PROSPECTING POSSIBILITIES OF A PORTION OF NORTHWESTERN BRITISH COLUMBIA

A Report to Granduc Mines, Limited

by

Erik A. Ostensoe, geologist

January 31, 1967.

PART THREE

TED RAY CLAIMS

INTRODUCTION

The Ted Ray claims, Sulphurettes Creek area, may cover low-grade deposits of the "Porphyry Copper" type. Geological and geophysical surveys and drilling have not yielded sufficient information to permit adequate evaluation of the property.

This report outlines a proposal for further preliminary studies. The first phase should be carried out in 1967. The timing of further efforts is open.

Details of the physical setting and history of the property are given and several maps are included.

LOCATION

The Sulphurettes Creek-Mitchell Creek area forms part of the Unuk River watershed and is situated about 42 miles north-northwest of Stewart, British Columbia and 21 miles northeast of the Alaska border (figure 2). The Stewart-Cassiar road will pass to the north and east within 24 miles of the area. The shortest road route from the property to the Stewart-Cassiar road is about 40 miles. Stewart, B. C. by this route is an additional 95 miles.

Granduc Mine is 21 miles south of the area; Max iron-copper deposit, 12 miles southwest; the E and L nickel-copper deposit, 17 miles west. No other properties of much value are known at present but prospecting possibilities have not been exhausted.

CLIMATE

The climate of Sulphurettes area is typical of the northern Pacific Coast. Moderate to severe winter conditions prevail from October until May and summers are generally wet and cool. Annual precipitation probably exceeds 100 inches, about equally divided between snowfall and rainfall.

Heavy autumn rains can cause dangerous flood contiions and in winter some areas are subject to avalanches.

PHYSIOGRAPHY

The Sulphurettes area is in the eastern part of the Coast Mountains. Peaks up to 8000 feet in elevation rise above snowfields and deeply incised ice-filled drainages. Stream gradients are gentle up to 800 feet elevation then

steepen markedly. Canyons developed on many streams between 800 and 1500 feet in elevation suggest that there was a period during which the main Unuk River valley was deepened at a greater rate than were tributary valleys. This development probably coincided with flow of ice from the Cassiar Ice Mass that occupied the area east of the Coast Mountains. From its confluence with Sulphurettes Creek, Unuk River flows 40 miles to Burroughs Bay, Alaska with an average gradient of 19 feet per mile, about 0.4 per cent.

A narrow canyon that extends 3 miles east from the head of Sulphurettes Creek greatly increases problems of overland access to the Ted-Ray claims but may be of value with respect to the development of hydro-electric power. Several possible generating sites have been recognized and a major power installation on Iskut River about 20 miles northwest of Sulphurettes area has been proposed.

In Sulphurettes area much of the geologically interesting ground is exposed on steep valley walls above the Sulphurettes and Mitchell Glaciers. The steepness of these slopes is due to glacial action, erosion having been facilitated in part by ice plucking and other frost action rather than by flowing water. Retreat of ice has been sufficiently recent that slopes have not been significantly modified by streams. Rock and mud slides are rather common events as ice recession leaves unsupported slopes, and as dissection of slopes by stream erosion progresses.

The top of Sulphurettes-Mitchell Ridge is a moderately to gently-rolling upland entirely above tree line.

PROPERTY OWNERSHIP

Claims are held in Sulphurettes area by three groups (1):

(1) Granduc Mines, Limited (N.P.L.) and Granduc Operating Company (a Newmont subsidiary)

(2) Dawson-Ross interests

(3) M. G. Kemp.

Granduc Mines and Granduc Operating Company hold 33 claims that cover the main copper zone and an area of gold-silver-lead-zinc mineralization. Dawson-Ross interests, represented by Don Ross of Ketchikan, hold 24 claims on a molybdenum occurrence and adjoining Granduc claims.

M. G. Kemp is the owner of 17 claims tied on to the gold-silver-lead-zinc area. These claims were, and may still be, optioned to Silver Ridge Mining Company Limited.

The claims have not been surveyed.

HISTORY

The Unuk River area was first prospected in the 1880's. Interest in placer mining continued to 1903 and was revived in 1930. Some Keystone drilling was done near the junction of Sulphurettes and Mitchell Creeks in 1935. Prospecting for lode deposits was inhibited by the difficulties of access, the rugged terrain and dense vegetation at low elevations but the Cumberland, near the mouth of Sulphurettes Creek; the Globe, on South Unuk River; a galena prospect on Divelbliss Creek and prospects in the vicinity of Tom McKay Lake, received considerable attention before 1940. The Halport, a vein gold deposit on South Unuk River, was diamond drilled in the mid-1940's.

Claims were located on Sulphurettes-Mitchell Ridge in 1935 on copper mineralization but very little development work was done. In the 1950's the area was examined several times and in 1959 Stu Barclay located a group of claims near Brucejack Lake, 5 miles to the southeast.

In April, 1960 Granduc Mines, Limited carried out a helicopter-borne magnetic survey of much of the Unuk River drainage and subsequently staked several hundred claims, including the Ted-Ray claims. Ross and Bishop of Ketchikan, staked adjoining claims in June, 1960. It is not known whether molybdenite showings on these claims were known before staking occurred.

Granduc efforts in 1960 and 1961 included reconnaissance and detailed mapping and prospecting, ground magnetometer surveys and packsack diamond drilling. In 1962 two drill holes, one 1012 feet and one 504 feet deep, were drilled to explore a fault structure and prospecting of the area was continued.

In 1964 Stu Barclay found an area mineralized with base and precious metals to the east of the main copper showings. A small amount of trenching indicated better values in fresh rock as compared to surface sampling but no large zone was outlined. At this time the CA 1-40 M.C.'s were staked by J. McGoran and subsequently transferred to M. G. Kemp. A small geochemical survey of part of this claim group was recorded for assessment in October, 1966.

Since 1962 the only work on the copper showings has been an air-borne magnetometer survey. The molybdenite showings have been examined by several companies. Phelps Dodge did some work, including bulk and chip sampling, but dropped the option.

Present claim status is as follows: (see also figure 8)

	In good standing until
Kemp (Silver Ridge Mining Company Ltd.)	
CA 1, 3-8, 17, 19, 21, 33-38, 40	October 19, 1967
Dawson-Ross interests	
Arbee 35, 39 and 55	June 16, 1968
Arbee 54	June 14, 1968
Dawson Ross 1-8	July 24, 1968
John Bull 3-6 and 19-22	June 22, 1968
John Bull 23-24	June 22, 1967
Granduc Mines, Limited	
Ray 19, 20, 22	May 31, 1967
Ray Y Fraction	August 6, 1967
Ted 19	June 3, 1967
Patty 1-6	August 8, 1967
Granduc Mines, Limited, leased to Granduc Operating Company	
Ted 1, 3, 4, 6, 8, 11-18	June 3, 1967
Ted 31, 32 Fraction	June 24, 1967
Ted 2	June 3, 1968
Ray 1-14	May 31, 1973

REGIONAL GEOLOGY

The regional geology of Sulphurettes-Unuk River area was mapped by G.W.H. Norman in 1960 and 1961. His technique employed several two-man mapping crews who, with the aid of helicopters, mapped the geology in reconnaissance fashion on one-half mile scale. More detailed mapping was done in areas of potential economic significance.

The Sulphurettes area lies about 12 miles east of the main Coast Range intrusions and on the western limits of the Bowser sedimentary basin. The bedded rocks, volcanic as well as sedimentary, are, according to R. V. Kirkham (M.Sc. thesis, U.B.C., 1963, The Geology and Mineral Deposits in the Vicinity of the Mitchell and Sulphurets Glaciers, Northwest British Columbia), "part of the Lower Hazelton Group and/or possibly part of the Upper Takla Group (?)".

The western part of Sulphurettes-Mitchell Ridge and the upper part of Sulphurettes Creek consist mainly of sedimentary rocks. Siltstone and greywacke are predominant, with subordinate amounts of conglomerate, argillite

and dark silty limestone. The sediments are characteristically immature: poorly sorted and only slightly rounded.

Pyroclastic volcanic rocks with intercalated feldspar porphyry flows and minor sedimentary rocks predominate in the eastern part of the Sulphurettes area. Pervasive alteration has destroyed many of the original characteristics and has resulted in formation of calcite, chlorite and sericite.

Of greatest economic interest is a zone of faulting, acid intrusions and intense but rather low temperature hydrothermal alteration that extends from snow and ice fields south of Sulphurettes Glacier, across Sulphurettes-Mitchell Ridge to the north side of Mitchell Glacier. The main structure appears to be the Sulphurettes fault, a complex, probably composite, structure. Kirkham determined strike-slip movement with minor thrusting: the west block shifted to the south and slightly east relative to the east block. It occurs close to the western edge of the volcanic rocks and probably extends into the sedimentary rocks. A zone of intense shearing and alteration mainly in the footwall of the fault contains the Mitchell Intrusions, a suite of hypabyssal rocks that range from plagioclase-hornblende porphyry (mainly sills and dykes) to syenites (irregular bodies).

A sub-parallel, nearly vertical, structure, the Brucejack fault, passed about 2-1/2 miles east of the Sulphurettes fault. It seems to be the easternmost limit of the "disturbed" zone and may lack any economic significance. Kirkham was reluctant to designate it a true fault.

Notable alteration minerals in order of decreasing abundance are albite, calcite, sericite, quartz, chlorite, and pyrite. According to Kirkham regional albitization has occurred over an area of more than 20 square miles. This is considered a regional metasomatic effect imposed on the volcanic rocks and what were originally various differentiates of a normal magma. One result has been a shifting of compositions toward the sodic field.

Major periods of faulting and alteration probably coincided or at least overlapped. That alkalic fluids were the main agencies of alteration is suggested by the extent of albitization and sericitization. CO_2 or a soluble carbonate, and hydrogen sulfide or a similar compound, were also present.

Kirkham suggests that completely altered rocks may be better host rocks for ore minerals than are rocks altered to a lesser degree. Quartz sericite schists probably represent the highest grade of alteration and, incidentally, probably occur closest to "centers" of alteration.

MINERAL DEPOSITS

Disseminated chalcopyrite with abundant pyrite and traces of molybdenite, occurs in association with members of the Mitchell Intrusions. The area that has been diamond drilled is an alteration zone in an intrusion

near the crest on the south side of Sulphurettes-Mitchell Ridge. This may be a "horse" of sedimentary rocks that has been involved in the intrusive rocks. On the basis of core logs the writer believes that Drill Hole 1 was collared in this formation and passed into intrusive rock at from 80 to 100 feet. The first 80 feet averaged 0.36% copper. Drill Hole 2 was drilled entirely in the altered sedimentary material.

Copper mineralization associated with syenite and granite of the Mitchell Intrusions has been reported on the north side of Mitchell Glacier. The rocks have been shattered and permeated by mineralizing solutions but alteration is not extensive.

Near the toe of Mitchell Glacier sedimentary rocks have been extensively albitized but selectively pyritized. Small areas of chalcopyrite, traces of galena and veinlets of fluorite have been reported.

Molybdenite occurs in quartz sericite schist on claims of Dawson-Ross interest about 4000 feet east of the main porphyry intrusions at elevation 4000 to 5000 feet on Sulphurettes-Mitchell Ridge. Much of the molybdenite coats cleavage surfaces in the schist but crosscutting veins of molybdenite and molybdenite and quartz are also present. Pyrite is abundantly disseminated in the area. Estimation of grade on the basis of surface exposures is made difficult by great variations in sulfide content within the area, by the presence of veinlets of massive molybdenite in poorly defined zones and by frost action that may have plucked and wedged some portion of the molybdenite from the outcrops. Some areas that might grade 0.3 to 0.4% MoS_2 across 150 feet are present but most of the surface probably grades about 0.05% MoS_2.

Two types of mineralization have been located on Ted 2 M.C.: (1) small barite stringer veins containing pyrite, tetrahedrite, galena, sphalerite and ruby silver; and (2) disseminations of pyrite, galena, sphalerite and tetrahedrite (?) in altered limey and argillaceous sedimentary rocks. An assay of 236 oz. silver per ton across a 5-inch width was obtained from the barite stringers but no worthwhile zone was outlined. The other showings have been trenched and sampled. Part of the area of disseminated sulfides carries rather erratic values in gold, silver, lead and zinc and is difficult to evaluate. As indicated by the following, samples from trenches were consistently better grade in gold and silver and usually in lead than were samples taken from the oxidized outcrops.

Sample No.	Character	Width (in feet)	Au	Ag	Pb	Zn	Cu
3813	Surface	6	Tr	Tr	4.77	8.81	0.18
5770	Trench	6	3.42	85.0	14.54	20.54	0.37
3814	Surface	5	.02	.40	.77	1.22	0.06
5768	Trench	5	.04	1.20	1.22	2.29	0.19
3817	Surface	6	Tr	Tr	Tr	0.35	0.04
5771	Trench	6	0.74	11.4	2.8	11.0	0.26
3818	Surface	7 inches	0.36	20.7	5.10	44.98	0.24
5767	Trench	7 inches	0.61	24.6	2.14	24.9	0.74
5A	Surface	5 - 6 ft.	0.02	0.40	0.31	1.52	0.03
5769	Trench	5 - 6 ft.	0.05	0.58	0.41	1.05	0.05

All sampling was done by Newmont personnel.

MAGNETIC SURVEYS

In 1960 Granduc followed airborne magnetometer surveys with ground magnetic surveys of indicated anomalous areas. The upper part of Sulphurettes-Mitchell Ridge was not surveyed from the air at this time due to difficulties of flight control over snow fields. Further airborne work was done in 1964.

The ground surveys located several small magnetically anomalous areas of rather low intensity. These coincide fairly well with the pattern developed by the 1964 airborne survey and appear to be directly related to areas of Mitchell Intrusions. The area east of the Intrusions, largely quartz sericite schist and other rather highly altered rocks, is magnetically low (figure 9).

PHYSICAL WORK

In 1961 four areas on Sulphurettes-Mitchell Ridge were packsack diamond drilled. A total of 436 feet was drilled in two parts of a copper mineralized zone: in one, 185 feet of core averaged 0.50 per cent copper; in the other, 251 feet averaged 0.63 per cent copper. The other two areas had sparse sulphides: 100 feet of core averaged 0.295; 200 feet, averaged 0.144. The deepest hole of this project was 33 feet.

In 1962 a 1012 foot deep diamond drill hole was drilled on Ray 13 M.C. and a 504 foot hole on Ray Y Fraction M.C. Both sites are near the top of Sulphurettes-Mitchell Ridge. Zero to 80 feet in Drill Hole 1 assayed 0.36% copper. Drill Hole 2 did not intersect copper mineralization. Dr. Norman of Newmont, who was in charge of this drilling, determined that the copper mineralization was probably not related directly to the major faults. A tendency for better copper values to be associated with potash feldspar alteration was indicated: 0.49% copper with; 0.29% without.

Very little is known about the work on the Dawson-Ross claims. Phelps Dodge took a bulk-type sample at 100-foot spacings on a grid. In this work shallow holes were drilled in bedrock and blasted. The broken rock from each sample point was sacked and shipped for tests. The grid obviously extended into areas virtually barren of sulfide mineralization.

PROPOSALS FOR FURTHER WORK

By way of summation, the following points must be stressed:

(1) Sulphurettes is obviously a large area within which targets for exploratory work should be chosen with great care, (2) basic geological conditions have been determined; magnetic patterns, indicated, (3) three types of deposits are present: (a) copper and molybdenum of the "porphyry" type, (b) copper replacements, and (c) precious metals-base metals veins and replacements, (4) property ownership is awkwardly divided (5) the working season is short (6) costs are high. Although the area is highly regarded as warranting further work no orebodies have been located nor can any be inferred.

Recommendations are based in part on those made by G. W. H. Norman, October 24, 1963 and D. M. Cannon, October 4, 1964.

The following work is recommended:

(1) continued geological mapping with particular reference to structural controls of sulfides

(2) geochemical sampling, particularly silt sampling, in conjunction with the above

(3) further drilling, trenching and sampling in area of sulfides on Ted 2 M.C.

(4) reconnaissance induced polarization surveys with more detailed follow-ups in anomalous areas

(5) negotiation of an agreement with Dawson-Ross interests to enable studies to be extended into their ground and with Granduc Operating Company to transfer Ray 1 to 14 M.C.'s inclusive to Granduc Mines, Limited

(6) reconnaissance investigation of the extensions of the favorable structures, particularly to the south of Sulphurettes Glacier

(7) legal surveys of all claims, with the exception of CA claims

In all, a rather long-term exploration effort should be anticipated.

DETAILS OF RECOMMENDATIONS

(1) Geological mapping of selected areas is necessary as an aid to reconstruction of the complex history of the faulted-altered mineralized zone. Mapping on air photos is unsatisfactory due to distortion of steep slopes. Available topographic maps are on the scale of one inch to 500 feet or larger and lack sufficient control points for use in detailed work. Plane table mapping is a good alternative method but there are several problems inherent in its use:

(a) Generally wet weather may preclude its use even if waterproof paper is used; the instruments tend to become fogged;

(b) difficulties of finding set-ups and restrictions to rather shallow vertical angle observations will result in slow progress in mountainous terrain.

Accurate large-scale base maps prepared from recent air photos and on which prominent photo points have been located can be used effectively.

(2) Geochemical sampling can conveniently be included with mapping projects. In most areas samples should be analyzed for copper and molybdenum. The area of precious metals is of sufficient interest that analysis for gold, silver or the associated lead and zinc may be warranted. Advice on the techniques should be sought. In much of the areas of interest the ground surface has only recently been exposed by recession of glaciers and snowfields. Consequently soils, where present, have only poorly developed profiles. Experience gained in geochemical work in the Sulphurettes area will probably be of value in other areas of interest to Granduc.

(3) In his October 1964 report on the Ted No. 2 M.C. showings found and worked on by Stu Barclay, Mr. Cannon recommended that

> "a provision be made for a minimum four-man crew plus a geologist to spend at least one month in the further investigation of this mineralization during the 1965 season".

This follow-up has not yet been done. Barclay undoubtedly checked much of the nearby area but more prospecting, using a Cobra drill and blasting to break through gossans, is warranted. After careful geological mapping of the mineralized areas further trenching may be justified. EM surveys, employing a small unit such as a Sharpe SE 250, may be of use in areas of shallow overburden but the zones are probably too narrow to give reliable responses. Packsack drilling to test persistence of mineralization could be the more useful than trenching.

(4) Dr. Norman, in 1963, recommended 100,000 feet of I.P. survey to test copper-bearing syenite. In 1964, geophysicist Dr. A. A. Brant of Newmont visited the Sulphurettes area and expressed the opinion that the abundance of pyrite would render I.P. data of little value.

It is suggested that I.P. surveys be deferred until more comprehensive knowledge of the geology of the area is available to us. The cost of the required survey would likely exceed $20,000.

(5) Property ownership should be reconciled at an early date so that maximum benefit is obtained from our efforts. Parts of the Dawson-Ross ground, particularly the molybdenite zone, should be examined and mapped as part of our first season's work. Claims contiguous to the east side of Ray claims have potential of a lesser order than that of the Rays.

Granduc Operating Company has retained control of a key gro group of claims, the Rays 1 to 14. These are in good standing until 1973 and Granduc Operating Company is unlikely to press exploration work in this area much before that date. By staking and by maintaining claims already held, Granduc Mines, Limited can control much favorable ground but very little can be achieved without the cooperation of Granduc Operating Company.

The CA claims have no obvious merit and work on them will not be contemplated unless a very favorable deal on them is proferred by the owner or unless indicated by the work outlined in (3).

(6) The areas adjacent to existing claims should be prospected an and mapped.

(7) A legal survey of the claims is recommended to minimize the possibilities of outsiders staking nuisance claims. Surveys of a low order of accuracy were carried out in 1960 and 1961 and no great gaps remain. This project is of low priority.