

# GM 15481

GEOLOGICAL REPORT ON EAST PART OF 17 MILE BROOK GROUP, GASPE AREA

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Québec 

GEOLOGICAL REPORT

on

EAST PART OF

17 MILE BROOK GROUP

GASPE NORTH COUNTY

GASPE AREA

PROVINCE OF QUEBEC

(22B/16)

for

NEW JERSEY ZINC EXPLORATION COMPANY (CANADA) LTD.

by

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October 23, 1964.

Ministère des Richesses Naturelles, Québec

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## INTRODUCTION

### A. Location

The eastern part of 17 Mile Brook Group is located in Central Gaspé about twelve miles by road west of the Trans-gaspesian Highway, and just to the south-west of Mount Albert. The eastern part of the property extends from the tip of Mount Albert along the southern boundary of the Shickshock Mountains, to join with the western part just east of the Saumon Branch of the Cascapedia River.

### B. Previous Work

The area was first visited by Sir William Logan who ascended the Cap Chat River in 1844. He and his party climbed several of the summits such as Mount Albert and Mount Logan, while making general notes on the geology, then descended the Cascapedia. His observations were published in the "Geology of Canada", 1863.

Some geology was also done on Mount Albert by A. P. Coleman (1922) and F. J. Alcock (1926); west of East Go Ashore Brook by J. Beland and C. R. Mattinson, 1957; and by I. D. MacGregor on Mount Albert and environs, 1960 and 1964. A report published in 1954 by H. W. McGerrigle, Dept. of Mines, Province of Quebec, dealing partly with the N.J.Z. claim group, proved to be the most informative reference in attempting to decipher the regional picture.

Finally, the Report on 17 Mile Group, original fifteen claims, by K. M. Newman, 1963, was very helpful in the initial stages of mapping.

### C. Methods of Work, Results, & Recommendations

Work on the property consisting of geological mapping and prospecting, with soil sampling, and geophysical surveys, was carried out over lines cut and chained mainly by N. L. Doucet Co. Ltd. of Bathurst, New Brunswick, and some by N.J.Z. employees. The lines were cut at 400 foot or 800 foot separations extending north and south from baseline "A" to the north and south boundaries of the property.

The writer was assisted in the geological mapping by W. Gunter, B. Bell, K. Jameison, and R. Henning. The work was under the field supervision of K. M. Newman, and under the direction of E. A. Goranson.

The outcrops were plotted onto squared paper in the field on a scale of 200 feet to the inch, together with streams,

hills, and overburden, using the cut lines for ground control. Lithologies and structures were noted and together with the outcrops, were plotted onto a base map. All the outcrops on the property were visited and several were stripped. The banks of streams were found especially favourable for the location of outcrops.

The result of the year's work warrant a more extensive search for metal occurrences along the strike of the Siliceous Dolomite.

#### D. Surface Geology & Drainage

The valleys and gorges of the property have been overlain by an abundance of different types of detritus which has been deposited by extensive valley glaciation, and both southward-moving and northward-moving ice sheets. Near the east boundary of the property 17 Mile Brook passes through fifty feet of sand and boulders, which were deposited by glacial outwash and ice-rafting, probably from glaciers receded into the Shickshock Mountains from the south. Along the total length of the property sand and boulders were deposited upon the soft Silurian rocks beneath the Shickshock Mountains, sand predominating to the south of the western part of the property where there are no mountains south of the Silurian. In the eastern part of the property the valleys are filled with angular glacial debris derived from the harder formations which outcrop on the sides of the valleys.

Overburden on the Siliceous Dolomite formation in many places is not deep however. For three-quarters of a mile over the main trench area where it forms a hill, the Siliceous Dolomite is exposed or semi-exposed. Between here and the east boundary however, the overburden may be as deep as twenty to fifty feet, and could even be deeper. To the magnetic west of the main trench area to Line 184 W the Siliceous Dolomite is exposed here and there and is not deep. From here to the Little 17 Mile Brook where Siliceous Dolomite is again exposed, considerable overburden may again be encountered. The overburden from Little 17 Mile Brook to the Saumon Branch appears typical of the overburden west of the Saumon Branch as well. Here a few outcrops occur, but considerable debris has also come down from the Shickshock Mountains. This debris may be as thick as that occurring just east of Little 17 Mile Brook, but probably is not as deep as that just west of the east boundary.

The drainage is usually through fairly wide valleys often with steep sides, controlled by hard formations, and through gorges controlled by joint and faults. The area is well-drained due to the high relief with freshets tumbling into half-streams which enter the rivers which rise and fall rapidly after a rain.

## E. Geological Setting

The property straddles a large fault which forms the northern contact of the Silurian rocks of Central Gaspe. On the property the rocks to the north of the Silurian contact, or Shickshock Front, are the Shickshock, Precambrian-like mafic schist, whereas, east of the property they are highly metamorphosed Ordovician schists.

The Silurian and overlying Devonian to the south are gently dipping on the south boundary of the property, but are steeply folded and partly overturned farther to the north where there has been extensive gravity faulting.

Two types of intrusives occur south of the Shickshock Front: rhyolite, and gabbro-diorite. The rhyolite intrusions are much larger, and form mountains through Central Gaspe from the Saumon Branch to Murdochville. They cause extensive alteration or bleaching of the country rock. The gabbro-diorite intrusions are small dykes and sills occurring along faults in places, and also forming topographic highs.

A third type of intrusive, peridotite-serpentine, occurs along the Shickshock Front. The peridotite forms three mountains: Mount Paul, South Mountain and Mount Albert; whereas, the serpentinized peridotite occurs in topographic lows, almost continuously, if not continuously, from the Mount Albert Group off the east end of the property, to the West Go Ashore Brook Group, off the west end, a distance of about 16 miles.

## SEDIMENTARY ROCKS

### A. Quartzite

#### (1) Age

This rock is similar to the Val Brilliant Quartzite which has been mapped in the Matepedia Lake area as the base of the Middle Silurian.

#### (2) Lithology

The quartzite is a white weathering, white to black pure quartzite, in part, with argillaceous sandstone members stained with limonite and hematite which occur as grains. Other rock types in this formation include (a) dirty grits with possibly a montmorillonite matrix as on West Go Ashore Brook, (b) limy quartzite, and (c) limestone beds near the top with quartzite boudins. On the Transgaspeian Highway the pure quartzite is overlain by friable quartz-grain quartzite partly limy, which in turn is overlain by fine-grained orange to blue dolomite.

### (3) Exposures

The partly limy quartz-grain quartzite is also found on the property on Line 60 West where it is associated with rocks that have affinities (in part) to the Ordovician east of the Transgaspesian Highway. These rocks include quartz-chlorite schist and quartz-feldspar-limy-gneiss schist. The other rocks in the block include quartzite well-fractured and rusty, dolomitic quartzite pale blue and rusty weathering, and blue limestone beds one to three feet thick. This block contains minor iron sulfides and is cut by carbonate veins varying up to one foot wide. Chalcopyrite, galena, and sphalerite are found as scattered grains near cross faults which cut this block.

Other exposures of this formation occur on the C.M.T. road south of the junction with the N.J.Z.-2 road, and on Line 176 West. Cross-bedding has been observed in semi-outcrop, and brachiopod *Conchidium* in a boulder south of quartzite outcrop in the western part of the property, and massive iron sulphide in a quartzite boulder on 17 Mile Brook beside a major cross fault eight miles west along strike from a iron sulphide zone in quartzite drilled by a Newmont-Sullico Joint Venture in 1964.

## B. Fossiliferous Limestone

### (1) Lithology

The more diagnostic members of this formation are lenses of conglomerate consisting of pure blue limestone pebbles and cobbles, partly elongated, in a matrix of dark blue pure limestone, containing crinoid stems, brachiopods, cup corals, and straight corals.

Another facies of this formation includes silty dark blue to grey limestone, partly laminated, cross-bedded, and micaceous, with occasional one foot beds of coarse-grained recrystallized grey carbonate with occasional crinoid stems, straight corals, and bryazoa.

### (2) Exposures

The limestone conglomerate member of this formation is well exposed on the Saumon Branch and Little 17 Mile Brook. Here it is pure and wide with many fossils. Boulders of recrystallized fossiliferous carbonate beds, weathering pink, were found on the north side of Little 17 Mile Brook between Lines 240 West and 248 West. Some of these boulders contain 5% iron sulphides.

Fossiliferous limestone is also exposed on the C.M.T. road south of N.J.Z.-2 road, and overlying the Quartzite on the Transgaspeian Highway.

### C. Limestone & Shale

#### (1) Age

This appears to be the thickest of the three Silurian formation as it underlies at least 50% of the property. It consists of silty limestone with cross-bedding and grey-green shaly limestone, which has been placed at the top of the Silurian of Central Gaspe by geologists of the Dept. of Natural Resources, Québec. *Monograptus* has furthermore been found in this formation on East Go Ashore Brook.

#### (2) Lithology

Beds, one to two feet thick, of coarse-grained grey carbonate, and broken beds of pure limestone, from three to twenty feet wide also occur. The latter are beds of automorphic conglomerate, which appear in two places on the North Branch of 17 Mile Brook, and as semi-outcrop in the stream south of the Siliceous Dolomite on the Saumon Branch. The fragments are elongated, mostly angular, partly rounded, with one or two foreign cobbles present, and range in size from pebbles to cobbles. The rock has a silty limestone matrix constituting about 20% by volume. A similar rock but less fragmented, occurs about 19 miles west of the North Branch of 17 Mile Brook, on the Cap Chat Road, in a similar stratigraphic sequence.

Top determinations, from crossbedding, have been made on two fine outcrops of silty limestone, one on 17 Mile Brook at Line 128 West, and the other in the stream south of the Siliceous Dolomite on the Saumon Branch. Bedding is both outcrops, is steeply dipping to the south, but shows tops to the north.

The formation is often sheared parallel to the strike, east north-east, or cut by shearing striking north-east. Dragfolds occur frequently with low plunges. These are seen along parallel faults and cross-faults, but some in the east end of the property may be due to folding.

#### (3) Exposures

The formation is exposed on 17 Mile Brook, the North Branch, the C.M.T. road along the south boundary of the property, in the stream south of the Siliceous Dolomite on the Saumon Branch, and in the north-west branch of 14 Mile Brook.

## D. Devonian

### (1) Structure

The normal stratigraphic and structural position of the Devonian in Central Gaspé is to the south of and overlying the Silurian. We believe these systems here are on the southern gently dipping limb of a regional anticline overturned to the north. The southern contact of the Silurian and Devonian is only present from Line 176 West to Line 264 West, elsewhere being south of the property, and furthermore the contact is not exposed here, so that exact relationships are unobtainable, yet the Devonian appears generally conformable to the underlying Silurian. On the Cap Chat road and on the C.M.T. road just south of the N.J.Z.-2 road, the southern limb of the Silurian is exposed and seen to be extensively gravity faulted. Generally these faults appear to continue into the Devonian to the south, into Lemieux Township and as far east as Murdochville.

The northern contact of the Silurian and Devonian occurs only locally on the property between Lines 176 West and 80 West, where the Devonian has been down-faulted in a graben between deep-seated faults trending north-east and east-west, along the Shickshock Front.

### (2) South Limb

The Devonian, south of the Silurian, forms a mountain extending from Line 176 West to 280 West. It is a homogenous rock for the most part, a dark blue to grey, brown to grey weathering, silty to micaceous limestone, partly laminated and fissile. A semi-outcrop of brown limy argillite and dark blue fossiliferous pure limestone with cephalopods and brachiopods occurs on Lines 180 West and 184 West respectively.

### (3) North Limb

The Devonian occurring north of the Silurian consists of different kinds of clastic sediments. The part that weathers high is of grey sandstones finely micaceous, with lenticular shaly partings, well-bedded, and with dolomitic rusty weathering beds, up to one foot wide. These rusty weathering beds have undergone pyrometasomatism and brecciation with carbonate veins within 200 feet of the Siliceous Dolomite.

The parts that weather low are well-exposed on 17 Mile Brook. They are well-bedded green montmorillonite-quartz-feldspar-chlorite grits, partly with plant fossils,

dark grey montmorillonite-serpentine-quartz, quartzite and argillite-pebble-conglomerate, green and red shales, and dark blue limestone conglomerate with some green quartzite and black siliceous slate or mylonite pebbles. The pebbles are well-rounded to sub-angular.

## STRUCTURE

### A. First Deformation

### B. & Second Deformation

The Silurian and Devonian has undergone a period of maximum stress from the south south-east, causing a regional, partly overturned, anticline, which underlies more than 50% of the property. This anticline is cut off at the Shickshock Front by a second period of deformation consisting of gravity faulting in an east-west and north-east direction. A third period of deformation consists of cross-faulting of the Silurian and Devonian south of the Shickshock Front. The property can, in fact, be divided into three main blocks, the eastern, middle, and western, separated by two major cross-faults.

### C. Third Deformation

The eastern cross-fault trends from the Shickshock Front south south-west to Line 176 West at the baseline and farther south into the Devonian. The horizontal displacement on this fault is about half a mile as indicated by the offsetting of three formations which have gentle dips to the south, namely the Quartzite, Fossiliferous Limestone, and the Devonian. The movement is thought to be vertical, due to the lack of displacement on the Shickshock Front, which is steeply dipping. The western cross-fault occurs near Line 580 West on the west part of the property. Exposures are poor but the Quartzite is seen displaced to the north from its regional position, presumably by faulting similar to the eastern one.

The Quartzite formation is also exposed on East Go Ashore Brook within 800 feet of the Shickshock Front, and in contact with serpentine near the Shickshock Front on West Go Ashore Brook, so that it appears that the Quartzite may extend to the Shickshock Front west of Line 580 West and that East Go Ashore and West Go Ashore Groups are underlain by the same fault block. The structure within this fault block appears to be gently south dipping Silurian formations on the south limb of an anticline, with the anticlinal axis close to the Shickshock Front. The Quartzite, could have reached its present exposed position close to the Shickshock, if the fault block moved up.

#### D. Limits of Siliceous Dolomite

It is believed that the Siliceous Dolomite Formation has been faulted up by the western cross-fault and eroded away. Quartz dolomitization in the western fault block occurs within the Quartzite formation but it is minor, occurring only in two or three thin pyrometasomatized beds of the Quartzite Formation. Mattinson, in fact, outlines on his map a zone of the Shickshock which has been quartz-carbonatized just east of the Cap Chat road. The Shickshock would not have been altered if there had been any Silurian limestones, which are much more suitable, nearby.

Therefore, it is thought that no Siliceous Dolomite occurs in the western fault block because while the favourable Shickshock Front is still present, the favourable Silurian limestone which undoubtedly was altered, has since been eroded away. Furthermore the alteration would be narrow as the Silurian limestone's gentle dip is less favourable for its inclusion into the Shickshock front.

The Mount Albert Group to the east of the property is underlain by the eastern fault block, but between the Mount Albert Group and the Transgaspeian Highway another cross-fault may occur as the Quartzite on Isabelle Brook at the Highway, is seen close to the Shickshock Front again, and the quartz dolomitization again appears of poor quality in the first brook north of Isabelle Brook.

#### E. Strike Faulting

Gravity strike faulting occurs on the property probably belonging to the second deformation forming shears often filled with gabbro-diorite dykes. The Quartzite Formation which is brought to the surface north of its normal stratigraphic location between Lines 60 West and 72 West on 17 Mile Brook, may be a horst or an anticline. If it is an anticline the Fossiliferous Limestone is missing on the north where the contact was exposed by stripping on Line 68 West. It may yet be an anticline however, as some geologists in the area believe the fossiliferous limestone to be a shoreline facies.

#### SHICKSHOCK SERIES

##### A. Lithology

The Shickshocks are the oldest series of rocks in Gaspe, consisting predominately of hornblende-schist. On the southern edge of the range where the property is located, the Shickshocks consist of hornblendite, hornblende-schists,

hornblende-feldspar-schists, hornblende-chlorite-schists locally, and hornblende-quartz-augen-gneiss. All are fine to medium-grained except the hornblendite which was formed predominately by the thermal metamorphism from the Mount Albert Peridotite. Pure quartzite occurs in the mountains north of Line 72 West, sausseritized arkosic quartzite locally north of the West Go Ashore Group, and quartz-chlorite veins are common in places. A band of rusty weathering magnetic mafic schist parallels the schistosity on the North Branch, where chalcopyrite is widespread but very minor. This band appears to be partly ultramafic.

## B. Structure

Faulting has occurred in east-west and north-east directions as witnessed by lineaments, contacts with the Devonian and Peridotite within fault blocks, and shearing. Drag folding of small amplitude and with axial planes gently dipping is common along the entire Front.

## IGNEOUS INTRUSIONS

### A. Peridotite

#### (1) Distribution

The Peridotite bodies of Central Gaspé, Mount Paul, South Mountain and Mount Albert, are probably the oldest intrusives in and around the property. They intrude the Shickshock Series in the Shickshock Front. Mount Albert is by far the largest of these three intrusives, being about 16 square miles in area, and occurring just east of a great 90° curve in the Shickshock Series just north of the east end of the property. South Mountain which occurs entirely within the property, and is well-exposed, appears to have intruded a tensional zone between faults trending north-east and east-west. Gravity faulting can in fact be seen cutting the South Mountain Peridotite body when looking up from the Saumon Branch. Two shears occur dipping about 60° south, showing drag-folding, and a gravity movement. The Mount Paul body is poorly exposed.

#### (2) Lithology

These intrusives are banded, coarse-grained, rich in orthopyroxene and olivine, and reported to contain chromite up to an average of 1% (I. D. MacGregor), and are serpentinized up to 90% on the borders. Magnetite, occurring as fine fracture fillings and disseminations, is present locally; namely, from an outcrop on the south side of South Mountain between Lines 280 West and 288 West. The magnetic anomaly

here was more than 100,000 gammas as measured by the Sharpe Fluxgate Magnetometer, but was not picked up on the lines in the course of the regular magnetometer survey. This anomaly was observed to trend north-south, so that it appears reasonable it may be associated with a north-south cross-fault.

### (3) Age

It therefore appears that the cross-faults are younger than the Peridotite, which suggestion may be reinforced by radioactive evidence which dates micas of the thermal aureole around Mount Albert at 495 million years (I. D. MacGregor).

## B. Serpentine

### (1) Lithology

Many bodies of serpentine are exposed cutting the Siliceous Dolomite Formation south of the Shickshock Front. They are mostly greenish-black, but some pink and orange serpentine occur in the main trench area. The less sheared dykes have coarse-grains of orthopyroxene and all are magnetic, with grains of magnetite sometimes visible in hand specimen.

### (2) Age

The age of the Serpentine is probably post-Peridotite and post-cross-faulting. The Siliceous Dolomite alteration is probably contemporaneous with the cross-faulting because of the control which cross-faulting has on the thickness of the Siliceous Dolomite. Since the serpentine cut it, the serpentine is younger than the Siliceous Dolomite, and thus the serpentine is younger than the cross-faulting.

### (3) Distribution

The attitude of the dykes is of considerable interest. Some are gently dipping to the south, others steeply dipping to the south. The dykes south of the north border of the Siliceous Dolomite in the main trench area appear limited to lengths of about 300 feet both by geology and magnetics, and are cut off by minor cross-joints or cross-faults older than the serpentine. The age of the cross-joints or cross-faults is witnessed by the change in texture of the serpentine along strike - from being sheared away from, to being massive adjacent to the cross-joints or cross-faults. It appears as though the dykes flowed actively in the centre but were slowed at the ends. The joints are

probably faults which have been obscured by pyrometasomatism before the intrusion of serpentine.

The dykes on the north border of the Siliceous Dolomite are large and long, giving magnetic, induced polarization, and possibly electromagnetic anomalies. They are poorly exposed, and their presence is partly based on geophysical evidence. All the serpentine dykes observed have strikes generally east-west, but many strikes vary 30° from each other.

The relaxation of the stresses of the third deformation probably caused tensional zones nearby, and openings appeared in the cracks and shears of the second deformation. Serpentine, still present in the last part of the ultramafic magma below, then was able to intrude into the old shears and tension cracks preserved in the Siliceous Dolomite.

### C. Gabbro-Diorite

#### (1) Distribution

Many diabase intrusions were mapped by McGerrigle in the vicinity of the property including several within the property. They occur as dykes up to 200 feet wide, some concordant others discordant to the bedding.

#### (2) Lithology

The only dyke on the property with good diabasic texture occurs as a sill cutting Devonian, on the top of the Devonian mountain on Line 232 West, the rest of the dykes being granular. They are blue, fine-grained, with local amygdules of carbonate, pyrite and chlorite, and commonly disseminated pyrite, up to 2% of the rock. One of the dykes just south of the property on 17 Mile Brook, was brecciated with fragments of diorite in gabbro; other dykes had feldspar phenocrysts. Cooling cracks are often visible as are green weathering rims, fractures almost semi-columnar, and some carbonate veining. Hornfels, drag-folding, and shearing rich in carbon, occur at contacts in the Silurian and Devonian along with local disseminated pyrite.

#### (3) Age

The intrusion of gabbro-diorite occurs along fault lineaments belonging to the second and third deformations, probably filling tension cracks and shears, and therefore it appears to be post-third deformation.

## SILICEOUS DOLOMITE FORMATION

### A. Distribution

A long zone of alteration extends for more than twelve miles, starting either on the Mount Albert Group or east of it, and extending to Line 580 West on the western part of the property.

### B. Origin

It is believed to be altered Silurian limestone from stratigraphically above the Quartzite, that has been included as a slice within the fault zone of the second deformation, being partly recrystallized and partly replaced by silica. Magnesia emanations from the parent magma, or the serpentine, at the time of its intrusion, are believed to have replaced the lime. Carbonate veining is observed cutting quartz veins and serpentine.

### C. Lithology

The gross texture of the Siliceous Dolomite is that of a breccia on the borders, with breccia fragments of Silurian argillite surrounded by vein carbonate. Otherwise, the Siliceous Dolomite is a rather uniform rock type, although it varies in colour from black, grey, orange to pink, being frequently dark blue, and in grain size from fine-grained to coarsely crystalline. It always contains more than 50% carbonate, and readily reacts (fizzes) with 10% H.Cl. acid under the hand lens. Quartz is also very abundant in places, finely disseminated and also as discontinuous stringers up to 3 inches wide.

There are many metacrysts of different kinds of black minerals within the Siliceous Dolomite Formation; including spinel, magnetite, and chromite, always seen within about 50 feet of serpentine; hornblende, seen where the Siliceous Dolomite is in contact with the Shickshock; and tar, which probably originated in the Silurian limestone and formed into aggregates by lateral metasomatism.

## TENTATIVE SEQUENCE OF EVENTS

- A. Island arcs formed in Central Gaspé, concave south, with volcanics extruded and eroded to form sediments, which were thrust and folded with more volcanics, into a semi-continent.
- B. The Ordovician was deposited in the seas around the Shickshock semi-continent, with some possible gravity tectonics along the Shickshock Front.

- C. The Silurian and Devonian were deposited from materials eroded from the Shickshock and Ordovician, and later folded from the south south-east by the first deformation.
- D. Gravity faulting of the Silurian and Shickshocks over the Devonian, and Shickshocks over the Silurian, in two directions east-west and north-east, during the second deformation along with the inclusion of Silurian limestone which was partly silicified.
- E. Peridotite Intrusion. The South Mountain Peridotite appears to be cut by a cross-fault which would date it as pre-cross-faulting. Intrusion could have occurred earlier however, in "A" or "D", which would be supported by a radioactive age date on Mount Albert of 495 million years ago. (I. D. MacGregor)
- F. Cross-faulting which offsets gravity faults of "D", and which appears to control the thickness of the Siliceous Dolomite; along with possible further silicification of the inclusion of Silurian limestone. Accommodation of cross-faulting movement would necessitate hinge movement at, or refaulting of the Shickshock Front, or folding in the Shickshock with axial planes of gentle dips, and trending north-south.
- G. Intrusion of serpentine with magnesia replacing the lime of the Silurian limestone, and forming Siliceous Dolomite. The age of the serpentine is supported by the fact that serpentine is post joints in the Siliceous Dolomite. These joints are taken to be minor faults sympathetic to the major cross-faulting. The dolomitization cannot at any rate be earlier than the cross-faulting because of the control cross-faulting has on its thickness.

Possible contemporaneous intrusion of gabbro-diorite.

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per [signature]

Ottawa, Ont.  
October 23, 1964

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