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FAUNA FROM THE EOCENE OF WASHINGTON

by
CHARLES E. WEAVER
and
KATHERINE VAN WINKLE PALMER

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CONTENTS

INTRODUCTION

The purpose of this paper is to place on record the description and illustration of new fossil molluscan species from the Eocene formations of western Washington. For several years the writers have been engaged in an investigation of the Washington Eocene, the results of which are to be published in a stratigraphical and faunal history of the Eocene of the Northwest. Extensive collections were made from the Eocene formations of Washington as well as those of Oregon. These were in every case, where possible, tied into stratigraphic sections. A preliminary study of the faunas was made in the paleontological laboratory of the University of California. Later the material was divided into duplicate collections, one of which was retained by the senior writer for study in the paleontological laboratory of the University of Washington and the other by the junior author at Cornell University. Accordingly there has been opportunity for study and comparison with the marine Eocene of California as well as with that of the Atlantic and Gulf. Of the new species recognized as a result of these investigations, sixty-four are described in this report. A list of faunal localities in western Washington has been included. This list is a continuation of the series as published in volume 1, number 1, of the University of Washington Publications in Geology.

FAUNAL LOCALITIES IN WESTERN WASHINGTON

315

At dam just below the railroad bridge on the west bank of Olequah Creek about one third of a mile below the junction with Stillwater Creek, near Vader, Lewis County Opposite 316. Section 32, Township 11 North, Range 2 West. Eocene.

316

At dam just below the railroad bridge on east bank of Olequah Creek about one-thir of a mile below the junction with Stillwater Creek near Vader, Lewis County, Section 3 Township 11 North, Range 2 West. Eocene. Old locality 240.

317

On the south bank of Stillwater Creek at its junction with Olequah Creek, nea Vader, Lewis County, Section 32, Township 11 North, Range 2 West. Eocene. Old locality

318

On the north bank of Stillwater Creek at its junction with Olequah Creek, opposit 317, near Vader, Lewis County, Section 32, Township 11 North, Range 2 West. Eocene

319

At McClarety ranch on the south bank of Stillwater Creek one mile west of Vade Lewis County, Section 30, Township 11 North, Range 2 West. Eocene. Old locality 29

320

On the south bank of Stillwater Creek below the graveyard about one and one-fourt miles from Vader, Lewis County, Section 30, Township 11 North, Range 2 West. Eocene

321

On Booth ranch two and one-fourth miles up Stillwater Creek from its junction wit Olequah Creek, near Vader, Lewis County, Section 25, Township 11 North, Range 3 Wes Eocene. Old Locality 296.

322

On small creek about one-third of a mile from its junction with Brinn Creek, unde an old bridge, Lewis County, Section 24, Township 11 North, Range 2 West. Eocene. Ol locality 3.

323

In bed of small creek entering Olequah Creek on the east, opposite locality 32 Section 29, Township 11 North, Range 2 West. Eocene. Old locality 297.

324

In west bank of Olequah Creek about one-eighth of a mile north of Vader statior Lewis County, Section 29, Township 11 North, Range 2 West. Eocene. Old locality 29

325

On Olequah Creek one-fourth of a mile above Vader station in the east bank o creek, just north of point where the small creek enters Olequah Creek on the east, Sectio 29, Township 11 North, Range 2 West. Eocene. Old locality 237.

326

Bluff on west bank of Olequah Creek about 500 feet below the little falls, back o Armstrong place about one-half mile north of Vader, Lewis County, Section 29, Town ship 11 North, Range 2 West. Eocene. Old locality 231.

327

East bank of Olequah Creek back of Cantwell place about one mile north of Vade Lewis County, Section 20, Township 11 North, Range 2 West. Eocene. Old locality 30

328

East bank of Olequah Creek about one and one-half miles north of Vader where creek runs near railroad track. Seam of brackish water fossils. Section 20, Township 11 North, Range 2 West. Eocene. Old locality 295.

329

West bank of Cowlitz River at bend and extending several hundred feet below near Vader, Lewis County, Section 28, Township 11 North, Range 2 West. Eocene. Old locality 233.

330

On east bank of Cowlitz River, about one mile above the ferry on Greece's ranch, four miles east of Vader, Lewis County, Section 25, Township 11 North, Range 2 West. Eocene or Oligocene. Old locality 239.

331

In railroad bluff about one and one-half miles south of Vader, Lewis County, about 700 feet below railroad post No. 79, Section 4, Township 11 North, Range 2 West. Eocene. Old locality 299.

332

Bluffs along Stillwater Creek about one-half mile above the junction of Olequah and Stillwater creeks, near Vader, Lewis County, Section 30, Township 11 North, Range 2 West. Eocene.

333

On Stillwater Creek about three-fourths of a mile above its junction with Olequah Creek. A narrow seam. Section 30, Township 11 North, Range 2 West. Eocene .

334

On Cowlitz River about three-fourths of a mile below Olequah station, about 800 feet below post No. 81, where path leads down the bank to the river. Section 4, Township 10 North, Range 2 West. Eocene.

335

At old dam about three-fourths of a mile above the junction of Mosquito and Coal Creeks, Cowlitz County, Section 10, Township 8 North, Range 3 West. Eocene.

336

About one-fourth of a mile above the old dam on Coal Creek, Cowlitz County. Brackish water shells and fossil leaves found in high water bed across from high bluffs. Section 11, Township 8 North, Range 3 West. Eocene.

337

About one-half mile above old dam, on west bank of Coal Creek, Cowlitz County. Fossil seam in high bank. Section 11, Township 8 North, Range 3 West. Eocene.

338

About 400 feet below locality 339, on Coal Creek, Cowlitz County, Section 11, Township 8 North, Range 3 West. Eocene.

339

About one-fourth of a mile below Inman-Polson shops at bend in creek about 200 feet below high bluff where railroad is visible on Coal Creek, Cowlitz County. Large oyster bed. Section 11, Township 8 North, Range 3 West. Eocene.

340

About 200 feet below railroad trestle on east bank of Coal Creek, Cowlitz County. Oyster beds. Section 11, Township 8 North, Range 3 West. Eocene.

341

At Inman-Polson shops (old Inman-Polson store) about two and one-half miles up Coal Creek from Mount Solo, Cowlitz County, Section 2, Township 8 North, Range 3 West. Eocene.

342

About one-fourth of a mile above Inman-Polson shops on Coal Creek, Cowlitz County, Section 2, Township 8 North, Range 3 West. Eocene.

343

On west bank of Coal Creek, Cowlitz County, about one-half mile above where small creek enters on the east, at Inman-Polson shops, Section 2, Township 8 North, Range 3 West. Eocene.

344

On Coal Creek, Cowlitz County at falls about one-fourth of a mile above wagon road bridge, Section 35, Township 9 North, Range 3 West. Eocene.

345

On Coal Creek at large falls about one-half mile below the schoolhouse, Cowlitz County, Section 35, Township 9 North, Range 3 West. Eocene.

346

At small falls just below bridge at schoolhouse settlement on Coal Creek, Cowlitz County, Section 35, Township 9 North, Range 3 West. Eocene.

347

Back of old Leybo place about one-half mile below old Inman-Polson camp, on Coal Creek, Cowlitz County, Section 27, Township 9 North, Range 3 West. Eocene.

348

On Coal Creek just above old Leybo place about one-half mile above the footbridge, Cowlitz County, Section 27, Township 9 North, Range 3 West. Eocene.

349

On Coal Creek at old Inman-Polson camp about six or six and one-half miles up Coal Creek, just above where small creek enters on the east side. Section 27, Township 9 North, Range 3 West Eocene. Old locality 243.

350

On Coal Creek about one-fourth of a mile below the old Inman-Polson camp, Cowlitz County, Section 27, Township 9 North, Range 3 West. Eocene.

351

On the east bank of Cowlitz River about one-fourth of a mile below Greece's ranch, small seam in the river bed, Section 26, Township 11 North, Range 2 West. Oligocene or Eocene.

352

In railroad cut on Oregon-Washington R. R. & Navigation Co. line, one mile north of Lincoln Creek station in Section 27, Township 15 North, Range 3 West. Oligocene. Old locality 256.

353

One mile south on west shore of bay, from boulders not in place, near Quilcene, Jefferson County, Section 24, Township 27 North, Range 2 West. Oligocene.

354

About one-half mile north of Centralia, on the Northern Pacific Railway, Lewis County, Section 4 North, Township 14, Range 2 West. Eocene.

355

From cliffs about one mile north of Point Grenville, north of Moclips, Grays Harbor County, Section 13, Township 21 North, Range 13 West. Pliocene.

356

From cuts on grade of Willapa Harbor branch of Milwaukee R.R. at Sudbury, 15 miles east of Raymond at summit, four miles east of P. and E. junction, Pacific County. Miocene.

357

From cuts in grade of Willapa branch of Milwaukee R.R., in cuts about two miles east of P. and E. junction, 13 miles east of Raymond, Pacific County. Miocene.

358

At Joyce Station, one-fourth mile east of Tongue Point R. R. at Port Crescent, Clallam County, Section 22, Township 31 North, Range 8 West. Eocene.

359

In wagon road cut just east of Porter, Grays Harbor County, Section 27, Township 17 North, Range 4 West. Oligocene.

360

From bluffs at Porter station in Northern Pacific R.R. cut, Grays Harbor County, Section 22, Township 17 North, Range 4 West. Oligocene. Old locality 160 .

361

Exposure on east bank of Porter Creek just above where wagon road crosses creek at the town of Porter, Grays Harbor County, Section 27, Township 17 North, Range 5 West. Oligocene.

362

Exposure about one mile up Porter Creek from station on east bank just above the wagon bridge, Grays Harbor County, Section 22, Township 17 North, Range 5 West. Oligocene.

363

Exposure on Porter Creek, one and one-half miles from Porter station, Grays Harbor County, Section 22, Township 17 North, Range 5 West. Oligocene.

364

Exposure at old dam about three miles up Porter Creek from station, Grays Harbor County, Section 14, Township 17 North, Range 5 West. Oligocene.

365

Bluff on west bank of Porter Creek about three and one-half miles up Porter Creek from station, Grays Harbor County, Section 22, Township 17 North, Range 5 West. Oligocene.

366

At contact between the Oligocene sediments and Eocene basalt four and one-half miles up Porter Creek, Grays Harbor County, Section 14, Township 17 North, Range 5 West. Oligocene.

367

On Gibson Creek, a few hundred feet above where the creek crosses the Northern Pacific R.R., about three miles southeast of Porter, Grays Harbor County, Section 2, Township 16 North, Range 5 West. Oligocene.

368

At German's place, Castle Rock, Cowlitz County, Section 24, Township 9 North, Range 2 West.

369

Head of Arkansas creek, Cowlitz County, Section 24, Township 10 North, Range 3 West.

370

At Scattagrece Falls, Cowlitz County, Section 18, Township 9 North, Range 2 West. Eocene.

DESCRIPTION OF NEW SPECIES

PELECYPODA

GENUS NUCULA LAMARCK

NUCULA (Acila) STILLWATERENSIS n. sp.

Plate VIII, Figure 8

Description.—Shell small, rectangular in outline; anterior dorsal margin nearly straight, posterior ventral margin nearly straight, sloping to a broadly rounded anterior end which approaches the dorsal margin with greater convexity; escutcheon impressed but not defined by an incised line; central portion of the area of the escutcheon raised, protruding slightly beyond the posterior margin; surface ornamented with radiating ribs medium in strength; above the central portion of the shell the divarication is single, below the mid-area the series of divarication is comparatively wide, the duplication increasing ventrad forming five sets along the ventral margin; the area of divarication occupying the middle third of the ventral portion of the shell; lunule not defined; surface with heavy, impressed growth lines forming wide undulations on the surface of the shell.

Dimensions.—Length 11 mm.; height 9 mm.; width 8 mm.

Occurrence.—At locality 319 (University of Washington Palaeontological Collection), McClarety ranch on the south bank of Stillwater Creek, one mile west of Vader, Lewis County, Section 30, Township 11 North, Range 2 West.

GENUS LEDA SCHUMACHER

LEDA COWLITZENSIS n. sp.

Plate X, Figure 4

Description.—Shell small and thin, sub-oval in outline; posterior end rostrate and pointed; anterior end regularly and broadly rounded, ventral margin curved, posterior end sloping at an angle of 30° to the ventral line terminating at the dorsal margin in a beak; posterior dorsal margin directed downward and concave; lunule narrow and elongate, only slightly impressed and limited by a fine line; escutcheon narrow and impressed; surface ornamented with concentric ribbing which continues from the anterior margin, regularly to the rostrum, the ribs are numerous with only slight interspaces, they are prominent and have the appearance of slightly overlapping each other from the ventral region toward the

umbones; a faint groove extends from the beaks to the posterior point of the ventral margin, just back of which the concentric sculpture is somewhat obliterated except for faint lines of growth.

This shell resembles somewhat the specimens which Dr. Dickerson has pictured as *L. gabbi,* from California localities. (Proceedings of the California Academy of Science, 1915, vol. V, No. 3, pl. 1, fig. 1; University of California Publications in Geology, vol. 9, No. 17, pl. 36, fig. 3, 1916). *Leda gabbi* Conrad as represented by Gabb (Geological Survey of California, 1864, vol. I, pl. 26, fig. 185; vol. II, p. 197) is less equilateral, the rostrum more pointed and the ribbing finer than *Leda cowlitzensis.*

Dimensions.—Length 20 mm.; height 11 mm. (largest specimen).

Occurrence.—At locality 329 (University of Washington Palaeontological Collection) at the bend in Cowlitz River, near Vader, Lewis County, Section 28, Township 11 North, Range 2 West; *type* locality 343 (University of Washington Palaeontological Collection) on Coal Creek, Cowlitz County near Inman-Polson Camp shops, Section 2, Township 8 North, Range 3 West.

GENUS YOLDIA MOLLER

YOLDIA DUPREI n. sp.

Plate X, Figures 2, 7

Description.—Shell small, plump, and subelongate in outline; inequilateral, beaks situated not quite a third of the distance from the anterior end; ventral and dorsal margins nearly parallel; anterior dorsal margin sloping at about an angle of 10° from the dorsal margin, rounded below into the ventral margin which is only slightly rounded, posterior end extends upward at about an angle of 40° with the ventral margin, posterior terminating at the dorsal margin in a point; posterior dorsal end concave; lunule faintly developed; escutcheon more deeply impressed; surface smooth except for the concentric growth lines which are fine and delicate; shell with a beautiful polish; outline of the teeth seen through the shell in the cardinal region.

Named in honor of Dr. Warren Du Pre Smith, professor of Geology, University of Oregon.

Dimensions.—Length 14.5 mm.; height 8 mm.; width 6 mm.

Occurrence.—At locality 329 (University of Washington Palaeontological Collection) at bend in Cowlitz River, near Vader, Lewis County, Section 28, Township 11 North, Range 2 West.

GENUS ARCA (Linne) LAMARCK

ARCA COLUMBIANA n. sp.

Plate VIII, Figure 1

Description.—Shell large and rectangular in outline; nearly equilateral; beaks prominent, umbonal area broad; hinge line straight; cardinal area narrow; dorsal line sloping slightly from the beaks; anterior end rounded, passing into the ventral margin with a curve; ventral margin only slightly curved, extending abruptly into the posterior end; posterior end straight; posterior end is more flaring and concave than the anterior end; there is a tendency for a slight umbonal ridge to extend from the beaks to the posterior ventral margin; shell ornamented with 22 flat-topped, wide, very prominent radiating ribs with interspaces nearly equal to the width of the ribs.

Dimensions.—Length 40 mm.; height 35 mm.; thickness 30 mm.

Occurrence.—At locality 337 (University of Washington Palaeontological Collection) on Coal Creek about one-half mile above old dam, Cowlitz County, Section 11, Township 8 North, Range 3 West.

SUBGENUS BARBATIA (Gray) ADAMS

ARCA (Barbatia) SUZZALLOI n. sp.

Plate VIII, Figure 6

Description.—Shell small, elongate in outline; inequilateral, beaks situated one-third the distance from the anterior end; dorsal margin straight; anterior end nearly straight, sloping at about an angle of 15° with the dorsal margin, passing into the ventral margin with a broad bow; ventral margin straight, produced obliquely; posterior margin broadly pointed at the ventral end, sloping to the dorsal margin at about an angle of 40°; a mid-umbonal sulcus extends to the ventral margin, sloping obliquely from the beaks; surface sculptured by concentric lines of growth crossed by numerous fine, delicate, radiating ribs which bifurcate, forming two ribs of equal width on the lower region. The bifurcation of the ribs occurs over the whole of the shell including the posterior as well as the anterior region of concaveness. Under the microscope these ribs show a beaded character, which are most numerous on the anterior, umbonal slope; cardinal area very narrow.

Named in honor of Dr. Henry Suzzallo, president of the University of Washington.

Dimensions.—Length 20 mm.; height 10 mm.; width 8 mm.

Occurrence.—At locality 324 (University of Washington Palaeontological Collection) in the west bank of Olequah Creek about one-eighth of a mile north of Vader, Lewis County, Section 29, Township 11 North, Range 2 West.

ARCA (Barbatia) COWLITZENSIS n. sp.

Plate VIII, Figure 9

Description.—Shell medium in size, oblong in outline; inequilateral, beaks situated one-fourth of the distance from the anterior end; dorsal margin slightly curved, anterior end sloping from the dorsal margin at an angle of 40°, rounding into the ventral margin which extends obliquely, nearly parallel to the dorsal line; posterior end broadly rounded, sloping from the dorsal line at an angle of 20°; beaks low and broad; valves convex, concave along the posterior and anterior borders; surface ornamented with numerous, fine, close-set, radiating ribs which cover the entire surface of the shell; interspaces very narrow, about one-third of the width of the rib.

Dimensions.—Length 22 mm.; height 14 mm.; thickness 12 mm.

Occurrence.—At locality 329 (University of Washington Palaeontological Collection) west bank of the Cowlitz River, near Vader, Lewis County, Section 28, Township 11 North, Range 2 West.

ARCA (Barbatia) LANDESI n. sp.

Plate VIII, Figure 4

Description.—Shell small, thin and delicate; elongate in outline; inequilateral, beaks situated about one-third of the distance from the anterior end; dorsal margin straight; anterior end well rounded, sloping from the dorsal margin at an angle of 35° and rounding into the ventral margin; ventral margin straight, nearly parallel with the dorsal margin; posterior end rounded ventrally, nearly vertical with the dorsal margin; surface sculptured with fine, radiating ribs which are uniform in character over the whole surface of the shell. On the anterior slope the ribs are separated by interspaces about twice the width of the ribs. Within the interspaces there may be developed threads; on the middle portion the ribs and the interspaces are narrow and about equal in width; approaching the posterior slope the ribs alternate in size; the central ribs are delicately beaded; the posterior ribs from the umbonal slope to the dorsal line are larger, with wider interspaces and are about 14 in number.

In general outline this species is similar to *B. morsei* Gabb but differs in the

areal differentiation of the radiating ribs. The anterior, dorsal margin does not slope obliquely as it does in *B. morsei.*

Named in honor of Professor Henry Landes of the Geology Department, University of Washington.

Dimensions.—Length 19 mm.; height 6 mm.; width 4 mm.

Occurrence.—At locality 329 (University of Washington Palaeontological Collection) at the bend in the Cowlitz River, near Vader, Lewis County, Section 28, Township 11 North, Range 2 West.

GENUS GLYCYMERIS DA COSTA

GLYCYMERIS SAGITTATA (Gabb) VAR. DICKERSONI n. var.

Plate VIII, Figure 5

Description.—Shell of medium size and subquadrate in outline; dorsal margin slightly convex; anterior margin nearly straight and sloping downward at an angle of 15° with the dorsal margin and gradually passing into the regularly rounded, ventral margin; posterior margin broadly rounded, the posterior ventral margin regularly bowed; surface ornamented with numerous close-set, flat-topped radiating ribs, which on the majority of the specimens examined are only well developed on the middle portion of the shell. The anterior and posterior surfaces of the adult specimens show a lack of, or at least poorly developed, radial sculpture, but the lines of growth are more strongly developed. In the young and more immature specimens, the radial ribs are better developed on the anterior and posterior areas, the outline is less quadrate, and the anterior and posterior margins slope downward making nearly equal angles with the dorsal margin, the posterior being a little more convex than the anterior.

The radiating and concentric sculpture in this variety seems to be less well developed, as exhibited on unweathered specimens, than in *Glycymeris sagittata* (Gabb). The diverging lines described for *G. sagittata* have not been noticed even on the worn specimens of this variety. The anterior margin is less rounded than in *G. sagittata.* The general outline of the shell is somewhat similar to *G. hannibali* Dickerson, but the width of the interspace in *G. hannibali* is equal to those of the radiating ribs, while in *G. sagittata* var. *dickersoni* the ribs are very much wider in comparison.

This variety is very abundant, occurring in a narrow, very fossiliferous sandy layer.

Dimensions.—(Average). Length 15 mm.; height 14 mm.; width 10 mm.

Occurrence.—At locality 329 (University of Washington Palaeontological Collection) bend of the Cowlitz River, near Vader, Lewis County, Section 28, Township 11 North, Range 2 West.

GLYCYMERIS CRESCENTENSIS n. sp.

Plate VIII, Figures 10, 12

Description.—Shell small, subquadrate; anterior end straight and inclined downward at an approximate angle of 45° from the dorsal margin to a point about one-half of the height of the shell, the remaining portion curving regularly into the ventral margin; posterior end rounded; surface delicately ornamented; the anterior portion with seven very wide radiating ribs obliquely sloping toward the anterior end, and which on the extreme anterior region decrease in size; when the shell is held with the anterior end directed toward the eye, the peculiar slope of the ridges causes the high point of each rib to appear as a very narrow rib, with a wide interspace about three times the width of the rib; the ornamentation on the posterior portion is composed of narrow, rounded, radiating ribs with interspaces of nearly equal width. The entire surface is also sculptured by numerous fine, concentric lines which give the ribs a microscopic, crenulated appearance.

Dimensions.—Length 10 mm.; height 9 mm.; width 6 mm.

Occurrence.—At locality 358 (University of Washington Palaeontological Collection) at Joice station, one-fourth of a mile east of Tongue Point, Port Crescent, Clallam County, Section 22, Township 31 North, Range 8 West.

GLYCYMERIS KELSOENSIS n. sp.

Plate VIII, Figure 2

Description.—Shell large and subquadrate; umbones large; cardinal area very narrow; hinge line straight; beaks situated near the mid-line of the shell; anterior dorsal margin abruptly rounded; anterior end straight rounding into the ventral margin; ventral margin curved to the posterior end; posterior end straight, oblique; posterior umbonal slope more convex than the anterior slope which flares out to the anterior margin; a slight flexure occurs at the posterior dorsal end; shell very convex; surface ornamented with 33 very flat, wide, radiating ribs with very narrow interspaces.

This species is like *G. veatchii* Gabb var. *major* Stanton but differs from that species in the straighter dorsal line, in a greater production of the anterior end dorsally and in the less pronounced character of the posterior flexure.

Dimensions.—Length 37 mm.; height 33 mm.; thickness 22 mm.

Occurrence.—At locality 343 (University of Washington Palaeontological Collection) on west bank of Coal Creek about one-half mile above Inman-Polson shops, Cowlitz County, Section 2, Township 8 North, Range 3 West.

GENUS PTERIA SCOPOLI

PTERIA CLARKI n. sp.

Plate X, Figures 5, 12, 15

Description.—Shell small to medium in size; oblique in outline; very inequilateral, beaks situated one-fifth of the distance from the anterior end; cardinal line straight, anterior end sloping sharply from the cardinal margin at an angle of 25° for a short distance then extending vertically to the ventral margin where it swings with a broad curve into the ventral margin; ventral margin broadly rounded and parallel with the dorsal line; posterior margin well rounded at the ventral end, extending nearly vertical or at a low angle into the dorsal margin; anterior ear small, posterior ear very broad, subcompressed; central area of the shell, extending obliquely from the beaks, broad and convex, often marked by an impressed groove which extends between the posterior and anterior slope of the body portion and the basal line of each ear; surface ornamented with prominent, close, concentric lines of growth; the growth lines curve sharply from the posterior dorsal line to the region of the body of the shell, where they turn at almost a right angle and follow the line of the umbonal slope for a short distance then curve regularly and extend parallel with the line of the ventral margin, anteriorly they extend parallel with the slope of the ear; shell of a light brown coloration, mottled with reddish-brown spots; the larger and more mature specimens have a uniform color of reddish-brown.

This species is somewhat like *Avicula pellucida* Gabb but the beak in *P. clarki* n. sp. is less prominent, the sculpture is more pronounced, and the curve of the concentric lines on the posterior ear is very much different from that exhibited in *A. pellucida.* In *P. clarki* they curve at a greater angle from the dorsal line with a deeper sinuosity in the region where the ear merges into the body of the shell.

Named in honor of Dr. Bruce L. Clark, professor of Paleontology, University of California.

Dimensions.—Maximum height 37 mm.; width 31 mm.; thickness 14 mm.

Occurrence.—At locality 323 (University of Washington Palaeontological Collection) in bed of small creek entering Olequah Creek, near Vader, Lewis

County; (*type*) at locality 324, on Olequah Creek about one-eighth of a mile north of Vader opposite locality 323; locality 325, on Olequah Creek about one-fourth of a mile north of Vader, Lewis County, Section 29, Township 11 North, Range 2 West.

GENUS OSTREA LINNEAUS

OSTREA COLUMBIANA n. sp.

Plate VIII, Figures 15, 16

Description.—Shell large and elongate in outline; right valve very convex and irregular; left valve flat or concave with the anterior end straight dorsally, swinging into the ventral margin with a broad curve which continues ventrally to the posterior ventral end; posterior end with a more or less deep concave area at about one-third of the distance from the dorsal line; shell very thick; surface of the left valve rough and irregular with overlapping laminae; surface of the right valve smoother, the growth lines more regular than those of the left valve; left valve with a glossy, corneous outer layer over which are fine yet conspicuous radiating lines; beaks deflected posteriorly; anterior and posterior margins internally or laterally with coarse transverse grooves.

This species is related to *O. idriaensis* Gabb. the left valve of *O. columbiana* n. sp. is typically broader dorsally and less curved, and the right valve is smoother and less squamose.

The fine striae on the external corneous layer of the shell is like that described and figured by Professor Harris* as occurring on *Ostrea alabamiensis* Lea of the Eocene of the Gulf and East Coast.

Dimensions—Co-types; height right valve 58 mm.; width right valve 43 mm.; thickness right valve 10 mm.; height left valve 60 mm.; width left valve 44 mm.; convexity left valve 30 mm.

Occurrence.—*Type* locality 340 (University of Washington Palaeontological Collection) on Coal Creek, Cowlitz County, Section 11, Township 8 North, Range 3 West; *type* locality 324 (University of Washington Palaeontological Collection) west bank of Olequah Creek about one-eighth of a mile north of Vader, Lewis County, Section 29, Township 11 North, Range 2 West; locality 319 (University of Washington Palaeontological Collection) at McClarety ranch, south bank of Stillwater Creek, one mile west of Vader, Lewis County, Section 30, Township 11 North, Range 2 West; locality 341 (University of Washington Palaeontological Collection) on Coal Creek about two and one-half miles up

Coal Creek from Mount Solo, Cowlitz County, Section 2, Township 8 North, Range 3 West; locality 343 (University of Washington Palaeontological Collection) on Coal Creek about one-half of a mile above Inman-Polson shops, Cowlitz County, Section 2, Township 8 North, Range 3 West; locality 320 (University of Washington Palaeontological Collection) on south bank of Stillwater Creek below the graveyard about one and one-half miles from Vader, Lewis County, Section 30, Township 11 North, Range 2 West.

GENUS ANODONTA CUVIER

ANODONTA ARNOLDI n. sp.

Plate X, Figure 10

Description.—Shell large and rectangular in outline; inequilateral, beaks situated about one-third of the distance from the anterior end; beaks broad and low; cardinal line straight; anterior end sloping from the dorsal line at an angle of 30° for about one-third of the length of the anterior end, then broadly curves into the ventral margin; ventral margin straight and parallel with the dorsal line, posterior end straight, broadly pointed at the ventral margin, extending at an angle of 40° to the dorsal line; an umbonal ridge extends from the beaks obliquely to the posterior-ventral end, above which the region is concave; surface sculptured only with fine, concentric lines of growth; shell thin and fragile; inner layer of shell nacreous.

Named in honor of Dr. Ralph Arnold.

Dimensions.—Length 43 mm.; height 23 mm.; thickness 11 mm.

Occurrence.—At locality 315 (University of Washington Palaeontological Collection) at dam just below the railroad bridge on west bank of Olequah Creek, about one-third of a mile below its junction with Stillwater Creek, near Vader, Lewis County, Section 32, Township 11 North, Range 2 West.

GENUS LIMA BRUGUIÈRE

LIMA PACKARDI n. sp.

Plate VIII, Figure 13

Description.—Shell small; obliquely oval in outline; inequilateral; beaks minute; posterior dorsal margin straight, sloping only slightly from the beaks; posterior end slopes roundly from the dorsal line at an angle of 40°, passing below

into the ventral margin at about the same angle; ventral margin curved, rounding more sharply into the anterior end; anterior end straight, extending at an angle of 60° with the cardinal line and extending directly from the anterior margin of the beaks; no anterior ear present; surface sculptured with numerous fine radiating ribs which on the posterior end of the shell have interspaces that are nearly equal in width to the rib, the ribs become broader on the middle portion of the shell with the interspaces about one-fourth of the width of the rib.

Named in honor of Dr. E. L. Packard, professor of Geology, University of Oregon.

Dimensions.—Height 10 mm.; width 7 mm.

Occurrence.—At locality 324 (University of Washington Palaeontological Collection) in the west bank of Olequah Creek about one-eighth of a mile north of Vader, Lewis County, Section 29, Township 11 North, Range 2 West.

GENUS MYTILUS LINNEAUS

MYTILUS STILLWATERENSIS n. sp.

Plate IX, Figure 13

Description.—Shell medium in size; outline subquadrate, convex; dorsal margin slightly rounded; anterior margin nearly straight; posterior end rounded, inflated at the ventral side; ornamentation consisting of coarse, radiating ribs with narrow interspaces; on the umbonal slope and along the dorsal margin many of the ribs bifurcate.

Dimensions.—Length 22 mm.; width 16 mm.; thickness 10 mm.

Occurrence.—At locality 319 (University of Washington Palaeontological Collection) McClarety ranch on south bank of Stillwater Creek, one mile west of Vader, Lewis County, Section 30, Township 11 North, Range 2 West.

GENUS MODIOLUS LAMARCK

SUBGENUS BRACHYDONTES SWAINSON

MODIOLUS (Brachydontes) OLEQUAHENSIS n. sp.

Plate IX, Figures 3, 17

Description.—Shell median, elongate; posterior end obliquely produced; hinge line straight and long; ventral margin sloping broadly and obliquely to the

posterior end; umbones strongly curved, forming a sharp ridge on the dorsal margin; umbonal slope extending from the beaks to the posterior end; in younger specimens the dorsal margin of this ridge is more rounded; sculpture delicate, consisting of flat, radiating ribs which are larger over the dorsal and posterior regions continuing to the lower surface of the umbonal slope; the ribs on the middle portion of the shell are very much finer and more delicate, increasing in size on the short anterior end; hinge margin crenulated, distinct on the anterior portion, very fine beneath the beaks and becoming obscure on the posterior region; shell with a beautiful nacreous luster.

Dimensions.—Length 21 mm.; length of umbonal slope 20 mm.; thickness 7 mm.

Occurrence.—At locality 324 (University of Washington Palaeontological Collection) in the west bank of the Olequah Creek, about one-eighth of a mile north of Vader, Lewis County, Section 29, Township 11 North, Range 2 West.

Modiolus (Brachydontes) cowlitzensis n. sp.

Plate IX, Figure 19

Description.—Shell medium in size; subovate in outline; dorsal line straight, curving regularly into the posterior end which extends almost vertically downward; posterior end broad and inflated; anterior end short; beaks low; umbonal slope prominent and arching downward, convex above with a prominent concavity beneath; surface ornamented with radiating ribs which over the posterior and umbonal regions are large and flat with narrow interspaces; on the middle portion of the shell the ribs are very fine and delicate; on the anterior end of the shell, there are five or six radiating ribs which are enlarged with wide spaces between, the interspaces equal to the width of the ribs; cardinal margin denticulate, the series of teeth are larger on the anterior margin, diminishing in size beneath the beaks and becoming obscure on the posterior end; shell very thin and fragile.

The sculpture of this species is like that of *M. olequahensis* n. sp. which has the tripartite differentiation of the radiating ribs. It differs from *M. olequahensis* in the distinct curving of the umbonal ridge and the almost straight vertical slope of the posterior end. The area above the umbonal slope in *M. cowlitzensis* is convex and slightly concave near the margin of the shell, the greatest concavity being beneath the ridge while in *M. olequahensis* the area above is concave and only slightly concave beneath.

Dimensions.—Length 15 mm.; thickness 7 mm.

Occurrence.—At locality 329 (University of Washington Palaeontological Collection) west bank of the Cowlitz River, near Vader, Lewis County, Section 28, Township 11 North, Range 2 West.

MODIOLUS KELSOENSIS n. sp.

Plate X, Figure 13

Description.—Shell large, narrow and elongate in outline; anterior end straight and vertical; ventral margin straight, rounding abruptly into the posterior end which is broadly pointed; the posterior dorsal margin is rounded obliquely to the dorsal line; beaks medium in size; umbonal ridge pronounced, narrow near the beaks, broadening posteriorly and occupying the whole width of the last third of the shell; the widening of the ridge gives the appearance of the fold being overturned. The shell is concave directly beneath the ridge in the middle portion of the shell and above, along the dorsal margin. The sculpture consists of prominent, radiating ribs over the umbonal and dorsal regions but which become obsolete on the middle area of the shell producing a smooth unstriated area as in Modiolaria; character of the ribs anteriorly unknown.

This species differs from *M. olequahensis* n. sp. and *M. cowlitzensis* n. sp. in the greater size and narrowness of outline. The angle of the umbonal ridge is more nearly like that of *M. olequahensis* but the anterior end is straighter and not produced, in that respect it is more like *M. cowlitzensis.*

Dimensions.—Length 50 mm.; greatest height 15 mm.; thickness 16 mm.

Occurrence.—Type locality 347 (University of Washington Palaeontological Collection) back of the Leybo place about one-half of a mile below old Inman-Polson camp on Coal Creek, Cowlitz County, Section 27, Township 9 North, Range 3 West; at locality 370 (University of Washington Palaeontological Collection) Scattagrece Falls, Cowlitz County, Southeast quarter Section 18, Township 9 North, Range 2 West.

MODIOLUS COLUMBIANUS n. sp.

Plate VIII, Figure 7

Description.—Shell large, oval-elongate in outline; inequilateral, breaks situlow; ventral margin straight; dorsal margin sloping obliquely upward from the beaks; posterior margin sloping at an angle of 45° from the dorsal line, rounding shortly into the ventral margin; umbonal ridge high, extending broadly to the

posterior ventral line; surface ornamented with medium, coarse, radiating ribs which become obsolete on the middle region of the shell below the umbonal ridge. In this respect the sculpture is like that of *M. kelsoensis* n. sp.

This species differs from *M. kelsoensis* n. sp. with which it compares more nearly in size and sculpture, in being less elongate but much broader and higher. The general character of the sculpture of the two species *M. kelsoensis* and *M. columbianus* is like that of the recent *M.* (*Brachydontes*) *demissus* (Dillwyn) of the Atlantic coast, and which now, having been imported from the east, occurs on the Pacific coast in San Francisco Bay.

Dimensions.—Length 35 mm.; height 20 mm.; width 20 mm.

Occurrence.—At locality 347 (University of Washington Palaeontological Collection) on Coal Creek, Lewis County, back of Leybo place about one-half of a mile below old Inman-Polson Camp, Section 27, Township 9 North, Range 3 West.

GENUS CRASSATELLITES KRUGER

CRASSATELLITES STILLWATERENSIS n. sp.

Plate IX, Figures 1, 2

Description.—Shell of moderate size, thick and trigonal in outline; inequilateral, beaks situated about one-third of the distance from the anterior end; beaks small; anterior margin sloping from the beaks at an angle of 30° for about half the length of the anterior end and then rounding into the ventral margin; ventral margin slightly curved; posterior truncate; extending vertically from the ventral margin for about half the height of the shell and then sloping to the beaks at an angle of 25°; an umbonal slope extends from the beaks to the posterior ventral margin; hinge heavy; large resilium scar; one large middle cardinal with a thin anterior cardinal; margin of hinge plate grooved anteriorly; area of lunule and escutcheon well developed; internal margin smooth; surface ornamented only with fine, concentric lines of growth.

Dimensions.—Length 43 mm.; height 32 mm.; thickness 18 mm.

Occurrence.—At locality 319 (University of Washington Palaeontological Collection) at McClarety ranch on south bank of Stillwater Creek, one mile west of Vader, Lewis County, Section 30, Township 11 North, Range 2 West.

GENUS VENERICARDIA LAMARCK

VENERICARDIA CLARKI n. sp.

Plate IX, Figures 4, 5; Plate X, Figure 8

Description.—Shell small and ovate; umbones small; anterior end slightly produced, sloping from the beaks at an angle of 20°, rounding into the ventral margin; ventral margin regularly rounded; posterior end rounded, passing from the ventral margin at about the same degree of convexity as the anterior end; posterior dorsal margin nearly straight or slightly curving to the posterior end; surface ornamented with 18 to 20 very well developed radiating ribs with rounded interspaces about half the width of the rib; the median portion of the ribs is raised and rounded, the base forming a lower ridge on each side of the ribs, giving them a tripartite character; the median, raised portion of the ribs is ornamented by fine nodes or pustules which occur on all the ribs on very young shells, and on the umbonal region and the anterior end of most of the shells; the ribs on the posterior end of the older specimens become broader and the pustulate condition obliterated; inner margin fluted.

Dimensions.—Length 17 mm.; height 15 mm.; thickness 11 mm.

Occurrence.—At locality 329 (University of Washington Palaeontological Collection) west bank of the Cowlitz River near Vader, Lewis County, Section 28, Township 11 North, Range 2 West.

VENERICARDIA CRESCENTENSIS n. sp.

Plate X, Figure 9

Description.—Shell small and subquadrate in outline; posterior dorsal line straight, slightly oblique; posterior margin straight, extending almost at a right angle to the dorsal margin and abruptly passing into the ventral margin which curves slightly to the anterior end; anterior moderately produced; surface ornamented with 22 wide, flat-topped, radiating ribs with interspaces about one-third of the width of the ribs; on the posterior dorsal region the ribs become narrower and the interspaces wider; an umbonal ridge extends from the beaks to the posterior ventral point.

Dimensions.—Length 15 mm.; height 12 mm.; thickness 10 mm.

Occurrence.—At locality 358 (University of Washington Palaeontological Collection) at Joice station, one-fourth of a mile east of Tongue Point railroad, Port Crescent, Clallam County, Section 22, Township 31 North, Range 8 West.

GENUS CARDIUM LINNEAUS

CARDIUM OLDROYDI n. sp.

Plate VIII, Figures 3, 11

Cardium brewerii Dickerson, 1915, Proc. Cal. Acad. Sci., Vol. V, No. 3, pl. 2, figs. 3a, b.

Description.—Shell moderate in size, subovate, beaks central; posterior margin nearly straight, rounding into the dorsal and ventral margins; anterior and ventral margins regularly rounded; surface ornamented with about twenty-seven wide, flat-topped, radiating ribs with interspaces about half the width of the ribs; on both sides of each rib at the angle is a series of delicate nodes which are continuous from the beaks to the ventral margin. On the umbonal area they are minute, increasing in size downward; on the portion of the shell below the middle they are very conspicuous; the first two or three posterior interspaces are coarsely cross-striated, many begin to show a divided condition which ultimately gives rise to the bi-pustulate character of the ribs. The ribs have the appearance of being barbed. On one specimen several distinct, short, spiny tubercles occur, situated along a faint mid-groove of the ribs. The whole sculpture is beautiful and delicate. Anteriorly the ribs are often eroded and the presence of the fine nodes obscure; internal margin fluted or grooved.

In shape this species is somewhat like *C. brewerii* Gabb but is more oval than that form. The posterior umbonal slope is less sharp and the posterior area less concave in *C. oldroydi.* The unique nodose character of the ribs with the possible development of tubercles makes this species distinct.

Named in honor of Mrs. Ida Oldroyd of Leland Stanford University.

Dimensions.—Length 26 mm.; height 25 mm.; thickness 20 mm.

Occurrence.—At locality 329 (University of Washington Palaeontological Collection) west bank of the Cowlitz River, near the town of Vader, Lewis County, Section 28, Township 11 North, Range 2 West.

GENUS PITARIA ROEMER

PITARIA (Lamelliconcha) EOCENICA n. sp.

Plate X, Figures 14, 16

Description.—Shell medium in size; ovate; beaks prominent, situated about one-third of the distance from the anterior end; dorsal margin high; posterior end sloping roundly to the ventral margin; ventral margin regularly and broadly rounded; anterior end produced; concave beneath the beaks; lunule heart-shaped,

impressed and bound by an incised line; escutcheon very narrow; surface ornamented with numerous, lamellar, concentric ribs with interspaces about three times the width of the ribs.

This shell is like that figured by Dr. Dickerson in the Prod. Cal. Acad. Sci., vol. V, no. 3, pl. 3, figs. 2a, b, to which he gave the new name *Meretrix tejonensis* to replace *Meretrix uvasana* Gabb. *Pitaria eocenica* n. sp. differs from *Meretrix uvasana* Gabb in smaller size, a more ovate shape and the posterior end more rounded and less attenuated.

Dimensions.—Length 25 mm.; height 22 mm.; thickness 16 mm.

Occurrence.—At locality 329 (University of Washington Palaeontological Collection) west bank of the Cowlitz River, near Vader, Lewis County, Section 28, Township 11 North, Range 2 West.

Pitaria stocki n. sp.

Plate X, Figure 6

Description.—Shell medium in size and ovate in outline; very convex; beaks small; anterior end short, slightly curved, extending from the beaks at an angle of 35°; ventral margin arcuate, rounding into the anterior and posterior ends; surface ornamented with numerous flat, concentric ribs with interspaces about half the width of the ribs; concentric ribbing more pronounced on the anterior and posterior slopes and on the lower part of the shell; a very large lunule, extending nearly the length of the anterior end; lunule bounded by an impressed line; teeth normal.

Named in honor of Dr. Chester Stock of the Paleontology Department, University of California.

Dimensions.—Length 24 mm.; height 22 mm.; thickness 14 mm.

Occurrence.—At locality 320 (University of Washington Palaeontological Collection) south bank of Stillwater Creek below the graveyard, about one and one-fourth miles from Vader, Lewis County, Section 30, Township 11 North, Range 2 West.

genus MACROCALLISTA Meek

Macrocallista williamsoni n. sp.

Plate X, Figures 1, 11

Description.—Shell large, oval-elongate in outine; inequilateral, breaks situated about one-fourth of the distance from the anterior end; beaks moderate in

size; dorsal margin sloping from the beaks, posterior end passing from the dorsal line at an angle of 30° forming a broadly pointed margin, ventral margin regularly curving from the posterior margin and rounding into the anterior end; anterior slightly produced, concave beneath the beaks; surface sculptured with prominent, wide, concentric ribs which cover the entire surface of the shell; the interspaces very narrow, about one-fourth of the width of the ribs.

This species differs from *Meretrix uvasana* Gabb, *Meretrix tejonensis* Dickerson and *Meretrix uvasana* Conrad (Dickerson) in being more elongate in the outline of the shell, and the ribs in *M. williamsoni* are very wide with narrow interspaces while on the species mentioned the ribs are narrow with wide interspaces. *M. williamsoni* differs from *Macrocallista conradiana* Gabb in being less narrowly pointed posteriorly and less elongate.

Named in honor of the late Mrs. Martha Burton Williamson of Los Angeles, California, who has been an ardent contributor to the conchology of the Pacific Coast.

Dimensions.—Length 39 mm.; height 28 mm.; thickness 10 mm.

Occurrence.—At locality 319 (University of Washington Palaeontological Collection), McClarety ranch on south bank of Stillwater Creek, one mile west of Vader, Lewis County, Section 30, Township 11 North, Range 2 West.

GENUS PSAMMOBIA LAMARCK

PSAMMOBIA COLUMBIANA n. sp.

Plate X, Figure 18

Description.—Shell large and oblong; inequilateral, the anterior end shorter; posterior end higher than the anterior; anterior and posterior dorsal lines straight and oblique, the anterior sloping at a greater angle; posterior and dorsal ends rounded below; ventral margin straight; surface of shell with coarse, concentric lines of growth.

Dimensions.—Length 75 mm.; height 36 mm.; thickness 19 mm.

Occurrence.—At locality 342 (University of Washington Palaeontological Collection) on Coal Creek, Cowlitz County, about one-fourth of a mile above Inman-Polson shops, Section 2, Township 8 North, Range 3 West.

PSAMMOBIA COWLITZENSIS n. sp.

Plate IX, Figure 18

Description.—Shell large and oblong in shape; inequilateral; anterior end shorter, convex; anterior dorsal margin sloping; shell rounded at both ends;

posterior end broader, concave above; line of the escutcheon straight, slightly oblique; shell thin; pallial sinus large, rounded in front, reaching beyond the middle of the shell; ventral margin straight; sculpture unknown except for concentric lines of growth.

In outline *P. cowlitzensis* is more nearly like *P. hornii* (Gabb) but is more inequilateral than that species and higher in proportion to the length.

Dimensions.—Length 53 mm.; height 28 mm.; thickness 12 mm.

Occurrence.—At locality 329 (University of Washington Palaeontological Collection) west bank of Cowlitz River near Vader, Lewis County, Section 28, Township 11 North, Range 2 West.

PSAMMOBIA OLEQUAHENSIS n. sp.

Plate IX, Figures 11, 12

Description.—Shell moderately large, thin; broad in outline; anterior end convex, shorter and sloping to a well rounded end; posterior end broadly rounded, concave above along a post-umbonal slope; posterior dorsal margin straight; ventral margin straight and parallel; surface with fine concentric lines of growth which on the posterior end become more acute and slightly raised; obscure radiating lines occur on the posterior margin of the shell.

Dimensions.—Co-types respectively: length 29 mm., 18 mm.; height 26 mm., 11 mm.; thickness 8 mm., 6 mm.

Occurrence.—At locality 324 (University of Washington Palaeontological Collection) on the west bank of Olequah Creek about one-eighth of a mile north of Vader, Lewis County, Section 29, Township 11 North, Range 2 West.

GENUS SOLEN LINNEAUS

SOLEN CLARKI n. sp.

Plate IX, Figure 16

Description.—Shell large and long; valves convex; ventral and dorsal margins parallel; anterior end oblique, rounded at the base; posterior tip unknown; a deep, anterior furrow extends from the umbones to the ventral margin, vertically inclined to the dorsal and ventral margins; surface with fine concentric lines of growth which extend parallel with the dorsal and ventral margins for about two-thirds of the length of the shell then turn abruptly and continue to the dorsal margin at right angles to the dorsal line.

This species is like *S. parallelus* Gabb in size and in the parallel character of the dorsal and ventral margins but differs in the presence on *S. clarki* of the deep anterior furrow.

Named in honor of Professor Bruce L. Clark of the University of California.

Dimensions.—Length 52 mm.; height 17 mm.; thickness 12 mm.

Occurrence.—At locality 342 (University of Washington Palaeontological Collection) on Coal Creek about one-fourth of a mile above Inman-Polson shops, Cowlitz County, Section 2, Township 8 North, Range 3 West.

Solen columbianus n. sp.

Plate X, Figure 3

Description.—Shell large and broad; dorsal region slightly convex; anterior end sloping from the dorsal line at an angle of 25° turning more vertically at the middle portion of the shell and passing below into the ventral margin at an angle of 40°; dorsal line nearly straight; a deep, anterior sulcus extends obliquely from the beaks to the ventral margin parallel with the anterior margin; surface smooth except for the growth lines which are moderately conspicuous.

This species differs from *S. clarki* n. sp. in being less convex, higher and in the oblique direction of the anterior sulcus.

Dimensions.—Length 45 mm:; height 21 mm.; thickness 4 mm.

Occurrence.—At locality 337 (University of Washington Palaeontological Collection) about one-half mile above old dam, on west bank of Coal Creek, Cowlitz County, Section 11, Township 8 North, Range 3 West.

genus CORBULA Bruguiere

Corbula dickersoni n. sp.

Plate IX, Figures 9, 10

Corbula hornii Dickerson, 1915, Proc. Cal. Acad. Sci., Fourth Series, Vol. V, No. 3, pl. 4, figs. 5 a, b; not *Corbula hornii* Gabb, 1864.

Description.—Shell small, sub-trigonal in outline; thick; inequilateral, beaks situated nearer the anterior end; beaks low and inconspicuous; anterior dorsal end sloping from the beaks at an angle of 25° rounding into the ventral margin; ventral margin slightly rounded, ending abruptly in the truncated, posterior ven-

tral end; posterior end sloping from the dorsal line at an angle of 30°, narrowly truncate at the base; a sharp ridge extends from beaks to the posterior ventral margin; valves very convex; left valve tends to be more pointed posteriorly and the ventral line less straight; surface ornamented with fine, distinct concentric ribs with interspaces about half the width of the ribs; concentric ribs terminate at the umbonal ridge, the area between the ridge and the anterior margin smooth except for lines of growth. Crossing the concentric ribs there are commonly threadlike, radiating lines on the lower portion of the shell, which extend from a mid-line to the umbonal ridge. These lines are very fine and often microscopic with very wide interspaces between, where they cross the concentric ribs they give the surface a cancellated appearance.

This form differs from *Corbula hornii* Gabb in being less equilateral, in the anterior end being less produced and the posterior end more pointed.

Named in honor of Dr. Roy E. Dickerson of the California Academy of Sciences, San Francisco, California.

Dimensions.—Length 12 mm.; height 8 mm.; thickness 6 mm.

Occurrence.—At locality 329 (University of Washington Palaeontological Collection) west bank of the Cowlitz River near Vader, Lewis County, Section 28, Township 11 North, Range 2 West.

Corbula stillwaterensis n. sp.

Plate VIII, Figure 14

Description.—Shell large, sub-ovate; rostrate; beaks large and prominent; valves very convex; dorsal margin slightly convex, anterior end rounded; ventral margin rounded anteriorly, sloping slightly upward in the region of the rostrated posterior end; extreme margin of the posterior end broken; dorsal margin concave, sloping to the beaks at an angle of 40°; shell thin, smooth except for the fine lines of growth.

Dimensions.—Length 22 mm.; height 16 mm.; thickness 13 mm.

Occurrence.—At locality 319 (University of Washington Palaeontological Collection), McClarety ranch on the south bank of Stillwater Creek, one mile west of Vader, Lewis County, Section 30, Township 11 North, Range 2 West.

PHAENOMYA NEW GENUS

Plate IX, Figures 6, 7, 8

Type *Phaenomya vaderensis* n. sp.

Description.—Shell medium in size, trigonal in outline; equivalve; gibbous, beaks high and full; anterior end rounded; posterior end produced, a slight ridge extends from the umbones to the posterior ventral margin; right valve with a tooth beneath the beak and in front of a wide and deep cartilage pit; in the left valve there is a narrow, deep socket which extends anteriorly beneath the beak and which lodges the tooth of the right valve; behind the socket and beneath the beak there is a wide projecting, spatulate cartilage process which fits into the cartilage pit of the right valve; posterior ligamental area present, internal, widest just behind the cartilage process; pallial sinus very slight; valves not gaping; escutcheon impressed; lunule not present; shell smooth.

The absence of the pallial sinus, the character of the tooth and socket of the right valve and the general shape of shell are characters which are like *Corbula*, the spatulate process of the left valve is like that of *Mya; Phaenomya* has in addition the deep groove or socket anterior to that process.

This form is associated with a fresh water fauna which includes *Goniobasis olequahensis* Arnold and Hannibal, *Goniobasis hannibali* n. sp., *Anodonta arnoldi* n. sp., *Hydrobia pontis* n. sp. and *Viviparus washingtoniana* Arnold and Hannibal.

PHAENOMYA VADERENSIS n. sp.

Plate IX, Figures 6, 7, 8

Description.—Shell medium; inequilateral, beaks situated about one-third of the distance from the anterior end; trigonal in outline, very convex; beaks high and prominent; anterior end concave; anterior margin sloping roundly to the ventral margin; ventral margin straight; posterior end truncate, passing into the ventral margin at a right angle and sloping to the beaks at an angle of 35°; a slight umbonal ridge extends from the beaks to the ventral margin; surface smooth except for the concentric lines of growth.

Dimensions.—Length 28 mm.; height 20 mm.; thickness 13 mm.

Occurrence.—At locality 315 (University of Washington Palaeontological Collection) at the dam just below the railroad bridge at Vader on west bank of Olequah Creek about one-third of a mile below its junction with Stillwater Creek, Lewis County, Section 32, Township 11 North, Range 2 West.

Gastropoda

GENUS FISSURIDEA SWAINSON

FISSURIDEA STILLWATERENSIS n. sp.

Plate XI, Figures 3, 6

Description.—Shell medium in size, outline elliptical; apex situated a little in advance of the middle; anterior slope moderately steep; angle of the posterior slope less than that of the anterior; surface ornamented with about 28 primary, radiating ribs between which are ribs secondary in size, in most cases there is a third, smaller, radiating rib between the primary and secondary ribs; the alternation in the size of the ribs is most conspicuous nearer the apex of the shell and on the anterior and posterior slopes; the radiating ribs are crossed by numerous, revolving lines which give the shell a close, cancellated appearance.

In size, shape and general rib arrangement this shell resembles *Fissuridea alabama* (Harris), (Bull. Amer. Pal. III, No. 11, p. 102, pl. 12, fig. 23, 1899) from the Sabine Eocene of Alabama, but from which it differs in having a greater number of primary ribs and in a greater tendency for the intervening ribs to be produced into secondary and tertiary, there never being more than three smaller radiating ribs between the primaries.

The type locality for this species is at 319 on the Stillwater Creek, Lewis County. An eroded specimen of this same species was found at locality 347, on Coal Creek, Cowlitz County. No other species of this genus has been described from the west coast Eocene.

Dimensions.—Greater diameter 19 mm.; lesser diameter 13 mm.; altitude 8 mm.; apical angle 113°.

Occurrence.—At locality 319 (type) (University of Washington Palaeontological Collection) McClarety ranch on south bank of Stillwater Creek, one mile west of Vader, Lewis County, Section 30, Township 11 North, Range 2 West; locality 347, back of Leybo place about one mile below old Inman-Polson camp, on Coal Creek, Cowlitz County, Section 27, Township 9 North, Range 3 West.

GENUS SOLARIELLA S. WOOD

SOLARIELLA OLEQUAHENSIS n. sp.

Plate XII, Figures 10, 12

Description.—Shell small; whorls five angulated; aperture round; suture impressed, slightly channelled; body whorl sharply angulated at the base; between

the angle of the whorl and the suture there are two revolving ribs on the penultimate whorl and three revolving ribs on the body whorl, below the angle of the whorl four revolving ribs occur, all cut by radiating striae which give the sculpture a nodose or beaded appearance; base of the body whorl has revolving ribs less pronounced than on the rest of the shell; umbilicus deep, moderately wide for the size of the shell, interior and margin beaded by radiating striae; where portions of the outer layer of shell material has been peeled off a nacreous inner layer is revealed.

Dimensions.—Co-types measuring respectively; altitude 2.25 mm., 4 mm.; width of body whorl 4 mm., 5.25 mm.

Occurrence.—At locality 326 (University of Washington Palaeontological Collection) on Olequah Creek, back of Armstrong place about one-half mile north of Vader, Lewis County, Section 29, Township 11 North, Range 2 West.

Solariella crescentensis n. sp.

Plate XII, Figure 11

Description.—Shell small; whorls four, rounded; suture impressed, slightly channelled; aperture round; surface of the whorls ornamented with prominent, revolving ribs crossed by radiating lines which dissect the revolving ridges into nodes or beads. This sculpture extends with equal prominence over the whole surface of the whorls and umbilical area.

S. crescentensis differs from *S. olequahensis* in the lesser angulation of the whorls and in the strength of the beaded sculpture. The revolving ribs on the base of the body whorl of *olequahensis* are much smaller and less noticeable than on the upper surface of the whorls and they are only crossed by faint lines, while in *S. crescentensis* the basal sculpture is as strongly developed as elsewhere; altogether in *S. crescentensis* there are eleven, revolving ribs including the rib which forms the margin of the umbilicus.

Dimensions.—Altitude 4 mm.; width of body whorl 5 mm.

Occurrence.—At locality 358 (University of Washington Palaeontological Collection) at Joice station, about one-fourth mile east of Tongue Point R. R., Port Crescent, Section 22, Township 31 North, Range 8 West.

genus Nerita Linne

Nerita washingtoniana n. sp.

Plate XI, Figure 4

Description.—Shell small, semi-globose; spire minute absorbed by the body

whorl; body whorl rounded; aperture elliptical; outer and inner lip finely dentate; callus large; surface with microscopic, spiral lines covered by dark brown, spiral stripes. The original coloration of the bands is preserved in part and their contour suggests that they would apparently extend regularly over the surface of the body whorl without a zigzag or wavy pattern.

Dimensions.—Altitude 3 mm.; width of body whorl 3.75 mm.

Occurrence.—At locality 329 (University of Washington Palaeontological Collection) at bend of the Cowlitz River, near Vader, Lewis County, in Section 28, Township 11 North, Range 2 West.

GENUS PYRAMIDELLA LAMARCK

SUBGENUS SYRNOLA ADAMS

PYRAMIDELLA (SYRNOLA) VADERENSIS n. sp.

Plate XI, Figures 16, 17

Odostomia new species Dickerson, 1915, Proc. Cal. Acad. Sci., vol. V, No. 3, pl. 5, fig. 10 a, b.

Description.—Shell small, slender and thin with a maximum of ten whorls which have nearly flat surfaces; suture very distinct; surface smooth except for numerous, very faintly developed lines of growth; base of body whorl ornamented by six very narrow, moderately deep, revolving grooves which do not extend upon the upper surface of the whorl; aperture entire, semi-ovate and narrow posteriorly but broader and rounded anteriorly. The columella is characterized by having one fold; outer lip with two or three internal, spiral ribs. These do not appear to be present on the young shells.

This species bears a resemblance to *Odostomia packi* Dickerson but differs from that form in having a lesser number of whorls, one columella plait and in the absence of the strong, spiral lines on the body whorl as is shown in the illustration of *packi.*

This shell was found to be quite abundant at locality 329. A specimen from the same locality was figured but not described by Dr. Dickerson. In size and shape this species is like the one previously figured by Dickerson. Since it is from the same locality there is little question as to its identity.

Dimensions.—Altitude 8 mm.; width of body whorl 2.25 mm.; apical angle 15°.

Occurrence.—At locality 329 (University of Washington Palaeontological

Collection) west bank of Cowlitz River near Vader, Lewis County, section 28, Township 11 North, Range 2 West.

GENUS EPITONIUM BOLTEN

SUBGENUS BOREOSCALA KOBELT

EPITONIUM (BOREOSCALA) WASHINGTONENSIS n. sp.

Plate XI, Figure 19

Description.—Shell large, elongate and thick; whorls eight or nine, convex, bulbous in shape; suture distinct; surface ornamented by about 10 rounded, slightly elevated, revolving ribs with numerous finer, intervening striae; the revolving ribs are crossed by ten very strong varices which extend over all the whorls, the varix of each lower whorl overlapping at the suture, the corresponding varix of the succeeding whorl; every other varix thickened; all are striate longitudinally; interspaces about two or three times the width of the varices; the basal, spiral rib slightly angulates the body whorl; aperture subovate, margin stoutly thickened.

It is interesting to note that the living representatives of the subgenus to which this handsome shell belongs are all of the boreal waters.

Dimensions.—Altitude 35 mm.; width of body whorl 17 mm.; apical angle 30°.

Occurrence.—At locality 319 (University of Washington Palaeontological Collection), McClarety ranch on the south bank of Stillwater Creek, one mile west of Vader, Lewis County, in Section 30, Township 11 North, Range 2 West.

GENUS LITTORINA FERUSSAC

LITTORINA MOUNTSOLOENSIS n. sp.

Plate XI, Figure 12

Description.—Shell small, smooth; apex acute; spire about one-half the length of the body whorl; whorls six, sides straight; suture linear and only minutely excavated; aperture oval; anterior end of outer lip not completely entire.

Dimensions.—Altitude 7 mm.; width of body whorl 4 mm.

Occurrence.—At locality 337 (University of Washington Palaeontological

Collection) on Coal Creek, Cowlitz County, about one-half of a mile above old dam, Section 11, Township 8 North, Range 3 West.

GENUS CREPIDULA LAMARCK

CREPIDULA DICKERSONI n. sp.

Plate XI, Figure 2; Plate XII, Figure 9

Crepidula n. sp. Dickerson, 1915, Proc. Cal. Acad. of Sci., Fourth Series, vol. V, No. 3 pl. 5, fig. 6 a, b.

Description.—Shell small to medium in size; sub-ovate; whorls about three and smooth except for lines of growth; spire twisted, apex raised above the margin of the body whorl; shell varies in height; septum well developed, extending about half the length of the shell, outer half of the margin of the septum convex, inner half concave.

This shell is very abundant in a lower, coarse, sandy layer at locality 329. The most common size of the species is about 6 mm. in length, the largest specimen is 12 mm. in length.

Species named in honor of Dr. Roy E. Dickerson of the California Academy of Sciences, by whom it was first figured, and who has described a large number of forms from this locality.

Dimensions.—Altitude (length) 12 mm.; width of body whorl 10 mm.; height above base 6 mm. (These measurements were taken on the largest specimen.)

Occurrence.—At locality 329 (University of Washington Palaeontological Collection) west bank of the Cowlitz River near Vader, Lewis County, Section 28, Township 11 North, Range 2 West.

CREPIDULA STILLWATERENSIS n. sp.

Plate XI, Figure 24

Description.—Shell large and globose; whorls two, smooth; anterior end rising abruptly and only slightly convex on top; spire not twisted; apex situated just above the margin of the shell; body whorl elevated.

Dimensions.—Altitude 15 mm.; width of body whorl 12 mm.; height 10 mm.

Occurrence.—At locality 320 (University of Washington Palaeontological Collection) on the south bank of Stillwater Creek, below the graveyard, about one and one-fourth miles from Vader, Lewis County, Section 30, Township 11 North, Range 2 West.

GENUS POLINICES MONTFORT

POLINICES HOTSONI n. sp.

Plate IX, Figures 14, 15

Description.—Shell large; spire short; suture distinct and appressed; whorls four in number; upper surfaces of the whorls slightly rounded to nearly straight; smooth except for lines of growth; body whorl very much elongated; callus thick, sometimes nearly covering the umbilical opening; umbilicus narrow and deep; aperture oblong.

This species is characterized by having the body whorl strikingly elevated with an elongate rather narrow aperture.

Named in honor of Professor Hotson of the Botany Department, University of Washington.

Dimensions.—Altitude 25 mm.; width of body whorl 20 mm.; apical angle 97°.

Occurrence.—At locality 370 (University of Washington Palaeontological Collection), Scattagrece Falls, Cowlitz County, Southeast quarter Section 18, Township 9 North, Range 2 West.

GENUS SINUM BOLTEN

SINUM OCCIDENTIS n. sp.

Plate XI, Figures 8, 26

cf. *Naticina obliqua* Dickerson, 1915, Cal. Acad. Sci., Fourth Series, vol. V, No. 3, pl. 5, fig. 5a, b. Not *Naticina obliqua* Gabb 1864.

Description.—Shell large, depressed, body whorl spreading, spire low; suture appressed; aperture distended; whorls three, sculptured by numerous, spiral striae of equal prominence; interspaces about equal to the width of the striae; basal portion of the body whorl smooth except for the lines of growth crowding at the umbilical area; umbilicus slight.

This shell is very much like the figure of *Naticina obliqua* Dickerson, both in size and sculpture. *N. obliqua* Gabb is figured as much too elevated to be either our specimen or that from the California collection of Washington material. There is no tendency shown on *S. occidentis* for alternation in size of the spiral ribs as described by Gabb.

Dimensions.—Altitude 8 mm.; length of body whorl 15 mm.; width of body whorl 12 mm.

Occurrence.—At locality 319 (University of Washington Palaeontological Collection) McClarety ranch on south bank of Stillwater Creek, one mile west of Vader, Lewis County, Section 30, Township 11 North, Range 2 West.

GENUS HYDROBIA HARTMANN

HYDROBIA PONTIS n. sp.

Plate XI, Figures 9, 11

Description.—Shell small and fragile; sub-conic; whorls about six, regularly increasing; suture distinct; whorls angulated medially, the upper portion of the whorl sloping at an angle of 45°, the lower half of the whorl at an angle of 20°; growth lines prominent, crossed by fine, revolving striae, of which the medial are the most pronounced; the shell has a nacreous luster; aperture ovate or quadrate; umbilicus minute.

This little shell is very abundant, occurring in masses in a coarse sandstone.

Dimensions.—Altitude 9 mm.; width of body whorl 4 mm.

Occurrence.—At locality 315 (University of Washington Palaeontological Collection) at dam just below the railroad bridge at Vader, Lewis County, on the west bank of the Olequah Creek, about one-third of a mile below its junction with the Stillwater, Section 32, Township 11 North, Range 2 West.

GENUS TURRITELLA LAMARCK

TURRITELLA UVASANA CONRAD VAR.

Plate XII, Figure 17

Turritella uvasana Conrad, 1885, Pac. R.R. Rept., Vol. 5, p. 321, pl. II, fig. 12.
Turritella uvasana Gabb, 1864, Geol. Sur. Cal. Pal, Vol. I, p. 134, pl. 21, fig. 92.

Original Description.—"Subulate, whorls with the sides straight and oblique above,

rounded below, and having revolving striae with intermediate minute lines; striae near the suture on the upper part of the whorls finer than the prominent lines below."

The illustration of Conrad's type shows a greater uniform convexity than that described. Gabb's figure shows the whorls to be less rounded. Conrad did not mention the number of revolving ribs but six or seven are represented on his illustration. The Washington specimen is more like the figure of Gabb in the less convexity of the whorls. Nine revolving ribs are present with wide interspaces containing intervening striae.

Dimensions.—Altitude 110 mm.; width of body whorl 19 mm.

Occurrence.—At locality 329 (University of Washington Palaeontological Collection) at bend in Cowlitz River near Vader, Lewis County, Section 28, Township 11 North, Range 2 West.

Turritella olequahensis n. sp.

Plate XII, Figure 15

Description.—Shell large; whorls 14 or 15; sides of the whorls straight with an abrupt, deep excavation just above the suture; suture linear; surface sculptured with six, prominent revolving ribs which are equal in size and have interspaces three times the width of the rib; interspaces with fine, intervening striae; growth lines prominent, very convex, sloping from the suture at an angle of 25° as far as the middle portion of the whorl then passing to the suture below at an angle of 30°.

Dimensions.—Approximate altitude of shell 120 mm.; width of lower whorl 16 mm.

Occurrence.—At locality 329 (University of Washington Palaeontological Collection) at bend of the Cowlitz River near Vader, Lewis County, Section 28, Township 11 North, Range 2 West.

Turritella washingtoniana n. sp.

Plate XI, Figures 13, 14, 16

Description.—Shell medium in size and conical in outline; whorls many, straight to very slightly concave, sloping from the suture about four-fifths of the length of the whorl to the base where it makes a sharp angle; surface below the angle beveled; suture moderately deep, appressed surface of the shell sculptured with six, equal prominent revolving ribs on each whorl with interspaces

equal to three times the width of the ribs; finer spiral lines occur on the beveled area and in the interspaces; on the first eight or ten whorls of the shell, the lower two revolving ribs are enlarged making a bicarinate sculpture; on the succeeding two or three whorls the three lower revolving ribs may be enlarged while the remaining whorls will have the six revolving ribs of equal prominence. Illustrations have been given to show the rib development. (Plate XI, Figures 13, 14, 16). Figures 13 and 14 are specimens of apical whorls which show the bicarinate condition. Figure 16 is a specimen with both the apical and lower whorls present. The change from the bicarinate through the tricarinate condition to the uniform size of all the ribs is illustrated.

This species has the same number of revolving ribs as *T. olequahensis* n. sp. but differs from that species in the sides of the whorls being more oblique, and the shell smaller. The ribs are sharper with the interspaces more concave. The change in the prominence of the revolving ribs from the apex to the lower whorls may be seen in many Turritellas. Specimens have not been found as yet which can be definitely stated to be the apical whorls of the other species described from the Cowlitz locality so that a comparison can not be made.

Dimensions.—Approximate altitude of shell 45 mm.; width of lower whorl 8 mm.; apical angle 18°.

Occurrence.—At locality 329 (University of Washington Palaeontological Collection) at bend in Cowlitz River near Vader, Lewis County, Section 28, Township 11 North, Range 2 West.

Turritella vaderensis n. sp.

Plate X, Figure 19

Description.—Shell large; sides of the whorls straight; suture very appressed; first revolving rib above the suture very sharp and protruding, below this rib the surface is beveled to concave and contains two fine revolving threads with finer, microscopic striae; in the area above the lower, pronounced or primary rib, between the rib and the suture above, there are two revolving ribs of secondary size; these ribs are smaller than the first but are still prominent and tend to become nodose; between the lower secondary and the primary rib below, there are two spiral threads, between which are finer, spiral lines; between the secondary ribs, as well as between the upper secondary rib and the suture, there is a finer spiral rib or thread; the finer ribs are minutely nodose.

Dimensions.—Width of median whorl 10 mm.

Occurrence.—At locality 329 (University of Washington Palaeontological

Collection)at bend in Cowlitz River near Vader, Lewis County, Section 28, Township 11 North, Range 2 West.

TURRITELLA VADERENSIS n. sp. var. KINCAIDI n. var.

Plate X, Figure 17

Description.—Shell large; number of whorls unknown; sides of the whorls straight; suture distinct, linear; surface ornamented with revolving ribs of unequal size; revolving rib on the lower portion of the whorl above the suture prominent and rounded; area below this rib and the suture excavated; between the primary rib and the suture above there are two revolving ribs of secondary size between which are smaller yet distinct revolving ribs; between the revolving ribs there are microscopic revolving striae; the ribs have the tendency to become delicately nodose; growth lines fine, very convex, swinging from the suture at an angle of 20° to the middle of the whorl and passing to the suture below at the same angle.

The revolving ribs and threads of this shell have the same arrangement and gradation in size as that of *T. vaderensis* n. sp. with the same tendency to become nodose. It differs from that species in a more rounded condition of the lower portion of each whorl, with the large, lower, revolving rib wider and rounded. All the revolving ribs are heavier and less delicately formed. This may be due to an older condition of growth.

Named in honor of Professor Trevor Kincaid of the Zoology Department, University of Washington.

Dimensions.—Width of median whorl 11 mm.

Occurrence.—At locality 329 (University of Washington Palaeontological Collection) at bend in Cowlitz River near Vader, Lewis County, Section 28, Township 11 North, Range 2 West.

GENUS ERATOPSIS HOERNES AND AURINGER 1880

ERATOPSIS CRESCENTENSIS n. sp.

Plate XI, Figures 10, 22

Description.—Shell small, ob-ovate; spire concealed; columella region attenuated; slight canal; aperture narrow; outer lip thickened, crenulated internally; surface ornamented by spiral ribs which anastomose in the dorsal region;

along the mid-dorsal line, the ribs are interrupted more or less by a shallow groove.

The sculpture of this shell is *Trivia*-like, but the anterior attenuation is not distinctive of that genus. Dr. Dall has kindly examined this form and pointed out its position in the genus *Eratopsis* Hoernes and Auringer. The type of that genus is *E. Barrandei* from the Miocene of Italy. (Abhand. der K. K. Geol. Reich. Band XII, Heft I, p. 63, pl. VIII, Fig. 8, 9, 10). Cossmann has figured *E. crenata* Deshayes from the Eocene of the Paris Basin. (Essais Comparrée p. 183, pt. V, pl. IX, figs. 16-17, 1903).

E. crescentensis n. sp. shows a greater constriction of the anterior region than that of the type of the genus.

Dimensions.—Altitude 6 mm.; width 4 mm.

Occurrence.—At locality 358 (University of Washington Palaeontological Collection) at Joice station, one-fourth of a mile east of Tongue Point, Port Crescent, Clallam county, Section 22, Township 31 North, Range 8 West.

GENUS GALEODEA LINK

GALEODEA TUBERCULATA (Gabb) var. CRESCENTENSIS n. var.

Plate XI, Figures 18, 20

Description.—Shell of medium size, spire acute; whorls six; suture appressed; canal short, reflected; callus thin, spreading; three small plications on the anterior end of the columella; aperture elongate, outer lip thickened with a groove along the interior of the margin; two rows of parallel tubercles on the body whorl, whorls of the spire also tuberculated with small tubercles which occur in two faint rows; entire surface of the shell sculptured by revolving, flat, imbricating ribs.

This shell is like *G. tuberculata* (Gabb) in general shape and the number of rows of tubercles. It is a smaller shell and carries the tubercles on the whorls of the spire, which character is not shown on the figure of Gabbs specimen. There is no indication of a vatrix on *G. crescentensis* nor is the outer lip crenulated. This may be due to a worn condition of the shell. The outer lip of *G. crescentensis* has a characteristic groove along the inner margin, which is not noted in the other forms.

Galeodea tri-tuberculata (Weaver) from the Cowlitz fauna has three rows of tubercles constant even in young specimens. It is a stouter form, the callus heavier and the canal longer and more strongly reflected. The sculpture of *G. tri-tuberculata* consists of alternating, large and small, raised revolving lines.

The striations in *crescentensis* are uniform in size and arranged in an overlapping manner which is distinctive. Figures 23, 27, plate XI are given of *G. tri-tuberculata* for comparison.

Dimensions.—Altitude 16 mm.; width of body whorl 11 mm.; apical angle 87°.

Occurrence.—At locality 358 (University of Washington Palaeontological Collection) at Joice station ,one-fourth of a mile east of Tongue Point Railroad, Port Crescent, Clallam County, Section 22, Township 31 North, Range 8 West.

GENUS COMINELLA GRAY

COMINELLA EOCENIA (Weaver)

Plate XII, Figures 5, 6

Nassa eocenica Weaver, 1912, Bull. 15, Wash. Geol. Sur., p. 42, pl. III, f. 32.

Amphissa eocenica Dickerson, 1915, Proc. Cal. Acad. of Sci., Fourth Series, vol. 5, No. 3, pl. 8, f. 6 a, b, c.

Original Description.—"Shell small and fusiform; spire moderately high; whorls eight and convex, last two on apex smooth, rounded and without ornamentation; upper portion of each whorl surrounded by a deep depression, above which a low collar extends upward to the suture; suture distinct. Surface of shell ornamented by eighteen longitudinal ribs which are very distinct on the spire but faint on the body whorls; they begin at the suture and extend the length of the whorls with the exception of the body whorl where they disappear a short distance below the convex portion; body whorl sculptured by eleven very prominent revolving ribs; alternating with these are eleven less prominent revolving lines and on either side of each of which is a fine but distinct revolving thread. Sculpture similar on the spire. Canal short and fairly strongly recurved; aperture moderately narrow and tapering towards the end of the canal; inner lip slightly incrusted; outer lip crenulated.

Dimensions.—Altitude 18 mm.; diameter 10 mm.; altitude of spire 6 mm.; angle of spire 57°

Occurrence.—Very common at Locality No. 1 (University of Washington Palaeontological Collection) one and one-half miles east of Sopenah (Little Falls) in bank of Cowlitz River, Lewis County, Sec. 27, T. 11 N., R. 2 W.

Horizon.—Cowlitz formation, Upper Eocene."

The presence of the posterior sinus as well as the other characters of the shell places this species in the genus *Cominella* as typified by the recent species *Buccinum porcatum* Gmelin. Just below the collar on *eocenica* there is a deep groove which causes the lower bordering, spiral rib to become slightly nodose.

This species has also been found at localities 329 (type) 323, 324, and 337 (University of Washington Palaeontological Collection) in the vicinity of Vader, Lewis County.

GENUS UROSALPINX STIMPSON

UROSALPINX MERRIAMI n. sp.

Plate XI, Figure 15

Description.—Shell of medium size; whorls five and convex; suture appressed; surface decorated with prominent, revolving ribs possessing a width about equal to the interspaces; within the interspaces there are interstitial riblets; over the surface of the shell there are wide, rounded, radiating ridges, the exact number and extent can not be determined, the species being described from one worn specimen. Canal short, twisted outer lip dentate; aperture sub-oval; a slight umbilicus present.

Named in honor of Dr. J. C. Merriam, president of the Carnegie Institution of Washington.

Dimensions.—Altitude 17 mm.; width of body whorl 9.5 mm.; apical angle 50°.

Occurrence.—At locality 336 (University of Washington Palaeontological Collection) on Coal Creek, Cowlitz County, about one-fourth mile above old dam, Section 10, Township 8 North, Range 3 West.

GENUS FICOPSIS CONRAD

FICOPSIS REMONDII (Gabb) var. CRESCENTENSIS n. var.

Plate XI, Figure 14

Description.—Shell medium in size, fusiform and slender; spire low; whorls four and angulated at the middle; body whorl tri-carinated; canal long; aperture wide and elongate; surface ornamented with delicate longitudinal ribs which are crossed by spiral ribs of the same size and character which give the shell a cancellated sculpture.

This form has the same type of cancellated ornamentation as *Ficopsis remondii* Gabb as well as a similar shape and character of the aperture. It differs from *F. remondii* in the pronounced tri-carination of the body whorl. Gabb mentions that on some specimens of *F. remondii* three faint angles may be seen. *F. crescentensis* has that character definitely developed.

This variety is like *F. hornii* Gabb and *F. cowlitzensis* Weaver in the triangulation of the body whorl but lacks the nodose character of the ribs.

Dimensions.—Altitude 17 mm.; width of body whorl 10 mm.; angle of spire 60°.

Occurrence.—At locality 358 (University of Washington Palaeontological Collection) Joice station, one-fourth of a mile east of Tongue Point Railroad, Port Crescent, Clallam County, Section 22, Township 31 North, Range 8 West.

GENUS HARPA LAMARCK

HARPA CRESCENTENSIS n. sp.

Plate XI, Figure 21

Description.—Shell small and globose; whorls five, apex minute; body whorl inflated; spire short, whorls broad and rounded; suture distinct slightly impressed; inner lip smooth, canal moderately elongate, slightly notched at the anterior end; aperture oblong; surface of the body whorl ornamented with sharp, lamellar, curved, longitudinal ribs with interspaces equal to about three times the width of the ribs; the longitudinal ribs extend from the suture line to the lower portion of the whorl where they curve and fold into the callus on the columella; the longitudinal ribs are present but only faintly developed on the whorls of the spire; faint, revolving striae occur on the upper portion of the body whorl which on the lower region of the shell become conspicuous, these ribs are separated by spaces about twice the width of the rib.

In generic classification this species is nearest to the group of *Harpa* represented by *Harpa mutica* Lamarck of the Eocene of the Paris Basin.

Dimensions.—Length 6 mm.; width of body whorl 3.5 mm.; apical angle 65°,

Occurrence.—At locality 358 (University of Washington Palaeontological Collection) at Joice station, one-fourth of a mile east of Tongue Point Railroad, Port Crescent, Clallam County, Section 22, Township 31 North, Range 8 West.

GENUS ADMETE KROYER

SUBGENUS BONELLITIA JOUSSEAUME

ADMETE (BONELLITIA) STANTONI (DICKERSON)

Plate XI, Figures 1, 5

Cancellaria stantoni Dickerson, 1913, Univ. Cal. Pub., Geol., vol. 7, No. 12, p. 282, pl. 12, fig. 2 a, b; Dickerson, 1915, Proc. Cal. Acad. Sci., Fourth Series, vol. V, No. 3, p. 49.

Original description.—"Shell, small, with five whorls, the first two, turbinate, smooth; the third whorl is cancellated by ten or twelve ribs. About every fourth rib is enlarged. These heavy ribs are well rounded on the fourth and fifth whorls and are more oblique than those on the third. They extend from an indistinct, irregular suture over the entire whorl. Strong revolving ribs with finer riblets also decorate this beautiful little shell. Mouth, sub-oval; outer lip thickened, rounded, and crenulated on interior. Columella marked by three strong plaits, the posterior one being the strongest. Canal short and very slightly notched.

Dimensions.—Length, 12 mm.; width of body-whorl, 6 mm."

The type locality of this species is on the west side of Marysville Buttes, California (University of California, Locality 1853). Dr. Dickerson also states that a specimen was found near Fort Tejon, California, and he later lists it from south of Mount Diablo, the Coalinga District, and San Diego.

In Washington it occurs abundantly at locality 329, on the Cowlitz River, and also from several other localities in the western part of the state.

After careful examination, the specimens from Washington appear to be the same as the California species. The majority of the northern specimens attain a larger size than that given for the type in California. The adult specimens have from 10 to 12 longitudinal ribs on the body whorl. The younger and more immature shells possessing an average altitude of 10 mm. have from 14 to 16 longitudinal ribs on the body whorl. These ribs on the younger forms are not as well developed in size and character as on the more mature specimens. Every fourth rib may or may not become enlarged into a varix. Other characters are as described by Dickerson for the species *stantoni.*

As far as the details of the shell are concerned *A. stantoni* shows a very close resemblance to *Admete evulsa* (Solander) from the Bartonian of England, and the Paris Basin. Illustration Pl. XI fig. 7 has been inserted for comparison. The nearest noticeable difference between the two species is the absence in *A. evulsa* of finer, interstitial threads between the larger revolving ribs.

A comparison made with specimens of *Admete tortiplica* (Conrad) in the Paleontological collections at Cornell University from the Sabine Eocene of Wood's Bluff, Alabama, show somewhat a close relationship. *A. tortiplica* shows considerable variation in the sculpture of the revolving ribs and threads. Some possess the ribs without the intervening threads as in the case of *A. evulsa,* while other specimens have the threads well developed as in the case of *A. stantoni.* The sculpture on *A. tortiplica* is much stronger and sharper than on *A. evulsa* or *A. stantoni* and the whorls are less ventricose.

Dimensions.—Altitude 18 mm.; width of body whorl 10 mm.; apical angle 55°. (Measurements taken on a large specimen.)

Occurrence.—At locality 329 (University of Washington Palaeontological Collection) west bank of Cowlitz River, near Vader, Lewis County, Section 28,

Township 11 North, Range 2 West; locality 321, on Booth ranch, two and one-fourth miles up Stillwater Creek from its junction with the Olequah, Section 25, Township 11 North, Range 2 West; locality 322 on small creek about one-third of a mile from its junction with Brinn Creek, near Vader, Lewis County, Section 24, Township 11 North, Range 2 West; locality 326 on Olequah Creek about one-half of a mile north of Vader, Lewis County, Section 29, Township 11 North, Range 2 West. (*Specimen figured from 329.*)

GENUS GEMMULA WIENKAUFF

GEMMULA FASTENI n. sp.

Plate XII, Figure 1, 4

Turris New species Dickerson Cal. Acad. Sci., Fourth Series, Vol. V, No. 3, pl. 10, f. 5.

Description.—Shell small and slender; whorls nine; nuclear whorls three, smooth; suture appressed; whorls angulated by a central, spiral carina which is formed by two close, fine, revolving ribs upon which occur numerous delicate nodes. The whorls of the spire carry about three spiral ribs below the carina and about five or six above, the body whorl has from 10 to 12 ribs below the carina; longitudinal sculpture consists only of growth striae, the sinuosity of which occurs at the carina, in the middle region of the whorl; canal short; aperture sub-ovate.

Named in honor of Dr. Nathan Fasten, professor of Zoology in the Oregon Agricultural College, at Corvallis, Oregon.

Dimensions.—Altiude 12 mm.; width of body whorl 4 mm.

Occurrence.—At locality 329 (University of Washington Palaeontological Collection) at bend of the Cowlitz River, near Vader, Lewis County, Section 28, Township 11 North, Range 2 West.

GENUS CLATHRODRILLIA DALL

SUBGENUS MONILIOPSIS CONRAD

CLATHRODRILLIA (MONILIOPSIS) FRYEI n. sp.

Plate XI, Figure 25

Description.—Shell small and slender with seven whorls, the last two of which are smooth; sides of whorls nearly straight but slightly concave at the

suture; canal short, wide; aperture subovate; suture appressed; sutural band on the upper portion of whorl bounded below by a depression; the sutural sinus, formed by the lines of growth, makes at the lower margin of the sutural band a reentrant curve at an angle of approximately 50°; whorls decorated by seven revolving lines, with 19 on the body whorl; the spiral lines are crossed by 12 or 13 longitudinal ribs which follow the curves of the growth lines, these ribs continue over the length of the whorls of the spire but are only slightly developed on the body whorl, becoming obsolete on the lower region of that whorl.

The sculpture of this shell is more like that of some of the recent West Coast species which Dr. Dall calls *Moniliopsis* than like that of the Eocene type *Pleurotoma elaborate* Conrad which is beautifully and profoundly cancellated. In shape, position of the sinus of the longitudinal striae, and the character of the aperture and canal, *fryei* has the characteristics of typical *Moniliopsis.*

Named in honor of Dr. T. C. Frye of the Botanical Department of the University of Washington.

Dimensions.—Altitude 7.5 mm.; width of body whorl 2 mm.

Occurrence.—At locality 329 (University of Washington Palaeontological Collection), at bend in the Cowlitz River, near Vader, Lewis County, Section 28, Township 11 North, Range 2 West.

GENUS CONUS LINNEAUS

CONUS VADERENSIS n. sp.

Plate XII, Figures 7, 8

Conus hornii Weaver, 1912, Wash. Geol. Sur., Bull. 15, pl. 11, fig. 17; not *Conus hornii* Gabb, 1864.

Conus remondii Dickerson, 1915, Proc. Cal. Acad. Sci., vol. V, No. 3, pl. 11, fig. 7; not *C. remondii* Gabb, 1864.

Description.—Shell of medium size, biconical; whorls four to five with three to four smooth, apical whorls which are very pointed; suture appressed; area between the suture and the shoulder of the whorls concave and sculptured with fine, curved striae; shoulder decorated with 16 or 18 nodes; body whorl covered with revolving, microscopically, raised ribs crossed by longitudinal lines. The spiral ribs or lines are better developed on the posterior region of the whorl; aperture long and narrow with parallel sides.

This shell is close to *C. remondii* Gabb. Gabb states that the sides of the whorls are straight and regularly conical. His illustration bears out this characteristic. The sides of the whorls of *C. vaderensis* are concave. The general

appearance of this species is somewhat similar to *C. cowlitzensis* Weaver, but the spire of both young and mature individuals of *C. vaderensis* is only about one-half that of *C. cowlitzensis.* The former possesses also a characteristically greater diameter.

Dimensions.—Altitude of shell 29 mm.; width of body whorl 12 mm.; apical angle 60°.

Occurrence.—At locality 329 (University of Washington Palaeontological Collection) at bend of Cowlitz River, near Vader, Lewis County, Section 28, Township 11 North, Range 2 West.

GENUS GONIOBASIS LEA

GONIOBASIS HANNIBALI n. sp.

Plate XII, Figures 2, 3

Description.—Shell medium, thin and polished; elongate-conic in shape; whorls probably eight, specimens usually broken at fourth or fifth whorl; sides of the whorls very slightly convex; suture linear; aperture subovate, produced below, not sinuated but widely united at the anterior end. Surface ornamented with from sixteen to twenty vertical ridges or plications which are developed in parallel waves over all the whorls; crossing the longitudinal ribs there are usually six spiral lines or ribs with interspaces half their width; at the intersection of the vertical and spiral ribs fine nodes are produced which give the longitudinal ridges a beaded appearance; the vertical riblets do not continue over the basal portion of the body whorl, that region ornamented by spiral lines only.

The decoration of this shell is extremely variable. The extreme form in sculpture has been taken for the type of the species. *Goniobasis olequahensis* (Arnold and Hannibal) represents the smooth type of shell. A large amount of material collected of this species contains specimens of all stages of sculptural development. The smooth shells reveal on the lower whorls only fine wavy, oblique lines; many shells have oblique, longitudinal, plications on the nuclear whorls which may be absent on the lower whorls. The occurrence of the spiral ribs is not definite, they may occur on one whorl and not on the others; they may be present on the upper portion of a whorl or whorls, or they may occur only on a portion of one or several whorls. The occurrence of the spiral band or line just below the suture is not a constant character, and on the lower portion of the body whorl there may or may not be a set of spiral lines. The figured specimens of this species (Pl. XII Figs. 2, 3) illustrate a difference in sculpture. The collection contains specimens which show transition stages between the two types of shell as illustrated.

Pachychilus drakei Arnold and Hannibal has the pattern of sculpture similar to that of this form, but the plications in that species are fewer. Arnold and Hannibal's species were collected at the same locality as *G. hannibali* n. sp.

This species as well as *Ambloxus olequahensis* Arnold and Hannibal has been determined by Dr. H. A. Pilsbry as belonging to the genus *Goniobasis* of the group *G. plicifera* Lea.

Dimensions.—Altitude 18 mm. (measurements taken of 5 whorls); width of body whorl 7 mm.

Occurrence.—At localities 315, 316, and 317 (University of Washington Palaeontological Collection) on Olequah Creek, near Vader, Lewis County, Section 20, Township 11 North, Range 2 West.

GONIOBASIS OLEQUAHENSIS n. sp.

Plate XI, Figure 13

Description.—Shell small and elongate; whorls five or six; whorls rounded; suture distinct, appressed; surface ornamented with eleven longitudinal, prominent ribs with interspaces three times the width of the ribs; the ribs are curved and increase in size at the middle point of the whorl where they tend to become pointed; on the whorls of the spire the longitudinal ridges may be crossed just above the suture with one prominent revolving rib; on the body whorl there are about eight pronounced revolving ribs which occur on the lower half of the whorl and extend to the base of the whorl; aperture ovate, entire; fine microscopic growth lines may be seen between the longitudinal ridges.

Dimensions.—Altitude 9 mm.; width of body whorl 4 mm.

Occurrence.—At locality 315 (University of Washington Palaeontological Collection) at the dam below railroad bridge on Olequah Creek about one-third of a mile below the junction of Olequah and Stillwater Creeks, near Vader, Lewis County, Section 32, Township 11 North, Range 2 West.

EXPLANATION OF PLATE VIII

All figures approximately natural size unless otherwise stated

Fig. 1. *Arca columbiana* n. sp. ---------- p. 8

Fig. 2. *Glycymeris kelsoensis* n. sp. ---------- p. 11

Fig. 3. *Cardium oldroydi* n. sp. ---------- p. 20

Fig. 4. *Barbatia landesi* n. sp. ---------- p. 9

Fig. 5. *Glycymeris sagittata* Gabb var. *dickersoni* n. var ---------- p. 10

Fig. 6. *Barbatia suzzalloi* n. sp. ---------- p. 8

Fig. 7. *Modiolus columbianus* n. sp. ---------- p. 17

Fig. 8. *Acila stillwaterensis* n. sp. x 5 ---------- p. 6

Fig. 9. *Barbatia cowlitzensis* n. sp. ---------- p. 9

Fig. 10. *Glycymeris crescentensis* n. sp. x 2 ---------- p. 11

Fig. 11. *Cardium oldroydi* n. sp. ---------- p. 20

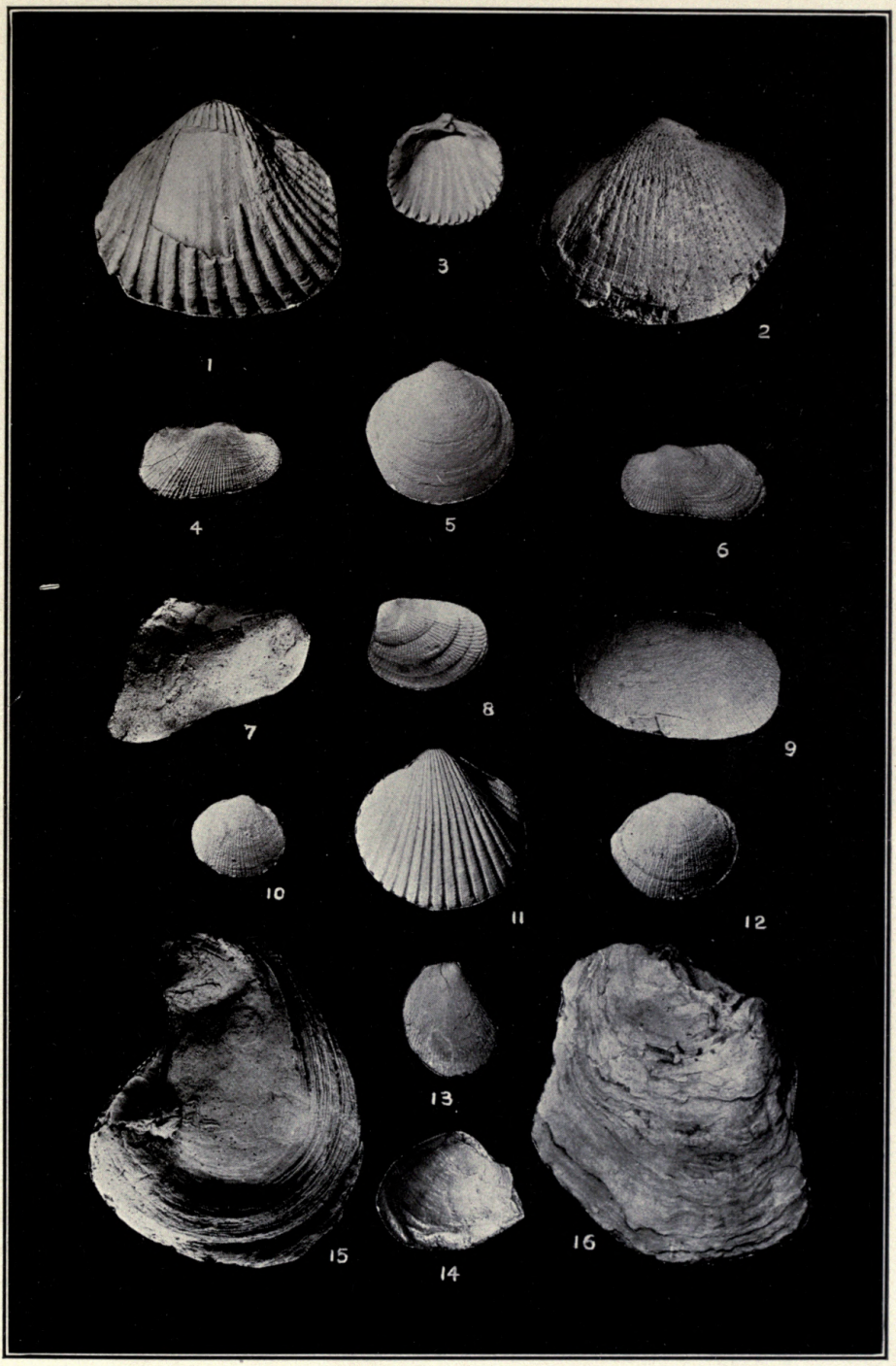
Fig. 12. *Glycymeris crescentensis* n. sp. x2 ---------- p. 11

Fig. 13. *Lima packardi* n. sp. x 5 ---------- p. 14

Fig. 14. *Corbula stillwaterensis* n. sp. ---------- p. 25

Fig. 15. *Ostrea columbiana* n. sp., Locality 340 ---------- p. 13

Fig. 16. *Ostrea columbiana* n. sp., Locality 325 ---------- p. 13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EXPLANATION OF PLATE IX

All figures approximately natural size

Fig. 1. *Crassatellites stillwaterensis* n. sp.----p. 18

Fig. 2. *Crassatellites stillwaterensis* n. sp.----p. 18

Fig. 3. *Modiolus olequahensis* n. sp.----p. 15

Fig. 4. *Venericardia clarki* n. sp. Young specimen----p. 19

Fig. 5. *Venericardia clarki* n. sp.----p. 19

Fig. 6. *Phaenomya vaderensis* n. sp.----p. 26

Fig. 7. *Phaenomya vaderensis* n. sp.----p. 26

Fig. 8. *Phaenomya vaderensis* n. sp.----p. 26

Fig. 9. *Corbula dickersoni* n. sp.----p. 24

Fig. 10. *Corbula dickersoni* n. sp.----p. 24

Fig. 11. *Psammobia olequahensis* n. sp.----p. 23

Fig. 12. *Psammobia olequahensis* n. sp.----p. 23

Fig. 13. *Mytilus stillwaterensis* n. sp.----p. 15

Fig. 14. *Polinices hotsoni* n. sp.----p. 32

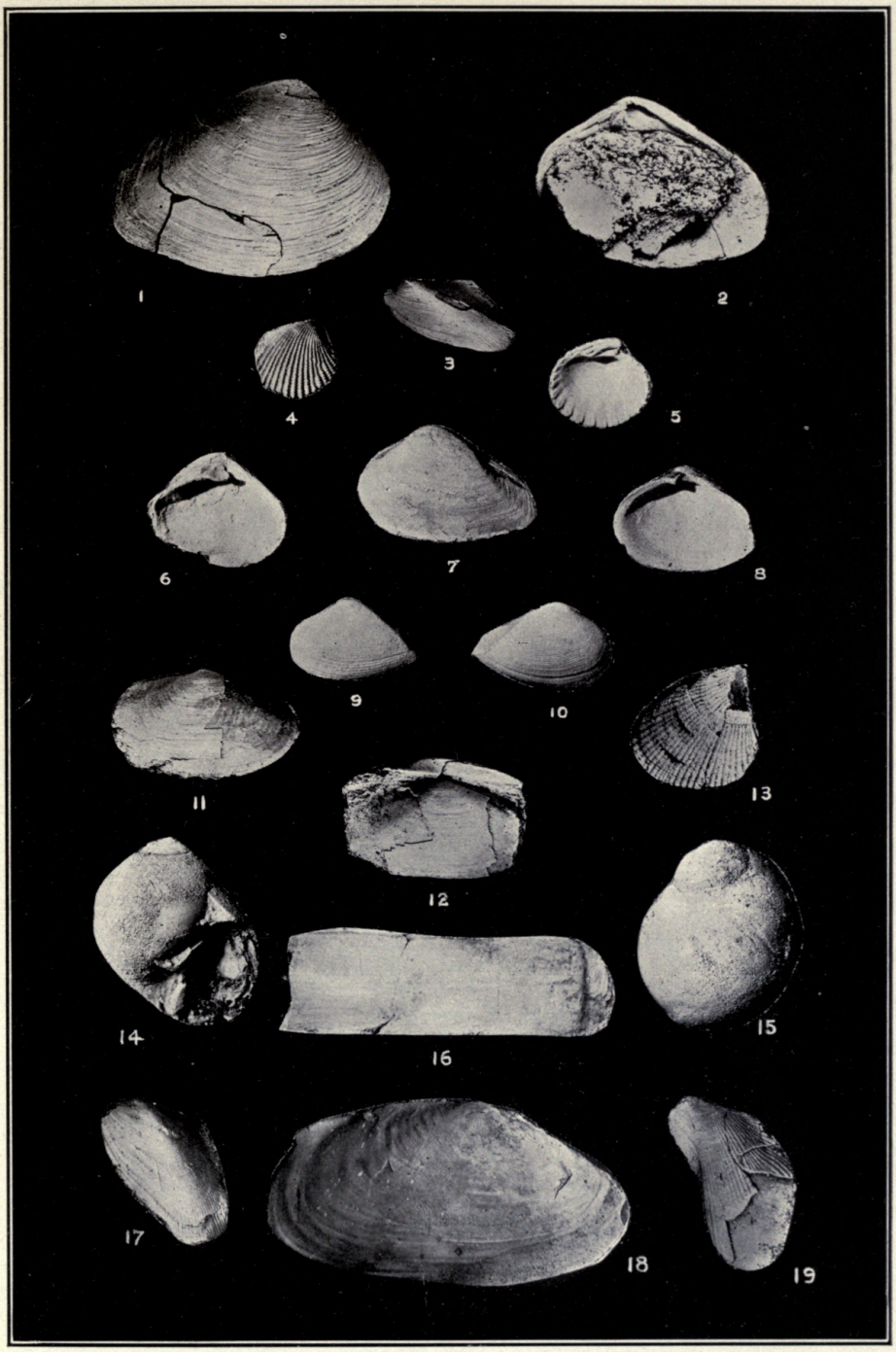
Fig. 15. *Polinices hotsoni* n. sp.----p. 32

Fig. 16. *Solen clarki* n. sp.----p. 23

Fig. 17. *Modiolus olequahensis* n. sp.----p. 15

Fig. 18. *Psammobia cowlitzensis* n. sp.----p. 22

Fig. 19. *Modiolus cowlitzensis* n. sp.----p. 16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EXPLANATION OF PLATE X

All figures approximately natural size unless otherwise stated

Fig. 1. *Macrocallista williamsoni* n. sp.----------p. 21

Fig. 2. *Yoldia duprei* n. sp.----------p. 7

Fig. 3. *Solen columbianus* n. sp.----------p. 24

Fig. 4. *Leda cowlitzensis* n. sp.----------p. 6

Fig. 5. *Pteria clarki* n. sp.----------p. 12

Fig. 6. *Pitaria stocki* n. sp. ----------p. 20

Fig. 7. *Yoldia duprei* n. sp. ----------p. 7

Fig. 8. *Venericardia clarki* n. sp. x 2 ----------p. 19

Fig. 9. *Venericardia crescentensis* n. sp. x 2 ----------p. 19

Fig. 10. *Anodonta arnoldi* n. sp. ----------p. 14

Fig. 11. *Macrocallista williamsoni* n. sp. ----------p. 21

Fig. 12. *Pteria clarki* n. sp. ----------p. 12

Fig. 13. *Modiolus kelsoensis* n. sp. ----------p. 17

Fig. 14. *Pitaria eocenica* n. sp. ----------p. 20

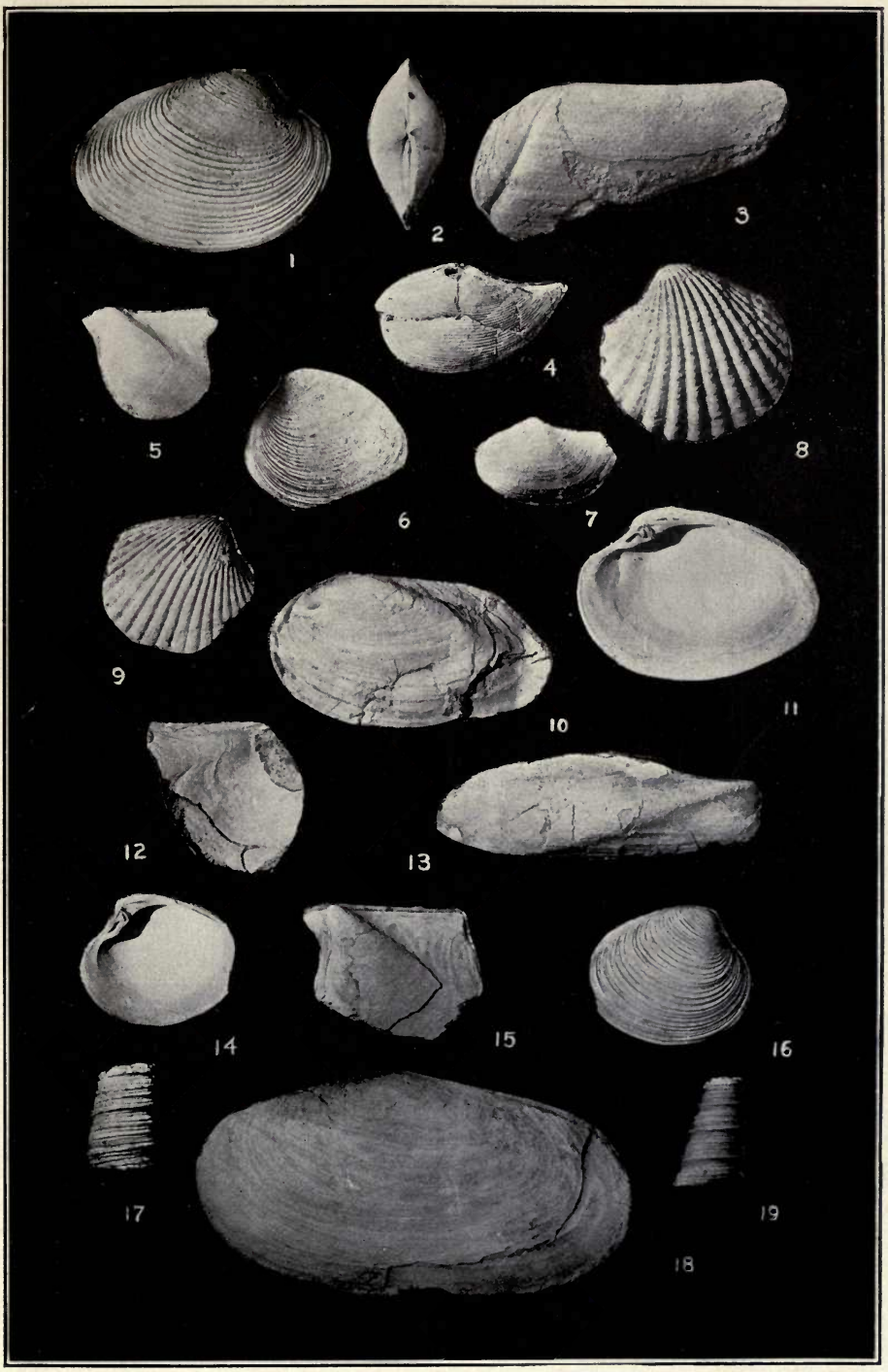
Fig. 15. *Pteria clarki* n. sp. ----------p. 12

Fig. 16. *Pitaria eocenica* n. sp. ----------p. 20

Fig. 17. *Turritella vaderensis* n. sp. var. *kincaidi* n. var.----------p. 36

Fig. 18. *Psammobia columbiana* n. sp. ----------p. 22

Fig. 19. *Turritella vaderensis* n. sp. ----------p. 35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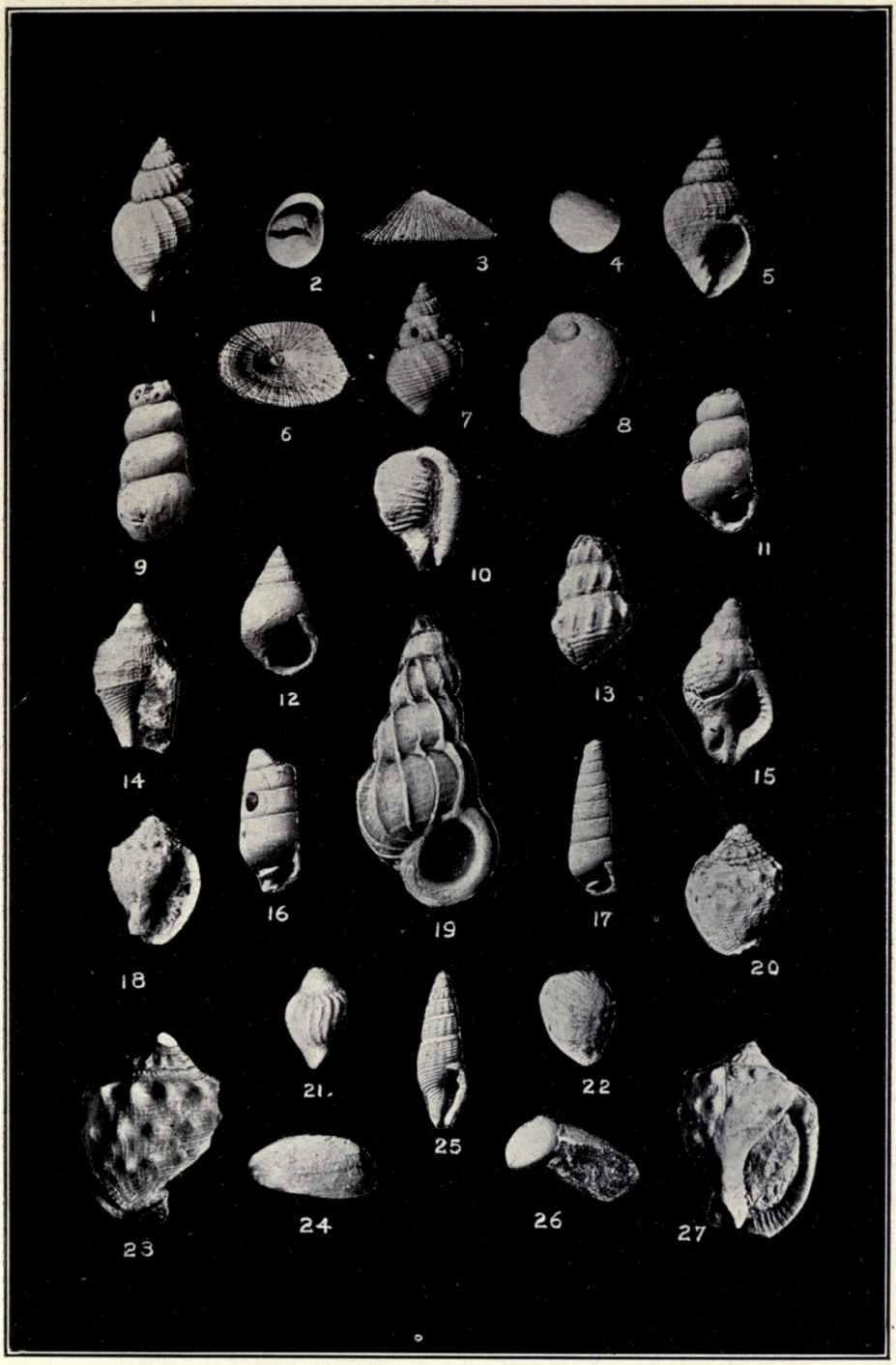
EXPLANATION OF PLATE XI

All figures approximately natural size unless otherwise stated

Fig. 1. *Admete stantoni* (Dickerson) ---- p. 40
Fig. 2. *Crepidula dickersoni* n. sp. ---- p. 31
Fig. 3. *Fissuridea stillwaterensis* n. sp. ---- p. 27
Fig. 4. *Nerita washingtoniana* n. sp. x 3 ---- p. 28
Fig. 5. *Admete stantoni* (Dickerson) ---- p. 40
Fig. 6. *Fissuridea stillwaterensis* n. sp. Apical view ---- p. 27
Fig. 7. *Admete evulsa* (Solander) Specimen from the Paris Basin. (Cornell University Museum Collection) ---- p. 41
Fig. 8. *Sinum occidentis* n. sp. ---- p. 32
Fig. 9. *Hydrobia pontis* n. sp. x 3 ---- p. 33
Fig. 10. *Eratopsis crescentensis* n. sp. x 3 ---- p. 36
Fig. 11. *Hydrobia pontis* n. sp. x 3 ---- p. 33
Fig. 12. *Littorina mountsoloensis* n. sp. x 2 ---- p. 30
Fig. 13. *Goniobasis olequahensis* n. sp. x 2 ---- p. 45
Fig. 14. *Ficopsis remondii* (Gabb) var. *crescentensis* n. var ---- p. 39
Fig. 15. *Urosalpinx merriami* n. sp. ---- p. 39
Fig. 16. *Syrnola vaderensis* n. sp. x 3 ---- p. 29
Fig. 17. *Syrnola vaderensis* n. sp. x 3 Another specimen ---- p. 29
Fig. 18. *Galeodea tuberculata* Gabb var. *crescentensis* n. var. ---- p. 37
Fig. 19. *Epitonium washingtonensis* n. sp. ---- p. 30
Fig. 20. *Galeodea tuberculata* Gabb var. *crescentensis* n. var. ---- p. 37
Fig. 21. *Harpa crescentensis* n. sp. x 3 ---- p. 40
Fig. 22. *Eratopsis crescentensis* n. sp. x 2 ---- p. 36
Fig. 23. *Galeodea tri-tuberculata* (Weaver) ---- p. 37
Fig. 24. *Crepidula stillwaterensis* n. sp. ---- p. 31
Fig. 25. *Moniliopsis fryei* n. sp. x 3 ---- p. 42
Fig. 26. *Sinum occidentis* n. sp. ---- p. 32
Fig. 27. *Galeodea tri-tuberculata* (Weaver) ---- p. 37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EXPLANATION OF PLATE XII

All figures approximately natural size unless otherwise stated

Fig. 1. *Gemmula fasteni* n. sp. x 2 ---------- p. 42

Fig. 2. *Goniobasis hannibali* n. sp. ---------- p. 44

Fig. 3. *Goniobasis hannibali* n. sp. Smooth specimen ---------- p. 44

Fig. 4. *Gemmula fasteni* n. sp. x 3 ---------- p. 42

Fig. 5. *Cominella eocenica* (Weaver) Specimen from Locality 329 ---------- p. 38

Fig. 6. *Cominella eocenica* (Weaver) Another specimen showing aperture, Locality 329 ---------- p. 38

Fig. 7. *Conus vaderensis* n. sp. ---------- p. 43

Fig. 8. *Conus vaderensis* n. sp. ---------- p. 43

Fig. 9. *Crepidula dickersoni* n. sp. ---------- p. 31

Fig. 10. *Solariella olequahensis* n. sp. x 5 ---------- p. 27

Fig. 11. *Solariella crescentensis* n. sp. x 3 ---------- p. 28

Fig. 12. *Solariella olequahensis* n. sp. x 3 ---------- p. 27

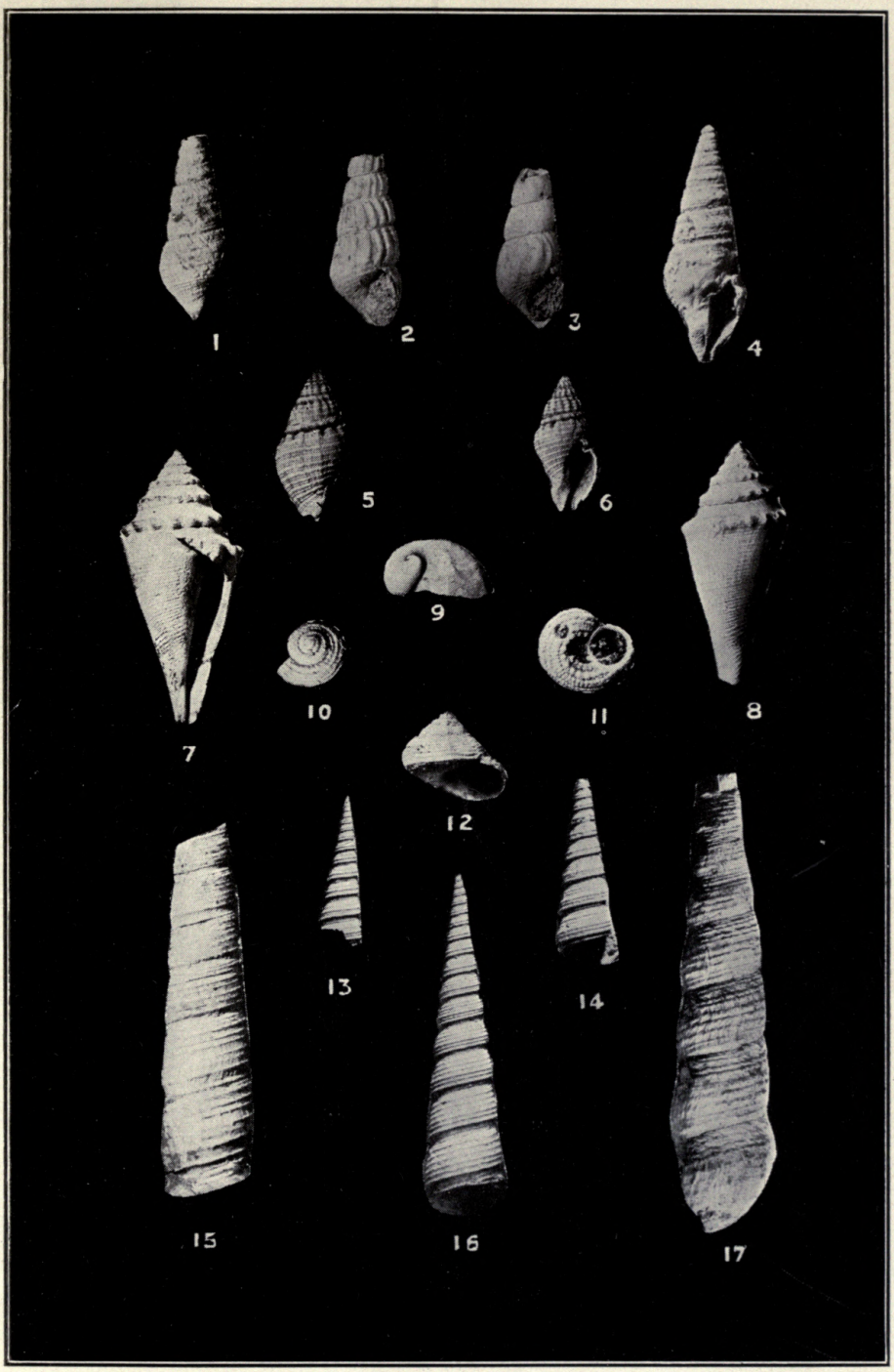
Fig. 13. *Turritella washingtoniana* n. sp. Apical whorls ---------- p. 34

Fig. 14. *Turritella washingtoniana* n. sp. Apical whorls of another specimen ---------- p. 34

Fig. 15. *Turritella olequahensis* n. sp. ---------- p. 34

Fig. 16. *Turritella washingtoniana* n. sp. ---------- p. 34

Fig. 17. *Turritella uvasana* Conrad var. ---------- p. 33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