THE UNIVERSITY OF MANITOBA

THE EVOLUTION OF THE ECHIMAMISH RIVER: NORTHERN MANITOBA

by

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A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE

OF M.Sc. (CIVIL ENGINEERING)

DEPARTMENT OF CIVIL ENGINEERING

WINNIPEG, MANITOBA

MAY 1975

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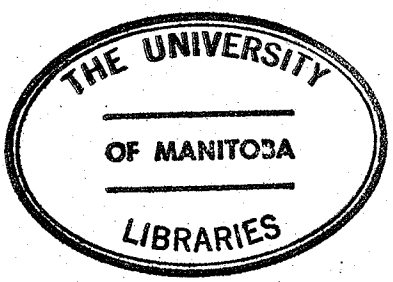
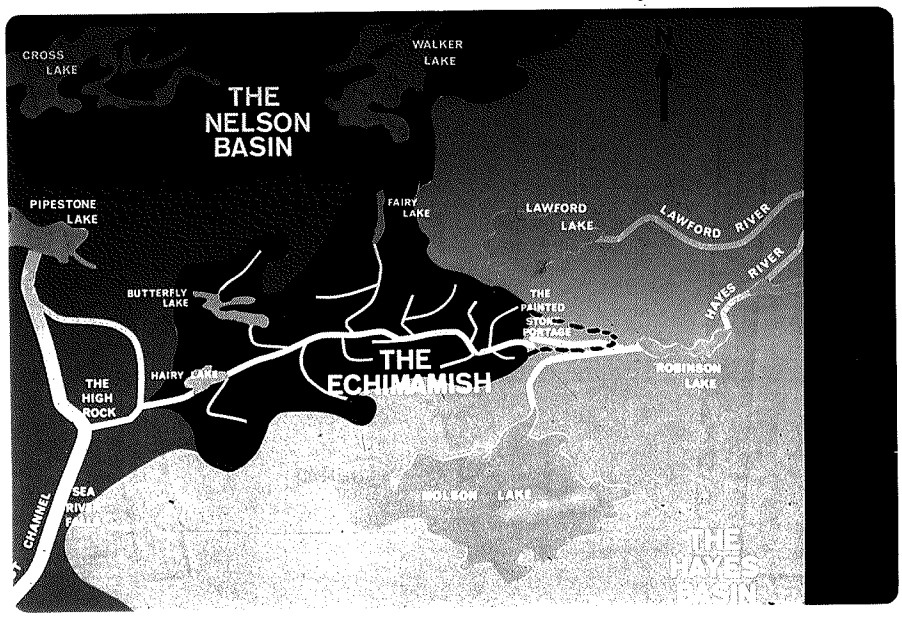
A dissertation submitted to the Faculty of Graduate Studies of the University of Manitoba in partial fulfillment of the requirements of the degree of

MASTER OF SCIENCE



Abstract

The contemporary Echimamish Basin is an extremely interesting and beautiful landscape. It is exciting from a geological, hydrological, geomorphological, archaeological, historical, mythological, and natural history point of view. Few watersheds can lay claim to being so diverse. Its unique form can be attributed to three things; a varying precambrian structure, and a multitude of processes working over an exceedingly long period of time. This thesis investigates the structure, process and form relationships and attempts to describe the contemporary Echimamish.


CROSS LAKE
WALKER LAKE
THE NELSON BASIN
PIPESTONE LAKE
FAIRY LAKE
LAWFORD LAKE
LAWFORD RIVER
HAYES RIVER
BUTTERFLY LAKE
THE PAINTED STONE PORTAGE
THE ECHIMAMISH
HAIRY LAKE
ROBINSON LAKE
THE HIGH ROCK
CHANNEL
WOLSTAN LAKE
THE HAYES BASIN

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Introduction

I was first introduced to the Echimamish by Professor R. W. Newbury. Anybody who loves the land has their own "magic place", a sanctuary where the heart and soul will always rest though the body may be removed by hundreds of miles. The Echimamish is Professor Newbury's magic place.

It was in the autumn of 1973 that I was offered the opportunity of accompanying Bob Newbury on a canoe passage of that unique river. It was then that I began to feel a bit of its magic. We only passed quickly over the river that fall and it was obvious that the Echimamish demanded and deserved far more attention. Plans were made to return the following year.

This river is fascinating. Its name, Echimamish, is a Cree word which translated into English means "water which flows both ways" or "both ways downstream". Though unobserved by early European and Canadian "explorers", it is indeed true that the water in this stream flows both ways. The headwaters of the two flows is a long, narrow pond. It drains to the east (to the Hayes River) and to the west (to the Nelson River) and is navigable throughout its length, but for a short distance at the eastern outlet of the headwater pond. Here a short portage of 30 paces leads over a low, smooth rock. This portage is known as the Painted Stone Portage, thus named for a rock formerly placed near the centre of the portage upon which the Indians made offerings and traced figures in reverence of the beautiful and simple passage from one watershed into another.

How did such a stream come to be? It did not

appear to adhere to Playfair's Law, which states essentially that a valley form is a result of the work done by the stream that flows in it. How could the evolution of this landscape be explained by Davis' factors - structure, process and time?

These questions have resulted in my writing the ensuing pages. I had the benefit of only two brief, personal encounters with the Echimamish. Thus, I was unable to investigate as fully as would be desireable the many facets of this river. However, a quantity of literature exists on the basin, mostly in the form of geological reports or the journals of the early explorers. These then, were the sources of my background data.

The thesis attempts at first to be an accurate description of the basin; its geology, its hydrology, the history and mythology that surrounds Echimamish. It also presents a brief summary of the natural history of the area. Finally, the thesis suggests a process sequence to describe the evolution of the basin into its contemporary unique form. The speculation upon which the process sequence was based was enjoyable but resulted in what I believe to be, some reasonable suggestions.

In short, I hope that from this thesis the reader can gain just a small appreciation for this river, its unique form, its mystery and its beauty.

Acknowledgements

I am very grateful to Professor R. W. Newbury for his role as my advisor, for his direction, criticism, and assistance, of both a financial and a conceptual nature, in the preparation of this thesis. I am also indebted to him for the use of some of the photographs appearing on these pages.

Thanks also go to Mr. R. V. Oleson of Winnipeg for his constructive criticism of the historical aspects given in Appendix B, to Dr. Jennifer Walker-Shay of the University of Manitoba for her assistance in plant identification and appreciation and for her criticism of the description of Echimamish vegetation in Appendix E, to Professor A. Rattray, Head of the Department of Landscape Architecture, University of Manitoba, and Mr. Hugh McKay of the Manitoba Water Resources Branch, both of whom read the entire thesis and provided me with their helpful comments and criticism, to Mr. Greg McCullough of Winnipeg who donated some of the photographs appearing herein, and to Miss Bonnie Davidson of Fredericton who assisted in the typing and preparation of the final document.

Special thanks are expressed to my wife, Janice, as well as to other members of my family who have been a source of encouragement throughout the preparation of this thesis.

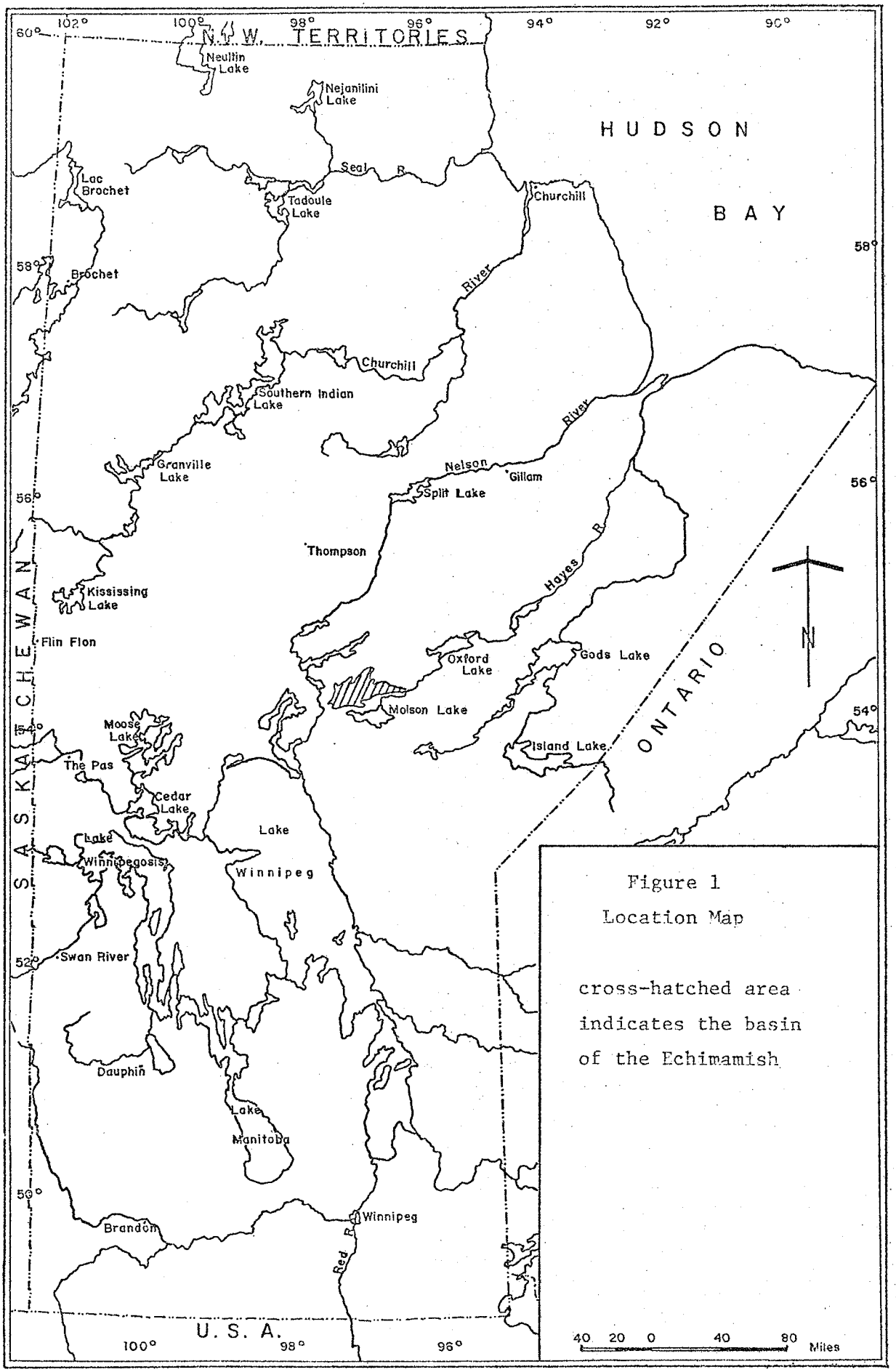


Figure 1
Location Map

cross-hatched area indicates the basin of the Echimamish

1. The Geology of the Echimamish Basin

1.1 The Bedrock Geology

The Echimamish Basin lies within that most extensive of all Canadian landforms, the Canadian Shield. A minute portion of the 2,000,000 square mile shield, the 388 square mile Echimamish watershed lies within a broad declivity through which flow the Hayes, Nelson, and in part the Churchill Rivers. This depression represents the boundary zone between the Superior and Churchill orogenic provinces and has become known as the Nelson River Gneissic Zone. The predominantly sedimentary rocks of the Churchill block, (some 1735 million years old), meet the mixed volcanic and sedimentary rocks of the Superior block (some 2450 million years old) in this Nelson - Churchill Trough.

The Echimamish area is underlain by an assemblage of consolidated rocks of Archean and Proterozoic age. The Archean rocks consist chiefly of altered sediments and lavas, while the younger rocks are batholithic intrusives composed mainly of granites.

The older rocks are known as the Hayes River Group and consist essentially of schistose and highly metamorphosed strata. Throughout the area underlain by these rocks are numerous small masses of hybrid rocks and intrusives. The rocks of the Hayes River Group are lithologically similar to the Keewatin rocks in Ontario. They run in a narrow belt along the Echimamish from just east of the Painted Stone to a point about 8 miles upstream of Hairy Lake from whence they continue in a northwesterly direction through Butterfly Lake towards Cross Lake. This forms part of a single, almost continuous, belt of such rocks extending from Knee and Ox-

ford Lakes to Cross Lake, and which Robert Bell, in 1879, referred to as the Huronian Trough.

Adjoining the long, narrow zone of the Hayes River Group, on the north and south, are extensive batholithic areas of granites and granite-gneisses.

The following is a description of the map units found on Figure 2. The description is taken from C. K. Bell (1961).

1.1.1 The Hayes River Group (1 - 3)

Volcanic Rocks (1)

The most widespread volcanic rocks are massive andesites, biotite-hornblend-plagioclase schist, and chlorite schist.

A belt of well-banded basic to intermediate volcanic rock crosses the Echimamish at Painted Stone Portage and continues west to form a narrow ridge paralleling the river (1b). Beds are of dacitic composition and narrow, pink aplite sills occur in the andesite, amphibolite and hornblend-biotite gneiss.

The largest continuous band of volcanic rocks parallels the Echimamish from the uppermost dam, west to Butterfly Lake where it veers northwest through Pipestone Lake to Cross Lake (1b). The rocks are again largely andesites with accompanying biotite-hornblend schist, amphibolite, porphyritic amphibolite, and hornblendite.

The volcanic rocks contain leucocratic sills and dykes, milky-white to colourless quartz veins and minor epidote patches and bands. Massive quartz diorite, diorite, and fine-grained gabbro are interbanded with these rocks. They intrude the volcanic rocks as sills and irregular tabular dykes.

At Butterfly Lake the volcanic rocks are less deformed and are predominantly massive andesites.

Sedimentary Rocks (2)

A narrow, 20-mile interformational belt of sediments (2a), lies in volcanic rocks and parallels the Echimamish from just west of Painted Stone to south of Butterfly Lake. The eastern members are grey, impure quartzite with interbedded conglomerate, dacite and greywacke.

A lens of sediments (2a), outcrops north of this band at the third dam. The basal member is a 200-foot thick conglomerate zone. It is separated from the underlying andesites by a 10-foot layer of chlorite schist.

Stretched, water-worked agglomerate (2b), lies within andesitic lavas on Butterfly Lake. The conglomerate is intraformational and contains fragments of rock from the adjoining beds.

Transition Rocks (3)

Adjacent to, within, and replacing Hayes River Group volcanic rocks are rocks that form a zone gradational to the granodiorite-tonalite-gneiss complex. Three phases are recognizable. They are, rocks containing still-recognizable volcanic rocks, rocks in which the original volcanic features are preserved as scattered relics, and a layered gneiss of intermediate composition.

The first phase is a layered rock composed of recrystallized volcanic material (chlorite and biotite schist, amphibolite) and secondary lit-par-lit layers and veins of quartz, epidote, pegmatite, aplite and leucogranite. The resulting rocks are the injection, lit-par-lit composite or mixed gneisses and migmatite. The second phase is a layered gneiss in which the struc-

tural features of the original volcanic rocks are still preserved as insitu relics and amphibolite bands. It may be considered as a banded paragneiss. The final phase is a rock with granitic texture, preserved gneissosity, and relic mafic lenses. It is considered to be a banded or a hybrid gneiss.

1.1.2 Intrusive and Granitized Rocks (4 - 6)

Basic and Ultrabasic Rocks (4)

Peridotite (4c), serpenite (4c), gabbro and diorite (4b), labradorite porphyry and anorthosite (4a), intrude volcanic rocks of the Hayes River Group as sills.

Anorthosite outcrops on Hairy Lake, Little Hairy Lake, and on the south side of Butterfly Lake.

Granodiorite-tonalite-gneiss Complex (5)

Much of the map area is underlain by rocks, the composition of which ranges from tonalite through granodiorite granite.

The most common rock in the area is biotite granodiorite-gneiss (5a). Although in most cases the gneissosity is preserved by an alignment of the quartz into lenticular masses and a rude parallelism of platy minerals, occasionally the gneiss loses its directional components and the rock becomes massive-looking. Coarse red biotite granite outcrops south of the inlet of Hairy Lake.

Biotite granodiorite-gneiss with inclusions and relic fragments of mafic material is ubiquitous in certain regions.

The augen gneiss is grey, medium to coarse-grained and invariably gneissic (5d). These rocks are all biotite-rich and are all cut by leucocratic granite.

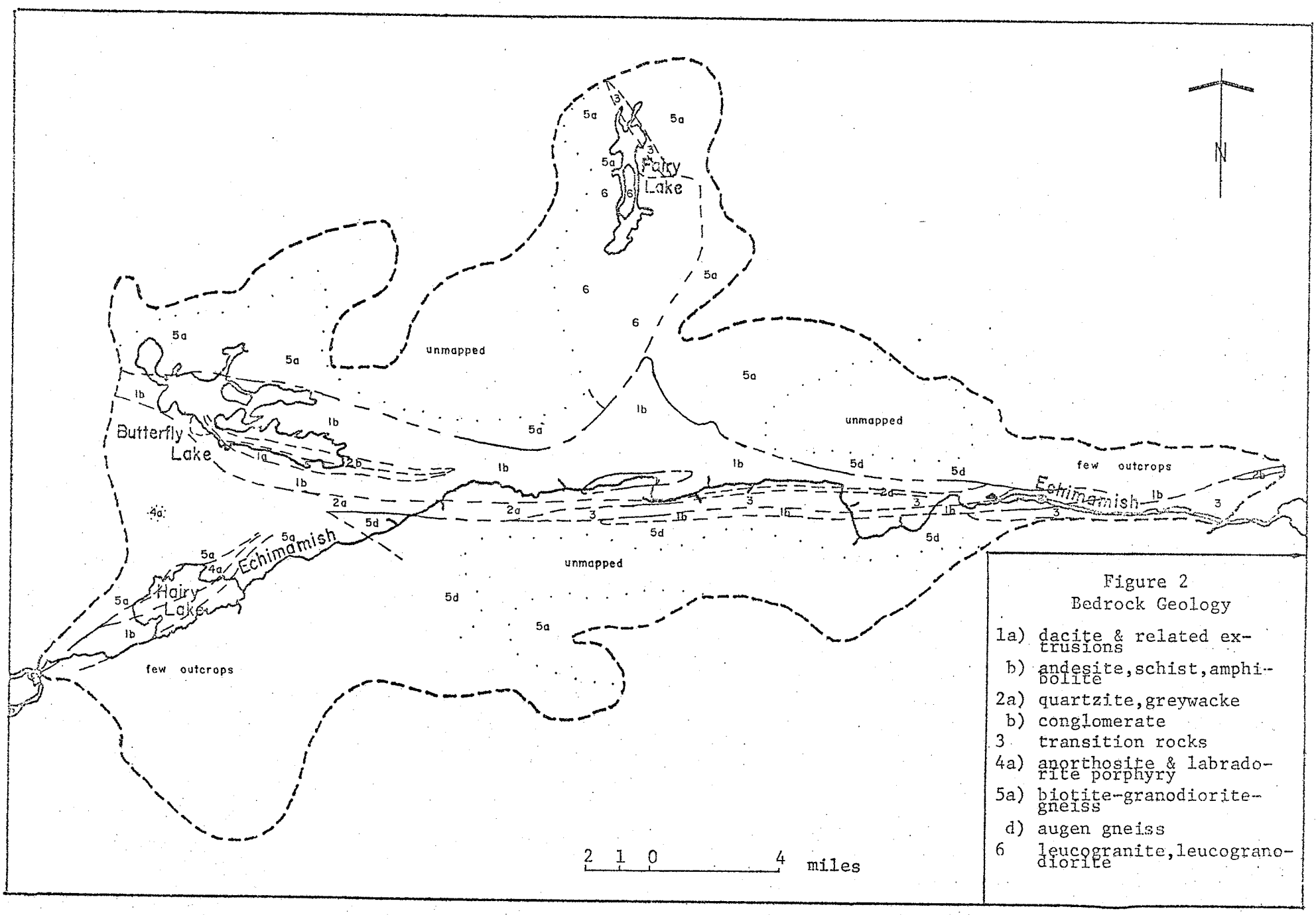


Figure 2
Bedrock Geology

1a) dacite & related extrusions
b) andesite, schist, amphibolite
2a) quartzite, greywacke
b) conglomerate
3 transition rocks
4a) anorthosite & labradorite porphyry
5a) biotite-granodiorite-gneiss
d) augen gneiss
6 leucogranite, leucogranodiorite

Leucogranite, Leucogranodiorite, Aplite and Pegmatite (6)

Locally, massive pink to grey leucogranite or leucogranodiorite outcrops as stocks or small batholiths. In places they form the only rock type; elsewhere they occur as stock-works intruding all the aforementioned rocks. Sixty percent of the outcrops on the south half of Fairy Lake is late leucogranite.

1.2 The Structural Geology

South and for a very short distance north of the Echimamish - Hayes River lineament, the regional strike of the gneisses is east - west with up to 20 degree variations to the north or south. The dip of the rocks appears to be vertical. In the Fairy Lake area the gneisses strike northwest. Elsewhere they trend northeasterly.

The major geological structural feature is the fold structure formed by the Hayes River Group. The structure is a truncated, abnormal anticlinorium.

A longitudinal fault lies within the gneiss and parallels the western contact of the northward peak in the andesite band near Taylor Lake and Fairy Creek.

Structural features are indicated on Figure 3.

1.3 The Economic Geology

The first suggestion that the rocks of the Echimamish Basin might contain minerals of economic importance, came from R. W. Brock, who in 1910, likened some of the rocks of the Hayes River Group to the Keewatin iron formation rocks of Ontario.

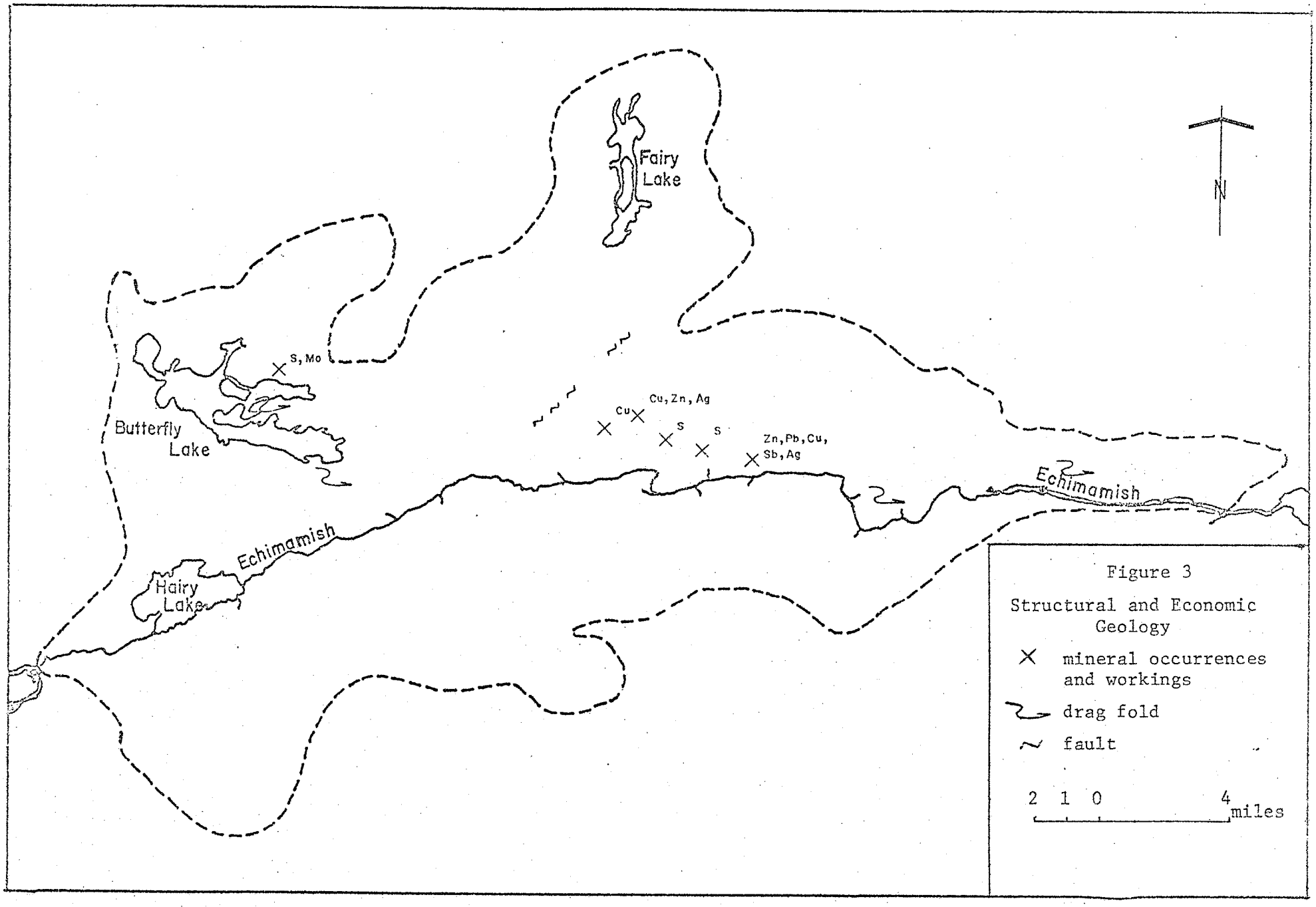
In 1926, some pyrite-bearing rock was staked in the Painted Stone Portage area. This led to the

staking, by several parties, of claims that extended for a short distance east and a few miles west along the belt of schistose rocks. No discoveries of interest resulted and the claims were allowed to lapse.

Prospecting, however, continued in the belt of altered sedimentary and volcanic rocks extending westerly from the stakings. Knowledge of a block of 25 claims known as Echimamish Gold Property- drew several prospectors to the area in the late summer of 1936. In the next few months 200 mining claims had been staked in an area extending 20 miles east - west along the Echimamish with a maximum width of 5 miles.

Two of the larger properties were the O'Day (1934), and Echimamish Gold (1935) stakings. O'Day is 200 yards northeast of Birch (Taylor) Lake. A lenticular quartz vein is visibly mineralized with grains of gold. A sample was reported to have assayed 2.25 ounces of gold per ton. Echimamish Gold Property is 2,000 feet north-northwest of the second dam. The mineralized zones are in the order of a few feet in length and a few inches in width. Assays were said to have carried commercial quantities of silver and gold. The Conx Group is a third property (1958) located a mile northeast of Taylor Lake. The assays from here yielded 0.015 ounces of gold and 2.89 ounces of silver per ton, with 3.51 percent copper. There were some 22 other showings, but none of them yielded economically significant quantities of minerals.

Economic features are indicated on Figure 3.


Fairy Lake
N
S, Mo
Butterfly Lake
Cu
Cu, Zn, Ag
S
S
Zn, Pb, Cu, Sb, Ag
Echimamish
Echimamish
Hairy Lake
Figure 3
Structural and Economic Geology
mineral occurrences and workings
drag fold
fault
2 1 0 4 miles

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Use was made also of the field notes and diary compiled by Dr. R. Bell and his wife. These are on file at the Public Archives of Canada in Ottawa.