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GEOLOGY
of the
MACBRIDE LAKE AREA
Granville Lake Mining Division
Manitoba

by
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MACBRIDE LAKE AREA

INTRODUCTION

LOCATION AND ACCESS

The MacBride Lake map-area lies approximately half way between the town of Lynn Lake to the west and the settlement of South Indian Lake to the east. The distances to these two settlements are 40 miles and 30 miles respectively. The map area covers about 165 square miles between 56° 45' and 57° 00' north latitude and between 99° 45' and 100° 00' west longitude.

The area may be reached by air from either Lynn Lake or Southern Indian Lake and by canoe from Southern Indian Lake via Opachuanau Lake. There are no portages on the canoe route through Southern Indian and Opachuanau lakes. The closest railhead is Lynn Lake. A canoe route from Lynn Lake to the map-area, via Cockeram Lake, Anson Lake, Cartwright Lake, Hughes Lake, Hughes River, and Barrington River could be used, but would involve twenty-one portages and many more rapids. The two longest portages are one hundred chains and eighty chains, both between Cartwright and Hughes lakes.

GENERAL CHARACTER OF THE AREA

The whole area is high and dry due to an extensive, thick glacial drift cover. The few swampy areas are generally no more than two thousand feet across.

The topography is hilly with local flat areas. The flat areas are high and dry rather than low and wet. In the northern third and along the eastern border of the area, the relief is very pronounced for Precambrian topography in this part of the country. The larger granitic outcrops in places rise 250 feet above the surrounding lakes. Particularly striking in this respect are the large granite outcrops in the northeast corner of the area and the pink porphyritic granite outcrops east of the MacBride River along the eastern border of the area. The granite batholith west of the MacBride River has a hilly relief which probably does not exceed 150 feet.

The large size of the outcrops in this map-area enables one to spot nearly every one on aerial photographs. Generally speaking, if no outcrops can be seen on the photographs, then none will be found on the ground. Small outcrops are rare except in the area extending for about 2 miles north of the Barrington River at the west side of the area, where outcrops of bedrock are abundant along the south shores of the lakes and rivers but few occur along the north shores.

The drainage for the whole area is southward through MacBride Lake, MacBride River, and Barrington River into the Churchill River system.

The complete map-area has been burnt over at one time or another. The latest burns are east of MacBride River and north of Whitefish Lake. Both areas present exceedingly difficult travelling due to thick deadfall and second growth spruce and pine.

Due to the extensive drift covering, jackpine is abundant. It occurs alone on many sand and outcrop ridges and is the principal coniferous tree on all hills. Black spruce, however, is the most common conifer in the valleys and on the low hillsides. Birch and poplar are more abundant in the central part than elsewhere in the area. Tamarack occurs in the low swampy areas and quite unusually on some drift ridges.

Wildlife is plentiful. Seven moose were seen along the MacBride and Barrington rivers within a period of two months. The good condition and fine repair of all beaver dams and houses indicate that the beaver are active and numerous.

PREVIOUS WORK

The map-area lies in the northwest corner of the Uhlman Lake area which was mapped by G. M. Wright[1] of the Geological Survey of Canada in 1953. The Barrington Lake area, which adjoins the MacBride Lake area to the west, was mapped by G. P. Crombie[2] of the Manitoba Mines Branch in 1947. The Barrington Lake area occupies the northeast corner of the Granville Lake area, mapped by officers[3] of the Geological Survey of Canada in 1932, 1933, and 1935.

PRESENT WORK AND ACKNOWLEDGEMENTS

This report is based on field work conducted during the field season, June to September, of 1955. The geology is plotted on a half mile scale base map which was constructed by slotted template and sketchmaster from vertical photographs. Pace and compass and shoreline canoe traverses were used to cover the map-area. The scale and spacing of traverses is primarily controlled by the location of the outcrops as observed on aerial photographs. The traverses were planned to cover the area at intervals of 1,500 to 2,000 feet. The pace and compass traverses, coordinated with aerial photographic interpretation, locate outcrops on the map to a degree accurate enough for half mile scale. In the large drift area in the central part of the area minor magnetic disturbances may have affected the accuracy of some traverses.

[1] Wright, G. M.: Uhlman Lake Map-Area, Manitoba (Preliminary Account); Geol. Surv., Canada, Paper 53-12, 1953.

[2] Crombie, G. P.: Geology of the Barrington Lake Area; Man. Mines Br. Prelim. Rept. 47-6, 1948.

[3] Henderson, J. F., Norman, G. W. H., and Downie, D. L.: Granville Lake Sheet (East Half); Geol. Surv., Canada, Map 344A, 1936.

Capable assistance in the field was provided by B. B. Bannatyne, M. D. Rowswell, C. K. Shepherd, and D. F. Porth. The willing cooperation of N. C. McCoy and R. Paquin of the Manitoba Government Air Service, R. Smith of the Manitoba Forestry Service, and the Hudson's Bay Company staff at Lynn Lake made it a pleasure to work and associate with them. The courtesy and patience of Wm. Thrall at South Indian Lake as radio contact was greatly appreciated. G. C. Milligan, of the Manitoba Mines Branch geological staff, has been of great assistance acting in an advisory capacity on the whole field operation as well as the geological methods.

GLACIAL GEOLOGY

The area is blanketed with glacial drift which has raised the level of the surface and evened off the topography. The greater part of the glacial drift consists of sandy and clayey silt. This is the type of drift which underlies the open alder-spruce and jackpine flats of the central part of the area. It forms the nearly bald hills which occur in the large drift area between Soulier and MacBride lakes.

Some of the sandy-silt hills, as seen on the aerial photographs, have a roughly oval shape in plan and resemble drumlins. Good examples of this can be seen just east of the MacBride River at latitudes 56° 48' N to 56° 49' N.

The outstanding glacial feature of the area is an esker which extends from the Barrington River north to MacBride Lake. The esker reaches 30 feet in height and consists of bouldery gravel with minor amounts of sand. The boulders are up to two feet across. No stratification was observed in the esker.

Along the eastern border of the area, between latitudes 56° 48' N and and 56° 54' N, for a width of about 7,000 feet, the surface is covered with a thick deposit of sand. This sand forms hills and knolls, filling in between and banking up around the outcrops. The sand is a very uniform, well sorted, fine-grained, quartz-feldspar aggregate. These sand hills carry no other covering than jackpine and moss.

North of the Barrington River, within a band about 11,000 feet wide along the western border of the area, the ground surface rises to a sort of low plateau. This plateau surface is extensively covered with sub-rounded to well-rounded boulder drift. The boulder drift locally forms boulder fields up to 200 feet across excluding all vegetation except lichen. Large ridge-like mounds of boulders also occur, striking roughly west-northwest. These ridges are 20 to 30 feet high and consist of boulders up to five feet across.

No glacial striae were observed.

GENERAL GEOLOGY

TABLE OF FORMATIONS

Recent and Pleistocene		Silt, clay, sand, gravel, and boulder gravel deposits
PRECAMBRIAN	Post-orogenic Intrusives	Barrington River Pink Granite Red-stained Quartz Monzonite Pink Porphyritic Granites Biotite Monzonite Diorites and Gabbros
	Synorogenic Intrusives	Granitic Gneiss Complex Gneissic Red-stained Granite Banded Diorite Gneiss Pinkish White Granite
	Pre-orogenic Granite	Gneissic White Hornblende Granite
	INTRUSIVE CONTACT	
	MacBride Lake Volcanic and Sedimentary Belt	Porphyritic and non-porphyritic andesites with minor amounts of basalt; interbedded pyroclastics
		Garnet-mica schists with minor feldspathic and gneissic varieties
	UNCONFORMITY	
	Barrington River Igneous Complex and Sedimentary Belt	Hornblende-plagioclase gneisses injected and assimilated by granites, pegmatites, and aplites
		Garnetiferous quartzites, arkosic quartzites, and arkoses; minor garnet mica schists

BARRINGTON RIVER IGNEOUS COMPLEX AND SEDIMENTARY BELT

Sedimentary Rocks (1)

Distribution and Size

These sedimentary rocks occur as a band north of the Barrington River Pink Granite and along the southern edge of the map-area. Narrow at the west end, the sedimentary belt widens eastward and extends for an unkown distance east. The sediments dip to the north beneath the Barrington River igneous complex.

Description

Sedimentary gneisses, with considerable variation in lithology along strike, comprise the rocks of this belt.

Fine- to very fine-grained, thinly laminated, or narrowly and evenly banded gneisses occur at the west end of the belt. The quartz and feldspar contents are high, with quartz by far the most abundant. Biotite is the predominant ferromagnesian mineral, with minor amounts of hornblende. Narrow chert and quartzite bands form very sharp and uniform layers.

The gneisses grade into schists about two and one half miles east of the west side of the area. They are more mica-and hornblende-rich, and garnetiferous. Midway across the area, the sediments are predominantly garnet-biotite schists, biotite-muscovite schists, and garnet hornblende-mica schists. Large lenses of epidote appear in the more quartzofeldspathic members.

Primarily medium- to medium-coarse-grained, biotite-quartz-feldspar gneisses, approaching granite in composition, predominate towards the pinkish-white granite.

Garnetiferous, mica-, hornblende-, and epidote-bearing schists and gneisses predominate near the mouth of the MacBride River. Alternating garnet-mica and quartz-feldspar rocks continue to the east side of the area.

The sedimentary series strikes generally east-west and dips 40° to 70° N at its east end.

At the west end, the sedimentary banding curves around the Barrington River Pink Granite. The trend of the rocks is not straight but rather an open rolling type of folding which locally tightens up to Z-shaped dragfolds. These dragfolds plunge 50° to 70° to the northeast, east, and southeast. The plunges fan out from the granite. The sediments are highly contorted and develop a pronounced lineation near the granite contact.

Pink and white pegmatite dykes, and aplite dykes intrude the sediments.

At the east end of the sedimentary belt, the trend is roughly parallel to the shore of the Barrington River and is relatively consistent and straight. There are local, small dragfolds plunging 25° to 35° NE. This type of dragfolding is the reverse of that found in the igneous rocks to the north.

The sediments dip north and plunge northeast under the pinkish white granite and the Barrington River igneous complex.

In all cases, bedding and gneissosity were found to coincide. No evidence could be found to distinguish tops of beds.

Igneous Complex (2)

Distribution and Size

The igneous complex occupies a belt, 2 to 2 1/2 miles wide, which extends across the width of the map-area, along the north shore of the Barrington River. It occupies an area of about 21 square miles. About six square miles of the central part of the complex is obscured by drift. Good exposures are found along the lower 1 1/2 miles of the MacBride River and east to the border of the area, along the north shore of the Barrington River at the center of the map-area, and for 2 to 2 1/2 miles north of the Barrington River at the west side of the map-area.

Description

The rocks in this area consist essentially of hornblende-plagioclase gneiss with textures typical of the granulite facies. These are generally fine- to medium-grained and consist of 40 to 50 per cent hornblende. The hornblende-plagioclase rocks are rarely found alone but usually contain numerous granitic injections. These injections occur as sill-like bodies which locally become discordant and cross the more basic bands. Injection sills and dykes, similar to the four adjacent granitic rocks, are found in the complex in the vicinity of the mother intrusives. These dykes and sills are woven through the hornblende-plagioclase rocks, and in many places have assimilated and/or granitized them. Most of the smaller granitic injections (up 2 feet across) are white or pinkish white in colour and are strongly gneissic. The larger sills and dykes (2 to 100 feet across) are generally pink in colour and have massive igneous textures.

One distinctive type of granitic injection is the gneissic, white, hornblendic, biotite granite. It was noted that these injections are hornblende rich at their borders, in contact with the hornblende-plagioclase rocks, but decrease in hornblende content away from the contact. Where schlieren and inclusions of hornblende-plagioclase rock are abundant, the granite is hornblende rich. Generally when the hornblende content increases the quartz content decreases. Thus assimilation gives rise to hybrid hornblende monzonite and hornblende diorite types. The granitic injection rocks are extremely variable in mineralogical composition due to this assimilation process.

The injection, granitization, and assimilation of the hornblende-plagioclase rocks by the various granites has formed a hybrid gneiss which in many places contains over 50 per cent granitic material.

Dispersed through both the hornblende gneiss and the complex of granite and engulfed material are small interbands, lenses, and irregular bodies of gabbro and diorite. Generally, these lenses are less than five feet long and one foot wide. They are similar to the larger occurrences described as post-orogenic intrusives, but contacts are sheared and no age relationships with the surrounding rocks could be determined.

The hornblende gneisses and hybrid orthogneisses strike roughly parallel to the sediments to the south and curve around the Barrington River Pink Granite. Their plunge is 15° to 40° ENE and NE, generally flatter than the sediments.

Metamorphism and Origin

The hornblende-plagioclase gneisses have been metamorphosed to the upper amphibolite or lower granulite facies of regional metamorphism. The younger granitic, gabbroic, and dioritic intrusives probably followed this regional metamorphism as they show no indication of being affected by it.

The hornblende-plagioclase gneisses are considered to be regionally metamorphosed volcanic rocks.

MACBRIDE LAKE VOLCANIC-SEDIMENTARY BELT

Sedimentary Rocks (3)

Distribution and Size

Sedimentary rocks constitute about one-third of a volcanic-sedimentary belt, two to two and a half miles wide, which extends across the map-area between latitudes 56° 54' N and 56° 52' N. Their areal extent cannot be estimated due to lack of outcrop and complex interfingering relationships with other rock types. Good exposures of the sedimentary rocks are found west of Magrath Lake and north of MacBride Lake.

Description

The sedimentary rocks are found to alternate with volcanic rocks in bands 500 to 1,000 feet wide. They consist primarily of fine- to medium-grained garnet-mica schists with narrow interbands of chert, biotite-quartz-feldspar gneiss, and hornblende-rich schist. Local shearing has converted these to biotite-sericite, and mica-chlorite, schists. The sedimentary rocks are evenly banded and locally uniform in grain size. In the east central part of the belt, around the biotite monzonite, the sedimentary rocks are coarser grained and feldspar grains begin to show in the garnet-mica schists.

No structures, such as graded-bedding, cross-bedding, or ripple-marks indicate stratigraphic orientation.

Volcanic Rocks (4)

Distribution and Size

Volcanic rocks constitute the remaining two-thirds of this belt of rocks. Once again the irregular shape and poor exposure prevents a reasonable estimation of their areal extent. Good exposures of the volcanic rocks occur around Magrath Lake and north of MacBride Lake.

Description

The volcanic rocks are remarkably consistent in type and composition throughout the belt. They consist of fine-grained dark green andesite, with minor black basalt. Porphyritic horizons exhibit excellent flow structures, especially around the phenocrysts. Local shearing has developed mica, chlorite, and sericite schists. In the east central part of the belt, around the biotite monzonite, the volcanics have been recrystallized to fine- and medium-grained hornblende-plagioclase gneisses. The eastern part of the belt, around Magrath Lake, consists entirely of volcanic rocks to the exclusion of sediments.

South of MacBride Lake at the west side of the area, a narrow tongue of greenstone 1,500 feet wide extends into the granite for a distance of one and one-half miles. The lavas are fine-grained andesitic types similar to the main greenstone belt. Here, however, narrow interlaminations of fine- to medium-grained pyroclastics are found which do not occur in the main belt.

No flow tops, vesicles, amygdules, or pillows were observed.

Metamorphism and Origin

The greenstones and garnet-mica schists have reached the garnet grade or lower epidote-amphibolite facies of regional metamorphism. Local, intense, thermal metamorphism around the biotite monzonite has recrystallized the lavas to fine-grained hornblende-plagioclase gneiss and increased the grain size of the garnet-mica schists. No directly related thermal effects are observed around the hornblende diorites.

The greenstones are considered to have been originally fine-grained andesites with local porphyritic or basaltic horizons. The sediments appear to have been principally argillaceous types which give rise to the garnet-mica schists with minor chert and quartzofeldspathic interbeds.

PRE-OROGENIC GRANITE

White Gneissic Hornblende Granite (5)

Distribution and Size

One pre-orogenic granite outcrops in the MacBride Lake area. It underlies an area of approximately two square miles on and west of the MacBride River about two miles north of the Barrington River.

Description

The granite is a fine- to medium-grained white, gneissic, hornblende variety. Mineralogically it consists of 20 to 25 per cent quartz, 3 to 5 per cent biotite, 0 to 5 per cent hornblende, 65 to 75 per cent feldspar, and an occasional trace of small garnets. The feldspar is white and has no visible polysynthetic, albite twinning in hand specimen. All of the minerals have crushed and brecciated outlines. The cataclastic nature of the gneissic structure obliterates any trace of the original texture.

Inclusions of hornblende-plagioclase rocks and hornblende-rich schlieren are found in the granite. There is a possibility that these inclusions are from the Barrington River igneous complex. If such were the case, this granite would be younger than the complex.

SYNOROGENIC INTRUSIVES

Pinkish-white Granite (6)

Distribution and Size

Pinkish-white granite occurs as a band 1,000 to 2,000 feet wide along the Barrington River, from the center to the east side of the area. It follows closely the contact between the sediments and the orthogneiss. Exposures are lacking at the east end and it could not be determined definitely whether the granite extends eastward from the map-area.

Description

The pinkish-white granite is a well-banded, gneissic, biotite granite. Its pink and white banding imparts to outcrops a pinkish-white colour when viewed at a distance. The bands differ mineralogically, giving rise to two types of granite; a pink, quartz-rich variety and a grey-white, hornblendic variety. Both varieties are fine- to medium-grained and contain biotite. Mineralogical compositions are: 20 per cent quartz, 75 per cent feldspar (pink), and 3 to 5 per cent biotite for the pink variety; and 8 per cent quartz, 80 per cent feldspar (white), 10 per cent biotite, and 1 per cent hornblende for the grey-white variety. The gneissic structure is cataclastic with a minimum of recrystalization.

The granite is a concordant intrusion along the contact between the sediments and the orthogneiss. It contains numerous small inclusions of hornblende-biotite schist and gneiss and takes on a deep pink colour along the contacts with these inclusions.

The contacts between the granite and the surrounding sediments and orthogneiss are irregular due to their lit-par-lit injection nature. The sill- and dyke-like extensions of the granite make up a major part of the orthogneiss. Excellent exposures of the lit-par-lit injection contact can be seen on the islands just west of the mouth of the MacBride River. Here large slices of the hornblende gneiss can be seen alternating with bands of pinkish-white granite. Coarse-grained, pink, biotite granite pegmatites intrude the granite.

Banded Diorite Gneiss (7)

Distribution and Size

The largest area of banded diorite gneiss adjoins the MacBride Lake volcanic-sedimentary belt on the north and extends the complete width of the map-area. This band is about one mile wide and covers an area of approximately 19 square miles. A small wedge of the gneiss, three-quarters mile at its widest point and two and three-quarters miles long, strikes eastward into the northwest corner of the area from the Barrington Lake area. Two small lenses occur at about the same latitude near the east side of the area.

Good exposures of this gneiss can be seen west of the North MacBride River and among the numerous outcrops southeast of McAree Lake.

Description

The banded gneiss consists of three units which occur in varying proportions at different localities. These three rock types form the complexly interbanded and interlensed gneiss which constitutes the main belt as well as the smaller occurrences along the northern margin of the area. They are:

(a) Hornblende diorite gneiss

(b) Quartz-diorite augen gneiss and hornblende granite gneiss

(c) Quartzofeldspathic gneiss

The predominant unit is gneissic hornblende diorite. It has a moderately to strongly gneissic structure and consists of 15 per cent hornblende, 10 per cent biotite, 75 per cent feldspar, and 0 to 1 per cent quartz Generally quartz is absent. A massive variety with interlocking igneous texture and euhedral plagioclase is occasionally seen. It consists of up to 25 per cent hornblende, 2 to 5 per cent biotite, 70 to 75 per cent feldspar, and 0 to 1 per cent quartz. The feldspar is calcic oligoclase to sodic andesine (An_{20} An_{35}). All textures from massive to strongly gneissic may be seen in single outcrops.

In many places the gneissic hornblende diorite will gradationally change to a quartz-diorite augen gneiss or hornblende granite gneiss by an increase in quartz content and the development of small lenses or augen of pink feldspar. The quartz content may increase to as much as 15 per cent and the pink feldspar content to as much as 30 per cent of the rock. The augen are not evenly distributed throughout the rock but rather occur in bands ten to thirty feet wide. Between these bands the quartz content may be 15 per cent but no augen are present. The gneissic structure is better developed in these areas of higher quartz and feldspar content.

The third rock type is a fine-grained, biotitic, quartzofeldspathic gneiss. This occurs as bands up to 40 feet wide, but usually forms lenses and irregularly shaped inclusions in the diorite gneiss. It generally consists of 2 to 5 per cent biotite, 15 to 20 per cent quartz, and 75 to 85 per cent feldspar. The equidimensional quartz and feldspar grains give the rock a granular appearance in places but the general foliation is due to streaks of oriented biotite.

The main belt of gneiss consists of approximately 70 per cent diorite gneiss, 15 per cent quartz-diorite augen gneiss and hornblende granite gneiss, and 15 per cent quartzofeldspathic gneiss. The smaller lenses and wedge to the north consist of approximately 60 per cent diorite gneiss and 40 per cent quartzofeldspathic gneiss.

The trend of the gneiss is consistent and straight within small areas. No folding or dragfolding was observed. The rocks have an easterly strike and a 30° to 70° southward dip. In the massive variety of diorite, an occasional flow structure may be seen; these trend northward.

Gneissic Red-Stained Granite (8)

Distribution and Size

The gneissic red-stained granite occurs as a band of batholithic proportions adjoining the banded diorite gneiss on the north. The batholith is two and three quarters miles wide at its west end, five and one half miles wide at its east end, and extends out of the map-area in both directions. It covers an area of approximately 40 square miles. In addition, it occurs as dykes, sills, lenses, and bosses in the gneisses and migmatites to the north.

Description

On its weathered surface the granite is pinkish white or white in colour with dark clusters of biotite which weather out to form a pocked surface. The quartz, and often some of the feldspar, contains a distinctive irregular red stain for which the rock is named. This red stain is due to included hematite and shows on fresh as well as weathered surfaces.

Mineralogically the rock consists of 20 to 25 per cent quartz, 45 per cent albite plagioclase (An_5 to An_{10}), 20 per cent potash feldspar, 3 to 7 per cent biotite (rarely as high as 15 per cent), and 0 to 15 per cent hornblende. The granite is generally strongly gneissic in texture but a massive type does occur within a small area at the east end of McAree Lake. The gneissic varieties vary from medium- to coarse-grain size and the massive varieties are coarse grained. The quartz occurs as equidimensional "eyes" in a coarser feldspar mesh. The quartz, plus rare small micropegmatite patches, has well-rounded shapes and replaces the earlier feldspar along grain boundaries. The biotite occurs in clots or clusters up to one inch long. These clusters are angular in shape and have a hornblende core in the massive varieties. In the gneissic varieties, the biotite clusters can be found in all stages of deformation as lenses or smeared stringers. These have no hornblende core. The biotite content is greater at the west end of the batholith. Highly disseminated, subhedral to euhedral crystals of sphene occur up to 3/16 inch by 1/16 inch in size.

Medium- to coarse-grained aplites and pegmatites occur in clusters, often comprising 90 per cent of the outcrops. Some of the aplites and pegmatites have the same red stain as the granite. These particular dykes occur only along planes of weakness such as the gneissosity or joint planes.

The jointing in the granite is generally related to the gneissosity. Two sets of imperfect low angle joints dip 15° to 30° S and 15° to 25° N. These are probably low angle expansion joints on the roof of the batholith. A third set strikes across the gneissosity at angles of 45° to 90° and dips 75° to 90° east or west.

The granite contains only a few small hornblende-rich inclusions along its northern margin.

Only one contact was actually observed between the granite and the banded diorite gneiss. This exposure is located on the south shore of McAree Lake, southwest of the island. The contact is gradational and sheared. The diorite gneiss contains upwards of 15 per cent pink feldspar augen at this locality. It is sheared near the contact but only a few feet away it is unsheared. The granite, however, has a strong cataclastic texture for some distance from the contact. The pink feldspar augen increase in abundance towards the granite but the granite itself contains no augen of pink feldspar.

Granitic Gneiss Complex (9)

Distribution and Size

These rocks extend north of the gneissic red-stained granite to the northern border of the area and at the west end of the MacBride Lake volcanic-sedimentary belt. The areal extent of the gneisses to the north of the granite is approximately 3 square miles; and to the west of the MacBride Lake volcanic-sedimentary belt, 2 square miles.

Description

The gneisses are variable in petrological composition and structural pattern. They may be divided into three general types:

(a) Banded gneisses consisting entirely of rocks of granitic composition.

(b) Banded gneisses consisting mostly of rocks of granitic composition but containing some basic members.

(c) Gneisses consisting mostly of granitized volcanic rocks and cataclastic granitic gneisses with lesser amounts of granitized sedimentary rocks.

Types (a) and (b) occur along the northern border of the area and all three types occur to the west of the MacBride Lake volcanic-sedimentary belt.

Type (a) is found in three forms: medium-grained pinkish-white or cream colored biotite granite gneiss; medium- to coarse-grained greyish-white biotite granite gneiss; and fine- to very fine-grained biotite granite with a granular texture.

The pinkish-white or cream colored gneiss is very similar to the gneissic red-stained granite to the south. Both have the red-stained quartz and occasional clusters of biotite. When found with the other two granitic rocks, the pinkish-white granite intrudes and includes the others. The pinkish-white granite gneiss always contains inclusions of the other two granitic gneisses, "biotite ghosts" of inclusions, or schlieren of biotite.

The greyish-white biotite granite gneiss is extremely variable in composition but uniform in grain size. The quartz content is generally high; 20 to 30 per cent. A few "biotite ghosts" or biotite schlieren are found in this gneiss but generally no distinct inclusions.

The granular biotite granite is white or greyish white in colour. The mineralogical composition is consistently about 15 per cent quartz, 5 per cent biotite, and 80 per cent feldspar. This granite contains no inclusions or "biotite ghosts". Schlieren are small and poorly developed.

Gneissic structure is imparted to the greyish-white and pinkish-white gneisses by an elongation of the quartz and feldspar grains as well as by the orientation of biotite flakes and oblong inclusions. In the fine-grained biotite gneiss, the quartz and feldspar are equidimensional and the gneissic structure is imparted by the orientation of biotite flakes.

The three varieties of granite gneiss of type (a) occur as interbands and lenses forming an injection gneiss. They occur in the ratio of 50:30:20, pinkish-white gneiss: greyish-white gneiss: fine-grained gneiss. Late, salmon-pink aplites and pegmatites criss-cross the outcrops.

The second type of complex gneiss (type b) consists of the three gneisses just described, occurring in different proportions and with larger amounts of basic material. It is more evenly banded, the bands consisting of the pinkish-white biotite granite gneiss and minor amounts of the other two granitic gneisses alternating with hornblende-feldspar gneiss, biotite schists, and/or hornblende-biotite schists. About 50 per cent of this type of gneiss consists of the hornblende and biotite rich rocks.

The third type of complex granitic gneiss (type c) consists of wide bands of granitized greenstones and cataclastic granite gneisses with minor amounts of granitized sedimentary rocks.

The predominant member of these gneisses is a medium-grained, biotite-granite gneiss. The quartz and feldspar are very fine grained, granular, approaching mylonitic in places. The biotite runs in streaks around crushed clusters or augen of quartz and feldspar. This gneiss may vary in colour from pinkish- to greyish-white. Along certain wide zones in this granite gneiss, the hornblende content increases to 5 to 7 per cent and abundant small rounded inclusions of granitized greenstone appear. Along some zones these inclusions may comprise 70 per cent of the gneiss.

Some parts of the hornblende-biotite granite gneiss, where interbanded with the granitized greenstone inclusions, are garnetiferous. There is a possibility that these are the remains of assimilated sedimentary interbeds.

POST-OROGENIC INTRUSIVES

Gabbro and Diorite (10)

Distribution and Size

Igneous rocks of gabbroic and dioritic composition occur at several localities in the central and southern parts of the area, particularly in the Barrington River igneous complex and in the eastern part of the MacBride River Volcanic-sedimentary Belt. A small area of diorite was seen a mile south of MacBride Lake at the west edge of the map-area, and numerous inclusions of gabbro appear in pink porphyritic granite west of the MacBride River.

Description

(a) Gabbro:

(i) Thirty-five hundred feet north of the Barrington River and four and one-half miles west from the east border of the area, three types of gabbro are exposed on an outcrop ridge. All three have massive igneous textures but vary in grain size and composition. The first gabbro is fine grained and consists of 50:50 hornblende: feldspar. The second gabbro is medium- to coarse grained and contains 60 to 65 per cent feldspar. The third is rich in mafic minerals (70 to 80 per cent). No contact was observed between it and the other two types.

(ii) On the east bank of MacBride River, 3,560 feet upstream from the Barrington River, an excellent exposure of two gabbros may be seen. The orthogneiss is intruded by, and included in, very coarse-grained gneissic gabbro. The hornblende in this gabbro is agglomerated in knots up to one-half inch across, whereas the feldspar is fine grained. A subsequent coarse-grained, diabasic, gabbro includes fragments of both the orthogneiss and the first gabbro. This second gabbro is characterized by large euhedral needles of hornblende up to one inch long.

(iii) Within an area of 1 1/2 by 2 1/2 miles, on the MacBride River and west of it, a pink porphyritic granite contains abundant angular inclusions of porphyritic gabbro. Outcrops that contain fragments of brecciated gabbro are indicated on the accompanying map by small equilateral triangles. The gabbro may constitute up to 90 per cent or more of the outcrop at some points. Large areas consist of 80 to 90 per cent gabbro, brecciated and cemented by granite. The larger masses of gabbro retain their massive interlocking porphyritic texture. The smaller gabbro fragments are gneissic, twisted, contorted, and hydrated to form biotite, hornblende, and/or chlorite schists and schistose gneisses. The borders of the massive breccia fragments usually show effects of assimilation and dragging.

The fresh gabbro is medium grained, with white feldspar phenocrysts up to 1/8 inch long and hornblende phenocrysts up to 1/4 inch long. These are set in a groundmass of hornblende and feldspar grains 1/16 inch across. The gabbro consists of 70 per cent hornblende and 30 per cent feldspar.

(iv) Two varieties of gabbro outcrop along the south side of the north bay of Magrath Lake. The first gabbro, a fine- to medium-grained hornblende variety, consists of about 68 per cent hornblende, 2 per cent biotite, and 30 per cent feldspar. It generally has a massive igneous texture, but becomes gneissic when it is intruded by the second gabbro. The second gabbro, an anorthositic variety, consists of about 5 per cent biotite, 10 per cent hornblende and 85 per cent plagioclase. It is medium to coarse grained and has a well developed interlocking igneous texture. An observed contact, dipping 15° NE, shows the anorthositic gabbro intruding the other gabbro. Dykes of biotite monzonite and quartz monzonite intrude both gabbros.

(b) Diorite:

(i) A narrow, lensing, band of gneissic diorite outcrops along the western end of the northern border of the Barrington River igneous complex. The diorite is medium grained and consists of about 2 per cent biotite, 40 per cent hornblende, and 60 per cent feldspar. The rock has been sheared and sliced in the direction of the regional strike. A golden-coloured mica has developed along slip surfaces. Bands which were not affected by the deformation, display a well developed flow structure striking S 65° W. These massive bands may contain knots of hornblende crystals up to 1/4 inch across; the hornblende is euhedral and the feldspar anhedral.

(ii) The diorite one mile south of MacBride Lake is a gneissic and hornblendic variety. Some of the hornblende grains are about 1/16 inch across, but the feldspar and most of the hornblende is finer-grained, about 1/32 inch across. All minerals are anhedral. The mineralogical composition is 38 per cent feldspar, 40 per cent hornblende, 20 per cent biotite, and 2 per cent quartz. About one-half of the feldspar exhibits polysynthetic twinning. The plagioclase is andesine (An_{30} to An_{32}). This diorite is an extension of the diorite and quartz diorite in the Barrington Lake[1] area. The diorite was observed to be in contact with the granite to the south, indicating that no gabbro occurs between these two rock types as it does to the west.

(iii) Several diorite intrusives occur as elongated bands and lenses within the limits of the MacBride Lake volcanic-sedimentary belt. They are medium-grained biotitic hornblende diorites. Mineralogically they consist of 5 per cent biotite, 35 per cent hornblende, and 60 per cent andesine plagioclase. Their textures are massive, interlocking, igneous. This rock type shows chilled contacts against the biotite monzonite and sedimentary rocks.

[1] Crombie, G. P.: op. cit., p. 9

Biotite Monzonite (11)

Distribution and Size

The biotite monzonite is confined to the eastern half of the MacBride Lake volcanic-sedimentary belt. It occurs as dykes, sills and lenticular stocks. The paucity of outcrop combined with irregular shape makes it impossible to give an estimate of surface area.

Description

The rock type is a medium- to coarse-grained, pinkish-white, biotite monzonite. Mineralogically the monzonite consists of 10 per cent biotite, 0 to 10 per cent hornblende, 35 per cent albite (An_{10}), 55 per cent orthoclase, and 0 to 1 per cent quartz. The texture is generally porphyritic, with the phenocrysts oriented in a preferred direction which is interpreted as a flow direction. The phenocrysts are subhedral to euhedral pinkish-white feldspar, which lack polysynthetic twinning but exhibit carlsbad twinning. They vary in size from 1/8 inch by 1/16 inch to 1/8 inch by 1/4 inch. The groundmass feldspar is predominantly white, and usually consists of one-half albite. The monzonite may consist of as much as 30 per cent phenocrysts in some locations though non-porphyritic equigranular types are not uncommon. The biotite is fine grained and accompanied by small grains of magnetite. Usually 5 to 8 small grains of anhedral sphene are seen in a thin section. In the vicinity of hornblende-rich inclusions, the monzonite develops small widely scattered anhedral hornblende crystals which locally make up as much as 10 per cent of the rock. This rock is very similar to the pink porphyritic granite in appearance and composition, the main difference being in the content of quartz and plagioclase.

The biotite monzonite intrudes the MacBride Lake volcanic-sedimentary belt both discordantly and concordantly. Locally it shows assimilation effects but generally it is consistent in texture and composition. The orientation of the flow structure conforms with the regional strike and dip or with the strike and dip of the included and intruded sediments. In places the phenocrysts are deformed and the groundmass is weakly gneissic indicating disturbance during crystallization. Few strongly gneissic varieties are present.

Pink Porphyritic Granites (12)

Distribution and Size

This group of rocks underlies an area approximately 4 miles square at the east side of the map-area and extends from the Elbow on MacBride River southward to within 1 1/2 miles of the Barrington River. It surrounds the white gneissic hornblende granite, and is bordered by the biotite monzonite to the north, the Red-Stained Granite to the west, and the Barrington River igneous complex to the south.

This rock is best exposed west of the MacBride River and along its shores in an area 1 1/4 by 2 miles near the eastern border of the map-sheet.

Description

The major rock in this group is pink granite which occurs as three main types.

The most abundant type is a coarse-grained pink porphyry. In hand specimen this rock is almost identical with the biotite monzonite and is believed to be closely related to it. The porphyry constitutes most of the granitic rock in the igneous breccias, half of the granite in the outcrops east of the MacBride River, and most of the outcrops northwest of the White Gneissic Hornblende Granite. Mineralogically it consists of 5 to 7 per cent biotite, 5 to 10 per cent quartz, 50 to 60 per cent orthoclase, 15 to 20 per cent microline, 10 to 15 per cent oligoclase (An_{16} to An_{24}), 0 to 4 per cent hornblende and a few small grains of subhedral sphene. About 30 per cent of the rock consists of pink or pinkish-white feldspar phenocrysts. The phenocrysts are generally 1/4 inch by 3/16 inch and the biotite and quartz 1/16 inch across. Hornblendic varieties occur near contacts with basic inclusions, and appear to result from assimilation of hornblende-rich rocks.

The next most abundant granitic type is a salmon pink, non-porphyritic, medium-grained granite. It has a massive interlocking texture and is very uniform in grain size. Mineralogically it consists of traces of hornblende, trace to 3 per cent biotite, 20 per cent quartz, and 75 to 80 per cent feldspar. The feldspar is the same as in the porphyritic variety. This type of granite occurs at the contacts with bordering rock types and is most abundant in the area around the Elbow on MacBride River.

The third granitic type is a pinkish-white porphyry. Most of the outcrops occur east of the MacBride River, but a few small occurrences were found on the west arm of the MacBride River Elbow. Mineralogically it has the same composition as the other porphyritic variety. Texturally it is different. The phenocrysts form only 5 to 10 per cent of the rock and are up to one inch square. The feldspar in the phenocrysts and groundmass has a paler pink colour than in the other porphyry. The feldspar in the groundmass is usually oriented in a flow direction. East of the MacBride River, numerous salmon pink aplites cut both porphyries. At this locality, both of the porphyritic granites contain occasional inclusions of a fine grained granular white biotite granite. This rock does not resemble any of the other granitic rocks in the area. There are many good exposures showing pink porphyry intruding pinkish-white porphyry in the form of dykes and apophyses. No contacts were observed between the non-porphyritic and porphyritic types.

Red-Stained Quartz Monzonite (13)

Distribution and Size

The red-stained monzonite forms a stock occupying 30 square miles at the west side of the map-area and extends westward from there. Three included lenses of greenstone and one of diorite occur in its northwest corner.

Description

The monzonite is a pinkish-white, medium-grained, biotitic rock. Generally it has a massive interlocking texture, but gneissic varieties are not uncommon. The feldspar occurs as pink and white grains 1/16 inch across and as phenocrysts 1/8 inch to 1/4 inch across. The phenocrysts are microcline and are highly disseminated, making up less than 1 per cent of the rock. Generally they have about a two foot spacing on the outcrop surface. Both orthoclase and plagioclase feldspars are present in the ratio 70:15. The plagioclase is oligoclase of composition An_{16} to An_{26}.

The quartz occurs as equidimensional rounded "eyes" larger than the feldspar. These quartz "eyes", up to 1/8 inch across, form phenocrysts in the feldspar groundmass. Quartz "eyes" and small patches of micrographic intergrowth replace the earlier feldspars in the groundmass. The red hematite stain, for which the rock is named, occurs most frequently in the quartz. In some localities it is also found in adjoining feldspar. This stain occurs in about 10 per cent of the quartz grains.

Hornblendic varieties outcrop near the contacts with hornblende rich rocks such as greenstone and gabbro. Generally the appearance of hornblende marks a complementary decrease in quartz content.

Mineralogically the monzonite consists of 2 to 5 per cent biotite, 15 to 20 per cent quartz, 15 to 20 per cent plagioclase, 60 to 70 per cent potash feldspar, and 0 to 7 per cent hornblende.

The south central part of the pluton has a quartz rich core. Here the quartz content increases to 25 per cent and the biotite content falls to less than 0.5 per cent. The quartz "eyes" increase in size to 3/16 inch across. The feldspar phenocrysts are more numerous but smaller.

A salmon pink, coarse-grained, biotite syenite forms intrusive lenses in the red-stained granite. These long narrow syenite bands are arranged in a pattern roughly parallel to the walls of the pluton. About one per cent of the syenite consists of feldspar phenocrysts 1/8 inch across. The mineralogical composition of the quartz syenite is 3 to 5 per cent oligoclase (An_{11} to An_{16}), 80 per cent microcline, 5 per cent biotite, and 1 to 2 per cent quartz. About 12 to 15 small euhedral sphene crystals are usually seen in a thin section.

In addition to the occurrences of syenite shown on the accompanying map, there are many too small to be shown on the present scale of mapping.

Gneissosity in the monzonite roughly parallels the contacts of inclusion and bordering rocks.

The flow layering strikes east or east-southeast and dips vertically or very steeply. The exceptions to this are the flow layers near to contacts, which they parallel. The flow lineations plunge to the east at angles as low as 35°. These features indicate that the monzonite moved up from the east.

The joints occur in pairs, one set roughly parallel to the closest contact and the other set at right angles to it. Within the pluton, away from its contacts, the joints dip 80° to 90°.

One occurrence of slickensides on a vertical joint surface indicates horizontal movement. This type of movement plus the conjugate arrangement of the two sets of joints suggests that they result from horizontal compressional forces effective after solidification. The vertical set of joints, which strike approximately at right angles to the contact, are frequently found to contain aplite and pegmatite dykes. This suggests that the movement which produced the joints occurred not long after the quartz monzonite solidified but before its last aplites and pegmatites had crystallized.

Near the contacts of the pluton, the joints dip 60° to 70° both towards and away from the contact. These are considered to be roof expansion joints. An additional set of roof expansion joints parallel the contact and dip 0° to 20° towards and away from the contact. It is interesting to note that the later syenite bands were intruded along the expansion joints rather than the high angle conjugate joints.

Barrington River Pink Granite (14)

Distribution and Size

This granite pluton occupies three square miles in the southwest corner of the map-area. It extends westward into the Barrington Lake area and southward into the Uhlman Lake area.

Description

The rock is very coarse-grained, pink, biotite granite. It has a massive, interlocking, equigranular texture which is locally porphyritic. The quartz grains are usually 1/8 inch across and the feldspar 1/4 to 3/8 inch across. Where the rock is porphyritic, some of the pink feldspar grains are about three times this size and minor amounts of a white feldspar make an appearance. The highest content of white feldspar that was recorded is 5 per cent. No polysynthetic twinning can be seen on the feldspar. Mineralogically the granite consists of 5 per cent biotite, 6 to 8 per cent quartz, and 87 to 89 per cent feldspar.

Three flow lineations were recorded. Two indicate a low angle movement up from the north and the third indicates a movement up from the west. All of the linear features plunge 50° to 60° northeast, roughly parallel to the dip of the rocks. One exception is the 25° N plunge which occurs farther south within the pluton and probably indicates a flattening of its roof. The one flow layer which was recorded, indicates movement up from the north.

Near the contact and within the pluton, most of the joints occur in pairs. One usually dips 40° to 60° towards the contact whereas the other is usually steeper (70° to 90°) and strikes at about right angles to the first. The low angle jointing is probably parallel to the roof of the pluton and the high angle jointing is the complementary cross-joint system. There is one low angle joint system dipping 15° E which is probably a roof expansion joint.

REGIONAL STRUCTURAL GEOLOGY

Throughout the area, the regional trend is eastward. In the southern parts of the area, dips are to the north. This dip trend is interrupted by the red-stained granite and the pink porphyritic granites. North of these intrusives, the dips in the volcanic-sedimentary belt are complexly north and south. These dips become consistently southward, south of McAree Lake. At the west end of the gneissic red-stained granite batholith in the McFadden Lake area, the dips are vertical or steeply north or south. Eastward, north of McAree Lake, the dips flatten. A line joining the east tip of McAree Lake and a point three-quarters of a mile north of the west tip of McAree Lake forms an axis about which the dips are oriented. North of this axis the dips are 60° to 80° S. The reversal is sharp and takes place within a distance of a few hundred feet on the north shore of the east end of McAree Lake. The massive varieties of granite occur on the south shore of McAree Lake, adjoining the axial zone of the dip reversal. The proximity of the massive granite and the axis of dip reversal suggests that the gneissic structure is a surficial feature which disappears with depth.

Three possible explanations for this gneissic shell enclosing a massive core are as follows:

1. Dragging against the walls of the magma chamber caused an orientation of mineral grains. Subsequently, the outer shell of the magma attained a rigid or semi-rigid state, and slippage planes developed parallel to the oriented grains, accentuating the gneissosity. In this case the granite would be post-orogenic.

2. The granite was structurally similar to the red-stained quartz-monzonite before the second orogeny and acted as a buttress during the folding. Most or all of the movement around it was taken up along slippage planes near its border. The direction of these slippage planes may be controlled by primary flow orientation. In this case, the granite would be pre-orogenic.

3. Most of the granite solidified during folding but the core solidified after folding. This would give rise to a synorogenic granite with a post-orogenic core.

There is no field evidence to indicate which of these possibilities is correct. The second possibility is accepted here but the other two are possible.

There are two significant structural features in the MacBride Lake volcanic-sedimentary belt. East of the North MacBride River it is possible to trace a flexure in the regional trend. The nose of the flexure points and plunges 70° to 80° north. The greenstones surrounding Magrath Lake have been folded more intensely as indicated by the minor folds observed on outcrops. The S-dragfolds predominate but a Z-dragfold to the north and the folding on the islands on Magrath Lake indicate a synclinal axis striking and plunging about 50° northwest.

No evidence of faulting could be found.

BASIS FOR CHRONOLOGY

BARRINGTON RIVER IGNEOUS COMPLEX AND SEDIMENTARY BELT

1. The surrounding granites intrude this belt; the pre-orogenic granite contains inclusions of hornblende-plagioclase gneiss; no evidence was found to indicate that any of the other intrusives in the area are older than this belt.

2. This belt is metamorphosed to the upper amphibolite or lower granulite facies of regional metamorphism. The MacBride Lake volcanic-sedimentary belt is metamorphosed to the lower epidote-amphibolite facies of regional metamorphism. It is concluded that the MacBride Lake belt was not present when the highest grades of metamorphism were impressed on the Barrington River belt. Hence, the Barrington River belt is assigned a greater age than the MacBride Lake belt.

MACBRIDE LAKE VOLCANIC-SEDIMENTARY BELT

1. The surrounding rocks, in contact with this belt, intrude it. There is no evidence to indicate any of the other intrusives in the area are older than this belt of rocks.

2. An age younger than that of the Barrington River igneous complex is assigned to this belt of rocks on the basis of the lower phase reached in metamorphism.

The ages of the intrusives are assigned relative to one another and to a period of orogenic movement which folded the MacBride Lake and Barrington River belts. This orogeny was probably accompanied by regional metamorphism which reached the lower epidote-amphibolite facies. Previous to this orogeny and the deposition and outflow of the MacBride Lake rocks, an earlier orogeny occurred which folded and metamorphosed the Barrington River rocks to the upper amphibolite or lower granulite facies.

PRE-OROGENIC GRANITE

1. This granite is intruded by the granite that surrounds it.

2. No other intrusive in the area has such a complexly folded structure. It is concluded that orogenic forces formed this structure and so the granite is pre-orogenic.

SYNOROGENIC INTRUSIVES

1. These rocks have a gneissic structure. They are concordant intrusives which suggests that the structural pattern of the area controlled their emplacement.

2. The relative ages of the Banded Diorite Gneiss and Pinkish-white Granite could not be determined.

3. Gneissic Red Stained Granite has introduced "augen" of pink feldspar into the Banded Diorite Gneiss. It is concluded that the granite is younger than the gneiss. See also the discussion of regional structure.

4. The Complex Granitic Gneisses were formed by intrusion by the Red Stained Granite. Relative ages of the intruded gneisses and rocks to the south could not be determined.

POST-OROGENIC INTRUSIVES

1. These intrusives show little or no gneissic structure. It is concluded that these rocks were not present when the gneissic trends were impressed on the area.

2. Biotite monzonite intrudes some of the gabbro and is therefore younger.

3. Pink Porphyritic Granites include fragments of gabbro and are therefore younger that some of the gabbros.

4. Some of the diorites have a gneissic structure indicating that they are late synorogenic or early post-orogenic.

5. The relative ages of the four granitic post-orogenic intrusives could not be determined.

ECONOMIC GEOLOGY

There are no known orebodies in the MacBride Lake area. Numerous small sulphide occurrences were found. These are generally pyrite mineralization. The hornblende-plagioclase gneisses and greenstones in the sedimentary belts carry the same highly disseminated pyrite and pyrrhotite. One spotty pyrite gossan, 200 to 300 feet across, occurs 2 1/2 miles north of MacBride Lake and 1 mile west of the North MacBride River.

One and a half miles north from MacBride Lake and one mile east from the North MacBride River, an interesting gossan occurs in mica schist. The sericite-muscovite schist is part of a shear zone in sediments. Disseminated magnetite, pyrite, and traces of pyrrhotite and chalcopyrite have entered

along these shears. The whole shear zone is heavily stained red and yellow. The mineralized zone is 40 feet wide and 200 feet long. Magnetite, which is abundant, gives rise to a magnetic anomaly in this vicinity.

No other interesting mineralization was observed. The numerous gabbro and diorite intrusions possibly deserve closer prospecting for copper and nickel. Geophysical reconnaissance investigations of the main gabbro zones would serve to locate any interesting base metal sulphides.

The most favourable zone for prospecting would be the Barrington River and MacBride Lake volcanic-sedimentary belts.

No claims have been staked in the MacBride Lake area.