

**QUEBEC RADIOCARBON MEASUREMENTS III**

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The results presented in this list have been obtained by benzene synthesis and liquid scintillation counting: ages are calculated using the  $^{14}\text{C}$  half-life of 5570 yr with 0.95 activity of NBS oxalic acid as modern standard, with no correction. The given precision is obtained from a one-standard-deviation criterion.

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## I. GROUNDWATER SAMPLES

*Quebec, Canada*

Groundwater samples were coll in three regions of Quebec and subm by G Simard. Carbonate extract was made on the sampling site according to procedure of Feltz and Hanshaw (1963).  $^{14}\text{C}$  concentrations are reported as % modern without correction.

**Mirabel area series**TABLE I  
Mirabel

Sample	Well	Sampling date	Well depth (m)	Age BP	$^{14}\text{C}$ (% modern)
QU-87	R-1	30-01-74	91.4	5810 ± 270	62.2 ± 2.1
QU-169	R-3	13-06-74	91.4	860 ± 190	89.8 ± 2.1
QU-92	R-7	25-10-73	91.4	7350 ± 500	22.2 ± 1.2
QU-135	R-8	26-10-73	91.4	2210 ± 180	75.9 ± 1.7
QU-178	R-13	27-10-73	91.4	12,260 ± 210	21.7 ± 1.2
QU-88	R-14	06-02-74	48.8	630 ± 200	92.4 ± 2.3
QU-86	R-15	27-10-73	91.4	3870 ± 310	61.8 ± 2.4
QU-134	R-16	06-02-74	61.0	7560 ± 450	39.0 ± 2.2
QU-137	R-17	30-01-74	77.1	7680 ± 500	38.4 ± 2.4
QU-171	R-19	22-06-74	61.0	280 ± 170	96.5 ± 2.0
QU-177	R-1-69	23-07-74	49.4	5070 ± 110	53.2 ± 0.7
QU-172	R-2-70	11-06-74	47.2	2780 ± 650	70.7 ± 5.7
QU-166	MT-2	26-10-73	9.7	1010 ± 180	88.2 ± 2.0
QU-168	MT-7	13-06-74	33.5	6440 ± 450	44.9 ± 2.5
QU-136	MT-8	29-01-74	18.3	3170 ± 170	67.4 ± 1.4
QU-167	MT-12	28-05-74	35.7	6000 ± 570	47.4 ± 3.4

Sampling of water was part of hydrogeologic study of fractured rocks belonging to the Cambro-Ordovician series (45° N, 74° W). Samples were coll from wells drawing water from Postdam sandstone, Beekmantown dolomite, and a limestone sequence of Chazy, Black River, and Trenton group (Simard, 1976).

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**Eaton River Basin series**

Sampling was part of study to determine replenishment rate of Quaternary sand and gravel aquifers laid down in preglacial valleys of SE Quebec (45° N, 71° W).

TABLE 2  
Eaton River Basin

Sample	Well	Sampling date	Well depth (m)	Age BP	<sup>14</sup> C (% modern)
QU-64	F-2-b	07-08-73	36.9	9780 ± 400	29.6 ± 1.5
QU-65	F-7	07-08-73	25.0	3120 ± 140	67.8 ± 1.2
QU-89	F-10	25-10-73	3.6	—	108.0 ± 1.6
QU-170	F-12	05-06-74	14.0	360 ± 140	95.6 ± 1.2
QU-28	F-14	07-08-73	31.1	5280 ± 210	51.8 ± 1.3
QU-90	F-15	25-10-73	24.4	1760 ± 120	80.3 ± 1.2

*General Comment (GS):* <sup>14</sup>C and <sup>3</sup>H measurements of groundwater coll in these units and along flow system in Paleozoic rocks indicate that ages obtained from waters in different aquifers vary from recent infiltrated water to old groundwater when recharge occurs in low permeability bedrock. Flow rate of 0.5m/yr has been established by Simard (1973).

**Iles de la Madeleine series**

Isotope determination of groundwater from Iles de la Madeleine (47° N, 62° W) was carried out as part of global study on saltwater intrusion that occurs in major aquifers located in permo-carboniferous red sandstone. A thorough description of the problem was given by Sylvestre (1974).

TABLE 3  
Iles de la Madeleine

Sample	Well	Sampling date	Well depth (m)	Age BP	<sup>14</sup> C (% modern)
QU-179	P74-1	27-06-74	61.0	2750 ± 170	71.0 ± 1.5
QU-180	P74-2	02-07-74	91.5	1240 ± 130	85.7 ± 1.4
QU-176	Havre aux-Maisons	02-08-74	73.2	2260 ± 130	75.5 ± 1.2

*General Comment (GS):* <sup>14</sup>C results indicate presence of old groundwater in bedrock of Magdalen I. and a low recharge rate.

## II. GEOLOGIC ORGANIC SAMPLES

## Canada

## Quebec

**QU-327. Valley-Junction****>39,000**

Organic debris (mostly mosses id. by WC Steere, NY Bot Garden) coll in sec made by artificial excavation along Morency R near Valley Junction (46° 22' 40" N, 70° 55' 00" W) alt 170m. Coll and subm by P LaSalle. *Comment (PL):* bryophyte material shows very little wear and transport is min. Bryophyte flora (LaSalle, Martineau, and Chauvin,

1979) forms assemblage growing on stream bed with intermittent flooding. Episode so dated can probably be correlated with deglaciation that preceded Massawipi or perhaps Gayhurst. Pollen flora (high NAP, low Ap) indicates that plants were possibly growing during deglaciation episode in shallow bay of glacial lake dammed by retreating ice in Chaudière Valley.

**QU-579. Beaupré** **7760 ± 130**

Wood (*Larix* or *Picea*) coll by P LaSalle, G Martineau, L Chauvin, in peat layer possibly formed in abandoned erosional channel at mouth of St-Anne R (47° 02' 25" N, 70° 53' 45" W) alt 15m. *Comment* (PL): date is min for abandonment of channel; also min age for retreat of water plane below present 15m contour line.

**QU-504. Rivière du Moulin** **2050 ± 100**

Wood coll in a river sec in landslide colluvium (48° 24' 42" N, 72° 02' 00" W) alt ≈50m. Coll by J Vallée. *Comment* (PL,JV): landslide scar probably assoc with several landslides. Dates is max for one of several landslides.

**QU-383. Perkins** **10,160 ± 120**

Marine shells (*Hiatella arctica* and *Macoma* sp) in thanatocenosis from base of marine sand unit lying above fluvioglacial deposit at depth 10m, 1.6km S of Perkins, Ottawa valley, Quebec (45° 34' N, 75° 37.5' W) alt 137m. Coll in 1975 by M Allard. *Comment* (MA): dates late phase of Champlain Sea in Ottawa valley after it had regressed to present 137m contour line and agrees with other dates for Ottawa lowlands.

**QU-382. Lascelles** **10,700 ± 150**

Non-articulated marine shells (*Hiatella arctica* and *Macoma* sp) from shore deposit at 170m elev, 1.6km N of Lascelles, Gatineau valley, Quebec (45° 43.8' N, 75° 57.4' W) at depth 3m. Coll 1974 by M Allard. *Comment* (MA): probably indicates age of short stand of Champlain Sea at this level during regression phase. Although in general agreement with many dates in Ottawa area, it is younger than other dates at same elev, downstream from present site (GSC-842: 11,600 ± 150 at 170m; GSC-982: 11,300 ± 180 at 155 to 160m).

**Goldthwait Sea series**

Samples coll and subm by J C Dionne.

**QU-492. Morigeau (Montmagny)** **10,900 ± 150**

Shells (*Balanus hameri*) from glacio-marine clays S of St Lawrence (46° 52' 45" N, 70° 39' 30" W) alt 70m. Age is too young for Goldthwait Sea submergence (QU-93: 12,230 ± 250), but fits 70 to 75m shoreline in lower St Lawrence estuary (QU-266: 10,400 ± 320; Locat, 1977). *Comment* (PL): age range suggests deposition of material possibly assoc with St Nicolas-St Narcisse events (LaSalle, Martineau, and Chauvin, 1977).

**QU-500. St-Michel (Bellechasse) 3590 ± 110**

Trunk of *Quercus rubra*, 150-yr-old buried in sandy gravel bar in Boyer R cut into Goldthwait Sea clay and glacio-marine clay (46° 52' 10" N, 70° 52' W) alt 16m. Date is min for 15 to 20m shoreline.

**Otish series**

Gyttja samples from two cores in same lake (52° 26' 37" N, 70° 57' 10" W) alt 700m in Otish Mt, central Quebec. Coll and subm by M Bouchard.

**QU-476. 4270 ± 200**

Depth 120 to 135cm. Pollen assemblage indicates return to cooler conditions in Otish Mt.

**QU-328. 4190 ± 160**

Depth 140 to 146cm, near base of cone in same lake basin. Core incomplete, but similar pollen assemblage shows good agreement with QU-476.

**Mont Shefford series**

Woody peat coll from forested bog located on Mt Shefford (45° 21' 33" N, 72° 35' 05" W) alt 282 m. Coll and subm by P Richard.

**QU-515. 970 ± 110**

Dates end of alder thicket and beginning of forest phase of bog; pollen evidence shows regional vegetation dominated by sugar maple (Richard, 1978).

**QU-516. 2200 ± 90**

Dates end of low oak pollen max (Richard, 1978).

**QU-434. Lac Joncas 8120 ± 510**

Clayey gyttja from basal part (480 to 500cm) of lake core (47° 15' 30" N, 72° 35' 05" W) alt 282m. Coll by P Richard. *Comment* (PR): pollen diagram indicates tundra-like vegetation and date confirms very young age of this type of environment in region (Richard, 1971).

**James Bay series**

Samples coll and subm by JC Dionne (1979).

**QU-493. Rupert River I (Peat) 5020 ± 100****QU-494. Rupert River II (*Picca* sp) 5920 ± 100**

Samples from base of bog 3m thick, overlying marine clay, and with numerous roots and tree remains at base (51° 22' N, 77° 45' 15" W) alt 183m. The 183m shoreline is ca 1000 yr old (Hardy, 1977). Results indicate migration of trees lagged by ca 1000 yr at that site and peat formation by ca 2000 yr.

**QU-495. Nottaway River I (Peat) 5840 ± 100**

**QU-496. Nottaway River II (*Picea* sp) 6390 ± 130**

Samples from base of bog 2m thick, overlying lacustrine clays, with roots and tree remains at base (50° 30' N, 77° 48" W) alt 275m. As glacial lake Objibway drained ca 7900 yr ago (Hardy, 1977) migration of trees lagged by ca 1500 yr and peat formation by 2000 yr at this site.

**QU-497. Harricana River I (Peat) 3830 ± 120****QU-498. Harricana River II (*Picea* sp) 4200 ± 100**

Peat from base of bog 2.5m thick, overlying marine clay, with abundant roots and tree remains at base (50° 42' N, 79° 20' W) alt 60m. With 60m shoreline, ca 4500 yr old (Hardy, 1977). Apparently migration of trees lagged by 300 yr and peat formation by ca 700 yr.

**QU-499. Soscumina Lake 6890 ± 120**

Peat from base of bog 2.5m thick, overlying glacio-lacustrine clays (50° 17' 30" N, 77° 24' W) alt 240m. Drainage of glacial Objibway dated to 7900 yr ago, peat formation lagged by ca 1000 yr.

**Havre St-Pierre series**

Samples coll and subm by JCD.

**QU-830. 50 ± 70**

Shells (*Mytilus edulis*) buried 40cm in beach ridge, underlain by calcareous bedrock, ca 1m above high tide level on Ile-aux-Goélands (50° 12' 20" N, 63° 35' 30" W). *Comment* (JCD): age too young for 2m marine level. Material possibly emplaced during exceptional storm water levels. Shells were not in growth position; probably redeposited from lower levels.

**QU-831. 5700 ± 100**

Peat from base of large peat bog 2 to 3m deep, overlying deltaic sediments of Romaine R at 16m alt (50° 17' 40" N, 63° 38' W). *Comment* (JCD): min age for emergence of level of present 15 to 16m contour line.

**QU-832. 4750 ± 100**

Wood (*Picea* sp) from trunk 10cm above base of peat bog, 2 to 3m thick, lying on deltaic sediments of Romaine R at 16m above sea level (50° 17' 40" N, 63° 38' 10" W). *Comment* (JCD): dates beginning of forest growth on bog at same site as QU-831.

**QU-833. 2940 ± 90**

Peat at base of organic deposit, 1.5 to 3m thick, between two beach ridges on deltaic sediments of Romaine R at 16m above sea level (50° 16' 35" N, 63° 38' 20" W). *Comment* (JCD): dates beginning of peat formation in lagoon sometime after emersion at level of present 15 to 16m contour line (QU-831).

**QU-834. 102 ± 1% modern**

Peat at base of organic deposit 1.5m thick overlying deltaic sediments of Romaine R at 15m level (50° 18' 50" N, 63° 33' 15" W). *Comment* (JCD): probable contamination; age too young for emergence of level of present 15m contour line.

**QU-835. 3080 ± 110**

Organic debris from base of peat knoll, 175cm high, developed on Precambrian bedrock along Romaine R at alt 130m (50° 28' 30" N, 63° 16' 50" W). *Comment* (JCD): result dates beginning of peat formation at site.

**QU-836. 470 ± 100**

Peat coll 85cm below surface of peat knoll 175cm high, developed on Precambrian bedrock along Romaine R alt 130m (50° 28' 30" N, 63° 16' 50" W). *Comment* (JCD): result gives rate of peat accumulation of ca 2mm per year for upper part of peat knoll.

**QU-837. 2440 ± 100**

Peat at base of organic deposit 75cm thick lying on deltaic sediments of Romaine R, at 15m above sea level (50° 13' 45" N, 63° 22' 40" W). *Comment* (JCD): min age for beginning of peat growth. Result compatible with QU-833.

*Manitoba***QU-154. (1) Brookdale Road 1 24,280 ± 940****QU-154. (2) Brookdale Road 2 23,510 ± 950**

*Comment* (LB): these two results are from separate measurements of the same sample. A horizon of buried soil developed in sands of Assiniboine delta of Lake Agassiz (Elson, 1960) overlain by dune sands, 1.15m thick, exposed in roadcut along W side of rd leading to Brookdale, 1.3km N of Trans-Canada Hwy, ca 8km ENE of Douglas Sta (49° 54' 20" N, 99° 35' 30" W). Coll 1970 and subm 1974 by P P David, Univ Montreal. *Comment* (PPD): sample preparation same as for GSC-949 (R, 1971, v 13, p 283). Date does not fit geol setting (David, 1971) and suggests part of organic contribution may be from lignite common in deltaic sediments and likely to be humified (comment on GSC-1129: R, 1971, v 13, p 290).

*Saskatchewan***QU-622. Yakon Lake 102 ± 1% modern**

Wood from outer rings of trunk of formerly buried pine tree exhumed in blowout depression of actively advancing sand dune on S side of Lake Athabasca (59° 12' N, 108° 03' W). Coll and subm 1977 by P P David. *Comment* (PPD): clean sample of well-preserved wood, evidently too young.

*Northwest Territories***Cumberland Peninsula, Baffin Island series**

All samples coll in 1974 and subm by A S Dyke, formerly Univ Colorado, presently Geol Survey Canada. Dates are described in detail in Andrews (1976) and Dyke (1977).

**QU-240. Millut Bay 1560 ± 120**

Whale bone from surface of emerged marine terrace at 1.5m alt (66° 38' N, 67° 34' W). Dates time when sea level was 1.5m higher than present.

**QU-241. Shark Fiord 770 ± 80**

Whale bone from Thule eskimo site at head of fiord (66° 36' N, 66° 44' W). Sample site is 1m above high tide line but lowermost tent rings are being destroyed by sea. Dates occupation of site and time of slightly lower relative sea level.

**QU-299. Near Penny Ice Cap 6800 ± 600**

Fibrous peat bed, 3cm thick, overlain by 106cm glacial outwash sands (66° 50' 30" N, 66° 17' 30" W). Sec 1km from margin of Penny Ice Cap. Date is min on recession of ice cap during early Holocene.

**QU-301. 8km NW of Windy Lake 1170 ± 150**

Fibrous peat (buried soil) overlain by outwash sands (66° 36' 30" N, 65° 43' 30" W). Dates burial of soil and accumulation of outwash.

**QU-302. Near Penny Ice Cap and Cirque Glacier 2120 ± 80**

Detrital organics in sands deposited by glacial meltwater, 1km from glacier (66° 39' N, 65° 46' 30" W). Sands overlie boulder gravel and date relates to decrease in stream competence which is controlled by glacier ablation rate.

**QU-303. Near Penny Ice Cap 1640 ± 130**

Fibrous peat (buried soil) overlain by outwash sands, 130cm thick (66° 39' N, 65° 46' 30" W). Dates burial of soil and accumulation of outwash.

**QU-304. Near Penny Ice Cap 4460 ± 210**

Fibrous peat overlying oxidized gravel and overlain by 5.6m eolian sand in valley which drains S margin of ice cap (66° 39' 30" N, 65° 46' 30" W). Sec 2km from ice cap. Sample dates onset of eolian sand accumulation and formation of soil following deglaciation.

**QU-305. Fiord N of Kekertelung Island 830 ± 70**

Buried soil A-horizon overlying marine sand and overlain by 50cm dune sand. Soil horizon is 55cm above high tide line at head of fiord (66° 24' N, 66° 30' W). Dates onset of eolian sand accumulation and relative sea level position below 0.5m alt.

**QU-306. Shark Fiord** **280 ± 160**

Thin vegetation mat (buried soil) on oxidized beach gravel overlain by 18cm of active beach gravel near head of fiord (66° 36' N, 66° 44' W). Sample site is 0.5m below high tide line. Date relates to progradation of beach sediments during ongoing coastal submergence. Same site as QU-241.

**QU-307. Near Greenshield Lake** **1610 ± 230**

Fibrous peat (buried soil) overlain by 45cm outwash sand in terrace 1.5km from margin of Penny Ice Cap (67° 06' 36" N, 67° 03' W). Dates deposition of uppermost sediments forming terrace.

**QU-308. Clearwater Fiord** **620 ± 210**

Peat near fiord head (66° 36' N, 67° 55' 30" W). Material occurs in present intertidal zone, and date relates to ongoing relative sea-level rise.

## III. GEOLOGIC CARBONATE SAMPLES

*Quebec, Canada*

Carbonate samples (calcareous concretions) coll and subm by C Hillaire-Marcel.

**QU-279. Deschaillons** **36,300 ± 2400**

Elliptic calcareous concretion embedded in Lake Deschaillons varves (freshwater) at Deschaillons Brickyard (46° 33' 10" N, 72° 08' 07" W). S bank of St Lawrence R. *Comment* (CH-M): two phases of carbonate precipitation may be identified in these varves: oldest one preceded Gentilly till deposition, while youngest took place during Champlain Sea and Lake Lampsilis time. Dated concretion belongs to first group.

Its age agrees with dates of QC-559; 34,900  $\begin{matrix} + 1625 \\ - 1350 \end{matrix}$  and QC-357: 37,500

$\begin{matrix} + 2300 \\ - 1800 \end{matrix}$  obtained on other specimens (QC-559 corresponding to innermost part of concretion). Although they approach limits of <sup>14</sup>C dating method, ages are considered significant. But long interval between St Pierre beds

(QL-198: 74,700  $\begin{matrix} + 2700 \\ - 2000 \end{matrix}$ , Stuiver, Heusser, and Yang, 1978) and the overlying Deschaillons lake deposits is puzzling.

**QU-280. Little Whale River I** **7820 ± 100**

Calcareous endocasts of *Portlandia arctica* in glacio-marine rythmites of Tyrrel Sea (55° 59' 10" N, 76° 42' 16" W) alt 0m. *Comment* (CH-M): date agrees with I-8363: 8230 ± 135 also on concretions (Hillaire-Marcel, 1976).

**QU-281. Great Whale River II** **7940 ± 140**

Calcareous concretions in glaciomarine rythmites of Tyrrel Sea (55° 17' 07" N, 77° 36' 37" W) alt 2m.

*General Comment* (PL): one must consider that <sup>14</sup>C results obtained on



concretions represent an average of several periods of precipitation and of several types of material. Ordovician or older carbonates together with younger ones having no definite relation with period of existence of Lake Deschaillons and, hence, its true  $^{14}\text{C}$  age may have contributed to QU-279 (Tarr, 1935; Garrels and Christ, 1965; Pearson and Hanshaw, 1970; Simard, 1977; Gadd, 1980).  $^{14}\text{C}$  activity of QU-280 and QU-281, *ie*, calcareous precipitates in marine environment, seem to bear some relation to  $^{14}\text{C}$  activity of shells of contemporaneous Tyrrel Sea. However, no direct comparison has been made with shells collected *in situ* with concretions.

## IV. ARCHAEOLOGIC SAMPLES

*Quebec, Canada***Kamouraska Rimouski series**

Samples coll and subm by P Dumais.

**QU-444. 2700  $\pm$  120**

Charcoal from oldest occupation layer of archaeol site (DcEe-3A) near village of Bic, Rimouski Co (48° 21' N, 68° 48' W), on raised beach, 7.3m above mean level of St Lawrence estuary. Date places this site in Archaic period of cultural sequence of S Quebec. It is believed that beach had emerged only a short time before that date.

**QU-445. 1240  $\pm$  80**

Charcoal from archaeol site (Dbef-4) at St Fabien-sur-Mer, Rimouski Co (48° 19' N, 68° 51' W) on raised beach, 6.5m above mean level of St Lawrence estuary. Date is acceptable for prehistoric occupation of site, but contamination by younger material is possible.

**QU-446. 390  $\pm$  90**

Charcoal from more recent occupation layer of archaeol site described for sample QU-444 (Site DcEe-3A). Date obtained is plausible and places this cultural level at end of prehistoric period or beginning of contact period.

*Iran***Kermanshah series**

Samples coll July 1975 and subm by IA Brookes during work for Royal Ontario Mus.

**QU-396. Kermanshah I 106  $\pm$  2% modern**

Left and right valves of one riverine pelecypod from surface of muddy point bar exposed at low water in Ab-Marik channel floor, 20km W of Kermanshah, Iran (34° 17' N, 46° 47' E) alt 1355m. Sample coll to determine effect of "hard" water environment and post-1950 atmospheric  $^{14}\text{C}$  level on radiocarbon age of modern shell.

**QU-395. Kermanshah II 7620  $\pm$  140**

Several intact valves of pelecypod from sandy, partly iron-stained alluvium in bank of Qara Su, 30km NW of Kermanshah, Iran (34° 31'

N, 46° 50' E) alt ca 1310m. Prevalence of carbonate in regional bedrock and warm, sub-humid climate raise suspicion that this sample is contaminated with excess non-radioactive carbon and is, thus, radiometrically "too old".

*Martinique, Lesser Antilles*

**Macabou site series**

Samples coll (14° 31' N, 60° 50' E) and subm by L Allaire.

**QU-632. 610 ± 80**

Worked lip of *Strombus gigas* shell, from ashy midden deposit. Dates late Suazoid culture component in Area B (Levels I and II) which lacks finger-indented rims.

**QU-633. 420 ± 220**

Charcoal flecks, ca 80cm, below surface, Area B (Level I). Because of small size and possible contamination, date must be rejected. It is also inconsistent with typologic date of cultural assemblage and its stratigraphic position.

**QU-634. 760 ± 100**

Whole rib of *Manatee trichechus nanatus* assoc with thick, mostly *Strombus gigas* in shell midden. Dates early Suazoid cultural component with finger-indented rims and Caliviny type painting (Area F at Macabou and possibly Level III in Area B). Samples QU-632 and QU-634 are well within range of other determinations for Suazoid in Lesser Antilles (Rouse and Allaire, 1978), all from bone or shell samples. However, Macabou dated material is assoc with a good cultural assemblage in undisturbed stratigraphic context. Chronologic difference thus indicated between Area F, with finger-indented rims and linear painting, and Area B (Levels I and II), which lacks both diagnostic traits, is further documented stratigraphically (Allaire, ms).

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