The Petrogenesis of the Paragneisses

Quesnel Lake

Manitoba

A Thesis

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Master of Science

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Abstract

Detailed mapping and sampling were completed over an area of two square miles, on the north-west end of Quesnel Lake, Manitoba.

In all, 175 samples were collected, and classified into; 1a) quartz-oligoclase-biotite gneiss, 1b) quartz gneiss, 2) migmatite, 3) amphibolite, 4) pegmatite, and 5) granite. Thirty-two thin sections were studied, and modal and chemical analyses were carried out on fifteen samples. Biotite separates from these fifteen samples were analysed chemically.

The gneisses consist of quartz, oligoclase, biotite, and sillimanite with minor amounts of potash feldspar and garnet; accessory minerals are chlorite, muscovite, magnetite, zircon, and hematite. They represent equilibrium assemblages of the sillimanite-almandine-orthoclase sub-facies of the amphibolite facies. The chemical compositions of the gneisses are similar to that of greywacke-type sedimentary rocks. The gneisses display relic bedding structures, and they are therefore interpreted to be metamorphosed sedimentary rocks.

Temperature and pressure conditions were uniform across the area. Temperatures reached 680-700° C and pressures exceeded 4 kilobars, conditions which are related to a depth of 15-20 kilometers. The gneisses can therefore be interpreted as part of an uplifted block exposed by erosion.

Under the conditions of metamorphism, the three gneissic units may represent differing degrees of anatexis or partial melting of original sedimentary rocks, which is now shown by differing amounts of quartz-feldspar layers.

Chapter 1

Introduction

The object of this study was to determine the effect and degree of regional metamorphism in the gneisses of the Quesnel Lake area and to look for contact effects due to granitic intrusions.

Detailed mapping was carried out in an attempt to define the areal distribution of metamorphic rocks. The results indicate compositional differences in the gneisses but whether these are original compositional differences or differences due to metamorphism is difficult to interpret. Chemical and modal analyses attempt to emphasize these variations as well as indicate probable element and mineral changes with relation to possible metamorphic centers.

Location and Access

Quesnel Lake is located six miles south of Bisset, Manitoba, which is one hundred air miles northeast of Winnipeg. Access is by an all-weather road which connects Bisset with Pine Falls, located on the Winnipeg River, and connected to Winnipeg by highway number 59. Access to Quesnel Lake is by a very rough winding eleven mile road which branches off the Bisset road four miles west of Bisset.

Quesnel Lake locally goes by the name of Caribou Lake and the access road is called the Caribou Lake Road.

Topographic Features

The topographic and physical appearance is typical of the Pre-cambrian Shield. Rock outcrops are rounded and well exposed. Areas

between outcrops are underlain by glacial deposits and swamps.

Summary of Previous Work

The Rice Lake area was mapped by Moore (1912), and he was the first to recognize the Rice Lake Series composed of lavas and derived schists and gneisses.

Wright (1923, 1927, 1932) worked in the Rice Lake district for several seasons and recognized;

1) an unnamed volcanic series (the lower portion of the Rice Lake Series of Moore).
2) a series of biotite schists and garnet gneisses conformably overlying the volcanic series (1).
3) a sedimentary series of arkose, quartzite, and conglomerate.

The second group he called the "Manigotagan Phase" of the Rice Lake Series. The gneisses in the Quesnel Lake area are part of this group.

Stockwell (1945) mapped the area (Fig. 1), and also classified the derived schists and gneisses as part of the Rice Lake Series.

Summary of the Present Study

Field work was carried out in September of 1967. Detailed mapping and sampling were completed with the use of an airphotograph as control, on a scale of 1"= 300', over an area of two square miles.

The numbers and locations of specimens of gneiss chosen for chemical and modal analyses are indicated by a circle in Figure 23 (in pocket).

The objective in choice of samples was to obtain from intervals across the gneissic belt, specimens that were representative of;

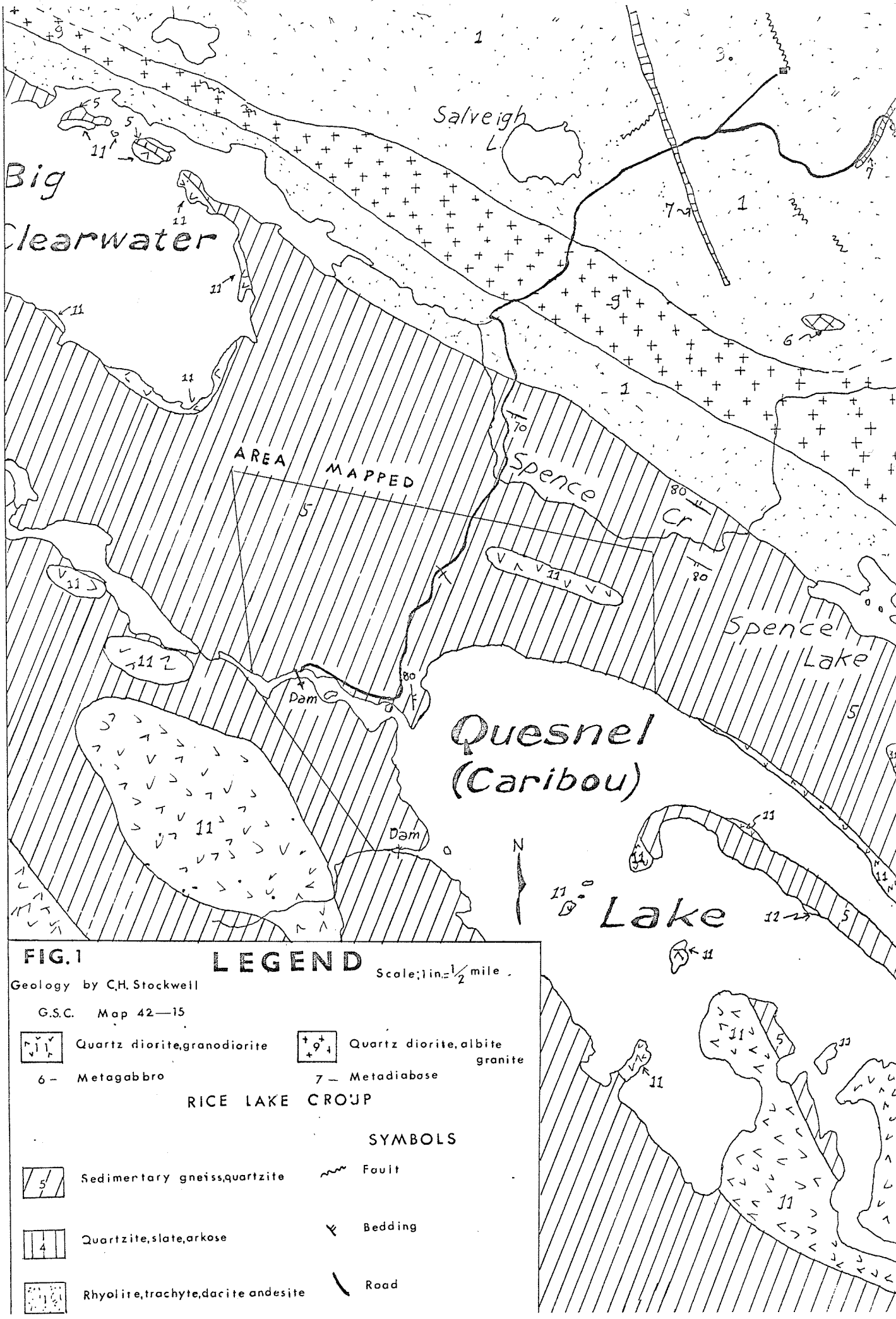

FIG. 1

LEGEND

Scale: 1 in. = 1/2 mile

Geology by C.H. Stockwell

G.S.C. Map 42—15

Quartz diorite, granodiorite

Quartz diorite, albite granite

6 — Metagabbro

7 — Metadiabase

RICE LAKE GROUP

SYMBOLS

Sedimentary gneiss, quartzite

Fault

Bedding

Quartzite, slate, arkose

Road

Rhyolite, trachyte, dacite andesite

1) the recognizable rock units, and 2) equilibrium and nonequilibrium rocks with both garnets and biotites visible.

The bulk rock samples were chemically analysed. Originally the study was to include analysis of both biotites and garnets, however, the work has been restricted to a study of the whole rock and biotites.

In all, 175 samples were collected, all of which were studied in hand specimen under the binocular microscope and classified as gneisses, amphibolites, and pegmatites.

Thirty-two thin sections were studied and modal and chemical analyses were carried out on fifteen samples. Garnet and biotite were separated from these samples.

Acknowledgements

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Chapter 2

General Geology

Regional Geology

The regional geology is illustrated by the compilation map, Figure 2.

The Rice Lake area, which is just north of Quesnel Lake, according to Davies (1963) is underlain by a series of Precambrian acid to intermediate volcanic rocks. These form the lower part of the Rice Lake group. A series of quartzites, greywackes, and slates conformably overly the volcanic rocks and make up the upper part of the Rice Lake group. South of these rocks, in the areas around Quesnel Lake and Manigotagan River, are high grade gneisses and amphibolites. Davies considers the gneissic belt to be metamorphosed sedimentary rocks of the type found in the upper part of the Rice Lake group.

Rocks of the Rice Lake group are intruded by calcic intrusions ranging from gabbro to granite. These intrusions are restricted to areas underlain by volcanic rocks. The Rice Lake group and the calcic intrusions are unconformably overlain by feldspathic quartzite and conglomerate of the San Antonio formation.

The entire Rice Lake group and San Antonio formation are surrounded by large plutons of potash-rich granites.

Previous Work on the Manigotagan River Gneissic Belt

Wright (1923) was the first to describe the gneissic rocks in detail. He divided the gneisses into three types: 1) biotite gneiss,