1-1-1973

Saint John Area

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TRIP A-13 and B-10, by I. M. Patel, The University of New Brunswick in Saint John.

SAINT JOHN AREA

INTRODUCTION

Geographically the city of Saint John and its outlying suburbs are a part of the Southern New Brunswick belt characterised by the northeast – southwest structural trend and involving rocks varying in age from Precambrian to Carboniferous. The succession is shown in Fig. 1. The object of this excursion is to illustrate the stratigraphic sequence and its deformation as well as the associated intrusive activity.

STRATIGRAPHY

The earliest sedimentary rocks in the St. John area are a group of metalimestones, impure sandy phyllites and quartzites, collectively known as the Green Head Group (Hayes and Howell, 1937). The group has been investigated by Leavitt (1963) and mapped out to the west and north-west of the city by Leavitt and Hamilton (1962). The carbonates of the group vary from blue-gray calcite marbles to yellowish and white dolomites and in places there are interbedded conglomerates. On Green Head islands the stromatolite Archeozoon acadiense (Matthew, 1890) has been recognised.

The rocks of the Green Head Group are overlain possibly unconformably by volcanics of the Coldbrook Group (Hayes and Howell). These have been recently dated by K-Ar isotope methods to yield an age of 750 ± 80 m.y. (Cormier, 1969). The contact between this group and the presumably older and more highly metamorphosed Green Head Group is everywhere faulted or affected by tectonic sliding. The volcanics consist of sub-acid, dacitic and rhyodacitic ash-flow and ash-fall tuffs, in parts andesites. The presence of well-developed ash-flow tuffs without any bedding suggests a sub-aerial origin for these rocks. In the city these rocks have been severely faulted (Fig. 1) and only a small thickness of them separates the Green Head Group from the Cambrian.

The Cambrian of the City of St. John presents an appreciable interest. The succession, although usually tectonically attenuated and strongly folded is nevertheless fairly complete. It starts with Lower Cambrian conglomerates, red beds, shales and quartzites which from exposures to be seen at various localities northeast of

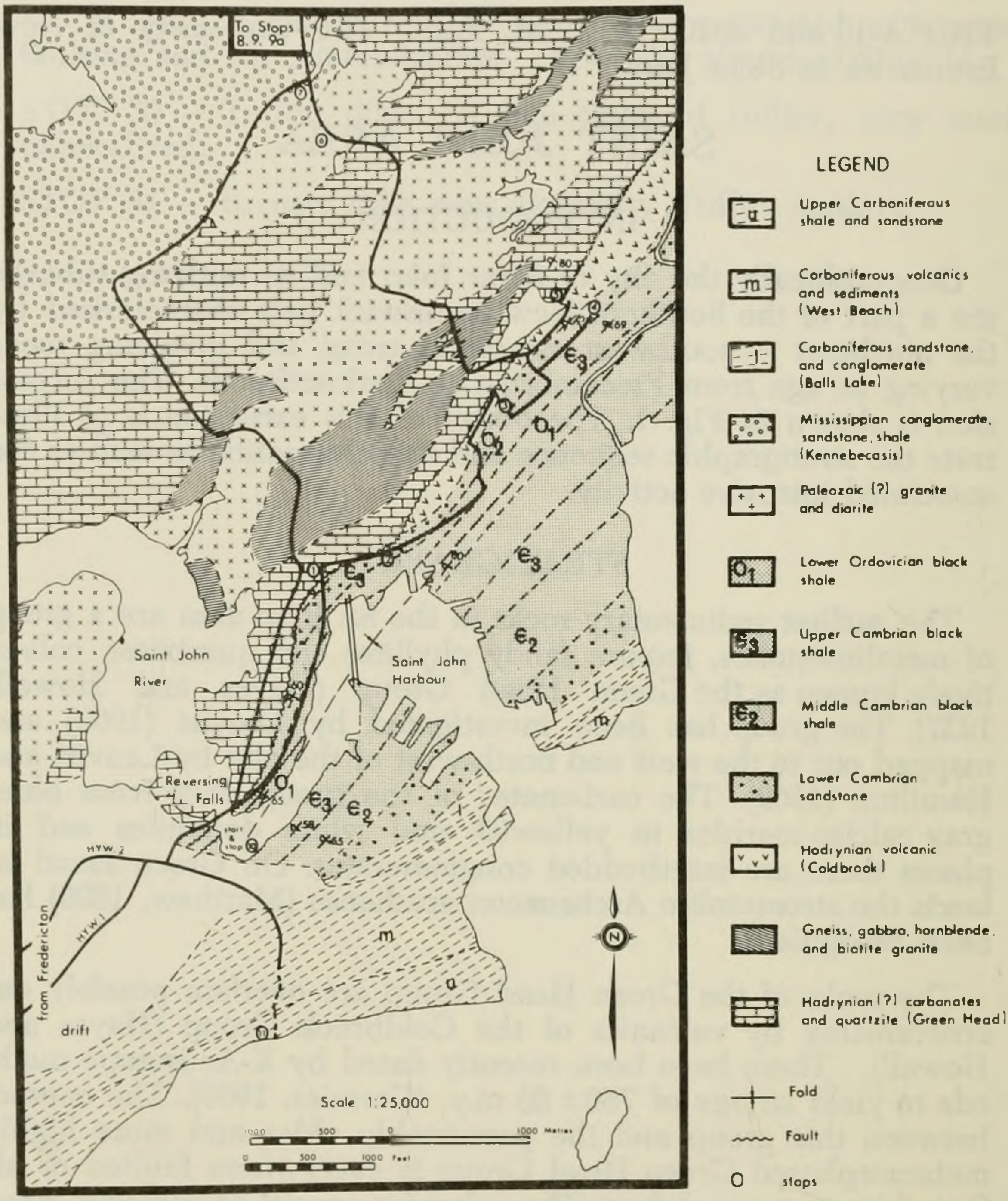


Fig. 1 Geology of Saint John from Hayes and Howell (1937) and Alcock (1938).

St. John could be demonstrated to have been derived from the northwest. Overlying these rocks are marine sediments (330 m.) of late Lower Cambrian to Lower Ordovician. These sediments consist of dark grey and black shales with subsidiary sandstones and limestones. In the City of St. John only very thin remnants of these rocks are present.

The Ordovician black shales are well exposed and in places

yielded Tremadoc and Arching graptolites. No Middle or Upper Ordovician or Silurian rocks have been found in the area.

In the northern part of the city the Precambrian and Lower Palaeozoic rocks are unconformably covered by the Lower Carboniferous Kennebecasis Formation of conglomerates and coarse sandstones usually showing signs of proximal derivation. In the south of the City the Carboniferous succession involving Lower and Upper Carboniferous formations, often in a strongly deformed state is in a fault contact with the Cambrian. Here, Lower Carboniferous rocks show signs of vulcanicity including well developed pillow lavas.

STRUCTURE

Under the Carboniferous cover the Precambrian and Lower Palaeozoic rocks are folded into a major anticline and the adjacent syncline. The syncline has been recently mapped by Richards (1971), who proposes that Precambrian and Lower Palaeozoic formations have been affected by two phases of Middle Devonian, Acadian Orogeny involving refolding and multiple cleavage. Recent work in southern St. John brings to light considerable overthrusting and deformation of Carboniferous rocks, which are in places overturned and face into the Cambrian.

LOG AND DIRECTIONS

Start from Reversing Falls Parking Lot.

Miles from
Last Stop

1.3 STOP 1 – Harrison St. Early & Late Precambrian carbonates & volcanics overlain by upper Lower and Middle Cambrian sediments.

0.5 STOP 2 – Main St. Base of Lower Paleozoic marine sequence, resting on volcanics, faulted against low-grade metamorphics.

1.2 STOP 3 – Goodrich St. Cambrian red beds, quartzite, slate and shales. Fossil locality.

0.5 STOP 4 – Highwood Drive. Basal Cambrian conglomerate resting on Precambrian volcanics.

0.5 STOP 5 – Rockwood Park. Slide contact between early Precambrian carbonates and late Precambrian volcanics.

2.3 STOP 6 – Sandy Point Road. Devonian diorite intrusives.

0.2 STOP 7 – Sandy Point Road & University Ave. Lower Carboniferous conglomerate and sandstone.

4.1 STOP 8 – New HWY. (north). Precambrian biotite gneiss and carbonates.

0.9 STOP 9 – New HWY. (south). Precambrian quartzites.

0.2 STOP 9A – New HWY. (south). Precambrian volcanics (ignimbrites)

7.6 STOP 10 – Reversing Falls. Lower Ordovician slate faulted against Precambrian carbonates.

1.4 STOP 11 – Duck Cove at Seaside Park. Upper Carboniferous "Fern Ledges". Plant fossil locality.

TRIP A-14 and B-11, by G. E. Pajari, University of New Brunswick.

THE HARVEY VOLCANIC AREA

INTRODUCTION

The Harvey Formation forms a distinctive unit along the northwestern margin of the extensive Carboniferous basin (Freeze, 1936; Laughlin, 1960; Kuan, 1970). The Harvey Formation is underlain by Mississippian red siltstones and conglomerates. The volcanic rocks are rhyolites (*sensu stricto*) in composition, plotting in and near the minima field of Petrogeny's Residua system, and are of similar composition in both members of the Harvey Formation. Flow folds in flow-layered lavas indicate a southerly source for the volcanic rocks. The Mississippian rocks unconformably overlie the Silurian strata and are overlain by the Mississippian and/or Pennsylvanian conglomerates and sandstones (Fig. 1).

The Harvey Formation has a regional dip of 10-20° southward toward the axis of the Carboniferous basin. The stratigraphic sequence is as follows:

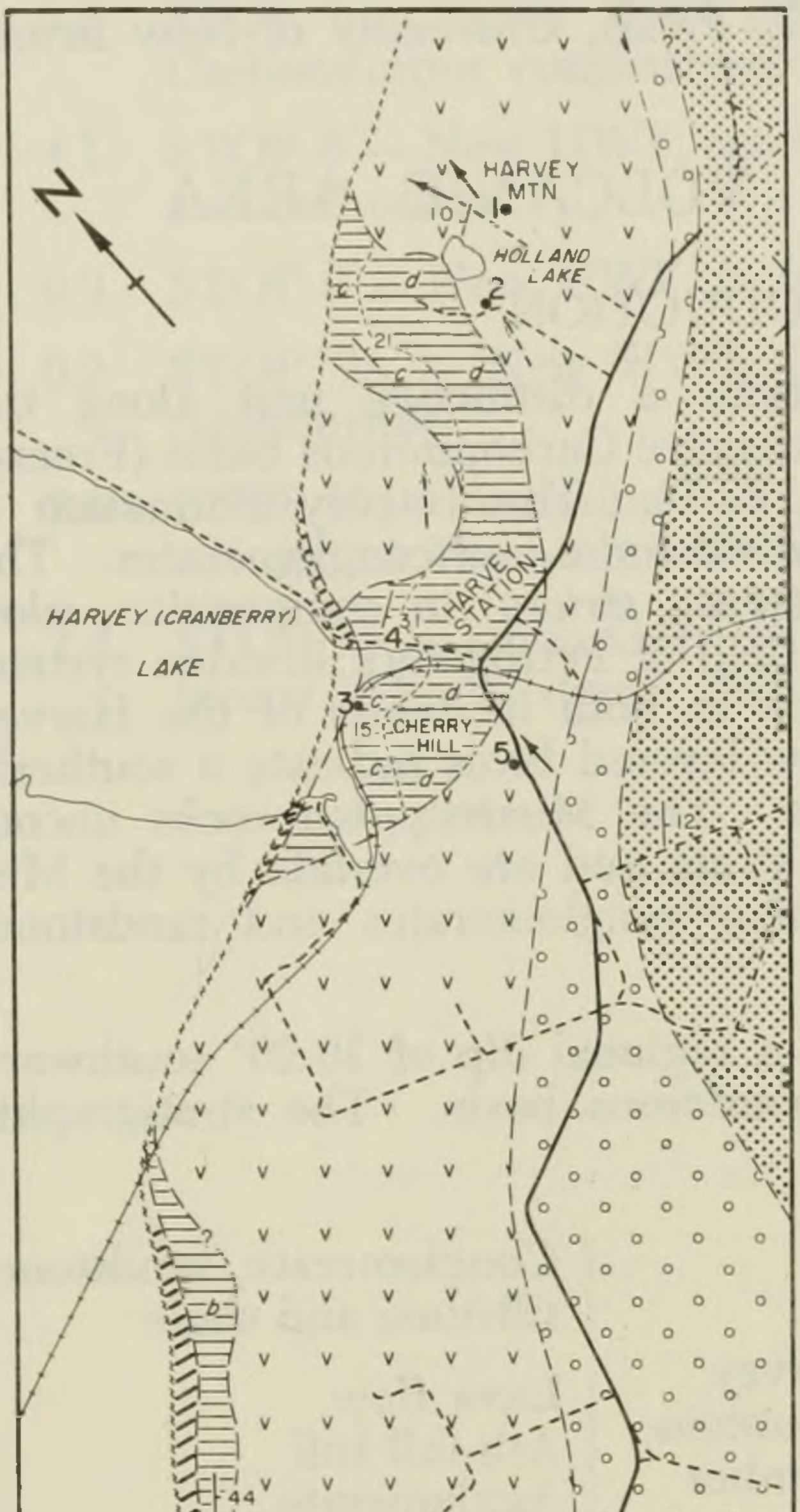
CARBONIFEROUS	Mississippian and/or Pennsylvanian		Conglomerate, sandstone, siltstone and shale
	Mississippian Harvey Formation	Harvey Mountain Member	Lava flow Ash-fall tuff Agglomerate
		York Mills Member	Ash-flow tuff volcanogenic sedimentary rocks & conglomerate and tuff.

Stratigraphic and petrologic data suggests that the Harvey Formation is correlative with the volcanic rocks of the Piskahegan Group at Mt. Pleasant along the southern edge of the basin — a distance of 15 miles (van de Poll, 1967; Kuan, 1970).

LOG AND STOP DESCRIPTIONS

MILEAGE

0.0 Parking lot beside Geology Department, U.N.B. Proceed west along Highway # 2 (Trans-Canada Highway).



GEOLOGY OF THE HARVEY AREA, NEW BRUNSWICK

PENNSYLVANIAN

GREY TO BUFF CONGLOMERATE AND SANDSTONE.

MISSISSIPPIAN / PENNSYLVANIAN

RED CONGLOMERATES, SANDSTONES AND SILTSTONES.

HARVEY FORMATION

MISSISSIPPIAN

LAVA FLOWS AND ASHFALL TUFF.

a CONGLOMERATE, TUFF.
b SANDSTONE, VOLCANIGENIC SEDIMENTARY ROCKS.
c IGNIMBRITE.
d PORPHYRITIC FACIES.

RED MASSIVE SILTSTONE

SILURIAN

GREY SILTSTONES, SANDSTONES; GREYWACKE.

•5 LOCATION STOP

44 STRIKE AND DIP OF UNIT

GEOLOGICAL CONTACT, GRADATIONAL

FAULT

DIRECTION OF LAVA FLOW, INDICATED

GEOLOGY BY

S.KUAN (1969), G.E. PAJARI JR. (1972, 1973)

0 1

SCALE IN MILE

Fig. 1 Geology of the Harvey Area, N. B.

9.0 On the right, the Mactaquac Hydroelectric Power Station.

14.0 Turn right on Highway # 3 and proceed toward Harvey.

28.0 Turn right along the fire-tower access road and proceed to tower. Follow trail westward (a distance of 250 yards) to the edge of the cliff overlooking Holland Lake.

STOP 1 The field immediately to the west of Holland Lake is underlain by a porphyritic facies of an ash-flow tuff that will be seen at Stops 3 and 4. The southeasterly slope of the field reflects the dip (10-14°) of the ash-flow sheet as determined from the attitude of columnar jointing in the woods above the field to the northwest. The sheet is overlain at the south end of the field by a layered lava flow which represents the basal unit of the interstratified ash-fall–lava flow sequence constituting the cliff below this lookout.

The cliff consists of a number of lava flows separated by a structureless aphanitic tuff which is softer and more porous than the lavas. Individual flow units are relatively constant in thickness whereas the inter-flow tuffs are extremely variable — ranging from a few inches to five feet in thickness. The lava flows are 5-30' thick and the flow layering dips consistently to the north from 4-28° at this location. Flow folds indicate a northerly flow direction for the uppermost three flows. Return to Highway # 3 and turn right.

28.3 Turn right along a narrow road and proceed to wood-waste dump on the north side of hill (500 yds.).

STOP 2 The flow layering at this outcrop dips uniformly 55° to the northwest. The few flow folds that have been observed here indicate a flow direction toward the northeast and parallel to the strike of the flow layering. This suggests that the lava flowed against an escarpment at this location. In the valley immediately to the north of the outcrop the flow layering forms a series of disharmonic folds varying in amplitude from a few inches to several feet. Similar folds have been observed at the base of lava flows (e.g. Stop 5) and at locations where the dip of flow layering decreases indicating a break in the original slope. A lava flow which has been in part confined to a valley 150' wide and 40' deep, and in which the flow layering is conformable to the shape of the valley, has been observed on the cliff to the east.

Return to Highway # 3 and proceed to Harvey Station.

29.3 Turn right at road 100 yds. before railway track in village; proceed a few hundred yards and leave vehicles at the public beach on the left. Proceed a quarter mile along the lake shore on the railway track to the western end of rock cut.

STOP 3 The cut consists of massive reddish-brown siltstone at the bottom overlain by two ash-flow sheets. The bottom unit is about 6-7 yards thick and the top of this unit is marked by a reddish-brown horizon. The upper ash-flow unit is 110 yards thick and extends to the top of Cherry Hill that rises above the railway cut to the south.

The bottom of the first ash-flow contains poorly sorted fragments up to 20 cm. in diameter, some of which have been completely altered to a mixture of illite and quartz. The size of the fragments decrease and become more uniform in size upward in the sheet. The base contains well preserved axiolites – the outlines of which are destroyed by post-devitrification recrystallization a few yards above. The reddish-brown horizon marks a distinct textural change from felsitic (recrystallization texture) at the top of the lower sheet to axiolitic in the bottom of the upper sheet. The changes in fragment size and textures in the basal section of the upper sheet parallel those observed in the lower unit. Poorly developed columnar joints can be observed at the top of the rock cut.

Return to the beach and proceed 300 yards northward along the road on the east side of the lake to columnar jointed outcrops.

STOP 4 The columnar jointed ash-flow shows a well-developed eutaxitic structure perpendicular to the axes of the columns and contains rock fragments and a few phenocrysts. Textures and fragment sizes at this location (the base is not exposed along the road) are equivalent to those in Cherry Hill section 30-50 yards above the base. The plunge of the column axes is 27° to the northwest and represents the steepest dip observed in the unit.

Proceed back toward beach (down dip) stopping at the outcrops at the cabin units on east side of road. These outcrops are stratigraphically higher than those immediately to the north and consist of quartz feldspar porphyry. The phenocrysts increase in abundance upward in the sheet from one percent near the base to 20%-25% as observed at this location. The quartz feldspar porphyry represents the top of the unit and is overlain by the lava flow – ash-fall sequence of the Harvey Formation (Stops 1 and 2).

Return to the vehicles and proceed to the intersection of Highway # 3 in the village. Turn right.

29.5 Turn into first road near the top of Cherry Hill and stop.

STOP 5 The outcrop along the north side of the main highway consists of lava with flow layering dipping 50° northward overlying a pyroclastic unit. Drag folds above the base at this locality indicate a northward flow direction (approximately down dip). The base of the flow contains a large number of folds without systematic shape or orientation. The dip of the flow layering can be seen to decrease northward from the main highway.

Proceed westward along Highway # 3.

33.4 Pull into parking lot of small restaurant on right.

STOP 6 The outcrops along the road and in the field behind the restaurant are of red Mississippian sandstones and conglomerates which overlie the lava flows. The transport direction for these sedimentary rocks overlying the volcanic rocks is eastward, i.e. approximately parallel to the axis of the Carboniferous basin (van de Poll, Department of Natural Resources, personal communication). Note the paucity of Mississippian volcanic clasts in the conglomerates.

Proceed westward along Highway # 3 to York Mills.

35.9 Turn right onto dirt road 50 yards before cement bridge and stop.

Proceed by foot to stream under bridge.

STOP 7 The sedimentary rocks along the bank consist of sandstones and conglomerates which dip 50-65° to the southeast. These rocks are stratigraphically below the red Mississippian conglomerates (seen at the last stop) which outcrop 300 yards downstream. The dip gradually decreases downstream from 55° to 15° over a distance of 500 yards. The high dips are anomalous and have been tentatively attributed to the affect of faulting.

The outcrop of lavas along the road parallel to and about 30' above the river level represents the westernmost extent of the Harvey Mountain Member.