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PRELIMINARY REPORT ON STUKELY AREA, SHEFFORD AND STANSTEAD ELECTORAL DISTRICTS

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P. R. NO. 422

PROVINCE OF QUEBEC, CANADA

DEPARTMENT OF MINES

HON. W. M. COTTINGHAM, MINISTER

MINERAL DEPOSITS BRANCH

PRELIMINARY REPORT

ON

STUKELY AREA

SHEFFORD AND STANSTEAD ELECTORAL DISTRICTS

BY

JOHN I. SHARPE

QUEBEC
1960

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INTRODUCTION

The Stukely area is located in the Eastern Townships of Quebec, 72 miles east of Montreal, and is bounded by latitudes 45°20' and 45°25' and longitudes 72°15' and 72°20'. This area of 25 square miles includes most of Stukely township and the very southwestern edge of Orford township in the electoral districts of Shefford and Stanstead.

Geological mapping was done during the summer of 1958 at the scale of one inch to 500 feet. The project is a continuation of detailed mapping done to the south by de Römer* in 1957.

Access to the area is provided by secondary roads which connect with Provincial Highway No. 1, some two and a half miles to the south. The Montreal-Sherbrooke line of the Canadian Pacific Railways crosses the area in a general north-south direction.

Topography and Drainage

The area lies within the Appalachian Uplands. The minimum and maximum elevations are 725 feet and 2,425 feet, in the northwest and southeast corners respectively, the latter being on the northwestern slope of Mount Orford.

Surface drainage is provided by small streams and brooks. The main stream in the northern part of the area flows westerly at close to right angle to the structure of the underlying bedrock. The brooks of the south part generally flow

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* De Römer, H.; Preliminary Report on Lake Orford Area, Electoral Districts of Brome, Shefford and Sherbrooke; Que. Dept. Mines, P.R. No. 372, 1958.

to the south, thus generally parallel to the underlying rock formations. The western part of Stukely lake occupies the east central part of the map-area.

GENERAL GEOLOGY

Introductory Statement

The Stukely area is underlain by steeply-dipping sedimentary and volcanic rocks of various composition and different degrees of structural disturbance and metamorphism. The age of these rocks is probably Early Palaeozoic. Dykes, sills and plutons, ranging from ultrabasic to granitic in composition, intrude the above-mentioned rocks.

The general trend in the southwestern part of the area is northerly, but the trends change gradually to northeasterly in the remainder of the area. Some evidence suggests that the area lies along the eastern flank of an anticlinorium.

Table of Formations

RECENT AND PLEISTOCENE	Till, sand, gravel, clay, stream deposits		
POST ORDOVICIAN?	Intrusive rocks	Granite, granodiorite and quartz diorite	
		Quartz gabbro	
		Hornblende gabbro, diorite, green gabbro	
		Pyroxenite; Serpentinite, serpentinized peridotite and dunite	
CAMBRIAN?	Caldwell rocks	Volcanic rocks	Intermediate lava; Siliceous lava and tuff; Altered basic volcanic rocks
		Sedimentary rocks	Subgraywacke, quartz graywacke, quartzite and conglomerate; Grey slate and siltstone; Graphitic slate; Black quartzite; Grey quartzite; Quartz-sericite schist; Purple slate; Limestone
	Sutton schists	Micaceous facies	Graphite-sericite schist; Sericite schist; Chlorite schist
		Quartzose facies	Quartz-sericite schist and quartzite; Quartz-sericite-chlorite schist; Quartz-sericite graphite schist; Chlorite schist; Marble

Sutton Schists

The northwestern part of the area is underlain by contorted schistose rocks, dominantly sedimentary in origin.

The division of these rocks into a quartzose facies and a micaceous facies is made on the basis of the lithology of the rocks, the amount of quartz and the degree of structural disturbance. Thus most rocks of the quartzose facies(except the magnetite-chlorite schist and marble) are quartz-rich, low in micaceous minerals and highly contorted and folded. The dominant lithologic types of the micaceous facies have very abundant secondary mica, they are commonly graphitic and poor in quartz. They do not exhibit the tight, complex folding observed in the quartzose facies of the schists.

The quartzose facies underlies the northwestern half of the map-area and grades southeastward into the micaceous facies except in the southwestern corner of the area, where the latter was not observed.

Quartzose Facies

Quartz-sericite Schist and Quartzite

Quartz-sericite schist is the dominant rock type of the quartzose facies of the Sutton schists and underlies most of the northwestern half of the area. The rocks are particularly well exposed in Lots 18 to 21, Range V, Stukely township.

The proportion of quartz to sericite is variable and the rock ranges in composition from that of a pure quartzite with traces of sericite to a fine-grained, dark, micaceous schist containing streaks, bands and lenses of milky quartz. The contact between the different varieties varies from gradual to sharply defined and the widths of the individual bands seldom exceeds one foot. Locally the zones rich in micaceous minerals contain abundant porphyroblastic, subeuhedral crystals of white feldspar. Cubes of pyrite and zones with red colouration due to iron oxide stains are common.

Quartz-sericite-chlorite Schist

The quartz-sericite schist just described grades into a quartz-sericite-chlorite schist and appears to be in places interbedded with it. These rocks form small north-south zones in Lot 20 of Range II, Lot 20 of Range III, Lots 19 and 20 of Range IV, Lots 19 and 22 of Range V, Lots 19 and 21 of Range VI, and Lots 20 and 22 of Range VII. Hand specimens of the rock are rather similar to those of the quartz-sericite schist. The rock has a light greenish tinge and seldom contains the segregations of micaceous minerals observed in the quartz-sericite schist.

Quartz-sericite-graphite Schist

Graphite-bearing schists with varying amounts of quartz and sericite are commonly interbedded with the quartz-sericite schist in Lot 19 of Range III, Lot 20 of Range IV, Lots 19 and 20 of Range V, Lots 19, 20, 21, 22 and 23 of Range VI, Lots 17, 20, 21, 22, 23 and 24 of Range VII, and Lots 17, 18, 20, 21, 22, 23, 24 and 25 of Range VIII. Individual beds and zones vary from less than a foot to several hundred feet in apparent thickness.

Chlorite Schist

Chlorite-rich rocks are an especially distinctive member of the quartzose facies of the Sutton schists. They crop out: a) along a generally north-striking, steeply-dipping horizon over 400 feet wide that extends from Lot 21 of Range III to the north part of Lots 20 and 21 of Range VII: b) as a still wider band in Lots 18 and 19 of Range VII; and c) as much thinner beds in Lots 20 and 23 of Range VII and in Lots 24 and 25 of Range VIII, all in Stukely township.

Hand specimens of the rock are dark green, foliated though cohesive, and usually contain small well-formed octahedrons of magnetite and in places flakes of specularite. Coarser-grained, hornblende-rich zones are commonly present in the finer-grained varieties of the rock.

The contacts of the chlorite-rich rocks with the more siliceous adjacent formation are distinct and appear conformable.

Marble

A few exposures of buff-weathering marble are present in Lot 21 of Range III and in Lot 23 of Range VI, Stukely township. They appear to represent a thin discontinuous horizon structurally, and probably stratigraphically, above the main occurrence of the chlorite schist.

Micaceous Facies

As noted previously, the quartzose facies of the Sutton schists grades eastward into a micaceous assemblage. Thus, the latter cannot be considered a distinct stratigraphic unit. The transitional zone (as seen on the surface) extends over a width of 1,000 feet and the outline of the contact on the accompanying map is somewhat arbitrary. However, the rocks east of the transition zone are distinctively poor in both primary and introduced quartz and rich in secondary mica.

These rocks are found in a band up to 4,000 feet wide, extending in a northeasterly direction from Lots 21 and 22

of Range IV to the northeast corner of the map-area, in Stukely township.

The assemblage is divided into graphite-sericite schist or phyllite, sericite schist and chlorite schist.

Graphite-sericite Schist

Graphite-bearing schist or phyllite occurs as thin beds in Lots 23 and 24 of Range VI, Lots 24 and 25 of Range VII, and Lots 26 and 27 of Range VIII, and forms a band reaching 2,000 feet in width and extending diagonally across most of the map-area.

The rock is black, usually stained with iron oxides and consists essentially of graphite, secondary micaceous minerals and varying amounts of quartz.

Some thin beds of calcareous rock are present and brecciated beds of fine-grained quartzite are common in the zone. The width of these beds does not exceed a few inches.

Sericite Schist

Sericite schist forms the western part of the zone of the micaceous assemblage. Hand specimens of the rock are very fine grained, light to dark grey in colour and consist essentially of plicated secondary mica with little quartz. Locally the rock is green and presumably contains some chlorite. Zones with small porphyroblasts of white feldspar are common.

The more western exposures of the rock are injected with quartz and grade into the quartz-sericite schist of the quartzose facies.

Chlorite Schist

Several exposures of chlorite schist, resembling the magnetite-chlorite schist of the quartzose facies, occur in Lot 27, Range VIII, Stukely township. These appear to represent a band of altered volcanic rock approximately 400 feet wide. Similar but thinner beds occur elsewhere in the assemblage.

Caldwell Group

The rocks mapped as Caldwell group in the Stukely area are dominantly sheared and folded sedimentary rocks apparently with interbeds of acidic to basic volcanics.

The group is in contact with the graphite-sericite schist of the Sutton schists and occupies most of the southeastern part of the map-area. The graphitic schist appears structurally conformable to the rocks of the Caldwell group. However, the destruction of primary bedding and the incompetency

of the former rock complicate the determination of the nature of the contact.

Sedimentary Rocks

Subgraywacke, Quartz Graywacke, Quartzite and Conglomerate

Coarse- to fine-grained clastic rocks ranging from quartz graywacke to rather pure quartzite are the dominant rock types of this sedimentary series. They form numerous bands ranging from 400 feet to 2,000 feet in width and extending in a northeasterly direction from the southern boundary to the eastern limit of the map-area. Because of the intergradational nature of the rocks, the limited width of individual beds and their interbedding, separate units have not been indicated on the map.

Subgraywacke is the most abundant variety and occurs in individual beds ranging from less than a foot to over 50 feet in thickness. Hand specimens of the rock are medium grey on fresh surfaces and commonly bleached in the zone of weathering. The coarsest and most abundant detrital material is made of angular to rounded grains of vitreous quartz (less than .1mm. to .5mm. in maximum dimension), which may constitute 30 to 60 per cent of the rock and may be graded as to size and quantity within specific beds. A few fragments of feldspar and slate are in places discernible in hand specimens. The groundmass consists of poorly-sorted argillaceous material converted more or less to secondary minerals.

The subgraywacke commonly grades into, and is interbedded with, quartz graywacke. The latter rock is darker and chloritic, and appears to the naked eye to contain more feldspar, fragments of slate and argillaceous material than the former. Small grains of quartz, similar to those in the subgraywacke are an essential constituent.

Light-coloured, fine- to medium-grained quartzites consisting mainly of a dense aggregate of quartz grains are commonly interbedded with the subgraywacke. Individual beds are generally thin, ill-defined and in places discontinuous.

Thin beds and lenses of intraformational, small quartz-pebble conglomerate are present within and grade into the medium-grained clastic rocks. The beds are usually less than two feet wide. Rounded pebbles of quartz and a few fragments of dark slate, feldspar and possibly chert constitute up to 70 per cent of the rock. The matrix is poorly sorted and its composition is similar to that of the subgraywacke.

Grey Slate and Siltstone

Several bands of grey slate apparently ranging

up to several hundred feet in thickness occur in the sedimentary rocks of the Caldwell group. They are all trending northeasterly and are located in Lots 22 and 23 of Range IV, from Lot 26 of Range VI to Lot 28 of Range VII, in Lots 27 and 28 of Range VI, in Lot 28 on the line between Ranges VI and VII, from Lot 26 of Range VI to Lot 28 of Range VIII, and in Lot 26 of Range VII, all in Stukely township. A few thin interbeds of similar rocks are also present in the coarser clastics described above. The slate commonly grades into light-coloured siltstone.

The rock tends to break into thin irregular flakes and the cleavage surfaces may contain crenulated secondary mica. Two cleavages are developed in places.

Thin horizons of subgraywacke and quartzite are present here and there in the slate and siltstone areas.

Graphitic Slate

Graphitic slate occurs along the south boundary of the area in Lot 26 of Range II and along the east boundary of the region in Lot 28 of Range VI.

The rock has an irregularly developed cleavage and tends to break into a multitude of thin flakes.

A few beds seldom exceeding a few feet in thickness of black quartzite, dark siltstone and silty slate are interbedded with the graphitic slate.

Black Quartzite

One outcrop of distinctive, black, fine- to coarse-grained impure quartzite occurs along the Stukely-Orford township line in Lot 28 of Range IV in Stukely township.

Grey Quartzite

A coarse, tough, dark-coloured quartzite, dissimilar to other rocks in the Caldwell group, outcrops immediately southwest, west and north of Stukely lake in the east central part of the map-area. The rock is intensely intruded by ultrabasic and acidic rocks and it is commonly included in and altered by these intrusions.

The rock contains a high proportion of quartz, and rounded pebbles of silica are present in places. Primary sedimentary structures are seldom discernible in the field.

Quartz-sericite Schist

Two northeasterly-trending zones of quartz-

sericite schist occur from Lot 23 of Range II to Lot 24 of Range III and from Lot 26 of Range VI to Lot 28 of Range VII.

Purple Slate

A few exposures of purple slate were encountered in Lot 28 of Range VI, Stukely township. This rock occupies a synclinal structure in the coarser Caldwell clastic rocks.

Limestone

A thin bed of dense, fine-grained, grey limestone is exposed in a creek in Lot 24 of Range III, Stukely township. The bed is less than 4 feet wide and is in contact with graphitic slate and contorted, laminated siltstone to the west and east respectively.

Volcanic Rocks

Volcanic rocks ranging in composition from chloritized basic flows to siliceous pyroclastic rocks occur in the area. Because of their general structural conformity with the sedimentary formations of the Caldwell group described above, they are also considered as part of the same group.

Intermediate Lava

Fine-grained, light greenish grey, massive lava flows crop out in a northeasterly direction from Lot 23 of Range III to Lot 26 of Range V, Stukely township, just west of Stukely lake. A lens of similar rock lies within the basic sill in Lot 24 of Range IV of the same township.

The main zone of lava exhibits sharp contacts with the rocks of the adjacent sill of basic intrusive to the west and a few amygdaloidal zones and pillow structures are present.

Siliceous Lava and Tuff

Siliceous volcanic rocks are irregularly distributed throughout the sedimentary and basic volcanic rocks. They occur in Lot 25 of Range II, in Lot 25 of Range III, in Lots 26 and 28 of Range IV.

The rock is hard, dense and breaks with conchoidal surface. A rude banding is usually present in the rock and the colour on fresh surfaces may be yellow, grey, light brown or black.

Fine-grained tuffaceous beds are everywhere associated with the lava flows.

Altered Basic Volcanic Rocks

Chloritized basic volcanic rocks crop out abundantly in the southeastern part of the map-area, in Lot 26 of Range II and in Lots 26, 27 and 28 of Range III, Stukely township.

The rock is generally fine grained and dark green and usually shows a laminated to banded structure owing to differences in hardness and colour of its constituents and to the presence of streaks of magnetite and specularite.

Intrusive Rocks

Serpentinite, Serpentinized Peridotite and Dunite

Serpentinized ultrabasic rocks intrude the sedimentary formations of the Caldwell group and sill-like bodies of them occur in Lots 22 of Ranges III and IV, in Lots 26 and 27 of Range IV, in Lots 26 and 27 of Range V, and in Lot 28 of Range VI. A long northeasterly-trending sill extends from the northern part of Lot 25 in Range V to the northern part of Lot 28 in Range VII, another one extends from Lot 27 of Range VI to Lot 28 of Range VII, and small ones are located in Lot 28 of Range III and in Lot 26 of Range VII.

The serpentinite and serpentinized peridotite vary in colour and texture from a dense greenish black or mottled green to a dark green rock in which remnants of a medium-grained texture are present. Locally the peridotite grades into granular dunite. Accessory magnetite, calcite and occasionally garnet(?) are present and minor amounts of slip and cross-fibre asbestos are not uncommon.

The border zone of the larger masses of these rocks is commonly characterized by the presence of light-coloured serpentine minerals and talc.

Pyroxenite

Massive pyroxenite with textures varying from pegmatitic to granular and fine grained occur as separate intrusions or are associated with the basic or the other ultrabasic intrusive rocks. One exposure is found in Lot 26 of Range III; others occur in Lot 22 of Range III, in Lot 24 of Range IV, and in Lot 25 of Range V.

Hornblende Gabbro, Diorite, Green Gabbro

A complex of transecting and intergradational hornblende gabbro and diorite underlies the extreme southeast corner of the area in Lots 26, 27 and 28 of Ranges II and III, Stukely township, and in Lots 20, 21 and 22 of Range XVIII, Orford

township. This rock also forms a sill of an average width of 1,000 feet extending northeasterly from Lot 22 of Range III to Lot 26 of Range V, Stukely township.

Hand specimen of these rocks exhibit a fine to very coarse, commonly diabasic texture. Giant crystals of poikilitic hornblende enclosing grains of plagioclase are locally abundant. The rock contains over 50 per cent light-coloured minerals, altered plagioclase and quartz; the remainder, being mainly black amphibole, was mapped as a diorite. Where the proportion of dark minerals was estimated to exceed 60 per cent, the rock was called a gabbro. The majority of the rocks, however, fall somewhere between the two extremes, and it is difficult to delineate large areas of diorite or gabbro.

The green gabbro is a more distinctive rock-type. It is green and medium to coarse grained and contains phenocrysts of plagioclase.

Small dykes of pyrrhotite-rich trap and of fine-grained grey rocks with small phenocrysts of white feldspar cut the hornblende gabbro and the diorite.

Quartz Gabbro

An elongate mass of quartz gabbro outcrops in the interior part of the basic intrusive complex in the extreme southeast corner of the map-area. Smaller masses are also present in Lots 26 of Ranges II and III and in Lot 28 of Range III, Stukely township. The rock is dark grey-green and contains round or irregular masses of clear quartz up to 7mm. in diameter imbedded in a groundmass of mafic minerals. The quartz constitutes up to 40 per cent of the rock in volume.

At many places the above rock contains zones in which the silica has more intimately impregnated the rock. Such zones have characteristics usually ascribed to secondary silicification.

Granite, Granodiorite, and Quartz Diorite

Small, medium- to fine-grained granitic dykes were observed to cut both the serpentinized ultrabasic rocks and the sedimentary formations of the Caldwell group in the vicinity of Stukely lake. They are located in Lots 26 and 27 of Range IV and in Lot 27 of Range V.

These rocks vary in texture and mineralogy. Locally the granite grades into a more mafic granodiorite. In places the rock is fine grained and appears aplitic.

The rocks here called quartz diorite are grouped with the granitic rocks because of their quartzose nature and

their spacial relation to them. They are mostly fine- to medium-grained and mottled grey in colour. They almost everywhere contain chloritic clots and small fragments of ultrabasic(?) material. Quartz is the main mineral identifiable in hand specimens and the border facies of the individual bodies commonly contain over 30 per cent quartz. The quartz diorite is difficult to distinguish from the adjacent intruded quartzites.

STRUCTURAL GEOLOGY

Regional mapping by previous workers* has suggested that the Stukely area lies along the limb of an anticlinorium, the axial zone of which lies to the west. Information gathered in the present area supports this hypothesis.

The most intense folding occurs in the Sutton schists where secondary structures, such as foliation imparted by the parallelism of platy minerals and planar concentrations of quartz in the schist, are abundant. The fold axes generally strike northeasterly. Reversals in plunge are common in the small folds, but the main structures plunge generally towards the northeast. The small folds are asymmetrical and the shorter limbs usually lie to the west of the crest.

A particularly interesting structure is that expressed by the variation in trend of the long band of magnetite-chlorite schist in the west central part of the area. This structure is interpreted as a large drag fold, overturned to the west and plunging 20° to 45° to the northeast.

A few small folds were mapped in the formations of the Caldwell group, north of Stukely lake. They are probably more abundant but the lack of good marker horizons and wide variations in the dips of both the bedding and the schistosity of the rock make their identification difficult.

A few small strike-slip faults marked by zones of brecciation and silicification occur in the rocks of the Caldwell group. Transverse or cross faults are also present. The most important of these occur west of Stulely lake and they have displaced formations of the Caldwell group and the intrusive rocks.

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*Cooke, H.C., Geology of a Southwestern Part of the Eastern Townships of Quebec: Geol. Surv. Can., Mem. 257, 1950.

Fortier, Y.O., Orford Map-Area; Geol. Surv. Can., Prel. Map 45-8A, 1945

ECONOMIC GEOLOGY

Although no important amounts of metallic minerals have been previously reported in the area, the presence, within its boundaries, of a wide variety of rock types and of interesting structural features, together with the occurrences a few miles to the southwest of an economically important copper deposit (Quebec Copper Corporation Ltd.), makes the area significantly interesting for the possible existence of ore deposits within its boundaries.

Copper Mineralization

Small amounts of disseminated chalcopyrite and of secondary copper carbonates occur at the following two places in the area: in the central part of Lot 28, Range III, Stukely township, approximately 2,400 feet south of the northern boundary of the lot and 1,000 feet west of the Stukely - Orford township boundary; in the quartzose rocks cropping out about 2,500 feet west of the southwestern tip of Stukely lake, in the middle of Lot 26, Range IV, Stukely township. The first occurrence consists of a few grains of chalcopyrite in massive, coarse-grained, green gabbro. The sulphide appears to be a primary mineral along with some magnetite. One small float of silicified rock containing disseminated pyrite and a few grains of chalcopyrite was also noted to the west of the assumed gabbro contact. The second occurrence consists of a small amount of malachite and azurite stains in commonly pyritic altered quartzite.

Asbestos

A little slip fibre and cross fibre chrysotile asbestos less than 1/8 inch long occurs throughout the serpentinized rocks just west of Stukely lake.

Talc

Bands and lenses of impure talc are common along the border zones of the serpentinized rocks. The best occurrences were seen in the southern portion of Lot 26, Range V, Stukely township, where the width of one zone exceeds 8 feet. This zone is located approximately 500 feet east of the road crossing the lot, and 500 feet north of the south boundary of the lot. Talc also occurs 700 feet farther south, in Lot 27 of Range IV.

Gravel and Sand Deposits

Accessible deposits of sand and gravel occupy parts of Lots 19 and 20, Range VI, and Lot 17, Range VIII, Stukely township. These are being utilized for road fill and cover. A few small deposits occur elsewhere, particularly in those areas indicated as drift covered on the map.

Marble

The occurrences of crystalline limestone in Lot 21, Range III and in Lot 23, Range VI, Stukely township, although of good quality, are too limited in extent for commercial development.