basin; also in another strip on the south side of Harrison river. In both sections the argillites are overlain by an accumulation of well-stratified tuffs that on Mysterious creek are about 1,800 feet thick. They have yielded early Upper Jurassic fossils.

The early Upper Jurassic argillites and tuffs on the south side of Harrison river are overlain unconformably by the rocks to which Bowen applied the name Agassiz series. The lower part of this series consists of about 3,000 feet of unfossiliferous conglomerates. These are overlain by about 5,000 feet of black argillites which contain poorly preserved, unidentifiable fossils. At this point the sequence is broken by the thrust faults. However, presumably the same formation occurs as narrow strips on the west shore of the peninsula where it yields the Argovian ammonite, *Anacardioceras*.

The argillites that on the peninsula are regarded as part of the Agassiz series and the stratified Upper Jurassic tuffs near Deer creek, are overlain unconformably by early Cretaceous deposits bearing abundant fossils, mostly of the genus *Aucella*. The lower part of the Cretaceous series consists of a basal conglomerate overlain by grey sandstones and totalling 1,260 feet in thickness. The upper part is made up of 2,200 feet of pyroclastics overlain by about 1,500 feet of sandstones composed of waste from the volcanics. These Cretaceous beds occur in a strip running northwest from the peninsula, along the west side of Long island, to Broken-back hill and beyond. This strip is cut off along its east side by the thrust fault.

The sedimentary rocks of the district are cut by plutonics thought to be of two ages. Those of one age are mostly altered quartz monzonite and occur in masses of various sizes, the largest of which is a batholith lying west of Chehalis creek. It intrudes the Middle Jurassic rocks and appears to have supplied pebbles to the basal conglomerate of the early Cretaceous. It is placed tentatively as late Jurassic.

The other plutonic intrusive is a fresh quartz diorite. It occurs in stocks in various parts of the area, notably between Agassiz and Harrison Hotsprings, and at Doctor point, also in a batholith lying mostly in the upper part of the Chehalis drainage basin. These quartz diorites cut both Jurassic and Cretaceous strata and intersect the great overthrusts

and the high-angled structures of the district. They are, therefore, subsequent to the main orogeny of the region which is thought to be Laramide.

A system of dykes of basalt cuts all the other rocks of the district. These are thought to be of fairly late date.

FOSSIL LOCALITIES AND FAUNAL LISTS

The localities, and the fossils found there, are here listed according to the known or presumed ages of the strata. Individual localities are distinguished by numbers and these numbers on the accompanying index map (Figure 1) indicate the positions of the various fossil-bearing localities.

PENNSYLVANIAN

(1) West side of Bear mountain, at an elevation of 2,000 feet, 1½ miles due east of the Harrison Hotsprings hotel.

Large crinoid stalks—Melocrinidae?
Small crinoid stalks—Batocrinidae?

(2) West shore of Harrison lake, 2½ miles from Harrison River point. Conglomerates. The fossils occur in pebbles of limestone derived from a Pennsylvanian formation.

Productus cf. *clarkei* Ischernychew
Crinoidea, several species

JURASSIC

(3) West shore of Harrison lake, 1,820 yards north of Harrison River point.

Rhynchonella sp.
Entolium volcanicum Crickmay
Cylindroteuthis themis Crickmay

(4) East shore of Echo island, 1,860 yards north of the southeast corner.

Belemnites sp.

(5) South end of the first small islet southeast of Echo island.

Belemnites sp.
Pelecypoda, various unidentifiable forms.

(6) Northeast side of the second small islet southeast of Echo island.

Belemnites sp.

(7) West shore of Harrison lake, 600 yards south of the mouth of Deer creek.

Inoceramus ? sp.

(8) South shore of Harrison river on the west side of a small point 150 yards east of V. Macdonald's house, or 2½ miles from Harrison River point.

Lilloettia sp.—crushed specimens of slightly earlier date than the described species

- (9) Deer creek at 1,450 feet altitude, $1\frac{1}{2}$ miles from the mouth.

Lilloettia sp.

- (10) Deer creek at 1,275 feet altitude, $1\frac{1}{2}$ miles from the mouth.

Lilloettia sp.

- (11) Deer creek at 300 feet altitude, 700 yards from the mouth.

Paracadoceras sp.

- (12) Deer creek, $\frac{1}{4}$ mile from the mouth.

Paracadoceras harveyi Crickmay

Cadoceras catostoma Pompeckj

" *schmidtii* "

" *brooksi* Crickmay

"Belemnites" sp.

- (13) On the small tributary which joins Deer creek from the north at 1,700 feet elevation or $2\frac{1}{4}$ miles from the mouth.

Parallelodon sp.

Entolium hertleini Crickmay

Ammonoid fragment, cadoceratoid

"Belemnites" sp. indet.

- (14) South side of Mysterious Creek valley $2\frac{1}{2}$ miles from the mouth and at 1,400 feet elevation.

Parallelodon sp.

"Belemnites" sp.

- (15) Billhook creek, a tributary to Mysterious creek, at 3,100 feet altitude, and 4 miles in a direct line from the mouth of Mysterious creek.

Callovian (Proplanulian)

Anomia columbiana Crickmay

Lilloettia lilloetensis Crickmay

" *mertonyarwoodi* "

Buckmaniceras buckmani "

- (16) One hundred yards from shore and 600 yards north of the mouth of Deer creek.

"Belemnites" sp.

- (17) West shore of Harrison lake, 720 yards north of the mouth of Deer creek.

Pelecypoda, various, unidentifiable

- (18) Southwest slope of Fossil hill at 1,850 feet.

Haidaia aff. *dawsoni* Whiteaves

"Belemnites" sp.

- (19) Small creek 1 mile east of Billhook creek at 1,500 feet.

Astarte harrisonensis Crickmay

(in talus)

- (20) Billhook creek at 3,270 feet elevation and slightly over 4 miles from the mouth of Mysterious creek.

Cylindroteuthis sp.

- (21) Billhook creek at 3,400 feet elevation.

Haidaia aff. *dawsoni* Whiteaves

" *billhookensis* Crickmay (talus)

" *packardii* " (talus)

Ammonoid, a young cadoceratoid form

- (22) Billhook creek at 3,600 feet elevation.

Pelecypoda, various, unidentifiable
Haidara staliensis Crickmay
 Ammonoid, a young cadoceratoid form
 "Belemnites" sp.

- (23) Southernmost tip of the more westerly of the two small hills lying west of Agassiz.

Ammonoid, indeterminable

- (24) Southwest side of a narrow point which bounds on the west the small bay on the southwest shore of the peninsula, and 1,850 yards from the southeast point of the peninsula.

Parallelodon cardioceras Crickmay
Anacardioceras perrini Crickmay
Phylloceras columbianum Crickmay

- (25) East shore of Long island, $2\frac{1}{2}$ miles from its south end.

Ammonoid, a young cadoceratoid form
 "Belemnites" sp.

- (26) A little islet off the middle of the three points at the north end of the peninsula.

"Belemnites" sp.

- (27) At 250 feet altitude on hillside half a mile south-southwest from Doctor point.

Ammonoid, indeterminable

CRETACEOUS

- (28) West shore of a little bay on the southwest shore of the peninsula.

Aucella acutistriata Crickmay
 " *catamorpha* "
 " *spasskensoides* "
 " *cascadensis* "
 " *canadiana* "
Entolium aucellarum "

- (29) On the hillside one-quarter mile due north of the last locality.

Aucella catamorpha Crickmay
 " *spasskensoides* "
 " sp.

- (30) One-third mile south of the highest peak on the peninsula.

Aucella spasskensoides Crickmay
 " *canadiana* "
 " sp.

- (31) West shore of peninsula $3\frac{1}{2}$ miles in a straight line from its southern tip.

Aucella acutistriata Crickmay
 " *catamorpha* "
 " *spasskensoides* "
 " *canadiana* "
 "Belemnites" sp.

(32) West shore of Harrison lake, 900 yards north of the mouth of Deer creek.

Aucella acutistriata Crickmay
 " *spasskensoides* "
 " *canadiana* "
Cylindroteuthis baculus Crickmay
Pachyteuthis eocretacicus "

(33) Three hundred and fifty yards west of the shore of the lake and 1,200 yards north of the mouth of Deer creek.

Aucella acutistriata Crickmay
 " *calamorpha* "
 " *spasskensoides* "
 " *cascadensis* "
 " *canadiana* "

(34) Three hundred and fifty yards from shore and 1,400 yards north of the mouth of Deer creek.

Aucella acutistriata Crickmay
 " *spasskensoides* "
 " *cascadensis* "
Entolium aucellarum "
Mclearnia mclearnii "
Astarte barbara "
Phylloceras aff. *knoxvillensis* Stanton
 " sp. indet.
Cylindroteuthis baculus Crickmay
Pachyteuthis eocretacicus Crickmay

(35) One and two-fifths miles northwest of the mouth of Deer creek, at an elevation of 1,000 feet.

Aucella acutistriata Crickmay
 " *calamorpha* "
 " *canadiana* "
 " *spasskensoides* "

(36) Right bank of Mysterious creek at 1,000 feet altitude.

Aucella acutistriata Crickmay
 " *spasskensoides* "

(37) North slope of Fossil hill, 250 yards southwest of a point on Mysterious creek of 1,000 feet altitude.

Aucella acutistriata Crickmay
 " *spasskensoides* "

(38) Two hundred and fifty yards west of the last locality.

Aucella acutistriata Crickmay
 " *spasskensoides* "

(39) Two hundred and thirty-five yards from the shore, on the left bank of a little brook that enters Harrison lake from the west, 1,500 yards north of the mouth of Deer creek.

Aucella kwoiekensis Crickmay
Quoieccia aliciae "

(40) Lonetree island, off south tip of peninsula.

Aucella crassicolis Keyserling
Aucella solida Lahusen

- (41) East shore of peninsula, 200 yards north of Lonetree island.

Aucella crassicolis Keyserling
 " *solida* Lahusen
 " *harrisonensis* Crickmay
 " *gigas* "
Pleuromya harrisonensis "
Homalommiles poecilochotomus Crickmay

- (42) East shore of peninsula 400 yards north of Lonetree island.

Aucella crassicolis Keyserling
 " *solida* Lahusen
 " *harrisonensis* Crickmay
Pleuromya harrisonensis "
Homalommiles poecilochotomus Crickmay

- (43) Half a mile southeast of the highest peak on the peninsula.
 Pelecypod, unidentifiable

- (44) East shore of peninsula, 2½ miles north of Lonetree island.
Aucella crassicolis Keyserling

- (45) West shore of Long island 400 yards north of its southern tip.

Aucella crassicolis Keyserling
 " *solida* Lahusen

- (46) Little islet on south side of south entrance to Roberts bay, west side of Long island.

Aucella crassicolis Keyserling
 " *solida* Lahusen

- (47) South shore of a little point on the west side of Cascade bay, 1,090 yards south of the north end of that bay; or 4,660 yards north of Lonetree island.

Aucella teutoburgensis Weerth
Yaardia lewisagassizi Crickmay

- (48) Forty feet east of the *Yaardia lewisagassizi* locality on south shore of a little point on west side of Cascade bay 1,090 yards due south of the north end of that bay.

Aucella somewhat crushed and not identifiable with certainty, but probably the sharp ribbed species of the *canadiana* zone

- (49) Northeast side of the little point on west side of Cascade bay, 1,090 yards due south of the north end of that bay.

Aucella somewhat sheared and so unidentifiable, but probably the sharp ribbed species of the *canadiana* zone

- (50) East side of Cascade bay 2¾ miles from the north end of that bay, also

- (51) East side of Cascade bay 3¼ miles from the north end of that bay, also

- (52) East side of Cascade bay 4½ miles from the north end of that bay.

Aucellae, greatly sheared and so unidentifiable, but probably the sharp ribbed species of the *canadiana* zone

- (53) Northwest corner of Roberts bay, west side of Long island.

Aucellae, somewhat crushed and so unidentifiable, but probably the sharp ribbed species of the *canadiana* zone

- (54) East side of Roberts bay 650 yards from the north end, also
- (55) Islet, 100 yards west of the last locality, also
- (56) West shore of Long island, $2\frac{1}{4}$ miles south of the north end of that island, also
- (57) East shore of Long island, $3\frac{1}{4}$ miles in a straight line from the north end of that island.
Aucellae, strongly sheared and so unidentifiable, but probably the sharp ribbed species of the *canadiana* zone
- (58) West side of Long island, barely 2 miles south of the north end of that island.
Aucellae, considerably crushed and so unidentifiable with certainty, but nevertheless very probably *Aucella crassicolis* Keyserling
- (59) North side of Twentymile point, one-quarter mile from the point, also
- (60) West shore of Harrison lake, one-half mile south of Rock point.
 Pelecypoda, unidentifiable fragments
 "Belemnites" sp. indet.
- (61) Cut bank on south side of main line of Canadian Pacific railway 838 yards west of the west end of the Harrison River bridge.
Strongylocentrotus drobachiensis Müller
Mytilus edulis Linnæus
Terebratalia transversa Sowerby?
Balanus crenatus Bruguière
- (62) Cut bank on south side of main line of Canadian Pacific railway 750 yards west of the west end of the Harrison River bridge.
Saxicava rugosa Linnæus
 Other pelecypoda, indeterminable fragments

DESCRIPTION OF FOSSILS

Phylum, ECHINODERMATA

Class, CRINOIDEA

Order, Camerata

Family, MELOCRINIDAE?

Genus, (?)

Fragments of large stalks, 10 to 27 mm. in diameter, the joints of which exhibit the structure and intercolumnal spaces of those of this family. They are imperfectly preserved and do not admit of complete study.

Locality. West side of Bear mountain at 2,000 feet elevation, $1\frac{1}{2}$ miles due east of Harrison Hotsprings hotel. Similar crinoid stalks are common at the type locality of the Chilliwack series on Chilliwack river, also in the Pennsylvanian rocks of Kamloops district, British Columbia.

Family, BATOCHINIDAE?

Fragments of smaller stalks which closely resemble in a superficial way those of this family. The reference is, of course, far from certain. There are probably several forms: the shapes of the small columnals differ somewhat. Diameters from 3 to 8 mm.

Locality. West side of Bear mountain at 2,000 feet, 1½ miles due east of the Harrison Hotsprings hotel.

Class, ECHINOIDEA

Order, Centrechinoidea

Family, STRONGYLOCENTROTIDAE

Genus, *Strongylocentrotus* Brandt*Strongylocentrotus drobachiensis* Müller

Fragments of corona and spines belonging to this species.

Locality. Main line of Canadian Pacific railway 838 yards west of the west end of Harrison River bridge.

Phylum, MOLLUSCOIDEA

Class, BRACHIOPODA

Order, Protremata

Family, PRODUCTIDAE

Genus, *Productus**Productus* cf. *clarkei* Tschernychew

Specimens comparable with this species from limestone pebbles in conglomerate.

Locality. West shore of Harrison lake 2½ miles from Harrison River point.

Order, Telotremata

Family, RHYNCHONELLIDAE

Genus, *Rhynchonella**Rhynchonella* sp.

Indeterminable fragments belonging to this genus.

Locality. West shore of Harrison lake 1,820 yards from Harrison River point.

Family, TEREBRATELLIDAE

Genus, *Terebratalia**Terebratalia transversa* Sowerby?

Small, decrepitated fragments that have the structure of this species. Occurs with *Mytilus edulis* and *Strongylocentrotus drobachiensis*.

Locality. On main line of Canadian Pacific railway 838 yards west of the west end of Harrison River bridge.

Phylum, MOLLUSCA

Order, Prionodesmacea

Family, PARALLELODONTIDAE

Genus, *Parallelodon* Meek*Parallelodon cardioceratanum* sp. nov.

Plate VIII, figures 1, 2, 3

Surface marked only by excessively delicate, concentric lines.

Dimensions. Holotype, a left valve—length, 22 mm.; height, 14; semidiameter (diameter of one valve, or distance from lateral convexity to median plane), 5.

Locality. Southwest shore of peninsula, on west side of point that bounds the small bay.

Family, PERNIDAE

Genus, *Inoceramus* Sowerby

Indeterminable fragments belonging to this genus.

Locality. West shore of Harrison lake, 600 yards south of Deer creek.

Family, PTERIIDAE

Genus, *Mclearnia* gen. nov.

A giant pteriid without sculpture. Right valve flattish with peciniform byssal notch. Left valve, somewhat more convex. Ears, subequal, all well developed. Chondrophore, small, central, and vertical.

Mclearnia mclearnii sp. nov.

Plate VIII, figure 4; Plate IX, figure 1

Umbo lies at centre of hinge-line, somewhat posterior to centre of disk, giving the shell a peculiar outline. Shell is much thickened in the umbonal region. Surface smooth except for occasional growth-lines. When split the shell shows traces of fine, radial ribbing. Interior smooth except for the single, large, bilobate muscle-scar; and two curved lines of "dimples", one on each side of the umbo. These appear in the figures, as does also the central chondrophore.

Dimensions. Holotype, a right valve seen from interior aspect—length, 115 mm.; height, 112; semidiameter, 11; hinge-line, 71. Paratype, a left valve, cast of interior—height, 118; semidiameter, 25; hinge-line, 78.

Locality. Zone of *Aucella canadiana*, west side of Harrison lake 350 yards from shore and 1,400 yards north of Deer creek.

Name. Generic and specific name after F. H. McLearn, palæontologist.

Family, MYALINIDAE

Genus, *Aucella* Keyserling

The species of *Aucella* from Harrison lake form a considerable and an important assemblage belonging to four separate hemeræ. This was obvious at the beginning of this study, but at that time it was thought that the earliest Harrison forms corresponded to the earliest California Cretaceous species—*Aucella piochii*, and, in consequence, some mistaken identifications were made. Subsequently, larger collections and a more exhaustive study have shown that the species of the *A. canadiana* zone are later than *A. piochii*. Moreover, they are not related to that species but rather to the group of *A. bononiensis*. They seem to represent large shelled derivatives of this group evolved during the great expansive evolution of *Aucellae* which occurred at the end of the Jurassic period. They represent one of the earliest Cretaceous hemeræ, probably that of *Craspedites stenomphalus*. The other Harrison *Aucellae*, except *A. kwoiekensis*, belong to the period of restrictive and degenerative evolution of *Polyptychites polyptychus* and later time.

Aucella acutistriata sp. nov.

Plate IX, figure 2

Resembles *A. andersoni* somewhat but differs in its much larger size and greater diameter. The ornament consists of concentric costæ that are as sharp as knife-blades and stand 0.5 to 1 mm. above the general surface. They are spaced 8 or 9 in a cm. of radius. Become obsolete on anterior and posterior ends of shell which are striate concentrically.

Dimensions. Holotype, a left valve—long axis, 78 mm.; short axis, that is the greatest line at right angles to the long axis, 42; semidiameter, 28; apical angle, 69 degrees. Paratype, both valves in contact: left—long axis, 42; short axis, 25; semidiameter, 13; apical angle, 65 degrees; right—long axis, 39; short axis, 25; semidiameter, 11; apical angle, 80 degrees.

Locality. Zone of *Aucella canadiana*, west side of Harrison lake, 350 yards from shore and 1,200 yards north of Deer creek.

Aucella catamorpha sp. nov.

Plate IX, figure 5

Very similar to the last except that the shell is unornamented. It is marked only by growth lines. Also the right valve has a more acute apical angle, and the diameter is slightly less.

Dimensions. Holotype, right valve—long axis, 37 mm.; short axis, 25; semidiameter, 7; apical angle, 60 degrees.

Locality. Zone of *Aucella canadiana*, west side of a small bay on southwest shore of the peninsula.

Aucella spasskensoides

Plate IX, figures 3, 4

Resembles *A. spasskensis* Pavlow, but the diameter is notably greater and the right valve has a greater apical angle. Strong concentric costæ, sharp as in *A. acutistriata*, spaced 4 to 5 in a cm. of radius on the mature shell, though closer in the umbonal region.

Dimensions. Holotype, right valve—long axis, 38 mm.; short axis, 29; semidiameter, . . .; apical angle, 80 degrees; right valve—long axis, 36; short axis, 29; semidiameter, 7; apical angle, 90 degrees. Paratype, left valve—long axis, 55; short axis, 39; semidiameter, 16; apical angle, 67 degrees. The largest specimen found, a left valve, had a long axis measuring 60 mm.

Locality. Zone of *Aucella canadiana*, west side of small bay on southwest shore of peninsula.

Aucella cascadenensis sp. nov.

Plate X, figures 1, 2

Having the same general aspect of the *fischeriana* stock which the last species shows. The costation is wider spaced; 3 costæ in a centimetre of radius on the mature shell. Also the costæ are sharp like those of *A. acutistriata*.

Dimensions. Holotype, left valve—long axis, 57 mm.; short axis, 43; semidiameter, 15; apical angle, 80 degrees. Paratype, right valve—long axis, 63; short axis, 54; semidiameter, 15; apical angle, 105 degrees.

Locality. Zone of *A. canadiana*, west side of Harrison lake, 350 yards from shore and 1,200 yards north of Deer creek.

Name. Cascade mountains.

Aucella canadiana sp. nov.

Plate X, figures 3, 4, 5

This form has departed farther from the *fischeriana* ancestry than the preceding species. These costæ are wide spaced: 1.5 to each centimetre of radius, and are sharp like those of *A. acutistriata*.

Dimensions. Holotype, a left valve—long axis, 54 mm.; short axis, 43; semidiameter, 22; apical angle, 75 degrees. Paratype, right valve—long axis, 60; short axis, 49; semidiameter, 12; apical angle, 93 degrees.

Locality. Zone of *Aucella canadiana*, west side of Harrison lake 350 yards from shore and 1,200 yards north of Deer creek.

Name. A Canadian species, and peculiarly so, because it is strikingly different from any of the foreign forms.

Aucella kwoiekensis sp. nov.

Plate X, figures 6, 7

Resembles members of the *inflata* group, but differs markedly from all in proportions and in the fine, closely spaced, concentric striæ. Byssal sinus unusually long.

Although Pavlow suggests a very different history, yet it is quite possible that this form is ancestral to the *crassicollis* group.

Dimensions. Holotype, a right valve—long axis, 42 mm.; short axis, 38; semidiameter, 15; apical angle, 90 degrees.

Locality. Zone of *Quoiechia aliciae*, 235 yards from shore, on the left bank of a little brook which enters Harrison lake from the west, 1,450 yards north of the mouth of Deer creek.

Name. Kwoiek, Indian geographical name.

Aucella crassicollis Keyserling 1846

1846. Keyserling: Wissenschaftliche. Beobachtungen auf einer Reise in das Petschoraland.

The left valve is very strongly convex, and the left umbo is strongly incurved. Right valve, less so. The long axis of the left valve is about twice the short axis. The form is rather irregular. The external surface is marked by fine growth lines and concentric varices. The latter appear with maturity, but at slightly different stages in different specimens.

Locality. Zone of *Homolomites poecilochotomus*, Lonetree island; also on the southeastern shore of the peninsula, etc.

Aucella solida Lahusen

Aucella crassicollis var. *solida* Lahusen 1888: Mem. du Comité géol., St. Petersburg, vol. VIII, No. 1.

This species somewhat resembles the last, but differs in that the long axis is not much greater than the short.

Locality. Occurs associated with the last at all localities.

Aucella harrisonensis sp. nov.

Plate XI, figures 1, 2, 3

Left valve, somewhat convex. Left umbo, slightly incurved. Right valve, flattish. Right umbo, short, obtuse, and almost eurved. Shell, very thin, and, consequently, there is no ornament except joint growth lines. Concentric varices appear beyond 25 mm. from the umbo in some specimens.

Dimensions. Holotype, a right valve—long axis, 32 mm.; short axis, 30; semidiameter, 8; apical angle, 95 degrees. Paratype, a left valve—long axis, 30 mm.; short axis, 20; semidiameter, 9; apical angle, 73 degrees.

Locality. Zone of *Homolomites poecilochotomus*, southeast shore of the peninsula, 200 yards from the south end.

Aucella gigas sp. nov.

Plate XI, figures 4, 5, 6

Valves resemble each other strongly in shape. Both are broad, flattish, and rounded ventrally. Umbones, short, obtuse, very slightly incurved. Ornament of obtuse, concentric costæ that have a very characteristic curve. Ornament degenerates beyond 35 mm. from the umbo.

Dimensions. Holotype, left valve—long axis, 100 mm.; short axis, 78; semidiameter, 20; apical angle, 80 degrees; right valve—long axis, 83 mm.; short axis, 72; semidiameter, 16; apical angle, 90 degrees.

Locality. Zone of *Homolomites poecilochotomus*, southeast shore of the peninsula 200 yards from the south end.

Name. From the fact that it is the largest *Aucella* known.

Aucella teutoburgensis Weerth

Avicula (?) *teutoburgensis* Weerth 1884: Palaeont. abhandl. Bd. II.

Both valves notably convex, left valve somewhat more so than right. Umbones incurved. The outline is characteristic. Ornament, striate.

Locality. Zone of *Yaadia lewisagassizi*, on south shore of a little point on the west side of Cascade bay 1,090 yards south of the north end of that bay.

Family, TRIGONIIDAE

Genus, *Haidaia* Crickmay

Of the Harrison Lake species referred to this genus only one is typical. This form, related to *H. dawsoni* Whiteaves, is unluckily not represented by material good enough for specific description. The other three are new species which are referred to this genus for convenience, as it seems undesirable to make any further division until more forms are known.

Haidaia sp. nov. aff. *H. dawsoni* Whiteaves

Fragments of a new form, similar to *dawsoni* in the main but larger, longer in proportion to height, and having a narrower area.

Locality. Southwest slope of Fossil hill at 1,850 feet; and on Billhook creek at 3,400 feet.

Haidaia billhookensis sp. nov.

Plate XII, figure 1

Costæ, numerous for a member of this genus. Tubercles, numerous, arranged in concentric series, degenerating toward basal margin. Costellæ become irregular at maturity, rather resembling coarse growth lines. Marginal carina at maturity is a line of weak, irregularly spaced bullæ. Median carina, lacking. Inner carina, not seen. Median furrow, shallow.

Dimensions. Length, 77 mm.; height, 70; semidiameter, 25.

Locality. Talus at 3,400 feet on Billhook creek.

Name. After the locality.

Haidaia packardi sp. nov.

Plate XII, figures 2, 3

Radial costæ, strong. Tubercles, strongest on a concentric zone midway between umbo and base; that is, degenerating before maturity—a sign of catamorphism. Tubercles are arranged in concentric series and are joined by weak, concentric costæ. Costellæ, very fine, degenerating with maturity to coarse, irregular striæ resembling rugose growth lines. Inner and marginal carinæ strong, coarsely tuberculate. Median carina, absent. Furrow, weak. Posterior basal margin has three or four crenulations on the inside.

Dimensions. Length, 70 mm.; height, 58; semidiameter, 20.

Locality. Talus at 3,400 feet on Billhook creek.

Name. After E. L. Packard, in recognition of his work on west American Trigonidae.

Haidaia statluensis sp. nov.

Plate XII, figures 4, 5, 6

Costæ weak, though marked by strong, obtuse tubercles that are arranged in concentric series and joined by concentric costæ. Two figures of specially prepared artificial casts are introduced to show this peculiarity, which does not appear very plainly on the holotype. Both costæ and tubercles are small and weak on the umbonal region and anterior end. Area marked by faint, transverse striæ which become with maturity coarse costellæ. Carinæ not specially marked. Furrow, shallow, becoming obsolete with maturity.

Dimensions. Length, 65 mm.; height, 54; semidiameter, 15.

Locality. Billhook creek at 3,600 feet.

Name. Geographical—Statlu creek.

Genus, *Yaadia* gen. nov.Genotype, *Yaadia lewisagassizi* sp. nov.

This genus is instituted for a branch of the pseudoquadrate Trigonidae that has a discrepant ornament on the anterior end of the disk, and so can not well be included in the true pseudoquadrate, genus *Steinmanella* nov. genotype of which is *S. holubi* Kitchin. The discrepant anterior ornament of *Yaadia* is not necessarily any indication of relationship with *Scaphitrigon*, because this kind of thing might well be developed independently. *Steinmanella* is an Indo-Pacific genus of the early Cretaceous. *Yaadia* is presumably a north Pacific group of the same time.

Name. From Yaada, Indian legendary name.

Yaadia lewisagassizi sp. nov.

Plate XIII, figures 1, 2

Near the umbo, the two sets of ornament are united into one resembling that of Trigonina s.s. The two sets of ornament on the disk are separated by a perfectly smooth area. Carinæ marked only by rows of coarse

tubercles (tubæ), which are widely spaced and have a peculiar oblique elongation. Area, otherwise smooth. Escutcheon, marked by transverse lines of small tubercles continuous with tubercles of inner carina.

Dimensions. Length, 77 mm.; height, 63; semidiameter, 22. This length and height may be slightly vitiated by diastrophic distortion.

Locality. Zone of *Yaadia lewisagassizi*, on the south shore of a little point on the west side of Cascade bay, 1,090 yards south of the north end of that bay. Occurs with *Aucella teutoburgensis*.

Name. In honour of Captain Lewis N. Agassiz, Royal Welsh Fusiliers, one of the pioneers of British Columbia.

Genus, *Quoiecchia* gen. nov.

Genotype, *Quoiecchia aliciae* sp. nov.

The genus is distinguished by the small-sized shell and the peculiar arrangement of the ornament. It is unlike any other group of Trigonæ, though there is a suggestion of this style of ornament in *Haidaia statluensis*.

Name. From Kwoiek, Indian geographical name.

Quoiecchia aliciae sp. nov.

Plate XIII, figures 3-8

According to the Agassiz classification this species would be referred to "les lisses" (glabrae of Lycett), a group of composite origin, being smooth derivatives of various stocks. The form is probably an aberrant offshoot of the great, protean *Haidaia*. The ornament of the disk is formed by two sets of furrows. One, a radial set, is strong near the umbo but becomes obsolete near the middle of the disk. The other, a concentric set, appears first at 10 mm. from the umbo and becomes increasingly stronger toward the basal margin. The spaces between furrows stand up as low, obtuse costæ; between two intersecting sets of furrows, as low, squarish tubercles. The carinæ are obsolete, the area being ornamented only by the posterior continuation of the concentric furrows. The interior surface of the posterior half of the basal margin is crenulated, forming four or five broad, tooth-like processes which interlock in opposite valves when the shell is closed.

Dimensions. Holotype, a right valve—length, 21 mm.; height, 19; semidiameter, 6. Paratype, a right valve—length, 30; height, 34; semidiameter, 15. This shows that as it grows the shell becomes disproportionately high and robust.

Locality. Zone of *Quoiecchia aliciae*, 235 yards from lake shore, on the left bank of a little brook that enters Harrison lake from the west 1,450 yards north of the mouth of Deer creek.

Name. Geographical—St. Alice' well.

Family, PECTINIDÆ

Genus, *Entolium* Meek*Entolium hertleini* sp. nov.

Plate XIV, figure 1

Shell, very flat. Ears, small. Upper margins of the ears make a shallow re-entrant. External surface appears smooth, but the X 10 power of magnification shows it to be marked by even, continuous, concentric striæ. These have a characteristic curve which is shown in the plate by a black line. Lateral margin of disk, also ears, are marked by faint, microscopic radial striæ as well. The species is very similar to the wide variety of *Entolium leachii* McLearn, but is separable by its smaller ears, concentric curve.

Dimensions. Holotype—length, 27 mm.; height, 27; semidiameter, 2; base of anterior ear, 5.5; base of posterior ear, 7; upper margins of ears, total 6.5; re-entrant angle, 165 degrees; apical angle, 115 degrees. Paratype—length, 57; height, 56; apical angle, 125 degrees. Both types are right valves.

Locality. Above zone of *Cadoceras brooksi*, at an altitude of 2,100 feet on a small brook which enters Deer creek from the north at 1,700 feet.

Name. After Mr. Leo G. Hertlein.

Entolium vulcanicum sp. nov.

Plate XIV, figure 2

Shell, very flat, large. Ears, small, with a notable re-entrant above. Next below the dorsal margin of the shell, and bounded below by a radial line, there is an area where the shell is thickened. These are plainly visible in the figure. Exterior, smooth or nearly so. Some specimens have an appearance of faint, concentric striæ.

Dimensions. Holotype, a left valve—length, 68 mm.; height, 62; semidiameter, 4; base of anterior ear, 12; base of posterior ear, 17; upper margins of ears, total, 17; re-entrant angle, 140 degrees; apical angle, 128 degrees.

Locality. Associated with *Cylindroteuthis themis*, on the west shore of Harrison lake, 1,820 yards north of Harrison River point.

Name. In allusion to habitat. The species was an inhabitant of the powerfully volcanic British Columbia of Bajocian times.

Entolium aucellarum sp. nov.

Plate XIV, figure 3

Shell, flat, smooth. The ears are larger than those of *E. hertleini* and *E. vulcanicum*, and are of a different shape from those of either, or of *E. leachii* McLearn. As is usual with this genus the apical angle increases with age.

Dimensions. Holotype, a right valve—length, 27 mm.; height, 29; midiameter, 2; base of anterior ear, 7; base of posterior ear, 8; upper

margins of ears, total, 9; re-entrant angle, 160 degrees; apical angle, 113 degrees.

Locality. Zone of *Aucella canadiana*, west side of a small bay on the southwest shore of the peninsula.

Name. The species is a syntopite with the *Aucellae* of the *canadiana* zone.

Family, ANOMIIDAE

Genus, *Anomia* Linné

Anomia columbiana sp. nov.

Plate XIV, figures 4, 5, 6

Differs from *A. albertensis* McLearn in its larger size and in having a much finer ornament of radial striæ. The striæ become slightly stronger as they strike the margin of the shell. The outline of the shell is rather variable. The shell is marked also by concentric irregularities of surface comparable with varices.

Dimensions. Holotype—equidimensional, though somewhat crushed; width, 57 mm. Paratype—width, 55; height, 60.

Locality. Zone of *Lilloettia lilloetensis*, on Billhook creek at 3,100 feet altitude.

Name. After British Columbia.

Family, MYTILIDAE

Genus, *Mytilus* Linnaeus

Mytilus edulis Linnaeus

Fragments of this common living species, very typical as regards form and dimensions.

Locality. Main line of Canadian Pacific railway, 838 yards west of the west end of the Harrison River bridge.

Order, Anomalodesmacea

Family, PLEUROMYACIDAE

Genus, *Pleuromya* Agassiz

Pleuromya harrisonensis sp. nov.

Plate XV, figures 1, 2, 3

Shell, pleuromyiform, small, robust, not perceptibly gaping, having a shallow sulcus in the antero-lateral area running radially from umbo to basal margin. Cardinal area obscure. Post-umbonal slope, concave. Posterior dorsal margin, expanded postero-dorsally. No cardinal groove. Maximum diameter is vertically below the umbones. Ornament of concentric wrinkles, which become weak on the posterior end of the shell. They are obscured by matrix on the anterior end of the only specimen.

Dimensions. Holotype—length, 42 mm.; height, 35.5; semidiameter, 13; horizontal distance from anterior extremity to umbo, 15.

Locality. Zone of *Homolomites poecilochotomus*, on the southeast shore of the peninsula.

Order, **Teleodermacea**

Family, **ASTARTIDÆ**

Genus, *Astarte* Sowerby

Astarte harrisonensis sp. nov.

Plate XV, figures 4, 5

Lunule and escutcheon, deeply impressed. Ornament of high, concentric costæ, which are somewhat irregular as to size and continuity. On a shell of 21 mm. height there are $8\frac{1}{2}$ costæ in 10 mm. of radius, counted about the centre of the disk. Superimposed upon this ornament are fine growth lines visible only with a magnifier. The whole basal margin from lunule to escutcheon is finely denticulate inside. The species might be confused with *A. dacotensis* Whitfield and Hovey, but it is distinguished by its much less diameter.

Dimensions. Holotype—length, 21 mm.; height, 21; semidiameter, 4.3; apical angle, 108 degrees.

Locality. Talus on small creek one mile east of Billhook creek at 1,500 feet altitude.

Astarte barbara sp. nov.

Plate XV, figure 6

Subquadrate, with the umbo extremely anterior. Ornament of weak, concentric costæ. Basal margin, denticulate. Somewhat resembling *A. californica* Stanton, but differing in the more anterior and less prominent umbo.

Dimensions. Holotype—length, 38 mm.; height, 30; semidiameter, 5.5; apical angle, 116 degrees.

Locality. Zone of *Aucella canadiana*, west side of Harrison lake 350 yards from shore and 1,400 yards north of the mouth of Deer creek.

Name. The word *barbarus* denoted to the Romans that which was not Roman, that is to say, foreign. So this *Astarte*, a lonely foreigner in the great community of *Aucellæ* of the *canadiana* zone, may well be called *barbara*.

Family, **SAXICAVIDÆ**

Genus, *Saxicava* Fleurian

Saxicava rugosa Linnaeus

Two well preserved specimens from the clay of the Squawkum formation.

Locality. Main line of Canadian Pacific railway, 750 yards west of the Harrison River bridge.

Class, *CEPHALOPODA*Order, *Ammonoidea*Family, *CARDIOCERATIDAE*

The family name was published first by Hyatt who included *Cardioceras*, *Cadoceras*, *Quenstedticeras* (Hyatt¹ always spelled it this way so we can not accept *Quenstedticeras* as Buckman insists nor *Quenstedticeras* as Reeside demands), and *Neumayria*. H. Douville's supposed publication was not distributed. In 1900 Hyatt attempted to change the name to *Cadoceratidae*, but this is not valid. Also some later writers have included a lot of utterly unrelated genera, which has caused some confusion. However, excellent summaries of the family have been given by Buckman² whose interpretation of the group is clear and connected. Many genera occur in North America as yet unreported. For instance, among the species described by Reeside³ under "*Quenstedticeras*" and *Cardioceras* there are a dozen or so generic groups; some named, some unnamed. Two known genera and one new genus occur in the Upper Jurassic deposits of the Harrison Lake country. The occurrence of species of *Cadoceras* in the Mysterious Creek formation establishes the general age of that deposit. Also it establishes the exact date of *Paracadoceras* gen. nov. which is associated with *Cadoceras*. Also it establishes the approximate date of *Lilloettia* and *Buckmaniceras*, family *Macrocephalitidae*, which occur a short distance above *Cadoceras* and associated with cadoceratoid forms close to *Cadoceras*, but not sufficiently fully grown to be generically identified.

Genus, *Paracadoceras* nov.

A cadoceratoid serpenticone. The young is like that of *Cadoceras*, but inflation that supersedes the elevation of the whorl is so moderate that the mature form is only a robust serpenticone. Ribbing notably prorsiradiate. However, the genus differs strongly from *Prorsiceras* Buckman in that the number of secondary ribs is less than double that of the primaries, and in its narrow umbilicus and depressed whorls. Also in the ventral ribbing.

Paracadoceras harveyi sp. nov.

Plate XVI, figures 1, 2; Figure 2

Ornament. In the young that part of the rib within the umbilicus is reclined as in the Canadian and Alaskan *Cadocera*, but at 27 mm. diameter this part of the rib becomes versiradiate. The extrumbilicate portion of the rib is prorsiradiate at all stages. Ribs cross venter with only a slight forward bend. Venter is almost smooth on last part of last whorl.

Table showing number of ribs in a quadrant at various stages.

Diameter		
18 mm	10 primaries	14 secondaries
34 "	8½ "	14 "
53 "	8 "	15 "

¹Hyatt: Bull. Geol. Soc. Am., vol. 3, p. 410 (1892).

²Type Ammonites, vols. II and III (1913-1921).

³Reeside: U.S. Geol. Surv., Prof. Paper 118 (1919).

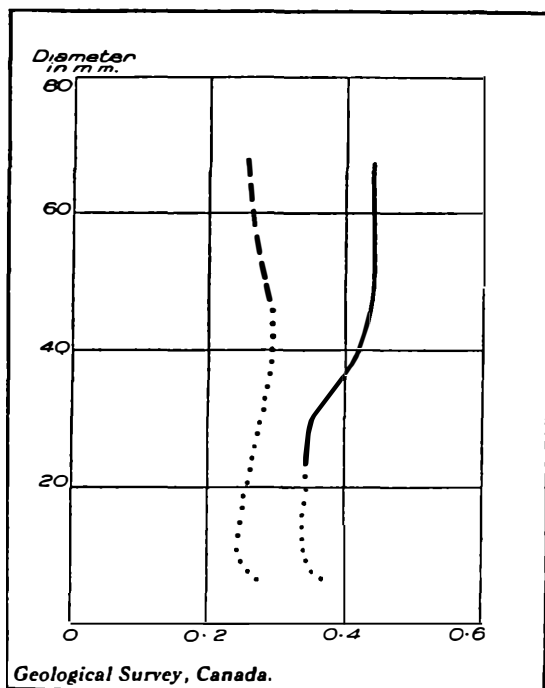


Figure 2. *Paracadoceras harveyi* sp. nov.; width of umbilicus and thickness of whorls expressed as fractions of the diameter. Umbilicus of holotype shown by a broken line; whorls of holotype by a solid line; continuations of curves, based on topotypes, by a dotted line.

Locality. Zone of *Cadoceras brooksi*, on Deer creek one-quarter mile from its mouth, west side of Harrison lake.

Name. After Robert Valentine Harvey.

Genus, *Cadoceras* Fischer 1882

The North American forms of this genus differ somewhat from the European, but not enough to warrant separation. The young are very similar to those of *Paracadoceras* and other genera from North America and the Arctic regions as yet unnamed. It is, therefore, quite unsafe to name a form of less than 45 or 50 mm. diameter unless the development curves of several features show that the specimen is mature. Much revision of the *Cadoceratoids* is necessary, and it is among Arctic faunas that this can be done. Probably in the Arctic Jurassic is to be found the early history, as yet unknown, of the great *Cardioceratid* family.

Two Alaskan and one new species of *Cadoceras* were found at Harrison lake.

Cadoceras catostoma Pompeckj 1900

Figure 3

1900. Pompeckj: Verhandl. Kais. Russ. Min. Gesell. St. Petersburg, 2 to Ser., Bd XXXVIII.

Costæ, strong, strongest on venter, bent forward, but not strongly, in crossing venter, strongly reflexed in crossing umbilical border. At 30 mm. diameter there are eight primaries and twelve secondaries in a quadrant. Resembles *C. growingki* in form and rib-curve, but differs in its more closely crowded ribs. Only immature specimens were found.

Dimensions. See graph.

Locality. Zone of *Cadoceras brooksi*, on Deer creek one-quarter mile from its mouth; also other places.

Cadoceras schmidti Pompeckj 1900

Figure 3

1900. Pompeckj: Verhandl. Kais. Russ. Min. Gesell. St. Petersburg, 2 te Ser., Bd. XXXVIII.

Somewhat similar to the last, but having a much narrower umbilicus and costæ bent strongly forward in crossing the venter. At 30 mm. diameter there are eight primaries and fourteen secondaries in a quadrant. This species like the last has the costæ strongly reflexed in crossing the umbilical border.

Dimensions. See graph.

Locality. Zone of *Cadoceras brooksi*, on Deer creek, one-quarter mile from the mouth; also other places.

Cadoceras brooksi sp. nov.

Plate XVI, figures 3, 4, 5; Figure 3

Inner whorls rounder in cross-section than is usual in this genus. Cadicone is attained at about 38 mm. diameter, so possibly a large size is never reached. Costæ, obtuse, very slightly bent forward in crossing venter, and slightly reflexed in crossing umbilical border. Table showing number of ribs in a quadrant of whorl at various stages.

Diameter

30 mm.	8 primaries	13 secondaries
50 "	primaries obsolete, 8 butlæ on umbilical "keel"	13 "

Locality. Zone of *Cadoceras brooksi*, on Deer creek, one-quarter mile from its mouth, west side of Harrison lake.

Name. After Mr. Allan Brooks, in recognition of his inimitable pictorial contributions to natural history.

Genus, *Anacardioceras* Buckman 1923'

This stock has not previously been reported from North America, but it seems likely that it is represented by some of the species of "*Cardioceras*" described from Wyoming and Alaska. The form from Harrison lake, described in the sequel, differs from the typical British species in its perfect smoothness, venter of persistently knife-edge sharpness, and

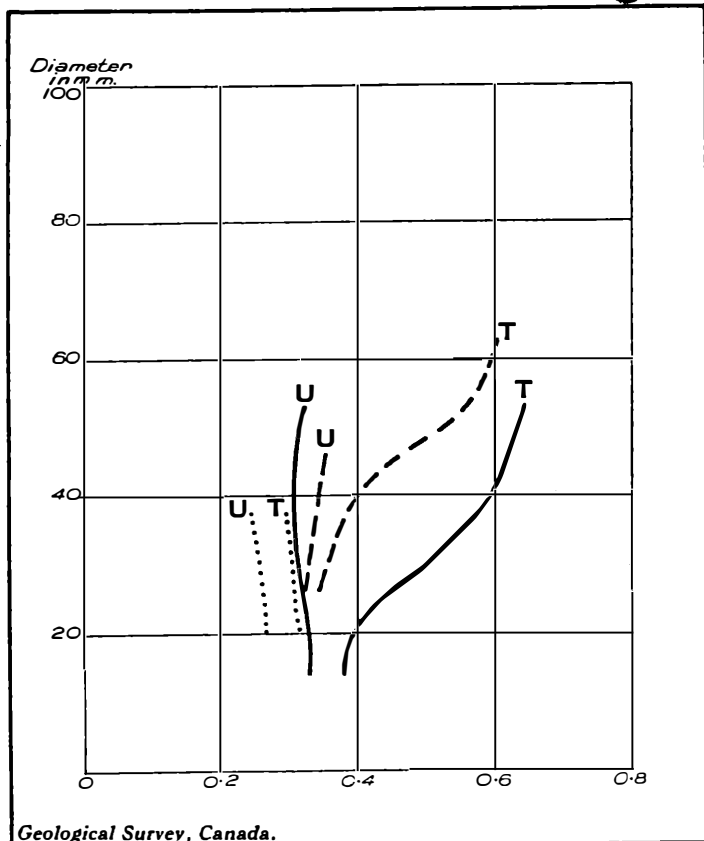


Figure 3. *Cadoceras brooksi* sp. nov.; *C. catostoma*; and *C. schmidtii*; widths of umbilicus and thicknesses of whorls expressed as fractions of the diameter. Umbilicus of *C. brooksi*, holotype, shown by a solid line marked U; thickness of *C. brooksi*, holotype, by a solid line marked T; umbilicus of Harrison Lake specimens of *C. catostoma*, by a broken line marked U; thickness of specimens of *C. catostoma* by a broken line marked T; umbilicus of Harrison Lake specimens of *C. schmidtii* by a dotted line marked U; thickness of specimens of *C. schmidtii* by a dotted line marked T.

slightly ellipticonic periphery. However, these differences are acquired only with late maturity so are not to be taken as a basis for separation. The genus indicates a late Cardioceratan date; most of the European species being in the *excavatum* zone.

Anacardioceras perrini sp. nov.

Plate XVII, figures 1, 2, 3; Plate XXII, figure 1; Figures 4, 5, 6

Living chamber, one-half whorl. Ornament, striate in the young. Becomes heavy enough to be called costate at about 20 mm. diameter.

Ornament reaches acme at 45 mm., then declines. Smooth from 90 mm. on. Table showing number of ribs in a quadrant of whorl at various stages.

Diameter

16 mm.	8 primaries	13 secondaries
30 "	6 "	16 "
62 "	7 "	15 "

and 17 peripheral knots

Venter rounded up to 5 mm. at which it becomes fastigate. It develops a knotted keel at about 15 mm. Loses its knots about 85 mm. becoming more acute. A true knife-edge from 90 mm. onward. Mouth border

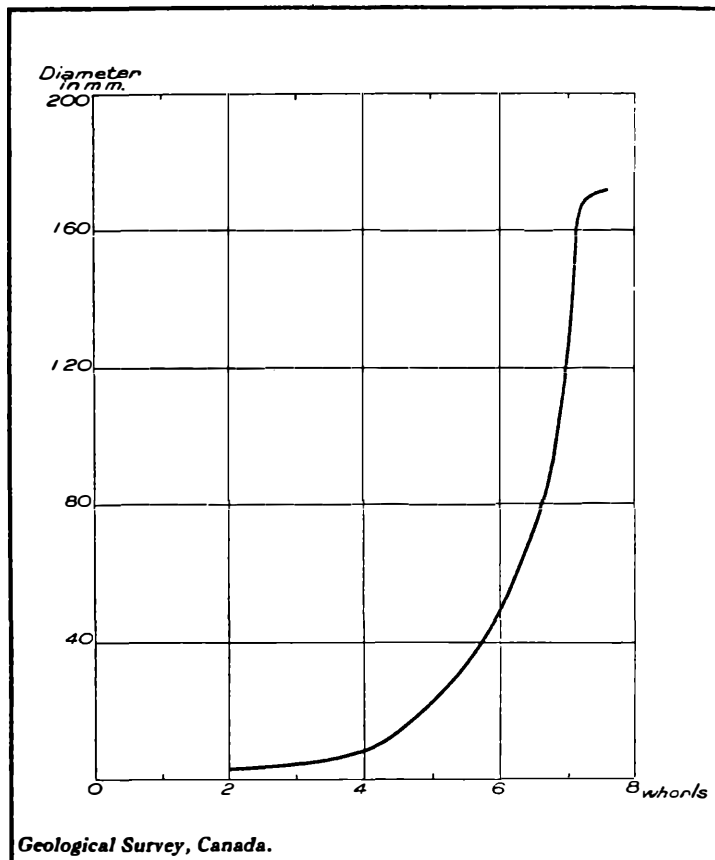


Figure 4. *Anacardioceras perrini* sp. nov.; correlation of diameter and number of whorls.

inclined and rostrate. Conch form, complicated—an oxygastric contracti-ellipti-oxycone. The species differs from the genotype in having the primary rib furcation nearer the umbilicus: about one-third way across the

flank. The ribs are more crowded. Also the persistently acute venter, smoothness, and catagenetic peripheral spiral. The last is not uncommon in various large *Cardioceratoids*.

$$EL = L_2 < L_1$$

Locality. On the west side of the point that bounds on the west the small bay on the southwest shore of the peninsula.

Name. After my teacher, Professor James Perrin Smith.

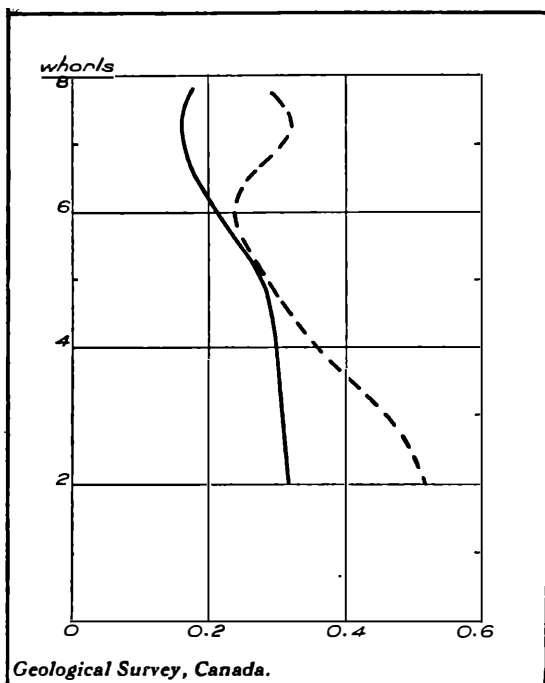


Figure 5. *Anacardioceras perrini* sp. nov.; width of umbilicus (shown by a broken line) and thickness of whorls (by a solid line) of holotype correlated with number of whorls.

Family, MACROCEPHALITIDAE

Genus, *Lilloettia* nov.

The family is represented by two new genera of slightly later date than most of the group and corresponding in age to *Catacephalites*. Both are widespread in deposits of the same age in southern Alaska where they are associated with *Cadoceras* sensu lato.

The young of *Lilloettia* have the ornament and something of the form of *Dolikephalites*, but a smaller umbilicus. The ornament degenerates during late adolescence. Smoothness supervenes first round the umbilicus,

then spreading across the flank it finally extinguishes the ventral ornament. Conch form, a compressed sphaerocone from youth on. Flanks become convergent with maturity. Mouth border, plain, i.e., without lappets, strongly inclined, slightly swollen. A helically twisted umbilical

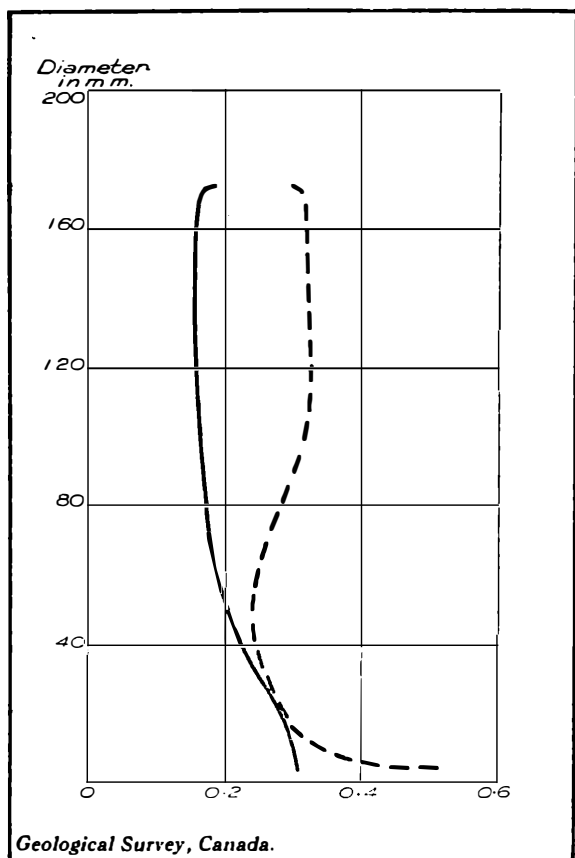


Figure 6. *Anacardioceras perrini* sp. nov.; width of umbilicus (shown by a broken line) and thickness of whorls (by a solid line) of holotype expressed as fractions of the diameter.

columella is present. Differs from other macrocephalitids in its early smoothness and narrow umbilicus. Differs from *Buckmaniceras* in septal line: $L1 > EL$, $L1$ has longer though less divergent branches; and in conch form. Septal line rather simple as late as early maturity. Resembles *Buckmaniceras* in its obtuse ornament.

Lilloettia lilloetensis sp. nov.

Plate XVIII, figures 1-4; Figure 7

Body chamber of holotype seven-eighths whorl.

Table showing number of ribs in a quadrant of whorl at various stages.

Diameter

27 mm.	6 primaries	16 secondaries
55 "	primaries obsolete	17 "
70 "		19 "
85 "	complete smoothness	

Dimensions. See graph under *Buckmaniceras*.

Locality. Zone of *Lilloettia lilloetensis*, on Billhook creek at 3,100 feet altitude.

Name. Of both genus and species Indian geographical name Lillooet.

Lilloettia mertonyarwoodi sp. nov.

Plate XIX, figures 1, 2; Figure 7

Body chamber of holotype slightly more than two-thirds whorl.

Table showing number of ribs in a quadrant of whorl at various stages.

Diameter

55 mm.	8 primaries	25 secondaries
60 "	primaries obsolete	25 "
80 "		33 "
87 "	complete smoothness	

Dimensions. See graph under *Buckmaniceras*.

Locality. Zone of *Lilloettia lilloetensis*, on Billhook creek at 3,100 feet altitude.

Name. After my former teacher, Professor Merton Yarwood Williams.

Genus, *Buckmaniceras* nov.

Robust, rounded, sphaerocones with the ornament of *Lilloettia*, from youth on. Differs from *Lilloettia* in a few important respects, such as a total lack of compression and in septal line. $EL=L_1$, L_1 branches are short.

Buckmaniceras buckmani sp. nov.

Plate XX, figures 1-4; Figure 7

Table showing number of ribs in a quadrant of whorl at various stages.

Diameter

23 mm.	6 primaries	16 secondaries
55 "	primaries obsolete	17 "
90 "	complete smoothness	

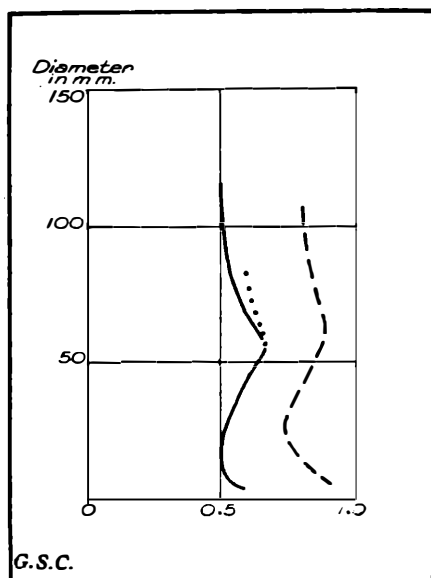


Figure 7. *Lilloettia lilloetensis* sp. nov. shown by a solid line; *L. mertonyarwoodi* sp. nov. by a dotted line; and *Buckmaniceras buckmani* sp. nov. by a broken line; thickness of whorls of holotypes expressed as fractions of the diameter.

Locality. Zone of *Lilloettia lilloetensis*, on Billhook creek at 3,100 feet altitude.

Name. Of genus and species after Mr. S. S. Buckman, the great master of ammonitology.

Family, VIRGATITIDAE

Genus, *Homolsomites* nov.

To be included in this family is the great series of forms of late Jurassic and early Cretaceous showing relationship to the planulates with virgatome ornament typified by *Virgatites*. The genus *Homolsomites* includes platycones with narrow umbilicus and narrow though rounded venter. Costæ, delicate, branching according to various plans, but mostly virgatome, and crossing centre unbroken and with a strong forward bend. In maturity all but the ventral ornament become obsolete. Septum, strongly reclined. Stems of lobes narrower than is usual with this family.

Name. Indian geographical—Homolsom.

Homolsomites poecilochotomus sp. nov.

Plate XXI, figures 1-4

Ornament is striate up to early maturity. It branches according to several plans and combinations thereof, including dichotomous, bidichotomous, and virgatome (3-branch). The plans of branching become more

complex, thereby increasing the number of secondary ribs. After 35 mm. diameter the costæ on the umbilical half of the flank become obsolete, after which the remaining ornamented area narrows so that at 100 mm. only the centre and one-sixth of the flank are costate.

Table showing number of ribs in a quadrant of whorl at various stages.

Diameter

20 mm.	9 primaries	21 secondaries
35 "	8 "	33 "
90 "	primaries obsolete	25 "

Dimensions. Holotype has a maximum diameter of about 105 mm. Thickness at this diameter is 18 mm. Width of umbilicus, 18 mm.

Name. In allusion to the various plans of branching of the costæ.

Locality. Zone of *Homolomites poecilochotomus*, on the southeast shore of the peninsula.

Family, PHYLLOCERATIDÆ

Genus, *Phylloceras* Suess 1865

Phylloceras columbianum sp. nov.

Plate XXII, figures 1, 2, 3

Shell, quite smooth. Septal line with about seven lobes, exclusive of the external lobe. Mouth-border unknown.

Dimensions. Holotype—maximum diameter, 65 mm.; major radius, 40.5; minor radius, 24.5; thickness, 21.5; thickness at minor radius, 16; umbilicus, 4.5 per cent of diameter.

Locality. On the southwest shore of a small point on the southwest side of the small bay on the southwest shore of the peninsula, where it is associated with *Anacardioceras perrini*.

Name. Geographical from British Columbia.

"*Phylloceras*" aff. *knoxvillense* Stanton

Stanton: Bull. 133, U.S. Geol. Surv.

Fragments of a very large form highly similar in ornament and septal line to Stanton's species. It may differ in proportions. Not sufficiently complete for naming or special description.

Locality. Zone of *Aucella canadiana*, 350 yards from shore and 1,400 yards north of the mouth of Deer creek.

"*Phylloceras*" sp. indet.

Fragments of a smooth, latumbilicate "*Phylloceras*", having a complex septal line. Quite distinct from *Phylloceras* s.s., but not sufficiently complete for further description.

Order, **Belemnnoidea**Family, **BELEMNITIDAE**Genus, *Cylindroteuthis* Bayle 1879*Cylindroteuthis themis* sp. nov.

Plate XXIII, figures 1, 2

Rostrum, cylindroid, very blunt pointed. Dorsum and flanks, smooth, rounded. Venter, straight, flattish, bearing a broad, shallow canal which is deepest near the apex and becomes so shallow as to disappear 15 mm. from the apex. Taper, very slight, except in the apical region. Axis, slightly eccentric. Phragmacone, very nearly right conical. Septa, alveolus, and proostracum, not preserved.

Dimensions

Vertical diam., at apex of phragmacone.....	10 mm.
Ventral radius " "	3.5
Lateral diam. " "	10.5
Axis, apex of phragmacone to apex of rostrum.....	40
Apical angle of phragmacone, lateral.....	21 degrees

Locality. Associated with *Entolium vulcanicum*, on the west shore of Harrison lake, 1,820 yards north of Harrison River point.

Name. Themis, of Greek mythology.

Cylindroteuthis baculus sp. nov.

Plate XXIII, figures 3, 4

Rostrum, very long, almost perfectly cylindrical through most of its length. Resembling "*Belemnites*" *tehamaensis* Stanton and certain Russian species of similar date, such as "*Belemnites*" *obeliscoides* Pavlow and Lamplugh, but differs from some of these in its very gentle taper, from others in its almost perfectly circular cross-section. The holotype has a nearly right conical phragmacone, containing thirty-three chambers and occupying two-fifths of the length of the alveolus. The alveolus is slightly more than one-fifth the entire length of the rostrum.

Dimensions

Vertical diam. at apex of phragmacone.....	14 mm.
Ventral radius " "	6.5
Lateral diam. " "	15
Axis, from apex of phragmacone to apex of rostrum, from a composite specimen.....	230
Phragmacone, length.....	20
Alveolus, length.....	50
Apical angle of phragmacone.....	15 degrees

Locality. Zone of *Aucella canadiana*, 350 yards from shore and 1,400 yards north of the mouth of Deer creek.

Name. In allusion to external form.

Genus, *Pachyteuthis* Bayle 1879

Pachyteuthis eocretacicus sp. nov.

Plate XXII, figure 4; Plate XXIII, figure 5

Rostrum, very short and thick, resembling the Russian species, "*Belemnites*" *subquadratus* Pavlow and Lamplugh, but differing slightly though distinctly in outlines and cross-section. Surface, perfectly smooth. The type specimens are moulds.

Dimensions

Vertical diam. at apex of phragmacone.....	31	mm.
Ventral radius " "	15	
Lateral diam. " "	31	
Alveolus, length.....	65	
Axis, apex of phragmacone to apex of rostrum.....	59	
Apical angle of phragmacone.....	21	degrees

Locality. Zone of *Aucella canadiana*, 350 yards from shore and 1,400 yards north of the mouth of Deer creek.

Name. In allusion to the date of existence of the species—the dawn of the Cretaceous.

Phylum, ARTHROPODA

Class, CRUSTACEA

Order, Cirripedia

Family, BALANIDAE

Genus, *Balanus* da Costa

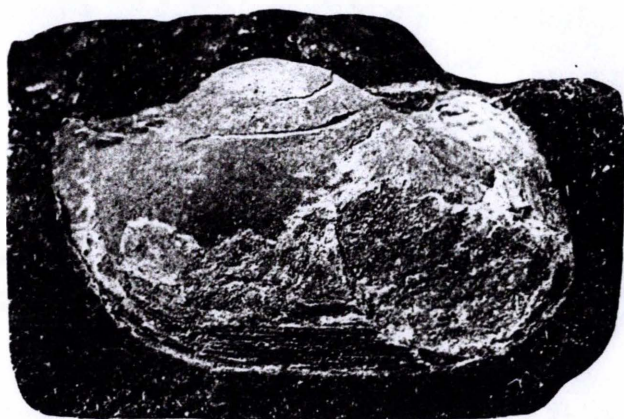
Balanus crenatus Bruguière

Several well-preserved fragments of this species. This may well be the form referred to by Lamplugh as "*Balanus* sp."

Locality. Main line of Canadian Pacific railway 838 yards west of the west end of the Harrison River bridge.

PLATE VIII

- Figure 1. *Parallelodon cardioceratanum* Crickmay sp. nov., holotype, X 3·28. Locality No. 24, Upper Jurassic. (Page 45.)
- Figure 2. *Parallelodon cardioceratanum* Crickmay sp. nov., ink-print of the teeth of the holotype (gelatine process), X 3·6. The black areas correspond to the sockets of the right valve. (Page 45.)
- Figure 3. *Parallelodon cardioceratanum* Crickmay sp. nov., holotype about natural size. A left valve. (Page 45.)
- Figure 4. *Mclearnia mclearnii* Crickmay sp. nov., holotype, about natural size. A right valve showing byssal sinus, small central chondrophore, and single, large muscle-scar. Locality No. 34. Lower Cretaceous. (Page 45.)



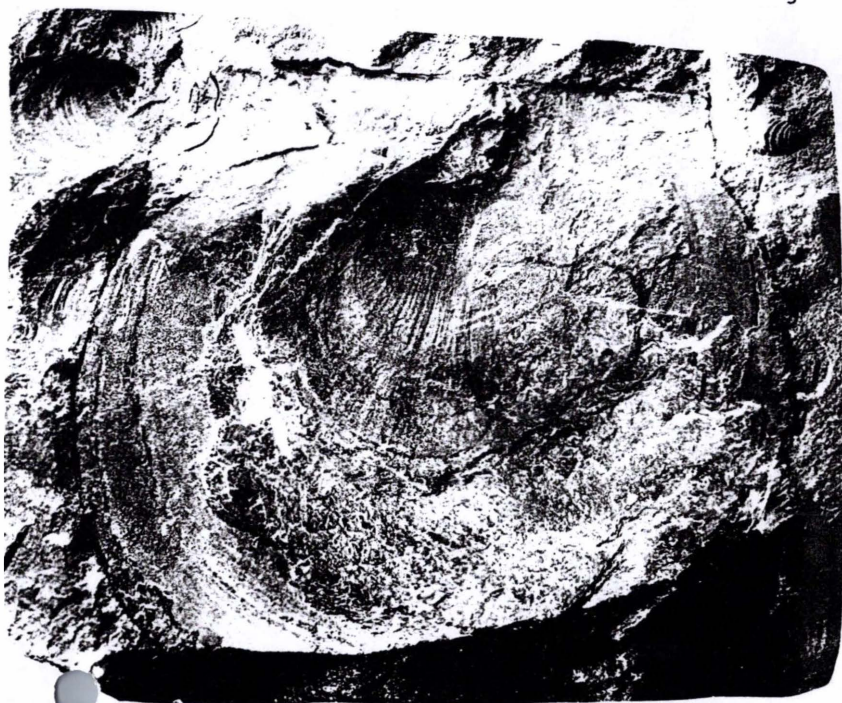
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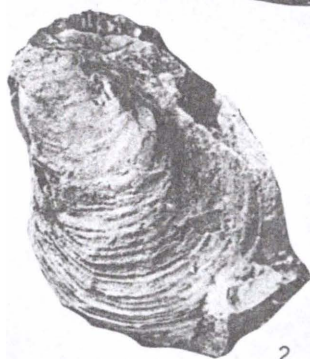
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PLATE IX

- Figure 1. *Mclearnia mclearnii* Crickmay sp. nov., paratype, about natural size. A left valve, natural cast of interior of shell. Shows a peculiar sinuous series of small muscle scars quite separate and distinct from the large adductor scar. Locality No. 34. Lower Cretaceous. (Page 45.)
- Figure 2. *Aucella acutistriata* Crickmay sp. nov., holotype, about natural size. A left valve. Locality No. 33. Lower Cretaceous. (Page 46.)
- Figure 3. *Aucella spasskenoides* Crickmay sp. nov., holotype, about natural size. A right valve. Locality No. 28. Lower Cretaceous. (Page 47.)
- Figure 4. *Aucella spasskenoides* Crickmay sp. nov., paratype, about natural size. A left valve. Locality No. 28. Lower Cretaceous. (Page 47.)
- Figure 5. *Aucella catamorpha* Crickmay sp. nov., holotype, about natural size. A right valve. Locality No. 28. Lower Cretaceous. (Page 46.)



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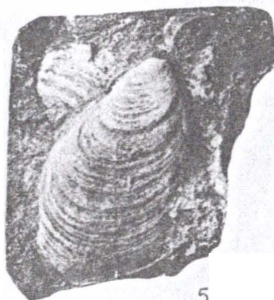
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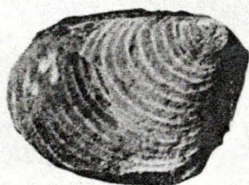
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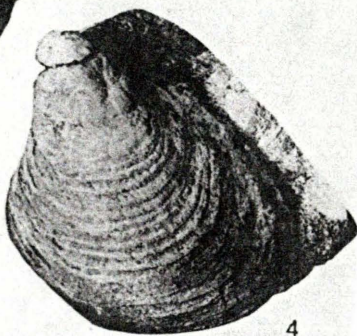
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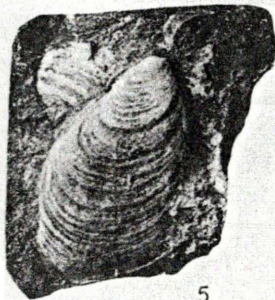
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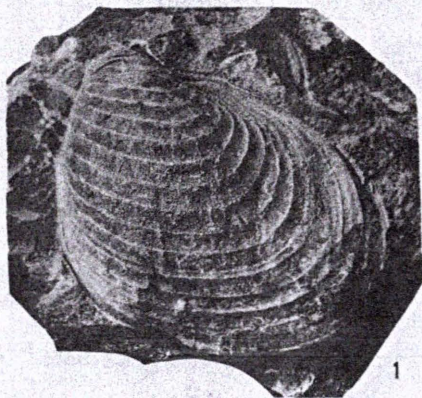
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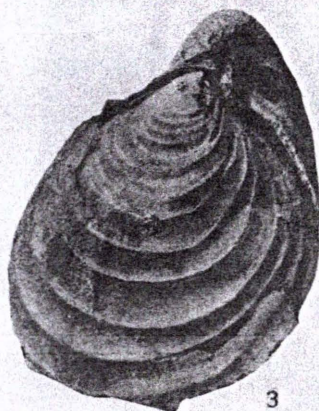
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PLATE X

- Figure 1. *Aucella cascadiensis* Crickmay sp. nov., holotype, about natural size. A left valve. Locality No. 33. Lower Cretaceous. (Page 47.)
- Figure 2. *Aucella cascadiensis* Crickmay sp. nov., paratype, about natural size. A right valve. Locality No. 33. Lower Cretaceous. (Page 47.)
- Figure 3. *Aucella canadiana* Crickmay sp. nov., paratype, about natural size. Two valves in contact. Right aspect. Locality No. 33. Lower Cretaceous. (Page 47.)
- Figure 4. *Aucella canadiana* Crickmay sp. nov., holotype, about natural size. A left valve. Locality No. 33. Lower Cretaceous. (Page 47.)
- Figure 5. *Aucella canadiana* Crickmay sp. nov., holotype, anterior aspect. (Page 47.)
- Figure 6. *Aucella kvoickensis* Crickmay sp. nov., wax cast of holotype. (Holotype consists of natural cast of interior of shell, and a small impression of part of the external surface.) A right valve. Locality No. 39. Lower Cretaceous. (Page 48.)
- Figure 7. *Aucella kvoickensis* Crickmay sp. nov. Anterior aspect of the specimen of figure 6. (Page 48.)



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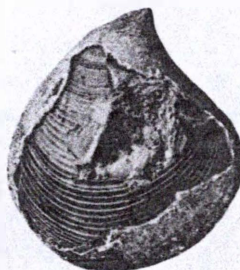
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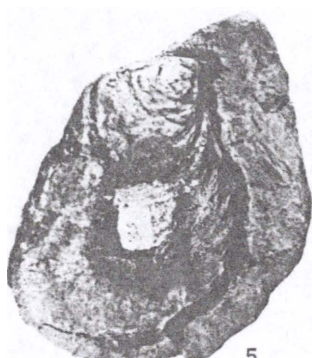
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PLATE XI

- Figure 1. *Aucella harrisonensis* Crickmay sp. nov., paratype, X 1·8. Anterior aspect of left valve. Locality No. 41. Lower Cretaceous. (Page 48.)
- Figure 2. *Aucella harrisonensis* Crickmay sp. nov., paratype, X 1·8. Left valve. Locality No. 41. Lower Cretaceous. (Page 48.)
- Figure 3. *Aucella harrisonensis* Crickmay sp. nov., holotype, X 1·5. Right valve, anterior aspect. Locality No. 41. Lower Cretaceous. (Page 48.)
- Figure 4. *Aucella gigas* Crickmay sp. nov., holotype, X ·53. Two valves in contact, left aspect. Locality No. 41. Lower Cretaceous. (Page 49.)
- Figure 5. *Aucella gigas* Crickmay sp. nov., holotype, X ·53. Right aspect. (Page 49.)
- Figure 6. *Aucella gigas* Crickmay sp. nov., holotype, X ·49. Anterior aspect. (Page 49.)



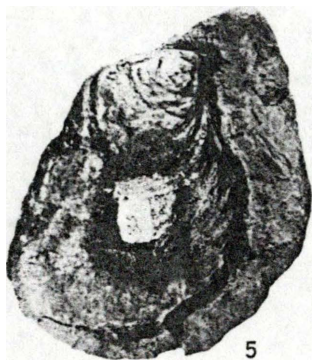
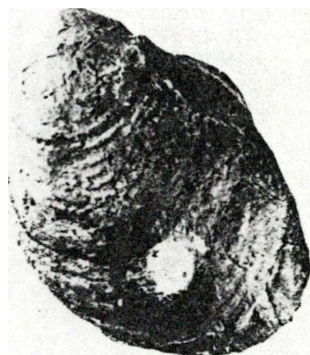
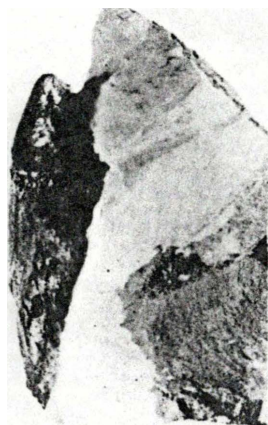
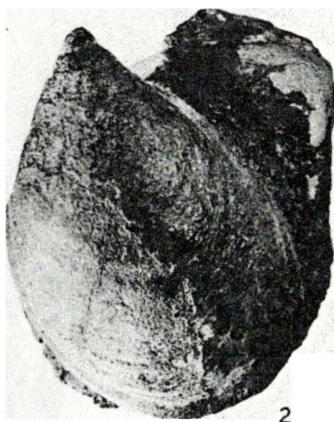
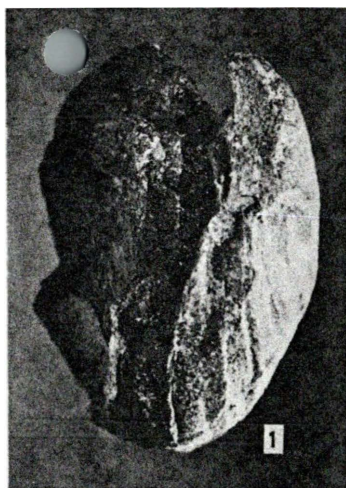


PLATE XII

- Figure 1. *Haidaia billhookensis* Crickmay sp. nov., plaster cast of holotype, an external mould of the left valve. Anterior and dorsal outline, partly restored. Locality No. 21. Upper Jurassic. (Page 49.)
- Figure 2. *Haidaia packardi* Crickmay sp. nov., plaster cast of holotype, part of which is an external mould of the right valve, .73 of natural size. Locality No. 21. Upper Jurassic. (Page 50.)
- Figure 3. *Haidaia packardi* Crickmay sp. nov., internal natural cast of holotype, with some shell attached, .73 of natural size. Locality No. 21. Upper Jurassic. (Page 50.)
- Figure 4. *Haidaia statluensis* Crickmay sp. nov., plaster cast of holotype, an external mould of two valves in contact, left aspect, .73 of natural size. Shows outline and conch contour well, but gives poor idea of ornament. Locality No. 22. Upper Jurassic. (Page 50.)
- Figure 5. *Haidaia statluensis* Crickmay sp. nov., wax cast of first paratype, .73 of natural size, to show ornament. Locality No. 22. Upper Jurassic. (Page 50.)
- Figure 6. *Haidaia statluensis* Crickmay sp. nov., wax cast of second paratype. (Page 50.)

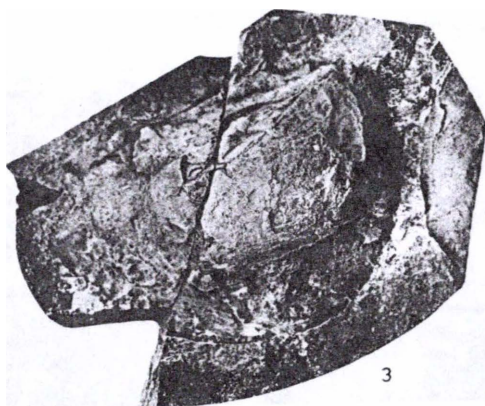
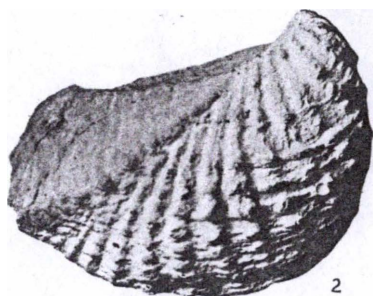
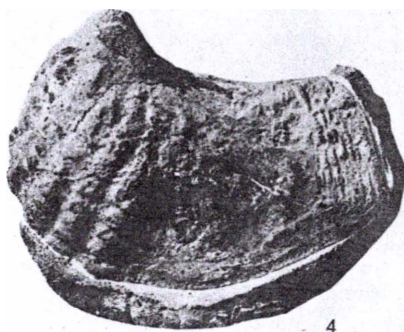
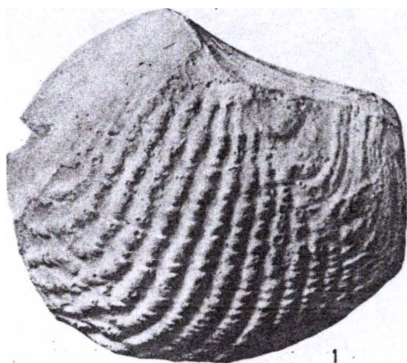
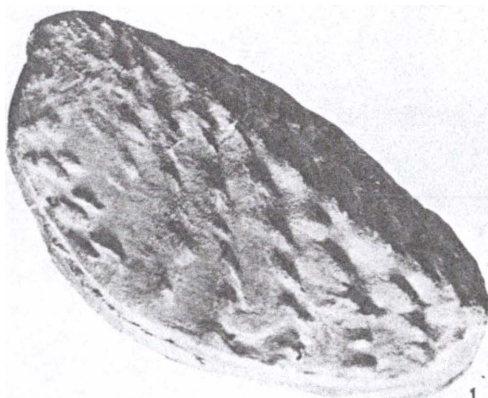
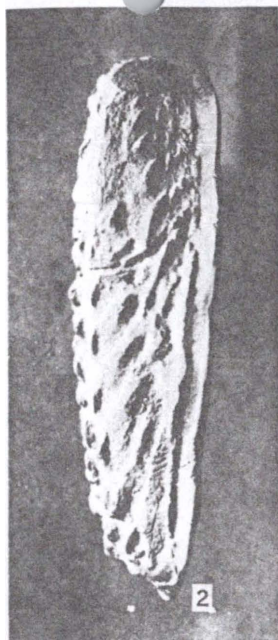


PLATE XIII

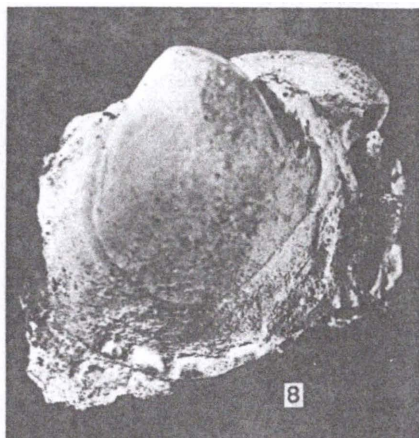
- Figure 1. *Yaadia lewisagassizi* Crickmay sp. nov., wax cast of holotype, an external mould of left valve, .87 of natural size. Locality No. 39. Lower Cretaceous. (Page 50.)
- Figure 2. *Yaadia lewisagassizi* Crickmay sp. nov., wax cast of holotype, .87 of natural size, postero-dorsal aspect. Shows ornament of area and escutcheon. (Page 50.)
- Figure 3. *Quoieccchia aliciae* Crickmay sp. nov., holotype, .87 of natural size, posterior aspect. Locality No. 39. Lower Cretaceous. (Page 51.)
- Figure 4. *Quoieccchia aliciae* Crickmay sp. nov., holotype, a right valve, .87 of natural size. (Page 51.)
- Figure 5. *Quoieccchia aliciae* Crickmay sp. nov., holotype, anterior aspect. (Page 51.)
- Figure 6. *Quoieccchia aliciae* Crickmay sp. nov., paratype. Juvenile, right valve. Locality No. 39. Lower Cretaceous. (Page 51.)
- Figure 7. *Quoieccchia aliciae* Crickmay sp. nov., paratype, same specimen as figure 6, dorsal aspect, .87 of natural size. (Page 51.)
- Figure 8. *Quoieccchia aliciae* Crickmay sp. nov., paratype, internal mould of right valve, X 1.9. Shows crenulation of ventral margin. Locality No. 39. Lower Cretaceous. (Page 51.)



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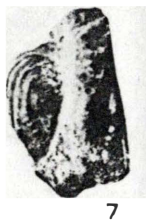
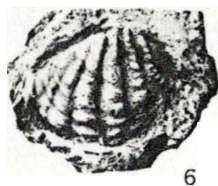
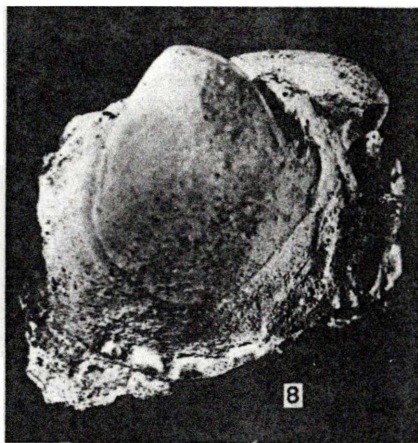
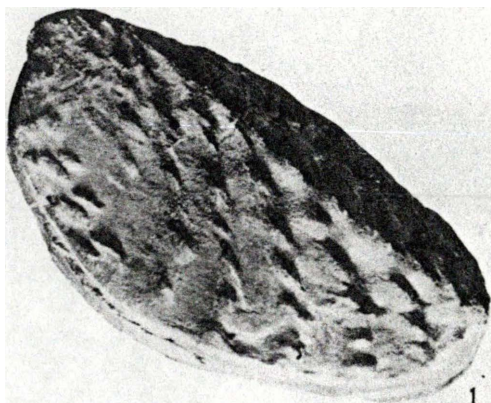
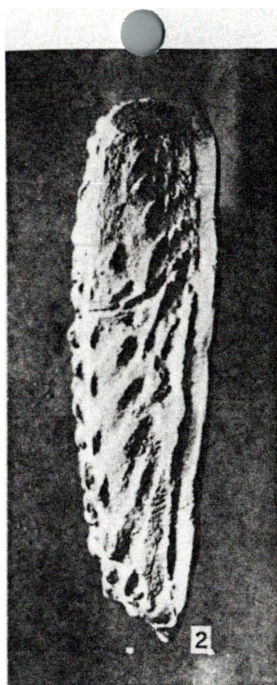
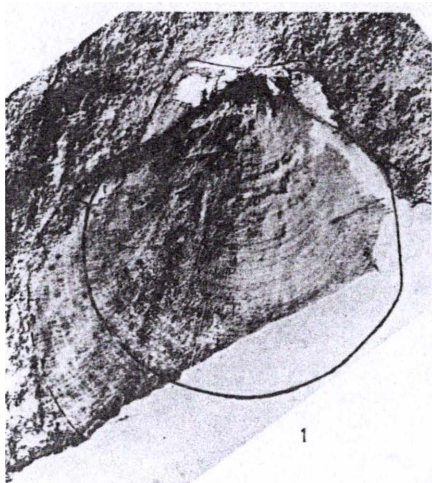


PLATE XIV

- Figure 1. *Entolium hertleini* Crickmay sp. nov., holotype, a right valve, external aspect, X 3·19. Shows the microscopic ornament. Dark line shows curve of concentric striae. Locality No. 13. Upper Jurassic. (Page 52.)
- Figure 2. *Entolium vulcanicum* Crickmay sp. nov., holotype, an internal mould of left valve, X ·66. Locality No. 3. Middle Jurassic. (Page 52.)
- Figure 3. *Entolium aucellarum* Crickmay sp. nov., holotype, an external mould of right valve, $\frac{1}{8}$ natural size. Locality No. 28. Lower Cretaceous. (Page 52.)
- Figure 4. *Anomia columbiana* Crickmay sp. nov., holotype, external aspect, $\frac{1}{8}$ natural size. Locality No. 15. Upper Jurassic. (Page 53.)
- Figure 5. *Anomia columbiana* Crickmay sp. nov., holotype, X 1·9. (Page 53.)
- Figure 6. *Anomia columbiana* Crickmay sp. nov., paratype, external mould with some shell attached. Locality No. 15. Upper Jurassic. (Page 53.)



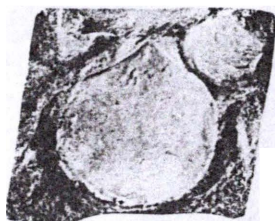
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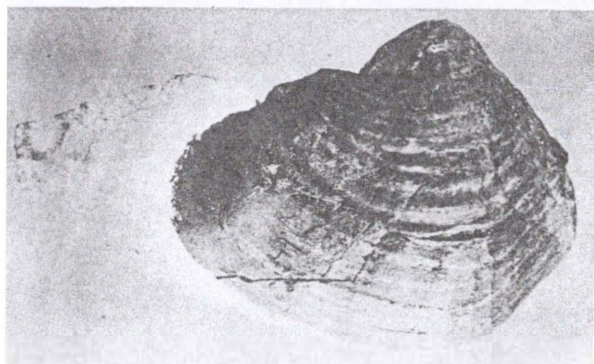
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PLATE XV

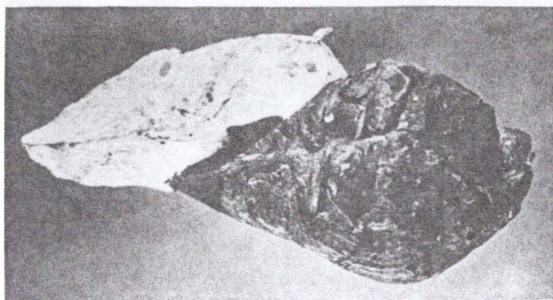
- Figure 1. *Pleuromya harrisonensis* Crickmay sp. nov., holotype, two valves together, right aspect, X 1·3. Locality No. 41. Lower Cretaceous. (Page 53.)
- Figure 2. *Pleuromya harrisonensis* Crickmay sp. nov., holotype, dorsal aspect, X 1·18. (Page 53.)
- Figure 3. *Pleuromya harrisonensis* Crickmay sp. nov., holotype, anterior aspect, $\frac{7}{16}$ natural size. (Page 53.)
- Figure 4. *Astarte harrisonensis* Crickmay sp. nov., artificial cast in clay of part of holotype, mould of two valves in contact, X 1·5. Left aspect, showing ornament. Locality No. 19. Upper Jurassic. (Page 54.)
- Figure 5. *Astarte harrisonensis* Crickmay sp. nov., artificial cast of holotype, X 1·5. Left aspect, showing outline, etc. (Page 54.)
- Figure 6. *Astarte barbara* Crickmay sp. nov., holotype, a left valve with shell mostly decorticated, $\frac{7}{16}$ natural size. Locality No. 34. Lower Cretaceous. (Page 54.)



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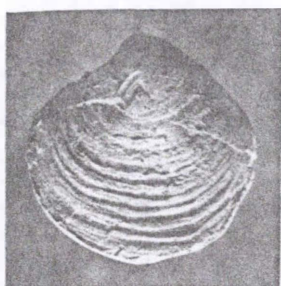
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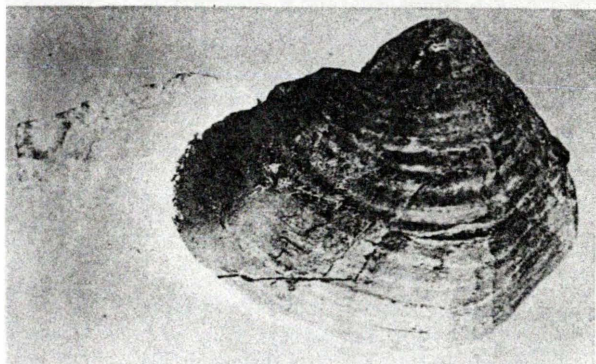
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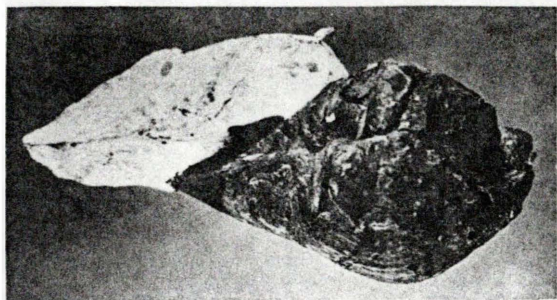
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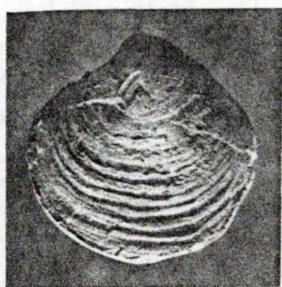
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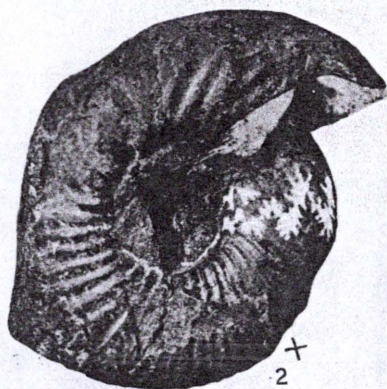
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PLATE XVI

- Figure 1. *Paracadoceras harveyi* Crickmay sp. nov., holotype, about natural size. Anterior aspect, showing mouth-border, which is somewhat distorted, and ventral portion of septal lines. Locality No. 12. Upper Jurassic. (Page 55.)
- Figure 2. *Paracadoceras harveyi* Crickmay sp. nov., holotype. Lateral aspect. Shows living chamber, $\frac{3}{4}$ whorl. (Page 55.)
- Figure 3. *Cadoceras brooksi* Crickmay sp. nov., holotype, about natural size. Ventrolateral aspect. Locality No. 12. Upper Jurassic. (Page 57.)
- Figure 4. *Cadoceras brooksi* Crickmay sp. nov., holotype, about natural size. Lateral aspect. (Page 57.)
- Figure 5. *Cadoceras brooksi* Crickmay sp. nov., holotype, with some of the missing parts restored in clay, X 1·6. (Page 57.)



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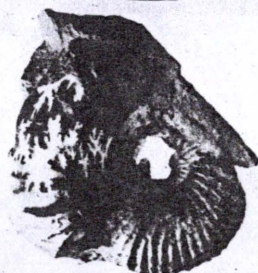


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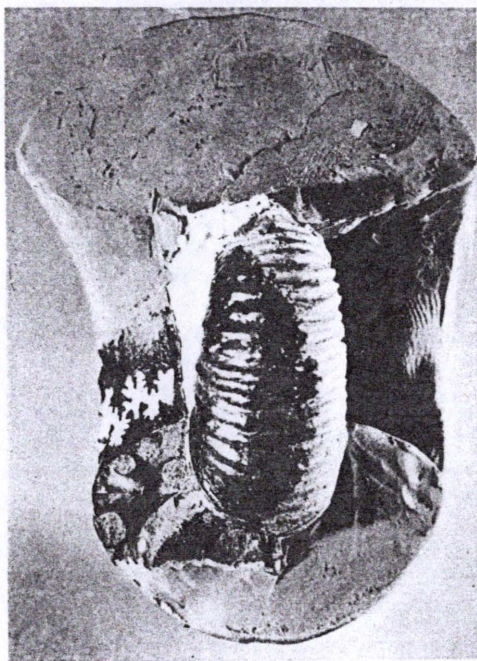
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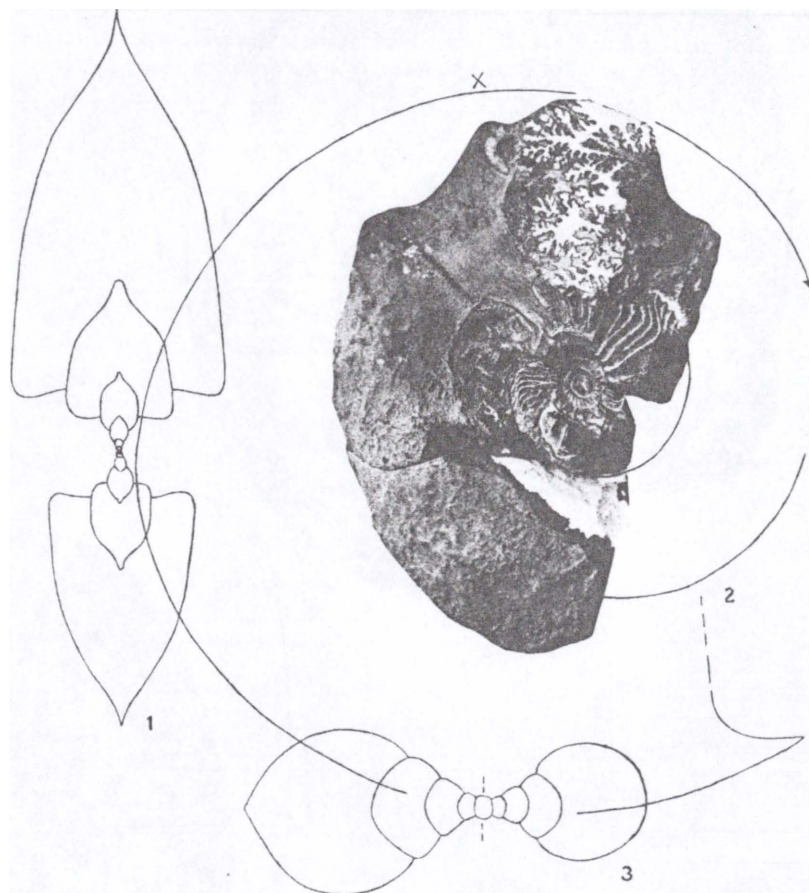
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PLATE XVII

- Figure 1. *Anacardioceras perrini* Crickmay sp. nov., cross-sectional outlines of holotype, taken at 90 degrees behind the mouth border, $\frac{1}{16}$ natural size. From external mould of holotype. (Page 58.)
- Figure 2. *Anacardioceras perrini* Crickmay sp. nov., holotype, lateral aspect, $\frac{1}{16}$ natural size. The reconstructed peripheral curve and mouth-border were obtained from part of the holotype not included in the photograph, namely an external mould of the full-grown shell. At 5 and 5½ whorls the ribbing and venter are well shown. At 6½ whorls a small fragment shows the ornament of the umbilical border. The entire specimen consists of 7½ whorls. Locality No. 24. Upper Jurassic. (Page 58.)
- Figure 3. *Anacardioceras perrini* Crickmay sp. nov., paratype, X 5.2 cross-sectional outlines at 3½ whorls. Protoconch is marked by a line of dashes which represents the central axis of the shell. Shows elevation of whorl between 2½ and 3½ whorls, and appearance of fastigate venter between 3½ and 3¾. Locality No. 24. Upper Jurassic. (Page 58.)



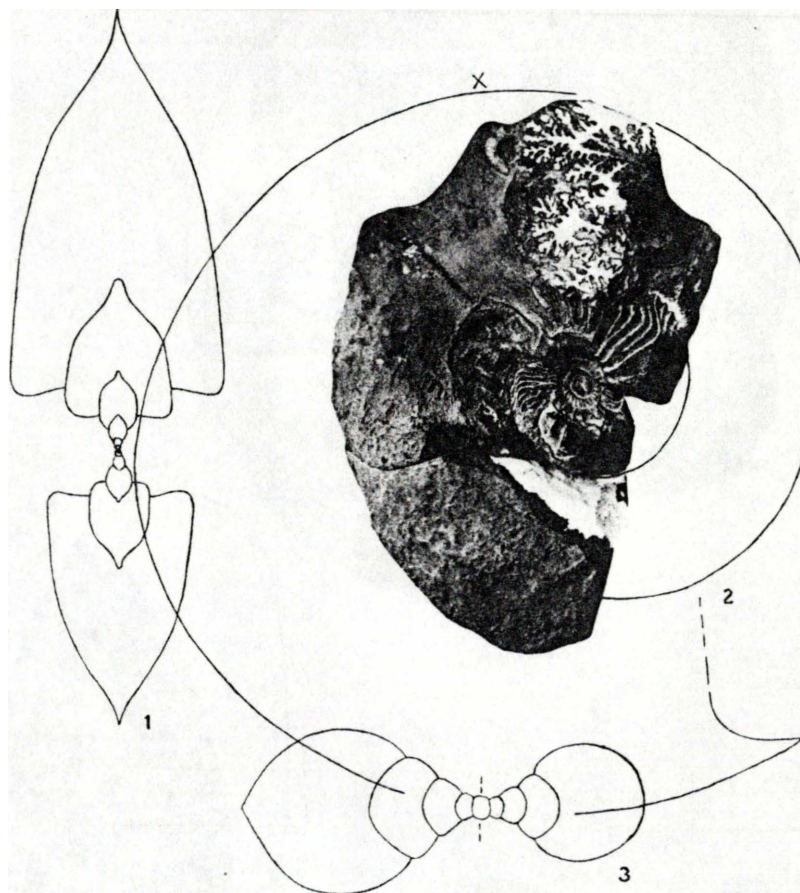


PLATE XVIII

- Figure 1. *Lilloettia lilloetensis* Crickmay sp. nov., holotype, genotype, apertural aspect, about natural size. Last whorl slightly distorted by diastrophic forces. Mouth border outlined in black. Lost parts of shell partly restored in outline from measurements of the rest of the shell. Locality No. 15. Upper Jurassic. (Page 62.)
- Figure 2. *Lilloettia lilloetensis* Crickmay sp. nov., holotype, genotype, lateral aspect, about natural size. Mouth border outlined in black. Periphery partly restored in outline by proportional method (*vide* Crickmay: Am. Jour. Sci., 5th ser., XIII, 1927). (Page 62.)
- Figure 3. *Lilloettia lilloetensis* Crickmay sp. nov., holotype, about natural size, lateral aspect. Shows ornament of fifth whorl. (Page 62.)
- Figure 4. *Lilloettia lilloetensis* Crickmay sp. nov., holotype, peripheral aspect, about natural size. Same specimen as shown in figure 3—the internal whorls of the holotype. (Page 62.)

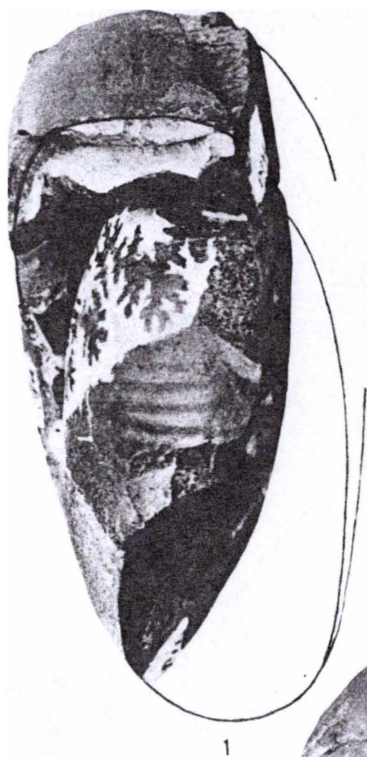
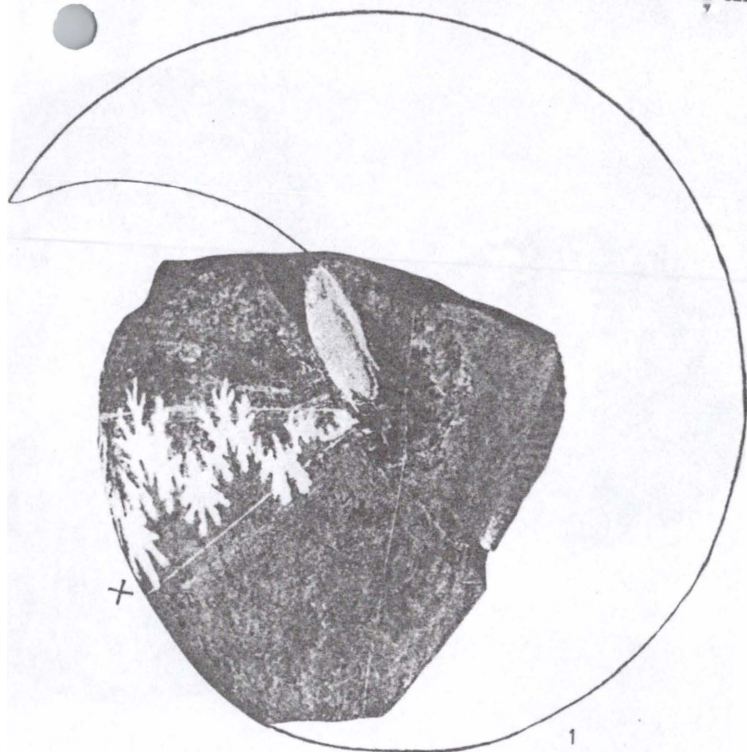


PLATE XIX

- Figure 1. *Lilloettia mertonyarwoodi* Crickmay sp. nov., holotype, lateral aspect, $\frac{1}{2}$ natural size. Mouth border restored in outline from about one-third of it preserved and by the analogy of the other species of this genus. Periphery restored purely on basis of proportional method. This is unreliable when used for extrapolation, especially on the ultimate whorl of ammonites. So this outline is intended only to complete the picture and so elucidate the interpretation of the specimen. Ornament is seen 1 and $1\frac{1}{2}$ whorls behind mouth border. Locality No. 15. Upper Jurassic. (Page 62.)
- Figure 2. *Lilloettia mertonyarwoodi* Crickmay sp. nov., holotype, peripheral aspect, $\frac{1}{2}$ natural size. (Page 62.)



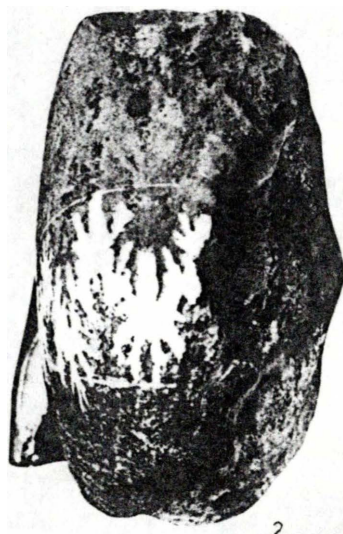
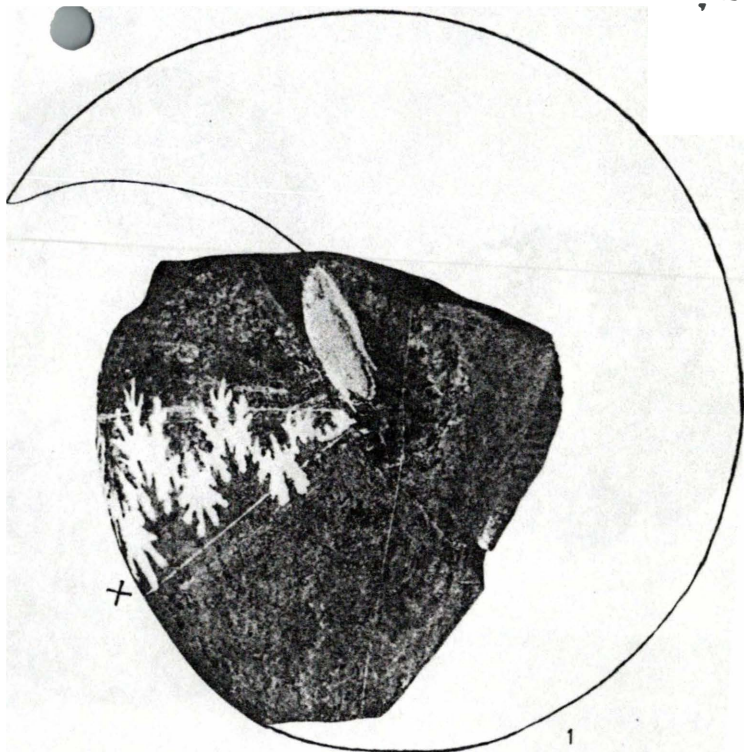


PLATE XX

- Figure 1. *Buckmaniceras buckmani* Crickmay sp. nov., holotype, lateral aspect, about natural size. Small black line shows position of emergence of penultimate whorl. Mouth border not preserved. Dotted lines show the great thickness of shell substance around the umbilicus. Locality No. 15. Upper Jurassic. (Page 62.)
- Figure 2. *Buckmaniceras buckmani* Crickmay sp. nov., holotype, peripheral aspect, about natural size. This, as well as figure 1, shows the disappearance of ornament on the last whorl. (Page 62.)
- Figure 3. *Buckmaniceras buckmani* Crickmay sp. nov., holotype, last quadrant of penultimate whorl, lateral aspect, about natural size. (Page 62.)
- Figure 4. *Buckmaniceras buckmani* Crickmay sp. nov., holotype, last quadrant of penultimate whorl, ventro-lateral aspect, about natural size. (Page 62.)

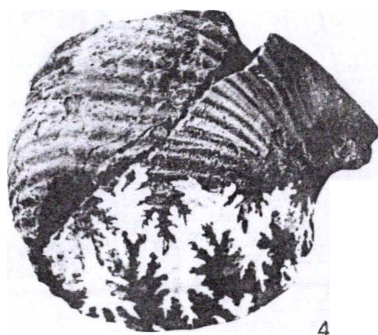
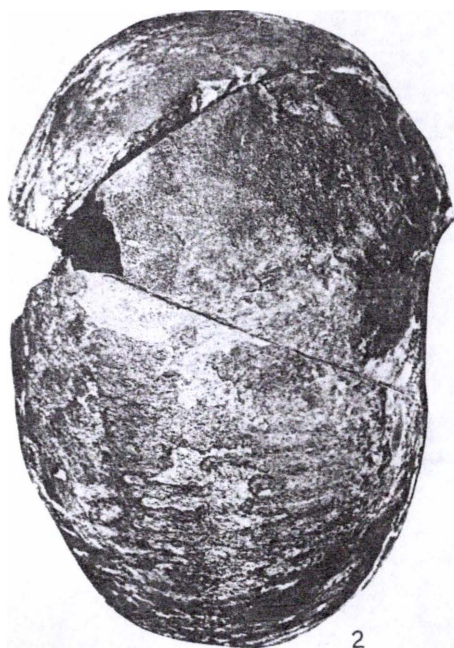
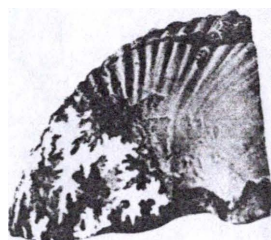
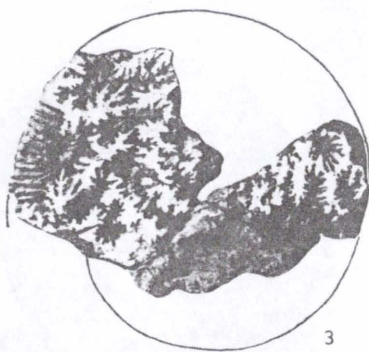
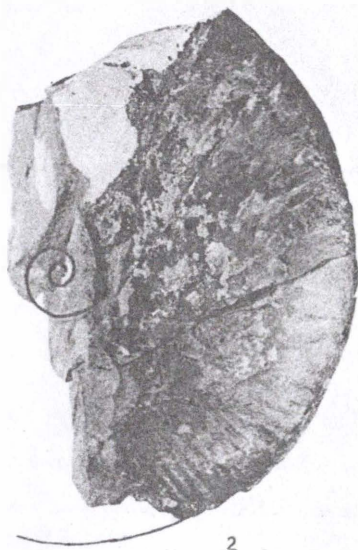
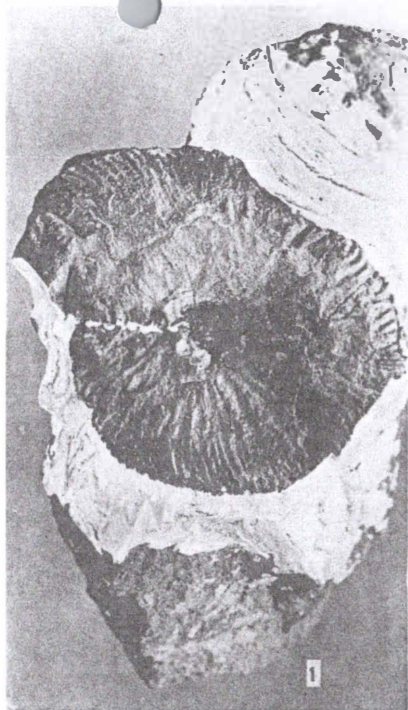


PLATE XXI

- Figure 1. *Homolsomites poecilochotomus* Crickmay sp. nov., paratype, X 1·5. Locality No. 41. Lower Cretaceous. (Page 63.)
- Figure 2. *Homolsomites poecilochotomus* Crickmay sp. nov., holotype, ·77 of natural size. Restoration of spiral by proportion. Locality No. 41. Lower Cretaceous. (Page 63.)
- Figure 3. *Homolsomites poecilochotomus* Crickmay sp. nov., paratype, ·77 of natural size. Locality No. 41. Lower Cretaceous. (Page 63.)
- Figure 4. *Homolsomites poecilochotomus* Crickmay sp. nov., paratype, X 3·08. Two primary ribs are outlined with their secondaries. They show two styles of furcation common with this species, the bidichotomous and the virgatome. Locality No. 41. Lower Cretaceous. (Page 63.)



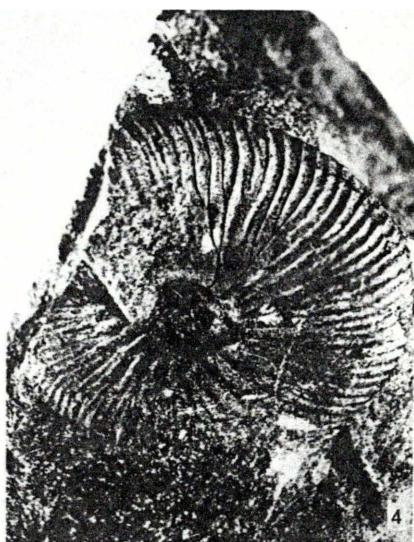
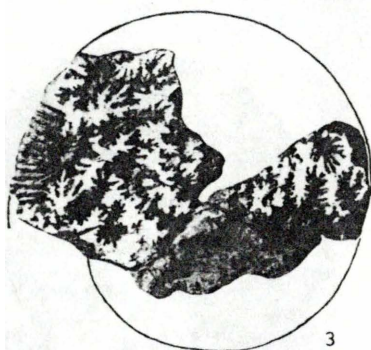
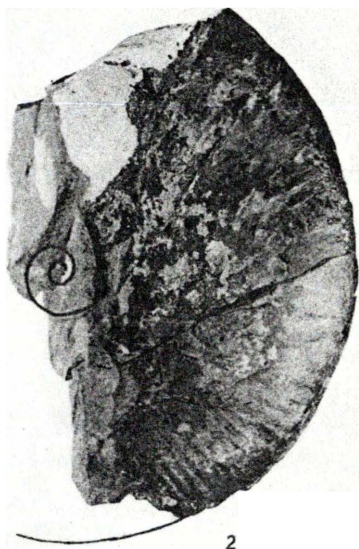
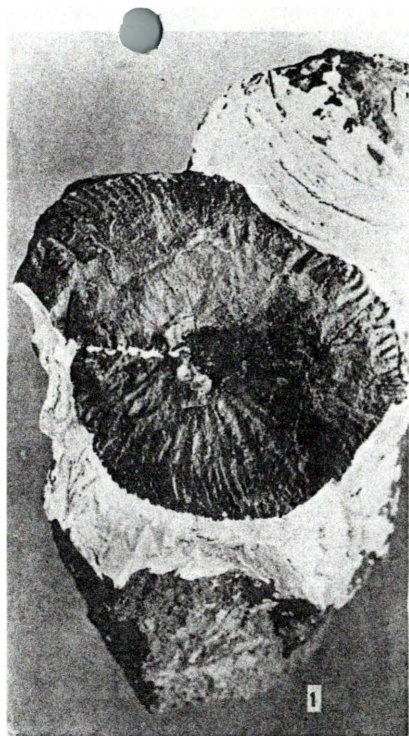


PLATE XXII

- Figure 1. *Phylloceras columbianum* Crickmay sp. nov., holotype, natural size. A young specimen, and several impressions of *Anacardioceras perrini* are to be seen on this specimen. Locality No. 24. Upper Jurassic. (Pages 58, 64.)
- Figure 2. *Phylloceras columbianum* Crickmay sp. nov., holotype. (Page 64.)
- Figure 3. *Phylloceras columbianum* Crickmay sp. nov., holotype. (Page 64.)
- Figure 4. *Pachyteuthis eocretacicus* Crickmay sp. nov., cross-sectional outline of paratype, natural size. Locality No. 34. Lower Cretaceous. (Page 66.)

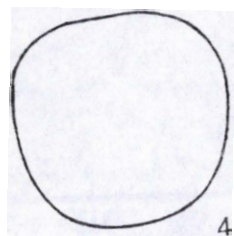
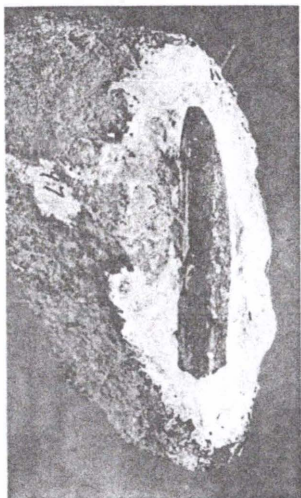


PLATE XXIII

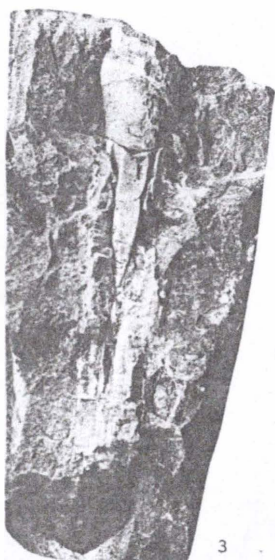
- Figure 1. *Cylindroteuthis themis* Crickmay sp. nov., holotype, lateral aspect, .66 of natural size. Locality No. 3. Middle Jurassic. (Page 65.)
- Figure 2. *Cylindroteuthis themis* Crickmay sp. nov., holotype, ventral aspect, .66 of natural size. (Page 65.)
- Figure 3. *Cylindroteuthis baculus* Crickmay sp. nov., holotype, lateral aspect, .66 of natural size. Locality No. 34. Lower Cretaceous. (Page 65.)
- Figure 4. *Cylindroteuthis baculus* Crickmay sp. nov., outlines restored from the holotype and several paratypes, .66 of natural size. (Page 65.)
- Figure 5. *Pachyleuthis eocretacicus* Crickmay sp. nov., holotype, an external mould, lateral view, X .44. Locality No. 34. Lower Cretaceous. (Page 66.)



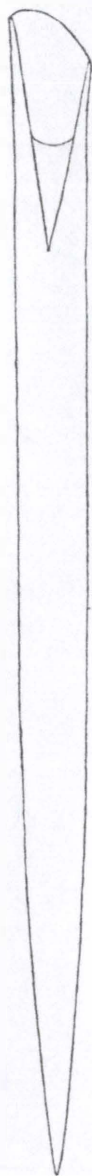
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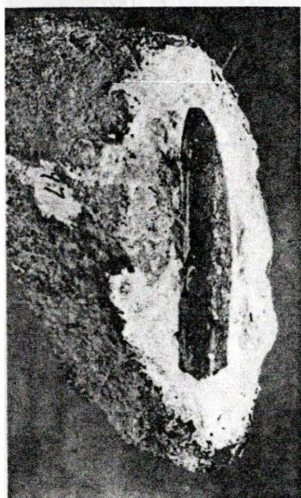
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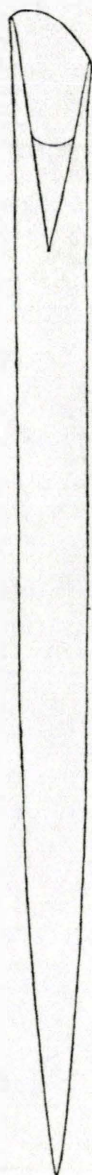
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