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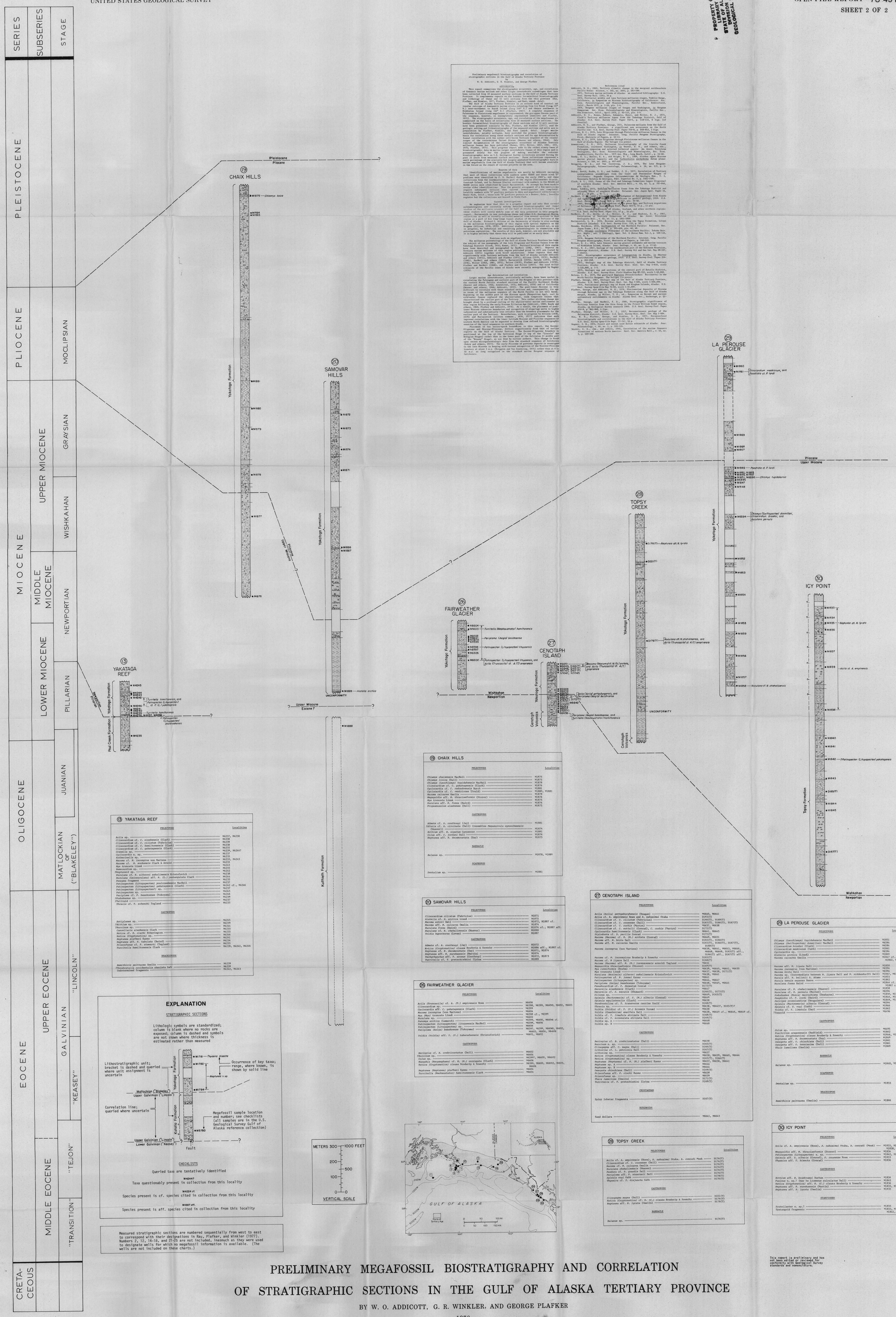

Preliminary megafossil biostratigraphy and correlation of stratigraphic sections in the Gulf of Alaska Tertiary Province

by

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Introduction

This report summarizes the stratigraphic occurrence, age, and correlation of Cenozoic marine mollusk and other larger invertebrate assemblages that have been collected from 18 measured stratigraphic sections in the Gulf of Alaska Tertiary Province. It complements reports on the benthic foraminiferal biostratigraphy and lithology of these and 12 well sections from the this province (Rau, Plafker, and Winkler, 1977; Plafker, Winkler, and Rau, unpub. data).

The Gulf of Alaska Tertiary Province is an arcuate band of coastal and insular outcrops of dominantly marine strata extending from Icy Point (long 139° W.) west-northwest to Kayak Island (long 144° W.) and thence southwest to Middleton Island (long 146° W.) (Plafker, 1967). A complete sequence of Paleocene to Pleistocene megafaunas is represented; the pre-upper Eocene part of the sequence, however, is incompletely represented (Addicott and Plafker, 1971). The stratigraphic occurrence, age, and correlation of the megafaunas are summarized on the basis of collections from 18 measured surface sections. The benthic foraminiferal biostratigraphy of these sections and of 12 well sections have been presented similarly by Rau, Plafker, and Winkler (1977), and the geologic setting and lithostratigraphy of the measured sections and wells are in preparation by Plafker, Winkler, and Rau (unpub. data). Most megafossil invertebrates, notably mollusks, have provided the primary biostratigraphic and paleoecologic information from the Gulf of Alaska Tertiary because their faunal correlation with the rather well-known Tertiary sequence of the coastal ranges of the conterminous United States (Weaver and others, 1944). Only limited documentation of the stratigraphic occurrence of Alaskan Tertiary mollusca faunas has been published (Kanno, 1971; Miller, 1957, 1961, 1971, 1975; Plafker, 1974). This progress report adds to the rather scanty base of biostratigraphic data on marine larger invertebrate faunas of this region and is presented solely for the purpose of making available the evident biostratigraphic data on U.S. Geological Survey collections secured during the past 15 years from measured surface sections. These collections represent a small percentage of the available but largely unstudied biostratigraphic data on marine megafossils from the Gulf of Alaska Tertiary that will become available in the future as the result of current projects in the area.

Sources of data

Identifications of marine megafossils are mostly by Addicott excepting that most of those collections with numbers under the M5000 and those with "D" prefixes were identified by F. S. MacNeil during the early 1960's, and those collections from the southeastern part of the region (Fairweather Glacier, Topsy Creek, and Icy Point) and those collections with numbers in the M6500 and M600 series were identified by Louis Marincovich. No attempt has been made to revise older identifications. Thus the generic assignment of a few species may require subsequent revision when current investigations are completed. Locality numbers with "M" prefixes pertain to data and megafossil collections in Menlo Park, Calif.; those with "D" prefixes pertain to a Denver, Colo., locality register but the collections are housed in Menlo Park.

Current investigations

We emphasize here that this is a progress report and note that several paleontologists are currently making detailed biostratigraphic and faunal studies of the mollusca sequence of the Gulf of Alaska Tertiary Province, and these studies will surely modify some of the data presented in this progress report. Marincovich is now restudying these and other U.S. Geological Survey collections as well as recently collected material from several sections in this region as a part of his doctoral dissertation at Stanford University. Marincovich and Gulf of Alaska Richard C. Fitzgerald are also studying the Gulf of Alaska in also working on a biostratigraphy of this region with special emphasis on the Neogene (Allison, 1978, 1979). Additional studies have been carried out, or are in progress, by industrial and consulting paleontologists in connection with petroleum exploration. The results of this work, however, are not available and it is highly unlikely that these data will be published at an early date.

Previous work on megafossils

The molluscan paleontology of the Gulf of Alaska Tertiary Province has been the subject of two monographs of the late Oligocene and Miocene faunas from the Yakataga District (Clark, 1932; Kanno, 1971). Pectinid bivalves of this region have been described and monographed by MacNeil (1961, 1967). Reports on Tertiary marine mollusks of this region published prior to 1971 are listed by Addicott (1973) together with brief annotations. Other reports dealing significantly with Tertiary mollusks from this region include Addicott (1966), Addicott and others (1971), Addicott and Plafker (1971), Allison (1978, 1979), MacNeil (1965), Marincovich (1973, 1976), Marincovich (1976), Nesuda (1972, 1973, 1976), Miller (1953, 1961, 1971), Nelson (1979), Plafker and Addicott (1976), Plafker and MacNeil (1966), and Plafker and Miller (1957). The sand dollar echinoids of the Pacific coast of Alaska were recently monographed by Wagner (1974).

Age determination and correlation

Larger marine invertebrates, particularly mollusks, have been useful in correlating the Paleogene and earliest part of the Neogene of this province with the eastern North Pacific standard sections of the Pacific Northwest States (Weaver and others, 1944; Armentrout, 1975; Addicott, 1976) and of California (Weaver and others, 1944; Addicott, 1972). The post-lower Miocene is very difficult to correlate with these standard sections and, consequently, its age in terms of the molluscan sequence of the North Pacific is not well known. Beginning in the middle part of the Miocene epoch (Newportian Age), cool to cold-water faunas replaced the shallow-water, warm temperate faunas that characterized the earlier part of the Tertiary. This rather striking change was brought about by a profound cooling of the shallow-water marine environment in this region following the early Miocene Pillarian Age (Addicott, 1970; Addicott and others, 1969; Plafker and Addicott, 1976). As a result, the placement of post-lower Miocene subseries boundaries and correlation of stage/age units is highly inferential and substantially less reliable than the boundary placements for the Paleogene and earliest Miocene. Nevertheless, work in progress by Allison (1978, 1979) and Marincovich (written commun., 1976, 1977) indicates that much improved correlations with the lower latitude Miocene and Pliocene sequences of western North America can be expected to develop from refined biostratigraphic zonation of the local sequences in southern Alaska.

Placement of two series-epoch boundaries in this report, the Eocene-Oligocene and Miocene-Pliocene, differs significantly from that of earlier reports on the Gulf of Alaska Tertiary. The Eocene-Oligocene boundary is positioned at the top of the Galvinian Stage (= top of the "Lincoln" and Refugian Stages) rather than in the lower part of the Galvinian (= middle part of the "Keasey" Stage), as was done by earlier authors. This change is based upon recent micropaleontologic data from the standard sequence of California (Bukry and others, 1977). The early Pliocene of previous reports is reassigned to the late Miocene in keeping with current recognition of the Miocene-Pliocene boundary at about 5 m.y. (Berggren and Van Couvering, 1974) rather than at 9 to 10 m.y. as long recognized in the standard marine Neogene sequence of California.

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13 YAKATAGA REEF

PELECYPODS	Localities
Acila sp.	M4237, M4238
Clinocardium cf. *C. alaskensis* (Clark)	M4238
Clinocardium cf. *C. ciliatum* (Fabricius)	M4239
Clinocardium cf. *C. hamltcoensis* (Clark)	M4238
Clinocardium cf. *C. yakataganensis* (Clark)	M4235
Crenella sp.	M4239, M4244?
Cyclocardia n. sp.	M4237
Katherinella sp.	M4235
Macoma cf. *M. inconspicua* von Martens	M4235, M4245
Macoma cf. *M. sookensis* Clark & Arnold	M4235
Mya truncata Linné	M4245
Nemocardium sp.	M4235
?*Neptunea*? sp.	M4242
Nuculana cf. *N. alferovi sakalinensis* Kristofovich	M4238
Nuculana (*Leionuculana*) aff. *N.* (*L.*) *postangulata* Clark	M4244
Panopea fragment	M4235
Patinopecten (*Lituypecten*) *poulcreekensis* MacNeil	M4237
Patinopecten (*Lituypecten*) *yakataganis* (Clark)	M4242 cf., M4246
Patinopecten (*Lituypecten*?) sp.	M4237
Patinopecten sp.	M4245
Periploma cf. *P. besshoense* (Tokoyama)	M4246
?*Pododesmus* sp.	M4239
?Tellinid	M4237
Thracia cf. *T. schencki* Tegland	M4235
GASTROPODS	
Antiplanes sp.	M4245
?*Bittium* sp.	M4239
?*Buccinum* sp.	M4244
Cancellaria alaskensis Clark	M4235
Natica cf. *N. clarki* Etherington	M4235
Natica (*Cryptonatica*) sp.	M4246
Neptunea plafkeri Kanno	M4241
Neptunea aff. *N. tabulata* (Baird)	M4236
Priscofusus cf. *P. stewarti* (Tegland)	M4235
Turritella hamiltonensis Clark	M4239, M4242, M4246
BRACHIOPODS	
Hemithiris psittacea Gmelin	M4239
?*Terebratalia occidentalis obsoleta* Dall	M4239
Undetermined fragments	M4242, M4243

EXPLANATION

STRATIGRAPHIC SECTIONS

Lithologic symbols are standardized; column is blank where no rocks are exposed; column is dashed and symbols are not shown where thickness is estimated rather than measured

Lithostratigraphic unit; bracket is dashed and queried where unit assignment is uncertain

Correlation line; queried where uncertain

M1781 — *Thyasira bisecta*
M1782
Neptunea n. sp.
M1784
M5750
Yakataga Formation
Katalla Formation
Matlockian ("Blakeley")
Upper Galvinian ("Lincoln")
Upper Galvinian ("Lincoln")
Lower Galvinian ("Keasey")
Fault

Occurrence of key taxa; range, where known, is shown by solid line

Megafossil sample location and number; see checklists (all samples are in the U.S. Geological Survey Gulf of Alaska reference collection)

CHECKLISTS

Queried taxa are tentatively identified

M4244?
Taxa questionably present in collection from this locality

M4224 cf.
Species present is cf. species cited in collection from this locality

M1887 aff.
Species present is aff. species cited in collection from this locality

Measured stratigraphic sections are numbered sequentially from west to east to correspond with their designations in Rau, Plafker, and Winkler (1977). Numbers 2, 12, 14-18, and 21-25 are not included, inasmuch as they were used to designate wells for which no megafossil information is available. (The wells are not included on these charts.)

19 CHAIX HILLS

PELECYPODS	Localities
Chlamys chaixensis MacNeil	M1875
Chlamys hoicis (Dall)	M1875
Chlamys (*Leochlamys*) *tugidakensis* MacNeil	M1878
Clinocardium cf. *C. yakataganensis* (Clark)	M1876
Cyclocardia cf. *C. redondoensis* Burch	M1881
Cyclocardia cf. *C. ventricosa* (Gould)	M1880, M1881
Macoma calcarea Gmelin	M1879
Megayoldia aff. *M. thraciaeformis* (Storer)	M1876
Mya truncata Linné	M1875
Nuculana aff. *N. fossa* (Baird)	M1876
Propeamussium alaskense (Dall)	M1875
GASTROPODS	
Admete cf. *A. couthouyi* (Jay)	M1881
?*Aforia* cf. *A. circinata* (Dall) (resembles *Megasurcula wynoocheensis* (Weaver))	M1876
Bittium aff. *B. nigatum* Carpenter	M1881
Colus aff. *C. jordani* Dall	M1876
Neptunea aff. *N. decemcostata* (Say)	M1875
BARNACLE	
Balanus sp.	M1878, M1880
SCAPHOPOD	
Dentalium sp.	M1881

20 SAMOVAR HILLS

PELECYPODS	Localities
Clinocardium ciliatum (Fabricius)	M1871
Histella cf. H. arctica Linné	M1872
Macoma atrocirrata Dall	M1872, M1887 cf.
Macoma aff. M. calcarea Gmelin	M1874
Nuculana fossa (Baird)	M1874 cf., M1887 aff.
Nuculana cf. N. chehalisensis (Weaver)	M1890
Yoldia hyperborea (Lovén)	M1887
GASTROPODS	
Admete cf. A. couthouyi (Jay)	M1872
Natica (*Cryptonatica*) *clausa* Broderip & Sowerby	M1886 aff., M1887 cf.
Neptunea cf. N. decemcostata (Say)	M1871, M1874
Neptunea aff. N. eurakesania (Martin)	M1874
Tachybrynchus aff. T. erosus (Couthouy)	M1872, M1873
Turritella cf. T. gretschiskini Ilyina	M1889

26 FAIRWEATHER GLACIER

PELECYPODS	Localities
Acila (*Truncacila*) cf. *A.* (*T.*) *empirensis* Howe	M6606
Clinocardium sp.	M6598, M6599, M6600, M6602, M6603
Cyclocardia aff. *C. yakataganensis* (Clark)	M6599
Macoma inconspicua (von Martens)	M6604
Mya (*Mya*) *truncata* Linné	M6598 cf., M6599
Nuculana sp.	M6602
Panopea arctica (Lamarck)	M6599, M6600, M6606 cf.
Patinopecten (*Lituyapecten*) *lituyaensis* MacNeil	M6598, M6606
Patinopecten (*Lituyapecten*) sp.	M6606
Periploma (*Aegila*) *besshoense* (Tokoyama)	M6597, M6599, M6600, M6602, M6603, M6604, M6606
Yoldia (*Yoldia*) aff. *Y.* (*Y.*) *takaradaensis* (Kristofovich)	M6601, M6602
GASTROPODS	
Beringius cf. *B. crebricostatus* (Dall)	M6602
?*Buccinum* sp.	M6604
Colus sp.	M6597, M6600, M6602
Musashia (*Neopsephaea*) cf. *M.* (*N.*) *corrugata* (Clark)	M6606
Natica (*Cryptonatica*) *clausa* Broderip & Sowerby	M6599, M6600, M6602, M6603, M6606
Neptunea (*Neptunea*) *plafkeri* Kanno	M6606
Turritella (*Neohaustator*) *hamiltonensis* Clark	M6604

27 CENOTAPH ISLAND

PELECYPODS	Localities
Acila (*Acila*) *gettysburghensis* (Reagan)	M6640, M6641
Acila cf. *A. empirensis* Howe and *A. nakazimai* Otuka	D165(T)
Clinocardium cf. *C. ciliatum* (Fabricius)	D166(T), D169(T)
Clinocardium cf. *C. coosense* (Dall)	D165(T), D166(T), D167(T)
Clinocardium cf. *C. corbis* (Martyn)	M6637, M6638
Clinocardium cf. *C. nuttalli* (Conrad), *C. corbis* (Martyn)	D172(T)
Cyclocardia hamiltonensis (Clark)	M6641, M6645
Diplodonta cf. *D. parilis* Conrad	D172(T)
Macoma (*Macoma*) cf. *M.* (*M.*) *arctata* (Conrad)	M6649, M6651
Macoma aff. *M. brota* Dall	D165(T), D166(T)
Macoma aff. *M. calcarea* Gmelin	D165(T), D166(T), D167(T), D168(T)
Macoma incongrua (von Martens)	M6638, M6641, M6643, M6646, M6648, M6649, D165(T) aff., D166(T) aff., D167(T) aff.
Macoma cf. *M. inconspicua* Broderip & Sowerby	D165(T)
Macoma cf. *M lipara* Dall	D168(T)
Macoma (*Macoma*) aff. *M.* (*M.*) *lorenzoensis arnoldi* Tegland	M6651
Megayoldia thraciaeformis (Storer)	D169(T)
Mya cumiformis (Boehm)	M6639, M6640, M6641, M6650
Mya truncata Linné	M6637, M6638, D171(T)
Nuculana (*Borissia*?) *alferovi sakalinensis* Kristofovich	M6638, M6641
Patinopecten cf. *P. jonesi* Kanno	M6641
Patinopecten (*Lituyapecten*) sp.	M6646, M6647
Periploma (*Aegla*) *besshoense* (Tokoyama)	M6638, M6640, M6641
Pseudocardium cf. *P. densatum* Conrad	D172(T)
Securella alaskensis (Clark)	M6647
Securella cf. *S. securis* (Shumard)	D166(T), D172(T)
Siliqua sp.	M6649, D165(T)
Spisula (*Mactromeris*) cf. *S.* (*M.*) *albaris* (Conrad)	M6649
Spisula equilateralis (Clark)	M6638
Terebratalina cf. *T. transversa caurina* Gould	D168(T)
Thracia sp.	M6638, M6643?, D165(T)?
Yoldia (*Yoldia*) cf. *Y.* (*Y.*) *biremis* Dall	M6638
Yoldia (*Cnesterium*) *emsifera* Dall	M6638, M6640 cf., M6646, M6649 cf.
Yoldia cf. *Y. limafula strigata* Dall	D168(T)
Yoldia cf. *Y. scissurata strigata* Dall	D168(T)
Yoldia sp. A	M6648
Yoldia sp. B	M6648
GASTROPODS	
Beringius cf. *B. crebricostatus* (Dall)	M6638
Buccinum n. sp.	D165(T)
Clinopegma aff. *C. magna* (Dall)	D166(T)
Littorina cf. *L. petricola* Dall	D167(T)
Littorina sp.	M6637
Natica (*Cryptonatica*) *clausa* Broderip & Sowerby	M6638, M6639, M6640, M6644
Natica (*Cryptonatica*) sp.	D165(T), D166(T)
Neptunea (*Neptunea*) cf. *N.* (*N.*) *plafkeri* Kanno	M6637, M6638, M6641
Neptunea sp. A	M6644
Neptunea sp. B	M6644
Oenopota chiachiana (Dall)	D169(T)
Priscofusus aff. *P. clarki* Kanno	M6638
Priscofusus sp.	M6639
Thais lamellosa (Gmelin)	D171(T)
Turritella cf. *T. gretschiskini* Ilyina	D168(T)
CRUSTACEAN	
Spiny lobster fragments	D167(T)
ECHINOIDS	
Sand dollars	M6641, M6643

28 TOPSY CREEK

PELECYPODS	Localities
Acila cf. *A. empirensis* (Howe), *A. nakazimai* Otuka, *A. conradi* Meek	D176(T)
Clinocardium cf. *C. coosensse* (Dall)	D176(T)
Macoma cf. *M. calcarea* Gmelin	D176(T)
Nuculana chehalisensis (Weaver)	D176(T)
Pandora cf. *P. grandis* Dall	D176(T)
Periploma aff. *P. stearnsii* Dall	D178(T)
Spisula vogi Gabb	D176(T)
Thyasira cf. *T. disjuncta* Gabb	
GASTROPODS	
Clinopegma magna (Dall)	D221(T)
Natica (*Cryptonatica*) cf. *N.* (*C.*) *clausa* Broderip & Sowerby	D176(T)
Neptunea aff. *N. lyrata* (Gmelin)	D178(T)
BARNACLE	
Balanus sp.	D176(T)

29 LA PEROUSE GLACIER

PELECYPODS	Localities
Chlamys (*Leochlamys*) *tugidakensis* MacNeil	M1851
Chlamys (*Swiftopecten*) *donnilleri* MacNeil	M6594
Clinocardium brooksi (Clark)	M6594
Clinocardium meekianum (Gabb)	M1861
Cyclocardia sp.	M6594
Histella arctica (Linné)	M1860
Macoma calcarea Gmelin	M1847 cf., M1849, M1850 cf., M1862, M1865 cf., M1866
Macoma aff. *M. lipara* Dall	M1850
Macoma incongrua (von Martens)	M6594
Macoma brota Dall	M6594
Macoma sp. (intermediate between *M. lipara* Dall and *M. middendorffi* Dall)	M1867, M6594
Nucula aff. *N. belloti* A. Adams	M1853
Nucula tenuis expansa Reeve	M1862
Nuculana fossa Baird	M1846 cf., M1855 cf., M1867 cf.
Nuculana cf. *N. chehalisensis* (Weaver)	M1858
Nuculana cf. *N. pernula* (Müller)	M6594
Pododesmus (*Monia*) *macrochisma* (Deshayes)	M1850, M1866, M1869
Paephidia cf. *P. lordi* (Baird)	M1846, M1861
Saxipes greenlandicus (Krupitzer)	M1849, M1861
Spisula (*Mactromeris*) *albaris* (Conrad)	M6594
Spisula cf. *S. vogi* (Gabb)	M1866
Yoldia cf. *Y. limatula* (Say)	M1862
?Veneri*d*	M6496
GASTROPODS	
Colus sp.	M6495
Fusitriton oregonensis (Redfield)	M1862
Natica (*Cryptonatica*) *clausa* Broderip & Sowerby	M1846, M1848
Neptunea aff. *N. decemcostata* (Say)	M1849
Oenopota aff. *O. chiachiana* (Dall)	M1861
Oenopota aff. *O. tenuissima* (Dall)	M1861
Thais lamellosa (Gmelin)	M1869
BARNACLE	
Balanus sp.	M1848, M1856
SCAPHOPOD	
Dentalium sp.	M1853
BRACHIOPOD	
Hemithiris psittacea (Gmelin)	M1866

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PELECYPODS	Localities
Acila cf. *A. empirensis* (Howe), *A. nakazimai* Otuka, *A. conradi* (Meek)	M1833, M1834, M1836, M1837, M1838, M1839 aff.
Megayoldia aff. *M. thraciaeformis* (Storer)	M1834
Patinopecten (*Lituypecten*) n. sp.	M1842, D187(T)
Spisula aff. *S. albaris* (Conrad), *S. coosense* Howe	M1833
Thyasira aff. *T. bisecta* (Conrad)	M1836
GASTROPODS	
Bittium aff. *B. brankrampi* Durham	M1836
Fusinus n. sp.? (may be *Liomesus sulculatus* Dall)	M1845
Natica (*Cryptonatica*) aff. *N.* (*C.*) *clausa* Broderip & Sowerby	M1836
Neptunea aff. *N. eurakesania* (Martin)	M1835, M1836, M1838
Neptunea aff. *N. lyrata* (Gmelin)	M1835
STARFISHES	
Scutellaster n. sp.?	M1835
Spatangoid fragments	M1833, M1835, M1839, M1840, M1841, M1843, M1845

PRELIMINARY MEGAFOSSIL BIOSTRATIGRAPHY AND CORRELATION OF STRATIGRAPHIC SECTIONS IN THE GULF OF ALASKA TERTIARY PROVINCE

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This report is preliminary and has not been edited or reviewed for conformity with Geological Survey standards and nomenclature.