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DEPARTMENT OF MINES AND RESOURCES

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PAPER 49-19

MacALPINE CHANNEL MAP-AREA, NORTHWEST TERRITORIES

(REPORT AND MAP)

By

M. Feniak

OTTAWA

1949

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MACALPINE CHANNEL MAP-AREA, N.W.T.

INTRODUCTION

GENERAL STATEMENT

MacAlpine Channel map-area includes the islands and mainland of the east side of Great Bear Lake, bounded by latitudes 66° 15' and 66° 30' and by longitudes 117° 30' and 118° 00'. Its south boundary is 12 miles north of Eldorado mine. The party, consisting of R. Mulligan, J. McGlynn, and S. E. Jenness, with the writer in charge, was in the field from June 26 to September 10, 1947, but because of ice it was not possible to travel by canoe between Port Radium and Hunter Bay before July 22.

TOPOGRAPHY

The map-area has the aspect of a deeply incised plateau with maximum relief of 880 feet, 4 miles west of the mouth of Norrie Bay. The shoreline is extremely irregular, with deep fiord-like bays and long estuaries. In places the shore is marked by abrupt cliffs rising several hundred feet above the level of Great Bear Lake. The country to the north, underlain by the Hornby Bay series, is lower in elevation and less rugged than that underlain by the older rocks. Here, erosion causes mesa-like hills and east-facing cuestas where diabase sills have intruded the gently west-dipping sandstones.

FUEL AND POWER

Good timber is scarce, but there are enough scattered stands of spruce on sheltered slopes to provide lumber, mine timber, and wood for the initial stages of a normal mine operation. The nearest important sources of fuel are oil at Norman Wells, 280 miles westward, and coal of undetermined merit is found near Etacho Point on the west shore of Great Bear Lake. Sloan River, which drops approximately 175 feet in a series of rapids within the interval 6 to 5 miles from its

mouth, might serve as a source of power, but the volume of water is not large, particularly in the winter months.

ANIMAL LIFE

Animal life is scarce, but moose, caribou, bear, wolves, beaver, mink, and muskrats were seen. The lakes abound in fish of excellent quality, lake trout and whitefish being the most important for food.

GLACIATION

Effects of Pleistocene glaciation are evident throughout the map-area. Glacial striae indicate that the general movement was in the direction north 10 degrees west. Many of the hills have rounded tops, abrupt west-facing sides, and relatively gentle slopes in the east direction. Where leeward sides of hills have been plucked by glaciation, boulder trains are developed for a distance of several hundred yards. The glacial action in the area was largely erosive, resulting in more than 50 per cent outcrop. Scattered glacial erratics occur throughout the map-area, but sand and gravel outwash is scarce. One esker, trending west, enters the east end of Elizabeth Lake, 6 miles northeast of Doghead Point.

POST-GLACIAL DEPOSITS

Remains of old beaches are present throughout the area mapped, and are particularly well developed between Norrie Bay and Hornby Bay, and on the islands of Hornby Bay. West of Norrie Bay the highest beach is approximately 450 feet above the level of Great Bear Lake. As the highest post-glacial beaches on the north side of Hornby Bay are 500 feet above Great Bear Lake,[1] a

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[1] Kidd, D. F., Geol. Surv. Canada, Sum. Rept. 1931, pt.C, pp. 54, 55 (1932).

southerly tilting is indicated in post-glacial time. This suggestion is supported by a report[1] of post-glacial beaches

[1] Nesbitt, J., pilot, Eldorado Mining and Refining (1944) Limited, personal communication.

900 feet above sea-level on the Arctic coast, 120 miles farther north.

The lithology of the beach material reflects the lithology of the underlying bedrock. Beach gravel and cobbles overlying the Hornby Bay series are composed almost entirely of sandstone, whereas beach pebbles in sections underlain by porphyry are largely porphyry. Beach material of some beaches is better sorted, more rounded than similar material on a higher or lower beach, but there does not appear to be any consistent relationship between these properties of beach material and height above present lake level. In general, the larger, better developed beaches show more rounding and better sorting.

Whitish weathering silts in which are embedded trunks of coniferous trees extend along the lower few miles of Sloan and Harrison Rivers, a short distance northeast of the area mapped. The uniform texture of the silt, the prominence of crossbedding, and the marked slope towards the lake all indicate strongly that these are deltaic deposits, probably contemporaneous with the post-glacial beach deposits.

GENERAL GEOLOGY

CAMERON BAY GROUP (?)

All the consolidated rocks of the map-area are Precambrian. The oldest rocks are a complex of volcanic and pyroclastic rocks (2)[2]

[2] Figures in parentheses are those of map-unit numbers in map-legend

interbedded with sedimentary rocks (1). The lavas are largely maroon to pinkish dacites with marked trachytic structure. In some places, particularly towards the north of the area where flows are dominant, maroon to purplish andesites are present. These commonly show concentrations of amygdules in the upper parts of flows. On the whole, however, the volcanic rocks of MacAlpine Channel are somewhat more siliceous than those near Echo Bay. In many places it is possible to determine the general strike and direction of dip from the trachytic structure of flows.

The sedimentary rocks (1) consist of conglomerate on Achook Island, Rocher Rouge, Cornwall Island, and north part of Stevens Island, and parts of Doghead Peninsula. Elsewhere they are largely gritty quartzite, impure quartzite, and argillite. The conglomerate is ferruginous, coarse to fine, poorly bedded, and contains fairly well-rounded pebbles and cobbles of altered porphyry, quartzite, chloritic argillite, some vein quartz, and granite. Most of the conglomerate is loosely consolidated, rusty weathering, and in general similar in appearance to the Cameron Bay conglomerate of Cameron Bay and vicinity. Much or all of these two groups is tentatively correlated with the Cameron Bay group on the basis of their lithological similarity. Their thickness in the area mapped is measurable in thousands of feet, but faulting, intrusion, and separation of occurrences by water does not permit compilation of a section. Sedimentary rocks are prominent towards the base, in the southern part of the map-area, whereas flows predominate towards the upper part of the section, north of Western Channel.

QUARTZ ANDESITE PORPHYRY

Rocks of the Cameron Bay group (?) (1 and 2) have been intruded by numerous irregular bodies of diabase and by a number of more acid intrusions, the oldest of which is a body of quartz andesite

porphyry (3). This porphyry consists of phenocrysts of euhedral, whitish weathering feldspar up to one-half inch long, quartz, and some hornblende and biotite in a grey to maroon felsitic groundmass. Many of the large plagioclase crystals are corroded and zoned.

In the map-area, quartz andesite porphyry (3) occurs along a north-trending belt extending from the peninsula northeast of Stevens Island (Popes Peninsula), along the east side of Cornwall Island to the west side of Boadway Island, and on some of the small intervening islands. It is largely bounded by younger rocks or by water. However, on Popes Peninsula the west boundary of the quartz andesite porphyry cuts a conglomerate-flow contact, and a small dyke intrudes the conglomerate in one place. This and its trend establish its intrusive nature. One observation of the main boundary indicates that the west contact dips easterly at approximately 40 degrees.

GRANITE

A large body of granite (4) occupies most of Hogarth and Workman Islands, and extends into parts of Achook Island, Stevens Island, and some of the smaller islands. Smaller irregular bodies of granite (4) also occur near the east boundary of the map-area and are probably apophyses of a granite batholith farther east. Most of this granite is light to medium pink and medium grained, but is fine grained on much of Hogarth Island and fairly coarse grained on the west side of Cornwall Island. The variation in composition at different places, from that of a normal granite to that of a granodiorite, suggests the possibility of separate intrusions. However, similar variation was observed in what is believed to be a single intrusion, with the two rock types grading into each other. Where observed, all the granitoid rocks have the same age relationships with the surrounding rocks and, therefore, tentatively, they are all assigned to a single period of intrusion. No pegmatites were found associated with the granite, but

light pink aplite dykes averaging about 1 foot wide, but 6 feet wide in places, occur within the granite and in the country rock near the contact.

A small body of porphyritic granite (4a) with prominent phenocrysts and fine to medium granitoid groundmass, occurs about half a mile southwest of the south end of Hook Lake. The phenocrysts are up to half an inch across, whitish weathering, and commonly display prominent carlsbad twinning. The color of the groundmass is rusty to purplish pink, much like that of the adjacent rhyolite porphyry (5a). This granite has indistinct boundaries and appears to grade into porphyry, and is probably a local, coarse facies of the main porphyry mass.

PORPHYRIES

Intrusive porphyry (5), largely of granitic composition, extends southward from Hunter Bay across the map-area, and for some distance farther, with greatest width on the mainland immediately south of Domex Bay. Smaller porphyry masses of similar composition, and possibly derived from the same magma, occur on Achook Island, Rocher Rouge, Cornwall Island, and on the mainland near Norrie Bay and Hunter Bay. These porphyries intrude both the conglomerates (1) and the volcanic rocks (2) of the Cameron Bay group (?). In some places they appear to grade into granite (4), but in a number of places the granite is distinctly intruded by the porphyry. Between two small lakes, at a point approximately 1½ miles southeast of the head of Domex Bay, a dyke of pink rhyolite porphyry up to 60 feet wide can be traced in granite for 200 yards, back to the main porphyry mass. This dyke does not cut the main porphyry mass, but merges into it. On the first small island northeast of Boadway Island a small body of granite, less than 300 feet in diameter, occurs within porphyry and is cut by narrow porphyry dykes. It would seem, therefore, that the prophyry is probably

slightly later than the granite, but that the two may be derived from a common magma. This is supported by the fact that near the head of Norrie Bay and on a hill approximately 1½ miles northwest of Rogers Lake where the porphyry intrudes granite, aplite dykes, presumably derived from the granite magma, cut both the granite and porphyry.

Although most of the porphyries are essentially granitic, there is some variation in composition. Feldspar phenocrysts, in some instances both orthoclase and plagioclase, are prominent in all the porphyries observed. However, the percentage of quartz and hornblende or biotite phenocrysts varies somewhat from place to place, even within a single large body. The texture and colour also vary considerably. The most common colour is light to deep salmon-pink, as typically developed by the porphyry on Boadway Island. On Achook Island, on Rocher Rouge, and on the northwest side of Cornwall Island, the porphyry appears to be altered and is fine grained and slightly purplish in colour. Near quartz veins and shear zones pink porphyry is altered to a light chloritic green. In the main mass south of Domex Bay samples of fairly coarse, greyish pink granite porphyry and of reddish pink rhyolite porphyry can be obtained within a few feet of each other, yet no intrusive contacts were detected between the two facies. It is possible that the main rhyolite porphyry fractured while cooling and that more aqueous magma, crystallizing into a rock with a coarser texture, was locally injected along fractures while the host rock was still hot. The reddish coloration of the main porphyry results largely from iron exide coating of mineral grains in the rock.

Large bodies of granitic porphyry, such as the main mass in MacAlpine Channel map-area, are uncommon elsewhere in the Northwest Territories. Granitoid texture is common in much smaller intrusives of granitic composition. The absence of pegmatite dykes and lack of

metamorphism in the adjoining intruded rocks suggest the scarcity of water and other mineralizers in the parent magma. This condition is generally considered a factor in suppressing coarseness of crystals. The volume of the porphyry mass may not, however, be as great as indicated at the surface. The few dip observations that were made suggest that the main porphyry is an easterly dipping tabular body of limited thickness.

HORNBY BAY SERIES

The Hornby Bay series (6, 7) of MacAlpine Channel map-area consists of two members, neither of which is completely exposed; nor is the top or bottom of the series visible. The lower member (6) is a rusty red, fine- to medium-grained, thin-bedded, quartzitic sandstone. Crossbedding and ripple-marks are plentiful. Locally the red sandstone is mottled with white patches, up to about 1 inch in diameter, visible on both the fresh and weathered surfaces. These patches probably result from reduction of ferric iron around small particles of organic matter.

Overlying the red sandstone member is white to light pink, coarse, quartzitic sandstone with interbeds of pebble conglomerate (7). The sand grains and pebbles are well rounded and consist of more than 90 per cent quartz, most of the remainder being reddish cherty material. Bedding is much thicker and fainter than in the lower sandstone. Crossbedding is common, but no ripple-marks were seen.

The contact between the Hornby Bay series (6, 7) and the Cameron Bay group(?) (1, 2) is not exposed within the map-area. However, the absence in the Hornby Bay series of the granite and porphyry intrusives that cut the Cameron Bay group(?) suggests that the former is considerably younger than the latter. The difference in general strike of the beds indicates an angular unconformity between the two.

DIABASE

Diabase (8) of at least two different ages was recognized in the MacAlpine Channel map-area, but no attempt was made to map them separately. The most common diabase is dark grey on the weathered surface, greenish grey on the fresh surface, and is similar to the late quartz diabase dykes of the Eldorado Mine area. It occurs largely as gently dipping sheets in the igneous rocks and as sills in sediments. Other occurrences are in the form of irregular dykes, some of which are apophyses of the larger sheet-like masses. Diabase is more resistant than the clastic rocks, and for that reason caps many of the hills, particularly north of Western Channel. Columnar jointing is well exhibited in the thicker, flat-lying sheets. The greenish grey diabase cuts an older brownish grey, rusty diabase, and is the youngest rock in the area, as it also cuts giant quartz veins and intrudes the Hornby Bay series.

GIANT QUARTZ VEINS

Quartz veins up to 300 feet wide, and similar to those described by Furnival[1], traverse parts of the map-area in a northeast

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[1] Furnival, G. M.: The Large Quartz Veins of Great Bear Lake, Canada; Ec. Geol., vol. 30, pp. 843-859 (1935).

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direction. Some occupy fault zones that suffered repeated movements, resulting in vein breccia and stock-works. At least three generations of quartz were recognized. The earliest is a light grey, cherty quartz that appears to replace and grade into the wall-rock. This early quartz, which probably forms more than 70 per cent of the total, is cut by veinlets of milky quartz and banded clear and milky quartz. These in turn are cut by glassy quartz, locally vuggy. Metallic mineralization, which is present in some of the veins, appears to accompany or follow the latest generation of quartz, as some occurs in the vugs mentioned

above.

In a number of places, giant quartz veins are cut by small basic dykes, but on the north shore of Broadway Island a quartz vein carrying chalcopyrite, pyrite, and carbonate cuts and alters what appears to be the late diabase. Quartz veins, with mineralization similar to the giant quartz veins, cut the Hornby Bay series north of Elizabeth Lake. Elsewhere, some giant quartz veins are overlain unconformably by the Hornby Bay series.[1] A long time range is thus indicated for

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[1] Kidd, D. F.: Geol. Surv., Canada, Sum. Rept. 1931, pt. C, p. 16 (1932).

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the development of the giant quartz veins of the Hornby Bay-MacAlpine Channel region.

STRUCTURE

The regional trend of rocks of the Cameron Bay group (?) (1, 2) is northwesterly, with dips, for the most part, less than 45 degrees to the northeast. However, in many places, particularly near the larger intrusions and faults, there is much divergence from this general condition, and steep dips and folds occur. Beds of the Hornby Bay series (6, 7) are gently warped, with dips averaging 5 to 10 degrees in several directions. Apparently the Cameron Bay group (?) was intruded by granite and porphyry, folded, and probably extensively eroded before the Hornby Bay series was laid down. Since the deposition of the latter series, deformation consisted mainly of tilting and faulting.

The main faults of the district strike northeast. They displace all rocks except the greenish grey, late diabase. Displacements, some of which are measureable in miles, indicate that in most instances, the northwest sides moved relatively northeastward. MacAlpine Channel, and possibly other northeast trending channels, occur along such faults. Another set of faults with less displacement trend nearly north. Along

these also the west side has moved relatively north, and some appear to be truncated by the northeast trending faults. Two easterly trending faults on Stevens Island, and on the mainland south of Domex Bay, appear to have left-hand displacements. The vertical component of faulting was not determined on any of the faults. Dips are indicated only in a few places, and are from approximately 70 degrees to vertical.

METAMORPHISM

Metamorphism of the MacAlpine Channel rocks is dominantly hydrothermal and has affected all the rocks, including diabase. The oldest rocks, however, are the most altered. Schistosity is local and only faintly developed; faults are characterized by breccia. In most places the composition of the country rock and that of the intrusions does not differ greatly, and for that reason contact metamorphism is slight. Argillite on the east shore of Hogarth Island is locally recrystallized to hornfels, but its contact with granite is sharp and easily followed. Hydrothermal alteration near the giant quartz veins is indicated by the marked development of chlorite and sericite, and by the greenish discoloration of the country rock for distances up to 100 feet from the veins.

Red, hematitic alteration[1], which is intense and prevalent

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[1] Murphy, R.: The Eldorado Enterprise; Can. Inst. Min. Met. Trans., vol. XLIX, p. 432 (1946).

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in the vicinity of Eldorado Mine, has affected the rocks of MacAlpine Channel map-area only slightly.

MINERALIZATION

No minerals were being mined in MacAlpine Channel map-area in 1947 and only one property on Hunter Bay was undergoing minor surface development. However, a large part of the map-area was prospected in

1947 by Eldorado Mining and Refining (1944) Limited, and to a much lesser extent by members of the Geological Survey party. The only known minerals of economic interest are those of uranium and copper. Uranium minerals occur in association with giant quartz veins on Workman Island and west of the mouth of Sloan River, and with minor quartz-hematite-carbonate-chalcopyrite veins near a northeast trending fault on Achook Island.

Near the mouth of Sloan River, within a granite mass, a small amount of pitchblende and uranium stain occurs in a narrow quartz vein, consisting of milky comb quartz, abundant powdery hematite, and a pinkish carbonate. Radioactivity was recorded for a distance of 5 feet along the vein. The vein, which is less than 1 foot wide, trends west-southwest towards a giant quartz vein, but is not exposed where they meet. However, roughly on strike with the uranium-bearing vein is a narrow hematite-rich quartz vein that cuts across the main vein. The uranium occurrence is approximately 20 feet from the giant quartz vein.

The other occurrence associated with a giant quartz vein is on the east side of Workman Island, a short distance south of the point where a diabase dyke cuts the quartz vein. Here a few shallow pits show some specular hematite and copper stain in milky quartz on the edge of the main vein. Only faint radioactivity was detected with the Geiger counter. The occurrence is no doubt the same as that described by Kidd[1] in 1934. The quartz vein is in granite that is chloritized

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[1] Kidd, D. F.: Rae to Great Bear Lake, Mackenzie District, N.W.T.; Geol. Surv., Canada, Mem. 187, pp. 40-41 (1936).

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near the vein.

Five occurrences of uranium minerals were examined on Achook Island. All are near a northeast fault that marks the easterly side of a prominent peninsula on the south side of the island. Four occurrences

are on the peninsula itself. These are in steeply dipping, narrow, lenticular veins less than 1 foot wide and trending nearly east. The veins consist of milky and glassy quartz, which is locally vuggy. They carry powdery and botryoidal hematite, carbonate, some chalcopyrite, and, in two places, uranium stain. Pyrite occurs in the country rock, but none was seen in the veins. The country rock is a porphyritic dacite with prominent feldspar and quartz phenocrysts.

The other occurrence is near the same fault, on the north shore of a deep, V-shaped bay that cuts across -thirds of the island. The uranium-bearing vein, 2 to 4 inches wide, is nearly vertical and is exposed on the face of a steep, rust-stained cliff. Minerals identified in the vein are milky and clear greyish quartz, chalcopyrite, bornite, barite, iron-bearing carbonate, pyrite, and uranium oxide. A similar quartz vein nearby, with manganese and rust stains on its walls, is lacking in barite and radioactivity on the exposed surface. The country rock is porphyritic dacite or, possibly, andesite.

The uranium occurrences located to date are of no economic importance. However, they indicate that at least part of the uranium mineralization is localized by the northeast faults. Some uranium is associated with the giant quartz veins and stock-works, whereas on Achook Island it is associated with small quartz veins that may or may not be of the same age and origin as the giant quartz veins. Near Great Bear Lake pitchblende occurs in siliceous argillite, in porphyry, in granite, and in the early diabase. No occurrences have yet been reported in the coarse, Cameron Bay type conglomerates. The common association of red, powdery hematite and hematitic alteration with uranium minerals suggests that areas containing these should be carefully examined.

Copper mineralization occurs within a giant quartz vein (locally called the Sloan dyke) on the north shore of Hunter Bay,

approximately 1,300 yards west of the east boundary of the map-area. Here two trenches and some pits expose bornite, chalcopyrite, pyrite, hematite, and carbonate mineralization within vugs, along fractures, and in vein breccia for a distance of nearly 150 feet. Limonite, malachite, azurite, and chalcanthite (?), largely as stains, are secondary. Quartz-bornite stringers cut quartz stringers that are later than the main quartz. Near the surface, distribution of copper minerals is erratic. The quartz vein at this point is approximately 100 feet wide and is bounded by granite on the northwest side, and by porphyritic dacite on the southeast side. Both are considerably altered to a greenish colour for a distance of more than 50 feet from the vein. This copper occurrence is on the GW group of claims and was developed by a small amount of surface work in August 1947. Sparse copper mineralization was noted elsewhere on the same quartz vein and within other quartz veins, but these occurrences are of no economic interest.