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PRELIMINARY MAP

YELLOWKNIFE
NORTHWEST TERRITORIES

(TWO SHEETS ANE DESCRIPTIVE NOTES)

By
J. F. Henderson and I. C. Brown

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Illustration

YELLOWKNIFE AREA, NORTHWEST TERRITORIES

GENERAL GEOLOGY

Yellowknife Group

The oldest rocks of the area (1-4)[1] are lava flows

[1] Numbers in parentheses are those of map-units of accompanying geological map.

interbedded with tuffs and other fragmental volcanic material. They form the lower part of the Yellowknife group of volcanic and sedimentary rocks in this general region. The lava flows (1a-1e) are predominantly fine-grained, dark green rocks of probable original basaltic to andesitic composition. About 40 per cent of them are massive (1a); the remainder have well-developed pillow (1b and 1c) structures. Some of the pillowed flows are variolitic (1c), the variolites forming lighter coloured spheroids up to the size of peas around the rims of the pillows. Light grey to white weathering flows of dacitic composition (2) commonly contain phenocrysts of feldspar and quartz up to one-eight inch long. Coarse fragmental rocks (3), including agglomerates and flow breccias, are more abundant in the upper part of the volcanic assemblage. Some of them form remarkably persistent layers that may pass into tuffaceous rocks along strike. The tuffs (4) are mainly white weathering, thinly bedded, cherty rocks that occur interbedded with the flows as thin, but continuous, layers commonly less than 10 feet thick. Bedded crystal tuffs (4a), composed largely of small feldspar crystals, are well developed on Latham and Jolliffe Islands, where they occur interbedded with lava flows and thinly bedded argillaceous sediments. In places along or near contacts with bodies of granodiorite, the lava flows have been brecciated and injected by much granodiorite (1d).

Early Sills and Dykes

The volcanic flows of the Yellowknife group are intruded by several meta-gabbro sills (5). The larger sills are medium- to rather coarse-grained dark green rocks composed of hornblende and

altered feldspar. The smaller, finer grained sills are difficult to distinguish from the coarse, massive lava flows (1a) and some of them may be included with the flows. One porphyritic sill (5a), which underlies the northern part of Sand Lake and extends northeast to Yellowknife Bay, carries scattered, white weathering feldspar phenocrysts up to 1 inch long.

The volcanic flows (1a-1e) and meta-gabbro sills (5) are cut by a swarm of meta-gabbro and meta-diorite dykes (6). The dykes dip west and southwest at angles that range from nearly vertical to 40 degrees or less. Most of them are fine- to medium-grained, dark to light green weathering rocks, but some of the finer grained ones weather a rusty brown. The dykes are composed mainly of hornblende and altered plagioclase, and many have a poorly preserved ophitic texture. All the dykes show chilled contacts with the lava flows and meta-gabbro sills. Many of them are porphyritic (6a), with scattered, white weathering feldspar crystals or aggregates of crystals that range from a minute size to an inch or more in length. Some of these dykes change from porphyritic to non-porphyritic along strike. Most of them have no distinguishing features, but several dykes possess characteristic phenocrysts, colours, and textures that enable them to be followed from outcrop to outcrop for thousands of feet along strike. One such dyke has been traced more than 3 miles north and northwest from the shore of Yellowknife Bay north of Kam Point to the south shore of Stock Lake, where it is cut off by the granodiorite.

Conglomerate and Quartzite

Interbedded conglomerate and quartzite (A) underlie the Sub Islands and the western half of Jolliffe Island. The conglomerate beds are composed of poorly sorted, rounded to subangular pebbles and boulders of granitic rocks, grey felsite and chert, greenstone, argillite and slate, and ferruginous carbonate, in a sandy, quartzitic matrix. The quartzite is grey to white weathering,

of fine to medium grain, with numerous interbeds of conglomerate; much of it is distinctly crossbedded. Contacts between the conglomerate and quartzite and the Yellowknife group lavas and tuffs are not exposed, and the structural relations between them have not been established. On Jolliffe Island nearly vertical conglomerate and quartzite beds face west whereas the Yellowknife group strata face east.

Granodiorite

The granodiorite (7) is a light grey to pink or reddish, medium-grained, granitic rock. It intrudes the Yellowknife group rocks and the early basic sills and dykes. For the most part the granodiorite is a massive, homogeneous rock composed of oligoclase, microcline, quartz, and biotite or hornblende. In some areas, however, it contains numerous angular inclusions of older rocks, mainly greenstones (7a).

Diabase, Gabbro

The youngest rocks in the area are rusty brown weathering, fine- to medium-grained, gabbroic dykes(8) that generally have a well-developed ophitic texture. They are composed of about equal parts of plagioclase and pyroxene. In general they can be readily distinguished from the early meta-gabbro and meta-diorite dykes by their characteristic reddish brown weathered surface and the comparatively unaltered appearance of their constituent minerals on fresh fractures.

STRUCTURAL GEOLOGY

The lava flows and interbedded fragmental rocks of the Yellowknife group strike northeast and dip southeast at steep to vertical angles. Many excellent determinations of the tops of flows and tuff beds indicate that the steeply inclined strata face southeast throughout; that is, the structure is homoclinal, with successively younger beds from the northwest to southeast.

The whole greenstone belt is much faulted. The faults may be divided into two types: (a) early, pre-diabase faults,

and (b) late, post-diabase faults. The early faults are of the shear-zone type, in which chlorite schist is developed along them in widths of from a few inches, in the smaller shear zones, to several hundred feet, in the larger ones. The late, post-diabase faults, on the other hand, are clean-cut, narrow fissures. The rock along them is brecciated, and a clay-like fault gouge may be present, but no schist is formed. Most faults can be readily recognized as early or late, but some are difficult to classify and some are not exposed. To avoid using a third symbol on the map for faults of doubtful age, arbitrary decisions have been made that are open to revision.

A large, northeasterly striking fault lies about 800 feet southeast of the Negus Mines shaft. Along this fault the movement is left hand, that is, the northwest side has moved southwest relative to the southeast side. The fault displaces several early gold-bearing shear zones, and, hence, is included with the late faults. However, no direct evidence has been obtained on its age relative to the diabase dykes, and it is displaced by several late faults. This fault and others with the same strike and left hand displacement may be pre-diabase and of intermediate age.

The early, pre-diabase shear-zone faults seem to belong to two main sets. One set strikes north to northeast, dips in general steeply west, and transects the lava flows. Many of the smaller shear zones of this set are localized along the borders of meta-gabbro and meta-diorite dykes. The other set includes the northeasterly striking faults that are parallel with the lava flows and very commonly lie along tuff beds. The movement along them is almost invariably right hand, that is the northwest side has moved northeast relative to the southeast side. Many of the early, shear-zone faults, especially those trending north to northeast, have been the loci of further movement during the late faulting.

The major, late, post-diabase faults strike between north and northwest and dip steeply west to vertically. The movement along them is left hand, that is the east side has moved north relative to the west side. The largest of these is the West Bay fault, along which, according to Campbell[1], the west side

[1] Campbell, Neil: The West Bay Fault, Yellowknife; Can. Inst. Min. Met. Trans., vol. L, 1947, pp. 509-526.

has moved 16,140 feet south and 1,570 feet down relative to the east side. The effect of the late faulting is well shown by the northeasterly striking diabase dyke that crosses Kam Point. This dyke has been faulted to the northwest in many places, and its faulted segments outcrop near the shore of Yellowknife Bay between Kam and Negus Points. Likewise, northeast of Kam Point, the Kam Point meta-gabbro sill is displaced northwest by several late faults; farther northeast, beneath Yellowknife Bay, it meets the West Bay fault and is displaced more than 3 miles north to appear on the east side of the fault at the town of Yellowknife.

GOLD DEPOSITS

The two producing gold mines in the area are the Con-Rycon, at present milling about 275 tons a day, and the Negus, which has recently raised its milling capacity to about 125 tons a day. Giant Yellowknife Gold Mines lies just beyond the northern border of the map-area. On this property diamond drilling has indicated a large tonnage of ore, which is at present being developed underground from two shafts; production is planned to begin in 1948.

The gold deposits occur along the early, pre-diabase shear zones, and are displaced by the late, post-diabase faults. The main gold deposits have been found along shear zones that strike north to northeast, dip, in general, about 50 to 60 degrees northwest, and transect the lava flows. The ore deposits may be divided into two types, but the two are closely related. The Negus and Rycon ore deposits are well-defined quartz veins introduced

along narrow shear zones. The shear zones are rarely more than 5 to 10 feet wide but can be traced for thousands of feet, and tend to occur along the borders of meta-gabbro and meta-diorite dykes that transect thick, massive lava flows. The veins are narrow and high grade, with an average width of not more than 3 feet; they are not continuous along the shear zones, but may be as much as several hundred feet long. They contain a wide variety of metallic minerals, including, in addition to gold, pyrite, sphalerite, galena, and chalcopyrite, some sulphantimonides, sulpharsenides, and tellurides. In the aggregate the metal content is low, amounting to probably less than 1 per cent of the volume of the veins.

The other type of ore deposit, also occurring along northeasterly trending shear zones that transect the lava flows and dip northwest, is a mineralized, sericite-chlorite schist. It is represented by most of the large orebodies along the Con C-4 shear, which passes through Rat Lake, and by those on the Giant-Yellowknife property. The shear zones attain widths of several hundred feet, and the orebodies in them form large, lenticular masses of highly mineralized sericite schist and, locally, may occupy as much as 75 per cent or more of their width. Typical ore is a sericite schist, ribboned with cherty quartz and heavily mineralized with fine arsenopyrite and pyrite, the sulphides comprising, perhaps, 5 to 10 per cent of the volume of the ore.