BORNS

LATE PLEISTOCENE STRATIGRAPHY AND HISTORY OF SOUTHWESTERN MAINE

Guidebook for the

FRIENDS OF THE PLEISTOCENE

24th Annual Reunion

May 20 and 21, 1961

Portland, Maine

by

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SCHEDULE OF THE REUNION

Friday evening, May 19, 1961.

Informal gathering of Friends, Lafayette Hotel, Portland.

Saturday, May 20.

8:00 A.M. - Buses leave the hotel for the Saturday field trip.

12:30 P.M. - Lunch stop at Cole Farms Restaurant, Gray.

5:00 P.M. - Return to Lafayette Hotel. Informal hour before dinner.

7:00 P.M. - Annual banquet, Colonial Room of the Lafayette Hotel. A brief business meeting will follow the dinner.

Sunday, May 21.

8:30 A.M. - Caravan of private cars leaves the hotel for the Sunday field trip.

12:30 P.M. - Group disbands at Merriland Ridge, Wells.

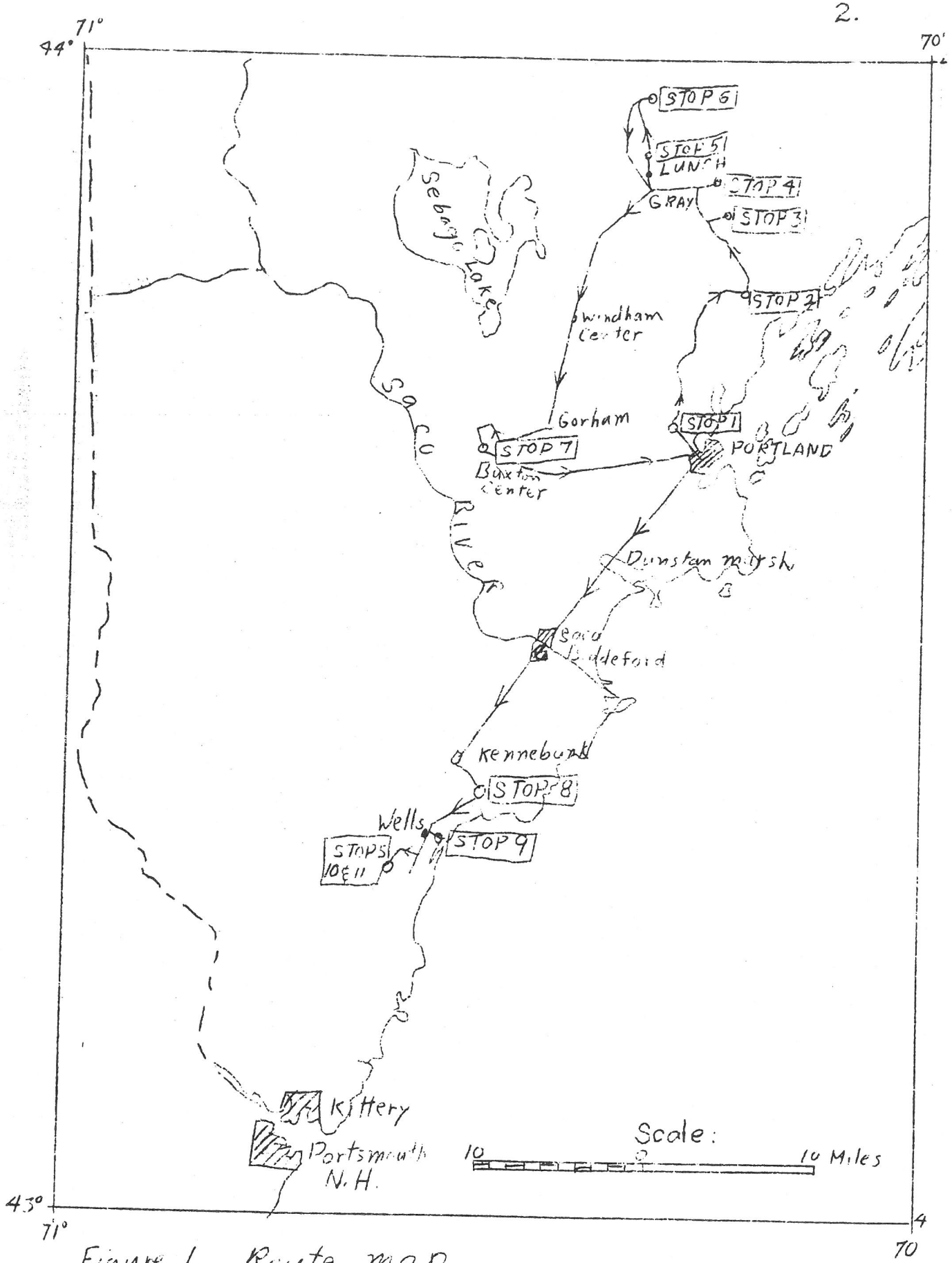


Figure 1. Route map.

ROAD LOG

Saturday, May 20

Mileage

0.0 Lafayette Hotel (Portland West 7½' quad or Portland 15' quad). Buses will be ready to load at 7:45 A.M. Departure time 8:00 A.M. Park St (one way) one block to Spring St, turn right on Spring St to State St, turn right on State St, continue through Congress Sq. and Deering Oaks Park to Forest Ave (Rt. 100).

0.9 Turn left on Forest Ave (Rt. 100). At Woodfords, Rt. 302 enters from the left. Continue north on Forest Ave to Deering.

3.3 Turn left on Rt. 302 at Deering road fork. Rt. 100 to the right.

4.7 Underpass beneath the Maine Turnpike.

5.0 Turn right on Riverside St at blinker light.

5.4 STOP ONE. 40 minutes.

P. E. Hamlin Co. gravel pit, left side of Riverside St. General surficial stratigraphy of the Portland area. Stratified drift and till are overlain with sharp unconformity by marine gray silty clay. The marine sediment has been named the Presumpscot Formation (Bloom, 1960, p.55) and the exposure in this pit is representative of the unit in the type area.

For the following reasons, I believe the Presumpscot Formation was deposited in this area during marine transgression over a deglaciated landscape:

1. Underlying sand and gravel have abundant characteristics of fluvially deposited glacial drift. Meltwater stream gradients must have been sufficient to transport silt and clay-size material from the site of deposition of stratified drift, implying drainage to a lowered base level-the sea.

2. The basal contact of the Presumpscot Formation is sharp. Underlying topography appears to have been formed prior to submergence. One would expect considerable contortion and slumping of ice-contact deposits if supporting ice walls had been removed by flotation during marine submergence.

3. The basal contact of the Presumpscot Formation dips radially away from the former crest of buried hills at an angle that never exceeds the angle of repose of unconsolidated sand and gravel. This further suggests that stable subaerial slopes had been attained, free of confining ice walls, prior to submergence.

4. Deposition of the Presumpscot Formation began in now-

buried valleys nearby when rising sealevel was at least 60 ft below its present position relative to the land (Bloom, 1960, p.58). If valley floors were open to marine deposition during progressive submergence, the higher parts of the premarine landscape that are now above sealevel would also have been ice-free at the time they were submerged.

Questions:

1. How much reworking of previously deposited glacial drift was accomplished during submergence? Is the lack of a weathered zone beneath the Presumpscot Formation a valid criterion of a short postglacial, premarine interval?

2. Is the brownish-gray color of the upper part of the Presumpscot Formation a weathering phenomenon, or does it represent a compositional or grain-size change from the lower blue-gray clay?

CAUTION: The vertical columnar structure formed in the Presumpscot Formation on drying produces unstable, steep pit faces. Keep a sharp eye above you if you dig at the foot of a clay wall.

Return to buses, continue northeast on Riverside St.

6.6 Turn left on Washington Ave.

7.3 Cross Presumpscot River. The valley in this vicinity is the type area of the Presumpscot Formation. Fossils from exposures in landslide scars on the valley sides were described as early as 1842 (Mighels and Adams).

7.8 Turn right on Brook Rd. At 8.0 keep left at road fork.

9.0 Turn right on Mountain Rd. Overpass over Maine Turnpike.

Cross Rt. 100-26.

9.5 Turn left on Winn Road at Huston School road fork. (Shift to Cumberland Center 7½' quad or Gray 15' quad). Road crosses clay-covered lowland with a few protruding knolls of rock or stratified drift.

12.6 Turn left on Rt. 9 toward Cumberland Center. Note the fine-textured dissection of the clay plain, and the flat-floored gullies. Are these gullies relict forms from the emergence of the coastal plain, or are they forming by present-day processes?

13.6 Continue on Rt. 9 through Cumberland Center. (Shift to Yarmouth 7½' quad or Freeport 15' quad.)

14.6 Turn right on Greely Rd., continue 0.6 mi across a small valley.

15.2 Turn left 110° on unpaved road, continue 0.2 mi to large pit on the left.

15.4 STOP TWO. 40 minutes.

Dowdy gravel pit, Walnut Hill. Several large pits in this area are opened in stratified drift that forms a collar around a rock ridge. The Presumpscot Formation pinches out at an altitude of about 200 ft. The land surface around the pit is a plain of marine erosion and deposition.

Highly fossiliferous beds dip steeply west on the western side of this pit. See Bloom (1960, Fig. 3, Loc. 13-57) for a list of the fauna. All species collected here now live at least as far south as the Gulf of Maine, although most are described as Arctic forms. Nucula expansa and Yoldia arctica, two species not now found south of Cape Breton Island but common as fossils in the Presumpscot Formation, are absent from this locality.

Questions:

1. Do the fossiliferous beds represent the transgressive or regressive marine phase? Can we distinguish transgressive and regressive phases of the Presumpscot Formation?

2. Do the arguments for pre-submergent deglaciation presented at the first stop apply here?

Return to buses, continue north on unpaved road 0.6 mi to Rt. 115.

16.0 Turn left on Rt. 115. Route 9 joins from the left. Keep left on Rt. 115 at fork in village of Walnut Hill. (Shift to Cumberland Center 7½' quad or Gray 15' quad).

17.4 Turn left at North Yarmouth Congregational Church, following Rt. 115. Look left (south) from bus windows at the abrupt steepening of slope on the east side of Walnut Hill at about 280 ft (road level). A sandy plain slopes east from the foot of a narrow bench, although no clay was found above 200 ft. The sandy plain may be a beach and the scarp a wave-cut cliff.

19.5 After crossing Walnut Hill and a shallow valley on the west, Rt. 115 follows the contact between rock hills and clay-covered lowland. Note the contrast in drainage texture on the Presumpscot Formation in the Royal River valley and on the adjacent highlands.

20.3 Turn right on Mill Rd, go 0.8 mi down hill to Blais Bros. Brickyard.

21.1 STOP THREE. 30 minutes.

Blais Bros. Brickyard, North Yarmouth. Water-struck bricks, fired by pine slabs, are still being manufactured at a number of small brickyards around Portland. The clay

of the Presumpscot Formation was an important resource a century ago, worked at many large brickyards.

Clay is loosened from the supply area with a disk harrow. Abundant fossils are strewn over unworked, rainwashed parts of the clay field. This locality (Bloom, 1960, Fig. 3, Loc. 11-57) has a more typical Presumpscot Formation fauna than STOP TWO. The marine embayment must have been at least 150 ft deep over the axis of the Royal River valley.

Return to buses and return 0.8 mi on Mill Rd to Rt. 115.

21.9 Turn right on Rt. 115.

22.0 Rt. 115 climbs onto a large kame terrace that extends about 3 mi north through East Gray. Note the boulder erratics and the level, sand and gravel terrace surface.

23.4 Continue straight ahead as Rt. 115 turns left.

24.0 Turn right at East Gray (a populated road intersection), go downhill off of the kame terrace. Thin clay beds in sand in road cut on left at 24.4. Lawrence Goldthwait (1951, p.28) traced marine clay up this valley side to an altitude of 266 ft. Note change in drainage texture below the limit of marine deposition.

24.5 Stop at sharp right turn. Water Co. access road on left.

STOP FOUR. 50 minutes. Pownal Water Station on Collyer Brook, Gray. Stratigraphy near the inland edge of marine submergence. NOTE: Please move as quickly as possible on the 0.3 mi walk to the exposure. Cross the water co. bridge, turn right (downstream) along the north bank of the stream to the first high bank. The following section is exposed:

	Feet
Sand, buff, fine to coarse	3
Clay, gray, silty, in 1-in. beds alternating with 1-in. beds of fine sand; becoming sandier downward	1
Clay-sand alternation as in next unit above	1
Clay-sand alternation as in next unit above	1
Sand, buff, medium to coarse, with a few thin clay beds	5
Clay, gray, silty, ½-in. beds with micaceous-sand partings	2
Sand, buff, medium to coarse, with thin clay beds (seepage zone; lower part of the section relatively impermeable)	1

Section at Collyer Brook (cont.)

	FEET
Silt, gray, clayey, with micaceous-sand partings; one natural mold of a small clam.....	4
Clay, gray, silty, rhythmically thin bedded with thin sand partings; transitional to unit below.....	15
Clay, blue-gray, plastic when wet, homgeneous; contains marine fossils and calcareous concretions.....	20
Stream bed; base of section (Alt. 100 ft.)	
Total measured section	53

The upward transition from clay to sand represents the southward advance of bottomset beds from a delta 3 mi northwest (to be examined in subsequent stops). Superimposed on the gross change from clay to sand is a finer rhythmic alternation that could represent seasonal variations in meltwater discharge.

Question: Are these rhythmites marine varves?

Return by bus to East Gray

25.0 Continue straight ahead through East Gray. Road climbs onto kame terrace again. A very large kettle indents the surface just north of the road. Rejoin Rt. 115 at 25.7 mi. Between 26.3 and 27.0 the road crosses the south nose of a rock ridge that is fringed by the kame terrace; the village of Gray is built on the westward continuation of the same terrace. Lack of marine deposits in the large kettle at East Gray and on the kame terrace surface, and the fresh ice-contact topography of the terrace surface suggest that the terrace was above the limit of maximum submergence.

27.4 Turn right in Gray onto Rt. 100-202. Continue north through the village center

28.3 LUNCH STOP. One hour. Cole Farms Restaurant, Gray. A block of booths and tables has been reserved in the dining room on the south end of the restaurant. Rest rooms are at the north end, through the lunch counter section. Individual orders and checks.

At the restaurant the kame terrace pinches out against the rock core of the hill. Across the valley to the west, a matching kame terrace fringes Libby Hill. The valley between has a fill of Presumpscot Formation.

29.3 Turn left on Mayall Rd (unpaved).

29.9 Road climbs the foreslope of a large delta. Topography is hummocky due to repeated earthflows along a line of springs on the delta face. Note the striking change in topography as the bus rises onto the delta surface.

30.0 Turn left on farm access road. 0.2 mi to sand pit at delta edge.

30.2 STOP FIVE. 30 minutes.

Hansen's truck farm. Stratigraphy at the inland edge of marine submergence (cont.). Pit was dug to store seepage water for irrigation of carrots on the delta surface; the dam failed and the project was abandoned. Clay exposed near the floor of the pit, overlain by sand foreset beds. The line of springs along the delta front implies that a clay tongue extends at least a short distance under the sand of the delta. A boring for the Maine Turnpike in the delta surface one mile to the north penetrated 77 ft of fine sand and silty sand.

This exposure can be taken as an upward continuation of the river-bank exposure at the previous stop. Together, they record the building of a delta into a long deep marine embayment not unlike those along the present Casco Bay coastline.

Return to Mayall Rd.

30.4 Turn left on Mayall Rd for a 2.5 mi traverse across the delta. Note the absence of gravel on the southern part of the surface.

31.2 Cross Maine Turnpike overpass. Excellent view of the delta surface. The heavy scrub woods on the left grows in a shallow abandoned channel on the delta. Pebbles and cobbles appear at the surface north of the overpass.

32.8 Turn right on Rt. 26, prepare to turn right again at first road.

33.0 Turn right on Snow Hill Rd (unpaved).

33.2 Turn right on unnamed gravel road; road to left is Sunset Shores Private Rd #1. Continue east for 0.5 mi, keep right at road fork. Stop at edge of gravel pit.

33.8 STOP SIX. 30 minutes.

Transitional zone from ice-contact stratified drift to deltaic outwash. Mean grain size has increased in the delta from fine sand at the previous exposure to cobble gravel here. Gravel is evenly bedded, but the coarseness suggests a nearby source. Sabbathday Lake, ½ mi west, is a kettle lake. I mapped a transitional contact between ice-contact stratified drift and outwash just west of this pit. An esker can be traced intermittently about 13 mi from the north end of Sabbathday Lake through the town of Poland.

Summary of Stops Four, Five and Six:

1. Marine submergence to an altitude of more than 260 ft, and probably to 280-300 ft, occurred after the deposition of kames and kame terraces at Gray, but preceded the melting of ice less than three miles north of Gray in the Sabbathday Lake basin.

2. A proglacial delta, fed by meltwater streams emerging from ice-filled valleys north and west of Sabbathday Lake, was built into an estuary formed by the submergence of the newly deglaciated valley.

3. The transition from ice-contact stratified drift through outwash and deltaic sediment to the Presumpscot Formation proves that deglaciation of this area was contemporary with marine submergence.

Return via unpaved roads to Rt. 26.

34.6 Turn left on Rt. 26.

36.6 Crystal Lake on the right is a kettle lake nestled against the west valley wall, similar in many respects to Sabbathday Lake. Many of the largest kettles and kettle lakes are close to the west side of the valleys in this area. What can this tell us about the melting of the last ice in the valleys?

37.6 At the village of Crystal Lake (formerly Dry Mills) Rt. 26 climbs from the delta surface to a kame terrace. For the next two miles, the matching kame terrace on the east side of the valley, the setting of our lunch stop, will be visible to the left, through the trees.

39.2 Cross Maine Turnpike on overpass from the western to the eastern kame terrace. Presumpscot Formation at least 25 ft thick underlies the lowland along the turnpike right-of-way.

40.1 Turn right in Gray, at 40.2 turn right again on Rt. 202.

Continue south on Rt. 202 for 16 mi to Gorham.
(Shift to North Windham 7½' quad or continue on Gray 15' quad.)

48.4 Village of Windham Center; continue south on Rt. 202.

48.6 Buses slow for view to left of three till ridges in end view. Ridges are about 500 ft long and 15 ft high, and are evenly spacedabout 200 ft apart. More of these ridges at the next stop. (Shift to Gorham 7½' quad or Portland 15' quad.)

56.2 Gorham. Turn right, continue on Rt. 202, 0.4 mi to center of town.

56.6 Straight ahead through Gorham traffic light for 0.2 mi.

56.8 Keep right at blinker, follow Rt 25 for 0.1 mi.

56.9 Turn left 30° from Rt 25 on Flag Meadow Road. (Shift to Buxton 15' quad.)

60.7 Groveville. Road curves right along the base of low scarp. This may be an emerged wave-cut bench and cliff. An apron of sand slopes gently off to the left toward marshy ground underlain by clay. The low scarp forms the southern face of a flat topped, kettle-marked mound of ice-contact stratified drift. Altitude at Groveville Corner, at the foot of the scarp, 251 ft.

61.5 Buses slow to observe a group of closely spaced till ridges (washboard moraines) at 300° relative bearing. Aerial photos show about 17 ridges in this group, covering a belt about 4000 ft wide. Ridges range up to one-half mile in length. Note schist boulders in road cuts.

Buses continue north through this group of ridges in order to approach the final stop heading toward Portland.

63.4 Turn left on Rt 112 at Kimbles Corner.

64.6 Turn left on Rt 22.

66.6 Through a minor intersection and down a steep 20 ft scarp between the 260 and 280 ft contours. This also may be a wave-cut scarp. Presumpscot Formation covers the lowland at the foot of the scarp.

67.0 View toward the left of another group of till ridges approaching the road obliquely. Farm appropriately named "The Ridges".

67.5 STOP SEVEN. 40 minutes.

Washboard moraines, Buxton Center, (see Bloom, 1960, p 28-32). Aerial photos show 21 ridges in this group, spaced evenly through a zone 5500 ft wide. Presumpscot Formation apparently overlies till in the troughs, as exposed in a farm pond excavation several hundred feet north of the stop.

Questions:

1. Clusters of these ridges are associated (Bloom, 1960, Map 2) with directional indicators of southward-moving ice.

Do the ridges represent progressive, cyclic frontal retreat of glacier ice?

2. What temporal relationship of deglaciation and marine submergence is represented here? Did the ridges form in the sea? If not, why were they not destroyed during marine submergence?

Return to Portland via Rt 22. Note till ridges trending obliquely up the hillsides on the south edge of the village of Buxton Center.

71.1 Keep left on Rt 22 at South Buxton.

71.8 Note pit on right side of road. Presumpscot Formation draped over fluvially stratified drift.

82.7 Lafayette Hotel via Rt 22 and Congress Street, Portland.

Sunday, May 21

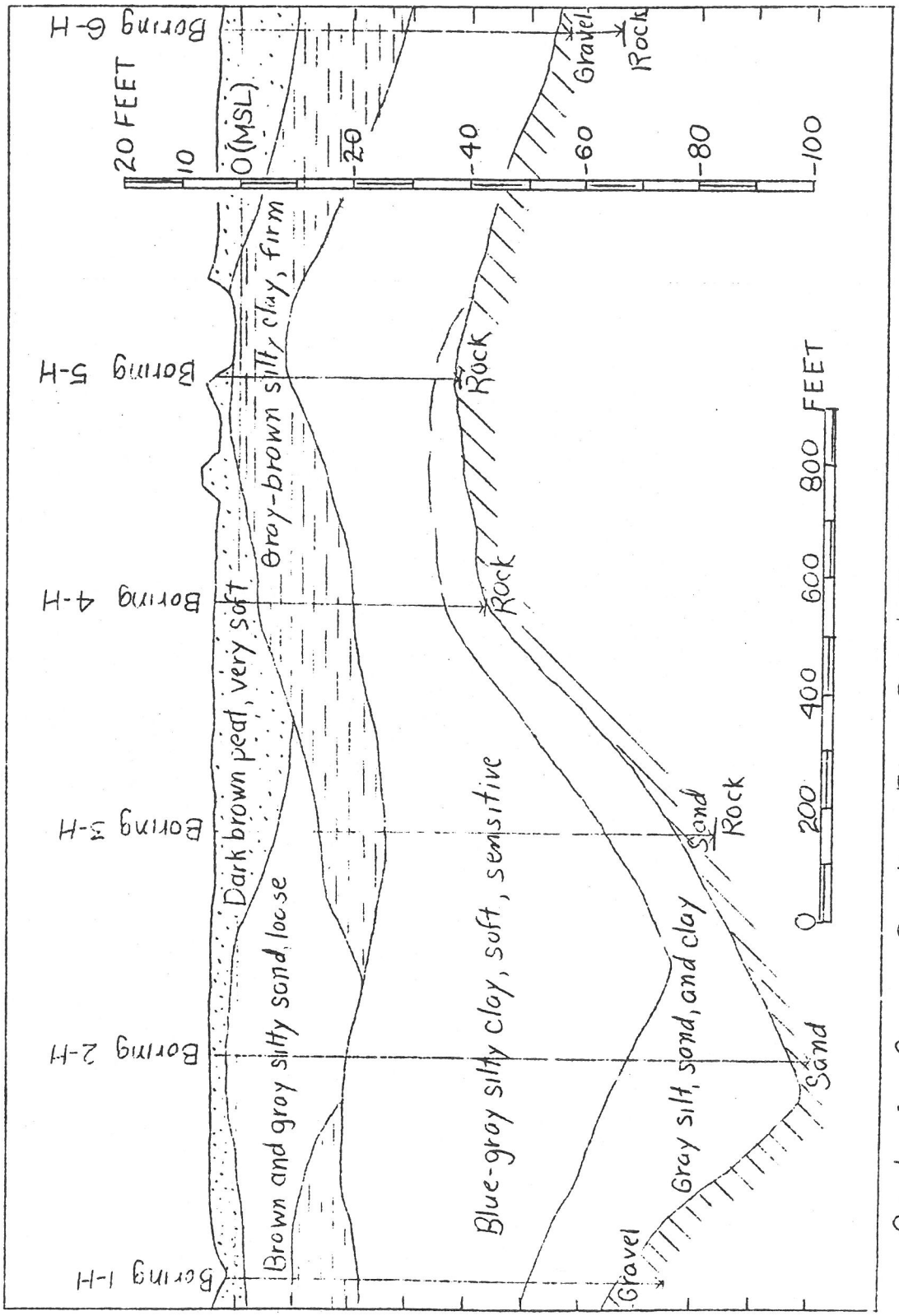
Caravan of private cars will depart from the parking area at 8:30 a.m. Caravan speed on the open road will not exceed 40 mph. If you are delayed in starting, proceed independently to the first stop of the day.

Mileage

0.0 Hotel parking area. Follow Park St. one-half block to Spring Street, turn right on Spring St to State St, turn right on State St, go one block to Congress Square. Turn left at Square on Congress St, go 0.7 mi to intersection with U.S. Highway 1 at Valley St. Follow U.S. 1 south out of Portland over the Veteran's Memorial Bridge toward Biddeford.

7.5 U.S. 1 crosses Dunstan River tidal marsh. Differential subsidence of the roadbed of up to 3 ft resulted in an engineering study here in 1954. The results showed (Gray, 1954, p 1) "that there exists over the greater part of the marsh a surficial layer of up to 20 ft in thickness which is composed essentially of organic material. This organic substratum does contain variable quantities of sand, but in spite of this it is very soft and unstable... Underlying the organic stratum in numerous localities is a layer of firm weathered silty clay. It is characterized by its consistency and frequently by a brownish color. At the southwest end of this section this clay appears at the ground surface. Elsewhere it is buried at depths varying from 10 to 20 or more feet. It appears to represent the weathered surface zone of a mush thicker stratum Presumpscot Formation which was formerly exposed to atmospheric conditions..."

Figure 2 is a section constructed from highway borings 2.5 mi southwest of U.S. Rt 1 on the Pine Point Road, across another branch of the Dunstan marsh. Note that tidal marsh peat has accumulated to a thickness of 15 ft. Moreover, note that gray-brown, firm silty clay, interpreted by highway engineers and myself as a weathered zone on the Presumpscot Formation, extends 35 ft below the high-tide marsh surface. Thus, some time subsequent to the deposition of the Presumpscot Formation, coastal Maine must have been emerged at least 35 ft more than present, for it seems doubtful that the Presumpscot Formation could be discolored and partly cemented with oxidized iron in the reducing environment of a tidal marsh. Comments on this issue will be heard at STOP NINE.



Geologic Cross Section, Pine Point Road, Scarboro, Maine

17.0 Biddeford. Continue south on U.S. Rt 1. (Shift to Kennebunk 15' quad.)

25.3 Kennebunk. Turn left on Rt 35 at first stop light, at the Unitarian Church (built 1750). Follow Rt. 35 for 0.6 mi, over the RR bridge to the first right turn beyond the bridge.

25.9 Turn right on Kennebunk Beach Road, go 0.6 mi. (Shift to Wells 7½' quad or remain on Kennebunk 15' quad.)

26.5 STOP EIGHT. 40 minutes.

Kennebunk town gravel pit. Park cars as far as possible off on the right shoulder.

This pit is the type locality for the Kennebunk glacial advance in southwestern Maine (Bloom, 1960, p. 68-71, 129-130). Although near Portland the Presumpscot Formation unconformably overlies previously deposited glacial drift at a depth of 60 ft or more below present sealevel, here at about 40 ft above present sealevel, marine and glacial sediments are intimately mixed. See Bloom (1960, Fig. 2) for a view of this pit as it appeared in 1958. Map 2 of the same reference shows the southeasterly trend of glacial lineations in the area of the Kennebunk advance, which is inferred to be late because marine submergence was well underway at this time. The Kennebunk advance entered the sea here when submergence progressed to 40 ft above present sealevel. Maximum submergence in this area was about 200 ft. At Waterville, Maine, where maximum submergence was at least 320 ft, a radiocarbon date of 11,800 + 240 years was determined on shells in a gravel pit about 186 ft above present sealevel (W-737, Rubin and Alexander, 1960, p.130). As maximum submergence must have been a single event in time, and the altitudes below maximum submergence of the radiocarbon-dated shells at Waterville (320-186=134 ft) and the Kennebunk town pit (200-40=160 ft) arecomparable, it can be inferred that the Kennebunk glacial advance reached the sea at Kennebunk about 11,800 years ago and deglaciation was still in progress at the somewhat later time of maximum submergence, as evidenced by delta building along the now emerged strandline.

Questions:

1.By what criteria other than the fossils could we identify the sediments in this pit as of marine origin?

2. Where was the ice cap that supplied the Kennebunk advance? Over the White Mountains?

Continue south on Kennebunk Beach Road for 1.8 miles.

28.3 Turn right at blinker light on Rt. 9.

31.2 Turn left on U.S. 1.

32.2 Turn left on Upper Landing Road at Wells village limit.

32.5 STOP NINE. 30 minutes. Wells tidal marsh.

Fifty feet south of the landing, numerous stumps are exposed beneath eroded peat banks and on low-tide flats, overlain by about 2 ft of salt-marsh peat. Wood from this exposure has been radiocarbon dated at 2980± 180 yrs B.P. (W-396, Rubin and Alexander, 1958, p.484). Related dates from stumps in similar positions, and the amount of submergence indicated at each site, are:

W-508	2810 ± 200	Wells Beach (6 ft)	USGS V
W-509	1280 ± 200	Kennebunk Beach West (10-13 ft)	USGS V
W-510	3250 ± 200	Kennebunk Beach East (7-13 ft)	USGS V
L-118	4150 ± 200	Sagadahoc Bay (9 ft)	Lamont II
Y-156	4190 ± 200	Odiorne Point, N.H. (7.6 ft)	Yale IV
Y-773	2970 ± 140	Blue Hill Bay (13.5 ft)	Yale VI (in press)

The dates show no consistent relationship of age and amount of submergence. Some of the stumps are rooted in peat that has been compacted by the landward retreat of a barrier beach over it; the amount of submergence indicated by such stumps is excessive.

Questions:

1. If pollen stratigraphy implies (Bloom, 1960, p.85) that coastal Maine emerged from the sea and deposition of the Presumpscot Formation ended about 7000-8000 years ago, and these radiocarbon-dated stumps suggest submergence for the last 4200 years, when was the time of maximum emergence as represented by oxidation of the Presumpscot Formation to a depth of 35 ft below present high tide?

2. What is the cause of coastal submergence in New England over the last 5000 to 6000 years?

Return to U.S. 1.

32.8 Turn left on U.S.1, move to the right lane.

33.6 Wells. Turn right on Rt. 9-109 at stoplight.

35.0 Underpass beneath Maine Turnpike. Recommended fastest route home, either north or south.

35.7 Turn left on Rt. 9. Route 109 continues straight ahead. (Shift to North Berwick 7½' quad or continue on Kennebunk 15' quad). Merriland Ridge on the right. Note the abrupt steepening of slope behind the houses at an altitude of between 200 and 220 ft.

36.3 Route 9 climbs to the foot of the scarp and crosses it in a shallow road cut at the crest of the hill.

36.6 Turn right into gravel pit.

STOP TEN. 10 minutes.

A brief stop to examine the interior of Merriland Ridge. Bloom (1960, p.26-27, 98-102) described the ridge in detail, and considered this segment to be an elongate crevasse filling. Coarse gravel beds dip off both flanks of the ridge, but in the core of the hill the beds dip southwest, parallel to the long axis of the ridge.

Continue 1.2 mi southwest along Merriland Ridge to the Boston and Maine Railroad overpass.

37.8 STOP ELEVEN. 45 minutes. Railroad cut through Merriland Ridge.

Believed to be the only sizeable wave-built feature on the strandline of maximum submergence in southwestern Maine. Although coarse ice-contact stratified drift is exposed less than 300 ft north of the RR cut and about 1000 ft south of it, within the cut almost the entire exposure is of well sorted, in part ripple-marked, sand. I interpret this segment of the ridge as a tombolo built between islands of ice-contact stratified drift. Katz and Keith (1917) interpreted Merriland Ridge as a moraine bank, an end moraine formed at an ice front standing in the sea.

Questions:

1. How accurately can we locate the former sea level at Merriland Ridge? Are the bench and scarp on the seaward (eastern) side of the ridge wave cut? The break in slope between bench and scarp at Merriland Ridge is at an altitude of 214 ft. Does that represent the high tide or the low tide level, assuming the present tidal range of about 10 ft?

2. What is the origin of the cap of poorly sorted, subrounded gravel on this sandy segment of the ridge? Is it a storm beach?

Note: The north end of the RR bridge is an excellent vantage point for a photograph of the south face of the cut.

Cars may continue southwest on Rt. 9 for 0.7 mi and turn around in a large gravel pit on the left. The pit reveals the ice-contact character of the next segment of Merriland Ridge south of the RR cut.

END OF THE 1961 FRIENDS' REUNION.

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