

U S GEOLOGICAL SURVEY, MENLO PARK, CALIFORNIA
RADIOCARBON MEASUREMENTS IV

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The Menlo Park Radiocarbon Laboratory utilizes gas proportional counting of carbon dioxide in counters installed 9.5m below the ground surface for background reduction (Robinson, 1977, 1979; Robinson & Trimble, 1981, 1983). The reported results of geologic samples closely follow the guidelines of Stuiver and Polach (1977). The standard errors for analyses earlier than USGS-500 are based solely upon counting statistics, while later analyses include estimates of uncertainty in voltage, pressure, temperature, and $\delta^{13}\text{C}$. Unless otherwise noted, organic samples are pre-treated in NaOH and HCl, and carbonate samples in HCl.

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United States

Alaska

Titaluk River series

Samples coll from alluvial and lacustrine deposits exposed in a bluff 20m high on Titaluk (69° 42.2' N, 155° 12.8' W).

General Comment (LDC): dates middle Wisconsin episode of alluviation and formation of late Holocene thaw lake basin (Nelson, 1982). Coll and subm by L D Carter, USGS.

USGS-628.	2500 ± 50 <i>Est $\delta^{13}\text{C} = -25\text{‰}$</i>
Detrital peat coll 9m below top of bluff.	
USGS-745.	28,000 ± 240 <i>Est $\delta^{13}\text{C} = -27\text{‰}$</i>
Detrital peat coll 4m above base of bluff.	
USGS-746.	43,000 ± 1400 <i>Est $\delta^{13}\text{C} = -27\text{‰}$</i>
Detrital wood coll 3m above base of bluff.	
USGS-747.	43,000 ± 1700 <i>Est $\delta^{13}\text{C} = -27\text{‰}$</i>
Detrital wood coll 1m above base of bluff.	

USGS-360. Teshekpuk Lake **>44,000**
Est $\delta^{13}C = -25\text{‰}$

Driftwood from beach deposits of fossil barrier island chain exposed in bluffs along N side of Teshekpuk Lake (70° 43' 30" N, 153° 32' 45" W). Sample coll 4.5m above base of bluff 10.6m high. *Comment* (LDC): date suggests that islands are Sangamon in age and that little or no uplift of the coastal plain has occurred (Carter & Robinson, 1981). Sample coll and subm by L D Carter.

USGS-676. Teshekpuk Lake **>51,000**
Est $\delta^{13}C = -25\text{‰}$

Detrital peat coll 6m above base of bluff 10.6m high along N side of Teshekpuk Lake (70° 43' 31" N, 153° 42' 48" W). Peat underlies pebbly, silty sand to sandy silt, and overlies by fossiliferous beach deposits of ancient barrier island chain (see USGS-360). *Comment* (LDC): sample may represent a mid-Wisconsin interstadial (Carter & Robinson, 1981). Coll and subm by L D Carter.

USGS-454. Harrison Bay **9840 ± 90**
Est $\delta^{13}C = -25\text{‰}$

Willow (*Salix* sp) stump in growth position in eolian sand 2m above base of coastal bluff 7.6m high on Harrison Bay (70° 29' 37.2" N, 151° 45' 51" W). Sand occurs in lee of fossil barrier island chain and overlies marine sand contemporaneous with barrier island. *Comment* (LDC): sand postdates last major transgression; stump is probably contemporaneous with one of woody horizons dated by USGS-377 and -378 (Robinson & Trimble, 1983). Coll and subm by L D Carter.

USGS-455. Colville River **>48,000**
Est $\delta^{13}C = -25\text{‰}$

Wood fragment 7.6m below top of 17.7m section of Gubik Formation. *Comment* (LDC): sample confirms early age obtained on peat (USGS-186: 38,300 ± 1300, Robinson & Trimble, 1981). Coll and subm by L D Carter.

USGS-624. Kealok Creek **13,600 ± 130**
Est $\delta^{13}C = -25\text{‰}$

Moss coll from thin-bedded pond sand 2m above base of bluff 6.7m high on Kealok Creek (70° 18' 24" N, 153° 26' 21" W). *Comment* (LDC): dates Wisconsin episode of activity of large dunes (Carter, 1983). Coll and subm by L D Carter.

USGS-629. Harrison Bay **10,000 ± 70**
Est $\delta^{13}C = -25\text{‰}$

Peaty sand coll 1.8m above base of coastal bluff 4m high on Harrison Bay (70° 33' 12" N, 151° 51' 36" W). Sample is from paleosol 10cm thick, that underlies eolian sand and overlies pebbly marine or alluvial sand. *Com-*

ment (LDC): date provides lower limiting age for late Wisconsinan/early Holocene episode of eolian activity. Coll and subm by L D Carter.

USGS-630. Itkillik River **>48,000**
Est $\delta^{13}C = -25\text{‰}$

Detrital wood coll from alluvial deposits exposed in bluff 3.6m high that forms part of E boundary of Itkillik R/Colville R flood plain (70° 09' 29" N, 150° 48' 21" W). Sample coll 1m above base of bluff. *Comment* (LDC): dates major terrace of the Colville R (Carter & Galloway, 1982). Coll and subm by L D Carter.

USGS-631. Colville River **>48,000**
Est $\delta^{13}C = -25\text{‰}$

Detrital wood (*Picea* sp) coll from alluvial deposits exposed in bluff 7m high that forms part of W boundary of Colville R flood plain (70° 9' N, 151° 1' 45" W). Sample coll 2m above base of bluff. *Comment* (LDC): dates major terrace of Colville R (Carter & Galloway, 1982). Coll and subm by L D Carter.

USGS-675. Colville River **>50,600**
Est $\delta^{13}C = -25\text{‰}$

Detrital wood (*Alnus* sp) coll from alluvial deposits exposed in bluff 7.5m high along Nechelik Channel of Colville R (70° 18' 18" N, 151° 07' W). Wood coll 4.8m above base of bluff. *Comment* (LDC): dates this bluff which forms W boundary of Colville R delta (Carter & Galloway, 1982). Coll and subm by L D Carter.

USGS-804. Titaluk River **28,700 ± 460**
Est $\delta^{13}C = -20.8\text{‰}$

Metacarpal and proximal toe bone of horse (*Equus lambei*) coll with bones of other large mammals from surface material along base of bluff 7.6m high on Titaluk R (69° 40' 48" N, 155° 22' W). Bluff material consists of alluvium deposited when lowest alluvial terrace in this part of Titaluk R valley was formed. Wood from gravel at base of bluff has been dated to 7940 ± 130 BP (I-10, 874), and wood in growth position 5m above base of bluff is 8050 ± 130 BP (I-10,252). *Comment* (LDC): age of horse bones indicates that bones of large mammals are being concentrated in Holocene alluvium as Titaluk R cuts down through Pleistocene valley fill. Coll and subm by L D Carter.

USGS-414. Allen River **>48,000**
Est $\delta^{13}C = -25\text{‰}$

Detrital wood from 24m bluff exposure, E side of Allen R (67° 28' N, 151° 49' W). *Comment* (LDC): date appears to be too old, wood may have been reworked from older deposit, or Allen R may have intersected fan alluvium of pre-Itkillik II age (Hamilton, 1980a). Coll and subm by T D Hamilton, USGS.

Chandalar Bluffs series

Samples coll from 80m bluff, West Fork Chandalar R (67° 12' N, 148° 50' W).

General Comment (TDH): samples were between two tills correlated with glacial advances of Sagavanirktok R age (Hamilton, 1979, 1980a). Coll and subm by T D Hamilton.

USGS-415. **>42,000**
Est $\delta^{13}C = -25\text{‰}$
Detrital wood near top of bluff.

USGS-416. **150 ± 50**
Est $\delta^{13}C = -25\text{‰}$
Charcoal and wood from organic silt deposit beneath 0.4m loess cap.
Comment (TDH): may be anomalously young owing to contamination by modern rootlets and burrowing ground squirrels.

Alatna River series

Samples are from 39m succession of till and outwash gravel exposed along E side of Alatna R 24km below its head (67° 44' N, 154° 58' W).

General Comment (TDH): originally interpreted as sediments of Itkillik II age (Hamilton & Porter, 1975), but consistently infinite dates suggest deposit probably is older and that detrital wood and peat probably was not all reworked from earlier deposits. Restudy of exposure in 1979 revealed very sparse erratics scattered along top of bluff, implying overriding of older deposit during last glaciation (Hamilton & Brubaker, 1983). Coll and subm by T D Hamilton.

USGS-465. **>55,300**
Est $\delta^{13}C = -25\text{‰}$
Detrital wood.

USGS-466. **>47,300**
Est $\delta^{13}C = -25\text{‰}$
Peat clumps.

USGS-467. **>45,600**
Est $\delta^{13}C = -25\text{‰}$
Detrital wood.

USGS-468. **>42,900**
Est $\delta^{13}C = -25\text{‰}$
Bedded peat.

USGS-469. **>52,500**
Est $\delta^{13}C = -25\text{‰}$
Detrital wood.

USGS-470. **>45,800**
Est $\delta^{13}C = -25\text{‰}$

Wood and assorted plant fragments.

USGS-250. Ribdon River **2030 ± 120**
Est $\delta^{13}C = -25\text{‰}$

Peaty sand 0.5m below surface in outwash terrace near head of Ribdon R (68° 32' N, 148° 03' W). Lies at contact between peat cap and Neoglacial outwash. *Comment* (TDH): provides min age limit on late Holocene advance of nearly cirque glacier. Coll and subm by T D Hamilton.

USGS-694. Anaktuvuk River **13,170 ± 70**
Est $\delta^{13}C = -25\text{‰}$

Peat and detrital organic fragments from sand between outwash deposits near mouth of Anayaknaurak Creek (68° 34' 30" N, 151° 17' 30" W). *Comment* (TDH): dates interstade between two glacial advances of late Wisconsin (Itkillik II) age in Anaktuvuk Valley (Hamilton, 1980b). Coll and subm by T D Hamilton.

USGS-695. Anaktuvuk River **13,000 ± 140**
Est $\delta^{13}C = -25\text{‰}$

As described above. Check sample on USGS-694.

USGS-696. Anaktuvuk Valley **7940 ± 80**
Est $\delta^{13}C = -25\text{‰}$

Twigs from alluvium exposed in gravel pit 1km W of Tiglukpuk airstrip (68° 25' N, 151° 29' 30" W) at W margin of Anaktuvuk Valley floor. *Comment* (TDH): dates renewed fan deposition following episode of surface stability and peat formation (Hamilton, 1980b). Coll and subm by T D Hamilton.

USGS-697. Anaktuvuk Valley **9620 ± 60**
Est $\delta^{13}C = -25\text{‰}$

Wood and peat from Tigluk gravel pit (described above). Dates 40cm bed of compact black peat buried beneath 1.5m fan gravel. *Comment* (TDH): represents early Holocene soil-forming episode (Hamilton, 1980b). Coll and subm by T D Hamilton.

Lost Chicken series

Coll in Lost Chicken gold placer mine in Fortymile R drainage basin (64° 3' 48" N, 141° 53' 48" W).

General Comment (DMH): Lost Chicken Mine has yielded rich series of Pleistocene and Holocene mammalian fossils, and ^{14}C samples were coll in order to establish age and history of the faunal remains. Coll by Lee Porter and D M Hopkins; subm by D M Hopkins, USGS.

USGS-371. **41,000 ± 2500**
Est δ¹³C = -25‰

Roots and twigs hand-picked from sandy silt enclosing a caribou antler. The sandy silt and underlying gravel fill shallow bedrock channel along right side of mining pit.

USGS-372. **8620 ± 380**
Est δ¹³C = -25‰

Log several cm thick and several tens of cm long from gravel occupying bedrock channel along left side of mining pit, ca 100m N of site of USGS-371. *Comment* (DMH): date and stratigraphic observations show that gravel occupies a channel incised early in Holocene time into perennially frozen silty loess and colluvium of late Wisconsin age.

USGS-370. **4180 ± 50**
Est δ¹³C = -25‰

Spruce twigs from lowest forest bed exposed in Lost Chicken Mine. Forest bed is lowest in a sequence of woody layers interbedded with perennially frozen detrital peat and silty colluvium ca 5m thick, and it rests on >3m of perennially frozen cross-bedded silt and sand containing a few peat lenses but no wood.

USGS-384. Utukok River **12,410 ± 60**
Est δ¹³C = -25‰

Wood twigs from pebble gravel in terrace deposit on W bank of Utukok R (68° 56' N, 161° 13' W). Sample coll ca 8m below surface of terrace. Terrace is overlain by 1 to 2m of silt and muck. *Comment* (WY): date will aid in establishing chronology of the gravel terraces and assoc glacial and marine deposits in this part of Alaska. Coll and subm by W Yeend, USGS.

USGS-615. Utukok River **3620 ± 140**
Est δ¹³C = -25‰

Twigs from base of muck overlying terrace gravel (same location as USGS-384). Muck layer 1 to 2m thick. *Comment* (WY): date is min for gravel deposition in this area and helps establish postglacial chronology for landscape development. Coll and subm by W Yeend.

USGS-616. No Luck Lake **8800 ± 70**
Est δ¹³C = -25‰

Wood from base of muck, S shore bank of No Luck Lake (68° 49' N, 160° 3' W). Sample coll ca 3m below land surface and 2m above lake level. Muck here overlies gray clay with included pebbles. *Comment* (WY): dates aids in establishing chronology of lake development in foothills of National Petroleum Reserve, Alaska. Coll and subm by W Yeend.

43,700 + 3900
 - 2600

USGS-617. Colville River Bluff

Est $\delta^{13}C = -25\text{‰}$

Wood from ancestral Colville R gravels (high terrace) (68° 55' N, 160° 20' W). Sample was coll from a gravel terrace ca 50m above Colville R and 2 to 3m below top of terrace. *Comment* (WY): will help date ancestral Colville R gravels and contribute to chronology of gravel terraces in this part of Alaska. Coll and subm by W Yeend.

9180 ± 100

USGS-618. Driftwood Camp Lake

Est $\delta^{13}C = -25\text{‰}$

Peat from base of muck section in lake bluff (68° 55' N, 161° 15' W). Sample was coll ca 1m above lake level and 1m below land surface. The muck overlies massive ice lens. *Comment* (WY): will help establish chronology of thaw lake development within foothills of National Petroleum Reserve, Alaska. Coll and subm by W Yeend.

5070 ± 90

USGS-619. Seismo Lake

Est $\delta^{13}C = -25\text{‰}$

Peat enclosed by ice in lake bluff (68° 55' N, 160° 57' W). Sample coll ca 2m above lake level and 1m below land surface, in section of alternating muck and ice lenses. *Comment* (WY): date will help establish thaw lake chronology in foothills of National Petroleum Reserve, Alaska. Coll and subm by W Yeend.

Colville Delta Front Platform series

Samples were taken within 50m distance on uniformly flat platform, 5km wide, at almost identical depth in central section of Colville Delta (70° 32' 36" N, 150° 28' 36" W).

General Comment (ER): dated horizons represent first unit of fibrous organic matter in vibracores, and were thought to be correlated. The 440-yr discrepancy reflects cut and fill of strudel scours, and shows there are no continuous horizons. Coll and subm by Erk Reimnitz, USGS.

2930 ± 50

USGS-575.

Est $\delta^{13}C = -25\text{‰}$

Sample at 2.0m depth, 110cm below sea floor, from layer of fibrous organic matter, 30cm thick.

2490 ± 50

USGS-577.

Est $\delta^{13}C = -25\text{‰}$

Sample at 2.5m depth, 120cm below sea floor, from layer of fibrous organic matter, 5cm thick.

4760 ± 100

USGS-578. Simpson Lagoon, Beaufort Sea

Est $\delta^{13}C = -25\text{‰}$

Sample coll in Beaufort Sea (70° 30' 26" N, 149° 14' 29" W) from peat layer with sticks, 2 to 4cm thick. Coll at water depth of 2.5m with vibra-

corer, 100cm below lagoon floor. *Comment* (ER): dates onset of lagoon sedimentation or transgression. Coll and subm by Erk Reimnitz.

USGS-656. McKinley River **19,700 ± 200**
Est $\delta^{13}C = -25\text{‰}$

Peaty plant fragments in organic silt in alluvium below till of last glaciation. Locality is river bluff along N side of McKinley R several km W of Wonder Lake at (63° 26' N, 151° 5' W). *Comment* (RMT): date is max limit for Wonder Lake glaciation (Hamilton, 1982). Coll and subm by R M Thorson, USGS.

USGS-655. McKinley River **9580 ± 100**
Est $\delta^{13}C = -25\text{‰}$

Wood fragments in organic silt in lake sediments just above till of last glaciation. Locality is river bluff along N side of McKinley R near Muldrow Glacier (63° 26' N, 150° 30' 30" W). *Comment* (RMT): date is min limit for Wonder Lake Glaciation (Hamilton, 1982). Coll and subm by R M Thorson.

USGS-838. Southern Bering Sea **29,300 ± 320**
Est $\delta^{13}C = 0\text{‰}$

Marine gastropod (*Neptunea heros*) from 90m depth in USGS core S4-76-G113. *Comment* (JVG): shell is from dark grayish green silty clay that is now interpreted to be glacial-period sediment deposited prior to sea-ice breakup. Coll and subm by J V Gardner and D L Kuse, USGS.

California

USGS-858. Callahan Flow, Lava Beds National Monument **1110 ± 60**
Est $\delta^{13}C = -27\text{‰}$

Wood of tree engulfed by lava, SW corner of Lava Beds National Monument (41° 42' N, 121° 34' W). *Comment* (JDN): dates one of youngest basaltic flows at Medicine Lake Volcano. Coll and subm by J Donnelly-Nolan, USGS.

USGS-453. Northern San Francisco Bay **9580 ± 70**
Est $\delta^{13}C = -25\text{‰}$

Freshwater peat containing achenes of *Scirpus* from core sample 36m below msl (37° 58' N, 122° 26' W). *Comment* (BA): peat probably accumulated in alluvial flood basin perhaps subject to tidal inundation during low river stages. Dates inception of widespread intertidal deposition inside Golden Gate. Age matches (± 300 yr) other dates on freshwater peat from comparable stratigraphic settings beneath floor of central San Francisco Bay (Atwater, Hedel & Helley, 1977). Coll by California Div Bay Toll Crossings; subm by B Atwater and D Mann, USGS.

USGS-493. Central San Francisco Bay **37,500 ± 60**
Est $\delta^{13}C = -25\text{‰}$

Peaty clay, probably deposited in brackish or saltwater tidal marsh, from core sample 28 to 29m below msl (37° 44' N, 122° 16' W) from top of estuarine unit designated as Sangamon (Atwater, Hedel & Helley, 1977). *Comment* (BA): date is min age for this unit because of possible contamination by younger roots. Coll by California Div Bay Toll Crossings; subm by B Atwater and B Ross, USGS.

USGS-570. Bradford Island **42,200 ± 1600**
Est $\delta^{13}C = -25\text{‰}$

Detrital plant fragments in soft, gray, fluvial mud from auger sample 14m below msl (38° 04' N, 121° 39' W) from top of 6m fining-upward sequence. *Comment* (BA): date is max for overlying eolian sand, which forms part of large dune field in E Contra Costa Co. Coll and subm by B Atwater.

Jersey Island series

Detrital plant fragments in interbedded gray mud and sand of fluvial origin from auger hole (38° 02' N, 121° 40' W).

General Comment (BA): dates episode of aggradation at this site and correlates it with fining-upward sequence at Bradford I (USGS-570). Coll and subm by B Atwater.

USGS-571. **43,000 ± 1700**
Est $\delta^{13}C = -25\text{‰}$

Sample from 20m below msl, separated from overlying eolian sand by 10m of fluvial sand. *Comment* (BA): date is max for dune field of E Contra Costa Co.

USGS-572. **46,300 ± 2400**
Est $\delta^{13}C = -25\text{‰}$

Sample from 24m below msl.

USGS-665. Little Packer Lake **830 ± 60**
Est $\delta^{13}C = -25\text{‰}$

Detrital wood in lacustrine mud from borehole sample 3.4 to 3.6m below surface of filled oxbow lake near Sacramento R (39° 27' N, 122° 01' W). *Comment* (BA): date is min for creation of lake. Coll by D Sullivan, D Belknap, B Atwater and subm by B Atwater.

USGS-666. Little Packer Lake **4060 ± 150**
Est $\delta^{13}C = -25\text{‰}$

Detrital wood in lacustrine mud from borehole sample 7.8 to 8.0m below surface of natural levee bordering oxbow lake of Sacramento R (39° 27' N, 122° 01' W). *Comment* (BA): date is max creation of these levees. Coll by D Sullivan, D Belknap, B Atwater and subm by B Atwater.

Clear Lake, Core 3 series

Carbonaceous sediments from Clear Lake, core 3 (39° 2' 54" N, 122° 50' 24" W).

General Comment (JDS): dates sedimentation rates and events in core and assists correlations with seven other cores in lake (Sims, 1976). Coll and subm by J D Sims, USGS.

USGS-432. **17,600 ± 450**
Est $\delta^{13}C = -25\text{‰}$

Depth in core 1216 to 1223cm.

USGS-433. **27,500 ± 700**
Est $\delta^{13}C = -25\text{‰}$

Depth in core 4517 to 4523cm.

USGS-434. **28,800 ± 640**
Est $\delta^{13}C = -25\text{‰}$

Depth in core 4778 to 4783 cm.

USGS-435. **34,400 ± 950**
Est $\delta^{13}C = -25\text{‰}$

Depth in core 5638 to 5642cm.

USGS-436. **29,800 ± 1600**
Est $\delta^{13}C = -25\text{‰}$

Depth in core 6662 to 6668cm.

USGS-437. **29,900 ± 800**
Est $\delta^{13}C = -25\text{‰}$

Depth in core 6765 to 6770cm.

Clear Lake, Core 4 series

Carbonaceous sediment from Clear Lake, core 4 (39° 2' 24" N, 122° 48' 36" W).

General Comment (JDS): dates and confirms pollen curve that is interpreted to represent an uncalibrated paleotemperature curve correlated with $\delta^{18}O$ curves from deep sea. Also dates sedimentation rates and events in this core and is used to correlate with seven other cores taken from lake (Sims, 1976). Coll and subm by J D Sims.

USGS-444. **26,350 ± 440**
Est $\delta^{13}C = -25\text{‰}$

Depth in core 4005 to 4015cm.

USGS-445. **10,410 ± 70**
Est $\delta^{13}C = -25\text{‰}$

Depth in core 1495 to 1505cm.

USGS-446. **6930 ± 90**
Est δ¹³C = -25‰
 Depth in core 807 to 812cm.

USGS-447. **32,800 ± 900**
Est δ¹³C = -25‰
 Depth in core 8005 to 8015cm.

Clear Lake, Core 6 series

Peaty sediment from Clear Lake, core 6 (39° 1' N, 122° 42' 30" W).

General Comment (JDS): dates sedimentation rates and events in core and assists in correlation with seven other cores taken from lake (Sims, 1976). Coll and subm by J D Sims.

USGS-520. **29,900 ± 550**
Est δ¹³C = -25‰
 Depth in core 1835 to 1840cm.

USGS-521. **29,400 ± 500**
Est δ¹³C = -25‰
 Depth in core 2052 to 2057 cm.

USGS-549. Three Peaks, Marin Co **<100**
Est δ¹³C = -25‰

Charcoal fragments in alluvial deposits exposed in stream cut 1km E of Three Peaks (38° 8' 15" N, 122° 46' 45" W). Charcoal occurs ca 0.5m below ground surface in discontinuous bed of coarse- to medium-size sand. Dated bed is truncated by deposits interpreted to be debris flow deposits. *Comment* (DMP): date is max of debris flow event. Coll and subm by D M Peterson and S Ellen, USGS.

USGS-550. Three Peaks, Marin Co **230 ± 70**
Est δ¹³C = -25‰

Charcoal fragments in alluvial deposits exposed in stream cut 1km E of Three Peaks (38° 8' 25" N, 122° 46' 45" W). Charcoal occurs 1.6m below ground surface in coarse sand lens. *Comment* (DMP): dated lens stratigraphically underlies deposits interpreted to be debris flow deposits, indicating max age of debris flow event. Coll and subm by D M Peterson and S Ellen, USGS.

USGS-551. Alpine Lake, Marin Co **1550 ± 80**
Est δ¹³C = -25‰

Carbonized wood in colluvium exposed in road cut at SW end Alpine Lake (37° 56' 15" N, 122° 38' 15" N). Wood specimen occurred ca 3m below ground surface in colluvial accumulation filling uppermost segment of small drainage. Base of deposit not exposed. Total thickness is estimated to be at least 6m. *Comment* (DMP): date is min of deposit. Similar colluvial

deposits are common through Marin Co. Apparently none of these deposits have been dated previously. Coll and subm by S Ellen and D M Peterson.

Kansas

USGS-744. Wilson Ford

>53,000
Est $\delta^{13}C = 0\text{‰}$

Shell (right valve of *Amblyema plicata* (Say)) from gravel unit near base of terrace exposed in E bank of Fall R (37° 31' 25" N, 95° 54' 57" W). Subm as check on date M-997 (Crane & Griffin, 1962, p 186) based on *Lasimigona complanata* Barnes from same unit. Original date (M-997: 31,000 ± 6000) has been used in literature as terminal date for extinction of *Bison alleni*, but this interpretation has been questioned by Robinson (1981). Coll July 1947 by C Carpenter and C W Hibbard; subm by B B Miller, Kent State Univ.

Washington

USGS-782. Big Lake

13,370 ± 70
Est $\delta^{13}C = 0\text{‰}$

Marine shell fragments from gray silts at NW end of Big Lake (48° 23' 30" N, 122° 14' 30" W), 23m above present sea level, overlying glacio-marine drift. *Comment* (DD): dates later Pleistocene marine incursion during deglaciation of NW Washington. Coll by J Minard and subm by D Dethier, USGS.

USGS-787. Big Lake

13,040 ± 70
Est $\delta^{13}C = 0\text{‰}$

Marine shells in growth position from silty sand which overlies Vashon till 24m above present sea level at SE end of Big Lake (48° 22' N, 122° 13' W). *Comment* (DD): dates later Pleistocene marine incursion during deglaciation of NW Washington. Coll and subm by D Dethier.

USGS-881. Gilligan Creek

3600 ± 50
Est $\delta^{13}C = -25\text{‰}$

Outer wood of log from sand and gravel exposure at ca 40m elev near mouth of Gilligan Creek (48° 29' N, 122° 8' W). *Comment* (DD): dates construction of alluvial fan by Gilligan Creek into Skagit Valley. Coll and subm by D Dethier.

USGS-905. Concrete East

1860 ± 180
Est $\delta^{13}C = -25\text{‰}$

Log in laminated silt and sand underlying ca 50m coarse gravel capped by till at ca 60m elev, 1km SE of Concrete (48° 32' N, 121° 44' W). *Comment* (DD): date is max limit for advance of Cordilleran ice up Skagit Valley. Coll and subm by D Dethier.

USGS-963. Freeland **>50,200**
Est $\delta^{13}C = -27\text{‰}$

Charcoal in sand rich in pumice lapilli, underlying ca 4m of Vashon Drift, at ca 40m elev, 2.5km NW of Freeland (48° 01' 30" N, 122° 33' W). *Comment* (DD): date is min limit for deposition of dacite-rich alluvium derived from Glacier Peak. Coll and subm by D Dethier.

USGS-967. Salkum **53,000 + 3000**
- 2200
Est $\delta^{13}C = -27\text{‰}$

Compressed wood in medium sand and silt, with pumice lapilli, underlying 5 to 10m of volcanic-rich alluvium capped by Evans Creek outwash. Coll 3km SW of Salkum, Washington (46° 30' N, 122° 38' 30" W) at ca 80m elev on N bank of Cowlitz R. *Comment* (DD): dates laharc fill of Cowlitz R during pre-Evans Creek eruption at Mount Rainier. Coll and sub by D Dethier.

USGS-864. Mundt Creek **>49,000**
Est $\delta^{13}C = -27\text{‰}$

Wood fragment from locally derived pebbly silt which directly underlies Vashon till 5km SE of Clear Lake (48° 27' 30" N, 122° 11' W). *Comment* (DD): dates period of landslides and fan construction as Vashon ice thinned, but before marine incursion in this area. Coll and subm by D Dethier.

USGS-865. Cicero **8420 ± 90**
Est $\delta^{13}C = -27\text{‰}$

Charcoal fragments in pumice-rich lahar which directly overlies Vashon recessional outwash 2km N of Cicero (48° 17' N, 122° 1' 30" W) at ca 85m elev. *Comment* (DD): young apparent age suggests charcoal is younger than lahar, or was contaminated. Coll and subm by D Dethier.

USGS-866. Collins Road, Sterling **1790 ± 80**
Est $\delta^{13}C = -27\text{‰}$

Charcoal fragments in gray silt interbedded with sand and pumice lapilli derived from Glacier Peak. Sample coll along Collins Road (48° 29' 30" N, 122° 17' W). *Comment* (DD): dates late Holocene influx of volcanic debris from Glacier Peak, and formation of terrace deposit, >10m thick. Coll and subm by D Dethier.

USGS-879. Gilligan Creek East **2180 ± 50**
Est $\delta^{13}C = -27\text{‰}$

Wood (log) in locally derived fine sand and silt underlying ca 1m oxidized sand and gravel 1km E of Gilligan Creek (48° 29' 30" N, 122° 7' W), at ca 28m elev. *Comment* (DD): dates deposition of broad alluvial fan complex into Skagit Valley. Coll and subm by D Dethier.

USGS-880. Day Creek **4790 ± 80**
Est δ¹³C = -27‰

Charcoal fragments from medium sand with pumice lapilli underlying 80cm massive silt and overlying >150cm oxidized sand and gravel at ca 25m elev, 2km NW of Day Creek (48° 30' N, 122° 5' W). *Comment* (DD): dates influx of laharc debris from Glacier Peak and formation of mid-Holocene fill terrace. Coll and subm by D Dethier.

USGS-766. Tulalip Creek Valley **47,200 + 2600**
- 1900
Est δ¹³C = -27‰

Compressed peat layer in thick bedded sand below Vashon advance outwash, 30 to 40m below Vashon till (48° 05' 45" N, 122° 16' 26" W). *Comment* (JM): provides age control on Esperance advance outwash. Coll and subm by J Minard, USGS.

USGS-765. Stillaguamish River Valley **23,700 ± 210**
Est δ¹³C = -27‰

Compressed peat layer in lower advance outwash or pre-advance outwash silt and sand 3 to 4m below base of Vashon till (48° 12' 5" N, 122° 11' 52" W). *Comment* (JM): provides age control on known stratigraphic section. Coll and subm by J Minard.

USGS-767. Stillaguamish River Valley **28,000 ± 160**
Est δ¹³C = -27‰

Compressed peat layer in thick lower advance outwash or pre-advance outwash sediment 2 to 3m below base of Vashon till (48° 12' 23" N, 122° 09' 04" W). *Comment* (JM): dates recessional sequence and relation to Vashon till. Coll and subm by J Minard.

USGS-768. Snohomish River Valley **>54,000**
Est δ¹³C = -27‰

Sample from roadcut along Hwy 2 just W of Westwick Rd (47° 54' 23" N, 122° 2' 36" W). Compact peat and flattened plant stems bedded in fine sand and silt in pre-Vashon-advanced outwash sediments 1 to 2m below Vashon till. *Comment* (JM): allows age correlation with advance outwash to W and E. Coll and subm by J Minard.

USGS-770. Stillaguamish River Valley **39,700 ± 1100**
Est δ¹³C = -27‰

Layer of wood-lignite in base of interbedded sand, silt, and clay in Stanwood Water Well roadcut (48° 12' 28" N, 122° 19' 55" W). Sample is just above oxidized possible Olympia interglacial gravel 70m below Vashon till. *Comment* (JM): provides age control in area. Coll and subm by J Minard.

USGS-771. Silvana Terraces **>49,000**
Est $\delta^{13}C = -27\text{‰}$

Brown to black compact peat 1m above glacial marine drift and below section of till and bedded sediments on bank of Stillaguamish R (48° 12' 17" N, 122° 17' 56" W). *Comment* (JM): dates fossiliferous glacial marine drift. Coll and subm by J Minard.

USGS-877. Silvana Terraces **46,500 ± 1110**
Est $\delta^{13}C = 0\text{‰}$

Pelecypod shell material in glacial marine drift 1m below peat of USGS-771. Dates fossiliferous glacial marine drift. Coll and subm by J Minard.

USGS-772. Pilchuck Creek Valley **24,700 ± 160**
Est $\delta^{13}C = -27\text{‰}$

Flattened plant stems, twigs, and branches in clay beneath 25m plus of bedded Vashon advance outwash and pre-Vashon sediments. Sample from N side of Pilchuck Creek Valley (48° 14' 18" N, 122° 12' 26" W). *Comment* (JM): date extends known date line near E limit of continental ice lake. Coll and subm by J Minard.

USGS-808. Marysville **13,300 ± 60**
Est $\delta^{13}C = 0\text{‰}$

Pelecypod shells (many in feeding position) near base of 6m of tidal flat muck, directly on Vashon till. Sample coll on Hickok Road (48° 3' 13" N, 122° 9' 8" W). *Comment* (JM): dates withdrawal of ice from area. Coll and subm by J Minard.

USGS-773. Lower North Creek Valley **49,900 + 3300**
- 2300
Est $\delta^{13}C = -27\text{‰}$

Single piece of flattened wood in slit layers in bedded pre-Vashon sand NW of Woodinville (47° 46' N, 122° 10' 25" W). *Comment* (JM): date helps understanding of times and rates of ice advance in area. Sample is possibly redeposited. Coll and subm by J Minard.

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