GEOLOGICAL REPORT

ON THE

HANS, WERNER, BILL, LUCK AND PUT

CLAIM GROUPS

SHELL CREEK

(Latitude 64° 35' N; Longitude 140° 20' W)

DAWSON MINING DISTRICT

YUKON

by

P. H. Riordon, Ph.D., B. Eng.

with a section on the

"General Geology" by E.L. Mann, M. Sc.

Thetford Mines

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INTRODUCTION

The Hans, Werner, Bill, Luck, and Put claim groups comprise a total of 36 claims situated about 50 miles northwest of Dawson, 5 miles north of the Yukon River, and 20 miles east of the Yukon-Alaska international boundary.

The claims may be reached by a 60 mile journey by boat down the Yukon from Dawson to the mouth of Shell Creek, or by a 50 mile journey by fixed wing aircraft, and thence by foot up the valley of Shell Creek.

On June 1 a party consisting of myself, a field geologist, his assistant, a cook, two wranglers and 5 horses proceeded by boat from Dawson to the mouth of Shell Creek. On June 3 a base camp was established about 7 miles up Shell Creek. A number of fly camps were used during the field season, which was terminated on September 17 when the base camp was struck. The party was supplied by air from Dawson to the mouth of Shell Creek, and by pack horses from here to the base camp over a very rough trail.

PURPOSE OF INVESTIGATION

Iron was discovered in the vicinity of Shell Creek in the summer of 1956 by Hans and Werner Krause and 32 claims were staked and recorded on January 14, 1957. In October 1957 these claims were optioned by Asbestos Corporation (Explorations) Ltd. The field work during the summer of 1958 was carried out for the purpose of determining, by surface work alone, the extent and grade of the iron formation. This work was carried out under the supervision of Mr. E.L. Mann.

METHOD OF INVESTIGATION

A portion of the 1 inch to 4 miles topographic map No. 116B and C was blown up to 1 inch to 1/2 mile in order to provide a small scale base map covering the area surrounding the claims. The 1 inch to 1 mile air photo of the same general area was blown up to 1 inch to 1/4 mile to provide a somewhat larger scale base map.

A base line 27,800 feet long was established roughly parallel to the NW-SE section of the iron formation. A subsidiary base line 5800 feet long was carried south from the SE end of the main base line and lay east of Shell Creek to assist in tying in this section of the iron formation. A number of cross section lines were laid out in conjunction with these base lines amounting to another 14000 feet. This gives a total of 47,600 feet of surveyed lines which formed the control for mapping purposes. Elevations were carried along these lines using a field clinometer. Additional control was provided by tying in outlying points by compass triangulation. Pace and compass was used to survey in the detail.

In conjunction with the geological work, six trenches were dug through broken rock (talus) to provide representative cross sections of the iron formation at intervals ranging from 2000 to 6000 feet. In all 800 feet of trenching was done for a total of 507-1/3 cubic yards of rock moved. 46 Chip samples were taken along these trenches. A representative bulk sample in 4 parts of 50 lbs. each was taken from one of the trenches.

To supplement the outcrop mapping and trenching 24 cross sections using a dip needle were run at intervals across the iron formation for a total length of 34,650 feet and involving approximately 1800 individual readings, or approximately 5.2 readings per 100 feet.

A master plan on a scale of 1 inch to 400 feet was prepared, and a copy is attached to this report. The base lines, cross section lines, triangulation points, claim posts and claim lines have been plotted on this plan. Contour lines, based on a datum of approximately 2400 feet A.S.L., have been drawn using the vertical control developed in conjunction with the horizontal control, and the 1 inch to 1/2 mile topograhic map of the area. The location of outcrops, float, and trenches along with magnetic anomallies, determined by dip needle, are shown on the plan. On the same plan insets showing the geology of each of the trenches is plotted on a scale of 1 inch to 20 feet.

To summarize, the control survey, geological mapping, and dip needle traverses involved the following amount of work:-

Total Surveyed Lines		47,600 ft.
- Main base line	27,800 ft.	
- Subsidiary base line	5,800 ft.	
- Cross section lines	14,000 ft.	
Points established by triangulation		32
Dip needle traversing		34,650 ft.
- Individual readings		1800

TOPOGRAPHY

The area lies along the southwestern fringe of the Ogilvie Mountains. Cliff Creek, Shell Creek and Coal Creek drain southwards from the area with the head of Shell Creek partially penetrating the mountains and Coal Creek completely truncating the chain of mountains on which the claims are situated. The broad valley north of the area is drained eastward by a tributary of Coal Creek and westwards by Eagle Creek. The maximum relief in the immediate vicinity of the iron formation is about 3000 feet, with the highest mountain rising to 5000 ft. above sea level. Round topped hills, ridges and spurs prevail in the area in contrast to the jagged topography of the ranges immediately to the north. The U shaped valley slopes are relatively smooth with only a few rock cliffs exposed. Outcrops, in consequence, are seldom numerous or large except on or near the crests, and even here the ground is usually covered by rubble. The slopes are mainly composed of talus and eluvial rubble. The tree line stands between 3500 and 4000 feet A.S.L.

GENERAL GEOLOGY
(by E.L. Mann)

The following rock types are found duplicated on both limbs of a fold which plunges gently eastwards:-

Limestone

Quartzite, grit and greywacke

Chlorite schists, phyllite, quartzite and calcareous beds.

Iron Formation. Banded iron in fine-grained quartzite and chlorite schist.

Phyllite. Blue, grey and green with occasional siltstone bands.

Epidote-chlorite rock. Probably an original volcanic rock with included tuffaceous sediments.

These rocks are intruded by small bodies of dioritic to granodioritic composition.

Epidote-Chlorite Rock:

A green epidote-chlorite rock occurs in the central portion of the area giving rise to the main ridge which forms the divide from Mount Bowen eastwards to the East Summit of Mount Simba. No trace of this rock-type is found east of Shell Creek and it is presumed to plunge beneath the surface at this point.

The rock is typically fine-grained, green and highly epidotized, composed of epidote, chlorite and black calcite. Angular and lenticular fragments of black chlorite, black calcite and green epidote occur abundantly through the rock, often completely enclosed by a thin film of white, cherty material. These fragments represent an earlier stage of brecciation but are themselves cut by later veinlets of epidote which suggest a second later stage of brecciation. It is suspected that the original rock had a volcanic origin as faint traces of amygdules and original pillow structures were found. What are thought to be amygdules now appear as small circular spots up to 1/4" in diameter scattered through a chloritic matrix. Both dark and light centered spots were observed, surrounded by epidote or light chlorite in a dark chloritic matrix. Large rounded and oval forms edged by coarse epidote and chlorite could similarly be interpreted as remnants of pillow structures but it must be remembered that this is scant evidence to prove a conclusive origin of the rock.

Occasional sedimentary bands within the epidote body are probably of tuffaceous origin. These rocks also occur along the contact of this rock type on the south and west flanks of Mount Simba. The sediments are composed of fine-grained reddish-brown horny material finely banded with more chloritic bands, some of which are rich in pyrite.

On the west face of Mount Simba below Simba VII the epidote is found in contact with phyllite. Although not observed in outcrop, abundant float reveals a thin band of 'intraformational breccia', which is composed of small fragments generally less than 1/2" in size but larger fragments up to 4" were noted. Without exception the fragments are all composed of dark green to black chlorite and are enveloped in a fine-grained, banded green cherty or tuffaceous hornstone containing pyrite cubes. The occurrence of these angular fragments probably represents a break in deposition. They appear to form depressions which suggests that the fragments may have dropped into the sediment and were later covered by further sediment. Their origin is completely hypothetical but an agglomerate composed of volcanic bombs might be suggested. Other specimens show flattened, schistose, lens-like inclusions of dark chlorite in a soft, light green matrix. Float material of a pale green, quartzose rock rich in epidote was also seen in places, together with segregations of medium-grained, white granular calcite which forms blebs and veinlets throughout the epidote rock. Large white quartz veins and accompanying quartz float occur on the main ridge.

The abundance of epidote and chlorite suggests that metamorphism has been moderate in the area. The grade appears to be higher than that required to form the greenschist facies but not high enough to form the abundant amphibole typical of the epidote-amphibolite facies.

Phyllite:

Parallelling the epidote to the north is a broad belt of phyllite which varies in width. To the east the belt narrows considerably while on the southern limb of the fold the phyllite is very narrow and alternates with chlorite schist and other sediments.

The phyllite is predominantly blue to blue-grey but outcrops of grey and greyish-brown varieties occur. Along the epidote contact the phyllite is greenish in colour which may be due to alteration during epidotization. The rock is fine to very fine-grained and exhibits a good schistosity in most specimens which is often oblique to the bedding. Siliceous, horny siltstone is sometimes finely interbedded with the phyllite. Distinct brownish spots can be seen in some specimens which contain ferruginous and calcareous material. Tight ptymatic and chevron folding, as well as tension and cleavage fractures are frequently seen but are of little value in determining the attitude of the beds as frost action is very active and the phyllite breaks into flat plates from 1/8" to 1" in width which form extensive talus slopes on all the steeper slopes above the tree line.

Iron Formation:

The iron formation forms the economic horizon in the area. It occurs immediately north of, and partly interbanded with, chlorite schist and the phyllite just described. The band has been traced by means of float and dip needle surveys for a strike of five miles on the north limb of the fold.

The iron formation east of Shell Creek is extremely difficult to follow. Very detailed traversing was conducted in an attempt to follow the formation from its float pattern but complex folding, together with poor exposures, deep weathering and thick vegetation give confusing results. A few dip needle surveys helped in some areas but the final interpretation is probably far from being accurate. Most of the outcrops in the area reveal a high degree of drag folding with a plunge east at about 10 to 30°.

The iron formation on the north limb of the fold is poorly exposed but its expression can be traced by scattered outcrops and an extensive float pattern in the valley west of the base camp and on saddles N1, N2 and N3. Further west traces of its presence were noted on N4 and N5 while on N6 and N7 the formation crops out with chlorite schists. Dip needle surveys were very helpful in denoting the presence of iron in the valleys. Trenching proved invaluable in giving detailed stratigraphy. Where dip needle surveys coincided with the trenching the detailed anomalies were found to reproduce the geology extremely well. Even narrow bands of chlorite-schist within the iron bands could be interpreted where the original survey was sufficiently detailed. The steep dips produced sharp cut-offs on the footwall (north contact) of the iron bands with slow drop-offs of anomalies up the hill on the hangingwall contact. However, the up slope limit of the iron bands along the hangingwall contact can often be followed better by the first appearance of iron float in the extensive phyllite talus.

The iron formation is composed of very fine-grained, crystalline magnetite in a matrix of banded quartzite or chlorite schist. It is often very finely banded, the laminations varying from mere partings to 2 and 3 inches. The alternating bands of blue or white quartzite give a hard, resistant rock, whereas chlorite schist bands and partings give a softer rock. Calcareous material is also present, both along the partings and within the bands. Minor amounts of pyrite occur scattered throughout the iron formation and sometimes become concentrated in certain horizons. Narrow quartz veins were seen to be interbanded or cutting across the iron formation. Folding is frequently observed causing duplication of the iron bands in drag folds. Excellent examples of fracture and flow cleavage have been observed in pieces of float which contain competent and incompetent beds.

Hematite has been recognized in a few localities, mainly on the flanks of the iron bands. It is usually very fine-grained, blueish-grey in colour, and almost completely non-magnetic, except in specimens containing recognizable octahedra of magnetite and gives a red powder when scratched. The hematite occurs interbedded with phyllite both as massive bands and thin partings. It has been recognized 650 feet down the slope north of 16260 W (Sample No. 427), as well as in Trench IVA and Trench V. Further evidence is seen down the spurs from claim posts Werner 12/34 and Werner 34/56 and east of camp near 1739 E.

A narrow, discontinuous band of conglomeratic ironstone was found east of the base camp near Trench VI. The pebbles vary from a fraction of an inch to 5 inches in diameter and are composed of fine-grained quartzitic material. The inclusions are mainly angular with rounded corners and tend to erode faster than the surrounding iron due to small amounts of included carbonate. The host rock or matrix is a typically banded ironstone composed of magnetite, quartz, chlorite and a variable amount of carbonate. Some specimens contain bands of jasper, while trace amounts of pyrite occur throughout the iron formation.

To the south in Trench III, good iron is exposed, together with magnetite-rich chlorite schist and barren blue phyllite. The matrix of the iron is strongly calcareous and chloritic. Across the stream to the northwest outcrops of a friable, white quartzite are exposed. Magnetite crystals are scattered throughout the quartzite which is interbedded with narrow bands of iron and magnetite-rich chlorite schist.

The only expression of the iron band along the southern, northward dipping limb of the fold appears to be a few scattered magnetite crystals in narrow bands of chlorite schist. However, on S2 and S3 a narrow band of chloritic iron formation as much as 30 feet wide forms slight ridges on the saddles. The presence of this iron formation is substantiated on S2 by a narrow magnetic anomaly.

Chlorite Schist, Phyllite, Quartzite and Calcareous Sediments:

The northern spurs are poorly exposed but a variety of float types suggest an interbedded succession of phyllites, chlorite schist, siltstone quartzite and gritty greywacke, together with calcareous rocks and narrow ferruginous and amphibolitic bands. Quartz vein material is often present, especially near the contact with the iron formation. Traces of quartz-congolomerate, conglomeratic limestone and limestone have also been found near the iron band on N1, N2 and N3, while in the headwaters of a stream draining the west flank of N3, bands of pyrite-rich rock are interbedded with chlorite schists. The banded pyrite occurs along the bedding planes or as cubes in bands of chlorite schist. Large rusty gossan boulders higher up the saddle suggest further pyrite. Pyrite rich bands are also found east of the Krause cabin, in a stream gully high on the west face of The Pyramid. Dip needle surveys reveal minor magnetic anomalies across the northern sedimentary bands suggesting the presence of weak ferruginous beds. A prominent band of platy, grey-blue limestone can also be traced from N6 across to N2. This broad band of limestone dips almost vertically to form a prominent ridge crossing N3 at 1157 N.

Round the nose of the anticline to the east of Shell Creek an extensive float pattern of chlorite schist and gritty greywacke is found, together with many outcrops which seem to form a band roughly parallel with that of the iron formation. Outcrops have steep dips both to the north and south which supports the theory of strong drag folding of the major fold. The grits and greywackes are dirty and friable with rusty patches of weathered pyrite. They generally contain blue, opalescent quartz grains in a dirty, slightly calcareous groundmass of quartz, muscovite and mafic minerals.

The southern limb of the anticline is much narrower than the northern counterpart but a similar interbanding of chlorite schist, quartzite and greywacke, phyllite and calcareous sediments are found. The iron formation is also much narrower and can be traced by the presence of magnetite crystals in sediments. Quartzites, grits and greywackes form a prominent band along the southern spurs which is best seen on S3 and S4. This band does not seem to be exposed on the northern spurs, though minor siltstone and siliceous bands are present.

Limestone

A wide belt of limestone can be traced all along the northern limit of the map. Northward flowing streams have cut deep, 'V'-shaped valleys through the limestone leaving prominent conical peaks. Over the less resistant phyllites and chlorite schists the streams have eroded the strata to give lower, more rounded relief. The headward erosion of small streams eroding over the parallel sedimentary strata have resulted in the formation of six saddles having almost identical profiles.

The limestone hills are steep and studded with stark, irregular pinnacles and rock masses of white and grey limestone. The mass wastage of the readily cleavable limestone gives rise to extensive talus screes of platy limestone similar to those produced by the phyllite. The majority of the limestone in the area is a compact, medium-grained white and grey rock but dirty, fetid, carbonaceous limestones of a dark blue

to black colour containing pyrite cubes are found near the Krause cabin. Schistose phyllitic and graphitic inclusions produce a conglomeratic phase. Narrow bands of clean conglomeratic limestone also occur within the main belt of calcareous rocks. The fragments are mainly calcareous but a few scattered siliceous pebbles were seen.

Aerial photos show that the limestone to the east of the area is highly folded and these apparently duplicate the pattern of folding traced by the underlying iron formation. Egil Lookout, The Pyramid and Chester's Peak are all composed of limestone whereas the intervening saddles are composed of underlying chlorite schist, phyllite and gritty, opalesent greywacke. The limestone band can be traced round to the southern limb of the fold, where scattered outcrops of grey, buff and reddish limestone form pinnacles and talus slopes at the end of the southern spurs.

Intrusives:

Very few intrusives occur in the area.

East of camp, high on the west face of The Pyramid a narrow sill of diorite dips gently to the south. This rock is a medium-grained diorite composed of cloudy, white and green feldspar (60%), amphibole and chlorite with little or no quartz. Pyrite is an accessory mineral. One exposure shows that the limestone in contact with the diorite has been tilted to a near vertical position with little or no alteration of the limestone. The diorite, however, contains coarse amphibole crystals along the contact while further away the grain size is normal. A concentration of float of a similar rock type is found 1000 feet south of 1739 E, but there is no indication of shape, size or relation of the intrusive to the surrounding rocks.

The top of Mount Simba is composed of a small, oval body of dioritic or granodioritic intrusive. The rock is medium-grained, pale greenish grey to white in colour and composed of plagioclase feldspar (50-60%) and sericitic (?) chlorite (30-40%) which is an alteration product of the original mafic mineral. Pyrite occurs in cubes which, on weathering, give rusty haloes and limonite-filled cavities, while calcite occurs as fracture filling material. A slightly elevated bench conforms closely to the shape of the intrusion with a slight boulder-strewn drop off of 10 to 20 feet to the flat top of Mount Simba.

A small, fine-grained, light grey porphyritic intrusive occurs as a mass of boulders just east of the fly camp on the west slope of N2. The rock is a quartz feldspar rock of 'aplitic' composition and contains small phenocryst laths of feldspar. The intrusion has brecciated and metamorphosed the shaly phyllite country rock to a hornfels and blocks of baked shale are completely enveloped by the intrusive rock which shows also good chill margins in some specimens. Later quartz-filled fractures cut both the intrusive and the baked shales.

No further intrusions were noted in the area.

Structure:

One interpretation might be that the exposures of iron formation east of Shell Creek are the result of an upthrusted block along a north-south fault up Shell Creek, but there seems to be no displacement of any particular band on either side of the creek. Along the main fold the dips are inwards with steep, southerly dips on the north limb and shallow, northward dips on the south limb, which suggests a syncline. However, if the structure were that of a syncline plunging east and up-faulted along Shell Creek, then some trace of the iron horizon should be found in the saddles between Egil Lookout, The Pyramid, Chester's Peak and Pramkop. No trace of the horizon exists, either from float or in the form of magnetic anomalies. Thus to explain both the inward dips on the limbs and the easterly plunge of the fold the structure must be that of an inclined, squeezed or 'fan' shaped anticlinorium with at least five minor snyclinal drag folds on the crest of the anticline. These are deduced from the trace of the iron band along the bluffs east of Shell Creek and two others are interpreted from the trace of the epidote - chlorite rock and the phyllite contact between Mount Simba and Mount Skokiaan. Other formations in the area also give supporting evidence to this theory.

The area mapped has thus been interpreted as being underlain by a long, narrow anticlinal fold producing duplication of beds on both limbs of the structure. The north limb of this structure dips steeply (60-70°) south whereas dips on the south limb appear to dip more gently to the north. This anticlinal structure plunges gently east at 10 to 30° and no trace of the extension of any marker beds could be found beyond the nose of the folding. To fit the foregoing facts the structure must be an inclined, squeezed or 'fan-shaped' anticlinorium which exhibits complex drag folding along its axis.

Metamorphism:

Metamorphism within the area is of medium to low grade. Rocks thought to be original volcanics have been altered to epidcte-rich rocks but the grade was not sufficiently intense to produce the epidote-amphibolite facies. However, all shales and argillaceous sediments now occur as phyllites, slates and schists, while the limestone are brittle and cleave easily. The iron formation shows abundant crystalline megnetite which has probably recrystallized from original ferruginous material laid down with the sediments.

ECONOMIC GEOLOGY

Trenching across the iron formation at 6 different points at irregular intervals over about 5 miles of its length has revealed that it is made up of layers ranging from fractions of an inch up to several tens of feet in thickness composed for the most part of fine-grained magnetite. These ferruginous layers are interbedded with chlorite schist, phyllite, quartzite and phyllitic shale.

Some of the ironstone bands are relatively pure, containing up to 75% magnetite, while others are considerably lower grade and composed of disseminated magnetite in chlorite schist and phyllite. Minor hematite is sometimes also present.

Heavy talus and permafrost caused hand trenching to be slow and arduous. A dip needle was used in an endeavour to supplement the trenching. In this manner it was possible to trace the main north limb iron formation with a fair degree of accuracy and detail.

Interpretation of the results indicates that northwestward as far as Saddle N3 the north limb iron formation is made up essentially of two parts. These consist of an interlayered zone of about 200 feet in thickness and a second somewhat similar zone of about 75 feet in thickness lying to the north with a barren zone of 300 feet separating the two. Some thickening and thinning of these zones probably occurs, however, the two zone relationship appears to persist over much of the length of this portion of the iron formation.

Northwest of Saddle N3 only the main unit of the iron formation appears to persist. Beyond Saddle N5 this unit was observed to thin noticeably. Between Saddles N1 and N6 outcroppings were observed about 1000 feet north of the main iron formation which suggest the presence of a fairly persistent but relatively narrow band of similar material.

The section of the iron formation lying east of Shell Creek is more difficult to define. Due to the complexity of the folding in this region there is considerable variation in the thickness, however, there is an obvious thinning from north to south. In other respects its character is similar to that of the north limb formation.

The geological map attached to this report shows in detail the results obtained in trenching.

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PHR/GR.

ASSAYS

Sample Number	Total Iron	Soluble Iron	Sample Number	Total Iron	Soluble Iron	Sample Number	Total Iron	Soluble Iron
401	25.0		418	31.6	24.6	435	24.9	
402	26.2	23.1	419	19.7		436	24.2	24.1
403	28.0		420	26.1		437	29.0	
404	14.4		421	32.1	31.8	438	14.3	
405	12.0		422	25.8		439	22.6	
406	7.3		423	17.3		440	30.5	
407	21.4		424	28.6		441	29.6	
408	28.9	28.5	425	35.2		442	10.7	
409	21.2		426	29.7		443	22.5	
410	29.4		427	40.3	33.2	444	29.5	
411	31.9	31.6	428	26.2		445	26.3	
412	15.1		429	19.5		446	27.3	
413	26.8		430	26.7		447	Bulk	Sample
414	27.8	23.6	431	23.6	23.6	448	Bulk	Sample
415	19.6		432	26.0		449	Bulk	Sample
416	8.6		433	24.9		450	Bulk	Sample
417	17.4		434	26.5				