Box 73

N.T.S. 114 - P. 12

YF-70-100-B-5

REPORT

ON

1959

NORTHERN PROSPECTING

NORTHERN B. C.

S.W.YUKON AND ALASKA

~~MINING DIVISION~~

Jas. J. McDougall
Geologist

~~ENGINEER~~

16,666

R E S U L T S

of

1959 NORTHERN PROSPECTING

NORTHERN B. C., S. W. YUKON AND ALASKA

by

JAMES J. McDOUGALL

Vancouver, B. C.
November 16th, 1959

R E P O R T

on

NORTHERN PROSPECTING - 1959 SEASON

(BRITISH COLUMBIA-YUKON-ALASKA)

Jas. J. McDougall

I N D E X

				Page
A.	CATAGA - KECHIKA PROSPECTING:			
	Descriptions:	(1)	Cataga Zinc	1
		(2)	Tuchodi Copper	2
		(3)	Dall Lake Fluorite	3
		(4)	Cry Lake Asbestos	4
		(5)	Finlay Asbestos	4
		(6)	Frog River Silver-Lead	6
		(7)	Paddy Creek Copper	7
		(8)	Turnagain Silver-Lead	8
	Maps, etc.	(1)	Map CK1 - Location of Discoveries 1" = 20 mi	1-a
		(2)	Assay Results	9
B.	ALASKA PROSPECTING:		Preface	11
			Summary and Conclusions	12
			Location, Access & Physical Features	13
			History and Organization	14
			General Geology	14
(a)	Description of Properties and Mineral Occurrences			
		(1)	Windy Craggy Copper-Cobalt	20
		(2)	Tats Group	27
		(3)	Gypsum	28
		(4)	Graphite	29
		(5)	Coal	29
		(6)	Cobalt	30
		(7)	Manganese	31
		(8)	Gold	31
		(9)	Silver	33
		(10)	Copper	34
		(11)	Lead-Zinc	37
		(12)	Molybdenum	37
(b)	Northern Exploration of other Groups			39

I N D E X - contd. Page

C. DESCRIPTION OF YUKON (Kaskawulsh) AREA AND FUTURE EXPLORATION META:

(a) North
(1) Hubbard Area 47
(2) Kennecott Contact 49
(3) Mount Miller 52
(4) Tats Lake 53
(5) Melberne Greenstone Belt 53

(b) South
(1) North Coastal Islands BC 55

(c) General Procedure, etc. 57
(a) Preparations Required 59
(b) Suggested General Itinerary 60
(c) Equipment 61

LIST OF ILLUSTRATIONS:

(1) General Regional Map 1" = 40 mi 11(a)

(2) Air Photo Composite Tats-Frobisher Glacier 1" = 2700' 21(a)

(3) Windy-Craggy Sections 1" = 100'
(a) A - A'
(b) B - B'
(c) C - C'
pp. 24a, 24b, 24c.

(4) Photos - (Back of Report)

W.C. #1 Craggy Zone
W.C. #2 " "
W.C. #3 Craggy-Windy
W.C. #4 Windy Zone
T.I. #1 Tarr Inlet
T.I. #2 Fremont Drilling
T.I. #3 Newmont Activities
T.I. #4 "
T.I. #5 "
W.C. #5 Windy Drilling
H. 2 Kennecott-type Contact
H. 2a "

(5) Diamond Drill Logs, Holes #1 to #5 (Windy Craggy) - Back of Report.

INDEX - contd.

(6) MAPS (In Pocket)

#59 "A" - Mineral Occurrence Map, Tats Lake Sheet - 1" = 4 mi

#59 "B" - Generalized Geology, Tats Lake Sheet - 1" = 4 mi

#K1 - Generalized Geology of portion of Kaskawulsh Sheet 1" = 4 mi

#C-W 2 - General Geology - Craggy-Windy Groups 1" = 500'

GATAGA-KECHIKA PROSPECTING

1959

During late June and early July approximately three weeks were spent prospecting the more promising sections of the Kechika River drainage in north-central British Columbia. Previous work in the Gataga was enlarged upon and time was spent checking little-known serpentine bodies in the Turnagain-Kechika area.

Mineral occurrences described in recent G.S.C. reports were prospected.

The following short summary outlines the more important work done in each area and Map GK #1 shows the mineral locations. A short summary of assay results is included. Due to the lack of major intrusives east of the Cassiar Batholith mineral deposits are not common.

GATAGA ZINC AREA:

Several days were spent checking the 20 mile-long zone of Gataga zinc-vanadium gossans. Although zinc assays of 0.5 to 2% were obtained from samples of these transported gossans, there is no evidence to suggest proximity to surface such as there is at the Springiron Lake Deposit. However, in one deposit east of the Gataga Lakes widespread pyrite mineralization is present in a cherty sedimentary breccia which has low zinc values associated with it.

No work was done on the Springiron showing this year. These were described in a separate 1958 report (#14

on Map GK1).

These somewhat unique deposits are a long-ranged gamble and incentive to investigate them more thoroughly will depend on an increased demand for zinc and vanadium.

TUCHODI LAKE COPPER:

Several days were spent in the rugged interior of the Rocky Mountains northeast of the Catage investigating mineralized zones previously noted on Super-Cub reconnaissance. Several showings containing disseminated chalcopyrite and/or galena were discovered but in amounts which would be interesting only if values in precious metals were five times higher than they are.

Due to remoteness and lack of encouragement to date this little known section of the country has not been seriously prospected. The Rocky Mountain-type sediments are cut by an interesting system of large, persistent, and steep basic dykes, many of which have copper values associated with them. Another feature also unlike the rest of the system in B. C. is the low-grade(?) dynamic metamorphism evident. Any hint of a granite break-through in this area would be of extreme importance as some of the major mining camps in the Cordillera, including Butte, Climax, Leadville, etc., occupy an environment not too unlike this. Our work in the unmapped Northern Rockies has been with this possibility in mind. Although results to date have been negative it must be remembered that we and the only other exploration groups that we know of have not

entirely covered the section under discussion, and to the writer and anyone else who has seen them the ease with which one could by-pass the aforementioned "Great Divide" mineral deposits hidden away in massive sediments is startling.

Although no program is suggested for this portion of B. C., which will not be mapped geologically by the government for some years, while passing through the area geological reconnaissance along differing routes is in order. During the past the persistently bad weather has cancelled the majority of such proposed flights and conditions will not improve.

DALL LAKE FLUORITE:

Late in 1958 the G.S.C. discovered a fluorite deposit several miles east of the headwaters of an unnamed creek a few miles northeast of Dall Lake. The showing is 10 miles west of the Trench and the Kechika River. As it had not yet been examined we put a crew in the area for a few days in the hopes of finding often-related epithermal(?) mineralization of importance.

The fluorite is deep blue in color and is best seen in large blocks of talus near the creek at the base of a moderately steep cliff. It is disseminated through the rock in a deposit probably restricted in size to a poorly exposed zone about 500 feet long in the direction of the creek and about 200 feet wide. The rocks involved are dolomitic limestones, schists, white limestones, dyke-like greenstones, and breccias. Mineralization is best develop-

ed in the breccia and dolomitic limestone which overlie a shear zone marking a possible thrust fault. It cannot be considered an important fluorite deposit and no larger showing could be found. Grade over the dimensions quoted would be less than 1% fluorite. However, we were able to locate patches containing disseminated galena in the zone near what appears to be highly altered andesitic dykes in the white limestone. Samples of the best mineralized material showed nothing more than trace amounts of gold and silver.

CRY LAKE ASBESTOS:

Following rather extensive Super-Cub work in the serpentine areas south and east of Cry Lake, the helicopter was used to check the least accessible showings indicated. Although much of the serpentine here had previously been prospected, our work showed smaller but favorably located outlying bodies of which no record existed.

Although some short 1/8" fibre of good quality was discovered, with the exception of slip fibre all thelonger chrysolite is too harsh to be of value.

A deposit of likely-looking nickeliferous pyrrhotite was found associated with one of the basic bodies but the nickel content of 0.25% is too low to be of interest.

FINLAY ASBESTOS:

It had been hoped that with the aid of the helicopter some useful work could be done in tracing down the excellent quality asbestos connected with an "Indian Story"

we uncovered two years ago. As the deposit in question is reportedly in a heavily wooded area (which adds the most authenticity to the story as all other known Northern asbestos deposits are above tree line) and landing spots at a premium, it was decided to wait until late in the program when the unusually high water had subsided and landings could be made on a number of favorably located creek bars. However, rain kept the streams high and the Indian who claims to know the general location of the deposit would not travel until the streams lowered. As the helicopter moved to the Alsek only one Super-Cub was left and the Indian, largely through an inbred fear of all things airborne, plus a mutual mistrust of the white man, decided to postpone his trip until he could walk without getting wet. Such conditions did not materialise this summer and weather conditions deteriorated steadily.

Further search from the air seems hopeless unless it is tied in with the more sensitive magnetometer we received this fall. On one of the few landings made in the suspected area this summer, some serpentinized-peridotite? float was picked up on a bar along Obo Creek. This may be indicative, as the nearest known serpentine is about 40 miles away.

A follow-through of the Turnagain Lake Serpentine Belt which contains the Conwest Le Taine asbestos property resulted in the discovery of several small outlying but related bodies along strike southeasterly over low ground toward the Pitman River. Two of these contained

considerable chrysotile but in veinlets less than 1/8" wide.

FROG RIVER SILVER-LEAD:

About ten years ago the first organized helicopter exploration party in B. C. discovered a silver-lead showing near the headwaters of the Frog River. This occurs in altered Cambrian or possibly Pre-Cambrian sedimentary rocks near the eastern contact of the Cassiar Batholith (#13 on Map GK2). The badly broken up and poorly exposed deposit exhibited considerable coarse galena float with interesting silver values. However, the company, Karl Springer's Helicopter Exploration Group, considered the deposit to be lying with the hill and to have no depth possibilities. This spring Nels Hall, one of the original discoverers, convinced Comwest that there was a chance that Springer's interpretation was wrong and the ground was taken over. Comwest's work this summer was inconclusive in that the two deep, divergent trenches they put in failed to reach bedrock. However, galena boulders were still present near the bottom of one of the 13 foot deep trenches and more extensive work is planned next year.

Quite independently of the above we rapidly prospected a large likely-looking limestone remnant in a wooded, more difficult accessible area several miles west upriver along the Frog. Quartz float weakly mineralized with galena was picked up on the north bank of the river, and when assayed showed a 1:2 silver to lead (Oz/%) ratio. Several miles farther along the river but within the granite itself a system of hotsprings in a park-like setting

was discovered. High water so common all summer prevented crossing the river to examine rusty zones in the granite. Prospecting here is slow and difficult. This small but well defined section should not be written off and should the Conwest showing take on added importance we might consider putting two better-equipped prospectors into this wooded area for two weeks.

Low-grade copper values were obtained along an argillaceous quartzite band several thousand feet above the river, but this is of no interest. Strong but barren quartz veins in Cambrian(?) quartzite are common in this section.

QUARTZITE RANGE, OATAGA MOUNTAINS:

PADDY CREEK COPPER:

The wide-open, easily prospected mountains stretching 30 miles on either side of the Rocky Mountain Trench between the junction of the Turnagain River and Sifton Pass were prospected rapidly but efficiently. We were able to tie in and help out the Geological Survey party currently mapping this area.

Some excellent fossils of probable Lower Cambrian Age were found in rocks overlying great thicknesses of sediments tentatively classed as uppermost Pre Cambrian. Such geological units any place in the world deserve to be looked at even if there is no known important mineral history locally connected with them as small "windows" of even older but more favorable rock may be exposed.

With the exception of about a dozen small 1 to 2" wide chalcopyrite veinlets associated with shear zones, no evidence of important mineralization was found in this entire area. The existence of high grade copper float on Paddy Creek, as reported by Indians, could not be confirmed unless such consisted of material from the small above-mentioned veins. Specimens representing a silicified and pyritised zone in quartzite of the Quartzite Range north-east of the fluorite assayed only 0.6 oz in silver. This was the only extensive mineralisation discovered. A large number of quartz veins, extremely plentiful in many areas on both sides of the Trench, were examined. Without exception they contain values of less than $1.00/ton. The veins themselves are largely, although not entirely, restricted to phyllitic or shaly members. These have almost certainly resulted from the "squeezing-out" of silica during weak dynamic metamorphism resulting from an evident but as yet unclassified structural condition which affected this part of the country.

TURNAGAIN SILVER-LEAD

Two silver-lead deposits were discovered by Gerry Davis later in the summer north of and about half way up the Turnagain River. The Turnagain granite stock was suggested through air photo interpretation by the G.S.C. in 1957 and we checked and outlined it shortly afterward. Several short prospecting trips in the area revealed only small erratic silver-lead and copper mineralisation.

One zone discovered this year, although not seen

by the writer, is reported to be a shear at least 60 feet wide with assays across this width indicating 3.6 oz of silver plus 1.02% lead. The length is not known. Although higher silver assays were hoped for, this zone should be looked into a little more carefully.

Asbestos prospects located by Alfred Day of Telegraph Creek were examined but the fibre is too short to be of interest.

Some small copper-bearing quartz veins located by Don McPhee (also of Telegraph) on the south side of the Pitman opposite Tuche Creek are too small to be of interest as are similar showings on the Lower Turnagain. Jack George of Telegraph Creek had discovered the latter.

The following assays were obtained from samples taken at the corresponding areas shown on Map 6K1:

#1. Dall Fluorite - (slight pyrite associated with disseminated purple fluorite & calcite).
Au - tr., Ag - tr.

#2 Dall Galena - (disseminated galena in carbonate rock near dyke(?) in fluorite zone)
Au - tr., Ag - tr., Pb - 1.78%

#3 Quartzite Range Pyrite - (siliceous, pyritic argillaceous quartzite-chips off 5 ton boulder in creek)
Au - tr., Ag - 0.6

#4 Frog River Silver-Lead - (quartz float showing 5% galena)
Au - tr., Ag - 1.3 oz. Pb 2.05%

#5 Paddy Creek (chalcopyrite-tetrahedrite(?) in quartz-carbonate zone - picked sample).
Au - tr., Ag - 0.3, Cu 15.3%.

#6. Tuchodi Lake Lead-Zinc - (best sample of PbS in banded calcareous argillite) (Validity of lead assay in doubt).

Au - tr. Ag - tr. Pb 0.08%, Zn 0.45%.

#7 Tuchodi Copper (2% chalcopyrite in altered white limestone)

Au - tr. Ag - tr. Cu 1.22%

#8 Composite Sample Pyritic country rock east of Gataga Lakes.

Zn - 0.20%, Pb - 0.08%.

#9 Red Stain Creek (Bog Iron - Tuffa) -

Au - tr. Ag - 0.4 oz. Zn 0.45%, Cu - tr.

#10 Areas of sub-commercial Asbestos Fibre.

#11 Turnagain Silver-Lead - (3 foot vein of galena).

Au - tr. Ag 0.7 oz. Pb - 46.94%.

#12 Turnagain Silver-Lead - Chip sample across a 60 ft. wide shear zone slightly mineralized with galena.

Au - tr. Ag - 3.6 oz. Pb - 1.02%.

#13 Toad River Copper.

ALSEK PROSPECTING
1 9 5 9

PREFACE:

The latter part of the 1959 field season, mid-July to mid-September, was spent in the Alsek River region of Northwestern British Columbia and Southwestern Yukon. This season's work enlarged on that started last year.

A new model 12E Hiller helicopter was used, supported by one Super-cub. This combindation was ideal for our work and the 12E introduced a safety factor never before available. The field crew consisted of one full time prospector, three geologist prospectors, one pilot prospector, a helicopter crew of two, and a cook. Base camp was established near the Yukon border on Survey Lake (the only lake with available firewood), and as the sole and part time two man field party required little support, the helicopter was used daily for reconnaissance prospecting remaining based at the lake. This method, quite unlike that used by most other exploration companies, had the advantage of being able to eliminate unfavorable or to outline favorable localities rapidly, thus enabling a large area to be covered. The disadvantages are that smaller or valley-bottom deposits are easily missed and the effectiveness of the whole prospecting operation usually comes to a halt while base camp weather is bad or the helicopter is down for repairs.

The 1959 crew consisted of George Chamberlain and

Roy Hepworth (Highland Helicopters), Stan Bridcut, Mike Donahue, Earl Dodson, John Clark, Alex Smith (part time), and the writer. Gerry Davis helped with assessment work late in the season. Stewart Holland of the B. C. Department of Mines spent a few days in the area so that his department would at least be partially informed about this unexplored portion of B. C.

Several nearby showings being actively tested by others were examined.

The geography of the Alsek is outlined in our 1958 report and will not be repeated here. The reconnaissance-type geology of the areas concerned has been plotted as well as was possible using uncontoured base map 59B in B. C., and Preliminary Map K1 in the Yukon. Map 59A shows the prospects which we discovered. 1959 was a bad season weatherwise with fog and wind restricting us to low valley work 75% of the time. No more than a one-week total of "ceilingless" weather was available all season, although a few extra good days were used up engaging in an air search near Alaska and awaiting helicopter repairs.

SUMMARY AND CONCLUSIONS:

During 1959 the remaining geological features of interest in the Tats Lake Sheet were recorded as were those of the South half of the Kaskawulsh Sheet in the Yukon. Approximately 150 "assayable" mineral occurrences were discovered and a "Kennecott-type" contact outlined

in the Yukon. Assessment work and further prospecting were done on the copper and gypsum properties discovered last year.

Despite very favorable geology, structurally and petrologically, no large high grade deposits could be located in this unusually well exposed area. Those deposits most interesting to date occur associated with greenstones. Most greenstone contacts are in depressions now ice or gravel-filled and mineralisation of note is represented by float only. Costly drilling following geophysical surveys would be required to explore these favorable zones.

Non-Metallic discoveries included several Tertiary coal assemblages and another gypsum deposit. Prospects containing strontium, cobalt and manganese were found.

Location, Access and Physical Features:

The prospecting area in general included the entire drainage system of the Alsek River in B. C., Yukon and Alaska plus extra ground to the south and north (See 1956 Report). Several of our discoveries are only a few miles from salt water whereas others are in difficult accessible glacier country up to 50 miles inland.

To date, no exploration program other than our own has been carried on in this section, although small inroads have been made around the fringes. The first preliminary 500 foot contour topographic map was completed this fall, too late for us to make use of, thus all our information remains plotted on uncontoured Forest Interim Sheets. The Kaskawulsh sheet in the Yukon is a prelimin-

ary map made especially for the G.S.C.

History and Organization:

In 1958 two ground parties supported by a float equipped Super-cub aircraft were used. A Bell 62 helicopter was employed for about two weeks. During 1959 a helicopter was employed all summer along with the same float plane. The Cub was used to spot geologically interesting areas and the helicopter used for more detailed checking. Examination of float on glacial moraines and gravel trains is of tremendous value in this region and we made wide use of this prospecting method. Climbing equipment had to be used to examine some prospects. It is interesting to note that in several areas major ice fields have receded seven or eight miles in the last 45 years and rock units such as the Kelberne Greenstone not previously exposed now form hills 500 feet high.

General Geology:

The main geological features are plotted on maps K2 and 59B. Some of the geology has been done in detail and accurately plotted whereas the remainder is the result of "intelligent" guesses, or the writer's interpretation. Should anyone desire to sub-divide this our field maps on file give more information than warrants inclusion in this report.

Generally most Cordilleran rock units are represented in the St. Elias but at present as the area stands alone (geologically speaking) correlation with the limit-

ed and themselves only partially correlated adjoining map sheets has not been attempted.

The sediments range in age from probably mid-Paleozoic to Tertiary. As only a few as yet unidentified fossils were found, no attempt has been made at subdivision within this range with the exception of the Tertiary. Mid-Devonian, Carboniferous and Mesozoic strata are suspected. Triassic and Cretaceous rocks may be widespread.

Except in the several localities where massive limestones are present, the pre-Tertiary sediments are notably thin-bedded and include limey shales, thin-bedded argillaceous limestones, carbonaceous shales, minor quartsitic members, and various other calcareous or argillaceous sediments. Metamorphism has converted many of these to various meta-sedimentary forms, including widespread horn-felsic assemblages. Only in the Mt. Hubbard section in the Yukon are well-defined massive limestones present. These die out or lose their identity (facies change?) along strike before reaching the Tats Sheet. Local limestone units on the Upper Noland and Upper O'Connor may be related to this horizon(?) however.

Several small sedimentary Tertiary remnants are present. Some of these are coal-bearing and all contain numerous plant fossils. At least a 1000' thickness of conglomerates or related rocks is closely associated with the coal-bearing sandstone and shale units.

Older volcanic rocks, believed to be the most important units because of their regional relation to ore de-

posits, are occasionally present. Included is the Tats Greenstone Complex which is at least severalthousand feet thick and which exhibits excellent pillow-lava structure in part. The less altered volcanics of the Melberne Greenstone Belt, unfortunately largely drift-covered, are also important. These exhibit some amygdaloidal and pyroclastic phases and may be related to the Tats Complex. Even less is known to date about the Hubbard Greenstones. The more basic volcanics here have an intrusive relationship in part.

Tertiary basalt is widespread in the eastern portion of the Kaskawulsh sheet but rare in the Tats sheet. Some poorly defined rhyolites shown on the latter may be Tertiary.

Basaltic(?) dyke swarms are an interesting and somewhat unique feature of this portion of the St. Elias. Whole mountains may contain up to 50% dyke material. Attitudes generally correspond to the existing joint pattern. Numerous sill-like bodies showing contact alteration are present in the calcareous sediments. Unfortunately no important mineralization was anywhere found associated with this impressive group of rocks. North of the O'Connor River one such dike cuts Tertiary sediments and on this criteria the whole system is classed as Tertiary.

Intrusives or granitic-type rocks are many and varied. The Noisy Range quartz-and/or granc-diorite is the best defined of these and forms a prominent range between the Alsek and the O'Connor Rivers. North across the Alsek this large stock loses its identity as it does to the south. The texture, as in most of the granitic rocks of the area, is fine

to medium-grained with pegmatitic types rarely occurring.

With the exception of the dioritic or gabbroic phases unassimilated inclusions or remnants so mask most of the remaining granitic rocks that it is often impossible to map them as individual units. As a rule if there is less than 50% included material the rock is referred to as granitic. When these types are again cut by Tertiary dyke swarms, as is commonly the case, a complicated puzzle ensues which will demand close study to decipher. Granitization appears a certainty in some areas, especially west of the Tatshenshini above the O'Connor junction. Here the small granitic bodies appear to overlie the sediments at a high angle and take on a distinctly bedded appearance.

The diorite and gabbro(?) bodies are generally spatially related to the more acidic granitic bodies. Some case may be found to classify the more basic rocks as mammoth, sill-like intrusives. The contact between the two is sharp and sometimes nearly flat. Detailed studies are required before additional comment is made on the question of origin. However, similar but thinner nickel and copper-bearing rocks in the Glacier Bay region to the south show such relations.

Between Tarr Inlet and the Alsek the high range west of Melberne Glacier along the Alaska border is composed largely of a red weathering biotite gneiss. This is cut by small but numerous aplitic to pegmatitic dykes. It has not been investigated in any detail to date as no evidence of important mineralization has been found in the great quantities of glacial transported debris coming from it. Such

rock does not occur in quantity anywhere else although smaller possibly equivalent bodies are present in the high reaches west of the Alsek and east on the Klehini.

Metamorphic rocks are widespread in the region. However with the possible exception of the biotite-gneiss previously mentioned, they do not form important regional units. With the exception of hornfelsic or cherty meta-sediments of thermal metamorphic origin near the granitic contacts, grade of metamorphism is not high. Phyllites and schists are less well developed than they are in the Northern Rockies.

Amphibole asbestos has developed near and in many of the larger sills and dykes which occur in the calcareous sediments. Most of the limestone has been converted into marble obliterating any or most fossils that may have been present. In such regions as the O'Connor a process of mamorization has probably upgraded the gypsum deposits as well as the associated massive limestones. A weak alteration process associated with thermal metamorphism is believed responsible in large part for the conversion of anhydrite to gypsum, and vice versa. Local skarn deposits are occasionally present and as previously mentioned some of the small hornblendite bodies may be of a more complex metamorphic origin.

Phyllitic schists are present in at least two localities, the best being west of the Alsek in the Yukon. No high grade dynamic metamorphism is indicated.

Structure is generally complex and hard to interpret as the numerous intrusions disrupt any continuity that the

highly-folded sedimentary rocks may possess. Glaciers mask many of the relevant contacts.

Good market horizons are not readily visible and easily identifiable units, such as the black shale pinch and swell so much as to be only of limited use for mapping on this scale.

One physiographic feature reflecting the structure is that of the transverse valleys. Many of these in certain areas, particularly east and west of the Tatshenshini, follow anticlinal trends as evidenced by opposing dips on the valley walls. A somewhat unique and puzzling feature, at least to the writer, is the overwhelming predominance of sediments in practically all valley bottoms except the Alsek itself with the widespread granitic accumulations invariably occupying the higher ground between.

Faulting is associated with most granitic bodies especially along the exposed northwestern flank of the Noisy Range intrusive. In the vicinity of Tats Lake related and similarly steep faults may have caused displacements of a mile or so.

There is no good evidence pointing to faulting or regulating structural trends along the main valleys of the Tatshenshini and the Alsek. Both of these north-south streams cut across the northwesterly grain of the country and are possibly antecedent(?) in nature although in their history ice dams have played a very important role.

Faulting is intimately connected with and possibly responsible for preservation of the remaining Tertiary basins.

What may be a major unconformity is well exposed in the Greenrock - Coal Creek - Beargoat Creek section. Orogenic processes are probably indicated by the conglomerates and breccias of the O'Connor and Noland River areas.

DESCRIPTION OF PROPERTIES:

The location and nature of most discoveries made are shown on Map 59A and only short descriptions will be given here. In general most of these occur along greenstone or granite contact belts as described on the map.

1. WINDY-CRAGGY COPPER-COBALT:

This is the largest sulphide body discovered to date. Conditions of its location have made it almost impossible to evaluate to date without considerably more work than we have yet been able to afford.

The deposit was first discovered while on Super-cub reconnaissance following the discovery of considerable high-grade copper float in the morainal debris near the foot of Tats Glacier. A ground search revealed copper-sulphides along the western upper border of an ice patch from under which a creek has carried and deposited obvious "tell-tale", red iron-sulphate residue. Although the grade of the exposed material was lower than hoped for, the intense mineralization present over such large areas, coupled with the presence of high grade float, obviously originating some place in this general section prompted the staking of the minimum number of claims necessary for preliminary coverage (Photo AF10).

Attempts this season to systematically explore and map

the showing were thwarted by this year's early snow which came before last year's unusually heavy fall had melted sufficiently to allow safe access. The precipitous cliffs at the north or Craggy end of the deposit are only partially accessible from below and then only with considerable danger because of loose rock and possible minor avalanches (see Photos #WC1 and WC2). An attempt to examine the main cliff showings by rope descent from the overlying unmineralized cap rock was halted by overhanging snow and ice which we were not experienced enough to cope with. Except for open cracks or bergschrund between the ice and the mineralized cliffs above, the Windy extension is not nearly as dangerous to prospect (See Photo #WC4). However, this showing may represent only an edge of the deposit with the main body being inaccessible under the ice.

Massive pyrrhotite-pyrite bands and lenses up to 100' wide occur as replacement bodies along an exposed zone of at least 4000 feet (see Maps #CW2 and AP10 accompanying). This zone, which is 1000 - 2000 feet wide where exposed in the Craggy cliffs, is believed by the writer to straddle a folded contact between previously highly folded argillaceous sedimentary rocks and the lower portion of an overlying greenstone assemblage.

The altered volcanic rock has been termed the Tats Greenstone Complex and consists of prominent pillow-lavas and flows of intermediate to basic composition. The volcanics are highly altered near the deposit and some of the pillows themselves have been completely replaced by sulphides. The

sediments involved are thin-bedded shales and argillites lacking any prominently limey members. Minor granitic sill or dyke-like bodies occur on the lower portion of the Craggy zone but their relation to the deposit is not known.

The whole mineralized zone is exposed through a vertical range of about 1500 feet. The lower limit in the mineralized section is against an as yet ice-filled cirque carved in the sediments about 500 to 1000 feet above Frobisher Glacier, while the upper limit is poorly marked by an unmineralized locally flay-lying zone in the volcanic Cap Rock (see Section C-C1). Attitudes are variable but generally steep near the mineralized zone. Away from it the sediments strike northwesterly and dip northerly. The volcanics rest, with varying attitudes, on what may be a major uniformity. The relationship is that which might be suggested by the draping of a large octupus or jelly fish. Again the apparently susceptible contacts have been largely eroded and are now ice-filled.

Mineralization in the partially explored western and lower section of the Craggy zone consists of bands and lenses of massive pyrrhotite and pyrite which have replaced favorable zones in the altered argillaceous sediments just below the volcanic contact. Replacement along folds plunging into the hill is common. Continuity of the bodies is broken by flat andesitic(?) dykes and minor-faulting. However, there appears to be several such sulphide bodies up to 80 feet wide exposed through vertical ranges of at least 200 or 300 feet.

Sampling of these accessible bands at an elevation

of about 5000 feet showed a low copper content of between 0.75 and 1.5% present as chalcopyrite. Rare limey sections within the sediments exhibit blue copper carbonates (see Photo WC2) and the surrounding rock up to 10 or 20 feet shows copper values in the order of 2 to 4%. Here the iron sulphides are lacking.

Near the upper eastern edge of the exposed zone at least one large, inaccessible sulphide band, possibly 100 to 150 feet wide, is throwing float a representative sample of which assayed 1.9% copper. Running water, iron rust and black stain so mask the picture that it is impossible to tell from a distance the vertical extent or number of such bands present. These do not project through the volcanic Cap Rock on top of the mountain but may extend down in the sediments for 500 feet or more.

Considerable float on Frobisher Glacier below assays up to 4% copper. This obviously comes from somewhere on the 50 to 75° Craggy cliff slopes.

The Windy zone is believed to be a continuation of the Craggy zone but with the intervening and surrounding ground ice or Cap Rock covered. The accessible mineralisation as presently exposed is a 600 - 800 foot long fringe zone along the western edge of the semi-circular divide ice cap which separates feeder prongs of Tats and Frobisher Glaciers. The showing is bounded by only slightly mineralised cap rock to the west and ice to the east (see Map CW2 and photo AP10). Along strike to the north ice and unmineralised volcanic cap rock obscure the zone. To the

south the contact is believed to steepen suddenly while still under the shallow ice cap and mineralisation may end here. However, rusty sulphate water-courses in this section may indicate repeated mineralisation at depth. The mineralised band exposed is 10 to 60 feet wide and is composed of massive pyrite and pyrrhotite with varying amounts of disseminated chalcopyrite. As shown by gradation in drill core it has clearly formed by replacement of the volcanics. The dip is not known but it is believed to be steeply east. Monoclinal structure is suspected. The underlying sedimentary contact within the mineralised zone has not been reached.

Several small concentrations of secondary cuprite and native copper are present in the talus slides of shaly sediments several hundred feet west of the contact. Such may indicate a higher grade copper deposit in this area or merely be the result of waterways through the massive sulphides. The conglomeratic masses assay up to 70% copper.

Packsack drilling late in the season was limited by available water to a two hundred foot strike-length (see photo WC4). Three of the five short holes drilled were collared within the mineral zone in the volcanics and are believed to have been necessarily drilled away from the richer sections into the hangingwall (see Section A-A1). With the Packsack Drill it was impossible to check the easterly-dipping theory. However, a fourth steep hole collared in unmineralised cap rock for assessment purposes showed gradation to massive sulphides at about 20 feet. Three of the holes encountered white, chalcopyrite-bearing quartz veins not visible on surface. These are in part related to a breccia zone marking

the gradation to unmineralised volcanics. This breccia may reflect an important structural control. Insufficient water caused abandonment of plans to test a siliceous copper-rich section several hundred feet north of the holes drilled. Drill logs are included in the report.

In all applicable cases copper content decreased toward the volcanic fringe to the west. Within the main sulphide zone as shown values ranged orderly from 3.2% to below 1%. The best section (DDH #4) assayed 2% across 35 feet but the average for the steep 90 foot hole which bottomed still in sulphides is 1.25%. The content of the accessible massive sulphides so far tested is probably about 1.0%. Composite assays show an iron content of 50%. Cobalt is present in amounts varying between 0.10 and 0.15% and values in gold and silver are probably in the order of 50 to 75¢/ton.

Large disconnected(?) patches of mineralised pillow lavas on the hillside assay 0.6 to 0.7% copper.

A multi-million ton deposit of massive sulphide containing low grade copper-cobalt is a certainty. The intense sulphide mineralisation over large areas and the apparently strong structural control are factors favoring this. Although such a deposit may be of interest in the future (when even the iron as well as the cobalt content may assume importance) it can hardly be at present. However, it remains a raw, only slightly tested prospect in which higher grade orderly zones have been indicated but not traced out or even sampled. Many features similar to Noranda are present where

large areas of low grade sulphides surround a high grade core. Had the country rock a greater lime content, much richer copper concentrations would have undoubtedly resulted.

Of the favorable 15 mile long contact between the Tats Greenstones and the underlying volcanics, only about 2 miles is not ice-covered leaving plenty of room for subsurface exploration. Although glaciers in some areas closer to the coast are so broken up as to be impassible, these inland are not and in many cases are level enough to make ideal airfields. Extensive truck-travel on the surface of a glacier is probably not as great a problem as the majority of Canadians who have never seen a glacier believe. Given some incentive such problems as continuous ice movement and bridging of the numerous small ice cracks could be solved using a steel or woodmesh screen-type roadbed (probably available in kit form from the Russians).

It is recommended that the fourteen Windy-Craggy group claims be kept in good standing until such a time as we are not occupied with exploration elsewhere and sufficient funds are available to allow some EX drill holes to be put down primarily to outline and evaluate the higher grade sections of the deposit. In the meantime, should we be in the area in good weather a transit survey is required. A ground geophysical survey carried out only by a competent geophysicist might prove of great value in outlining the weakly magnetic sulphide bodies under the ice. Anomalies could be easily tested by drilling, using fast and efficient helicopter transportation.

2. TATS GROUP:

Under prevailing conditions it was impossible to do the required assessment work for the four Tats claims on the mineral showing itself so two wildcat holes were drilled to sample unmineralised volcanic rock some distance away. Prospecting on the hillside above this area of widespread(?) glacial debris failed to uncover anything more than a few sulphide blebs. One large float sample of chalcopyrite in greenstone assayed $17.50 in gold while a sample of the common pyrrhotite-chalcopyrite float assayed 0.16% cobalt. The main deposit itself has not been tested for cobalt.

The Tats Group environment is not unlike that of the Craggy-Windy along strike to the north and occupies a similar position with respect to the Tats Greenstone. The cap-rock theory used in conjunction with the latter would also conveniently explain the sudden termination of the mineralised zone along strike on the hillside above. Native copper was found associated with sulphate springs in this supposed cap rock several hundred feet north of the main showing and the possibility of a Craggy-Windy type sulphide body underneath exists. For this reason the Tats Group claims should be kept up until the value of the Craggy-Windy is known.

3. GYPSUM:

Assessment work was done on the O'Connor Gypsum deposits found last year and a separate report again prepared. Limited prospecting in the vicinity uncovered some strontium sulphate (celestite) float at the base of an as yet unprospected limestone cliff immediately across from the Aunt Jemima showing. Studied in detail this whole deposit could form the basis for an interesting thesis on metamorphism related to the formation of gypsum and calc-silicates.

A gypsum deposit was discovered on a ridge protruding a few feet through the ice-cap which forms the divide between Frobisher and Kenshi Glaciers. The white granular gypsum occurs in a band about 100 feet wide and is associated with meta-sediments and what appears to be an altered porphyritic dyke rock. The length exposed is about the same as the width. The deposit is too remote to be considered but it is noted because it may help assign a geological age to the surrounding rocks. A small chalcopyrite-pyrite vein near the gypsum is of no interest.

A slightly gypsiferous sugary-textured limestone cut by numerous dykes was noted near a low grade copper-lead deposit on Callison Ridge about 6 miles south of Rainbo Lakes.

A series of sink holes very similar to those of the O'Connor deposit was seen just south of the maintenance camp on the Haines Highway west of Kelsall Lake.

No white gypsum is present in the lightly overburdened area but the obviously soluble material may be gray gypsum or gypsiferous shale. Should a market for gypsum develop this could be looked into.

4. GRAPHITE:

Graphitic schists containing a carbon content of 20 to 40% were discovered in a dynamically metamorphosed area on the Tahini River 15 to 20 miles above our Klukwan Iron deposit. These are of no interest but the occurrence should be kept in mind as we have been asked by metallurgical companies in the past about the availability of such material. It is possible that this area might contain some of the high temperature - high pressure "ceramic" minerals of importance, but otherwise presents little hope.

5. COAL:

Two small Tertiary coal basins each a mile or two in diameter were discovered west of the Tatshenshini but no attempt was made to prospect them. Several coal seams up to 4 or 5 feet in width are present as are numerous smaller ones. The grade of coal is probably sub-bituminous. It is fairly hard, is shiny black, and gives off considerable heat when burned. The ash content is quite high. Should fuel ever be required locally these deposits could stand investigation. Several samples and excellent plant fossils were given to the G.S.C. but as yet no determinations have been made.

At least one large fireclay(?) exposure is present near Tats Creek.

6. COBALT:

Besides the cobalt found associated with the copper showings of the Tats Glacier area some was also found on Kindle Ridge two miles northeast of Narrow Lake on the Dezadeash Sheet. Cobalt bloom and the primary mineral cobaltite are associated with chalcopyrite in a two to four foot wide vein exposed for several hundred feet as it crosses a ridge at elevation 5300'. Float on the north side of a small lake about 500' north-west along strike might indicate continuation in this direction.

The vein is largely a replacement of a minor limey band enclosed by intermediate to basic, partly pyroclastic, volcanics. This and several paralleling copper veins may in part be controlled by bedding faults.

Samples of some of the fresher material assayed Au 0.10, Ag 0.2 oz, Cu 3.0%, Co 2.08%. Two claims were staked to cover the known showings as we had anticipated higher silver assays. The claims were not recorded.

We can find no official record of a primary cobalt discovery in the Yukon, although the writer once found cobaltite on the Upper Liard River and it is probably present elsewhere in minute amounts. It occurs in the Kluane Nickel Belt.

High grade chalcopyrite float is common in the talus slide to the south-east several hundred feet along and below the exposed cobalt-rich vein. Ten pound boulders assaying 20% copper can be found. Most of this must be approximately in Situ as the favorable limey host rock does not outcrop on the hillside above, and the cobalt-copper vein, at least in

its exposed portion, is not large enough to account for this quantity of float.

Several miles to the northwest along Kindle Ridge plans to drill a copper deposit found by Dr. Kindle while mapping the area for the G.S.C. are being made by B.Y.N. Exploration Company. Their staking this fall reached almost to our cobalt-copper discovery. With this nearby proposed development in mind we should restake and record our claims first opportunity with a view towards dealing with B.Y.N. on them.

7. MANGANESE:

Small amounts of manganese carbonate (rhodochrosite) were found in calcareous sediments near a granite contact several miles upstream from the Bridge on Takhanne Creek in the Yukon. The showing is of no importance but may have some distant relation to high but erratic gold values found by C. M. & S. prospectors to the south.

8. GOLD:

In excess of 100 good looking quartz veins throughout the area were checked for gold and silver content but with poor results. Most were barren while several impressive veins or lodes assayed less than $3.00/ton.

(a) Near Diorite Glacier a few miles from salt water at Tarr Inlet considerable quartz float scattered through glacial debris was found to be gold-bearing (see Photo #TI 1). The float occurs mixed with and restricted to a few well de-

fined mile square conspicuous patches of peculiar "augen" volcanics and rusty meta-sediments surrounded by granite morainal material. None of these former rocks have been definitely found in place despite considerable prospecting. This is amazing because of the many millions of tons of material involved.

An unusually interesting problem in glacialogy is presented. Records show this area to have been ice-covered 50 years ago. The rocks in question could have conceivably come for distances of 20 miles or more and even from the other side of the Grand Pacific Glacier to the west. However, these red rocks are evenly spread and lack the decipherable gravel trains so common elsewhere. There are no quartz concentrations and the mixture is even and restricted in rock type as are most individual gravel trains in glacial regions. The likeliest possibility seems to be that the rock originated within the Melberne Greenstone Belt as outlined and the source may be underlying and close to the present material.

Assays of numerous angular quartz boulders sampled ranged from $2.00 to $32.00/ton in gold with minor silver values not exceeding 1/2 oz. A composite random sample of about 25 pieces generally unmineralized quartz assayed 0.22 oz in gold and 0.1 oz in silver.

Small amounts of arsenopyrite, sphalerite, pyrrhotite, pyrite, chalcopyrite and galena are present. Although the quartz with the best gold values had arsenopyrite associated with it, the gold content does not appear to increase

in proportion with arsenopyrite (or with the other sulphides) and may be disseminated in the quartz in native form.

The largest quartz boulders seen are about 2 feet square. It is not known whether this 2 feet represents the maximum width of the original veins or not. Some of the smaller fragments still have attached to them fine grained, somewhat schistose brownish meta-sediment host rock.

Should such quartz veins occur as a lode, even if the values associated with them are not high, the proximity to salt water would make them attractive if tonnage exists.

It is recommended that we shelve this occurrence until such a time as an increased gold price would allow sufficient exploration money to sink wildcat drill holes in an effort to find bedrock, and possibly higher grade material. In the meantime the Welberne Greenstone Belt requires some detailed ground prospecting along its low-lying northern end, plus a few helicopter checks of quartz veins on the high ground south near the Alaska border. On the Alaskan side small quartz veins assaying 3 to 5 oz were found years ago in granitic rock.

(b) The only other gold assays of interest were obtained from copper float in the Tats Glacier Area ($17.00).

9. SILVER:

Several interesting silver assays were obtained in the Tats Lake map area but in no case did prospecting reveal important deposits.

(a) House Creek: An assay showing 66 oz. of silver was obtained from samples of deeply weathered tetrahedrite

present in narrow shear zone near a granitic contact at the mouth of House Creek. Although extensive pyrite mineralization was found in nearby skarn, gold-silver values in this proved less than $2.00/ton.

(b) On the mountaintop immediately north of Tats Lake small amounts of high-grade copper float assaying 22 oz. of silver was again discovered close to that obtained last year but the source could not be located.

(c) In the same mineral belt as the Maid of Erin but west of Samuel Glacier low but persistent silver values of 3 to 5 ounces were obtained from a number of small and erratic copper, lead, and zinc showings. Only those associated with the somewhat larger zinc outcroppings would ever be of interest in this geologically complicated section.

(d) Silver values of 1 or 2 os are common in a number of copper showings and are only of by-product interest.

10. COPPER:

Copper, in the form of chalcopyrite and rarely bornite, is the most widespread metal of interest in the St. Elias Belt and its distribution within our area is shown on Map 59A.

Besides the already described Tats and Windy-Craggy showings which are the best discovered to date, the following might bear further checking should the area ever open up:

(a) Basement Creek: A grab sample of a 20 ft x 100 ft. massive pyrite-pyrrhotite chalcopyrite lense near Base-

ment Creek assayed 8% copper. The lense occurs in a pyritic skarn zone exposed for several hundred feet across a creek valley tributary to Basement Creek. About 70% of the projected zone is drift-covered.

(b) Icehole Lake: Disseminations and veinlets of chalcopyrite occur related to a strongly mineralized volcanic zone immediately north-west of Icehole Lake. Unfortunately pyrite is the chief mineral in the 100-200 ft. wide, mile-long band in this geologically favorable area. Copper values would not exceed 0.5%. The zone was not checked to the south because of fog.

(c) Kindle Ridge Area: Several copper showings were discovered along Kindle Ridge in the Yukon north of Survey Lake. The highest grade copper is associated with the cobalt and already described.

A limonite gossan zone about 200 feet square is present on the hillside near the headwaters of Silver Creek several miles southeast of Narrow Lake. The gossan, at approximate elevation of 4500 feet, contains chalcopyrite remnants.

Although the overall size is not great, this showing could stand some trenching should the B.Y.N. deposit to the north develop.

Our examinations of the B.Y.N. showing before it was staked failed to reveal anything not already described by its discoverer, E. D. Kindle. Disseminated chalcopyrite mineralisation is present in an altered zone at least 100'

square between granite and volcanics. Within this, fresh appearing, possibly reconstituted, fine-grained granitic rock appears to be the best mineralised. Small veinlets occur along local shear zones. Exposures are good and an overall grade exceeding 0.7% copper can hardly be expected. The deposit does not seem to "go anywhere" on the surface, but could conceivably do so at depth. The intersection of a strong regional fault with the above mentioned contact in this vicinity may be of importance. Work other than drilling or drifting on it would be of no value. B.Y.M., who this summer optioned the property from Jimmy Cain, plan to drill it next year. The Silver Creek Gossan Zone described may be a similar deposit.

Numerous chalcopyrite-bearing quartz veins occur along Kindle Ridge and Silver Creek but contain less than $2.00/ton in gold and silver.

A chlorite-mariposite(?) deposit at least 100 ft. wide was found along the Alsek just north of the Frobisher Creek junction. This green micaceous material, which is probably the result of metamorphism of an impure dolomitic rock, contains visible but very fine-grained sulphides such as chalcopyrite, galena, and pyrite. A composite assay from about 20 pounds of picked samples showed copper values of about 0.7%. Its extent is not known and it is only of geological interest at present.

In the Samuel Glacier area good copper values were obtained from small deposits found along the contacts of limestone bands and volcanics. Bornite is present in at

least one of these. Copper contents of between 1 and 2% were obtained from float near both the Fault Creek and Parton Glacier. Although much of this area is drift or ice-covered, there is no indication of an important mineral deposit.

No further work was done on the copper property found last year across from the Maid of Erin. Such could well be tied in with any exploration undertaken at the mine at a later date.

During our three trips in to the Kaskawulsh Map Area, while searching for a possible Kennecott type deposit, copper mineralization was noted in several places. So far only small chalcopyrite veinlets, which are responsible for large splotches of colored copper carbonates, have been found (see Photo #2). This area cannot yet be eliminated and is further described separately in this report.

11. LEAD AND ZINC:

Despite favorable structural conditions and generally favorable rock units, lead and zinc deposits are apparently a rarity in the St. Elias mountains and none so far discovered are worthy of mention. Several small zinc showings were located in the Maid of Erin mineral belt and some of these have small amounts of disseminated galena associated with them.

12. MOLYBDENUM:

Coarse molybdenite is present in some of the aplitic and granitic float boulders between Diorite Glacier and Tarr Inlet. The source is probably in the large unprospected ice-

covered granitic range to the east. The deposits are probably dyke-like.

No time was spent prospecting the area between Tate and Nanshi Creeks in which molybdenite was found last year. The lack of any quantity of float would indicate that no important deposit is present.

NORTHERN EXPLORATION ACTIVITIES OF OTHER GROUPS

Several major exploration companies were active in the St. Elias or related Coast Mountains this past season.

Fremont Exploration, during air reconnaissance in 1958, spotted a rust zone on a nunatak protuding through an extensive ice cap at the head of Brady Glacier in Alaska. Ground checks showed two 40 ft. x 10 ft. lenses of massive nickeliferous pyrrhotite in a dyke-cut granitic assemblage composed of diorite, gabbro and norite. The nunatak showing was drilled and although the results were not published the grade was reported to be about 1% nickel and 0.5% copper. The property, located about 15 miles south of Tarr Inlet, was visited briefly this year by the writer who was shown around a portion of the deposit. A somewhat unique, entirely helicopter-operated 20-man camp resembling Little Antarctica (see Photo TI2) was set up on the massive ice cap and diamond drilling through the ice at 1000 foot intervals undertaken to check magnetic anomalies. Austrian mountain climbers were imported by this well organized and cautious group to do all the mountain climbing. On La Perouse, a 10,000 foot peak several miles to the northwest, a banded "synclinal" assemblage of slightly mineralized intrusives was checked by these climbers. A long range correlation with Sudbury has been adapted supplying the incentive needed in this locality. Results are not known but are believed to be inconclusive to date.

Mr. Virgil Mann, an eastern geology professor, is consultant and field scout for this financially well equipped

group which has been quietly active for five years along Coastal B. C., and Alaska. This summer Mann spent two weeks flying geological reconnaissance in the Tats Lake and Kakamulsh sheets preparatory to a proposed move into this area next year. The chief concern is probably with the Alaska-type nickeliferous basic bodies which they expect continue across the border. (We have examined many such intrusives for nickel without results to date).

Late in the Season Fremont's Bell 62 helicopter was wrecked during a landing while carrying drill equipment.

Fremont Exploration, although they had done work previously in this section of Alaska, returned in force following Fremont's discovery and had a number of helicopter-supplied prospecting crews scattered around the Glacier-Lituya Bay areas. One of their overtaxed Bell 62 helicopters crashed this summer while following out the supposed "Fremont contact" killing a geophysicist and badly injuring the pilot and chief field geologist (see photos #3 and #4).

American Metals Climax retained interest in a molybdenum property on Muir Inlet but results have not been published. A molybdenite discovery has recently been reported west of Anchorage.

Kennecott Exploration, using the only 12E helicopter in Alaska, had a successful season on the Alaska Coast. This was marred only by the mysterious disappearance of one of their drill crew while walking across a large gravel bar.

Grizzly bears, flash floods or quicksand are suspected.

In 1958 Noneta discovered abundant copper mineralisation around the edges of a rapidly receding glacier just below Snettisham Inlet south of Juneau. This summer, the property, which is probably in the extension zone of an old, well known prospect several miles west on the coast, was tested by diamond drilling both under the glacier as well as along the sides. A fairly massive sulphide zone 8,000 to 10,000 feet long is indicated with widths in the order of 40 feet. The best section of 35 feet assayed 1.25% copper, 25% iron and gold-silver values of about $1.00. The average grade, expected to be between 0.8 and 1% copper, with only slight other values, is thought to be too low to bother with under present high costs in Alaska and the property is to be patented and held.

Noneta, using highly trained crews from the University of Alaska, have been prospecting the Alaska Coast between Ketchikan and Lituya Bay for two years. Using a helicopter they pay particular attention to glacial areas and intend to continue such work next year north into the St. Elias.

A number of smaller, less well organised syndicates were active in the Glacier Bay Region paying particular attention to the high grade but small and erratic gold prospects.

On the Canadian side of the St. Elias several companies were active. In the Squaw Creek area Ad Astra Minerals continued their attempts to re-open placer mining on a profitable basis and Zenmac Mines of Toronto examined a copper

showing in the same district.

Frank Young and Associates of Haines and Anchorage rebuilt the old Silver Creek road and intend to push it on to their placer ground on the Bates River.

British Yukon Navigation Co., has a revitalised exploration arm which this year took an interest in the Kindle Ridge Copper property previously described. They reportedly intend to drill this next year.

Conwest optioned a high-grade bornite copper property near Peacock Lake south of Mush Lake. This was also discovered by the C.S.C. about 1947. Diamond drilling failed to intersect the body at depth and the property returned to the owners who have since shipped 1000 tons to Haines and expect to stockpile all winter. The bornite is like that at the Maid of Erin except that there is only a one ounce silver content. It is rumoured that the Canadian Exploration is encouraging the present development which we have always felt would not pay for itself.

Can Ex had scouts around this area and had previously done work on the erratic asbestos deposit (examined by the writer) south of Haines Junction. They plan detailed prospecting in the St. Elias next year.

Yukon Consolidated Gold kept two prospectors in the vicinity.

Klondyke Helicopters of Dawson flew a mining group (Can Ex, Y.C.G.C. 77) into the Kluane and St. Elias Mountains west of Kluane Lake. On one such venture by this or another company, it is reported the Bell Pilot refused to

fly more than one person at a time into the St. Elias and little was accomplished.

Two hardworking Whitehorse prospectors located a previously undiscovered large sulphide deposit near Donjek Glacier. Interesting float had been known in this region for years and past attempts by Hudson's Bay and Helicopter Explorations to locate the source had not been successful. Following verbal agreement the writer had hoped to examine the prospect late this season but a last minute rush to get the helicopter south before expected bad weather prevented it. This should be done next season, if possible.

Phelps-Dodge have contracted a 12E helicopter from Highland Helicopters for a six month period and it is known that their geologist is interested in the Upper White River Area as outlined by the writer in last year's report.

Highland-Bell (Karl Springer) still plan on penetrating the St. Elias further than on previous occasions as do several other companies as yet with indefinite plans.

On the Kennecott side Bear Creek, an exploration arm of Kennecott, do intermittent work around their famous worked-out(?) deposit. This company and others have naturally carried on extensive exploration in the vicinity but we doubt if they have ever seriously worked the rugged highland area along strike to the southeast towards the Kaskawulsh.

Elsewhere in the northwest the Mackenzie Syndicate found that a copper prospect discovered and drilled previously by Kennecott (earlier reportedly noted by Ventures

Yukon Ranges Group) had impressive amounts of tungsten associated with it. Drilling has outlined between 1,000,000 and 2,000,000 tons of ore grading 1 to 1-1/2% WO . This much publicised "discovery" will have its immediate problems as there is virtually no market for tungsten at present and the transportation problem will be tremendous even though scheelite concentrates solve the bulk ore question. Elsewhere a base metal prospect on the Hyland discovered several years ago by a prospector now working for McKenzie reportedly carries smaller values in precious metals than had been deemed necessary in this location.

In the Stikine-Stewart area Newmont made a new discovery of gold-copper on the Todd Creek Glacier near Bowser Lake. Little is known about it at present except that it has been staked. This resulted from Super-Cub landings on the glacier made with ease by use of rented wheel-skis belonging to one of our own "leased" planes. Although the Todd Creek and other Stikine areas had been outlined by us for such work as done by Newmont (1957 Report), we or the pilots never had the necessary incentive to use the wheel-skis combination which remained stored in our garage until this summer.

General Regional prospecting for porphyry copper deposits, with the aid of geochemical tests for trace amounts of often associated molybdenum, was undertaken by Northwestern (Kennecott) Explorations in the Atlin-Stikine areas. Our work in that country showed that molybdenite could be turned up in traceable float at ease and it is hard to see

justification for the expensive project undertaken by Kennecott. One of the geologists and a pilot miraculously escaped when their helicopter came down after tangling with a telephone cable strung across the Stikine River Canyon at Telegraph Creek.

The flurry over the asbestos discovery reported by the G. S. C. on the Tuya west of Dease Lake rapidly died down as we had expected when it was found that the interpretations made of the G. S. C. report issued last winter were not too accurate. One of our pilot prospectors had previously made several trips into this zone but didn't find any of the deposits he saw worth staking. We are not at all in sympathy with those exploration (in name only) companies who, when they found they were not getting something for nothing, criticised the G. S. C. for inaccurate reporting. Our suggestive criticism of the Survey, although of no practical importance to any legitimate company in the long run, is to the effect that in such rapidly mapped portions more use be made of the "probable" and "possible" geological boundary symbols.

In the Canol Road area, drifting on a small high-grade molybdenite showing added no encouragement to a required increase in size. Small amounts of tungsten were encountered. A small asbestos showing in a gabbroic dyke was reported and has since been staked.

Work on the Ketza River and Carmacks area silver-lead and gold prospects by Cenwest and others has not been abandoned. A survey is now being made by the Northern Re-

sources Branch for a road link between Watson Lake and Mayo or Carmacks. This road will run along the Liard and Pelly Rivers or along paralleling tributaries, and although it will not alone make mining of known properties in its vicinity immediately feasible, it will greatly lower exploration and development costs. This road conception is much more appreciated than the government's proposal to prevent or greatly restrict prospecting in the entire St. Elias Range. This latter scheme must be vigorously protested. With respect to the St. Elias Park and its"non-mineral potential", our secrecy in the past, although largely necessary, has not helped us to date, as even the government people involved stated they knew of no-one interested enough in the area to bother working it. Thus it fitted their qualifications as being suitable for withdrawal.

VENTURES - FROBISHER PROGRAM

VANCOUVER OFFICE

FUTURE EXPLORATION BETS

A. NORTHERN B. C. - YUKON - ALASKA

Northern areas of particular interest to the writer as remaining virgin prospecting ground are listed below. Reconnaissance notes on the Kaskawulsh Area are included here rather than in the main report, as immediate reference is necessary and these notes are the sole basis for the proposed work.

1. Hubbard Glacier-Mt. Vancouver-Disenchantment Bay Area (N.W., B.C., S.W., Yukon, and Alaska.)

Several good days of helicopter prospecting is required to eliminate the possibility of a Kennecott or rich copper-type orebody in this little-known area. This extremely uninhabitable section of the country has been by-passed as the transportation difficulties appear enormous. Kennecott, in a similar but somewhat subdued setting, is about 100 miles from salt water and much more than this from a suitable shipping point. Most of the area under discussion is within 20 miles of protected salt water anchorages at Disenchantment Bay. As at both Tarr and Taku Inlets, large boats exercising a little extra caution can and have visited Disenchantment.

Foot travel or even roadways on many northern inland glaciers would be feasible during the summer, providing the necessary incentive existed. However, the lower five miles of Hubbard (probably the world's largest valley glacier), is by no stretch of the imagination so inclined. Here, where distances are not too great, tunnels through the flanking mountains and use of the limited side morraines could be considered.

All factors considered, only a large high-grade deposit would be of interest, but such does not have to be as good as Kennecott.

Prospecting in this section is difficult in that a lack of gravel trains and scarcity of side morraines prevent float tracing, so useful elsewhere.

Using Canadian territory the high ice-cap passes (5000'+) into the Hubbard area are often obscured by fog and "whiteouts" while flying these, even in a light base which would not be a hindrance elsewhere, are a serious threat. Thus, unless based on the lower Alaska side, this is strictly a good weather undertaking. Unless 1958 type weather returns, two weeks would be required to ensure three good flying days.

If anything more than general reconnaissance is required we would be obliged to base in Alaska. In this case an American helicopter and crew would be compulsory as a Canadian ship is not allowed to work in Alaska. Two 12E Hillers are to be based in Juneau and we could thus not cite

altitude restrictions as an excuse to use our Hiller there. We could possibly "trade" helicopter time with such companies as Newmont, Nonsta, or Fremont but other problems would then develop.

Kennecott Contact: A geological environment similar to that of Kennecott, Alaska, was found this past season within sight of tidewater in the Hubbard Glacier region of Alaska and the Yukon. At Kennecott, where copper-silver production was worth close to $250,000,000., the rich copper ores (mine average 12.5% Cu) were confined to the lower section of a thick Upper Triassic dolomitic limestone known locally as the Chitistone. This was underlain by an important volcanic complex termed the Nikolai Greenstone. This volcanic rock, although holding no ore deposits itself, contains over great areas, evenly disseminated copper sulphides. These appear almost as original constituents of the rock and, although the picture is confused, the relation to the nearby orebodies is more than coincidental. Low easterly dips characterize the lime-volcanic contact. Although the Nikolai Greenstones are considered older than the limestone, many, including the writer, feel they have a distinct genetic relation to the ore deposits in the limestone at Kennecott and that many less obvious counterparts are present, although not admitted, the world over.

Our exploration over the last two years was designed primarily to look for "Kennecott Geology" in the unprospected and unmapped Alsek drainage area of B. C. and the Yukon. It was hoped that the Kennecott Belt, which is

lost under the icefields and recent volcanics northwest of Mt. Logan, would continue along strike southeast of Mt. Logan and into the Alsek region. During 1958 exploration, encouraged largely by the occurrence of Nikolai-type greenstones in the Tats Lake area, we discovered the Craggy-Windy Copper-Cobalt showings.

As a result of considerable field evidence in the mineral belts of the western or coastal Mesozoic rocks, the writer feels that limestone similar to the Chitistone is a necessity for the precipitation or formation of high-percentage copper sulphides while those sulphides with less copper and considerable iron are equally at home in a meta-sediment, meta-volcanic, etc., environment. The Tats Greenstone, however, originally contained more iron sulphides in relation to the copper than did the Nikolai, although chalcopyrite is recognisable in most specimens of the former. Also, unfortunately, limestone is lacking near the volcanics in the Tats area - thus a large low-grade high iron-sulphur deposit has resulted with very little copper concentration.

With the possible exception of a far removed limb(?) in the Kluane Lake area, and the White River volcanics, the writer has not seen or heard of "Kennecott Geology" anywhere in the Yukon or Northwestern British Columbia. Certainly there is no equivalent to the Chitistone formation in the Tats Lake area unless it had lost most of its identity. Only the geology of the Hubbard area appears to approach that of the famous copper area. It must be re-

membered, however, that many miles of similar geological units near Kennecott are completely unmineralized.

During 1959 low cloud ceiling prevented more than two one-day helicopter trips into Hubbard. The lime-volcanic(?) contact under discussion had previously been located and partially mapped, while on a Super-Cub reconnaissance. Only a few landings were possible with the helicopter as we were based 90 miles away and gas was a problem. Our scanty information has been plotted on the enclosed preliminary edition of the Kaskawulsh Sheet obtained privately from the G.S.C.

The Hubbard limestone is very similar to the Chitistone which the writer saw while visiting Kennecott in 1958. The underlying basic volcanic , although containing more rusty streaks, resembles the Nikolai even to the moderate easterly dip (See Photo #1). One major difference is the number of sill-like bodies(?) of similar basic rock in the limestone south of Mt. Hubbard. The relation of the sill-like bodies to the underlying main altered volcanic(?) mass is unknown. If they are directly related the underlying rock must be an intrusive and be younger than the lime. This would be different than at Kennecott - or at least different than the current interpretation at Kennecott. Rock specimens collected have yet to be examined and may throw light on this problem.

The lower 15 miles of the contact in question were flown looking for the green carbonate stain in the limestone which is so obvious at Kennecott. Such "copper stain" was noticed in two places but occurs not in the

limestone but in the schistose volcanics or sills near the contact and is caused by weathering of a number of small chalcopyrite veins (See Photo #42).

About 15 miles of similar contact remains to be checked. We feel that in this area copper must occur in the limestone to be of value, and then the mass be large enough that the associated copper carbonate colors be readily visible from the air. The Hubbard contains no helpful gravel trains or moraines and direct visual prospecting only is possible. A regional and possibly important flexure occurs about half-way along the exposed contact giving it the shape of a boomerang on the map. As only scattered outcrop is present in this area where the change in strike occurs it requires a closer check than we were able to afford it. Such structure has not been noticed elsewhere.

2. Mount Miller and Logan Glacier Areas, Alaska:

Several years ago Alex Smith received information from a government source describing some very high grade copper float picked up in a creek in the Mt. Miller area about two-thirds of the way to the Gulf of Alaska from and due south of Kennecott. We doubt if the likely source in high country has ever been prospected. This area has fewer glaciers and less ice cap than that to the east. If some arrangement were made to base in Alaska, this section could be checked with a couple of days good flying weather. Several days could advantageously be spent in the more rugged

Logan Glacier where molybdenum and copper float have been picked up in gravel trains. Helicopter exploration has taken place in this area, (Newmont, Fremont, Bear Creek, etc.) but seldom if ever has the high country been investigated. Kometa is considering it next year.

3. Tate Lake Area:

The Craggy-Windy showings (see separate report) are still raw prospects and we do not yet know if they contain high grade material such as that found nearby as float or not. Certainly mineralization is intense and control is strong. To be interesting at the present time a copper equivalent of 2% is probably required. To date the average grade from the limited accessible portion is lower than this, but the possibility exists a smaller tonnage of higher grade can be outlined.

A magnetometer in the hands of a competent geophysicist might indicate whether the mineralization is present under the upper ice-cap and would serve as a guide for several long drill holes required before this property is booked as being too low grade to bother with. One good day's helicopter exploration is still required immediately north of Frobisher Glacier. Due to the lack of limestone copper carbonate development is rare and the exposed mineralization is not conspicuous without close examination.

4. Melberne Greenstone Belt:

The Melberne Greenstone Belt described separately

could stand several days of ground exploration at its lower or Tatshenshini end. Gold-bearing quartz veins are known to be associated with it in the south but the debri-ridden, scrub timbered area to the north discourages the use of helicopter. The probable contact zone between the green-stone and the Noisy granite may be important although it is probably drift covered. Little bed-rock is exposed and only a close ground search would be of value.

B. NORTH COASTAL ISLANDS:

During the past few years we have often flown over and partially mapped some of the larger and more remote coastal islands between Ocean Falls and Prince Rupert. Although much of the area in question is obviously granite, numerous inclusions, favorable for copper, gold, and iron deposits, do occur. Even several areas of limestone were noted and we have already investigated mountainous, low iron-bearing granitic areas. Worthwhile mineral deposits are present, although rarely, in similar rock to the north and south. Shear zones in this granite and have helped localise important gold deposits (Surf Inlet-Ferchar Island,etc).

These islands have been prospected to a limited degree, mostly around the sheltered inlets and larger waterways. However, some of the lower, outlying islands are quite swampy and must have turned away even the toughest of prospectors who lacked suitable transportation. While forced down several times because of weather on some of the small interior lakes, we have checked important looking quartz veins never before broken into with a pick. This area could be better prospected - partially with a Super-Cub but more efficiently with a float-equipped helicopter. This would be an unusually tedious job as the weather in this area is, in a word, extremely miserable. In the late spring, when such a program would fit in best time-wise, planes or helicopters could only fly advantageously about one day out of six. Magnetometers mounted in

the aircraft would be useful and if the emphasis is back on iron ore by then some close magnetometer work could be done in areas already known to contain magnetite.

We have also outlined a few relatively inaccessible roof pendants in the Coast Range east of Pitt and Banks Islands. Several days of Super-Cub reconnaissance could be used to advantage looking a little more closely at these but it would be useless to attempt this before late July.

G E N E R A L.

To those who claim that, because the Kaskawulsh (or the Alsek area in general for that matter) is largely devoid of mineral deposits it then affords little prospecting hope, a look at Kennecott should bring on a change in subject. Except for a few scattered prospects similar to those we have found in the Alsek, the unusually well-exposed Kennecott area is quite barren. With the exception of the 3-1/2 mile length within which all important copper occurs, the well-defined contact zone is as "hungry" as any ever seen by the writer. In view of this the Kaskawulsh can not be written off completely until all the remaining contact in question is looked at. The volcanics should be checked more closely and should they at any point show signs of disseminated copper mineralization extra attention is required.

Structure, although of undoubtedly great importance locally, is a tool of minor value in general regional prospecting in Northwestern Canada. On the relatively featureless Coastal Islands, however, it's interpretation from air photos could be of great value. In the Cordillera structure is unconsciously being used as a guide much of the time through physiographic representations, but it is useful in-so-far only as it effects favorable rock types. However, these may be well below the present surface and through-going structure would then be the major control of any ore-bearing agencies originating in such rocks. An important prospect has yet to be found in the west through air photo

structural interpretation alone, although several hundred thousand dollars has been spent by a few companies using it as a basis for "wildcat" exploration. Curiously enough some of their east-west "Structural Mineral Belts" discovered could also be more easily plotted by joining existing transportation limits on any good road map.

We have at all times in the field, when practical, most of the published structural information, as well as that which has not yet been published. This includes copied portions of the "Structural-Tectonic" map of British Columbia in preparation for years at University of B. C., and which is to be published by the Geological Association and others next spring. In addition, the U.S.G.S. periodically publish structural maps of Alaska prepared from air photos and limited ground observation. Lineaments are carefully plotted. We have and make use of most of these but they are valueless, at least in the Cordillera, without solid ground geology.

We have not yet reached the stage where all exploration has to be guided primarily by air photo interpretation or geophysics, although the day may be rapidly approaching. Solid structural and geophysical bets near known ore deposits are still in the books in B. C. and little if any capital has ever been available to investigate these. Nevertheless some local and some small regional areas require much closer structural analyses with lineament studies receiving the attention deserved. The coastal gold camps are the most obvious for local work

and the coastal islands the most suitable for regional. The writer cannot accept the idea that magic straight lines drawn on a map are going to lead to related mineral discoveries over vast distances unless they are wide enough to cover expanses of rock type also related in some decipherable way to the process which formed these lines or subterranean breaks.

PREPARATIONS REQUIRED:

1. Much of the work outlined must necessarily take place in Alaska. Preparations must be made well in advance, especially with regard to obtaining a special permit for a Canadian Aircraft to enter Alaska. However, with a spell of good weather and the blessings of the U.S. Border Patrol we could base temporarily on the Canadian side.

2. Several days work examining U.S.G.S. and Mines Department maps in Juneau would not be out of order.

3. Airphotos of the Alaskan sections of interest should be obtained and examined beforehand.

4. Some of the rock types collected this year should be studied under the microscope with an attempt to compare them to those at Kennecott.

5. A number of basic rock specimens were collected from various glacier moraines this past season. These should be examined to see if they are related to norites or gabbros such as those which the Fremont Nickel south

of Tarr Inlet is associated.

6. If work in the Coastal Islands and adjacent mainland is to be carried out in the spring, an airphoto study of the more interesting areas should be undertaken beforehand. Structural interpretations here would be of value in some of the featureless Islands where favorable rocks are present. Lineament studies of the Porcher and Surf Inlet gold belts is required. At a later date a similar study should be made of the Alice Arm - Portland Canal and the Zeballos area.

7. During 1958 and 1959 a number of outside properties were examined but due to a complete lack of available time in the office only a few of these were ever written up properly. Synopses at least should be prepared of these.

8. A combined "Property-Report Area" wall map of B. C., Alaska and the Yukon should be prepared. This would find much use as a means of ready reference around the office.

SUGGESTED PROCEDURE:

April - May - 3 weeks Super-Cub reconnaissance of Coastal Islands, possibly tied in with work at Redcone and examination of new prospects found north of Terrace.

May - June - If helicopter available, 10 days work checking inaccessible areas on Coastal

May - June contd.

Islands and magnetometer testing of areas known to contain magnetite.

June - July - 3 to 4 weeks work in Alaska and the Alsek accompanied and followed by Super-Cub reconnaissance.

July - August - Helicopter - Dodson in Shuswap.

On the trip north the helicopter could be used for spot checks of localities which have been on the books for years - i.e. several between Prince George and Anyox, Alex Smith at Taku, etc. On trip south nickel and asbestos areas in the McDame area could be rapidly checked, as could Farquharson's reported copper zone east of Prince George. Uninvestigated zones, which we have marked in the South Nahanni region north of Lower Post, could be rapidly examined if weather permits.

EQUIPMENT:

1. Work on the Coast would require a little more comfortable equipment than we are used to elsewhere.

2. A large dry tent with a good heater is a must if more than an overnight stop is required.

3. A collapsible canoe which the Super-Cub could carry is needed to check the shores of the numerous small lakes on the Islands.

EQUIPMENT: contd.

4. If a helicopter is again used, we should either apply for a higher radio frequency than we now have or make application to use that of the helicopter. Our low frequency is unsuitable over distances which we are required to use it. The Highland Helicopters should enquire about a set of floats and load cable attachments should be secured.

5. No matter where work is attempted, decent truck transportation is required somewhere along the line. The 1/2 ton panels bought in 1953 were too light for our work and considerable money was spent in repairing and trying to reinforce them. Only a panel or station wagon type with truck wheels should be considered. This should be a 3/4 or 1 ton vehicle employing the new anti-spin rear axle. The International station wagon has this type of axle as standard equipment but it can also be added to the G.M.C. or Ford lines.

Vancouver, B. C.
November 18th, 1959.

Jas. J. McDougall, Geologist.