DETAILED ROAD LOG AND FIELD TRIP NOTES

32nd Annual Reunion

EASTERN FRIENDS OF THE PLEISTOCENE

Sherbrooke, Quebec,

May 24-25, 1969

Leaders: *N.R. Gadd and B.C. McDonald*

Geological Survey of Canada

601 Booth Street, Ottawa

Saturday, May 24, 1969. 88 miles

Start: 8 a.m. sharp; main door of Maison des Etudiants.

The emphasis today will be on the Cherry River and Stoke Mountain Interlobate moraines and on glacial lakes that were formed during the northwestward recession of the ice-front. In addition, we will have an opportunity to discuss the directions of Pleistocene ice-movements and the succession of Pleistocene events in the region.

Mile	Route and Comments
0.6	From University Blvd., turn right on Galt Ouest.
0.8	Left on Laval
0.9	Right on Denault, then left over the bridge crossing the Magog River.
2.0	Right on Portland
2.8	Left on Queen Nord, then right onto Montreal.
3.15	Jog left on Dufferin, then right, and continue across Highways 5 and 22 on bridge over St. Francis River. Continue through lights and along Terrill.
3.8	Left on Parc
4.25	Right on DeSaulniers
4.35	Left on St-Michel

NOTE: The gravel pit on the left is in the Cherry River Moraine and exposes glacial-lake sand over ice-contact gravel.

Mile	Route and Comments
6.2	Right at T-intersection
7.0	At intersection with road left to Beauvoir continue straight ahead on gravel road.
7.5	Right at fork
8.6	Right at fork
9.6	Left at T-intersection
10.6	Crossroads at Mont-Dufresne. Turn right.

NOTE: From mile 11.2-14.0 the route is through a portion of the Cherry River Moraine. Numerous borrow pits display the ice-contact character of the gravel and sand; the topography is hummocky and has numerous closed depressions.

At mile 12.6 the bus will stop where we can see to the left a large ice-contact delta on the distal side of this morainic complex. The flat delta surface indicates the existence of a proglacial lake at an altitude here of ca. 815 feet. This was the Sherbrooke phase of Glacial Lake Memphremagog. Note the large-scale foreset strata exposed in pits, and the forested delta foreslope to the right.

Mile	Route and Comments
13.0	Left at T-intersection
NOTE:	The road climbs up over the side of the delta onto the flat but kettled delta top. An esker stream from the NW (left) fed this delta. Coarse gravel, reflecting inflow from this esker stream, is exposed to the left; sediments to the right are relatively well sorted sand.
14.0	Turn right. On the right can be seen the flat delta surface and the forested foreslope.
16.0	Railway Crossing. Abandoned clay pit in fine-grained glacial-lake sediments on far side of tracks to left of bus.
16.3	Right at T-intersection in Ascot Corner.
16.6	T-intersection with Hwy. 1. Turn left over bridge across St. Francis River, and continue on Hwy. 1 into East Angus.
22.4	Mileage at north end of bridge in East Angus.
22.45	Right on St. François
22.9	Left on Westgate
22.95	After railway crossing, turn right on St-Jean which becomes Bernier.
23.4	Right at road to East Angus Brick and Tile Co. pit.
NOTE:	We are driving along the top of a massive clay-till moraine which is thought to be a part of the Cherry River Moraine System. Note the very shallow closed depressions.
24.0	Stop in parking lot.

STOP ONE - East Angus Brick and Tile Co. pit.
The till exposed in this pit is composed almost entirely of glacial-lake silt and clay which has been reworked into a moraine by a forward movement of the ice-front. Boreholes indicate that the till is at least 90 feet thick locally. Except for patches of stony till as much as 4 feet thick, which locally cap the silt-clay till, stones are very rare in the till. Angular clasts, between $\frac{1}{4}$ and 2 in. in diameter, of unconsolidated glacial-lake silt and clay make up about 50 per cent of the till. These clasts are distinctly and evenly laminated (probably varved in places); lamination shows the clasts to be completely disoriented. Surfaces of the clasts are commonly parallel to internal stratification. The clasts are in a structureless silt-clay matrix, probably derived from comminution of the lake sediment during deposition. Workmen in the pit report the rare presence in the silt-clay till of well-defined, rounded "boulders" of well-sorted fine- to coarse-grained sand. At one time during the excavation, a broad sequence of gently concave-upward surfaces was exposed. These surfaces, interpreted as evidence of shear planes, rose toward the distal side of the moraine. Individual surfaces were represented by thin zones of fine sand with highly contorted laminae.

31.3	Retrace route to east end of bridge at Ascot Corner (former mileage 16.7). Turn left.

Mile	Route and Comments

NOTE: The gravel pits ahead mark the north end of the Stoke Mountain Interlobate Moraine which we will be following for the next 9 miles.

31.9 Turn left. Stoke Mountain visible to left (alt. of crest 2,150 ft.; alt. at bus 675 ft.)

NOTE: At mileage 33.5 route crosses onto the Stoke Mountain Interlobate Moraine. The moraine is characterized by hummocky terrain with closed depressions and rare large erratics; the material is mostly ice-contact gravel; till is present but not abundant.

At mileage 35.3: the morainic ridge ahead is 200 feet high and is composed entirely of ice-contact gravel and sand. It is oriented transverse to the trend of the interlobate moraine, but it is an extension of an end moraine position which has been traced several miles eastward.

37.2 Turn right onto Hwy. 28 at Sand Hill.

37.5 Turn left into gravel pit.

STOP TWO - Pit in Stoke Mountain Interlobate Moraine.

The sediments here are characteristic of those throughout the moraine. The following points should be noted:

(1) The transition upward from a basal proximal facies of very coarse-grained chaotic gravel to an overlying finer-grained and better sorted more distal facies.

(2) Current transport direction has been southward along and parallel to the crest of the moraine.

(3) The large boulders of grey, coarse-grained Devonian granite that have been derived from stocks more than 20 miles to the northeast.

37.7 Return to crossroads in Sand Hill and turn right. Continue straight on main gravel road.

NOTE: At mileage 40.1 a 200-foot-high portion of the moraine is visible on the left. Here, and for the next 5 miles, an esker occupies the crest of the interlobate moraine. Stream flow in it was southward.

40.7 Right at T-intersection.

42.5 Left at T-intersection.

42.7 Main road curves right. Turn left on private gravel road into cul-de-sac.

43.0 Road turns right, becoming farm lane.

43.3 Stop in pasture above Ascot River sections.

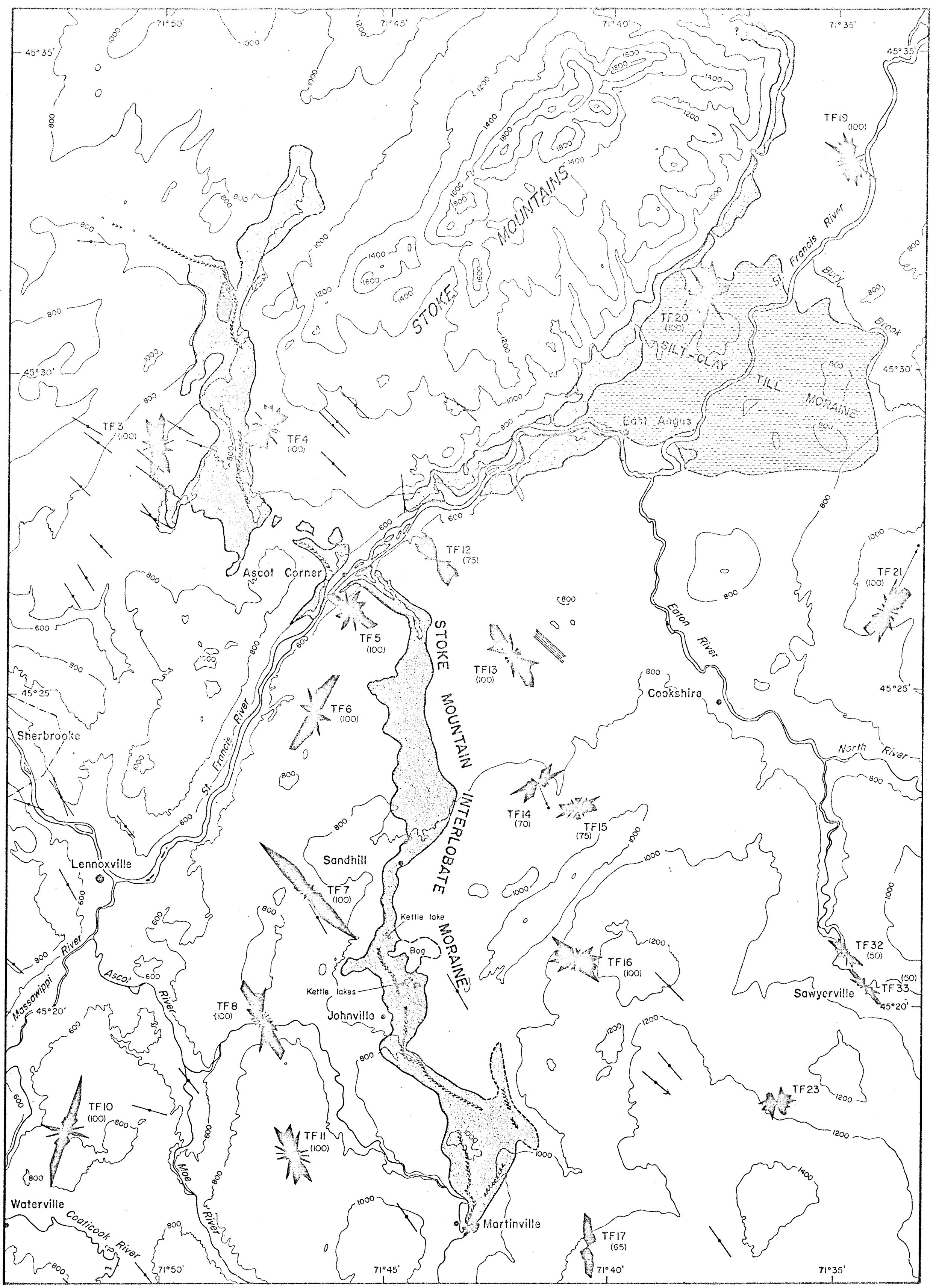


Figure 8. Stoke Mountain Interlobate Moraine with directions of ice movement.

Ice-contact stratified drift

Silt-clay till moraine

Glacial striation

Fluting

Fabric; number of pebbles in parentheses

Esker; arrowheads point downcurrent

0 1 2 3 4 miles

Contour Interval - 200'

Mile   Route and Comments

STOP THREE (see figure)

At this locality, two sections together display the complete glacial sequence proposed for this region. (All of this stratigraphy, usually in portions, is exposed in many other good river sections within a 15-mile radius of this locality.) All but the two lowermost units are exposed in the main section. The lower two units will be shown to those of you who would like to wade across the river to see them in the second section.

A C^{14}-date on the plant-bearing lake sediments at the base of the main section is >54,000 (Y-1683). A date from similar sediments on the Magog River (9 miles to west) is>41,500 (GSC-507).

The regional stratigraphy is summarized below:

Sediment	Environmental Phase	Direction from which ice flowed	C^{14}-Age (B.P.)
lake, marine, fluvial, etc.	postglacial		< 12,600
Lennoxville Till	glacial III	NW	
lake silt, sand	nonglacial III		
Till II	glacial II	NE, then NW	
plant-bearing lake seds.	nonglacial II		>54,000, >41,500
Till I	glacial I	NW?	
oxidized gravel	nonglacial I		

LUNCH BREAK   back at bus AFTER examining sections.

43.9   Retrace route to public road and turn left (former mileage 42.7).

46.7   T-intersection. Turn left over bridge, and left again onto Hwy. 28.

47.5   Right into gravel pit.

STOP FOUR - This pit is on the foreslope of a delta built northward into a proglacial lake when the retreating ice-front was at least 25 miles to the northwest. The sediments were contributed by the ancestral Moe River. The extensive, flat delta surface is at ca. 650 feet altitude.

47.5   Exit gravel pit and turn left on Hwy. 28.

49.3   Left on Hwy. 5.

51.3   Right toward Capelton and cross the Massawippi River.

Mile	Route and Comments
56.8	Right at T-intersection in North Hatley. Continue along lakeside road (fork left at Hatley Inn, and continue straight at Magog road marked by amber light). At mile 60.5, Mt. Orford (alt. 2,875 ft.) visible on skyline.
61.0	Stop street in Katevale. Continue straight.
61.2	Take left fork where main road curves right. At mile 61.3, ice-contact delta of Cherry River Moraine visible on right.
62.8	Right into gravel pit.

STOP FIVE - gravel pit in ice-contact delta. During excavation of this pit, it has been possible to trace the transition from a chaotic bouldery ice-contact proximal facies southward through large-scale foreset strata and into the relatively fine-grained and well sorted bottomset strata that underlie the low flat plain to the south. The top of this delta, which was built into the Sherbrooke phase of Glacial Lake Memphremagog, is at an altitude of ca. 760 feet.

62.8	Leave the pit and go left.
63.0	Turn left.

NOTE: Pit on left exposes ice-contact and lake sand and gravel. Crag-and-tail striations on bedrock in the pit floor indicate southward ice-flow.

64.1	Left on paved road at T-intersection.
65.1	Right on 4-lane Hwy. 10.
69.0	Merge with autoroute traffic.
70.3	Exit right off autoroute and turn right at T-intersection.
71.7	Right into gravel pit in village of Cherry River.

STOP SIX - This is the esker-fed ice-contact deltaic facies that was used in naming the Cherry River Moraine. The ice-front deltas indicate deposition into a proglacial lake at an altitude here of ca. 815 feet. We are on an isobase that includes the outlet of the lake and the delta we saw at mile 13.0. Isobases drawn on 15 control points indicate a postglacial tilt of 3.8 feet per mile up to the NW.

The low dip and fine-grained nature of the foreset strata suggest that much of the sediment entered the lake here as a suspended load in the contributing esker stream.

Mile	Route and Comments
71.7	Turn right out of pit, then immediately turn right again at crossroads onto gravel road.

NOTE: Ice-contact gravel can be seen in pits on the right, and at mile 72.5 the esker leading south into the deltaic complex is visible.

76.0	Right at T-intersection and follow the paved road into Sherbrooke.
84.7	Left on Hwy. 1 (rue King Ouest).
86.6	Right on Jacques Cartier Sud and cross Magog River.
87.3	Right on Denault then left on Laval.
87.4	Right on Galt Ouest.
87.6	Left on University.
88.0	Left into Sherbrooke University.
88.1	Stop in front of Maison des Etudiants.

END OF SATURDAY TRIP

Sunday, May 25, 1969. 89 miles

Start: 8 a.m. sharp; main door of Maison des Etudiants.

Today we will go northwest to the southern edge of the St. Lawrence Lowland where we have an opportunity to examine the Highland Front Moraine and discuss its significance. We will also visit a site from which Champlain Sea pelecypods were collected that dated at 12,000 ± 230 C^{14}-years B.P. (GSC-936).

Mile	Route and Comments
0.6	From University Blvd., turn right on Galt Ouest.
0.8	Left on Laval.
0.9	Right on Denault, then left over the bridge crossing the Magog River.
2.9	Right on Beckett.
3.3	Left on Ontario.

NOTE: The gravel pit visible across the St. Francis River to the right is in the Cherry River Moraine. The working face in this pit is 170 feet high.

3.5	Right on Des Sables.
3.7	Left on Hwys. 5 and 22. Follow Hwy. 22 north for 28.1 miles to stop #1. Several items of geological interest will be pointed out during the trip north.

NOTE: At mile 31.0, the first ridge of the Highland Front Moraine is visible ahead; the St. Francis River has been diverted eastward where it now flows through a bedrock gorge.

31.8	Left into gravel pit.

STOP ONE - Gravel pit in Highland Front Moraine.
This is an exposure of ice-contact gravel and sand that is characteristic of sediments throughout the moraine. The stop here affords an opportunity for an orientation discussion regarding the extent, characteristics, and age of this moraine.

31.8	Exit gravel pit, turn left on Hwy. 22, and drive through the moraine.
33.3	Right on gravel side-road.
33.7	Stop on top of hill.

STOP TWO - This is a vantage point from which we can see:
(a) A typical view of the Highland Front Moraine; and
(b) the St. Francis River issuing from the bedrock gorge, a course along which it has been diverted by the moraine.

Mile	Route and Comments
33.7	Continue on gravel road.
34.7	Left on main road, at fork.
35.9	Right.
36.6	Buses stop at vantage point. Do not leave bus.
37.7	Right at T-intersection.
38.4	Right at entrance to gravel pit.
38.9	Stop in pit.

STOP THREE - L'Avenir gravel pit; alt. ca. 400 feet.
Shells of *Hiatella* and *Macoma* (several specimens articulated) have been collected from a zone 10-12 feet below the surface of this pebble gravel and sand deposit. The pit underlies a terrace of the St. Francis River; abundant cross-stratification indicates current flow to northwest (parallel to present river). It is inferred that this gravel was deposited where the river entered the sea, and that the sediment represents an offlap facies of the regressing sea. The shell material, after the outermost 50% had been removed by acid leach, dated at 12,000 ± 230 C^{14}-years B.P. (GSC-936).

38.9	Exit gravel pit by same road as we entered.
39.4	Left toward L'Avenir.
40.7	Left at fork.
41.1	Left on Hwy. 22.
41.5	Right on paved country road.
45.1	Buses stop at vantage point. Do not leave bus.
47.5	Left. Highland Front Moraine visible on skyline ahead.
50.0	Left along side of cemetery; circle through pit in moraine to view isolated exposures of ice-contact gravel passing upward into finer-grained lake sand, and return to main road at mile 50.5. Continue into village of South Durham.
50.9	Left on Hwy. 32.
52.4	Left over railway overpass on country road.
53.1	Left into gravel pit.
53.2	Stop.

STOP FOUR - Gravel pit in Highland Front Moraine.
This pit illustrates both the ice-contact and lake facies that are characteristic of the moraine. The proximal coarse-grained facies passes upward into a finer-grained more distal facies. The proximal facies was fed by an esker just behind this pit, and the finer-grained upper facies was deposited when the ice-front had retreated to the vicinity of the large abandoned pit through which we drove at mile 50.5.

Mile	Route and Comments

This is the last stop. We can have lunch here, weather permitting. Afterwards, we return to the University of Sherbrooke and disperse.

53.3	After leaving pit, turn right.
54.0	Left on Hwy. 32.
61.4	Right on Hwy. 22, and retrace this morning's route back to the University.
89.0	Maison des Etudiants, Sherbrooke University.

END OF SUNDAY TRIP

Some Radiocarbon Dates Pertinent to Southeastern Quebec*

Locality	*Date*	*Lab No.*	*Altitude (feet a.s.l.)*
Dates on lake- or bog-bottom plant material			
St. Nazaire	12,640 ± 190	GSC-312	1,325
St. Hilaire	12,570 ± 220	GSC-419	892
Barnston	11,020 ± 330	GSC-420	1,360
Valcourt	9,130 ± 150	GSC-467	650
Champlain Sea shell dates			
L'Avenir	11,880 ± 180	GSC-505	ca. 390
L'Avenir	12,000 ± 230	GSC-936	ca. 390
Ste-Christine	11,530 ± 160	GSC-475	475
Ste-Christine	11,500 ± 160	GSC-475-2	475
Kingsey Falls	11,410 ± 150	GSC-187	ca. 400
Mount Royal	11,490 ± 110	GrN-1697	565
Meach Lake, Gatineau	11,600 ± 150	GSC-842	557
Maitland, Ontario	11,800 ± 210	GSC-1013	340
Sub-till plant-bearing beds			
Ascot River	> 54,000	Y-1683	650
Magog River	> 41,500	GSC-507	600
St. Pierre beds	67,000 ± 1,000	Gro-1711	ca. 50
	65,300 ± 1,400	GRN-1799	
	64,000 ± 2,000	Gro-1766	

*from various published sources.

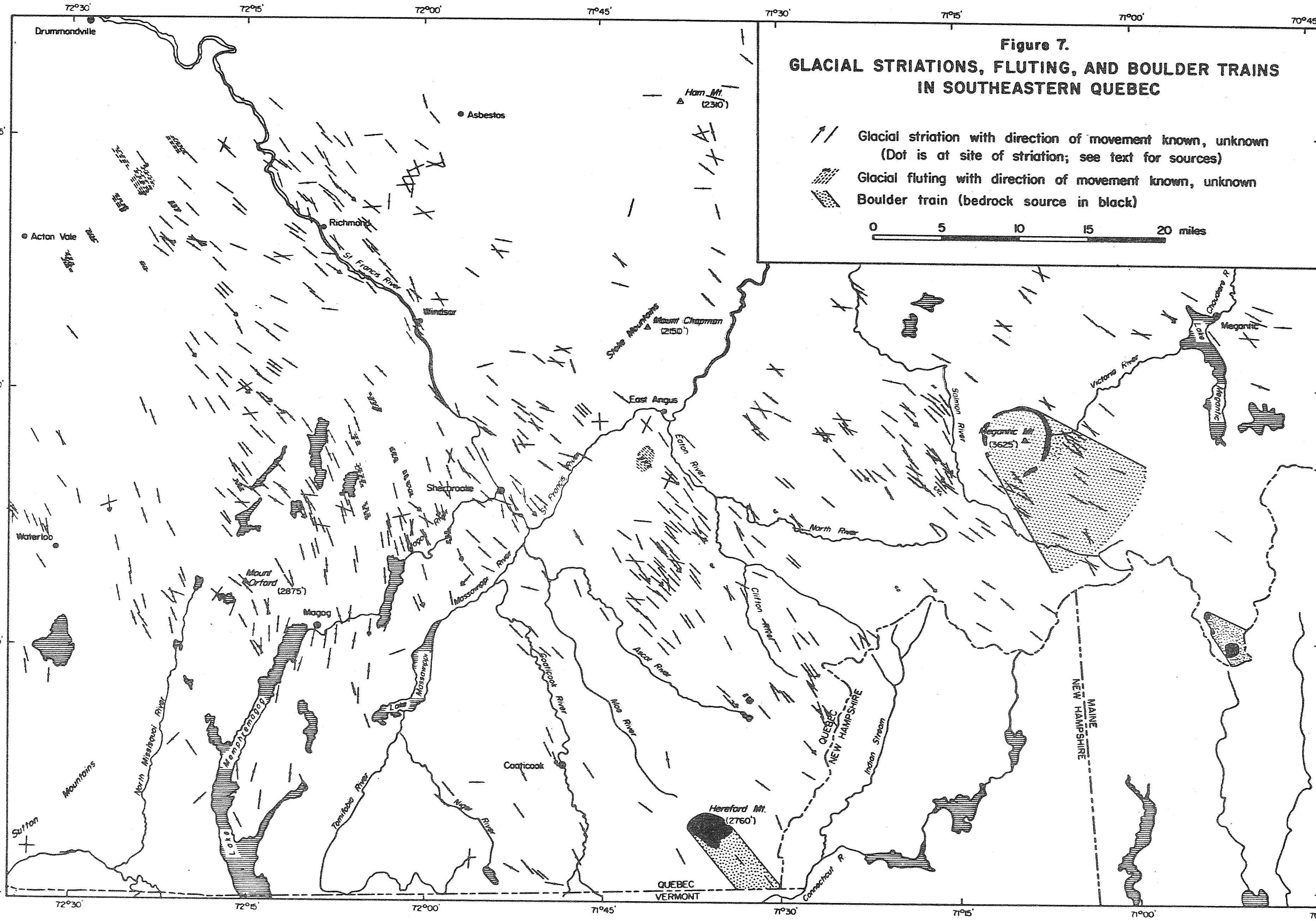
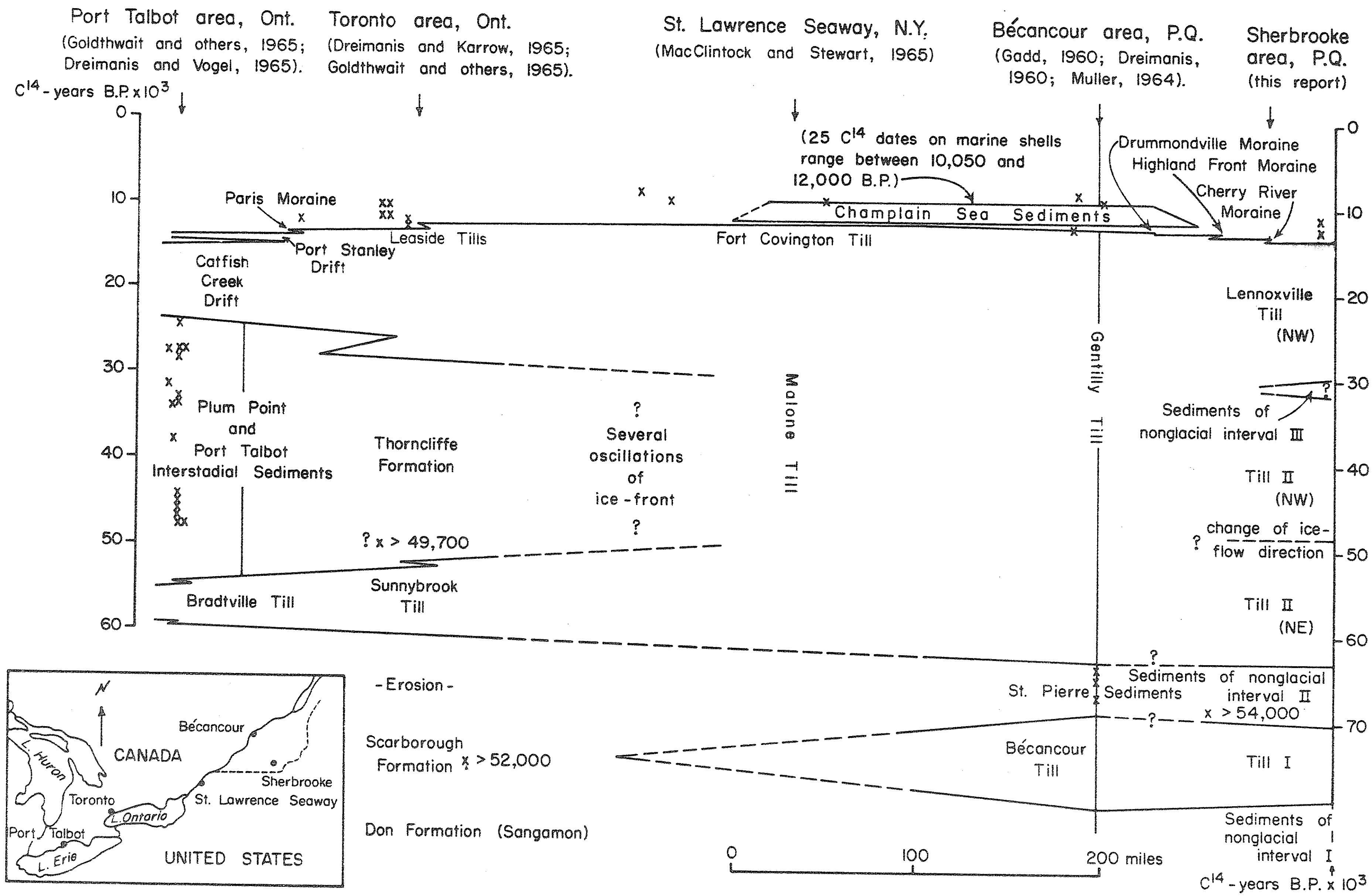
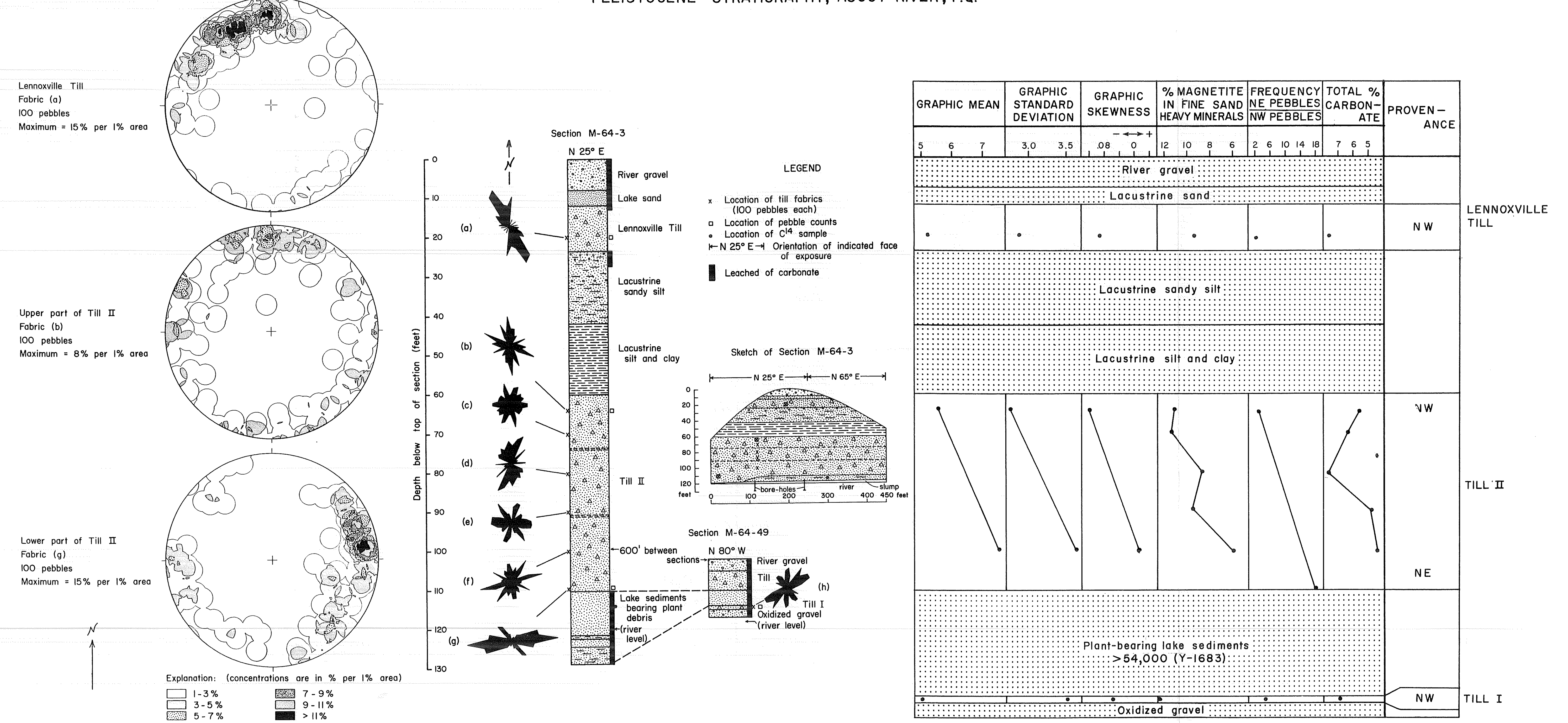


Figure 7.
GLACIAL STRIATIONS, FLUTING, AND BOULDER TRAINS IN SOUTHEASTERN QUEBEC
Glacial striation with direction of movement known, unknown (Dot is at site of striation; see text for sources)
Glacial fluting with direction of movement known, unknown
Boulder train (bedrock source in black)
0 5 10 15 20 miles
72°30'
72°15'
72°00'
71°45'
71°30'
71°15'
71°00'
70°45'
45°45'
45°30'
45°15'
45°00'
Drummondville
Acton Vale
Asbestos
Richmond
St. Francis River
Windsor
Ham Mt. (2310')
Stoke Mountains
Mount Chapman (2150')
East Angus
Sherbrooke
Waterloo
Mount Orford (2875')
Magog
Massawippi River
Lake Massawippi
Lake Memphremagog
North Missisquoi River
Sutton Mountains
Tomifobia River
Niger River
Coaticook
Coaticook River
Moe River
Ascot River
Eaton River
Clifton River
North River
Salmon River
Megantic Mt. (3625')
Victoria River
Lake Megantic
Megantic
Chaudiere R.
Hereford Mt. (2760')
Indian Stream
Connecticut R.
QUEBEC
NEW HAMPSHIRE
MAINE
NEW HAMPSHIRE
QUEBEC
VERMONT



Possible correlation of Pleistocene sediments from southeastern Quebec northwest to St. Lawrence Lowland, then southwest to Lakes Ontario and Erie. (x = finite C^{14} date on plant material; x > = infinite C^{14} date; "NE" or "NW" after some tills indicates direction from which associated ice advanced.)

PLEISTOCENE STRATIGRAPHY, ASCOT RIVER, P.Q.



LIST OF PARTICIPANTS

32nd Annual Reunion Friends of the Pleistocene

Sherbrooke, Quebec, May 23-25, 1969

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