

A Guidebook to

THE GEOLOGY OF NORTHEASTERN MAINE AND NEIGHBORING NEW BRUNSWICK

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TRIP B-4

ITINERARY

THE CORE OF THE WEEKSBORO-LUNKSOOS LAKE ANTICLINE, AND THE ORDOVICIAN,
SILURIAN, AND DEVONIAN ROCKS ON ITS NORTHWEST FLANK

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Topographic quadrangle maps:

15-minute

Shin Pond

Traveler Mountain

2-degree

Presque Isle

Assemble at site of Shin Pond House, now burned, Shin Pond, Maine ready for departure at 8:30 A.M., Saturday, October 11. Road limitations dictate that heavy-duty vehicles be used. Please insure that (1) each vehicle carries at least 4 people, (2) at the start the fuel tank of each car is full, and (3) the spare tire is inflated and useable. Most stops will be off the road, examining sections in the woods along streams. It will be in the best interests of all participants to keep the group as compact as possible. When the leader decides adequate time has elapsed for examination of the exposures, he will return to the cars and proceed to the next stop. Therefore, keep alert to the movements of the group, and do not risk being left in the woods.

Mileage

- 0.0 Site of Shin Pond House, facing northwest.
- 0.3 Roadside ledges are thin-bedded, crossbedded quartzite of the Grand Pitch Formation and fine-grained Rockabema Quartz Diorite.
- 0.4 Roadside ledges are medium- and dark-gray slate and quartzite of the Grand Pitch Formation.
- 0.5 Very light colored and fine-grained phase of the Rockabema Quartz Diorite and Grand Pitch slate.
- 0.9 T5R7 town line.
- 1.3 T6R6 town line.
- 1.5 T6R7 town line.
- 1.6 Road on right to Snowshoe and Whitehorse Lakes.
- 1.9 View of Sugarloaf Mountain straight ahead. The mountain is capped by a metadiabase sill in a syncline plunging northeast. Beneath the sill, on the slopes of the mountain is the Shin Brook Formation. The best fossils from the Shin Brook were found on the easily climbed southern slope at 1,500 feet altitude.

2.6 Spring and lunchgrounds.

- 2.7 **STOP 1. SHIN BROOK FORMATION (fig. 1):** Stop cars near Crommet Spring lunch ground; walk down road to left (west), (recently relocated from alignment shown on sketch map) to bridge over Shin Brook. Roadside exposures and east bank of brook are Grand Pitch Formation: medium- to dark-gray slate and thin-bedded, laminated, fine-grained light-gray quartzite, some crossbedded. Note tight, steeply plunging folds, especially in streambank.

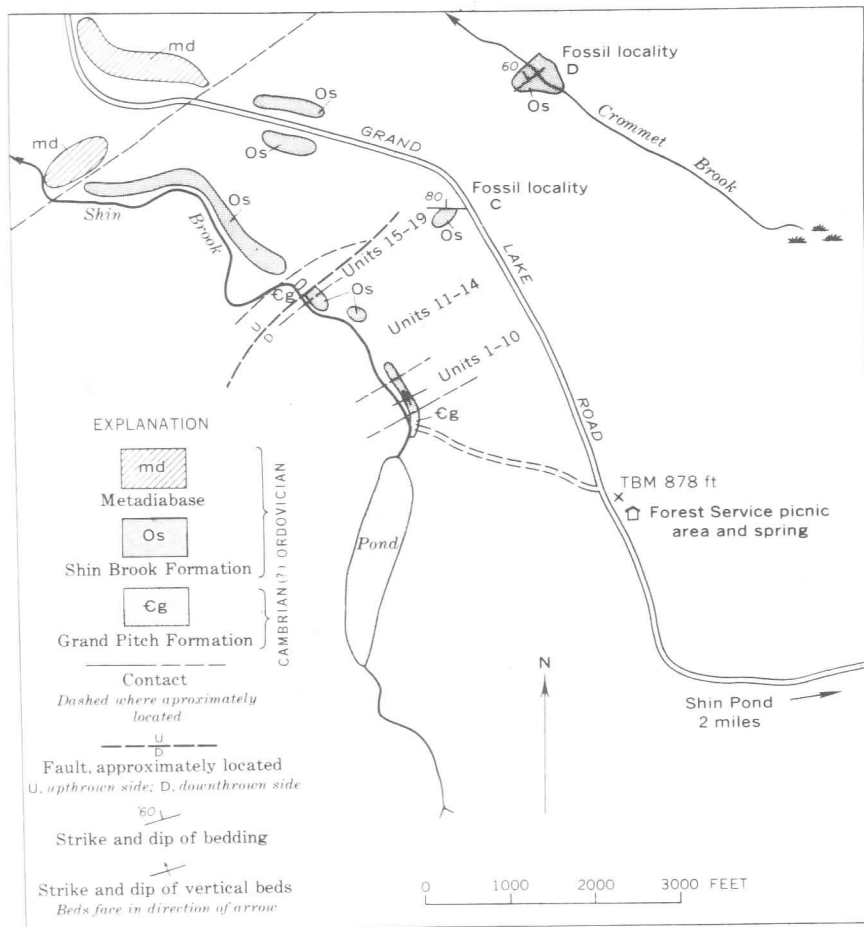


Figure 1. Geologic sketch map of the vicinity of the type section of the Shin Brook Formation; units 1-19 described in text. Outlined areas indicate outcrops. From U.S. Geological Survey Bulletin 1181-E, fig. 2.

The base of the Shin Brook Formation is a spotted slate which is about 60 cm (2 ft) thick. The type section measured here (taken from U.S. Geol. Survey Bull. 1181-E, p. E-6) consists of:

		Thickness	
		(Meters)	(Feet)
Shin Brook Formation: 280 m (902 ft) measured			
19.	Tuffaceous sandstone and siltstone in graded layers 8-30 cm (3-12 in.) thick, with coarse-grained sandstone in the basal part and finely laminated siltstone at the top; siltstone more abundant than sandstone; unit includes two layers of crystal tuff 16 cm (6 in.) and 60 cm (2 ft) thick, respectively.....	10	35
18.	Crystal tuff, greenish-gray; crystals are green altered plagioclase.....	3	10
17.	Covered.....	1	3
16.	Tuffaceous sandstone, grit, and conglomerate; finer grained part is well laminated, coarser part not laminated and includes fragments of porphyritic and nonporphyritic fine-grained igneous rock; ledge in stream-bed has distorted bedding structures that suggest deformation prior to lithification; base concealed.....	2	7
15.	Tuffaceous sandstone, fine- to medium-grained, calcareous; strongly sheared with weathered pits that may have been concentrations of fragmental fossils; fossils largely brachiopods, too strongly deformed to be identified.....	5	18
14.	Covered.....	20	70
13.	Crystal tuff, greenish-gray; with scattered angular cognate rock fragments 1-15 cm ($1\frac{1}{2}$ -6 in.) in average diameter; crystals of both matrix and fragments are green altered plagioclase; no primary layering seen; quartz veins abundant.....	6	20
12.	Covered.....	115	375
11.	Crystal tuff; light-green altered plagioclase phenocrysts in a darker aphanitic matrix; fractured.....	15	45

10. Covered.....	30	95
9. Tuff, fine-grained, light-greenish-gray; abundant carbonate; strongly sheared, with no bedding structures preserved.....	10	30
8. Covered.....	10	30
7. Volcanic conglomerate, with granules of aphanitic volcanic rock and dark slate, strongly sheared; bedding obliterated.....	15	50
6. Tuffaceous sandstone, gray, medium- and fine- grained; abundant carbonate; bedding obliterated by strong shearing.....	6	20
5. Covered.....	10	30
4. Volcanic granule conglomerate and coarse- grained sandstone, light-gray, strongly sheared.....	8	25
3. Sandstone and conglomerate, interbedded, with conglomerate beds 25-50 cm (10-20 in.) thick sandstone somewhat thinner; angular to subrounded fragments as much as 4 cm (1 1/2 in.) in average diameter include volcanic rocks and fine-grained quartzite....	12	35
2. Phyllite, light-gray, probably tuffaceous.....	1	2
1. Slate, dark-gray, with small (1/4 - 1/2 mm) white grains (altered plagioclase?) with rhombic outline abundant.....	1	2

Return to vehicles and proceed northwest on Grand Lake Road.

- 3.1 Ledges to left of road include fossil locality C of fig. 1 from which large specimens of Orthambonites robustus Neuman, deformed Platystrophia sp., and bryozoans were collected. Fossil locality D, shell beds of O. robustus, is about 500 meters (1,500 ft) to the northeast in Crommet Brook.
- 3.6 Ledges on left are metadiabase of the sill that overlies the Shin Brook Formation.
- 4.9 STOP 2. GRAND PITCH FORMATION AT SHIN FALLS: Walk south along old road about 500 meters (2,500 ft) to second small road to left (rushing water is plainly audible at this point). Turn left (to east) and follow this road about 1,200 feet to Shin Brook at bridge (do not cross bridge); then follow Shin Brook westward, downstream. The first large ledges are greenish-gray, fine-grained quartzite with interbedded gray and red slate. Crossbedding and graded

bedding are not as conspicuous as they are in the next exposures downstream. Exposures at the upper cascades of the falls have somewhat more slate and thinner quartzite layers than here. Graded bedding and crossbedding indicate that beds face in the same direction for only short distances, and then are abruptly reversed. Please do not descend waterfalls, but return to road and cars from above log sluice.

- 5.7 Ledges on left are quartzite of the Grand Pitch Formation.
- 5.9 Bridge over Seboeis River.
- 6.7 Scraggly Lake Road, TURN RIGHT.

STOP 3. SEBOOMOOK FORMATION AT SAWTELLE FALLS: Ledge on the north bank of Sawtelle Brook is fine-grained sandstone identical to that of the Matagamon Sandstone, one of several that occur throughout the Seboomook. Walk eastward along old road and trail about 2,000 feet to falls. The falls afford an especially informative exposure of the Seboomook Formation as large areas of bedding surface are visible. The ripplemarked fine-grained sandstone is especially interesting, as it reveals in plan view what is seen as small-scale crossbedding at the base of graded sets in cross section. Note the regular orientation of the ripplemarks and their elongation parallel to the intersection of bedding and cleavage. The plunge pool and its downstream extension follow the trough of a syncline, the beds on the opposite side of the stream dipping steeply northwest. This is the only fold seen in the area that has a horizontal axis.

Reverse direction; return to Grand Lake Road.

- 9.7 Grand Lake Road. TURN RIGHT.
- 10.6 Roadside ledge of Seboomook Formation.
- 11.0 Roadside ledge of Seboomook Formation.
- 11.3 Forest Service Camp, road right to Hay Lake; glimpse of lake from the highway.
- 11.5 Bowlin Pond Road. TURN LEFT.
- 12.8 Weathered exposure of Seboomook Formation.
- 13.3 Roadbed "pavement" of Seboomook Formation.
- 13.4 Woods road left. Before parking for Stop 4 prepare to reverse direction of caravan by proceeding past this road far enough so that last vehicle can back into it, leaving sufficient space so that all vehicles can be accommodated.

12.7

STOP 4. SILURIAN SEQUENCE AND CONTACT WITH GRAND PITCH FORMATION. Follow woods road on which vehicles are parked about 1,500 feet east and south to crossing of Bowlin Brook. In roadbed at and near crossing note red shale (Grand Pitch) interspersed with pebble conglomerate (Silurian), probably tectonically. Proceed about 300 feet south down small gully to its mouth at Bowlin Brook. Red and green slate and siltstone of the Grand Pitch form the southeast wall of the gully; southward along the brook for several hundred feet are nearly continuous exposures of red, green, and gray slate and greenish-gray, fine-grained, laminated, thin bedded quartzite typical of parts of the Grand Pitch.

Debris on the gully floor, about 10 feet wide, covers the trace of the contact between the Grand Pitch and the overlying Silurian rocks, which are gray and dark-gray slate and slaty siltstone containing thin seams of coarse-grained sandstone exposed in waterfalls. Note the contrast of deformation on opposite sides of the covered interval; also note that the lineation formed by the intersection of cleavage with bedding surfaces of the Silurian rocks plunges to the northeast. (Although the contact between the Grand Pitch and Silurian rocks here has previously been considered to be an unconformity, perhaps slightly faulted due to contrasts of structural competency of the rocks juxtaposed here, geologic relations in this vicinity, and the variety of units northwest of the Grand Pitch along this strike belt, some almost certainly overthrust by the Grand Pitch, suggest the possibility of major fault movement at this level, perhaps a decollement.)

About 50 feet west of the brook are beds of crudely graded quartzose pebble conglomerate and coarse-grained sandstone that are probably covered beneath the waterfalls in the brook. Above the waterfalls are about 30 feet of red slate and siltstone which are in turn overlain by about 50 feet of interbedded conglomerate, sandstone, and siltstone; these conglomerates contain Pentamerus and other Silurian brachiopods.

After examining this section, return to the Bowlin Pond Road for examination of the remainder of the section.

The following section (revised from U.S. Geol. Survey Prof. Paper 524-I) was measured in the woods west of the road (fig. 2).

	Thickness
	(Meters) (Feet)
Seboomook Formation, 51 m (170 ft) measured, of which 28 m (95 ft) is exposed):	

12. Siltstone, dark-gray, in beds 10-15 cm
(4-6 in.) thick; basal parts formed

EXPLANATION

Contact

Shown on geologic map (pl. 1); solid line where exposed; long dashed where approximately located; short dashed where inferred

60
Strike and dip of beds

75
Vertical Inclined
Strike and dip of cleavage

Area of exposed bedrock

7427-SD
x
Fossil locality

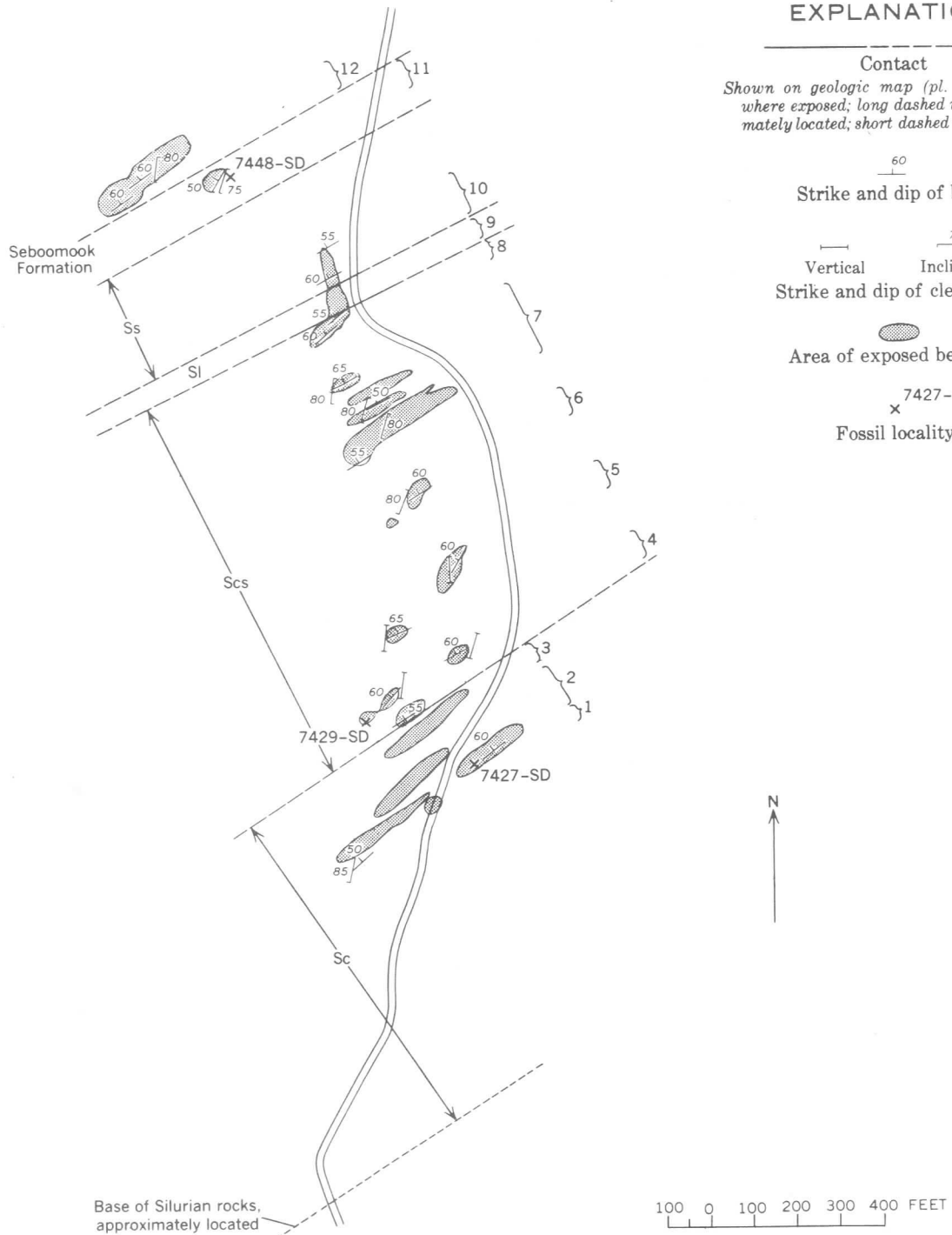


Figure 2. Location of exposures and units of Silurian sequence along Bowlin Pond Road, Shin Pond quadrangle, described in text. Sc-conglomerate, Scs-lower calcareous siltstone, Sl-limestone, Ss-upper calcareous siltstone. From U. S. Geological Survey Professional Paper 524-I, figure 2.

of fine-grained crossbedded sandstone 1-3 cm ($1\frac{1}{2}$ - $1\frac{1}{2}$ in.) thick.....	20	70
Covered interval.....	8	25
11. Siltstone, gray, sandy, noncalcareous; bedding obscure but shown in subtle contrast between more and less sandy parts; scattered small brachiopods, <u>Metaplasia?</u> sp. and <u>Plectodonta</u> sp.....	8	25
Covered interval.....	15	50
Upper Silurian Rocks, at least in part, 273 m (820 ft) measured, of which 153 m (515 ft) is exposed):		
Covered interval.....	55	180
10. Siltstone, gray, calcareous; bedding surfaces even, planar, at 5-25 cm (2-10 in.) intervals; widely scattered comminuted organic debris.....	25	85
9. Calcareenite, largely pelmatozoan debris; silty partings irregular and discontinuous; stromatoporoids and favositid corals as much as 15 cm (6 in.) in cross section.....	15	50
8. Siltstone, calcareous; contains silty lime- stone nodules a few centimeters (inches) in diameter, irregularly distributed.....	8	25
Covered interval.....	20	70
7. Siltstone, calcareous, gray, largely massive, but with a few scattered silty limestone nodules 3-5 cm (1-2 in.) in diameter, in beds 12-25 cm (5-10 in.) thick, separated by fine-grained lime- stone beds 2-5 cm (1-2 in.) thick, some of which are cut into boudins by partitions of siltstone parallel to slaty cleavage.....	50	170
Covered interval.....	20	70
6. Siltstone, gray, calcareous, in faintly laminated beds separated by prominent partings at intervals of 5-25 cm (2-10 in.); brachiopods fragmentary, scarce, <u>Monograptus</u> sp. rare.....	20	65

Covered interval.....	25	85
5. Siltstone, calcareous, like unit 6 above.....	15	50
4. Siltstone and fine-grained sandstone, calcareous, light-gray, mostly in well-defined graded beds 12-24 cm (8-10 in.) thick, some prominently laminated. A dark-gray noncalcareous siltstone bed 1 m (3 ft) thick, 20 m (60 ft) above the base of the unit contains 17 genera of brachiopods including <u>Cyrtia</u> sp., <u>Eospirifer</u> cf. <u>E. radiatus</u> (Sowerby), <u>Howellella</u> sp., <u>Merista</u> sp., and <u>Sphaerirhynchia</u> sp., trilobites and corals.....	20	70
Lower Silurian Rocks, 54 m (175 ft) measured, of which 36 m (115 ft) is exposed)		
3. Pebble and granule conglomerate, sandstone, and siltstone, calcareous, in well-defined graded beds 12-25 cm (4-8 in.) thick; fragments of brachiopods and corals.....	14	45
Covered interval.....	10	35
2. Conglomerate with rounded pebbles and granules, mostly of quartz, but with abundant felsitic volcanic rocks and tabular fragments of slate and siltstone as much as 15 cm (6 in.) long; beds poorly defined, about 1.5 m (4 ft) thick; scattered brachiopods including <u>Stricklandia lens ultima</u> Williams, tabulate and rugose corals.....	20	65
Covered interval.....	8	25
1. (Beds exposed in floor of Bowlin Pond Road) Siltstone, greenish-gray, and fine-grained sandstone; 2 beds of granule conglomerate, each about 25 cm (10 in.) thick.....	2	5
Beds below not exposed; distance to Grand Pitch Formation.....	175	575

Return to Grand Lake Road.

17.1 Grand Lake Road. TURN LEFT.

18.2 Enter Traveler Mountain Quadrangle.

- 19.3 STOP 5. "Hurricane Deck." Overlook and exposures of Matagamon Sandstone. For description and discussion see Stop 1 of trip B3 (Rankin, this guidebook).

Continue westward on Grand Lake Road.

- 20.8 Bridge over East Branch of the Penobscot River. Immediately after crossing bridge, TURN LEFT. Road skirts campground; keep right, away from campground.
- 21.0 Culverts (if luck is with us) over backwater. Woods road follows approximately old Eagle Lake Tote Road.
- 26.0 STOP 6. Haskell Rock; park vehicles as space permits here and half mile to south.

The purpose of this stop is to examine the Upper Ordovician succession along the west side of the river between Pond Pitch and Haskell Rock. Although fossiliferous Upper Ordovician rocks (equivalent to the British Ashgill Series) are known from a few other places in Maine (Lobster Mountain Volcanics of Boucot and Heath (1969); Blind Brook Formation of Hall (1970); and at several places in the vicinity of Ashland), this section has so far proved unique for its completeness, the apparent amount of time that it represents, the abundance and diversity of its fossils, the variety of rocks that it includes, and its relatively simple structure. The presence of this thick section (1,200 m, 3,500 ft) here, compared to the total absence of equivalent rocks in the Bowlin Brook exposures of Stop 4, three miles to the northeast in the same outcrop belt, may be due as much to structural causes as to stratigraphic ones. One possibility not hitherto entertained is that faulting at this level rearranged bodies of rock so their present distribution does not reflect their original relations.

Figure 3 represents exposures on both sides of the river constructed from a 1:2,400-scale tape and compass survey made in 1976. The exposures on the west side that should be seen during this trip are listed below, from south to north.

1. Basalts at Pond Pitch, identified by Rankin (1961) as olivine basalt with rare pillows, about 100 m (300 ft) thick; quartzite of the Grand Pitch Formations crop out about 75 m (200 ft) to the south of the southernmost basalt outcrop on the east side of the river, but the contact between them is not exposed. Small pillows near the top of the basalt, immediately below the contact with the overlying sediments, are visible when the river level is low.

2. Lower siltstone, about 25 m (80 ft) exposed; dark-gray siltstone, bedding obscure in most places, strongly cleaved; fossils obtained from small roadside ledge on west side of

BRACHIOPODS

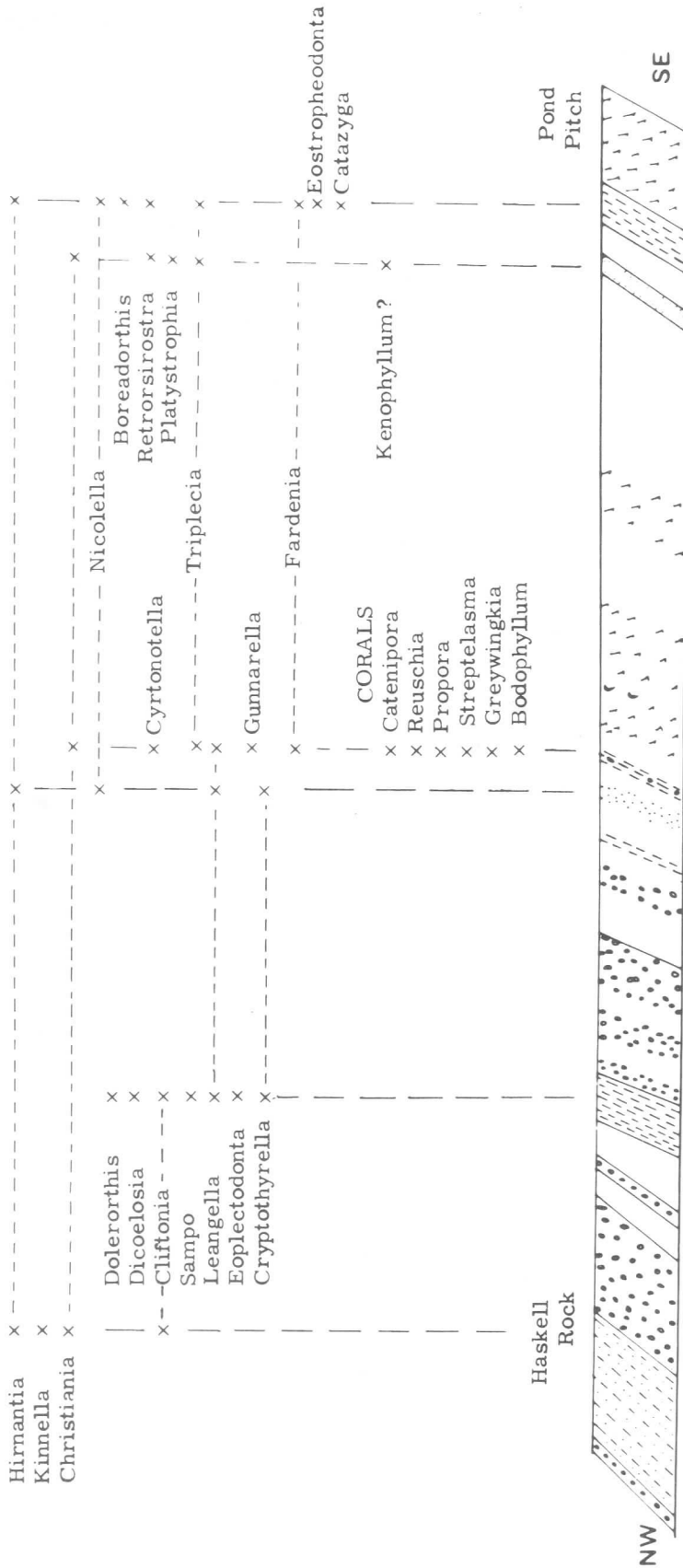


Figure 3. Geologic section between Haskell Rock and Pond Pitch of the East Branch of the

Penobscot River, constructed from a tape and compass map by R. B. Neuman assisted by Dane

Sparrow in August, 1976. Brachiopod identifications by Neuman, corals by Robert J. Elias of the University of Manitoba (written communications, 1979, 1980). See text for descriptions of

river and from roche moutonnée 40 m (125 ft) east of east river bank (the source of illustrated specimens of Catazyga cf. C. anticostiensis Billings (Plate 4 of Boucot and others, 1964). Of the 400 brachiopods identified from samples taken from the roadside ledge, half are strophomenides (about 100 each of Sowerbyella and Eostropheodonta, and a few of Fardenia) 40 percent are Catazyga, and the remaining 10 percent are punctate and impunctate orthids. Such an assemblage suggests correlation with the lower half of the British Ashgill Series (Pusgillian or Cautleyan Stages), and an environment of deep or cold water.

Massive sandstone in an isolated ledge on the east side of the river is composed largely of sand-size chips of gray and green slate or phyllite and a few rounded pebbles of quartz. Brachiopods scattered through this rock are dominantly impunctate orthids such as Retrorsirostra, Platystrophia, Hesperorthis, and others, together with the clitambonitid Vellamo and a rhynchonellid. Near the top of this exposure sand-size chips of phyllite float in limestone - the only limestone in the sequence - and the rugose coral identified by Elias (written communication, 1980) as Kenophyllum? was obtained here. This rock and its fossils indicate shallower water and higher energy conditions than did the underlying siltstone, more similar to the environments of some North American mid-continent Upper Ordovician rocks.

3. The thick body of basalt exposed in the roadway and on both sides of the river is presumably identical to that at Pond Pitch; some of its better pillows are exposed in the roadway near its top.

4. Pebbly siltstone rich in both tabulate and rugose corals, and containing a few brachiopods, crops out a short distance above the basalt in the roadside at the crossing of a small brook. Reuschia, the most abundant tabulate, is a syringoporoid genus related to Eofletcheria, originally described from the vicinity of Bergen, Norway but not known elsewhere in the Appalachians. The same genera of rugose corals occur in the pre-Hirnantian part of the Whitehead Formation at Percé, and in the Vaureal Formation on Anticosti Island (Elias, written commun., 1979), both limestones that are more normal hosts for such concentrations of corals than these pebbly siltstones.

On the steep slopes about 30 m (100 ft) west of the road are ledges of pebbly sandstone containing abundant slate particles, in graded beds averaging 0.5 m (1 ft) in thickness. Although small brachiopods and fragments of corals are abundant in the basal parts of several beds, few of the 200 brachiopod specimens are generically identifiable. Nevertheless, the assemblage here is different from that of the older sandstone mentioned above; more than half the specimens are dalmanellids, and nearly half are

rhynchonelliform shells that probably belong to several stocks. Such an assemblage suggests a habitat of intermediate depth-temperature conditions, followed by redeposition in deep water.

5. Haskell Rock. Poorly sorted conglomerate containing boulders of volcanic rocks, quartzite, and siltstone, and cobbles and pebbles of these rock and several other rock types, about 70 m (225 ft) thick, includes Haskell Rock. Gray pebbly siltstone on the eastern shore, about 30 m (100 ft) thick, underlain by still more conglomerate, yielded abundant small brachiopods. Recurrence of the plectambonitid-dalmanellid community (=deep, cold water) is inferred from the 350 brachiopod specimens obtained from this siltstone; more than half are Eoplectodonta and Leangella, about a fourth are dalmanellids, and 12 other genera are represented by 6 or fewer specimens.

Above Haskell Rock to the top of the exposed section, conglomerate is interbedded with well-bedded ankeritic siltstone and fine-grained sandstone. Brachiopods characteristic of the upper Ashgillian (Hirnatian), widely dispersed through the siltstone, include Hirnantia, Kinnella, Christiania, Cliftonia, and a rhynchonellid resembling Lepidocyclus.

Unfortunately there is a wide natural impoundment (Haskell Rock Deadwater) to the north, where Silurian rocks might be expected, so that the Ordovician-Silurian boundary has not been seen here nor elsewhere in the vicinity.

End of trip; retrace route to Shin Pond and proceed to Presque Isle for the evening's program.

References

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