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Late Cenozoic radiometric dates, Seward and Baldwin Peninsulas, and adjacent continental shelf, Alaska

by

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This map is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards and stratigraphic nomenclature.

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INTRODUCTION

The Seward and Baldwin Peninsulas and adjacent continental shelf form the heart of Beringia, the vast arctic landmass that was exposed during Pleistocene glacial epochs (Hultén, 1937), and is an area of wide interdisciplinary interest. Quaternary deposits there preserve an especially rich record of the paleogeographic evolution of Beringia. Stratigraphic and geomorphic relationships between glacial drift and interglacial marine deposits and shorelines reflect the chronology of alternating seaways and land bridges. These relationships have attracted considerable research attention (Hopkins, 1967, 1972, 1973; Hopkins and others, 1960, 1974; McCulloch and others, 1965; Péwé and others, 1965). Less work has focused on the record of fluctuating late Pleistocene and Holocene glacial activity carried in four small mountain ranges on the Seward Peninsula (Hopkins, 1953; Hopkins and others, 1983; Sainsbury, 1965, 1967a, 1967b) and on the widespread Cenozoic volcanism of the central Seward Peninsula (Hopkins, 1963, Turner and Swanson, 1981).

The greater part of the complex Quaternary geologic record preserved in this area lies beyond the range of radiocarbon dating. However, twelve previously published and one yet unpublished K/Ar age determinations on volcanic rocks provide a crude chronology of Cenozoic volcanism in the region. In addition, 156 published and previously unpublished radiocarbon dates obtained from 76 natural exposures, archeological sites, sediment cores, and test pits provide information about the paleogeographic history of the region during late Pleistocene and Holocene time.

Table 1 is a comprehensive listing of reported late Cenozoic radiometric ages from the Seward Peninsula and Kotzebue Sound area, and includes 26 dates published here for the first time. Omitted from the table are uranimum-series age determinations that have been attempted on marine mollusks; these have been discredited by Kaufman and others (1971). The nomenclature used in the table follows Hopkins (1963) for the volcanic rocks, Hopkins (1953) and Hopkins and others (1983) for glacial intervals, and Hopkins (1967) for marine transgressive units. Recent refinements in the glacial sequence and descriptions of the deposits mentioned in the table are presented in a surficial geologic map of the Solomon, Bendeleben and southern portion of the Kotzebue quadrangles (scale, 1:250,000) (Kaufman, 1985).

The frequency distribution of 113 finite radiocarbon dates for 1000 year intervals is shown in Figure 1. If the distribution of dates is a true representation of changing rates of organic productivity, then the pattern shown in Figure 1 may reflect late Quaternary environmental changes in the Seward Peninsula and Kotzebue Sound region. The histogram can be divided into five distinct segments, each reflecting a unique environmental condition:

1) The period between 17,000 and 30,000 years B.P. includes only 8 radiocarbon dates indicating that the climate of this period may have been unfavorable for the growth of vegetation. This period is encompassed by the Duvanny Yar

interval (Hopkins, 1982), which was characterized by extremely dry, probably cold periglacial conditions in unglaciated parts of Beringia, and by the Mount Osborn glacial phase of the central Seward Peninsula. The Mount Osborn interval coincides with the late Wisconsin Walker Lake glacial interval of the Brooks range which Hamilton (1982) has dated as beginning about 24,000 years B.P. and ending time-transgressively between about 12,000 and 10,000 years ago.

2) The period between 11,000 and 17,000 years B.P. includes 16 radiocarbon dates. Encompassed by this interval are five dates from off-shore bore holes that record an exposed continental shelf above approximately -20 m during the time when sea level was recovering from its Wisconsin minimum. The dates from this period establish the presence of large herbivores, and the initiation of an increase in the abundance of vegetation on the Seward and Baldwin Peninsulas.

3) The short period between 8,000 and 11,000 years B.P. is most distinct. A cluster of 28 radiocarbon dates records the rapid and dramatic environmental change of the late Wisconsin-early Holocene transition. This was a period of substantial climatic warming accompanied by the flooding of the continental shelf which brought an increase in moisture to the region. The time spanned by these dates is encompassed by the birch zone spectra in lake-sediment pollen cores (Hopkins, 1982) and was characterized by an overall increase in precipitation and development of snowy winters with warm, dry summers. Evidence of a warm climate includes the extension of the range of beaver, the melting of ice-wedges, the presence of tree species beyond their present limits, and widespread accumulation of peat. Also included in this time interval are three radiocarbon dates that record the volcanic eruptions at the Devil Mountain Lake maars.

4) The period of 3,000 to 8,000 years B.P. includes a sparse 17 radiocarbon ages reflecting environmental conditions less suitable to the growth of vegetation. This period may include one or more brief reversions to a colder climate and expansions of cirque glaciers along the crests of the Kigluaik and Bendeleben Mountains, as indicated by the presence of glacial moraines apparently older than Neoglacial but younger than the Mount Osborn glacial interval, and by the history of other regions (Calkin and Haworth, 1983; Ellis and Calkin, 1984).

5) Over two thirds of the 44 radiocarbon ages included in the period of 0-3,000 years B.P. were taken from archeological sites at Trail Creek Caves, Cape Prince of Wales, Deering, and the Choris Peninsula. Evidence for renewal of ice-wedge growth near Nome (Hopkins and others, 1960) and the presence of what are likely to be Neoglacial deposits in the Kigluaik Mountains (P. D. Calkin, oral communication, 1983) indicate that this interval includes a brief cold cycle. Buried peat layers suggest that though cooler, precipitation was not greatly reduced.

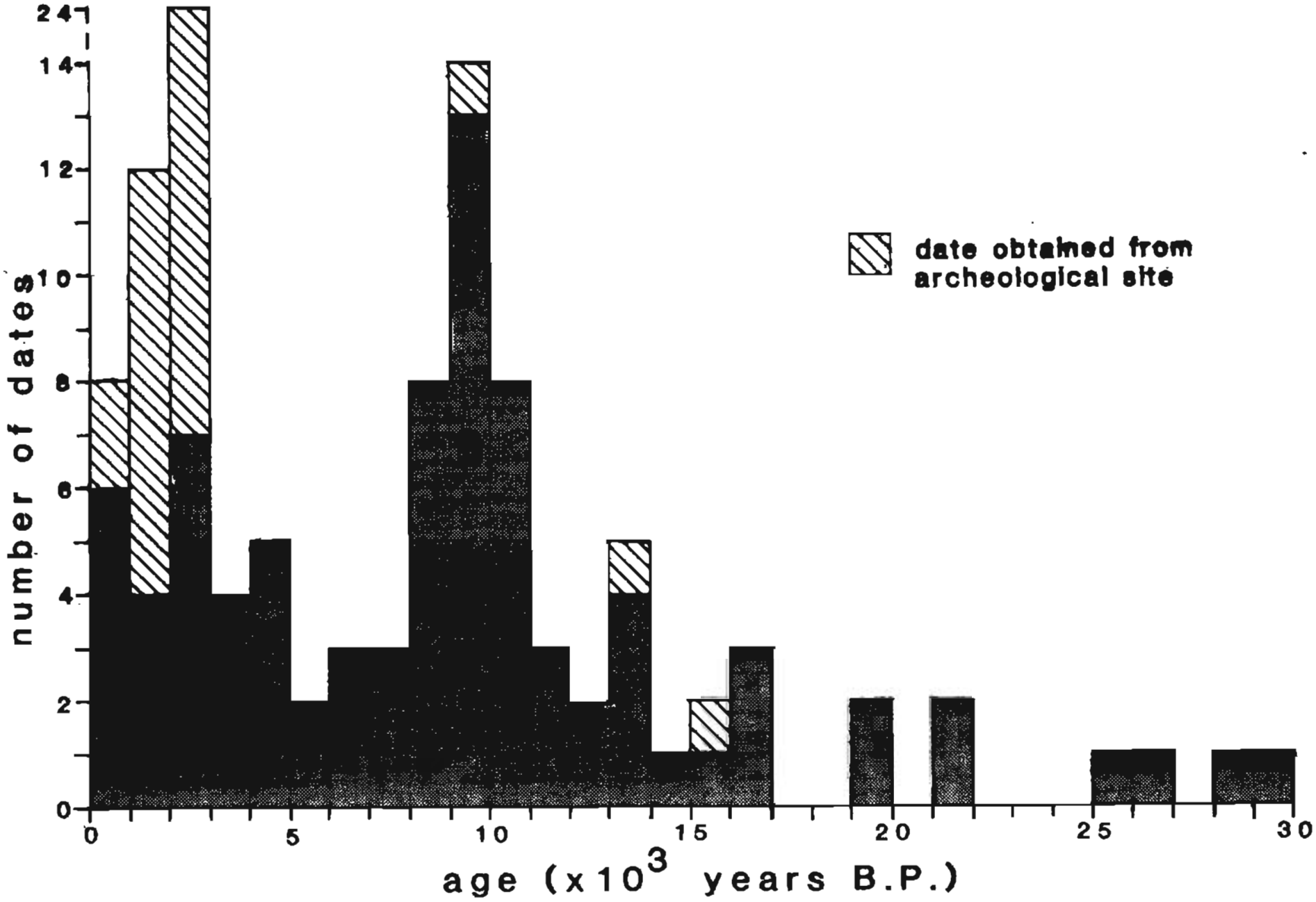

Figure 1. Frequency distribution of radiometric dates.

Table 1. Radiometric dates

[Locations, ages, and laboratory numbers are shown on Plate 1]

Quadrangle[1] Lat. (N) Long.(W)	Material and stratigraphic context	Chronological significance	Age (BP) Lab number[2]	Reference
		K/Ar DATES		
Bend:C-2 65° 34' 162° 56'	Three samples of basalt from one or more flows exposed in east wall of Kugruk River canyon.	Dates the type locality of the Kugruk volcanics [the unit was abandoned by Hopkins and others (1971)]	28.8 ± 1.8 my (PT80-40); 28.1 ± 1.4 my (PT80-38); 26.4 ± 1.4 my (PT80-37)	Swanson and others, 1981; Turner and Swanson, 1981
Bend:D-3 65° 34' 163° 56'	Basalt from tholeiitic flow overlying terrace gravel at Lava Camp Mine on the Inmachuk River.	Dates flow contemporary with the Imuruk volcanics.	5.85 ± 0.2 my (USGS determination)	Hopkins and others, 1971; Hopkins, 1972
Tell:B-4 65° 25' 166° 33'	Basalt from flow forming divide between California and Agiapuk Rivers.	Flow is cut by wave attack which formed the inner edge of the York Terrace thus providing a maximum limit on its age.	2.92 ± 0.14 my (MP-101)	Berry and others, 1976; Hopkins and others, 1974; Turner and Swanson, 1981
Tell:B-3 65° 18' 166° 10'	Three samples of basalt from one or more flows 15 km northeast of Teller at hill 1220, near Eva Mountain.		2.7 ± 0.2 my (PT80-50A); 2.6 ± 0.2 my (PT80-51D)	Turner and Swanson, 1981
Tell:B-3 65° 19' 166° 11'	Basalt from Eva Mountain, 15 km northeast of Teller.		2.5± 0.3 my (PT80-50B)	Turner and Swanson, 1981

Bend:C-2 65° 34' 162° 58'	Basalt from one or more flows 0.5 km west of head of Kugruk River canyon.	Dates the type locality of the Imuruk volcanics.	2.2 ± 0.02 my (PT80-33); 2.2 ± 0.02 my (PT80-35A)	Swanson and others, 1981; Turner and Swanson, 1981
Bend:C-2 65° 34' 162° 55'	Two samples of basalt from a single flow that entered the modern Kugruk River canyon.	Flow contemporary with the Gosling volcanics.	0.91 ± 0.09 my (PT80-36A); 0.82 ± 0.08 my (PT80-34)	Swanson and others, 1981; Turner and Swanson, 1981
Bend:B-4 65° 31' 164° 09'	Basalt from a lava flow assigned to the Gosling volcanics that overran a moraine of the Nome River glacial interval on the right bank of Minnie Creek where it bends sharply to the west; north flank of the Bendeleben Mountains.	Provides a limiting age for the Nome River glacial interval indicates that the Nome River glaciation is much older than previously thought (Hopkins, 1967). Age agrees well with others by Turner and Swanson (1981) from the Gosling volcanics. Flow is magnetically normal (Jack Hillhouse, written communication).	0.81 ± 0.09 my[3] (84 AKn 106; U.S. Geological Survey determination by Nora Shew and F. H. Wilson)	D. S. Kaufman, 1985, unpublished data
		^{14}C DATES		
Cand:D-6 65° 56' 161° 59'	Log from the base of a 21 m core taken from Mud Creek. The hole penetrated 10 m of ice-rich silt, 5 m of coarse gravel, and 6 m of sandy gravel.	Wood thought to have been taken from marine sediments.	>59,000 (QL-1725)	Noranda Exploration, Inc., unpublished data
Bend:B-6 65° 24' 164° 39'	Peat at top of silty, carbonaceous layer intercalated in Kougarok gravel of Hopkins (1963) in a pit at Kougarok landing strip.		>45,000 (W-2161)	Sullivan and others, 1970
Bend:B-6 65° 22' 164° 41'	Wood in carbonaceous lens of sand in Kougarok gravel of Hopkins (1963) from Brakes Bottom gravel pit.		>45,000 (W-2159)	Sullivan and others, 1970

Seli:B-5 66° 15' 161° 18'	Peat from approximately 8.5 m below surface of sea cliff at Elephant Point, Kotzebue Sound.		>44,000 (Y-1352)	Stuiver, 1969
Kotz:B-4 66° 16' 163° 50'	Shore bluffs about 0.5 km north of Kougachuk Creek, west shore of Goodhope Bay. Sample consists of rooted stems of dwarf Salix and Betula spp covering cryoturbated silt over an ancient ice-wedge about 3 m wide. Shrubs are buried by bedded tephra deposited as an alluvial fan at the time of eruption of South Killeak Lake maar; younger ice-wedge pseudomorphs are developed in tephra fan.	Dates eruption of South Killeak Lake maar, shows that permafrost on northern Seward Peninsula has persisted for more than 40,000 years, and provides well-preserved vegetation at time of eruption.	>42,000 (W-2670)	Spiker and others, 1978
Kotz:C-1 66° 44' 162° 28'	Logs directly overlying till of Nome River glacial interval and overlain by woody peat and silt on the Baldwin Peninsula.	Thought to represent a buried forest of last interglacial age.	>42,000 (W-1253)	Levin and others, 1965
Seli:B-6 66° 24' 161° 35'	Wood from ice-wedge cast enclosed in beach deposits of last interglacial age on the Baldwin Peninsula.	Provides a minimum age for the last interglacial (Pelukian) marine transression.	>42,000 (W-1251)	Levin and others, 1965; McCulloch, 1967; McCulloch and others, 1965
Kotz:C-1 66° 40' 162° 08'	Woody peat at the base of thaw-lake deposits on the Baldwin Peninsula.	Dates beginning of thaw-lake.	>42,000 (I-10,622)	D. M. Hopkins, 1979, unpublished data
Nome D-2 64° 59' 165° 59'	Fine organic detritus from a low horizon in lake clay over glacial drift of Salmon Lake age in Canyon Creek valley.	Provides a minimum age for the Salmon Lake glacial interval.	>40,000 (I-7710)	Hopkins and others, 1983
Bend:B-6 65° 20' 164° 40'	Plant material in block of silt exposed in sandy Kougarok gravel overlain by 3 to 8 m of windblown silt in a pit 0.5 km south of Quartz Creek bridge.	Provides a minimum age for the Kougarok gravel of Hopkins (1963) at the type locality. Reported as >30,000 years by Hopkins (1963) and Rubin and Alexander (1958).	>40,000 (W-196)	Rubin and Alexander, 1960

Tell:A-6 65° 08' 167° 36'	Peat from a fresh water mud layer of a core taken approximately 31 m below msl, 29 km northeast of King Island.		>40,000 (USGS-156)	Robinson and Trimble, 1981
Bend:A-4 65° 06' 163° 31'	Peat overlying foreset (lake delta?) sand in a river bluff exposure on the Pargon River.	Thought to date the existence of a moraine-dammed lake within the innermost moraine of Nome River age.	>40,000 (I-13,989)	D. S. Kaufman, 1985 unpublished data
Kotz:A-2 66° 05' 162° 50'	Deformed peat over interbedded silt and peat at a coastal exposure near Deering.		>39,900 (I-4099)	Giterman and others, 1982; Guthrie and Matthews, 1971; Matthews, 1974
Kotz:C-1 66° 40' 162° 09'	Twigs in ice-wedge pseudomorph at base of youngest of three thaw-lake sequences in coastal bluffs, Riley's Wreck area, Baldwin Peninsula.	Dates deposits of ancient thaw-lake.	>38,000 (W-1256)	Levin and others, 1965; McCulloch, 1967; McCulloch and others, 1965
Kotz:C-1 66° 42' 162° 12'	Twigs from frost-stirred silt and peat below pond sediments cut by ice-wedge casts from which W-1262 was collected on the Baldwin Peninsula.	Represents local ice-wedge melting of Wisconsin age.	>38,000 (W-1257)	Levin and others, 1965; McCulloch, 1967; McCulloch and others, 1965
Nome:C-1 64° 31' 165° 26'	Organic material from thick marine sand and gravel overlying glacial drift of the Nome River glacial interval.	Provides a distant minimum age for the type locality of the Pelukian marine transgression and the preceding Nome River glacial interval.	>38,000 (W-810)	Hopkins, 1973; Hopkins and others, 1960; Rubin and Alexander, 1960
Bend:C-3 65° 34' 163° 12'	Peat from 2.5 m below the top of a core from Imuruk Lake.	Pollen from this level assigned to an alder and spruce zone comparable to the surface spectra.	>37,000 (Y-1143)	Colinvaux, 1964; Colinvaux, 1967
Tell:C-3 65° 24' 166° 37'	Deciduous tree wood from top of marine gravel, California River.	Indicates marine gravel filling old cut in California River is pre- rather than post-Wisconsin. Reported as >35,000 years by Sainsbury (1967b).	>37,000 (W-1984)	Masters and others, 1969

Kotz:C-5 66° 31' 164° 02'	Cutbank of Espenberg River. Wood from 0.8 m layer of peaty pond silt and fine sand 6.9 m below top of bluff near river level. Over- and underlain by succession of thaw-lake deposits all resting on marine deposits of the Pelukian transgression.	Abundance and size of wood suggests that the thaw-lake existed during an interstadial interval, perhaps the Boutellier interval of Hopkins (1982).	>36,000 (W-2881)	Spiker and others, 1978
Tell:B-4 65° 24' 166° 36'	Wood from beach deposits which enclose a wedge of conglomerate of continental origin which is overlain by thin glacial deposits of the York glacial interval at the California River.	Provides a distant minimum age for the York glacial interval of Sainsbury (1967a). Reported as >37,000 years by Masters and others (1969).	>35,000 (W-1984)	Sainsbury, 1967b
Kotz:A-2 66° 51' 162° 45'	Wood from coastal exposure at Cape Deceipt.		>35,000 (W-192)	D. M. Hopkins, 1948, unpublished data
Bend:C-3 65° 34' 163° 12'	Peat from 1.2 m below the top of a core from Imuruk Lake.	Pollen from this level assigned to an herb zone.	>34,500 (Y-1142)	Colinvaux, 1964; Colinvaux, 1967; Stuiver and others, 1963
Kotz:C-5 66° 32' 164° 00'	Twigs in lacustrine silt interbedded with sand in cut bank of Espenberg River.	Deposits contain a distinctive Pelukian (last interglacial) fauna.	>34,000 (W-2878)	Spiker and others, 1978
Nome:B-1 64° 27' 165° 07'	Shells in marine nearshore sand, core depth 6.6 to 8.4 m, water depth 12.9 m near Cape Nome.		>34,000 (W-2116)	Spiker and others, 1978
Kotz:C-1 66° 42' 162° 12'	Twigs and willow leaves in basal transgressive layer of upper of two thaw-lake sequences in coastal bluff Riley's Wreck area, Baldwin Peninsula.	Dates deposits of ancient thaw-lake. Should probably be regarded as a minimum date (i.e., >34,000 years).	34,000 ± 2000 (W-1262)	Levin and others, 1965; McCulloch, 1967; McCulloch and others, 1965

Nome D-2 64° 59' 165° 59'	Fine organic detritus from a high horizon in lake clay over glacial drift of Salmon Lake age in Canyon Creek valley.	Provides a minimum age for the Salmon Lake glacial interval.	>33,000 (I-7709)	Hopkins and others, 1983
Kotz:C-5 66° 31' 164° 02'	Peat, possibly buried turf, interbedded with silt and sand, 1.8 m below W-2881, cutbank of Espenberg River.	Depauperate flora suggest full glacial conditions.	>32,000 (W-2882)	Spiker and others, 1978
Kotz:C-5 66° 32' 164° 00'	Screen residue from 2.4 m below W-2806, at base of thaw lake beds, cutbank of Espenberg River.	With W-2806, dates part of sequence of thaw-lakes and enclosed animal and plant remains.	>31,000 (W-2884)	Spiker and others, 1978
Tell:A-6 65° 05' 167° 43'	Peat under Yukon River silt, core depth 24 cm, water depth 36.5 m, 36.8 km west of Point Spencer.		>30,000 (W-2534)	Spiker and others, 1978
Nome:C-2 64° 31' 165° 40'	Wood in alluvium overlain by Holocene sand, core depth 3.6 to 5.4 m, water depth 13 m.		>30,000 (W-2115)	Spiker and others, 1978
Bend:B-6 65° 20' 164° 40'	Wood from the Kougarok gravel 0.5 km south of Quartz Creek bridge.	Provides a minimum age for the Kougarok gravel of Hopkins (1963) at the type locality. Reported as >40,000 years by Rubin and Alexander (1960).	>30,000 (W-196)	Hopkins, 1963; Rubin and Alexander, 1958
Bend:C-3 65° 34' 163° 12'	Peat from 7.5 m level of Imuruk Lake core.	Date incompatible with other pollen-stratigraphic and radiometric data from core; suggests possible contamination.	29,000 ± 1000 (Y-1417)	Stuvier, 1969
Kotz:C-5 66° 35' 164° 27'	Organic residue from loess exposed in wave-cut bluff at Northwest Corner Light.	Indicates that aeolian activity was not confined to late Wisconsin time but persisted throughout Wisconsin cold cycle.	28,700 ± 1000 (W-2804)	Spiker and others, 1978; Hopkins, 1982

Kotz:C-5 66° 30' 164° 06'	Organic material at base of thaw-lake sequence, artificial excavation in cut bank of Espenberg River. Same locality as W-2880.	An age reversal between this sample and underlying W-2880 suggests that either samples were mislabeled in the field or that this sample consists mostly of reworked organic debris.	>27,000 (W-2879)	Spiker and others, 1978
Kotz:C-1 66° 37' 162° 08'	Twigs and peaty debris from thaw-lake deposits underlain by glacial drift of Nome River age on the west coast Baldwin Peninsula.	Dates a mammoth skeleton buried at same horizon. Pollen suggests deposition during interstadial interval.	26,900 ± 3400 (AU-90)	Reeburgh and Young, 1976
Kotz:C-5 66° 31' 164° 00'	Well-macerated peat involved in ice-wedge collapse in exposure on Espenberg River. Ice-wedge pseudomorph lies below weathered loess and intrudes lake beds containing lenses of basaltic ash.	Unexpectedly old, ice-wedge collapse was thought to have formed during the early Holocene warm period. Ash may be correlative with ash collected near Kougachuk Creek dated as >42,000 years old (W-2670).	25,390 ± 800 (W-2807)	Spiker and others, 1978
Bend:C-3 65° 34' 163° 12'	Peat from 7.5 m level of Imuruk Lake core.	Infinite dates obtained higher in the core (Y-1142, Y-1143) suggest error.	21,700 ± 2000 (I-415)	Trautman, 1963
Kotz:C-5 66° 31' 164° 01'	Screen-washed organic material from thaw-lake sediments overlying aeolian sand near river level on cutbank of Espenberg River.	Confirms that thaw-lakes existed on Seward Peninsula during Duvanny Yar cold-dry interval of Hopkins (1982) and dates enclosed plant and animal remains.	21,600 ± 600 (W-2883)	Spiker and others, 1978
Kotz:B-6 66° 22' 164° 43'	Cutbank on thaw-lake about 1.2 km north of Whitefish Lake. Organic duff on soil developed in loess buried by basaltic tephra covered by 2.5 m of loess and aeolian sand, a few cm of basaltic tephra, and 1 m of aeolian sand and modern turf.	Dates vegetation buried by tephra probably from South Devil Lake maar. Upper tephra probably records eruption of North Kelleak Lake maar.	19,900 ± 800 (AU-112)	Reeburgh and Young, 1976

Kotz:B-6 66° 22' 164° 43'	Silt (W-3492) and wood and rooted twigs (W-3488) from a bluff at the westernmost tip of a small, unnamed lake, about 1 km southwest of Whitefish Lake.		19,600 ± 1000 (W-3492)	D. M. Hopkins, 1976, unpublished data
Kotz:C-5 66° 30' 164° 06'	Organic debris, 0.5 m below W-2879 in cutbank of Espenberg River. Much basaltic tephra is incorporated in deposits of a later thaw-lake 3.8 m higher in section.	Sample suspected of contamination.	16,950 ± 500 (W-2880)	Spiker and others, 1978
Tell:A-6 65° 07' 167° 31'	Peat layer with wood fragments from 120 cm level of core taken from 28 m below msl, 40 km west of Port Clarence spit.	Dates top of Pleistocene freshwater sediment below Holocene marine sediment in region subject to uplift.	16,540 ± 200 (USGS-356)	Robinson and Trimble, 1983
Tell:A-6 65° 08' 167° 03'	Peat and twigs from freshwater layer in core taken from approximately 28 m below msl 31 km northeast of King Island.	Dates pre-transgressive sediment. Helps establish history of Holocene sea level rise.	16,400 ± 430 (USGS-157)	Robinson and Trimble, 1981
Bend:D-3 65° 48' 163° 13'	Organic fraction of horse scapula from Trail Creek Cave 9. Found with heel bone of Bison which apparently had been worked by man.	Provides age when large herbivores were present on the Seward Peninsula. If carried into cave by man, it is the earliest evidence of man in Alaska.	15,750 ± 350 (K-1210)	Larson, 1968; Morlan and Cinq-Mars, 1982; Tauber, 1968
Tell:A-6 65° 08' 167° 36'	Peaty silt from 40 cm level of a core taken 31 m below msl, 35 km west of Port Clarence spit.	Dates top of Pleistocene freshwater sediment below Holocene marine sediment in region subject to uplift.	15,450 ± 250 (USGS-357)	Robinson and Trimble, 1983
Kotz:C-5 66° 32' 164° 00'	Screen residue from lakebeds exposed in cutbank of Espenberg River. Underlain by deposits of a series of older thaw-lakes, one of which is dated by W-2884 (>31,000 years).	Collected just below first appearance of Devil Mountain ash, providing a close approximation of the date of ashfall.	14,490 ± 400 (W-2806)	Spiker and others, 1978

Nome:A-1 64° 10' 165° 28'	Lenses of peat from 1.4 m level in a core taken 20 m below msl, 40 km south of Nome.	Dates top of Pleistocene freshwater sediment below Holocene marine transgressive sediment.	13,770 ± 210 (USGS-352)	Robinson and Trimble, 1983
Bend:C-3 65° 34' 163° 12'	Peat from 0.5 m below the top of a core from Imuruk Lake.	Pollen from this level assigned to the birch zone (Colinvaux, 1967).	13,250 ± 700 (I-588)	Colinvaux, 1964; Colinvaux, 1967; Trautman, 1963
Tell:A-6 65° 05' 167° 43'	Peat and wood fragments from freshwater layer in core taken from approximately 34 m below msl, 20 km northeast of King Island.	Helps date history of Holocene sea level transgression.	13,200 ± 110 (USGS-155)	Robinson and Trimble, 1981
Bend:D-3 65° 48' 163° 13'	Organic fraction of Bison heel bone found in Trail Creek Cave 9. Bone apparently had been worked by man.	Provides age when large herbivores were present on the Seward Peninsula. Found with horse scapula (K-1210).	13,070 ± 280 (K-1327)	Larson, 1968; Morlan and Cinq-Mars, 1982; Tauber, 1973
Nome:C-1 64° 31' 165° 28'	Wood and peat from silty colluvium overlying estuarine sediments of the the Pelukian marine transgression.	Wood identified as Alnus (alder) enclosed in sediment yielding typical herb-zone pollen spectrum with no Alnus pollen and very little pollen of Betula nana. This specimen also predates beginning of collapse over large ice-wedge pseudomorphs.	13,040 ± 300 (W-463)	Hopkins and others, 1960; Hopkins and others, 1981
Kotz:A-2 66° 05' 162° 50'	Wood fragments in clayey silt from a coastal exposure near Deering.		12,420 ± 180 (I-4781)	Giterman and others, 1982; Guthrie and Matthews, 1971; Matthews, 1974
Bend:C-3 65° 34' 163° 12'	Peat from 0.4 m below the top of a core from Imuruk Lake.	Pollen from this level assigned to the birch zone (Colinvaux, 1967).	12,355 ± 160 (Y-1144)	Colinvaux, 1964; Colinvaux, 1967; Stuvier and others, 1963

Kotz:B-6 66° 24' 164° 32'	Peaty lamina 0.3 m above base of 1.7 m layer thick of loess-like silty colluvium, the lowest unit in a sequence of non-volcanic sediments separating tephra of North Devil Mountain Lake maar (below) from tephra of South Devil Mountain Lake maar (above).	W-2801, W-2803, W-2802, and W-2800 form an ascending series that date sediments accumulated during interval between eruptions at Devil Mountain Lake maar. W-2801 provides minimum limiting date for South Devil Mountain Lake maar eruption.	11,610 + 500 (W-2801)	Spiker and others, 1978
Kotz:C-5 66° 31' 164° 02'	Wood fragments from base of thaw-lake deposits exposed in cutbank of Espenberg River. Represents youngest of a series of superimposed thaw-lake deposits.	Lake deposits contain rich "post-glacial" biota that accumulated after end of loess fall.	11,550 + 350 (W-2805)	Spiker and others, 1978; Reeburgh and Young, 1976; Hopkins, 1982
Kotz:C-1 66° 40' 162° 09'	Twigs in ice-wedge pseudomorph at base of one lacustrine unit in complex sequence of thaw-lake deposits in Riley's Wreck area, coast of the Baldwin Peninsula.	Dates occurrence of Populus beyond present limits.	11,340 + 400 (W-1254)	Levin and others, 1965; McCulloch, 1967; McCulloch and others, 1965; McCulloch and Hopkins, 1966
Solo:D-6 64° 57' 164° 44'	Peat and organic silt from pond deposits over glacial drift in a terrace of the Pilgrim River.	Indicates that the Salmon Lake glacial interval took place more than 10,900 years ago.	10,880 + 160 (I-7702)	D. M. Hopkins, 1973, unpublished data
Tell:D-5 65° 40' 167° 05'	Peat with wood in old filled lake in a cutbank of Pinguk River. Peat underlain by shingled outwash of the York glacial interval of Sainsbury (1967a).	Gives minimum age for retreat of the York glaciers.	10,880 + 300 (W-1776)	Masters and others, 1969; Sainsbury, 1967b
Kotz:B-6 66° 24' 164° 32'	Shore bluffs on southwest shore of North Devil Mountain Lake. From detrital peat and twigs 1.0 m above base of 1.7 m layer of loess-like silty colluvium, the lowest tephra of North and South Devil Mountain Lakes.	W-2801, W-2803, W-2802, and W-2800 form an ascending series that date sediments accumulated during the interval between eruptions at Devil Mountain Lake.	10,370 + 500 (W-2803)	Spiker and others, 1978

Nome:B-1 64° 27' 165° 25'	Wood picked from drill cuttings, 0 to 420 cm depth in core, water depth 20.4 to 18.6 m just southeast of Nome.	From an outwash fan of the Nome River.	10,250 ± 350 (W-2325)	Spiker and others, 1978
Solo:D-6 64° 57' 164° 44'	Peat from a continuous layer in pond deposits over glacial drift in a terrace of the Pilgrim River.	Indicates that the Salmon Lake glacial interval took place more than 10,000 years ago.	10,210 ± 160 (I-7701)	D. M. Hopkins, 1973, unpublished data
Bend B-6 65° 19' 164° 40'	Wood from thick organic-rich silt overlying gravel at Coffee Creek.	Provides age when climate and vegetation were much like present.	10,200 ± 800 (L-137G)	McCulloch, 1967; McCulloch and Hopkins, 1966
Nome:C-1 64° 31' 165° 28'	Wood and peat from silty colluvium overlying estuarine sediments of the Pelukian beach near Nome.	Dates local inception of deposition of colluvial silt and collapse of ice-wedges. Pollen spectra similar to modern except for abundant *Juniperus*.	10,050 ± 270 (W-461)	Colinvaux, 1967; Hopkins and others, 1960
Bend C-3 62° 37' 163° 07'	Wood in lacustrine peat from a terrace of Imuruk Lake at Granite Bay.	Provides a maximum age for faulting which warped the terrace and shifted the outlet of Imuruk Lake.	9900 ± 400 (W-1213)	Levin and others, 1965
Nome:B-1 64° 28' 165° 07'	Peaty mud from 0 to 1 m below sediment in 18 to 20 m of water off the mouth of Hastings Creek, approximately 7 km east of Nome.	Date is minimum for sea level rise to -20 m in northern Bering Sea. Sample apparently represents subaerial nonmarine bog soil.	9700 ± 350 (W-1800)	Masters and others 1969
Nome:C-1 64° 31' 165° 28'	Wood and peat from silty colluvium overlying estuarine sediments of the Pelukian beach near Nome.	Dates ice-wedge collapse during early Holocene interval of warm summers.	9690 ± 400 (W-485)	Hopkins and others, 1960; McCulloch, 1967
Kotz:B-6 66° 24' 164° 32'	Peat from bluffs at southwest shore of North Devil Mountain Lake.		9630 ± 350 (W-3491)	D. M. Hopkins, 1976, unpublished data

Kotz A-3 66° 04' 163° 03'	Populus wood from ice-wedge pseudomorphs at base of thaw-lake deposits in coastal bluffs between Cape Deceit and Rex Point on south shore of Kotzebue Sound.	Dates Populus beyond present western limits during early Holocene warm interval.	9625 ± 350 (W-2620)	Hopkins and others, 1981; Spiker and others, 1978
Seli:B-5 66° 15' 61° 18'	Wood from a beaver dam 6.7 m below the surface at Elephant Point, Kotzebue Sound.	Provides age when beaver and forest ranges were more extensive than present.	9480 ± 160 (Y-1351)	McCulloch, 1967; McCulloch and Hopkins, 1966; Stuvier, 1969
Kotz:B-6 66° 24' 164° 32'	Shore bluffs on southwest shore of Devil Mountain Lake. From sedge-sphagnum peat 0.6 m thick, the middle unit in a 2.3 m sequence of non-volcanic sediments.	W-2801, W-2803, W-2802, and W-2800 form an ascending series that date sediments accumulated during interval between eruptions at Devil Mountain Lake.	9410 ± 350 (W-2802)	Spiker and others, 1978
Cand:D-6 65° 52' 161° 50'	Wood from a beaver dam 3 m below the surface, enclosed in peaty silt at Candle Creek.	Provides age when beaver and forest ranges were more extensive than present.	9400 ± 750 (L-137N)	McCulloch 1967; McCulloch and Hopkins, 1966
Kotz:B-6 66° 24' 164° 32'	Shore bluffs on southwest shore of Devil Mountain Lake. From peaty, twiggy layer 0.5 cm thick within 0.5 m of colluvial silty gravel which forms the top unit in 2.3 m sequence of non-volcanic sediments.	W-2801, W-2803, W-2802, and W-2800 form an ascending series that dates sediments accumulated during interval between eruptions at Devil Mountain Lake. W-2800 closely dates the eruption that formed the South Devil Mountain Lake maar.	9350 ± 350 (W-2800)	Spiker and others, 1978
Bend:C-6 65° 44' 164° 52'	Wood from fossil beaver dam overlying auriferous gravel along Washington Creek.	Dates expansion of beaver far west of modern limits during early Holocene warm period.	9330 ± 300 (W-2160)	Sullivan and others, 1970
Kotz:C-5 66° 32' 164° 16'	Thaw-lake deposit containing beaver-chewed wood and Anodonta beringiana shells in exposure on shore of lake southwest of Cape Espenberg.	Dates extension of beaver and Anodonta beringiana west of present limits during early Holocene warm period.	9190 ± 350 (W-2619)	Spiker and others, 1978

Kotz:A-2 66° 05' 162° 50'	Fibrous peat more than 1 m thick overlying platey silt in a coastal exposure near Deering.		9150 ± 150 (I-4780)	Giterman and others, 1982; Guthrie and Matthews, 1971; Matthews, 1974
Bend:D-3 65° 48' 163° 13'	Marrow-cracked bones of caribou from Trail Creek Cave 2.	Layer contains implements older than Denbigh Flint Complex.	9070 ± 150 (K-980)	Tauber, 1968
Kotz:C-1 66° 43' 162° 26'	Wood in ice-wedge pseudomorph at the base of thaw-lake sequence, coastal bluffs, east of Cape Blossom.	Dates occurence of cottonwood and birch or aspen during early Holocene interval of warm summers.	9020 ± 350 (W-1255)	Hopkins and others, 1981; Levin and others, 1965; McCulloch and Hopkins, 1966
Bend:C-5 65° 31' 164° 12'	Poplar log from 1 m below the surface at Black Gulch.	Dates interval when poplar range was more extensive than present.	8800 ± 1000 (L-117F)	McCulloch and Hopkins, 1966; Hopkins, 1967
Kotz:C-1 66° 36' 162° 05'	Beaver-gnawed wood from a dam containing spruce, birch and poplar logs within a silty peat over deformed marine sediments on the Baldwin Peninsula.	Provides age when beaver and forest ranges were more extensive than present.	8550 ± 400 (W-1249)	Hopkins and others, 1981; Levin and others, 1965; McCulloch, 1967; McCulloch and Hopkins, 1966
Kotz:B-6 66° 30' 164° 47'	Birch or aspen wood from a fossil beaver dam from shore bluffs north of mouth of Kungealarook Creek, Goodhope Bay.	Dates extension of beaver and birch or aspen woodlands far west of present limits during early Holocene interval of warm summers.	8480 ± 300 (W-2596)	Hopkins and others, 1981; Spiker and others, 1978
Tell:C-6 65° 40' 167° 54'	Woody stems, some 6 cm thick and 0.6 m long, in locally thick peat; probably an ice-wedge pseudomorph exposed on south shore of Lopp Lagoon.	Dates ice-wedge pseudomorph and presence of large willow shrubs beyond present-day limits.	8360 ± 300 (W-2592)	Hopkins, 1972; Spiker and others, 1978
Bend:B-6 65° 18' 164° 43'	Wood from peat interbedded with silt overlying windblown silt and auriferous gravel on Coffee Creek.		8350 ± 200 (L-117C)	Kulp and others, 1952; McCulloch, 1967; McCulloch and Hopkins, 1966

Cand:D-6 65° 56' 161° 59'	Rooted birch stump (W-2809) and beaver-chewed birch wood (W-2808) from peat layer overlying course sand and overlain by about 2 m of even-bedded sand and silt on Mud Creek.	Dates occurence of species outside of present limits.	8310 ± 300 (W-2809) 8080 ± 300 (W-2808)	Hopkins and others, 1981; Spiker and others, 1978
Bend:C-3 65° 39' 163° 10'	Wood in lacustrine peat from a terrace of Imuruk Lake at Salix Bay.	Provides a maximum age of faulting which warped the terrace and shifted the outlet of Imuruk Lake.	7400 ± 300 (W-1235)	Levin and others, 1965
Kotz:C-1 66° 44' 162° 30'	Log from a wood-rich basal zone which fills ice-wedge casts in thaw-lake sediments, consisting of silt with fresh water mollusk shells on the Baldwin Peninsula.	Dates ice-wedge thaw and provides age when forest range was more extensive than present.	7270 ± 350 (W-1250)	Hopkins and others, 1981; McCulloch and others, 1965; McCulloch and Hopkins, 1966; Levin and others, 1965
Kotz:B-5 66° 16' 164° 01'	Alder wood from cutbank of outlet stream about 0.4 km downstream from North Killeak Lake.	Sample provides distant minimum age for North Killeak Lake maar and dates occurrence of large shrubs of Salix, Betula, and Alnus at this locality.	7070 ± 145 (AU-113)	Hopkins and others, 1981; Reeburgh and Young, 1976
Tell:B-2 65° 18' 165° 45'	Twigs from peat overlying river gravel in a terrace of the Agiapuk River.	Mammoth and bison bones scattered along beach at river level indicate that the gravel is of late Pleistocene age; a greater age had been anticipated for the buried turf layer.	6485 ± 110 (I-7705)	D. M. Hopkins, 1973, unpublished data
Bend:B-6 65° 18' 164° 44'	Peat from the base of a 3 m thick sequence of organic silt and peat at Dome Creek.	Dates the base of a section analyzed for pollen (T. A. Ager, unpublished data).	6450 ± 240 (I-13,991)	D. S. Kaufman, 1985, unpublished data
Nome D-2 64° 59' 165° 59'	Peat and wood from kettle-fill deposits in Canyon Creek valley.	Provides a distant stop date for the Salmon Lake glacial interval.	6150 ± 110 (I-7708)	D. M. Hopkins, 1973 unpublished data

Tell:B-3 65° 15' 166° 23'	Twigs from ice-wedge pseudomorph covered by 4 m of colluvial peaty silt and intruding Pelukian beach sediments in coastal bluffs on shore of Port Clarence about 1.6 km southwest of Teller.	Provides distant stop date for Pelukian marine transgression.	5170 ± 265 (AU-109)	Reeburgh and Young, 1976
Nome D-2 64° 59' 165° 59'	Two samples of peat and wood from kettle-fill deposits overlaying glacial drift in the Canyon Creek valley.	Provides distant stop dates for the Salmon Lake glacial interval.	5010 ± 100 (I-7707) 4430 ± 95 (I-7706)	D. M. Hopkins, 1973, unpublished data
Kotz:B-6 66° 22' 164° 43'	Peat from a bluff at westernmost tip of small, unnamed lake, about 1 km southwest of Whitefish Lake.		4300 ± 200 (W-3488)	D. M. Hopkins, 1976, unpublished data
Tell:C-6 65° 43' 167° 28'	Lacustrine sediments overlain by about 2.5 m of dimicton in a bank of an intermorainal pond within an end moraine of York age (Sainsbury, 1967a) near Lopp Lagoon.	Sample unexpectedly young. Probably collected from kettle lake that was later covered by colluvium from a nearby morainal knob.	4290 ± 250 (W-2810)	Spiker and others, 1978
Tell:A-3 65° 03' 166° 12'	Peat from a high terrace of Gold Run Creek.	Provides minimum age on an interval of alluviation.	4190 ± 90 Beta-7762	D. S. Kaufman and D. M. Hopkins, 1983, unpublished data
Bend:A-4 65° 06' 163° 31'	Peat beneath fine grained tephra taken from river bluff exposure on the Pargon River.	Provides a maximum age for a volcanic eruption of an unknown source which is possibly correlative with the tephra unit found at Dome Creek (Beta-7760, 7761), 75 km to the southwest.	4000 ± 100 (I-13,990)	D. S. Kaufman, 1985 unpublished data
Tell:D-5 65° 40' 167° 05'	Two samples of wood from upper part peat deposit underlain by shingled outwash of the York glacial interval of Sainsbury (1967a), on the Pinguk River.	Interpreted as shrub vegetation growing on old tundra or around a thaw-lake.	3760 ± 250 (W-1823) 3750 ± 250 (W-1773)	Masters and others, 1969; Sainsbury, 1967a

Cand:D-6 65° 56' 161° 59'	Wood from beaver dam burying flood-plain gravel with rooted stumps overlain by thick interbedded silt and peat on Mud Creek.	Date discredited by Spiker and others (1978). Date of 8310 ± 300 (W-2809) was obtained from the same location.	3600 ± 500 (L-117F)	Broecker and others, 1956; McCulloch and Hopkins, 1966
Bend:B-6 65° 18' 164° 44'	Peat layer below very fine grained, 2 cm thick tephra layer at Dome Creek.	Provides a maximum age for a volcanic eruption of an unknown source. A date of 2400 ± 80 (Beta-7760) was obtained on organics overlying tephra.	3340 ± 90 (Beta-7761)	D. S. Kaufman and D. M. Hopkins, 1983, unpublished data
Bend:D-3 65° 48' 163° 13'	Marrow-cracked bones of caribou from Trail Creek Cave 2.	Layer contained implements of older Choris or closely related culture.	2810 ± 110 (K-979)	Tauber, 1968
Nome:C-1 64° 31' 165° 26'	Wood and peat from silty colluvium over estuarine sediments of the Pelukian beach near Nome.	Dates small ice-wedges which began to form after peat accumulated.	2770 ± 300 (W-484)	Hopkins and others, 1960
Bend: 65° 48' 163° 13'	Dark-colored bones of caribou from layer in west room, Trail Creek Cave 9.		2770 ± 110 (K-1290)	Tauber, 1968
Bend:B-6 65° 19' 164° 44'	Sedge peat from 3 m below the surface at Coffee Creek.	Provides minimum age when climate and vegetation became similar to present.	2750 ± 350 (L-137F)	McCulloch and Hopkins, 1966
Bend: 65° 48' 163° 13'	Well-preserved antler of caribou from Trail Creek Cave 2.	Same layer as K-979.	2700 ± 110 (K-983)	Tauber, 1968
Sela:B-6 66° 16' 161° 52'	Charcoal from below roof level of Oval House 2 pit, Baldwin Peninsula.	From the Choris period.	2646 ± 177 (P-203)	Ralph and Ackerman, 1961
Sela:B-6 66° 16' 161° 52'	Wood from Oval House 1, Baldwin Peninsula.	From the Choris period.	2635 ± 125 (P-96)	Ralph and Ackerman, 1961

Bend:D-3 65° 48' 163° 13'	Antler from Trail Creek Cave 9.		2620 ± 120 (K-147)	Tauber, 1960
Tell:A-2 65° 10' 165° 52'	Wood from interbedded silt and peat on west shore of Imuruk Basin.		2605 ± 90 (I-7700)	D. M. Hopkins, 1973, unpublished data
Tell:C-7 65° 40' 168° 15'	Two samples of charcoal and charred sand from Norton stratum in House 2, approximately 1 m below sod, Cape Prince of Wales.	Considered to be of Norton culture.	2583 ± 60 (P-592) 2566 ± 53 (P-598)	Stuckenrath and others, 1966
Tell:C-7 65° 40' 168° 15'	Charcoal from Norton hearth on third beach line, Agulaak site, Cape Prince of Wales.	Considered to be of Norton culture.	2402 ± 43 (P-599A)	Stuckenrath and others, 1966
Bend:B-6 65° 18' 164° 44'	Peat overlying very fine grained, 7 cm thick tephra layer at Dome Creek.	Provides a minimum age for a volcanic eruption of an unknown source.	2400 ± 80 (Beta-7760)	D. S. Kaufman and D. M. Hopkins, 1983, unpublished data
Tell:C-7 65° 40' 168° 15'	Wood from post in pond associated with Norton houses, Cape Prince of Wales.	Considered to be of Norton culture.	2306 ± 38 (P-629)	Stuckenrath and others, 1966
Solo:B-6 64° 30' 165° 00'	Charcoal from single habitation level of Pit House 1, 29 km east of Nome.		2284 ± 56 (P-1633)	Lawn, 1971
Sela:B-6 66° 16' 161° 52'	Worked fragments of antler from floor deposits of Oval House 1.	From the Choris Period.	2244 ± 133 (P-175)	Ralph and Ackerman, 1961
Solo:B-6 64° 30' 165° 00'	Charcoal from hearth in single habitation level of House 285, 29 km east of Nome.	Comparable date for same site: 1970 ± 100 (I-5379).	2210 ± 90 (P-1809)	Fishman and others, 1977
Sela:B-6 66° 16' 161° 52'	Charcoal from Choris site, Area 3, two beaches forward of the "House Beach", Choris Peninsula, Kotzebue Sound.	Believed to be of Late Choris culture.	2190 ± 51 (P-611)	Stuckenrath and others, 1966

Nome D-1 64° 57' 165° 12'	Organic-rich silt overlying gray silt which overlies Mount Osborn age till at the mouth of Thompson Creek.	Provides a stop-date for the Mount Osborn glacial interval.	2180 ± 80 (I-11,131)	R. E. Nelson and D. M. Hopkins, 1978, unpublished data
Bend:D-3 65° 48' 163° 13'	Bones of caribou from Trail Creek Cave 2.	Layer contained implements presumably belonging to the Dengigh Flint Complex. Date is considered too young.	2160 ± 110 (K-1289)	Tauber, 1968
Tell:A-3 65° 03' 166° 12'	Peat from a low river terrace of Gold Run Creek.	Provides minimum age in interval of alluviation.	2090 ± 60 (Beta-7763)	D. S. Kaufman and D. M. Hopkins, 1983, unpublished data
Solo:D-6 64° 58' 164° 43'	Twigs from ice-wedge fill material in lower section of terrace of Pilgrim River.	Dates thaw of ice-wedge.	2025 ± 80 (I-7703) 1985 ± 80 (I-7704)	D. M. Hopkins, 1973, unpublished data
Bend:C-3 65° 39' 163° 10'	Wood from peat beneath white ash layer at Salix Bay, Imuruk Lake.	Dates volcanic eruption of an unknown source, perhaps the Lost Jim volcanic flow.	1655 ± 220 (I-8293)	D. M. Hopkins, 1961, unpublished data
Tell:C-7 65° 36' 168° 04'	Wooden dish from Kurigitavik site located south of Wales.		1480 ± 240 (P-63)	Ralph and Ackerman, 1961
Tell:A-7 65° 14' 168° 07'	Rounded shells in basal pebbly clay layer from a core at 47 m below msl, 43 km south of Cape Prince of Wales.	Helps establish transgressive history of northern Bering Sea.	1400 ± 250 (W-2684)	Spiker and others, 1978
Nome:D-1 64° 57' 165° 12'	Organic-rich silt overlying gray silt which overlies Mount Osborn age till at the mouth of Thompson Creek.	Provides a distant minimum age for the Mount Osborn glacial interval.	1390 ± 85 (I-11,143)	R. E. Nelson, and D. M. Hopkins, 1978, unpublished data
Kotz:A-2 66° 04' 162° 45'	Birch bark from main room of Ipiutak House, Deering.		1380 ± 200 (K-532)	Trautman and Walton, 1962

Tell:C-7 65° 36' 168° 04'	Wooden dish and shafts from Kurigitavik site located south of the village of Wales.	Associated with a Birnirk harpoon head.	1350 ± 360 (P-68) 1320 ± 230 (P-68)	Ralph and Ackerman, 1961
Kotz:A-2 66° 04' 162° 45'	Dog feces from Anteroom 3, Ipiutak House, Deering.		1290 ± 200 (K-537)	Trautman and Walton, 1962
Bend:D-3 65° 48' 163° 13'	Charcoal from fireplace in Trail Creek Cave 9.		1260 ± 130 (K-108)	Tauber, 1960
Tell:C-7 65° 36' 168° 04'	Wooden dish from Kurigitavik site located south of Wales.	Occurs with typical Thulepunuk artifacts.	1230 ± 240 (P-67)	Ralph and Ackerman, 1961
Bend:D-3 65° 48' 163° 13'	Marrow-cracked bones of caribou from Trail Creek Cave 2.		1100 ± 100 (K-982)	Tauber, 1968
Nome:B-2 64° 24' 165° 35'	Shell fragments in shell bed buried by fine sand from a core at 30.6 m below msl, 45 km southeast of Nome.	Helps establish Holocene transgressive history of northern Bering Sea.	980 ± 200 (W-2466)	Spiker and others, 1978
Nome:A-3 64° 14' 166° 15'	Shells in silty sand from a core at 24.6 m below msl, 45 km southeast of Nome.	Helps establish Holocene transgressive history of northern Bering Sea.	750 ± 200 (W-2462)	Spiker and others, 1978
Tell:A-6 65° 11' 167° 53'	Infaunal shells isolated in basal sand from 11 cm level of a core taken from 31 m below msl, 48 km south of Cape Prince of Wales.	Shell species: Hyatella Arctica and Mya Truncata.	740 ± 250 (W-2683)	Spiker and others, 1978
Bend:D-3 65° 48' 163° 13'	Light-colored bones of caribou from Trail Creek Cave 9.	Bones from same layer as K-1290 (2770 ± 110) suggest considerable mixing of bones in this layer.	510 ± 100 (K-1291)	Tauber, 1968

Shis:B-3 66° 15' 165° 02'	Peat underlying crossbedded sand at Shishmaref.	Provides maximum age of sand dune.	450 ± 200 (W-1778)	Sainsbury, 1967b
Bend:B-6 65° 18' 164° 43'	Wood and sedge peat 1 m below the surface of valley fill material at Coffee Creek.	Indicates that deposition of muck-like material has taken place during the past few hundred years.	450 ± 100 (L-117D)	Kulp and others, 1952; McCulloch and Hopkins, 1966
Tell:B-4 65° 22' 166° 45'	Deciduous tree from buried igloo exposed in beach cut at site of an Eskimo camp on Breving Lagoon.	Site was probably a bird-shooting camp.	400 ± 250 (W-1998)	Masters and others, 1969
Shis:B-3 66° 15' 166° 02'	Log within crossbedded sand overlying peaty zone at Shishmaref.		200 ± 200 (W-1771)	Sainsbury, 1967b

[1]Bend = Bendeleben quadrangle
Cand = Candle quadrangle
Kotz = Kotzebue quadrangle
Nome = Nome quadrangle
Sela = Selawik quadrangle
Solo = Solomon quadrangle
Shis = Shishmaref quadrangle
Tell - Teller quadrangle

[2]Radiocarbon laboratories as follows:
AU=University of Alaska
Beta=Beta Analytic, Inc.
I=Isotopes, Inc.
K=Copenhagen
L=Lam Geological Observatory, New York
P=University of Pennsylvania
QL=Quaternary Research Center, University of Washington, Seattle
USGS=U.S. Geological Survey, Reston, Virginia
W=U.S. Geological Survey, Washington D.C.
Y=Yale Radiocarbon Laboratory
Potassium/Argon laboratory:
PT=Geochron Laboratories Division, Krueger Enterprises Inc., Cambridge, Mass

[3]Analytical data: % K_2O = 0.154, 0.154
moles $^{40}Ar_{rad}$/gm = 1.8675×10^{-13}, $1.7153 \times {}^{-13}$
$^{40}Ar_{rad}/^{40}Ar_{total}$ = 0.031 (3.1%), 0.018 (1.8 %)
Constants: $\lambda_\varepsilon = 0.572 \times 10^{-10}$ year^{-1}, $\lambda_\beta = 4.93 \times 10^{-10}$ year^{-10}, $\lambda_{\varepsilon'} = 8.78 \times 10^{-13}$ year $^{-1}$

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