Geology of the Buchans Junction Area
Newfoundland

by

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Table of Contents

List of Illustrations | Page

List of Illustrations Page

INTRODUCTION

Purpose of the Investigation

The purpose of this investigation is to give a description of the geology, with accompanying maps, of two areas near Millertown, Newfoundland. The field work was done during the summers of 1950 and 1951 for the Buchans Mining Company as a part of its scheme of systematically mapping their large mineral concession. Although the areas are not adjoining, the geology of the two will give a picture of the rock types found in crossing the "Central Mineralized Belt of Newfoundland".

Location

The northern, or Buchans Junction Area, extends south of the C.N.R. tracks from points about eight miles west and two miles east of Millertown Junction to an east-west line running through the town of Millertown. The centre of this area is approximately located at 48° 55'N - 56° 20'W. The southern, or Ambrose Lake Area, has a northern boundary about eight miles southwest of the Buchans Junction Area. It extends southward between the Victoria River on the west and the Anglo Newfoundland Development Company tramway on the east, to an east-west line a mile south of the depot at Ambrose Lake. To the south, the area extends 3½ miles east of a north-south running truck road of the A.N.D. Co. and thence south and southwest of the Noel Paul Brook. The position of the Ambrose Lake depot is approximately $48^{o}36'N - 56^{o}38'W$.

History

Rough geological sketches of this area were first made by W.E. Cormack in his trek across the island in 1822. In 1871 Murray (20) made a trip up the Exploits River into Red Indian Lake, making notes on the natural resources and the bedrock. R. Perret (22) visited the site of the Exploits Dam in 1911 and made a few notes on the rocks he found. Twenhofel examined the exposures at Millertown during the same year. The mineralization at Buchans was first noticed, in 1905, by an Indian called Matty Mitchell. The Buchans Mine was later brought into production by the joint efforts of the American Smelting and Refining Co. and the Anglo Newfoundland Development Co. The area around Buchans has been thoroughly mapped by company geologists such as George (12), Newhouse (21) and the late Dr. H.J. MacLean.

Considerable work has been done to the northeast in the Notre Dame Bay Area by Heyl (16), Twenhofel (30), Sampson (24), and others. The closest work done by the Geological Survey of Canada is that of Kalliokoski (18) in the Gull Pond Area, and Hriskovitch (17) in the Little Rattling Brook Area.

No systematic mapping of the areas covered in this thesis have been made in the past.

Mapping and Field Work

The base maps were compiled by the writer on a scale of 5,000' to the inch, from maps drawn by the Buchans Mining Co. at 1,000' to the inch. These in turn were made from aerial photographs taken at approximately the same scale.

The plotting of exposures on the 1000'=1'' maps was made from the aerial photographs wherever possible but in dense wood the pace and compass method was used. Some structural lineaments were seen on the photographs. Over most of the area, however, the mantle of glacial drift, forest and marsh, obscures all but the major structural trends. Most of the area was traversed by foot, although canoes were of some use in the southern area. In both areas a speeder was extremely useful in extending the possible coverage from one base camp. Transportation in the southern area was most graciously provided by the truckdrivers of the Anglo Newfoundland Development Co. at Ambrose Lake.

Accessibility

The trans-Newfoundland Railway traverses the northern boundary of the northern, or Buchans Junction Area. From Millertown Junction, which is 310 miles from St. Johns, there is a spur line to the towns of Buchans and Millertown. The "tramline" continues beyond Millertown for a distance of 20 miles to the depot at Ambrose Lake.

Natural Resources and Settlement

The villages of Millertown Junction and Buchans Junction have populations of about 200 and 50 respectively. Railroading is the principal occupation of the male inhabitants. The people are almost entirely dependent upon food and supplies brought from elsewhere on the island although small gardens are capable of producing a limited vegetable crop. Millertown, on the southwest bank of Red Indian Lake, has a population of about 400 and is the regional headquarters for the A.N.D. Co. The limited extent of agriculture in the district is indicated by the fact that the total livestock seen in two summers fieldwork was two cows in Buchans Junction and a small herd of goats in Millertown Junction. Farming is possible, however, as indicated by a hay and oats farm operated near Millertown. The farm provides feed for the horses used in wood cutting operations.

The abundant fir forests in the district are cut for pulp production at the A.N.D. mill in Grandfalls. For these woods operations, transitory labour is obtained from all over Newfoundland.

Moose and caribou are abundant in the area and form a regular part of the diet of the inhabitants during the fall and winter months. Also present are bear, otter, beaver, fox, muskrat, rabbit and a variety of birdlife including ptarmigan and Canada geese.

Fig. 1. The valley of the Mary March, looking northwest from the Tetons. Gaff Topsail and Mizzen Topsail are on the horizon.

Fig. 2. The monadnock on the horizon is Skull Hill, as seen from the Tetons, looking northeastwards. The intervening flat marsh is the valley of Joe Glode's Brook.

TOPOGRAPHY and PHYSIOGRAPHY

A. Buchans Junction Area

Surface

The northwest part of the area, which is underlain by granitic rocks, is a gently undulating upland with a gradual slope to the southeast. The regularity of this plain is broken by the prominence of Mount Blanche on the west side of Joe Glode's Pond. Elsewhere the valley walls of the Mary March River show a gradual rise to a range of rounded hills which form the divide between it and the valley of Joe Glode's Brook. Taking the elevation of Millertown Junction at 690 feet above sealevel, the height of the upland near the tracks would be roughly 750 to 800 feet, decreasing gradually to the southwest.

In the northeast corner of the map sheet, the east bank rises steeply from the floor of the Valley of Joe Glode's Brook. There is an increase in height of about 300 feet, then levelling off in a well dissected plateau having a local relief of about 150 feet. This relief is notable when compared with the general flatness of the Valley of the Mary March, although both are underlain by granitic rocks. Farther northeast, beyond the boundary of the map, Skull Hill is seen rising abruptly to a 1359 foot elevation or about 400 feet above the surrounding plateau. (see photo) The summit of the hill constitutes a remnant of Twenhofel's

(28)-High-level Plateau, an uplifted Cretaceous peneplain, now visible as the summits of scattered monadnocks across the province.

West of Joe Glode's Brook there is a gradual rise to a flat upland with a slightly higher elevation than that of the Mary March valley. The drainage here is both northeast and southwest although no large streams are found; most of the water apparently percolates through the wet bogs. To the west of this plateau rises the dividing ridge between the valley of Joe Glode's Brook and the valley of the Mary March River. Immediately south of Joe Glode's Pond the divide is represented by a very gently rounded ridge. Proceeding southwest it rises higher and higher, culminating in two mamillary shaped hills, the Tetons, midway to the Mary March River. Thence to the Mary March it forms a low ridge dipping abruptly to the Mary March Valley but more gradually to the southeast. The ridge is made up of acid to basic flows which stand up quite sharply above the granite to the northwest. To the southeast the land dips gradually, with small terraces into the valley of Joe Glode's Brook. Southeast of the A.N.D. Ry. the land rises very gently in a series of low terraces to a height of land between the Red Indian Lake and the Exploits River drainages. Northwest of Buchans Junction the land rises gradually for about a mile, where there is a sharp escarpment rising about 200' to a comparatively rough plateau having a local relief of about 100'.

The underlying volcanic rock extends to Seal Pond where the contact of the intrusive granite is crossed with no topographic expression.

In the southwest corner of the map sheet is an arm of Red Indian Lake from which the land rises steeply to the northwest from an elevation of 500'at the lake shore to 1000'. On the western boundary of the map there is the broad valley of Warfords Brook, transecting the regional northeast - southwest structure and finally dropping with several falls into Red Indian Lake. Southeast of Red Indian Lake there is a steep rise to a rounded, hilly topography underlain mainly by volcanics.

Drainage

The trend of the hills is northeast - southwest giving a rectangular drainage pattern which has been modified by considerable amounts of glacial boulder till and sand. The rectangular drainage is well developed to the west of Joe Glode's Pond, where small streams flow sluggishly into the Mary March. The resistant ridge running southeast from Joe Glode's Pond causes rapids and waterfalls for a length of over a mile in the Mary March River. Downstream from these rapids the river flows at an estimated four miles per hour, cutting through the heavy glacial drift but only rarely reaching bedrock.

Joe Glode's Brook drains south through a broad valley where rock exposures are few and glacial drift appears to be up to thirty feet or more in thickness. From Joe Glode's Pond to Red Indian Lake there is a drop of 175' in approximately 17 miles, or roughly 10' per mile. As only four exposures of bedrock were found along the entire length of this waterway, the depth of glacial till must be considerable and must have had a marked effect on the drainage.

Physiographic Stage

Genetically then, the Mary March is an superimposed stream with subsequent tributaries forming a rectangular drainage pattern. Joe Glode's Brook is a superimposed stream joined by subsequent tributaries but forming no definite pattern. Faulting and fracturing seems to the guiding structure of the area. The well developed rectangular drainage just south of the C.N.R. tracks is underlain by granitic rocks which may be jointed, but along the south shore of Red Indian Lake slickensides and fracture zones parallel to the trend of the lake are an indication of faulting.

Assuming a peneplain at the level of the tops of monadnocks such as, Skull Hill and Mount Blanche; the area may then be described as a complex mountain area, peneplained in its first cycle of erosion then uplifted and maturely dissected in its second cycle. This was followed by continental type glaciation, depression, and later uplift.

B. Ambrose Lake Area

Surface

From Ambrose Lake northward the area is a very gently rolling upland with very little local relief until Highland Pond Ridge is reached near the northern boundary of the map. This ridge stands about 400' above the surrounding upland with a gentle slope at the base and becoming almost precipitous near the summit. The Victoria River Valley cuts across the northwest boundary of the map sheet. In general the valley walls have a gentle slope but throughout much of its length the river has cut its way down to bedrock. In many places the valley shows several small terraces in the river flat and a primary terrace approximately 200' in height. West of Ambrose Lake, four prominences called the Harpoon Hills rise abruptly out of the surrounding upland, giving a local relief of 350'. Southward the land continues flat but drops down with a regular gradient into the Noel Paul Valley. Downstream, where the Noel Paul leaves the map, the valley walls have an estimated slope of 20^{o} starting from the river bank. North and south of Haven Steady the gradient is about 10^{o}, but farther upstream at Lake Douglas the valley walls steepen considerably and on the south shore are precipitous. This is caused by a resistant, ridge forming, sill trending 040T and rising about 300' above the valley floor. To the south there is a gradual rise to two high, rounded, elongated hills, divided by a north running stream. South of these hills the land drops down to an open boulder plain which is underlain by granitic rocks. The contact in some places is shown by an escarpment but elsewhere it has no topographic relief.

Drainage

The Noel Paul Brook shows strong structural control, probably due to faulting. Elsewhere glaciation has disrupted the drainage so that bedrock has little effect in the direction of streams. The Victoria River, in general, has a wide valley but on the river itself rapids and waterfalls are common. Between these two main rivers is the Harpoon Brook, draining Ambrose Lake, Lost Pond, and Rogerson Lake. It is understood from conversation with A.N.D. woodsmen that Rogerson Lake was artificially drained into the North Branch Brook by dredging across the watershed.

Physiographic Stage

Genetically, the Ambrose Lake Area would be in the same physiographic stage as the Buchans Junction Area. The concordant tops of the Highland Pond Ridge, Harpoon Hills, and the "Tolts", south of Noel Paul Brook, representing a Pre-Cretaceous peneplain and the maturely dissected plateau surrounding them being glaciated and rejuvinated.

GLACIATION

Strong glaciation is apparent in both the Buchans Junction and Ambrose Lake Areas.

Several pentagonal blocks of columnar basalt were found four miles west of Highland Pond. These boulders correspond to the description given by Murray (20) of the rock occurring on Buchan's Island in Red Indian Lake. Because this structure is not a common phenomenon in the area, it might be safe to assume that the boulders were transported from the island itself, or in close proximity to it. The assumption is corroborated by nearby glacial striae striking 120T. The bearing and distance from Buchan's Island is 130T, 10 miles. The generally southern direction of glacial movement is also indicated by boulders of red conglomerate occurring only to the south of the conglomerate outcrop. Glacial polishing was only seen on a few outcrops. It is preserved on a hill forming the southeast limit of the Victoria River Valley, where bedded quartz-rich tuffs are smoothed and shallowly striated.

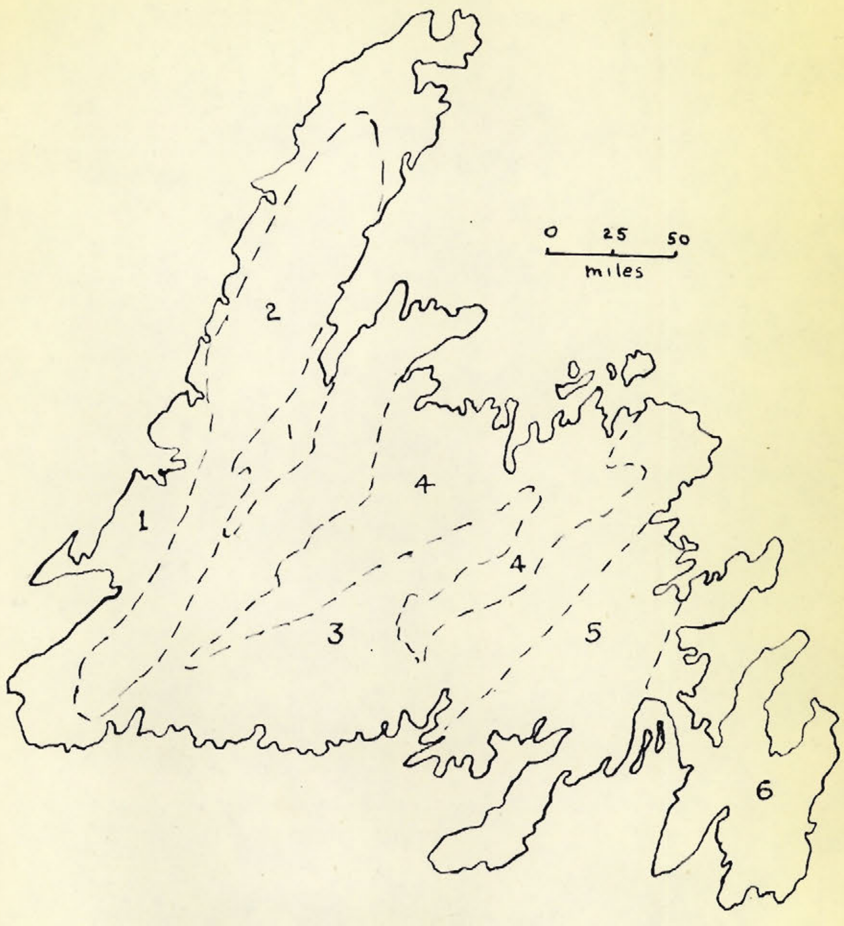
Striae were also noted on the right of way of the Buchans Railway, at a point about four miles southwest of Buchans Junction. Here they occur on the northwest side of the Red Indian Valley and strike at 060T. The writer believes that the deep valley guided glacial movement, although the depth of the ice must have filled the valley and covered the surrounding plateau as well. Granitic boulders are found a mile northwest of the railroad bridge over Warford's Brook and there is no evidence of a granite mass closer than the Mary March Batholith, two miles to the northwest.

From these data it would appear that the major movement of ice in the district came from the northwest, but that local topography caused deviations in direction, as would be expected under a moderate load.

There is no well stratified glacial drift although considerable outwash sand was observed two miles northeast of Ambrose Lake. A mile west of Mile 9 on the Buchans Railroad there is a northwest trending esker, about a mile in lenth and 300' in width. The commonest glacial material is fresh, unweathered, unsorted boulder till which covers an estimated ninety percent of the land surface. Coleman (5) noted boulders of greenstone on the Gaftopsail and Maintopsail granite but on the syenitic hills to the southeast of Millertown Junction, no glacial erratics were found. Gaftopsail has an elevation of 1822'. From the botanical studies of Dr. Ferland (5) it has been shown that most of the highlands of Newfoundland escaped glaciation and stood above the ice as nunataks. These were refuges for plants which were destroyed on the lower ground by glaciation.

Twenhofel and Mac Clintock (31) have suggested three stages of glaciation in Newfoundland, all corresponding to the Wisconsin. During the first period ice spread as a complete cap from the Long Range Plateau, the Central Plateau, and the Avalon Penninsula, outward beyond the present shore lines of the island. This was followed by a period in which fossiliferous marine sediments were laid down in places where the glacier had receded. Finally there was a cirque building period when the ice had retreated back into the higher valleys. It was originally believed by Daly (7) and Flint (11) that Newfoundland had been covered by the southernmost extension of the Labrador Ice Cap. However, Twenhofel and Mac Clintock found two sets of striae on the west coast indicating a southward movement of ice followed by a westward one. Coleman (5) also notes two periods of glaciation, one in early Pleistocene, followed, after a period of erosion, by one in late Pleistocene. Evidence found indicates that the most recent glaciation radiated from a local ice cap whose centre was located somewhere between Red Indian and Deer Lakes. The effect of this last period would be to obliterate any evidence of former glaciation.

Post glacial uplift has been reported from the west coast of Newfoundland as evidenced by raised beaches resulting from the Champlain submergence. The amount of the uplift since that time, according to Twenhofel (28), is about 400' on the west coast, while the east coast has been more or less a hinge line for the tilting.



Map showing the lithologic zones of Newfoundland

GENERAL GEOLOGY

I. Regional

Introduction

A brief account is given here of the geological history of Newfoundland and its relation to the Appalachian belt in Gaspe and New England. For convenience this is divided into two parts; Stratigraphy and Structure, although it is realized that the two are intimately associated in any one orogenic belt.

Lithologic Zones of Newfoundland

The rocks of Newfoundland can be grouped into six zones which have distinctive rocks types and tectonic histories.

Zone 1. Paleozoic sediments extending the entire length of the west coast and fringing the southeastern tip of Labrador from Brador Bay to York Point. Thence a narrow strip extending south from White Bay to Grand Lake.

Zone 2. The Long Range, underlain by Pre-Cambrian gneisses, schists, and granitic complex, extending northeast from near the south coast to Canada Bay.

Zone 3. A large upland area, underlain by granitic rocks, which are, for the most part, of Paleozoic age and probably Devonian.

Zone 4. Two sedimentary and volcanic belts, tapering to points southeast of Red Indian Lake and in the Bay Despoir area, coalescing on the east coast near Notre Dame Bay.

Zone 5. Between Bonavista Bay and the Burin Peninsula is an area underlain by presumed Paleozoic sediments which are infolded and faulted with the Pre-Cambrian basement complex.

Zone 6. The Avalon Penninsula is underlain by late Pre-Cambrian sedimentary series with occasional infolded Paleozoic sediments.

REGIONAL STRATIGRAPHY

Cambrian

3,000'-3,500' of conglomerates, sandstones, shales and some limestone are found in Zone 1. A thinner series is found in Conception Bay, Trinity Bay, the Burin Peninsula and at Rencontre East in Fortune Bay. No volcanics are found with any of the Cambrian formations.

Ordovician

In Zone 1, there is 6,700' of massive sandstone, shale, limestone and dolomite unconformably underlying 5,000 - 10,000' of thin bedded sandstone and shale, with minor conglomerate, arkose and limestone. Some lava flows and pyroclastics are represented in the Humber Arm Series.

In Notre Dame Bay, of Zone 4, there are great thicknesses of lava flows and pyroclastics, with interbedded black graptolitic shales, which have been definitely determined as Middle Ordovician in age. Sampson, (24) at Burnt Arm, finds a pillow lava with fossiliferous limestone in the spaces between the pillows. These fossils date the formation as Cardoc, or Upper Ordovician. Eardley (9) states that these volcanics and those in central Newfoundland resemble, in many respects, the Ordovician Amonoosuc volcanics of New Hampshire. Baird (1) finds that the Snook's Arm volcanics are underlain, underconformably, by red shales and sandstones which may be Lower Ordovician or older. Christie (4) reports Lower Ordovician brown shales and sandstones in Zone 5 at Snooks Harbour.

Silurian

Rocks of this age have been recognized only in the central belt, or Zone 4. Twenhofel and Shrock (32) mapped a band of clastics in the Exploits River Valley near Grand Falls as Silurian. Recent work has shown that the fossils were contained in pebbles of a conglomerate and hence the rock is younger than previously supposed. It was then correlated by lithological similarity with the Sprindale Formation by Espenshade (10), who placed it tentatively in the Silurian. It is now given a Devonian Age by Hriskovitch (17) and Kallioski (18) of the Geological

Survey of Canada. Twenhofel (30) considers it as possibly of Mississippian age. In regard to the confusion concerning Silurian rocks the writer concurs with Eardley (9), who states, "It seems more logical to regard the central belt as one of continuing but intermittent volcanic activity into and through the Silurian".

Devonian

Definitely dated Devonian sediments occur only in the west of Newfoundland or Zone 1. The Clam Bank series on the Port au Port Peninsula is of Lower Devonian age, and consists of red conglomerates, sandstones and shale. They are in places flat lying and in others steeply tilted. In La Poile Bay area of southeast Newfoundland, Dorf and Cooper (8) found Devonian plant impressions in the Bay du Nord series which had previously been thought to be Pre-Cambrian in age. As mentioned under "Silurian", the Springdale series, in Notre Dame Bay and Exploits River Valley areas, may be of Devonian age.

Carboniferous

Clastics and evaporites of Missippian age were laid down in the White Bay and Grand Lake districts of Zone 1, while a small amount of poorly consolidated red clastics are noted by Newhouse (21) on the north shore of Red Indian Lake in Zone 4. The Pennsylvanian is represented on the Port au Port Peninsula by a series of clastics.

Regional Structure

Newfoundland, being the northeastward extension of the Appalachians, has undergone very similar tectonic history. Although the ages of great orogenic movements correspond in Newfoundland with those of the rest of the Appalachians there is a difference in the degree of intensity and in the type of deformation. Thus, periods of great folding in Appalachian time in the southern states, are manifest by thrust faulting in Newfoundland.

Eardley (9) has recognized nine orogenic phases on the island which are here briefly summarized.

1. Early Cambrian Phase

    Slight uplift is noted from an unconformity in the Cambrian at Trinity Bay in Zone 5.

   Late Cambrian Phase

    In the Burin Peninsula, of Zone 5, a slight uplift occurred before Ordovician strata was laid down.

2. Early Ordovician Phase

    Sharp uplift of the Canadian Shield resulted in thick clastics and later carbonates in Zone 1. 6,000' of fine clastics were deposited in eastern Newfoundland but their source is not clear. After early Ordovician the whole of the central belt became the site great volcanic activity.

3. Mid-Ordovician Phase (Cow Head Orogeny)

On the west coast, thrust faulting caused the Cow Head Breccia while vulcanism was active in the east. Before the end of late Ordovician 5,000' - 10,000' of clastics were deposited on the west coast.

4. Late Ordovician Phase (Taconic Orogeny)

An angular unconformity between Ordovician and Silurian is only found in the Rencontre formation in Fortune Bay. The ultrabasic intrusives of Newfoundland intrude the Ordovician and according to Snelgrove (25) are related to those of the Quebec - Gaspe Taconic belt. Cooke (6) states that the ultrabasics of Quebec are Pre-Silurian.

5. Late Silurian Phase (Caledonian Orogeny)

The Clam Bank conglomerate of the west coast and the Great Bay de L'Eau conglomerate of Fortune Bay, both of early Devonian age, indicate a rapid rise of the Labrador coast to the west and of the Avalon Peninsula to the east. In Notre Dame Bay a great orogeny is indicated because, (a) the Devonian and Mississippian rocks are similar lithologically; and (b) the amount of deformation of these rocks is less than the older ones. Some of the granitic intrusives may also be of this age.

6. Late Devonian Phase (Acadian Orogeny)

Mississippian clastics of Zone 1 indicate a rapid uplift nearby and have themselves suffered little deformation. No contact between the Mississippian and Devonian has been found but granite is definitely found to intrude sediments of lower Devonian age. Hence, many of the granite batholiths of Newfoundland are probably of this age.

7. Mississippian Phase

The deposition of the Anguille conglomerates in the St. Georges Bay, and the Pliers conglomerate of Groais Island, both in Zone 1, indicate a sharp uplift of the Long Range mass in early Mississippian time. Eardley (9) states, "The Springdale clastics in the Notre Dame Bay area, if correctly dated, indicate orogeny nearby". Betz (3) places the Springdale in the Mississippian in the White Bay district, but Hriskovitch (17) reports numerous xenoliths of the Springdale formation in a presumably Devonian granite. If this is true then the Springdale is post-Silurian and pre-Upper Devonian.

8. Early Pennsylvanian Phase

This is indicated by coarse red clastics of the Barachois Series in the Bay St. Georges area, overlying the finer grained Lower Mississippian, Codroy formation.

9. Post-Early Penhsylvian Phase (Appalachian Orogeny)

The major fault zone, striking northeast through Grand Lake, cuts the Barachois series of early Pennsylvanian age. Betz (3) states that this is an expression of the northern extension of the Appalachian orogeny and that the faulting is recognizable in the parallelism of escarpments over much of Newfoundland.

The most intense folding in Newfoundland occurred in the central belt or Zone 4. It was probably due to compressive forces between the rigid Pre-Cambrian masses of the Avalon Peninsula and the Long Range Complex. Folding occurred between Ordovician and early Mississippian time but a precise dating is difficult. Silurian fossils in the pebbles of a conglomerate near Bishop Falls is evidence for folding in late Silurian or Devonian time. Nearly vertical early Devonian strata in the southwest of Newfoundland indicate that some folding must have occurred in late Devonian time or later.

The regional trend of the folds is northeast although many variations from this probably occur. The folds are often isoclinal and overturned as reported by Heyl (16, P. 17) in the Bay of Exploits Area, and by Baird (1, p.208) in the Burlington Peninsula.

Since Appalachian time there has been almost continuous erosion and two periods of glaciation, as described previously under "Glaciation".

II Local Geology

General Statement

The areas examined for this report cover contacts between two granites adjacent to the central belt, or Zone 1, described on page (17). Although the areas are not adjacent, a cursory examination of the intervening rock was made so that a general picture of rock types across the belt was obtained.

The volcanic rocks have compositions ranging from basalt to rhyolite with interbedded tuff, agglomerate, chert and volcanic grit. They have all been folded, faulted and intruded by igneous rocks ranging from gabbros to grantes. There has been considerable metamorphism of the volcanics near the granite contacts where hydrothermal solutions have injected many quartz stringers. The regional trend in the area is northeast but locally wide deviations are found. These aberrant strikes are more common in the sedimentary types than in the volcanics.

The volcanic formations in the Buchans Junction Area show similar contact relations to the nearby granite batholith and approximately on the projected strike of the Buchans Series of Newhouse (21). They are similar rock types and it is proposed that the same name be applied to the volcanics of the Buchans Junction Area.

The name Victoria River Series is proposed for the formations south of the Red Indian Lake basin and north of the granite to the south of the Noel Paul Brook. A further division will probably be made when more detailed work is done to the east.

There are three main acidic intrusives in the areas, two granites of batholithic proportions forming the boundaries of the central trough, and a syenitic mass southeast of Millertown Junction. On the accompanying map, the last occupies only 30 square miles but will probably be shown to be part of a larger mass including Skull Hill and a granite mapped by Kalliokoski (18) north of the C.N.R. tracks. The names, Mary March batholith for the granitic and dioritic complex north and south of the C.N.R. tracks to the west of Millertown Junction, Skull Hill intrusive for the mass southeast of Millertown Junction, and Boyd's Pond batholith for the granite south of the Noel Paul Brook, are here proposed.

The Mary March and Boyd's Pond granites are younger than the volcanics. The contact of the Skull Hill intrusive could not be found because of a thick mantle of glacial drift. The granitic intrusives are assumed to be of late Devonian age as in other places of Newfoundland although no positive dating is possible.

Intrusive masses of gabbro and diorite are found in both of the areas but are much more abundant and have more topographic relief in the Ambrose Lake Area. In the latter area they are hard, massive bodies; younger than the volcanic and sedimentary rocks and usually having a roughly elliptical outline. They are assumed to be older than the granites although again, no positive proof is possible. Baird (1) reports gabbros and diorites similar to these which, he states, are definitely younger than the ultrabasics but unfortunately the latter cannot be dated more accurately than post-Ordovician and pre-upper Devonian.

Some fine grained diabasic dikes were noted cutting the volcanics on and near the Mary March River, nowhere however, were they found to intrude the granitic rocks.

Outcrop numbers mentioned in the text, such as B56'50, represent specimen number 56 collected in the summer of 1950. Their locations may be found on the accompanying maps.

A Buchans Junction Area

Buchans Series

Distribution

The vocanic rocks of this series occur everywhere south of the granite contact which trends northeasterly through Seal Pond and swings northward into the outlet of Joe Glode's Pond.

Description of Formations

Volcanics

Fig. 3. Banded chert between an andesite and a basic tuff, near Rowsell's Siding.

Fig. 4. Overturned pillows at B111'50, to the west of the Mary March River.

Basic Flows

The oldest rocks of this series consists of dark green basaltic flows, coarse flow breccias, some interbedded agglomerate and basic tuff. Bedded chert is absent at the base of this formation possibly due to subaerial deposition. The individual flows vary in thickness from one foot to ten feet and are clearly distinguished in the exposures at B90'50, near the Mary March contact. The tops of the flows are sometimes fragmental; the bases commonly have coarse flow breccias with ellipsoidal fragments up to 6 inches in length. Pillow structures are not as common in the lower flows as they are near the top of the series. It is of interest to note how frequently the basic flows are pillowed when they are associated with chert and waterlain fragmentals. A subaqueous origin is suggested but not necessary, because erosion and sedimentation would be taking place concommitantly with vulcanism. Sampson, (24) in the Notre Dame Bay area, found fossiliferous Ordovician limestone interbedded between pillow lavas, clearly suggesting a subaqueous origin in that locality.

In hand specimen the individual flows vary considerably in grain size from coarse to fine and in color from light green to dark grey. In some cases, notably at B101'50, one mile east of the Mary March River, the lava is massive, porphyritic and almost black in color but a thin section of the rock shows the phenocrysts to be oligoclase and the rock type a dacite. These lower flows exhibit increased elongation of the pillows and fragments as the contact with the Mary March batholith is approached. In all cases shearing is parallel to the contact.

The total thickness of the flows is estimated at 5,000' but this thickness could vary widely due to irregularities of the surface at the time of extrusion. The strikes in this area are 060T and the dips are generally steeply northwestward or vertical.

At Millertown and on the south shore of Red Indian Lake, most of the pillow lavas are a deep red color while the more massive flows are green. Many top determinations were made from pillows south of Warfords Pond and in every case the tops faced towards the northwest.

At a point one mile north of Millertown, among the basic flows, there are several small exposures of a very fine grain, light grey, heavily pyritized rhyolite. This band must lens out in a short distance, however, as no similar rock is found on Warford's Brook to the west.

Along the shore of Red Indian Lake, near Millertown, the red coloured basaltic rock contains some bands of flow breccia showing elongation of the fragments approximately parallel to the shoreline. East of the town the rock is massive, dark green andesite containing some carbonate and pyrite. Pillows, on the southeast side of the lake, are conspicuously absent.

On the Mary March River, about two miles north of its confluence with Joe Glode's Brook, are several exposures of basic flows. One of the flows has a distinctive mottled texture and a light green colour not seen elsewhere. Pillows are found a mile farther upstream near the contact with acid flows and tuffs. An andesitic flow outcropping near Rowsell's Siding, is overlain by banded chert beds (see photo) which in turn are overlain by a dark red and green cherty fragmental. The andesitic formations are here overlain by a light green dacite which, in turn, underlies a coarse volcanic grit. This is a common sequence in the area.

Rhyolite and Pyroclastics

Rhyolites flows, seen outcropping on the banks of the Mary March River, are light grey in colour, fine grained and have a distinctive orbicular structure. Associated with them are porphyritic flows having phenocrysts of quartz and albite set in a very fine grained groundmass of quartz and feldspar. Interbedded with the flows are quartz rich tuffs and agglomerates (see photo). The latter have a very distinctive, knobby weathered surface on which a rude stratification can be seen. The tuffs are usually medium to coarse grained while the agglomerates contain bombs up to six inches in length.

No top determination could be made on these rhyolites or pyroclastics but from their relation with the pillowed lavas the tops appear to face to the south. Locally, then, almost 4,000' of acid flows and tuffs occurs between a lower and an upper band of pillowed andesite but in linear extent the lens is only four miles.

Total Thickness

If the broad synclinal structure proposed for the area north of Red Indian Lake is correct, (p.37), then the total thickness of the Buchans Series volcanics is at least 12,000'.

Sediments

The youngest formations in the syncline are folded, bedded cherts, fine grain tuff, and coarse, greenish grit. The beds vary in thickness from 1 inch to 3 feet and in most cases are persistent over several hundred feet of strike length. The grits weather to a light buff color but on a fresh surface there is generally a greenish cast with spots of red chert. The fragments range in size from minute up to a quarter of an inch. No sorting or graded bedding is in evidence. Calcite is present as an interstitial cement in most of the grits. Some beds, having a high percentage of calcite, are so deeply weathered that fresh specimens could not be obtained. The chert beds are thin bedded, very fine grained, usually having a buff to reddish color but in places are greenish.

The sediments to the east of the Mary March are similar to those just described except that there is some thinly bedded, fine to medium grained, feldspathic sandstone near the southern tip of the band.

A good exposure of the sediments occurs near the railroad bridge at Buchans Junction and the following sequence was obtained;

5. 12' Coarse, mottled grit
4. 4' Dark green grit
3. 15' Banded chert
2. 10' Very fine grained, sheared tuff
1. 50' Fine Grained, green andesite

Age

The age of these sediments seems to be younger than the andesites and dacites. Interfingered sediments and lavas half a mile southeast of Warford's Pond, suggests that deposition of the sediments and lavas was in part contemporaneous.

Red Shales

The red shales one and a half miles southwest of Buchans Junction were not mapped by the writer and their relation to other rocks in the area is not known.

Intrusive Rocks

The Mary March Granitic Batholith

The rocks included in this igneous mass range from gabbros and amphibolites to quartz-rich granites. Along the contact with the Buchans series volcanics, the granite shows a primary foliation which is parallel to the contact. The foliation is believed to be primary because the quartz grains are very elongated but fracturing is not apparent. (Turner p.153)(Harker p. 291).

Just north of the C.N.R. tracks, at outcrop B232A'50, the granite is massive, coarse grained and pink on both fresh and weathered surfaces. It contains about 50% quartz, 40% potassic feldspar and a little biotite.

To the southwest, undelying Mount Blanche, the rock is a dark grey, fine grained diorite or in places a gabbro. The diorite contains many pegmatite and aplite filled, irregular fissures suggesting that it is the result of block stopping of a large body of basic country rock.

Farther west, near the bridge over Patrick's Brook, the rock is medium grained and reddish green in color. It contains abundant yellowish feldspar, found in thin sections to be oligoclase, and only a very small amount of quartz. The quartz occurs as a graphic intergrowth in the groundmass. Quartz monzonite is the name given to the rock.

A mile and a half to the south, on the Mary March, the granitic rocks are highly sheared and have been intruded by dikes of porphyritic monzonite. The dike is similar to the rock at B102B'50, a marginal phase of the Skull Hill intrusive. If the two have the same origin then the Skull Hill intrusive is younger, in part, than the Mary March complex. Near the dike there is a band of gabbroic rock which, because its trend is parallel to the surrounding sheared granites, is thought to be a down faulted meta-volcanic.

Three volcanic inclusions were noted at distances varying from a half a mile to four miles from the contact with the Buchans series. These inclusions suggest that the batholith has not been too deeply eroded. In all cases the inclusions are highly sheared and usually are altered to amphibolite.

Skull Hill Syenitic Intrusive

In contrast to the Mary March batholith (p.33), this intrusive stands in relief above the Buchans series volcanics. It is a comparatively homogeneous mass with few acidic stringers and no xenoliths. It is fine to medium grained and has a distinctive brick red color. No quartz is seen in the hand specimen but in thin section it is visible as a graphic intergrowth with both pottasic and plagioclase feldspars. This intergrowth is common to all thin sections of this intrusive. In the field it was mapped as a syenite but a more accurate name for it would be a quartz monzonite. In places the quartz monzonite is porphyritic with phenocrysts of plagioclase up to an $\frac{1}{8}$"in length.

Dark minerals form a low percentage in the rock but magnetite is present in amounts up to 10%. Fracture zones are common and generally strike about 070T.

Gabbroic Intrusives

These basic intrusives are limited to a few small exposures to the east of the Mary March River; and two exposures to the north of the Buchans Railway tracks, near the western boundary of the map.

The rock is massive, unjointed, smooth weathering, and usually a dark grey color on the weathered surface. On the fresh surface it is coarse grained with a generally greenish cast but having yellowish laths of plagioclase feldspar. The outcrops are elliptical in outline and the trend is parallel to the regional structure. No actual contact was seen between the gabbros and the volcanics in this area but they were located to within five feet. No noticeable metamorphic effects were observed in the intruded rock.

One interesting observation about these intrusives is that they occur 3 miles from the contact between the Buchans series and the Mary March batholith. Basic sills intrude the volcanics at the Buchans mine, which is also 3 miles from the contact. In the Ambrose Lake Area (p.52) the first basic intrusives outcrop 3 miles north of the contact between the Boyd's Pond Batholith and the Victoria River

Series. The significance of this distance is not known but it is at least an interesting coincidence.

Trap Dikes

A few basic dikes and irregular chonoliths cut the acid tuffs and porphyritic flows on the Mary March River. Two others were found near Rowsell's Siding and one at B100'50. The dikes are less than 4 feet wide and all have a southeasterly strike.

Structural Geology

Folding

From top determinations which include pillows, amygdules and inclusions of underlying flows, the structure to the northwest of Buchans Junction is a syncline. The fold appears to be overturned but an accurate determination of the attitude is difficult because of minor faults and folds. The axial line trends roughly 060T, with a slight plunge to the southwest. The dips on the limbs of the fold are seldom less than 45° and are commonly between 75° and 80°.

Shearing and Foliation

The competency is variable between rock types. The basic flows are the most readily sheared as shown by the elongation of the pillows south of the contact with the Mary March granite. The grits, cherts and rhyolites are quite competent and seldom show any pronounced shearing.

The younger andesite flows on the Mary March River and the sediments to the east are both about the same distance from the granite contact. The andesite is highly sheared while the sediments are but slightly altered.

The flows on the south shore of Red Indian Lake are sheared at 030T but the width of the zone appears to be quite narrow. Flows a few hundred feet back from the shore are massive and unaltered.

The regional schistosity approximately parallels the bedding and flow contacts at about 050T to 060T. 2 miles west of the Mary March River, however, there is a gradual swing to 030T, while to the east of the river the bedding of a band of sediments if 000T to 020T. These strikes may be caused by movement somewhere near the Mary March River in which the western block moved to the south.

Faulting

Faulting in the area is complex but because of the lack of well defined horizons little can be told of the relative movements.

North-South Faults:-

On the Mary March River there is a set of vertical faults striking north-south. Horizontal slickensides were observed on one fault face and minute stoss and lea structure suggested that the final movement of the west block had been southward. This corroborates the relative movement suggested under "Shearing and Foliation".

Northeast-Southwest Faults:-

It is most probable that there has been faulting parallel to the regional shear and bedding of the area. Betz (3) proposed that high angle thrusting was caused by a northwestward directed force originating in the south-east of Newfoundland. He further maintains that many of the northeast trending cliffs are actually fault scarps formed in late Paleozoic time. The relative movement, in this case, would be for the south block to move upward. In the Buchans Junction Area, however, there is no evidence of the relative movement.

Near the bridge at Buchans Junction, well bedded sediments are dragged on the northwestern side of a shear zone. Unsheared chert and grit strike and dip at 160T 60W and abut against a highly sheared greenish grit which strikes at 030T. The unaltered rocks being north of the shear zone indicate that the northern block moved north-eastward.

B Ambrose Lake Area

Victoria River Series

Distribution

The rocks of this series underlie all the land south of the Victoria River and north of the Boyd's Pond Batholith, except those areas underlain by basic intrusives.

Fig. 5. The Harpoon Hills are to the right of centre on the horizon. The photograph was taken from the granophyre ridge looking northwards.

Fig. 6. An inter-flow breccia in andesites at B44'51. The top is towards the right hand side of the photo.

Fig. 7. Coarse agglomerate at B63'51, showing the various sizes of the volcanic ejectamenta.

Description of Formations

Volcanics

Basic Flows

The andesites and basalts in this area occur in narrower bands than in the Buchans Junction Area. They seldom exhibit the massive character common to the thick flows to the south of the Mary March batholith. The band of andesite extending from Black Creek, in the northeast corner of the map sheet, southwestward to the Victoria River is, in most places, a deep reddish to purplish flow. Pillow structures are commonly elongated and good top determinations from them are rare. An inter-flow breccia exposure was studied at B 44'51 (see photo) and provided an excellent top determination. The contact is between a coarse grained, porpayritic basalt on the north and a fine grained andesite, containing fragments of the former, on the south. There are a few bands of intercalated coarse grained, cherty breccia but at no place was seen the reddish banded chert commonly associated with the basic flows in the Buchans Junction Area.

A mile to the south there is another band of dark, rusty weathering, basaltic lava. It is a highly scoriaceous and ropey flow with some very small, bun shaped pillows. The flow appears to lens out or to be faulted and later eroded. To the east, on the projected strike of the basalts, scattered exposures of slates and tuffs were found but no basic flows.

South of the Harpoon Hills is a band of green to reddish andesites showing occasional good pillow structure. One characteristic and persistent flow in this band is easily recognized by its high content of rusty weathering ankerite. It is presumed that these flows are intruded by the Harpoon Hill gabbro to the north, although the contact was not seen. If the gabbro is intrusive into the andesites, then it is likely that they are the same flows which occur as included bands in the diorite and gabbro on the west side of Ambrose Lake.

Another band of andesite underlies the northwest shore of Lake Douglas, Haven Steady, and the Noel Paul Brook. It is generally more massive, finer grained and thinner bedded than the other basic flows in the area. Some pillows were noted. The thickness of the individual flows in one exposure north of Lake Douglas was observed to be three feet and containing no visible flow structure.

Farther east, on the north bank of the Noel Paul Brook, the rock may be the equivalent of these flows but it is so highly schisted that any original structures have been obliterated. The schist is light green in color, composed of chlorite, sericite and quartz and in most cases showing a fine crenulate structure. The acidic nature of the rock may be due to secondary quartz emanating from the Boyd's Pond batholith, two miles to the south.

The band of andesite south of Dinny's Pond is rather speculative as it is based on only three widely spaced exposures.

Acid Flows

A considerable area to the west of Ambrose Lake is underlain by porphyritic rhyolite flows. On the fresh surface the rock is a light grey or sometimes bluish color and weathers to a grey or white. The groundmass is very fine grained to glassy enclosing quartz eyes up to ¼" in diameter. In places the rhyolite is sheared and in which case it contains a moderate percentage of disseminated pyrite.

The rhyolite flow overlying the northern andesitic flow is different from the rock just described in that it is less massive and contains spheroidal buns up to a foot in length. There is one intercalation in this flow of tuff and agglomerate making the band quite similar to those acid tuffs and flows on the Mary March River in the Buchans Junction Area.

Sediments

Shale, Grit, Tuff, & Agglomerate

A considerable thickness of mixed cherts, agglomerates and waterlain grits underlies the pillow andesite in the northern part of the map. The beds vary from six inches to six feet in thickness. They are persistent in some cases over an estimated 500 feet. There does not appear to be any sorting within the beds so that deposition was rapid and transportation distance was short.

Farther to the north, according to other Buchans Mining Co. geologists, these massive coarse clastics are interfingered with dark grey to black shales. Similarly to the south, bands of coarse grit, tuff and occasionally agglomerate occur in alternating beds with a black, fine grained shale. The thickness of the shale beds varies from one inch to eight inches. This is particularly well shown at outcrop B24'51, where a thin section was made showing the sharp contact between the shale and the grit. The source of these sediments is not known but they are reported by Hriskovitch (17) and by Heyl (16) to the northeast. One possible explanation is that they are the result of rapid fluctuations of a stagnant sea on the margins of which were being deposited thick, coarse pyroclastics, and the erosion products of such pyroclastics.

Conglomerate

Overlying the andesite flows to the south of the Harpoon Hills is a band of reddish conglomerate. It is made up of boulders of the underlying andesite and other fine grained acidic volcanics. The pebbles vary in size from a fraction of an inch up to 8 inches and are cemented by a light buff, feldspathic material. The pebbles are usually well rounded and commonly exhibit the brown varnish, common to fluvial sediments. The thickness of the conglomerate is approximately 2,000 feet. It has been mapped to the west of this map sheet by MacDonald (19), who shows the outcrop width increasing to approximately two miles.

Sandstone

South of the conglomerate is a band of sandstone approximately 3,000 feet wide. No contact relation with the conglomerate was seen but it is assumed that the sandstone is younger. This assumption is based on the south facing top determinations made on the underlying conglomerate and andesite. The sandstone is a light, pinkish, buff color and weathers to a light cream. It is a fine to medium grained rock with more or less equidimensional quartz grains and fresh feldspar fragments. It is very thinly laminated but no cross bedding was observed.

Pyroclastics

Pirsson (23) points out that it is often difficult to draw a sharp line of distinction between pyroclastics and sediments. Hence, certain of the pyroclastics have been described under "Shale, Grit, Tuff and Agglomerate" because of their close association with the sediments.

Some definite volcanics occur south of Lake Douglas and the Noel Paul Brook but much of the rock is so highly sheared and altered by hydrothermal quartz injections that the original nature of the rock is difficult to determine. Between Lake Douglas and Haven Steady there is a contact between an andesitic flow and a quartz-rich tuff. The andesite, however, is but little metamorphosed while the tuff has been altered to a sericite and quartz schist. This suggests either a fault contact or an unconformity. Southward the tuff gives way to a coarse agglomerate which abuts against the granophyre dike at B195'51. One and one half miles to the south there is another exposure of agglomerate which, because of its limited extent, is assumed to be a lens in the surrounding tuffs.

At the outlet of Boyd's Pond, there are strong, hard, fine grained, quartz-rich beds, about eight inches thick, intercalated with a light buff, sericitic schist. The beds are described as a quartz-rich tuff because there is no sorting within the beds. No metamorphic minerals, common to pelitic rocks, were seen in the schists of this area. Any sediments are thus assumed to be derived from pyroclastics.

There is much injected quartz in this area but it contains no associated metallics. There is some disseminated pyrite and pyrrhotite at the contact between the granophyre dike and the volcanics.

Some bedded cherts and tuffs occur northwest of the Harpoon Hills but the relation of these sediments to others in the area is obscure. East of the Harpoon Brook they are thin bedded, light grey to black cherts interbedded with coarse grained tuffs. The sediments strike at about 130T and dip 45E. Farther west, beyond the Harpoon Brook are exposures of thick bedded, very fine grained, medium grey cherts dipping to the north.

Correlation of Sediment and Volcanics

Thirty miles to the east, Hriskovitch (17) has mapped an area in which the geological succession is interpreted by him as follows:

Age	Formation	Rock Types
Devonian ?	Springdale	Red sandstone and shale Yellow sandstone Conglomerate
	Unconformity	
Mid-Ordovician	Fortune	Rhyolite, tuff, minor sandstone, shale.
	Breakheart Basalt & Mortons Volcanics.	Basic to acid lavas
	Sivier	Slate, greywacke, minor flows.

He states that the pebbles in the Springdale conglomerate are composed mainly of the underlying equivalent of Heyl's (16) Breakheart Basalt and Mortons Volcanics. The conglomerate grades into a yellowish sandstone which in turn is overlain by red sandstones and shales.

South of the Harpoons we have a similar sequence up to, and including the sandstone. The sandstone is in contact with a chloritic schist just north of the Noel Paul Brook. The relationship of these formations will be discussed under "Structure".

In the Bay of Exploits Area, eighty miles to the northeast, the generalized section given by Heyl (16) of the rocks of Normanskill age is as follows:-

Age - Ordovician

Series - Exploits

Formation	Thickness	Rock Type
Fortune	600 - 1500 feet	Bedded red and green cherts, tuffs, cherty shales. Radiolaria.
Lawrence Harbour Shale	400 "	Shales, black shales. Graptolites of Normanskill age.
Breakheart Basalt	300 - 1500 "	Basalt flows, pillow lavas.
Mortons Volcanics	0 - 1500 "	Andesite and dacite flows and tuffs.
Sivier	3000 "	Blue grey slates and shales with some greywacke and abundant volcanics. Some black shale, one zone near top contains Normanskill graptolites.

In the northern part of the Ambrose Lake map sheet, the north limb of a syncline is postulated. The section is as follows:-

Victoria River Series

Thickness		Rock Type
2,000	feet	Shale, tuff, minor agglomerate
0 - 700	"	Rhyolite
300 - 2,000	"	Basalt and pillow andesite
2,000 - 4,000	"	Coarse agglomerate, grit and chert
?		Shale and tuff

Very generally, both series may be described as having an initial period of deposition of tuff and shale followed by a period of basic extrusions. Later there was intermittent deposition of shale and pyroclastics.

Intrusive Rocks

Distribution

The Boyd's Pond batholith is south of an irregularly curved line trending northeastwards through Boyd's Pond, Centre Pond, and Loon Pond. Roughly parallel to this line and two miles to the northwest is a granophyre dike up to 400 feet wide and at least two and one half miles long.

There are two main gabbroic intrusives, one underlying the Harpoon Hills and the other the Highland Pond

Ridge, near the northern boundary of the map. Minor offshoots of these masses occur and several smaller bodies are found near the western boundary of the map.

Boyd's Pond Granite Batholith

The Boyd's Pond batholith in contrast with the Mary March batholith, is a fairly homogeneous intrusive. It grades from a white, fine grained, granular rock at the contact to a gneissoid (Grout p.38) porphyritic granite near Gull Pond. The gneissic structure appears to be primary and is everywhere parallel to the contact. Some jointing planes have been developed however which are at right angles to the contact. The joints are numerous enough in places to give the rock a sheared appearance. The structure of the intrusive is very clearly shown in the aerial photographs north of Gull Pond. On the ground the rock shows a good example of primary flat lying joints, as described by Cloos and Balk (2). The porphyritic granite has a parallelism of biotite flakes but the large (½ inch), salmon pink phenocrysts of microcline are turned at various angles to the schistosity. Acidic, and in places pegmatitic, stringers and veins cut the granite, apparently in the last stages of cooling. One possible xenolith was noted about 2 miles from the contact with the Victoria River Series. The rock has been completely metamorphosed to a quartz biotite schist.

The granite at Mile 15, on the western boundary of the map is quite different from the main mass. It is a bright red and green color on the fresh surface and lacks the S-planes so visible at Gull Pond. It is a massive, coarse grained, perthitic, biotite granite. This granite's relationship with the rest of the Boyd's Pond batholith is not known.

In the southeast corner of the map sheet there is a sudden change with a visible lineament between the fractured pink granite to the north and a lower lying, smooth weathering, unjointed granite to the south. The latter is a dark grey weathering, biotite granite and is light grey on the fresh surface. It is medium grained, equigranular and is very homogeneous over the area exposed. This grey granite appeared in the field to be older than the pink granite but a study of thin sections shows the opposite to be true. The pink granite, at B188'51, shows great alteration of the plagioclase feldspars, addition of fresh microcline and chloritization of the biotite. The grey granite at B177'51 has fresh feldspars and biotite. The grey granite, massive on casual inspection, reveals a parallelism of the biotite grains. This gneissic structure is also parallel to the contact with the pink granite.

Granophyre Dike

This acid intrusive stands up as a high, rusty coloured ridge on the south shore of the Noel Paul Brook between Haven Steady and Lake Douglas. The rock is fine grained, hard, massive, light to dark grey on the fresh surface and weathering to a dark grey and sometimes reddish color. The granophyre breaks into large rectangular blocks on the cliff faces, which readily distinguishes it from the intruded, schistose tuffs. In hand specimen, small phenocrysts of feldspar are visible, but it is only under the microscope that the granophyric texture of the groundmass becomes evident. There are fine dark streaks through the rock which in some specimens shows a decided flowage. These were found to be minute stringers of biotite and magnetite. Blebs of pyrrhotite are common, especially near the margins of the dike.

Basic Intrusives

The Harpoon Hills are underlain by a coarse grained gabbro. The gabbro extends westward beyond Lake Ambrose, where it occurs as concordant sills into the surrounding volcanics. The rock is similar to gabbros already described but has a somewhat coarser grain. Segregations rich in magnetite and disseminated pyrite are common. The magnetite in the most westerly of the Harpoons is sufficient to cause an error of up to 45° in a Brunton compass. Near the fire tower, on the highest hill, there is a 5 foot band of very fine grained cherty rock which may be a baked inclusion of country rock. Near, the contact of the chert, the rock is a fine grained, banded, green, serpentinized micro-breccia containing some pyrite blebs. The chert band, the most prominent fracture planes, the contacts of gabbro and flow rocks on the west side of Ambrose Lake, and the general trend of the hills all strike at 090T. Hence the intrusive is slightly discordant in relation to the regional shear of 080T.

At Highland Pond Ridge, the rock varies between a medium grained, green "diorite" and a coarse grained, brown "gabbro". Both rocks were later found to have no feldspars more calcic than oligoclase and hence might properly be called mela-monzonites. The rock is somewhat altered by the introduction of albite and a small amount of quartz.

The country rock to the north of the intrusive is a highly sheared black slate and to the south it is a finely banded tuff. Inclusions in the mass, however, are andesitic in composition.

A small body of olivine diorite occurs at B25'51, to the southwest of Highland Pond Ridge. It may be a more basic facies of the neighbouring monzonitic intrusive.

Several small, concordant, basic intrusives cut acid tuffs and agglomerates near the western boundary of the map. The intrusives in the main are partly serpentinized olivine gabbros. Two contacts between the gabbros and tuffs were observed and in both cases the alteration amounted to only a few inches of intense shearing and a very minor amount of pyrite mineralization.

Structural Geology

Folding

Top determinations in the lavas and in the sediments (see photos), in the northern part of the map sheet, indicates a northeast trending, asymmetrical syncline which extends from west of Black Pond to the Victoria River. Near the Victoria River the southern band of basaltic flows is close to the synclinal axis while the northern band of basic flows is 4,000 feet to the north. Thrust faulting may have caused the southern band to move over the younger shales and tuffs. This is illustrated in the structure section AA on Plate 1.

There is evidence of another syncline in the southern half of the map sheet between the Harpoon Hills and the Noel Paul Brook. The sequence of the northern limb is andesite, conglomerate and sandstone but it is not repeated to the south of the Noel Paul. Hence, the writer believes that the southern limb was thrust faulted upward and later eroded.

Shearing and Foliation

The competencies of the rock types in the area are variable. The shales are the most easily deformed and are usually altered to slates or, in some cases, to sericite schists. The shales are followed in order of increasing competency by tuffs, andesites, coarser clastics and finally the cherts and agglomerates.

The strongest shearing in the area has occurred between the Noel Paul Brook and the Boyd's Pond batholith. Original structures are only seen in an acidic agglomerate at B133'51 and in the quartz-rich tuffs previously mentioned.(P.43). The schistosity of the tuffs near the batholith is always parallel to the contact between the two. This is well illustrated at the north end of Veneer Pond where a tongue of schist extends southward into the granite mass. This tongue has a gradational contact with the granite. The schist grades gradually into a biotite-rich gneiss near Veneer Pond and westward into a gneissic granite.

Faulting

Recognition of faults in the area was difficult because of the extensive overburden and the lack of well defined horizons.

The strike of the local shear in the vicinity of the Harpoon Hills is shown on the accompanying map at 090T. The 130T strike of the sediments to the north of the gabbro intrusive suggests that they may have been dragged into that position by movement near the contact of the intrusive.

Some fracture planes striking east-west were noted in the gabbro mass itself suggesting post-intrusive movement. The micro-breccia, however, indicates that intrusion and some movement were concomitant. It is most probable that several ages of faulting have occured.

The granophyre intrusion in the valley of the Noel Paul indicates that the valley represents a former line of weakness. Evidence for faulting in the valley is shown by the sudden change from a slightly sheared sandstone, on the north, to a chlorite schist, on the south. If a fault is assumed then the strongly metamorphosed rocks are probably older than the sediments. Thus the southern block would be upthrown relative to the northern block. With pressure coming from the granitic intrusion to the south it is probable that the type of fault most likely to develop in this case would be a high angle thrust.

The alignment of the tongue of schist into the Boyd's Pond batholith; a creek one half mile west of Ambrose Lake; and a pond in the North Branch Brook, suggests that there has been either faulting or jointing in a north-south direction. Faulting along this lineament may have caused the aberrant strikes of the sediments to the north of the Harpoon Hills. A relative movement southward of the east block would cause dragging of the sediments from an east-west strike to 130T. If the lineament is projected beyond the map area, it parallels the lower three miles of the Victoria River. The Victoria Mine is located one half a mile southwest of the mouth of the Victoria River, in Red Indian Lake. The mineralized zones strike east-west which parallels the trend of Red Indiam Lake. There thus appears to be a north-south trending band in which the strikes are nearly east-west and in which there are north-south lineaments. The causative force to produce these features is, in the opinion of the writer, a large couple in which the eastern block has moved southward. These forces are illustrated in Plate II.

PLATE II

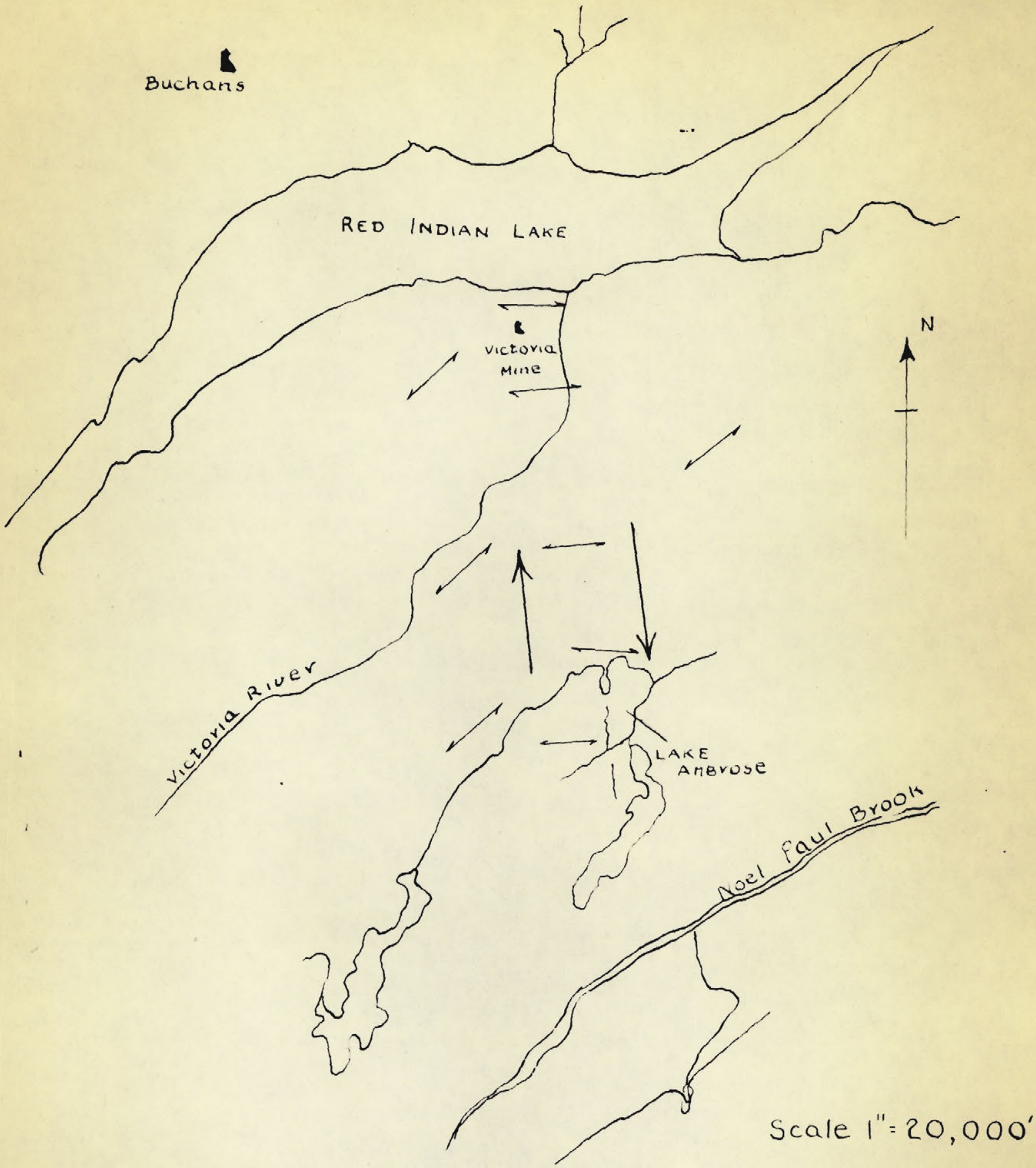


Diagram illustrating proposed N-S Couple.

Summary and Conclusions

The areas which have been described in this thesis are underlain by a band of interbedded sedimentary and volcanic rocks, approximately 25 miles wide. The band trends roughly northeast for a total length of 150 miles, and is bounded by granites on the northwest and on the southeast. The age of the sediments and volcanics in the map-areas is not known but they show a lithologic similarity to middle Ordovician formations in the Notre Dame Bay Area. The volcanic and sedimentary belt has been tentatively divided into two series, the Buchans and the Victoria River series. Both series have been tightly folded and complexly faulted.

Folding and possibly thrust faulting, accompanied by large scale granitic intrusions, are presumed to have taken place in late Devonian time. Basic intrusions are concordant with the volcanics and appear to have precedded the granites. The sedimentary and volcanic series have been laid down and folded before the intrusion of the gabbros and diorites. It seems probable then that there was great folding in the Taconic orogeny during late Ordovician, followed by intrusion of basic stocks in late Silurian time. Hence, there has been two, and possibly three, major periods of folding between the Ordovician and lower Carboniferous. The main granitic intrusives in the areas are, the Mary March batholith, the Skull Hill intrusive, and the Boyd's Pond batholith. The writer believes that the heterogeneous nature of the Mary March batholith and the slight metamorphism of the adjacent Buchans series volcanics, is evidence that the granitic intrusive has not been deeply eroded.

During the Appalachian orogeny, when great folding took place in the southern Appalachians, there was limited folding and faulting in Newfoundland. The Permian was probably a time of block faulting and tilting in the central zone.

Following the Appalachian revolution, the whole of Newfoundland was reduced to a peneplane. The time of completion of the erosion cycle, however, is not known. Uplift occurred in Cenozoic time with erosion of the weaker formations to lowlands and leaving resistant intrusives as monadnocks. After two or more periods of Pleistocene glaciation there was a submergence of all Newfoundland followed by a partial uplift of the western part of the island.

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APPENDIX

A petrographic description of some specimens collected in the Ambrose Lake and Buchans Junction Areas.

Granitic Rocks
Mary March Batholith

Specimen No. B232 A '50 Rock Type: Granite

Megascopic : Coarse grained, reddish, massive granite.

Microscopic:
Fabric: Equigranular, holocrystalline, allotriomorphic intergrowth of feldspar and quartz.

Minerals:

Essential	Feldspar	60%	Perthite intergrowth, in orthoclase. Some Carlsbad twins.
	Quartz	35%	Irregular lakes, clear
Accessory	Chlorite Magnetite	5%	Small irregular blebs

Alteration: Slight cloudiness of the orthoclase. Chlorite probably formed after hornblende.

Specimen No. B241 '50 Rock Type: Albite granite

Megascopic : Medium grained, white with slight foliation.

Microscopic:
Fabric: Equigranular, holocrystalline, hypidiomorphic intergrowth of feldspar and quartz.

Minerals:

Essential	Feldspar	50%	About an equal amount of plagioclase and orthoclase. Zones show calcic centers An10.
	Quartz	50%	Irregular clear lakes
Accessory	Chlorite Biotite	Minor	Small crystals

Alteration: Slight cloudiness of some of the feldspars and chloritization of the biotite.

Specimen B209 '50 Rock Type: Quartz Monzonite

Megascopic : Medium grained with larger yellowish crystals and some greenish blebs.

Microscopic:
Fabric: Ineguigranular, hypidiomorphic, holocrystalline.

Minerals:			
Essential	Feldspar	70%	Albite twinning gives composition of An5 to An10.
	Quartz	20%	Occurs as irregular, clear lakes and as graphic intergrowth with the albite.
Accessory	Amphibole	5%	Crystals up to 1.5mm long. Hornblende.
	Chlorite Magnetites	5%	

Alteration: Feldspars are all very cloudy. Some secondary epidote.

Specimen No. B212 '50 Rock Type: Amphibolite

Megascopic : Medium grained. speckled grey colour, slight foliation.

Microscopic:
Fabric: Inequigranular, holocrystalline, hypidiomorphic intergrowth of plagioclase feldspars, amphiboles and pyroxenes.

Minerals:			
Essential	Feldspar	85%	Mesh of plagioclase of composition An60, Labradorite. Good albite twins.
Accessory	Amphibole	10%	Irregular masses up to 2mm in length. Light green, pleochroic to yellow.
	Pyroxene	5%	Colourless, slightly fractured associated with the amphibole, in places as a core. Comp. of Leucoaugite.

Alteration: The feldspars are fresh but the pyroxenes are altered to horneblende.

Mary March Batholith (contd.)

Specimen No. B105A '50 Rock Type: Amphibolite

Megescopic : Fine grained, dark grey, foliated inclusion in granite.

Microscopic:
Fabric: Some phenocrysts up to 1mm in an eqquigranular holocrystalline groundmass of feldspar and amphibole. Preferred orienation of crystals.

Minerals:

Essential	Feldspar	40%	Phenocrysts - Some have sharp crystal outline but most are corroded. Composition An50. Groundmass - Plagioclase crystals average .15mm diameter. Composition An35.
	Amphibole	50%	Green, pleochroic with composition of actinolite. Amphiboles occasionally contain small, plagioclase filled cavities.
Accessory	Quartz		A small amount occurs with the plagioclase in the groundmass.
Varietal	Magnetite		Scattered specks

Alteration: The centres of the plagioclases are usually cloudy.

Mary March Batholith (contd.)

Specimen No. B239 '50   Rock Type: Porphyritic Monzonite

Megascopic : Yellowish phenocrysts, in a reddish fine grained groundmass. Occasional green inclusions up to 1cm. in length.

Microscopic:

Fabric: Phenocrysts of plagioclase feldspar in a semicrystalline groundmass of plagioclase, calcite and epidote.

Minerals:

Essential	Feldspar	90%	Phenocrysts - Subhedral to anhedral crystals. Composition An30. Groundmass - Lath-shaped euhedral crystals. Composition An17.
Accessory	Calcite	10%	Irregular mass surroun,ing the feldspars of the groundmass
Varietal	Epidote Chlorite		Widely scattered specks

Alteration: The feldspar phenocrysts are quite cloudy. Calcite seems to have been added as a late mineral. Some of the phenocrysts have vugs containing euhedral crystals of an unknown uniaxial mineral.

Skull Hill Intrusive

Specimen No. B102B '50 Rock Type: Porphyritic Monzonite

Megascopic : Yellowish phenocrysts in a fine grained, buff groundmass. Occasional small greenish spots.

Microscopic:
Fabric: Phenocrysts of plagioclase feldspar in a holocrystalline, idiomorphic groundmass of lath-shaped feldspars. Some clusters of epidote.

Minerals:

Essential	Feldspar	90%	Phenocrysts - Generally show albite twinning. Slightly cloudy. Composition of An15. Crystals average 1mm in length. Groundmass - Small euhedral crystals averaging .2mm in length.
Accessory	Epidote	5%	Occurs as irregular and rounded aggregates about 1mm in diameter
	Chlorite		Is associated with some of the epidote aggregates
Varietal	Apatite		A few slender crystals observed with the epidote.

Alteration: The epidote aggregates are probably the alteration product of some primary calcium-rich mineral.

Skull Hill Intrusive (contd.)

Specimen No. B66 '50 Rock Type: Quartz monzonite

Megascopic : Coarse grained, equigranular, having an even brick red colour.

Microscopic:

Fabric: Euhedral crystals of feldspar in a granophyric intergrowth of quartz and feldspar.

Minerals:

Essential	Plagioclase	60%	Euhedral crystals up to 5mm in length. All show zoning and albite twinning. Composition is An25.
	Orthoclase	20%	Occasional large crystals up to 3mm in length.
	Quartz	20%	Occurs as separate clear lakes and as a granophyric intergrowth in both orthoclase and plagioclase.
Varietal	Chlorite Magnetite		Occasional small crystals and blebs.

Alteration: The feldspar is very cloudy probably because of the introduction of micropegmatitic quartz. Note. Specimen B68 '50 is very similar to B66 '50 except that the large plagioclase crystals are not as cloudy.

Skull Hill Intrusive (contd.)

Specimen No. B53 '50   Rock Type: Quartz diorite

Megascopic : Medium grained, equigranular having a black and white speckled appearance.

Microscopic:

Fabric: Medium grained, equigranular, hypidiomorphic diorite.

Minerals:

Essential	Feldspar	70%	Euhedral crystals of zoned plagioclase having the approximate composition An50.
	Amphibole	20%	Light green hornblende, slightly pleochroic. Partially altered to chlorite in the smaller grains.
Accessory	Magnetite	5%	Small irregular grains and as tiny specks in the chloritized amphibole.
	Quartz	10%	Occurs as a granophyric intergrowth with feldspar in the interstices between the plagioclase crystals.
Varietal	Apatite		Slender crystals penetrating feldspars.

Alteration: Amphiboles are chloritized and some of the feldspars are cloudy. Cloudiness particularly near the intergrowths.

Boyd's Pond Batholith

Specimen No. B188 '51   Rock Type: Granite

Megasocopic : Pink, coarse grained, equigranular, massive rock.

Microscopic:

Fabric: Equigranular, holocrystalline, hypidiomorphic intergrowth of feldspar, quartz and chlorite.

Minerals:

Essential	Plagioclase	20%	Considerably altered but albite twinning is visible. Composition An20
	Microcline	40%	Is fresh, later than the plagioclase. Good cross hatching. Slight cloudiness.
	Quartz	25%	Clear, slightly strained, irregular lakes. Up to 5mm diameter.
Accessory	Chlorite	15%	Occurs as a pseudomorph after biotite. In some crystals is penninite. Numerous pleochroic haloes, occasional zircon cores.

Alteration: The plagioclase is highly altered. In places to flakes of secondary muscovite. Biotite is altered to chlorite as mentioned above.

Boyd's Pond Batholith (contd.)

Specimen No. B177C '51 Rock Type: Granite

Megascopic : Light grey, medium grained, equigranular, homogeneous rock. Some parallelism of the biotite grains.

Microscopic:

Fabric: Equigranular, holocrystalline, hypidiomorphic intergrowth of feldspar, quartz and biotite.

Minerals:

Essential	Plagioclase	20%	Fresh, euhedral crystals with fine albite twinning. Slight alteration near centres. Composition An15 at centres zoned to pure albite on borders.
	Microcline	20%	Anhedral, fresh,crystals. Good cross hatching.
	Quartz	40%	Irregular, clear lakes
Accessory	Biotite	20%	Strong pleochroism. Some pleochroic haloes.
Varietal	Muscovite		Occasional crystals

Alteration: A little granulation of small quartz crystals in one section. No chemical alteration.

Boyd's Pond Granite Batholith (contd.)

Specimen No. M 15 '51 Rock Type: Granite

Megascopic : Coarse grained, pale pink, biotite granite.

Microscopic:
Fabric: Inequigranular, holocrystalline, hypidiomorphic, intergrowth of feldspar, quartz and biotite.

Minerals:

Essential	Plagioclase	10%	Euhedral crystals up to 3mm in length. All show zoning. Composition of centre is An10. Pure Ab on borders.
	Microcline	55%	Large anhedral crystals up to 1cm. in length. All have perthitic intergrowth and Carlsbad twins.
	Quartz	20%	Irregular, slightly strained, clear crystals. Later than the microcline.
Accessory	Biotite	15%	Stubby, euhedral crystals. Strong pleochroism. Occasional pleochroic halo.

Alteration: The central portions of the plagioclase feldspars show some saussuritization.

Granophyre Dike

Specimen No. B195 '51   Rock Type: Granophyre

Megascopic : Medium to fine grain, grey, hard, massive rock. Tiny dark stringers.

Microscopic:
Fabric: Equigranular, holocrystalline, allotriomorphic, with occasional euhedral crystal of albite. Quartz and albite are mutually penetrating in typical granophyric texture.

Minerals:

Essential	Plagioclase	Euhedral crystals up to 1.5mm in length. Slight zoning. Composition An10 to Ab. Crystals completely surrounded by granophyre.
	Quartz	As clear, wormy intergrowths and as irregular grains.
Varietal	Biotite	Occasional tiny crystals.

Alteration: The biotite has in most cases been altered to penninite. Feldspars are unaltered.

Basic Intrusives

Ambrose Lake Area

Specimen No. B38 '51 Rock Type: Mela-monzonite

Megascopic : Dark grey, coarse grained, massive rock

Microscopic:
Fabric: Equigranular, holocrystalline, hypidiomorphic intergrowth of feldspar and chlorite.

Minerals:

Essential	Plagioclase	60%	Long lath-shaped crystals up to 1cm long. Composition An16. Crystals are often fractured and contain numerous chlorite inclusions.
	Chlorite	40%	Surrounds the feldspar crystals and replaces former crystals of probably amphibole. Often is mixed antigorite and penninite.
Accessory	Magnetite		Scattered crystals and blebs, associated with the chlorite.

Alteration: Considerable alteration of the mafics with development of chlorite and serpentine. Feldspars are only slightly cloudy.

Ambrose Lake Area

Specimen No. B25 '51 Rock Type: Olivine diorite

Megascopic : Fine to medium grained, greenish grey, massive rock.

Microscopic:
Fabric: Equigranular, holocrystalline, hypidiomorphic intergrowth of feldspar, amphibole, pyroxene, olivine and quartz.

Minerals:

Essential	Plagioclase	50%	Occur as euhedral crystals up to 3mm in length. Form an interlocking mesh. Composition An32.
	Olivine	15%	Has typical clear but fractured appearance with alteration around the borders of the crystals.
	Pyroxene	15%	Occurs as cores in the amphiboles or are surrounded by serpentine. Composition of Augite.
	Amphibole	10%	Light green borders around the pyroxenes.
Accessory	Biotite		Occasionally the amphibole shows a little alteration to biotite.
	Quartz	10%	Occurs as scattered irregular blebs.
Varietal	Apatite		A few very slender crystals.

Alteration: There has been some breakdown of the ferromagnesium minerals. The feldspars are unaltered.

Buchans Junction Area

Specimen No. B24 '50   Rock Type: Quartz Gabbro

Megascopic : Coarse grained, yellowish and black, massive.

Microscopic:

Fabric: Equigranular, holocrystalline. idiomorphic intergrowth of feldspar, amphibole, chlorite and quartz.

Minerals:

Essential	Feldspar	70%	Interlocking crystals up to 2mm in length. Composition of An45.
	Pyroxene		Minor amount as the cores of amphiboles
	Amphiboles	10%	Light green, slightly pleochroic.
	Quartz	10%	Small, irregular blebs. .5mm in diameter.
Accessory	Magnetite	5%	Small crystals associated with the amphiboles and chlorite.

Alteration: Much of the amphiboles have been altered to chlorite and magnetite. The quartz appears to be secondary. There has been slight alteration of the feldspars.

Volcanics

Buchans Junction Area

Specimen No. B47 '50 Rock Type: Porphyritic Rhyolite

Megascopic : It is a purplish red, rock with large phenocrysts of quartz in a very fine grained groundmass.

Microscopic:

Fabric: Inequigranular, hypocrystalline, rock containing phenocrysts of quartz and feldspar in a aphanitic groundmass.

Minerals:

Phenocrysts	Feldspar	Crystals are both anhedral and euhedral. Up to 2mm in length. Composition is orthoclase.
	Quartz	Generally occurs as round or irregular blebs. Most are corroded with embayments. Greater number than feldspars.
Groundmass		Is fine grained equigranular intergrowth of feldspar and quartz with some opaque mineral. Some flowage occurs around the phenocrysts.

Alteration: The feldspars are considerably sericitized. Some sericite occurs in the groundmass.

Buchans Junction Area

Specimen No. B101 '50 Rock Type: Porphyritic Dacite

Megascopic : A grey-green rock with light coloured phenocrysts of feldspar.

Microscopic:

Fabric: Inequigranular, hypocrystalline rock with phenocrysts of oligoclase in a finely crystalline groundmass.

Minerals:

Phenocrysts	Feldspar	Euhedral crystals up to 1.5mm in length. Good Carlsbad twinning, some albite. Small specks of chlorite enclosed in some of the larger phenocrysts. Composition An17.
Groundmass		A feltlike mass of feldspar, quartz, epidote, chlorite and magnetite. Occasional radiating spherules of feldspar. Magnetite is associated with the chlorite.

Alteration: The chlorite and magnetite suggests alteration of a mafic mineral but no crystal outline remains. Feldspars are clear.

Buchans Junction Area

Specimen No. B100B '50 Rock Type: Basalt

Megascopic : The rock is medium grained, equigranular, with a greenish-grey color and a slightly speckled appearance.

Microscopic:

Fabric: Inequigranular, holocrystalline intergrowth showing sub-ophitic texture.

Minerals:		
	Feldspar	Crystals subhedral and zoned. Usually fractured. Composition An53.
	Pyroxene	Clear crystals, somewhat broken averaging .5mm in length. 2V 20-30 Comp. Pigeonite. Considerable alteration of the smaller crystals and the borders of the larger crystals to antigorite.

Alteration: Serpentinization of the pyroxenes. Feldspars are clear.

Sedimentary Rocks

Buchans Junction Area

Specimen No. B72A '50 Rock Type: Grit

Megascopic : The rock is a medium grained, equigranular clastic having a mixed red and greenish colour.

Microscopic:

Fabric: Is made up of angular fragments of quartz, chert and feldspar in a chloritic groundmass. Preferred orientation of long crystals.

Minerals:	Feldspar	Crystals are anhedral. Up to 1.5mm in length. Composition of some plagioclase is An35. Most is highly altered.
	Quartz	Generally angular crystals. Some are strained. Most have tiny strings of bubbles.
	Amphibole	One good crystal was seen indicating rapidity of deposition.
	Groundmass	Is composed mainly of chlorite. In places it is opaque but reddish, probably limonite. One strained fragment of muscovite observed.

Alteration: The groundmass is chloritized. The feldspars are in various stages of sericitization.

Ambrose Lake Area

Specimen No. SS1 '51 Rock Type: Sandstone

Megascopic : A fine grained, buff coloured, thinly laminated clastic.

Microscopic:

Fabric: It is made up of angular and rounded fragments of both quartz and feldspar in a fine grained groundmass.

Minerals:	Feldspar	Fragments are up to .5mm in length. Most are plagioclase of compositions between Ab and An40. Very little altered.
	Quartz	Fragments are generally larger than the feldspars. Up to 2mm in diameter. Both angular and rounded.
	Groundmass	Is probably very fine grained feldspathic material

Alteration: Feldspars are notably less altered in this rock than in the grits.

Note. A rough sorting is observed in this section from which it might be possible to distinguish tops.

Fig. 8. Specimen No. B209'50. Large irregular grains of albite and a twinned crystal of hornblende are surrounded by interstitial micropegmatite. (Crossed nicols, x 30)

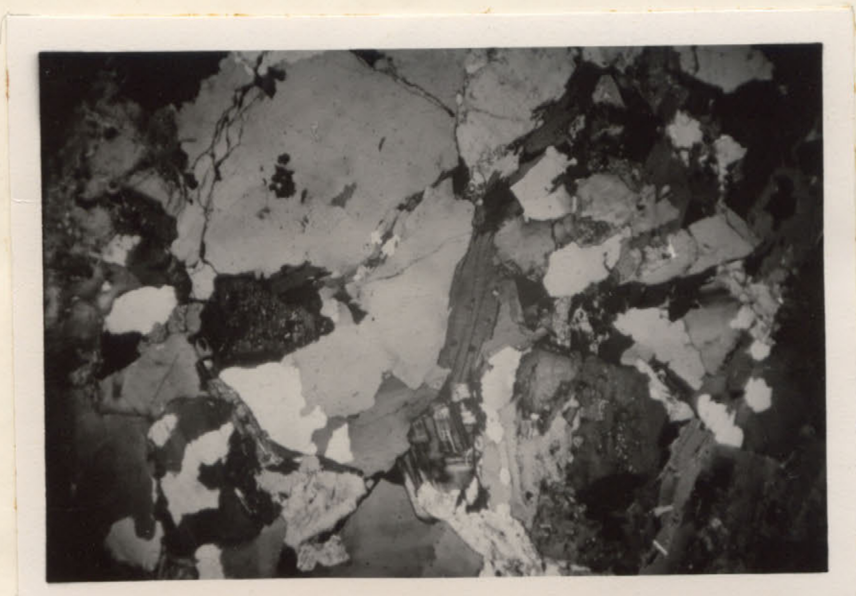


Fig. 9. Specimen No. B177C'51. Boyd's Pond granite showing fractured quartz crystals, biotite with pleochroic haloes, and interstitial microcline. (Crossed nicols, x 30)

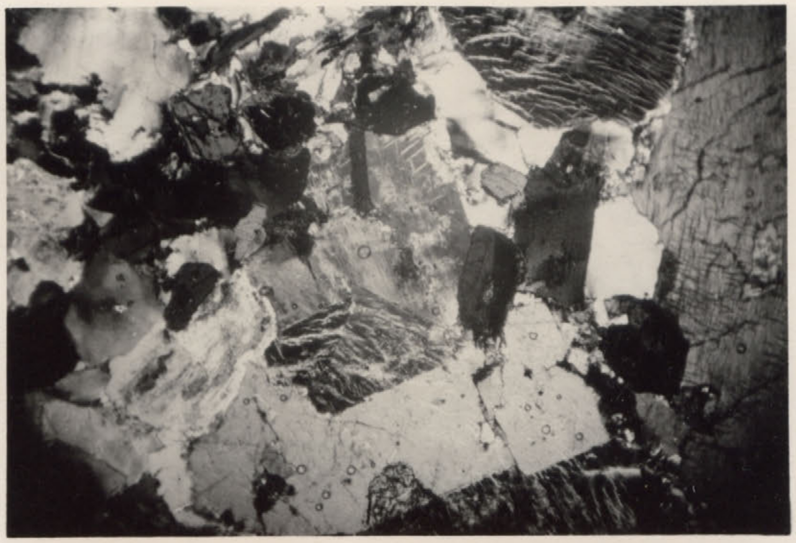


Fig. 10. Specimen No. M15'51. Biotite granite showing the abundance of perthitic feldspar. (Crossed nicols, x 30)

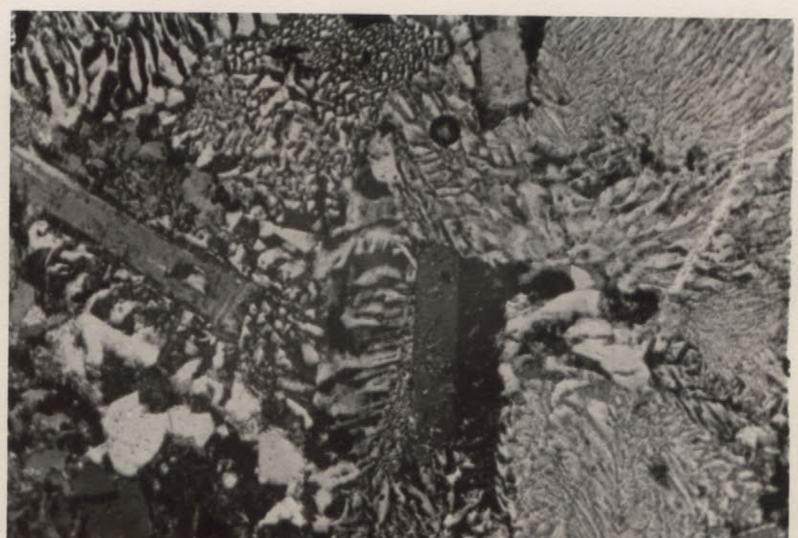


Fig. 11. Specimen No. B195'51. Granophyre dike, showing phenocrysts of albite enclosed by a micropegmatitic intergrowth. (Crossed nicols, x 60)

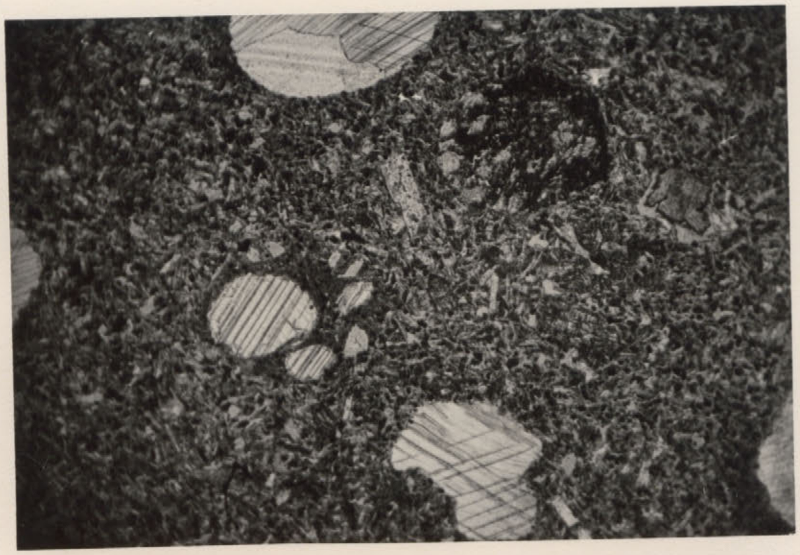


Fig. 12. Specimen No. B191'50. Pillow andesite with light calcite and dark chlorite amygdules enclosed by a mesh of feldspars and amphiboles. (Ordinary light, x 30)

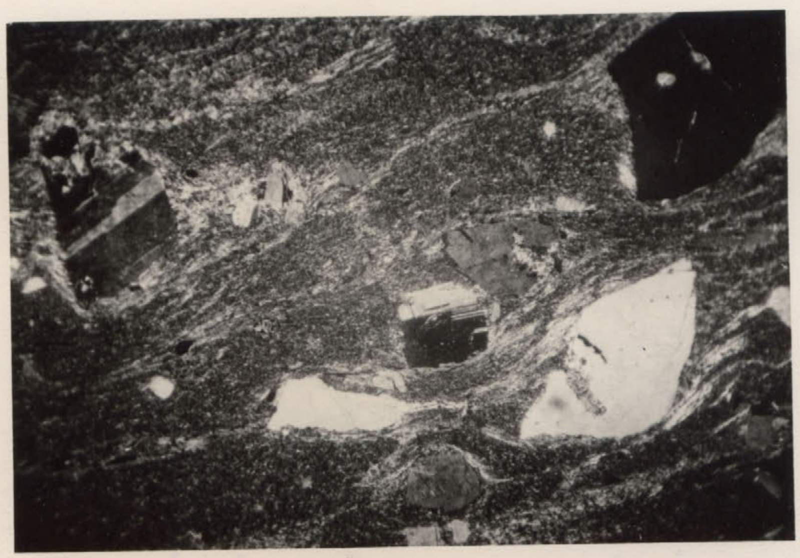
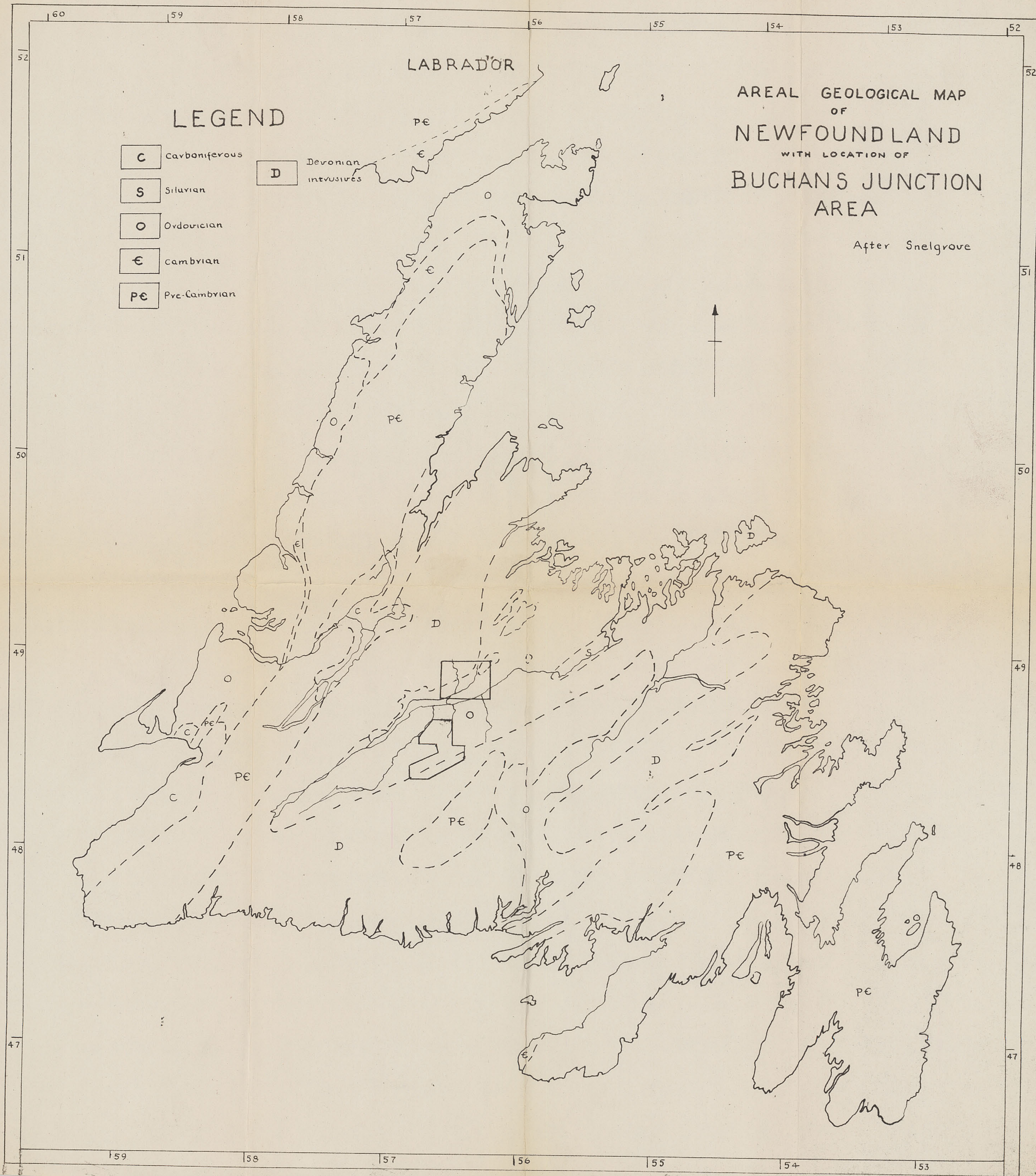


Fig. 13. Specimen No. B37'50. Porphyritic acid flow showing partial resorption of a quartz phenocryst. Flowage of the groundmass is seen around the phenocrysts of quartz and plagioclase. (Crossed nicols, x 30)

Fig. 14. Specimen No. SS1'51. Sandstone showing a rough parallelism of the long axes of the quartz and feldspar grains. (Crossed nicols, x 30)

Fig. 15. Specimen No. B72A'50. Volcanic grit showing the angularity of the quartz grains. (Crossed nicols, x 30)

Fig. 16. Specimen No. B24'51. Contact between shale and coarse grit. Channelling in the shale indicates that the top of the beds is towards the top of the page. (Plain light, x 30)



AREAL GEOLOGICAL MAP
OF
NEWFOUNDLAND
WITH LOCATION OF
BUCHANS JUNCTION
AREA
After Snelgrove
LEGEND
C Carboniferous
S Silurian
O Ordovician
€ Cambrian
P€ Pre-Cambrian
D Devonian intrusives
LABRADOR
60
59
58
57
56
55
54
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52
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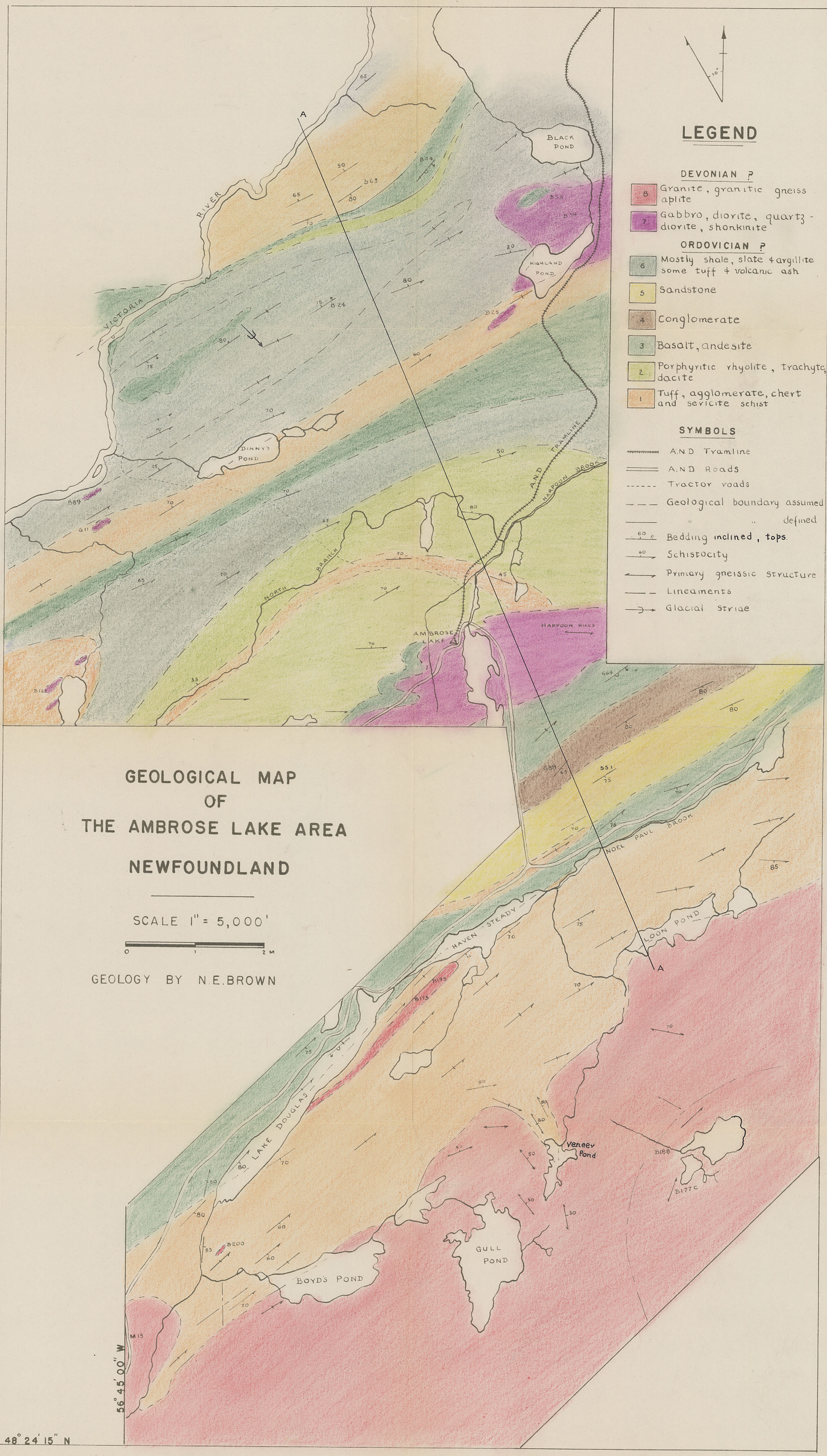
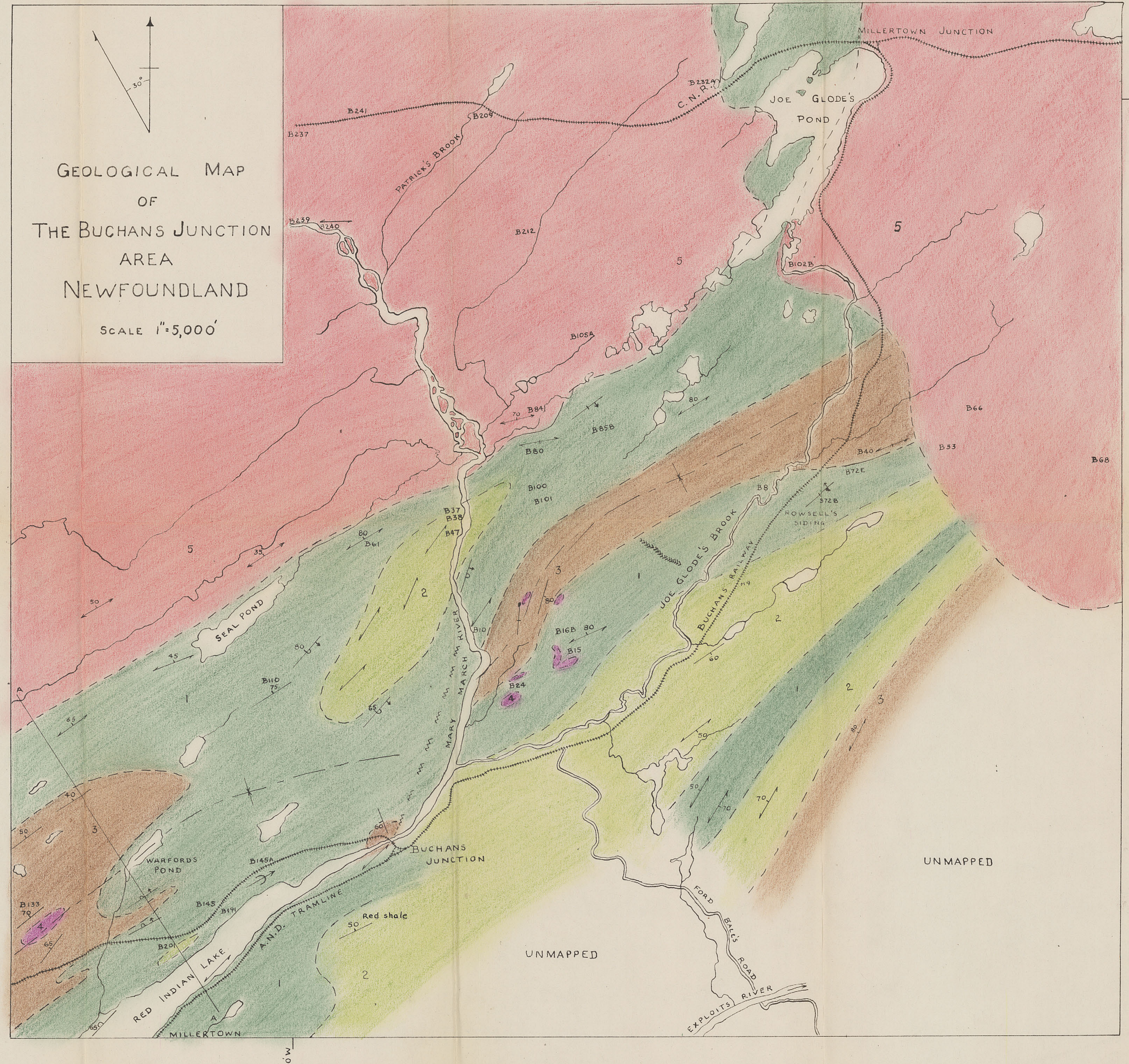

GEOLOGICAL MAP
OF
THE AMBROSE LAKE AREA
NEWFOUNDLAND
SCALE 1" = 5,000'
0 1 2 M
GEOLOGY BY N.E. BROWN
LEGEND
DEVONIAN ?
8 Granite, granitic gneiss aplite
7 Gabbro, diorite, quartz-diorite, shonkinite
ORDOVICIAN ?
6 Mostly shale, slate + argillite some tuff + volcanic ash
5 Sandstone
4 Conglomerate
3 Basalt, andesite
2 Porphyritic rhyolite, trachyte, dacite
1 Tuff, agglomerate, chert and sericite schist
SYMBOLS
A.N.D Tramline
A.N.D Roads
Tractor roads
Geological boundary assumed
" " defined
Bedding inclined, tops
Schistocity
Primary gneissic structure
Lineaments
Glacial striae
VICTORIA RIVER
BLACK POND
HIGHLAND POND
DINNY'S POND
NORTH BRANCH
A.N.D TRAMLINE
HARPOON BROOK
AMBROSE LAKE
HARPOON HILLS
NOEL PAUL BROOK
STEADY HAVEN
LOON POND
LAKE DOUGLAS
Veneer Pond
GULL POND
BOYD'S POND
A
A
56° 45' 00" W
48° 24' 15" N



LEGEND

DEVONIAN ?

5 Granite, syenite, monzonite

4 Gabbro, diorite

ORDOVICIAN ?

3 Grit, bedded chert, sandstone

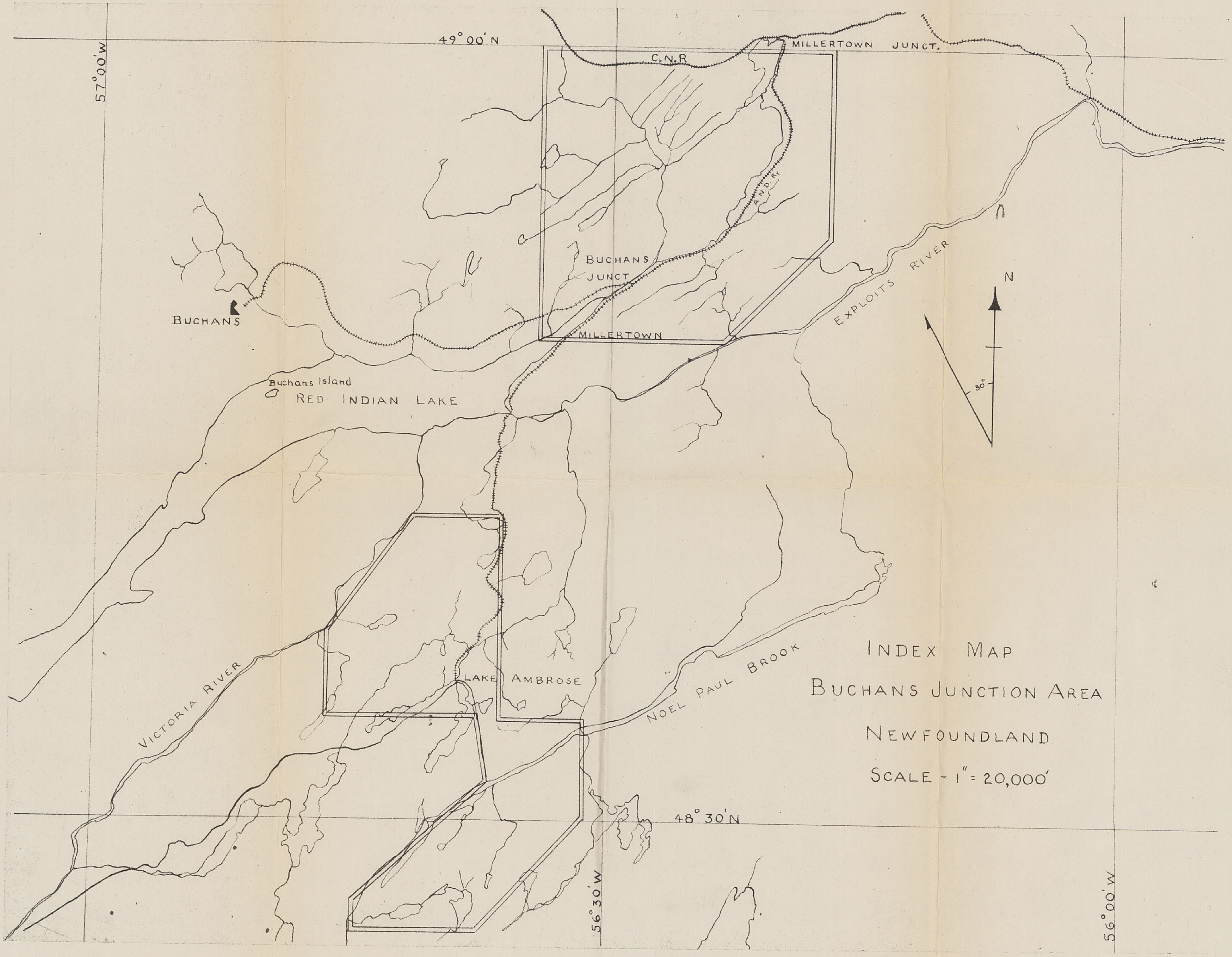
2 Porph. rhyolite, tuff, agglomerate

1 Basalt, andesite, dacite

SYMBOLS

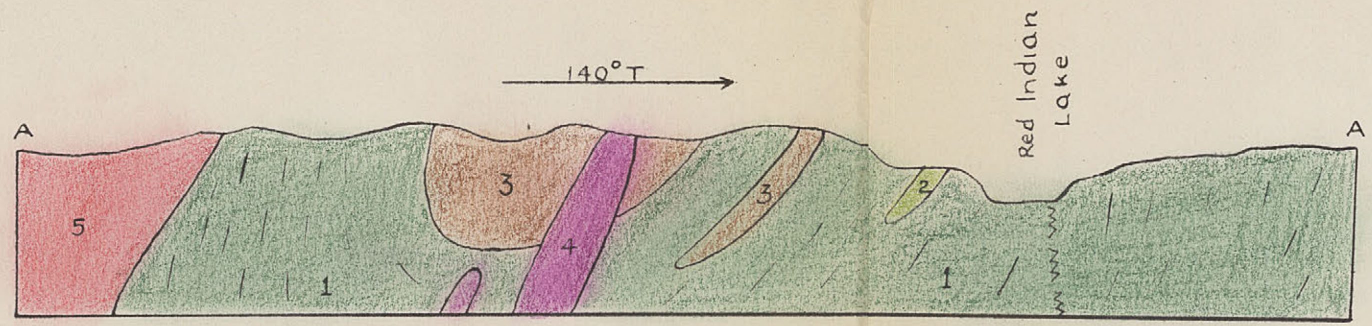
- Fault - assumed
- Geological boundary defined
- " " assumed
- Synclinal axis - approximate
- Bedding, inclined, vertical
- Pillows, inclined, vertical, overturned
- Top determinations
- Schistosity, inclined, vertical
- Primary gneissic structure
- Glacial striae
- Esker
- A.N.D. Co. truck road
- Railway

Geology by
N. E. Brown
for
The Buchans Mining Co.
1950

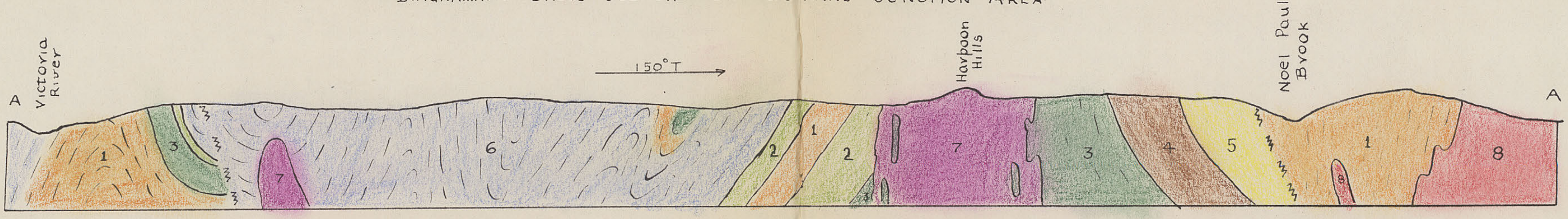


49° 00' N
57° 00' W
C.N.R
MILLERTOWN JUNCT.
A.N.D. RY
BUCHANS JUNCT
BUCHANS
MILLERTOWN
Buchans Island
RED INDIAN LAKE
EXPLOITS RIVER
N
30°
VICTORIA RIVER
LAKE AMBROSE
NOEL PAUL BROOK
48° 30' N
56° 30' W
56° 00' W
INDEX MAP
BUCHANS JUNCTION AREA
NEWFOUNDLAND
SCALE - 1" = 20,000'

PLATE I



DIAGRAMATIC CROSS SECTION OF BUCHANS JUNCTION AREA



DIAGRAMATIC CROSS SECTION OF AMBROSE LAKE AREA

SCALE 1" = 5,000'

For Legends - see maps