PLIOCENE AND PLEISTOCENE FOSSILS FROM THE ARCTIC COAST OF ALASKA AND THE AURIFEROUS BEACHES OF NOME, NORTON SOUND, ALASKA.

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INTRODUCTION.

Exploration of the geology of the Arctic and subarctic shores of Alaska began as early as the voyages of Kotzebue and Beechey, in 1816 and 1826, and a detailed report on the vertebrate fossils found there, with a wealth of illustration, was made by Sir John Richardson in 1854, in the "Zoology of the voyage of the *Herald*." Nothing of importance bearing on the Tertiary invertebrates of this region appears in the literature of the nineteenth century, and but little on those of the older formations. A search of the marine sandstone strata on the right bank of the Yukon near Nulato, made by me in 1867 and 1868, disclosed only a few traces of fossils belonging to the genus *Mytilus* and led to the supposition that the age of the deposit might be Tertiary, but later investigations place it in the Mesozoic. While I was in the Coast Survey service in 1880 the Pleistocene deposits in Kotzebue Sound and near Bering Strait previously referred to by Chamisso, Beechey, and Richardson were examined,[1] and numerous vertebrate remains were collected; but, with the exception of a species of *Pisidium*, no invertebrates were found.

With the explorations of F. C. Schrader and W. J. Peters, of the United States Geological Survey, in 1901 [2] the first really systematic geologic reconnaissance of the Arctic coast of Alaska was begun. They described the stratification of the coastal deposits and collected marine invertebrate fossils from them, part of which were submitted to me and determined to be of Pliocene age. A brief summary of the species was prepared for the above-cited report.

When gold was discovered in the beach sands of the north coast of Norton Sound, near Nome, in 1898, attention was attracted to this part of Alaska, and the Geological Survey, represented by A. H. Brooks and F. C. Schrader, began geologic work in the following year, but it was not until 1905 that any invertebrate fossils were received from the region; in that year a small lot of nine species received by F. H. Moffit, from Mr. J. J. V. Beaver, of Nome, were submitted to me, and later a report on them was published in the American Journal of Science.[3] The interest attaching to these fossils was so great that the members of the Survey working in the region were urged to make special exertions to obtain a larger series.

In 1908 E. M. Kindle, P. S. Smith, and R. D. Mesler succeeded in obtaining a considerable number of specimens from various localities in the vicinity of Nome, of which I prepared a preliminary list.[4]

In the summers of 1912 and 1914 collections were made on the Arctic coast of Alaska at Peard Bay, about 30 miles southwest of Point Barrow, and at Carter Creek, Camden Bay, about 1 mile from the coast, by E. de K. Leffingwell. A small series of specimens submitted by Leffingwell to the United States Geological Survey was determined by me and considered, to belong to a stratum of the same Pliocene age as those obtained farther east on the Arctic coast by Schrader and Peters.

GEOLOGY.

COLVILLE "SERIES."

The portion of the Colville "series" referred to the later Tertiary is thus described by Schrader:[5]

> This portion of the section is practically free from indurated rock. It consists of nearly horizontally stratified beds of fine gray, slate-colored, or ash-colored calcareous

[1] Am. Jour. Sci., 3d ser., vol. 21, pp. 104–111, 1881.

[2] U. S. Geol. Survey Prof. Paper 20, 1904.

[3] Am. Jour. Sci., 4th ser., vol. 23, p. 457, 1907.

[4] Moffit, F. H., Geology of the Nome and Grand Central quadrangles, Alaska: U. S. Geol. Survey Bull. 533, pp. 45–46, 1913.

[5] U. S. Geol. Survey Prof. Paper 20, pl. 83, pl. 14, *A*, 1904.

silts, containing faunal remains. It is tentatively referred to the Pliocene on the basis of fossils collected in place by the writer in the bluff (near its top) on the west side of the Colville about a mile north of the seventieth parallel.

The section assigned to the Pliocene horizon at Carter Creek, 1 mile from the coast of Camden Bay, on the Arctic shore of Alaska, was measured by Leffingwell as follows:

Section at Carter Creek.

Top.	Feet.
A. Sand with intermixed humus	30
B. Sand without fossils, some gravel	80
C. Pale-gray sand with marine fossils	100

The fossils appear from the collections to be most abundant in the lower 100 feet of the section.

GUBIK SAND.

Schrader[1] describes the supposed Pleistocene deposit of the Colville River region as follows:

> Besides the Tertiary Colville series, which underlies the coastal plain along Colville River, the section here comprises deposits supposed to be Pleistocene. Of these, probably the most important and interesting is a surficial deposit of brownish sand or loam about 10 to 15 feet in thickness, which unconformably overlies the beds of the Colville series, apparently as a continuous mantle. * * * The deposit consists of fine sand, with apparently an admixture of considerable silt. In some localities it seems to be more sandy toward the base and more earthy toward the top, where it terminates in from one to several feet of dark-brown or black humus, clothed at the surface with moss and a little grass. It is ordinarily free from gravel, but in several instances subangular cherty pebbles, ranging from mere sand grains to fragments as large as one-fourth inch in diameter, were found. These occur very scatteringly and are sometimes roughened, as if wind worn. In some localities a fine gravel seems to intervene between the base of the deposit and the underlying Tertiary beds, as if representing the basal part of the deposit. The deposit as a rule is structureless, or without stratification planes. Owing to this fact, together with its surficial and widespread occurrence and the homogeneity of its materials, for want of a better term in field work it was called loess, but in the fear that this term may be undesirable, it is here named the Gubik sand, after the Eskimo name of Colville River.

In a low bluff on the coast 15 miles southwest of Point Barrow settlement and in the talus from this bluff Leffingwell found five species of invertebrate fossils, all belonging to recent species. This deposit is probably Pleistocene and may be tentatively correlated with the Gubik sand of Schrader, which occupies a similar position in the section farther east.

[1] Op. cit., p. 93.

NOME ELEVATED BEACHES.

On the south side of Seward Peninsula (originally given the native name Kaviiak), on the north shore of Norton Sound, the gold prospectors have revealed the presence of a series of ancient beaches the gravels of which contain numerous marine fossils, including a considerable proportion of extinct species leading to their identification as of Pliocene age. In referring the horizon containing the numerous extinct species to a pre-Pleistocene age my conclusions rest entirely upon the paleontologic evidence.[2] It is proper to state that P. S. Smith and A. H. Brooks, of the Geological Survey, from physiographic observations, are disposed to assign a Pleistocene age to the beaches. In regard to the succession of the strata there is no difference of opinion.

The present beach near Nome may be considered the "first beach." The "second beach" lies inland, at an irregular distance that varies with the topography but is everywhere less than a mile, and has an elevation above sea level of 37 feet. The "third beach," some $2\frac{1}{2}$ to $3\frac{1}{2}$ miles inland, has been elevated to the height of 79 feet above the sea.[3] Between the second and third beaches are several less well-defined intermediate beaches, one of which is 22 feet above sea level, thus being lower than the second beach, to the south of it. Between the second beach and the present beach shafts have been sunk to a depth of 65 to 70 feet which reach at about 20 feet below the present sea level the oldest beach of all those now known, which has locally received the name submarine beach or beaches. These beaches have been described in detail by Moffit in the bulletin cited. Doubtless still others remain to be discovered.

INDICATIONS OF ELEVATION AND CLIMATE.

The indications of the Tertiary geology of the northern and northeastern shores of Alaska are therefore, in substance, that from early Pliocene (if not even older) time the land underwent a general elevation, broken by periods of rest sufficient to allow the formation of low scarps with their attendant beaches, and at least one unimportant depression during the earlier portion of the period. The massive granite extrusions, such as form Cape Prince

[2] Of 62 species 23, or 37 per cent, are extinct.

[3] Moffit, F, H., U. S. Geol. Survey Bull. 533, p. 41, fig. 9, p. 78, 1913.

of Wales, the Diomede Islands of the Bering Strait, and a considerable portion of the Asiatic coast on the west side of the strait, though probably not all of one age, are almost certainly all older than the period during which these beaches were in process of formation.

The presence of widely distributed Eocene or Oligocene leaf beds and lignitic coals, covered in some localities by beds of sandstone containing marine Miocene fossils, shows that a milder climate in earlier Tertiary time, allowing a profuse growth of oaks, planes, figs, and other trees, was succeeded during the Miocene by a depression of much of the land below the sea level with a much colder climate and considerable volcanic activity. This was followed by a moderate amount of elevation, which has been practically continuous to the present time. During the Pliocene the climate seems to have moderated, judging by the character of the marine fauna, to be later subjected to the Arctic temperatures which came in with the glacial epoch and still persist.

ROUTES OF MIGRATION OF FAUNA.

The bearing of these conditions upon the theories relating to the immigration of Asiatic land animals into America is important. A superficial glance at an ordinary map is likely to lead the observer who goes no deeper into the subject to the conclusion that land bridges, including the Bering Strait region and the Aleutian Island chain, may reasonably be assumed as the routes by which Asiatic immigrations took place.

I have elsewhere[1] pointed out the serious objections to these assumptions that arise from a more thorough knowledge of the geology. So far as the Aleutian route is concerned it must be positively rejected as impracticable. The Bering Strait region offers more plausibility, yet the evidence so far gathered from geologic exploration indicates not only that no closer land connection than at present has existed between the two continents at Bering Strait since Miocene time but, on the contrary, that the present separation is less than at any period during that time. The conclusion from our present knowledge is inevitable either that the postulated land bridges must have existed in some other locality or that the assumed migration must have taken place over the ice of the strait when frozen, possibly during the glacial epoch.

[1] Am. Anthropologist, vol. 14, pp. 12–18, 1912.

INTERCOMMUNICATION OF ATLANTIC AND PACIFIC FAUNAS IN PLIOCENE TIME.

Still another important conclusion is indicated by a study of the characteristics of the Pliocene marine invertebrate fauna. I have already stated that the fauna indicates a more temperate sea than at present washes those shores. Taken in connection with other data derived from a study of the North Atlantic Pliocene deposits in England, Iceland, and on the New England coast, the present investigation shows that a more free connection probably existed in Pliocene time between the North Atlantic and the Bering Sea regions. This is indicated by the presence in North Atlantic Pliocene beds, as fossils, of species still living in Bering Sea, and conversely by the presence in the North Atlantic recent fauna of species belonging to groups now extinct on the Pacific side in the Pliocene at Nome. F. W. Harmer,[2] who is at present revising the fauna of the Crag of England and Iceland, has already found genera and species now extinct in the North Atlantic region but living in Bering Sea. It is probable that on the completion of his monograph a still larger number will be noted.

In an investigation of the fossils of the marl at Sankaty Head, Nantucket, the lower horizon of which is probably upper Pliocene, J. Howard Wilson,[3] in 1904, found several Bering Sea species now extinct in the Atlantic region. The presence of *Corbicula* in a small Pliocene lens discovered by Woodworth above the Miocene beds of Gay Head, Marthas Vineyard, is proof that on the Atlantic, as on the Pacific coast, the Pliocene was an epoch in which the temperature of the sea in that region was higher than in the preceding and subsequent epochs. The presence of *Rangia* in the fossil fauna of Cornfield Harbor, Chesapeake Bay, is confirmatory evidence to the same effect.

There is also evidence of a southward extension of the cooler-water fauna of the Californian

[2] Pliocene Mollusca of Great Britain, Paleontographical Society, 1913, pl. 1, 1914; pt. 2, 1916.

[3] The Pleistocene formations of Sankaty Head, Nantucket: Jour, Geology, vol. 13. pp. 713–734, 1905.

Pleistocene on the Pacific coast as far as the island of Socorro, which will be presented in a future publication.

LISTS OF SPECIES.

The species collected at each locality on the Alaskan coast above indicated will now be enumerated. The collectors' station numbers are given when such numbers appear on their labels. The large numbers are those of the stations as registered in the official records of the United States Geological Survey.

Otter Creek, 2 miles from the coast near Nome, 50 feet below the surface and at an elevation above the present sea level of about 20 feet. Collected by J. J. V. Beaver, 1905. Those marked with an asterisk now live south of the line of floating ice in winter, or, roughly, in about the latitude of the Aleutian Islands. Pliocene.

Pecten islandicus Müller.
Pecten lioicus Dall (temperate type). Extinct.
Pecten kindlei Dall (temperate type). Extinct.
*Monia macroschisma Deshayes.
Cardium sp. (fragment).
Venericardia crassidens Broderip and Sowerby.
Venericardia crebricostata Krause.
Macoma sabulosa Spengler.
*Panomya ampla Dall.
Hemithyris psittacea Gmelin var. alaskana Dall.
Balanus sp. (fragments).

Station 18*a* (5074). Second beach, about 1½ miles north of Nome, at Center Creek, 32 feet below the surface and about 20 feet above the present level of the sea. Collected by E. M. Kindle, 1899. Pliocene.

*Pecten kindlei Dall.
*Monia macroschisma Deshayes.
Mytilus edulis Linné.
Venericardia crebricostata Krause.
*Astarte rollandi Bernardi.
Astarte arctica Gray.
Astarte actis Dall.
Cardium ciliatum Fabricius.
Macoma middendorffii Dall.
Macoma incongrua Martens.
Macoma sabulosa Spengler.
*Siliqua cf. S. patula Dixon.
Spisula polynyma var. alaskana Dall.
*Mya sp. (aff. M. japonica Jay).
Saxicava arctica Linné.
*Panomya ampla Dall.
Panomya arctica var. turgida Dall.
Chrysodomus mesleri Dall.
Chrysodomus (fragment).
Thais (Nucella) nomeana Dall.
Trichotropis insignis Middendorff.
Natica sp.
Natica aff. N. clausa Broderip and Sowerby.
Cryptoctenidia magna Dall.
*Balanus rostratus (Hoek) alaskensis Pilsbry.
*Balanus evermanni Pilsbry.

Station 21*a* (5075). Five miles east of Nome, from the second beach. Collected by E. M. Kindle, 1908. Pliocene.

*Magasella aleutica Dall.
Hemithyris psittacea Gmelin var. alaskana Dall.

Station 21*b* (5076). Five miles east of Nome, from prospect holes in second beach. Collected by E. M. Kindle and R. D. Mesler, 1908. Older Pliocene.

Pecten islandicus Müller.
Chrysodomus sp. (fragment).
Thais (Nucella) nomeana Dall.
Hemithyris psittacea Gmelin var. alaskana Dall.
*Magasella aleutica Dall.
*Balanus rostratus alaskensis Pilsbry.

Station 22*a* (5077). One and one-half miles east of Nome, from prospect holes in second beach. Collected by E. M. Kindle and R. D. Mesler, 1908. Pliocene.

Pecten islandicus Müller.
*Monia macroschisma Deshayes.
Mytilus edulis Linné.
Cardium (Serripes) grönlandicum Gmelin.
Cardium ciliatum Fabricius.
Astarte sp. (fragment).
Venericardia crassidens Broderip and Sowerby.
Macoma middendorffii Dall.
Macoma incongrua Martens.
Saxicava arctica Linné.
*Mya sp. (aff. M. japonica Jay).
*Panomya ampla Dall.
Buccinum sp. (fragment).
Trichotropis insignis Middendorff.
Hemithyris psittacea Gmelin var. alaskana Dall.
*Balanus rostratus alaskensis Pilsbry.

Station 22*b* (5078). One-fourth to one-half mile east of Nome, on the second beach, in prospect holes. Collected by E. M. Kindle and R. D. Mesler, 1908. Pliocene.

*Monia macroschisma Deshayes.
Cardium ciliatum Fabricius.
Astarte actis Dall.
Macoma incongrua Martens.
Macoma middendorffii Dall.
Saxicava arctica Linné.
*Panomya ampla Dall.
Spisula polynyma Stimpson var. alaskana Dall.
Thais (Nucella) nomeana Dall.
*Littorina palliata Say.
Littorina sp. (aff. L. grandis Middendorff).
Cryptoctenidia magna Dall.
*Balanus balanoides (Linné) Pilsbry.
*Balanus rostratus alaskensis Pilsbry.

Station 627. Forty miles up Colville River from its mouth on the Arctic coast. Collected by F. C. Schrader, 1901. Pliocene.

Chrysodomus leffingwelli Dall.
Pyrulofusus schraderi Dall.

Station 706?. Peard Bay, about 30 miles southwest of Point Barrow, from top of high bank. Collected by E. de K. Leffingwell, 1914. Pleistocene (?).

Astarte bennetti Dall.
Astarte borealis Schumacher.
Astarte leffingwelli Dall.
Venericardia crebricostata Krause.

Station A (7068). Carter Creek, 1 mile from the Arctic coast at Camden Bay, in fine consolidated silt from top to 30 feet below. Collected by E. de K. Leffingwell, 1914. Pliocene.

*Nucula mirabilis A. Adams (Japan).
Astarte actis Dall (fragment).
Venericardia crebricostata Krause.
Saxicava arctica Linné.
Lora sp.? (fragment).
*Antiplanes sp.? (fragment).
Buccinum sp. (fragment).
*Balanus crenatus (Bruguière) Pilsbry.

Station B (7069). Carter Creek, 100 yards east of station A (7068) and 80 feet below it. Collected by E. de K. Leffingwell, 1914. Pliocene.

Astarte carteriana Dall.
*Antiplanes sp.? cf. A. purpurea Dall.

Station C (7070). Carter Creek, 200 yards east of station B (7069) and 100 feet below it. Collected by E. de K. Leffingwell, 1914. Pliocene.

Leda sp. (cf. L. arctica Loven).
Leda sp. (cf. L. frigida Torell).
Astarte sp. (fragment).
Cyrtodaria camdenensis Dall.
*Cadulus arcticus Dall.
Dentalium sp. (fragment).
*Philine sp. (fragment).
Turris (Antiplanes?) sp. (fragment).
Cryptonatica sp. (aff. C. clausa Broderip and Sowerby).
Amauropsis sp. (cf. A. islandicus Gmelin).
*Caecum sp. (fragment).

Station 7228. Fifteen miles southwest of Barrow village, Point Barrow, Alaska, from talus below bluff on the coast. Collected by E. de K. Leffingwell, 1910–12. Pliocene.

Macoma sabulosa Spengler.
Astarte actis Dall.
Astarte leffingwelli Dall.
Venericardia crebricostata Krause.
Balanus rostratus alaskensis Pilsbry.

Station 7229. Specimens in place at same locality as station 7228, taken from the bluff. Pliocene (?).

Astarte sp. (fragment).
Venericardia crebricostata Krause.
Chrysodomus fornicatus Gray.

Station 200*a* (7230). Camden Bay, Arctic coast, at Carter Creek. Collected by E. de K. Leffingwell, 1912. Pliocene.

Astarte martini Dall.
Astarte sp.
Venericardia nuwokensis Dall.
Buccinum sp. (fragment).

Station 200*b* (7231). Same locality as station 7230. Collected by E. de K. Leffingwell, 1912. Pliocene.

Musculus sp. (fragment).
Serripes grönlandicus Gmelin.
Astarte arctica Gray.
Astarte martini Dall.
Cyrtodaria camdenensis Dall.
Colus sp. (fragment).
Balanus sp. (fragment).
Balanus balanoides (Linné) Pilsbry.

Station 19*a* (7618). One mile north of Fort Davis, east of Nome, Alaska, near parting of Florence and Otter Creek gulches (Gallatin mine). Collected by R. D. Mesler, 1908. Pliocene.

Pecten islandicus Müller.
*Monia macroschisma Deshayes.
Cardium ciliatum Fabricius.
Venericardia crebricostata Krause.
Venericardia crassidens Broderip and Sowerby.
Astarte actis Dall.
Macoma incongrua Martens.
*Macoma brota var. lipara Dall.
Macoma balthica Linné.
Spisula polynyma Stimpson var. alaskana Dall.
Saxicava arctica Linné.
Panomya ampla Dall.
*Panomya arctica Lamarck var. turgida Dall.
Hemithyris psittacea Gmelin var. alaskana Dall.
Balanus sp. (fragment).

Station 18*a* (7619). Center Creek mines, 2 miles northwest of Nome, at second beach. Collected by E. M. Kindle and R. D. Mesler, 1908. Pliocene.

*Pecten kindlei Dall.
*Monia macroschisma Deshayes.
Cardium ciliatum Fabricius.
Astarte actis Dall.
Macoma middendorffii Dall.
Macoma balthica Linné.
Spisula polynyma Stimpson var. alaskana Dall.
Chrysodomus saturus Martyn.
Chrysodomus mesleri Dall.
Thais (Nucella) nomeana Dall.
Trichotropis insignis Middendorff.
*Natica sp. (aff. N. russa Gould).
Cryptoctenidia magna Dall.
Balanus sp. (fragment).

Station 20*a* (7260). Half a mile west of Nome, from tailings of Welsh mine on second beach. Collected by E. M. Kindle and R. D. Mesler, 1908. Pleistocene.

Astarte fabula Reeve.
Saxicava arctica Linné.

Station 20*b* (7621). Half a mile west of Nome, from prospect holes on the tundra near Snake River, second beach. Collected by E. M. Kindle and R. D. Mesler, 1908. Pliocene.

Mytilus edulis Linné.
Cardium ciliatum Fabricius.
Astarte sp. (fragment).
Venericardia crassidens Broderip and Sowerby.
Macoma balthica Linné.
Macoma middendorffii Dall (fragment).
Chrysodomus sp. (fragment).
Thais (Nucella) nomeana Dall.
Balanus sp. (fragment).

Station 2 (7622). Half a mile northwest of Nome, from gravel 10 feet below the surface, near submarine beach, in prospect holes. Collected by E. M. Kindle and P. S. Smith, 1908. Pliocene (?).

Mytilus edulis Linné.
*Monia macroschisma Deshayes.
Cardium ciliatum Fabricius.
Venericardia crassidens Broderip and Sowerby.
Macoma incongrua Martens.
Macoma middendorffii Dall.
Thais (Nucella) nomeana Dall.
Balanus sp. (fragment).

Station 1 (7623). Mine on submarine beach 30 feet below present sea level, half a mile northwest of Nome. Collected by E. M. Kindle and P. S. Smith, 1908. Pliocene.
Cardium ciliatum Fabricius.
Venericardia crassicostata Krause.
Astarte hemicymata Dall.
*Astarte (Gonilia?) diversa Dall.
Macoma balthica Linné.
*Mya sp. (aff. M. japonica Jay).
Chrysodomus sp. (fragment).
Balanus sp. (fragment).

Station 3 (7624). Prospect hole half a mile northwest of Nome, on submarine beach. Collected by E. M. Kindle, 1908. Pleistocene (?).
Astarte fabula Reeve.

Station 7477. Dump of shaft 80 feet deep on the tundra between Dry and Bourbon creeks 1 mile from beach at Nome. Collected by F. L. Hess, 1905. Pliocene.
Admete sp.? (fragment).
Chrysodomus sp. (fragment).
*Tachyrhynchus lacteola Carpenter.
*Pecten (Chlamys) n. sp. (fragment). Southern type.
Pecten (Chlamys) islandicus Müller.
Astarte sp. (fragment).
Astarte hemicymata Dall.
*Astarte diversa Dall.
Astarte arctica Gray.
Serripes grönlandicus Gmelin.
Cardium ciliatum Fabricius.
Venericardia paucicostata Krause.
Macoma calcarea Gmelin.
*Mya (n. sp.?) (fragment).
Saxicava arctica Linné.
Balanus rostratus alaskanus Pilsbry.
Myriozoum "truncatum Pallas" (n. sp.?).

DESCRIPTIONS OF NEW SPECIES.

GASTROPODA.

Antiplanes? cf. A. purpurea Dall.

A decorticated specimen of about six whorls presents the appearance of an *Antiplanes* of the type of *A. purpurea* Dall. It is in a state too dilapidated to serve as the basis of a description but is worthy of mention as an indication of the probable presence of this genus in the fauna.

Station 7069, in the Pliocene, horizon B, 80 feet below horizon A, and about 300 feet east of station 7068. U. S. Nat. Mus. catalogue No. 324316. It is about a mile from the Arctic coast in the Camden Bay region; the matrix appears to be a hardly consolidated ash. There is a possibility that the specimen may represent a broken and decorticated *Colus*.

Chrysodomus mesleri Dall, n. sp.

Plate V, figures 2, 3.

A fragment only of this species was obtained, but its characteristics are so pronounced that it can not fail to be recognized when better specimens are found. The shell had more than four whorls, with a smooth surface and an appressed suture strongly undulated by the ribbing; the penultimate whorl has seven extremely strong protractively angular axial ribs, projecting as stout knobs at the shoulder, which are connected by an obscure spiral ridge; the interspaces are deep and about as wide as the ribs; on the upper whorls the series of knobs develop into a continuous broad undulating spiral ridge and the ribs disappear; the last whorl is deficient, but the remaining portion indicates that it was ribbed, at any rate near the suture. Height of the penultimate whorl, 25 millimeters; diameter, 36 millimeters.

Station 7619 (18*a*). Pliocene. From the Center Creek mines, 2 miles north of Nome. Collected by E. M. Kindle and R. D. Mesler, 1908. U. S. Nat. Mus. catalogue No. 324317.

The species perhaps nearest allied to this, though sufficiently distinct, is *C. saturus* Martyn, of the Recent fauna of Bering Sea.

A fragment (fig. 3) from station 5074 (18*a*) at Center Creek, 1½ miles north of Nome, from the second beach, is probably of the same species and indicates that the ribs reached over the last whorl clear to the beginning of the twisted and recurved canal.

Chrysodomus leffingwelli Dall, n. sp.

Plate V, figure 11.

Shell of moderate size, with more than four rounded whorls (apex decollate) separated by a distinct, deep, but not channeled suture; whorls widest at the shoulder; spiral sculpture of (between the sutures three, on the last whorl about 14) strong, somewhat flattened cords regularly spaced and separated by wider channeled interspaces in which run from one to three minor cords which, toward the canal, may be absent; axial sculpture of (on the last whorl eight or nine) rather narrow, not very prominent sigmoid ribs extending from the suture over the body and becoming obsolete on the base; these ribs are less distinct on the spire, and the surface also bears fine, close-set incremental lines; pillar twisted, inner lip slightly erased; canal moderately long with a very feeble siphonal fasciole, slightly recurved; outer lip defective in the specimen. Height of (decollate) three whorls, 74 millimeters;

diameter at shoulder, 40 millimeters; height of last whorl, 60 millimeters; of aperture, 40 millimeters.

Station 627, 40 miles up Colville River from the Arctic coast, with *Pyrulofusus schraderi*. Pliocene. Collected by F. C. Schrader, 1901. U. S. Nat. Mus. catalogue No. 210853.

This species belongs to the general group represented by *C. lyrata* Martyn but does not agree closely with any of the known recent forms. Other specimens have the ribs more or less obsolete.

Pyrulofusus schraderi Dall, n. sp.

Plate V, figures 10, 13.

Shell large, solid, dextral, with a short spire and expanded last whorl; whorls about five, rapidly increasing; nucleus large, swollen, of about two whorls (decorticated in the specimen); subsequent whorls sculptured all over with extremely fine, close-set spiral threads; axial sculpture of inconspicuous incremental lines and on each whorl five very prominent rounded sigmoid ribs diminishing toward the base and stronger at the shoulder, below which they are very obliquely inclined forward; the interspaces are much wider than the ribs; the suture is deep but hardly channeled; the whorl rises a little at the posterior corner of the aperture and on the inner lip is a thin layer of enamel. The base and aperture of the unique specimen are deficient. Diameter of specimen at aperture from the inner lip, about 50 millimeters; estimated original length, about 75 millimeters.

Pliocene at station 627, 40 miles up Colville River from its mouth at the Arctic coast, in silt beds 80 feet above the river, 5 to 15 feet below the base of loess, 20 feet below the surface of the soil. Collected by F. C. Schrader. U. S. Nat. Mus. catalogue No. 210854.

Thais (Nucella) nomeana Dall, n. sp.

Plate V, figure 9.

This form is represented only by worn and more or less defective specimens which resemble the form from the Pliocene of Coos Bay, Oreg., described by the writer.

It is certainly a precursor of *N. lamellosa* Gmelin and would probably by casual observers be referred to as a variety of that species. The shell is nearly smooth, only obsolete traces of spiral sculpture being apparent. The general aspect is rude, the suture closely appressed. None of the specimens show any denticulation on the inside of the outer lip; there is a strong siphonal fasciole and a very narrow chink between the fasciole and the pillar, which is thick and callous, though there are no indications of a thickening of the inner lip. In size and general characteristics this form closely approaches *N. lamellosa*.

Station 5074, Pliocene on Center Creek, about 1½ miles north of Nome, from the second beach. Collected by E. M. Kindle. U. S. Nat. Mus. catalogue No. 324318.

Littorina palliata Say.

Plate V, figure 12.

Shell small, smooth, solid, turbinate, of about four rounded whorls; suture distinct, appressed; surface with hardly visible incremental lines; the rotundity of the whorls slightly compressed in front of the suture; aperture rounded, slightly angulate at the posterior commissure; outer lip thick, not reflected, entire; body and umbilical region with a thin flattened layer of callus which merges evenly into the basal lip; base convexly rounded. Height, 12 millimeters; diameter, 12.5 millimeters; last whorl, 10 millimeters in height.

Station 5078 (22*b*). Pliocene. From prospector's pits on the second beach, one-half to one-fourth mile east of Nome. Collected by E. M. Kindle and R. D. Mesler, 1908. U. S. Nat. Mus. catalogue No. 324319.

This species is of the type of *Littorina palliata* Say, of which no living form now inhabits the Pacific Ocean or any part of the Arctic coast west of Mackenzie River and east of the Lena. The specimen retains some of the yellowish coloration characteristic of the Atlantic form, and after a scrutinizing comparison with specimens of *Littorina palliata* from Rhode Island and with all the varieties of *obtusata* from Europe, no characters have been discovered by which the Nome fossil can be distinguished from *Littorina palliata*. This is natural enough, as *obtusata* has never been found in America, whereas *palliata* is excessively common on the New England coast in localities where it has not been supplanted by the introduced *Littorina litorea*.

The differences of size, form, and geographic distribution seem to be conclusive as to the specific distinction between *Littorina obtusata* and *Littorina palliata*. They are not Arctic shells.

Cryptoctenidia magna Dall, n. sp.

Plate V, figure 1.

Shell large for the genus, ovate, apex very anterior, the back behind it roundly arched, the anterior slope more steeply descending; the apex blunt, usually eroded; sculpture of fine radiating threads with subequal interspaces, more or less cut into segments by incised lines corresponding to resting stages and equally distributed over the shell; interior white, the margins entire, smooth; the muscular impression narrow, connected in front of the head by a linear scar indicating the attachment of the mantle. Height, 10 millimeters; length, 29 millimeters; breadth, 25 millimeters; apex behind the anterior margin, 5 millimeters. A defective specimen measures 34 millimeters long and 29 millimeters wide.

Stations 5074, 5078, and 7619. Pliocene of Center Creek, 1½ miles north of Nome, from the "second beach," collected by E. M. Kindle. Also from prospect holes on the second beach, one-fourth to one-half mile east of Nome; and from Center Creek mines 2 miles northwest of Nome. Collected by E. M. Kindle and R. D. Mesler, 1908. U. S. Nat. Mus. catalogue No. 324320.

The species of this genus are very similar to one another, but this is larger than any of the recent forms and differs in details of sculpture.

Cadulus arcticus Dall, n. sp.

Plate V, figure 8.

Shell small, slender, arcuate, smooth, with circular section and no swelling ventrally; the color is white with narrow translucent zones irregularly disposed. Length, 7 millimeters; diameter at anterior end, 0.75 millimeter; height of arc described by the ventral curve, 1.2 millimeters.

Station 7070. Pliocene of Carter Creek, in the Camden Bay region of the Arctic coast, stratum C, 100 feet below stratum B and 600 feet east of station 7069, 1 mile from the coast. Collected by E. de K. Leffingwell, 1914. U. S. Nat. Mus. catalogue No. 324322.

This stratum, from the collector's notes, seems to be some 220 feet below the uppermost stratum of the section.

PELECYPODA.

Pecten (Chlamys) kindlei Dall, n. sp.

Plate VI, figures 2, 7.

Shell large, rather rude, belonging to the group of *Pecten swifti* Bernardi. Right valve with four broad, low radial ribs separated by much narrower, shallow, ill-defined interspatial furrows; the whole surface sculptured with strong radial, more or less paired flattish cords, often minutely medially grooved and sometimes separating into two distinct radii; the interspaces are about as wide as the cords and distinctly channeled; they also retain patches of a minute reticulated surface lamellation; the beak is pointed, the anterior ear large, aliform, with an acute but not deep notch, leaving a broad concentrically laminate fasciole, the margin of the disk at the notch with a ctenolium of two or three rather widely separated short spinules; the radial threads crossed by rather coarse incremental lines; the posterior ear is very short, narrow, and oblique; inner surface of the valve smooth except near the distal margin, where it reflects the external sculpture; the adductor scar large, the resiliary pit rather small for the size of the shell, with the lateral margins raised; a narrow, transversely striated area exists, broader on the left valve; there are no auricular crura. Left valve with five narrow radial ribs separated by wider shallow interspaces which are wider on the posterior half of the disk; the surface is covered with radial cords as in the other valve, but these are finer and closely crowded on the submargins; the reticular surface layer is the same as in the left valve, but the right valve as usual is more convex; anterior ear triangular, large, with about eight or ten radial cords; posterior ear narrow and short; both set off from the submargins of the disk by a deep, wide furrow; hinge line straight, with a flat area half as wide as the length of the pit. The young valves retain a reddish tinge in their substance. Height of adult valve, 92 millimeters; width of disk, 78 millimeters; of hinge line, 45 millimeters; diameter, 27 millimeters.

Station 7619, Pliocene of Center Creek mines, 2 miles north of Nome, from the

second beach. Collected by E. M. Kindle and R. D. Mesler, 1908. U. S. Nat. Mus. catalogue No. 324301.

This species, from fragmentary remains collected by J. J. V. Beaver, of Nome, was identified by me in 1907,[1] with *P.* (*C.*) *swifti* Bernardi, of northern Japan. The present much more complete material, obtained the following year, enables me to correct this identification. The shell indeed much resembles the Japanese form, but it has not the concentric waves due to resting stages that appear in *P. swifti*, and the posterior ear is of quite different shape. The two bear to one another much such a relation as is found between *Pecten nodosus* of the Antilles and *P. subnodosus* of the Pacific coast of America.

Related to this species is the *P. parmeleei* Dall from the Pliocene of San Diego, Calif., with which fragments from a Pliocene deposit near Crescent City, Calif., were identified. The latter (figured by Arnold[2])upon later and more exact study prove to be indistinguishable from the true *P. swifti* of Japan. The minute structure of the reticulated outer layer of *P. parmeleei* is quite distinct from that of *P. swifti* or the present species, but this delicate structure is so rarely preserved intact in the fossils that its help in specific discrimination is seldom available.

Pecten (Chlamys) lioicus Dall.

Pecten (*Chlamys*) *lioicus* Dall, Am. Jour. Sci., 4th ser., vol. 23, p. 457, fig. 1, 1907.

From 50 feet below the surface in marine gravels near Nome, Norton Sound, Alaska, from a collection received by F. H. Moffit from Mr. J. J. V. Beaver, of Nome; donated to the U. S. Geological Survey. U. S. Nat. Mus. catalogue No. 110480. Pliocene.

No further specimens of this very distinct species have come to hand.

Pecten (Chlamys) n. sp.

In the material from the dump of an 80-foot shaft about a mile north of Nome (station 7477) were fragments of a *Pecten* undoubtedly distinct from any known northeastern Pacific species, but insufficiently complete to warrant naming. The ribs are high, with wider channeled interspaces. On the back of the ribs in the middle of the valve is a strong radial cord on each side of which is a smaller cord separated from the median one by a narrow groove. The more lateral ribs have a groove between two moderately strong cords, the inner cord of the medial ribs becoming obsolete. The ribs bear small low imbricating scales. In the interspaces the fine sculpture is minutely tessellate, the alternate scales sometimes raised, giving a minutely pustular effect. The medial ribs are about 3 millimeters and the interspaces about 4 millimeters wide. The submargins are feebly and more numerously threaded. The interior is smooth, grooved in harmony with the external sculpture. The shell probably reaches a length of some 3 inches when adult.

Astarte actis Dall, n. sp.

Plate VI, figures 4, 5.

Shell of moderate size, rounded, very thick, nearly equilateral, beaks rather pointed, not conspicuous, usually more or less eroded; lunule lanceolate, narrow, elongate, shallow; ligamentary nymph strong, the nearly linear escutcheon extending beyond it 3 or 4 millimeters; outer surface rather rudely sculptured with coarse concentric incremental lines; hinge extremely heavy, in the right valve a strong thick cardinal with deep pits on each side to receive the two narrower cardinals of the left valve, the posterior of which is more or less radially furrowed; there are traces of an obsolete anterior lateral in the left valve and of a receptacle for it in the right valve which vary in distinctness with the individual specimen; impressions of the adductors and mantle attachment are usually deep and distinct; the inner margins of the valves are entire. Height, 33 millimeters; length, 36 millimeters; diameter, 20 millimeters.

Station 5074 (18*a*). Pliocene on Center Creek, about half a mile north of Nome, from the second beach; collected by E. M. Kindle. U. S. Nat. Mus. catalogue No. 324302. Also station 7619 (18*a*), Center Creek mines, 2 miles northwest of Nome; collected by E. M. Kindle and R. D. Mesler, 1908.

Astarte carteriana Dall, n. sp.

Plate VI, figures 1, 3.

Shell of moderate size, rather inflated, the general profile like *Saxidomus giganteus* on a small scale; surface sculptured with rather

[1] Am. Jour. Sci., 4th ser., vol. 23, p. 457, 1907.

[2] Arnold, Ralph, The Tertiary and Quaternary pectens of California: U. S. Geol. Survey Prof. Paper 47, pl. 41, figs. 5, 5*a*, 1906.

rude incremental lines; anterior end shorter, beaks rather pointed over a conspicuously depressed but not sharply limited lunular area; there is no escutcheon; a rather long nymph supported an external ligament under which in one specimen in the left valve is an excavated space having the aspect of the resilifer for a rather large internal resilium; in front of this is a single strong cardinal tooth with a well-marked socket for a cardinal of the opposite valve; the hinge of the right valve is deficient in the specimen, but under the lunule there is a rather well-marked lateral lamina; the posterior end of the shell is rather bluntly rounded, the base evenly arcuate; the muscular scars are emphatically excavated, the inner valve margins smooth. Proportions taken from the incremental lines of a fractured specimen: Height, 16 millimeters; length, 25 millimeters; diameter, about 10 millimeters. The whole specimen when entire must have had a height of about 30 millimeters, and a length of more than 37 millimeters.

Station 7069. Pliocene of Carter Creek, stratum B, 80 feet below stratum A, and 100 yards east of station 7068. U. S. Nat. Mus. catalogue No. 324304.

The specimens of this species consist of three fragments, only one showing the entire hinge. The excavation resembling a resiliary pit is probably the effect of erosion, in which case the shell would be allotted to the genus *Astarte*. At any rate the species can not be a typical *Crassatellites*, on account of the well-marked external ligament. Other specimens otherwise similar have the hinge of *Astarte*, though the teeth are more oblique and less triangular than in most of the Recent species.

Astarte leffingwelli Dall, n. sp.

Plate VI, figures 6, 8.

Shell of moderate size, with high pointed prosocoelous beaks curving over a deeply excavated, lanceolate lunule; anterior end shorter, dorsal margin concave, below evenly rounded; posterior dorsal margin nearly straight, descending, with a short ligamentary nymph and a narrow escutcheon nearly three times as long as the nymph; posterior end rounded, attenuated, base evenly arcuate, with a smooth inner margin; sculpture nearly smooth, under a lens with faint concentric narrow undulations and very fine, even incremental lines; hinge compressed, in the left valve with two thin and prominent cardinals and a long, little elevated, but distinct posterior lateral lamina; muscular scars excavated. Height, 25 millimeters; length, 32 millimeters; diameter, 12.5 millimeters.

Station 7228. Pliocene. In talus below low bluff on the seacoast 15 miles southwest of Point Barrow; collected by E. de K. Leffingwell; U. S. Nat. Mus. catalogue No. 324305. Also station 7067, about 30 miles southwest of Point Barrow at Peard Bay; probably Pleistocene; collected by E. de K. Leffingwell.

Astarte martini Dall, n. sp.

Plate VI, figure 12.

Shell small, ovate, with inconspicuous pointed beaks, dorsal slopes straight, anterior end rounded, shorter, base evenly arcuate, posterior end slightly longer, attenuated and almost obliquely truncated; a narrow elongate escutcheon and shorter, narrower, slightly excavated lunule present; sculpture of somewhat irregular, slightly raised, close set, concentric, narrow wavelets, becoming almost lamellose near the edge of the lunule; and in other specimens reduced to narrow threads on the disk; hinge heavy, normal, muscular impressions somewhat excavated, inner margin smooth. Height, 15 millimeters; length, 19 millimeters; diameter, 10 millimeters. A larger but defective valve is 25 millimeters long.

Station 7231. Pliocene. Carter Creek. Collected by E. de K. Leffingwell, 1912. U. S. Nat. Mus. catalogue No. 324307.

Astarte hemicymata Dall, n. sp.

Plate VI, figures 9, 10.

Shell triangular, basally rounded, flattish; beaks narrow, high and pointed, prosocoelous; lunule deeply excavated, lanceolate; escutcheon feebly defined, narrow, obscure; sculpture of seven or eight broad concentric flattish waves with narrower shallow interspaces, obsolete toward the base, and fine feeble incremental lines; hinge compressed with (in the left valve two) slender, somewhat arcuate teeth; muscular impressions moderately impressed; inner margins of the valves smooth; anterior end below the lunule evenly rounded into the base;

posterior end more attenuated, rounded. Height, 20 millimeters; length, about 24 millimeters; diameter, 6 millimeters; but the fragments available indicate that it may attain double the above dimensions.

Station 7623. Pliocene. From submarine beach, 30 feet below sea level, half a mile northwest of Nome. Collected by E. M. Kindle and P. S. Smith, 1908. U. S. Nat. Mus. catalogue No. 324308.

Astarte (Gonilia?) diversa Dall, n. sp.

Plate V, figure 6.

Shell small, rounded triangular, with prominent prosocoelous pointed beaks; nearly equilateral, the anterior end slightly shorter; lunule lanceolate, deeply impressed, concentrically striated, bounded by a sharp angular keel; escutcheon narrow, elongated, obscure; umbonal angle about 90°, dorsal slopes straight, ends and base evenly rounded; sculpture divaricate, some specimens with narrow ribs with the apex central and the interspaces equal, the ribs becoming wider and more irregular toward the ends of the shell, others with few broad divaricate ribs tending to obsolescence in the middle of the disk, and still others having broad, low ribs irregularly broken up into flattish nodules distributed divaricately but more or less irregularly; cardinal teeth short, narrow, two in the left and one in the right valve; ligament short; margin of the left valve, under the escutcheon, grooved; cavity of the valve extending under the hinge, adductor scars impressed, internal margins of the valves smooth. Height, 15 millimeters; length, 18 millimeters; diameter, 8 millimeters; but reaching a larger size as indicated by fragments.

Station 7623 (1). Pliocene. Half a mile northwest of Nome, from submarine beach 30 feet below the level of the sea. Collected by E. M. Kindle and P. S. Smith, 1908. U. S. Nat. Mus. catalogue No. 324309.

This is a remarkable species. The typical *Gonilia* (*bipartita* Philippi, as *Lucina*) is a small Mediterranean shell with a crenulate inner margin and obsolete lunule. Otherwise the only systematic difference is of size. The current descriptions of the original *Gonilia* are in error in giving it three cardinal teeth in each valve and stating that it has no epidermis. The latter feature is due to the fact that the specimens dredged have been decorticated single valves. As there was an earlier *Astarte bipartita* of Sowerby when the Mediterranean species was assigned to the genus, Philippi's specific name could not be retained, and in 1903 I proposed as a substitute the name *calliglypta*. The present species may, however, be more nearly related to the Pacific *Rictocyma* than to the Mediterranean *Gonilia*.

Venericardia nuwokensis Dall, n. sp.

Plate V, figure 14.

Shell small, rotund, moderately inflated, with slightly prominent beaks, dorsal angle about 85°; sculpture of about 20 radiating ribs with somewhat narrower channeled interspaces, crossed by rather regularly spaced low threads which swell into nodules on the back of the ribs at their intersections; base semicircular, internally crenulate in harmony with the external sculpture; hinge normal, teeth short and very strong for the size of the shell. Height, 13 millimeters; length, 11 millimeters; diameter, 9 millimeters.

Station 7230. Pliocene. Carter Creek. Collected by E. de K. Leffingwell, 1912. U. S. Nat. Mus. catalogue No. 324310.

Macoma middendorffii Dall.

Plate VI, figures 11, 13.

This peculiar species seems rather characteristic of the Pliocene at Nome, although in the Recent fauna it is more southern in its general distribution, not having been found living north of Bering Strait. It has been obtained at stations 5074, 5077, 5078, 7619, 7621, and 7622.

Cyrtodaria camdenensis Dall, n. sp.

Plate V, figure 7.

Shell of moderate size, nearly equilateral, equivalve, gaping at both ends; the umbones subcentral, inconspicuous, the anterior end slightly longer; valves thick, with an unsculptured surface, more or less marked by concentric incremental lines; dorsal and ventral margins nearly parallel, anterior end rounded, posterior end subtruncate, rounded above and below; ligament strong and prominent; adductor scars small, pallial line distinct, entire, with a small round scar at the ventral anterior end

indicating the attachment of an area of the mantle; hinge edentulous; a small portion of the periostracum appears to be preserved and shows a black color. Height at umbones, 23 millimeters; length, 48 millimeters; diameter, 15 millimeters; umbones behind the anterior end, 25 millimeters.

Station 7070. Pliocene. Horizon C, 100 feet below horizon B, at Carter Creek, Arctic coast, in the Camden Bay region. Collected by E. de K. Leffingwell. U. S. Nat. Mus. catalogue No. 324311.

This is larger and broader than the *C. kurriana* Dunker, the only species now found living on the coast, and differs in outline from the Atlantic *C. siliqua* Daudin, which has also a more irregular pallial line and larger adductor scars.

Mya n. sp.?

The genus *Mya* is represented in the collection only by fragments including the more solid parts of the valve near the hinge. The chondrophore is more oblique than in any recent American species and resembles that of *Mya japonica*, but the receptacle of the flatter valve is entirely different in details from that of any of the boreal species, all of which have been compared with it. This leads to the conclusion that it represents a distinct species, but I refrain from naming it until specimens showing the characters of the entire shell shall have been collected. Numerous defective specimens have been examined. Pliocene.

Fragments were collected at stations 18*a* and 22*a* (U. S. G. S. stations 5074 and 5077) from the second beach within 1½ miles of Nome, by E. M. Kindle, and at station 7623, from the submarine beach, 30 feet below the sea level, half a mile northwest of Nome, by E. M. Kindle and P. S. Smith. U. S. Nat. Mus. catalogue No. 324312.

BRACHIOPODA.

Hemithyris psittacea Gmelin var. alaskana Dall, n. var.

Plate V, figures 4, 5.

Shell very thin, resembling the typical form of the species but much more delicate, pale buff, passing into yellowish gray, surface marked by irregular lines of growth and sculptured with radiating incised lines with much wider interspaces; pedicel valve less convex than the other, the hinge moderately strong. Height, 22 to 25 millimeters; breadth, 22 to 26 millimeters; diameter of pedicel valve, 6 millimeters; of ventral valve, 9 millimeters.

Station 7618 (19*a*). Older Pliocene. One mile north of Fort Davis (Gallatin mine), east of Nome, near the parting of Florence and Otter Creek gulches. Collected by R. D. Mesler, 1908. U. S. Nat. Mus. catalogue No. 324313.

Magasella aleutica Dall.

I have catalogued this species under the name by which it was originally designated, though I have a suspicion that it represents the *Magasella* stage of development of some larger terebratelloid species. It does not agree closely with the young of *Terebratalia frontalis* Middendorff, and *Terebratalia coreanica* Gould has not been found in the Aleutians. In the absence of any other available species the question must be left open. Pliocene to Recent.

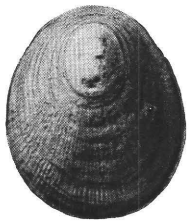
POLYZOA.

Myriozoum n. sp.

At station 7477, in the dump of an 80-foot shaft about a mile north of Nome, occurred fragments of a *Myriozoum* which were submitted to R. S. Bassler. He reported: "This is usually identified as *Myriozoum truncatum* Pallas but undoubtedly is a distinct species." The horizon is probably Pliocene.

PLATES V-VI.

PLATE V.



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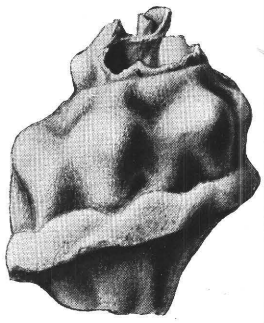

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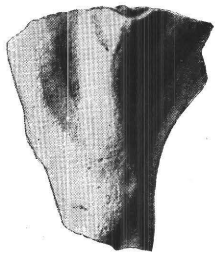

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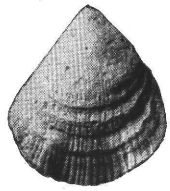

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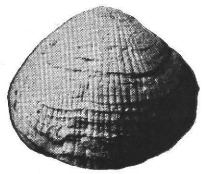

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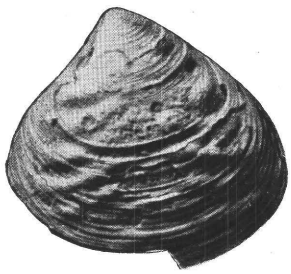

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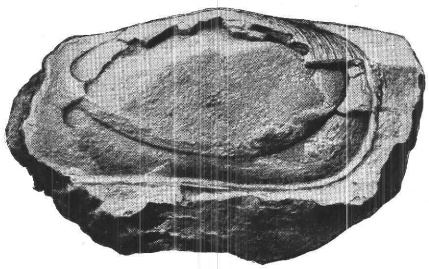

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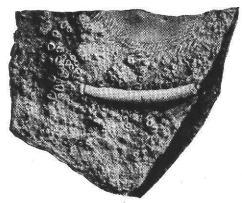

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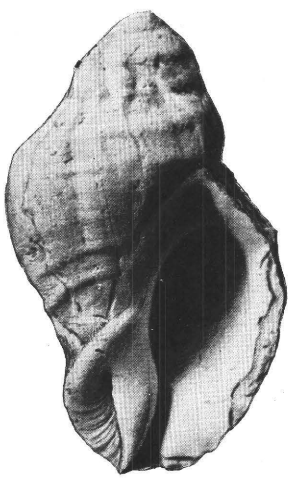

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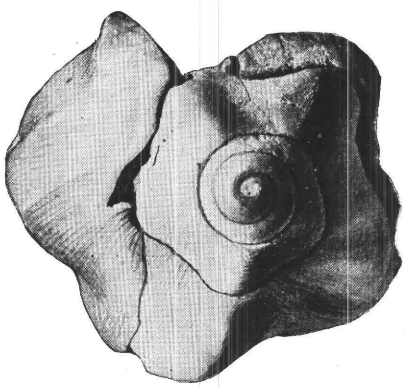

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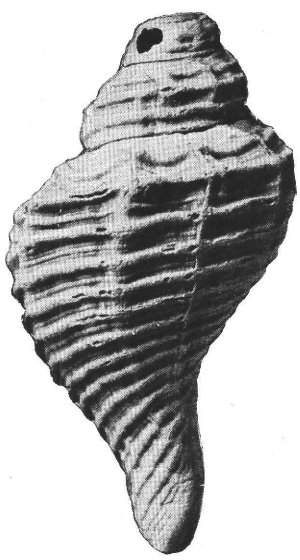

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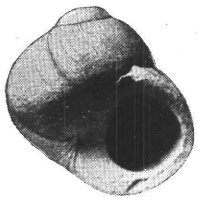

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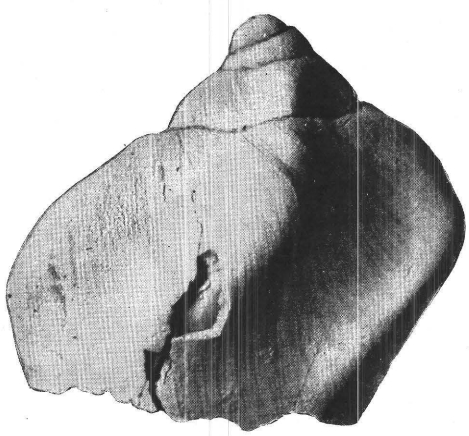

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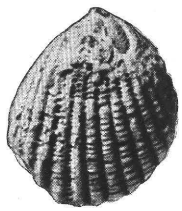

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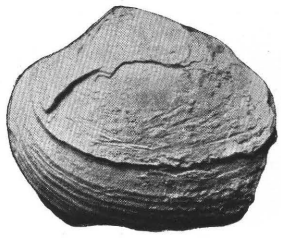
ALASKAN FOSSILS.



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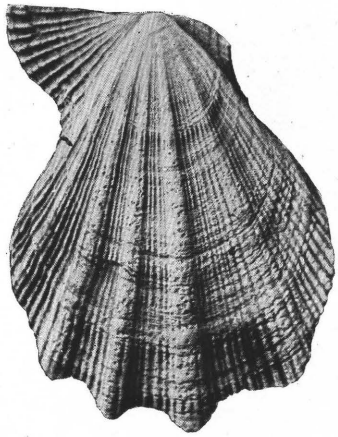

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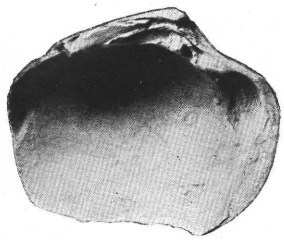

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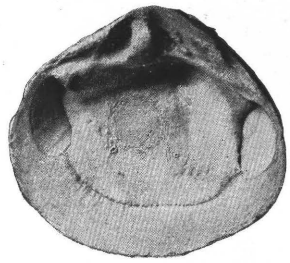

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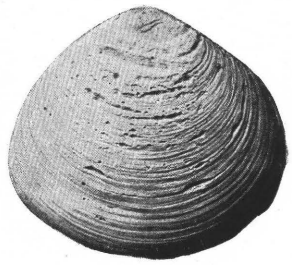

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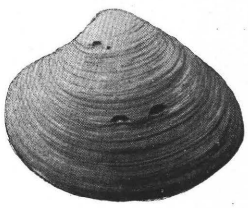

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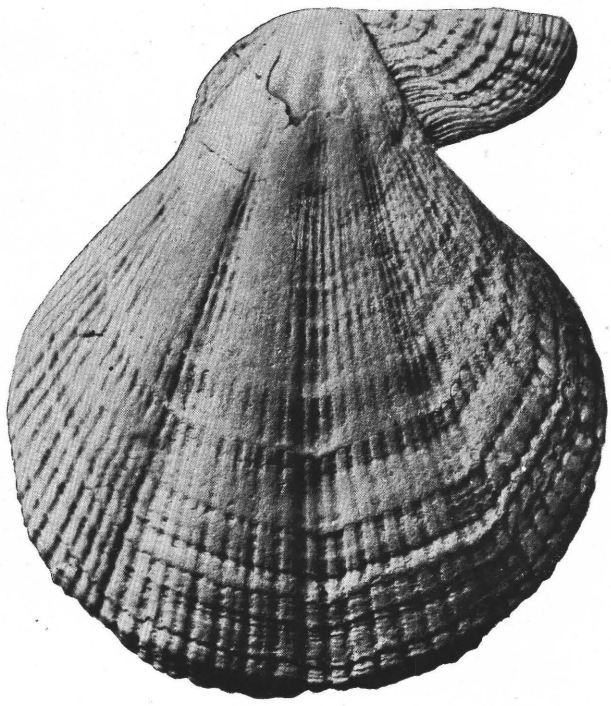

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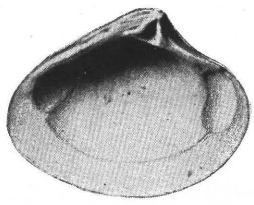

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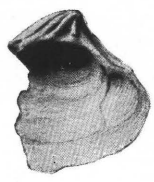

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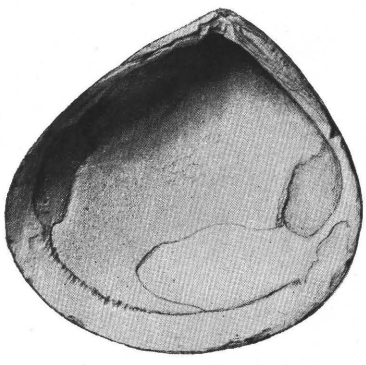

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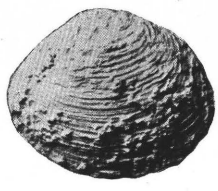

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ALASKAN FOSSILS.

PLATE VI.