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AN INITIAL GEOLOGICAL APPRAISAL OF THE ALMA MINE, YUKON TERRITORY, CANADA

by

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Prepared for:

120120

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C O N T E N T S

FIGURES

SUMMARY AND CONCLUSIONS

A. Two main pay channels, with several minor ones have been outlined and mined; these probably continue through to the adjacent Brisbois claim to the west. The development ends A, B and C are heading up the valley side; it is unlikely they are in an island.

B. It is estimated that between 30,000 and 35,000 cubic yards have been mined this past season; the gold content is at least 2,700 oz.

C. The average grade of the gravels mined since January 1986 is estimated at c 0.15 oz/cubic yard (c. 5 gm/cubic yard).

D. Although there is some understanding of the gravels and their gold content, more systematic work is required over several months to understand them more fully.

E. It appears that the area mined to date (1982-1985), follows an ancient channel with an overall gradient of 1 in 27, and that this channel is itself multi-channelled in nature. The main pay zones mined during the last season appear to follow these channels.

F. There are three areas of potential underground reserves:

1. The area to the west of the current workings.
2. The area immediately to the south (and possibly north) of the

old workings.

3. Bench Discovery.

Of these, Bench Discovery has a potential gold content of 35,000 oz.

G. It is recommended that next season's mining should be in Bench Discovery using the present adit as access with a tramming route on the southern edge of the old mine; another ventilation raise will be needed as will another truck and driver.

H. Instead of a sampler, a geologist could be employed at relatively little extra cost.

I. A surface drilling programme should be implemented in Bench Discovery during the summer of 1987.

J. The sample processing facilities should be up-graded enabling at least three times as many samples to be processed.

Surveying of the advancing mine should be given a higher priority than in the past; the relative levels of the pay zones should be tied into the government survey on surface.

1. INTRODUCTION

Following commissioning by Klondike Underground Mining Limited, C/o Guaranty Trust Company of Canada (UK) Limited, 65/66 Queen Street, London, EC4R 1EB, a 24 day visit from 3 March 1986 to 26 March 1986, was made to Canada; of this time, 19 days were spent at the property known as the Alma mine.

The Client required an initial geological appraisal of the Alma Mine in Miller Creek, a tributary of the Sixtymile River in the Dawson mining district of the Yukon. The Alma Mine is an underground operation situated along the left limit of Miller Creek approximately 1 km (0.6 mile) upstream from its confluence with Sixtymile River. The placer gold deposits presently being mined occupy an old channel of Miller Creek separated from the existing channel by a ridge of bedrock approximately 100 metres (330 feet) wide.

The appraisal was to include, where possible and within the available time, the following:

1. A plan of the mine, particularly the new development carried out during the last six months, and that which had not been previously surveyed.

2. A survey of the levels of the bedrock-gravel contacts throughout the whole mine and produce a contour map of the results.

3. The sampling of workings and pillars relating gold and heavy mineral content to bedrock configuration.

4. An attempt to identify overall differences between gravels using parameters such as cobble rock-type, size, shape and colour, position in relation to bedrock and other gravels, and heavy mineral content.

5. An attempt to identify the direction of the original stream(s)that deposited the gravels and gold.

6. An estimate of the amount of gold that will be produced from the 1985/86 mining season.

7. The economic potential of the property.

Due to the short time spent at the mine and lack of data from previous mining seasons, this report cannot be regarded as an evaluation of the property but only as an appraisal of its economic potential.

Prior to visiting the property, I read the two reports on the mine prepared by Robertson Research International Limited, the progress report by M G Scoretz and the section on Miller Creek in D J Copeland's report. These reports contain detailed descriptions of the extent and location of the mine and its surrounding properties, the climate, topography and geology of the area and the history of Miller Creek mining. For this information reference should be made to the individual reports, and only brief descriptions will be included in this report when considered necessary.

2. MILLER CREEK - GENERAL

2.1 Geology and Geomorphology

The Miller Creek headwaters are close to the Alaska-Yukon boundary and empty into the Sixtymile River. The Creek valley is 6.5 miles long, about 600 ft wide near the mouth and has a gradient of approximately 100 ft per mile (1 in 53).

Miller Creek valley is mostly underlain by rocks of the Nasina Quartzite that are dark grey to black, graphitic and micaceous quartzite, graphitic biotite muscovite schist and contain thick lenses of grey marble. The lower part of the valley near the mouth has been intruded by more recent andesite and other volcanic rocks.

The area is reported to be unglaciated and hill summits in the region have approximately the same elevation. Deep chemical and mechanical weathering of the original peneplain resulted in the liberation of gold and the formation of the original river terraces. Crustal warping and uplift followed, which in turn caused tilting, stream incision and terrace bevelling. The aggradation of streams resulted in intermediate terraces between the present creek bottoms and valley ridges. Further uplift near the end of the Pliocene resulted in a new regime of stream incision (Copeland, 1984).

2.2. The Gravels

There are basically three types of gold-bearing placer deposits in the Miller Creek area; these are:

- Undisturbed bench gravels on the terraces above the present creek level with the original concentrates of gold.

- Recent or modern creek gravels that contain moderate gold values.

- Enriched creek gravels where the bench gravels have slid into the present creek bottom; the gold is then redeposited and concentrated into the modern creek gravels.

2.3. The Alma Mine

In 1981 a 12 ft by 8 ft adit was driven in Patsy Claim No 7 through a ridge of outcropping bedrock on the left bank for a distance of approximately 330 feet before gravels were encountered. This bedrock ridge separates the present creek from the higher gravels which were deposited in an old river channel; within these gravels pay channels exists which, from both past and present mining activity in Miller Creek, are found to be located towards the base of the older gravels. It is this gold-bearing channel that is exploited in the Alma Mine. From the evidence of present day workings along Sixtymile River, immediately downstream from the junction with Miller Creek, it is probable that an ancient alluvial fan exists at the mouth of Miller Creek.

3. RESULTS OF WORK - MARCH 1986

3.1. Underground Workings

Figure 1 shows the extent of the workings up to the end of March 1986.

Work prior to the 1985-1986 season is shown, as are the headings A, B and C and their related cross-cuts, and headings A2, D, E and F and their related cross-cuts.

The A, B and C development, started at the beginning of the season, was terminated in January 1986 when it became obvious that grades were poor and that the pay gravels had been lost.

In January 1986, the development ends A2, D, E and F were started and it soon became obvious that higher grades were being intersected; this development and subsequent pillar extraction was continued until the end of the mining season in April 1986.

The decision to proceed with the development of A, B and C was taken in an effort to find a parallel pay-channel to that of the previous mining. The rise in the gravel-bedrock contact as the headings developed, was interpreted as a possible island separating the old channel from the sought-after adjacent channel. By January 1986 it became clear that development in this NNE direction should cease.

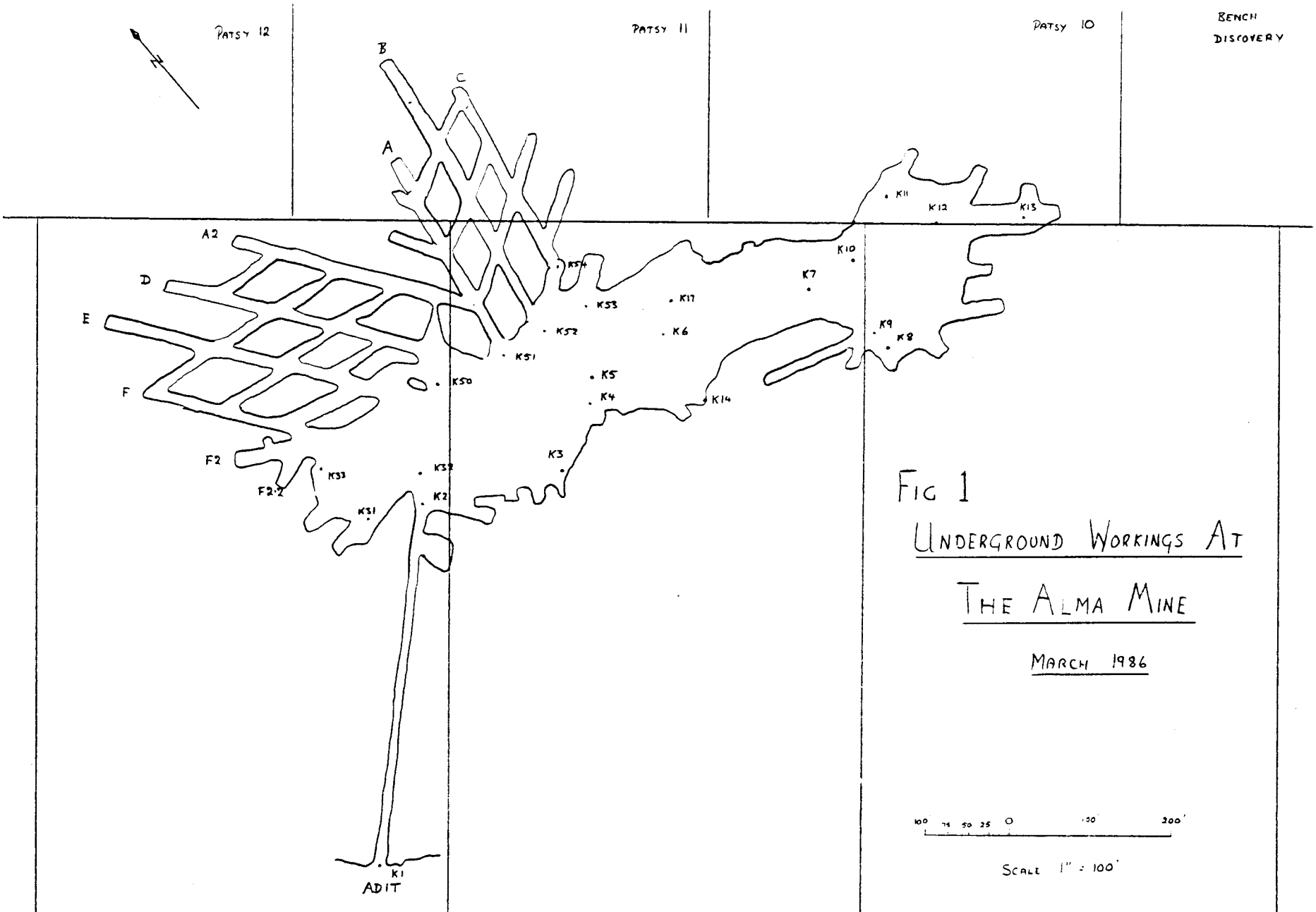


FIG 1

UNDERGROUND WORKINGS AT THE ALMA MINE

MARCH 1986

100 75 50 25 0 100 200'

SCALE 1" = 100'

The headings A2, D, E and F proceeded in an approximately NW direction in Patsy 7 and are now approaching the adjoining Brisbois claim; heading E is now approximately 100 ft away from this claim boundary.

3.2. Gold Distribution in the Mine Gravels

The older part of the mine does not appear to have been worked systematically and has been described as a combination of room and pillar mining and gopher holing. No records exist of the grades obtained in the older part of the mine, although it is reported that the main pay zones are known from the 1984-1985 mining season. Consequently, it is extremely difficult, if not impossible, to establish where the major pay zones occurred; it can only be assumed that where the pillars have been drastically stripped and collapses have occured, the grade was high.

Since the start of the 1985-1986 mining season a sampler has been employed to continually sample the development headings. This has enabled much more selective mining to be carried out and has produced a record of the grade distribution throughout the current workings.

As mentioned above, work ceased in headings A, B and C in January 1986. At the beginning of the A and B headings interesting grades were intersected but these were short-lived. My conclusion is the same as that of Scoretz that 11,000 cubic yards were extracted from the headings A, B and C and their related cross-cuts, with an average grade of 0.5 g of gold per cubic yard.

Figure 2 shows the distribution of gold from gravel samples taken in the headings and cross-cuts of A2, D, E and F. From the diagram it can be seen that two main pay channels are present; these are:

a). from E through D4 and D

and b). through F2 and F2.2.

By the middle of March most development had stopped and work was concentrated on slashing the pillars in the higher grade areas; this will continue through to mid-April.

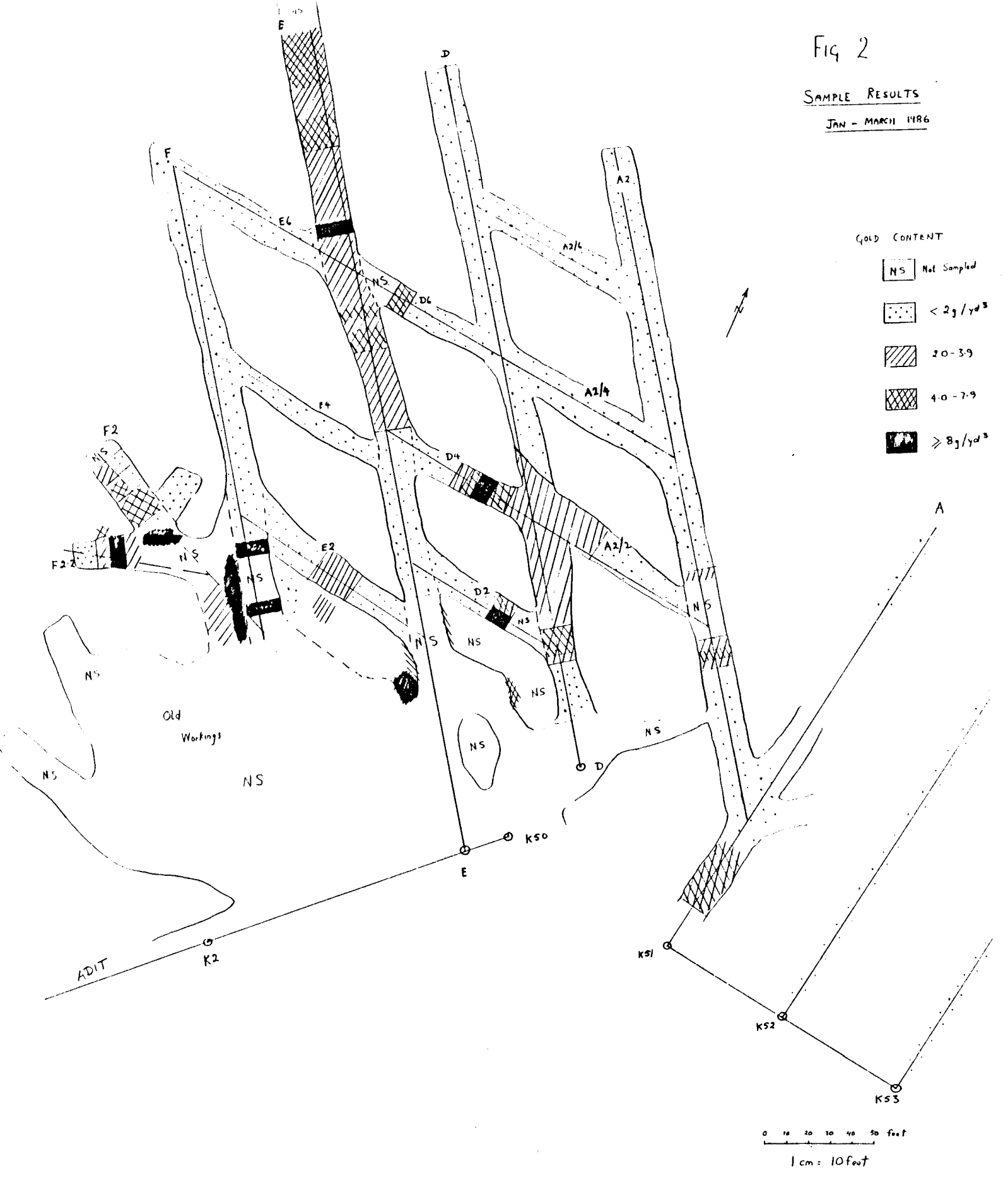


Fig 2
Sample Results
Jan - March 1986
Gold Content
NS Not Sampled
< 2 g/yd³
2.0 - 3.9
4.0 - 7.9
≥ 8 g/yd³
E
D
F
A2
E6
A2/6
NS
D6
A2/4
E4
F2
NS
D4
F2.2
NS
E2
A2/2
NS
NS
D2
NS
NS
NS
NS
NS
Old
Workings
NS
NS
NS
D
A
K50
E
ADIT
K2
K51
K52
K53
0 10 20 30 40 50 feet
1 cm = 10 feet

3.3. Estimate of Gold Mined During The 1985-1986 Season

A. Headings and cross-cuts - A, B and C

c. 11,000 cubic yards at 0.5 gm = 5500 gm+ = c. 200 oz

B. Headings and cross-cuts - A2, D, E and F

1). "Non-Pay" (<2 gm/yd^3) Areas

Development End	Length (ft)	Width (ft)	Height (ft)	Estimated Grade (gm/yd^3)
A2	170	15	10	0.5
A2.2	45	15	10	0.5
A2.4	70	15	10	0.5
A2.6	70	15	10	0.5
D	220	15	10	0.5
D2	30	15	10	0.5
D4	20	15	10	0.5
D6	35	15	10	0.5
E	70	15	10	0.5
E2	60	15	10	0.5
E4	80	15	10	0.5
E6	80	15	10	0.5
F	190	15	10	0.5
F2.2	10	15	10	0.5
F2.1	20	15	10	0.5
11 to E2	20	15	10	0.5

Total Volume = $\frac{1190 \times 15 \times 10}{27}$ cubic yards = 6611 yards

Gold = 6611 x 0.5 = 3306 gm = c. 110 oz

2). "Pay" (>2 gm/yd³) Areas

Development End	Length (ft)	Width (ft)	Height (ft)	Estimated Grade (gm/yd³)	Au Content (gm)
A2	50	15	10	3.0	833
A2.2	25	15	10	3.0	417
D	90	15	10	3.0	1500
D2	30	15	10	7.0	1167
D4	40	15	10	7.0	1556
D6	25	15	10	5.0	694
E	40	15	10	3.5	778
	140	15	10	3.0	2000
	80	15	10	6.0	2667
	10	15	10	8.0	444
E2	20	15	10	3.0	333
F	50	15	10	31.0	8611
F2.2	45	20	10	4.0	1333
	15	20	10	31.0	3444
F2	50	20	10	6.0	2222
Slashes up to c. 21/3/86					
LHS at	30	10	10	31.0	3444
bottom of F	30	10	10	3.0	333
11 to E2	20	15	10	3.0	333
Top of E	180	5	10	5.0	1667
	120	17	10	5.0	3778
D4	60	10	10	5.0	1852
				Total =	39405 gm

Total Volume = c. 5,700 cubic yards

Gold = c. 1271 oz

C. Estimated Areas To Be Slashed By Mid-April 1986

			Grade (gm/yd^3)	Gold Content (gm)
1. Top of E to E6:				
LHS	370 cubic yards	x	4.0	1481
RHS	444 cubic yards	x	5.0	2222
2. D4/D6 Pillar:				
	420 cubic yards	x	5.0	2100
3. D2/D4 Pillar:				
	260 cubic yards	x	6.0	1560
4. Corner of Pillar below A2.2:				
	185 cubic yards	x	3.0	550
5. Bottom of A:				
	333 cubic yards	x	4.0	1333
6. Pillar at bottom of E, LHS:				
	444 cubic yards	x	7.0	3111
7. F2 and F2.2 area:				
Estimated:				
i. Between Old Workings and F2.2				
	592 cubic yards	x	3.0	1778
ii.F2 development and slashes				
	888 cubic yards	x	5.0	4444
8. Pillar, East of D2:				
	444 cubic yards	x	5.0	2222
				c. 21000 gm

Estimated Total: 4,380 cubic yards producing 677 oz

Total Estimated Gold Mined:

	Gold:	Yardage
1. A B C	c. 200 oz	c. 11,000
2. A2 D E F and cross-cuts with slashes to 21/3/86	c. 1400 oz	c. 12,400
3. Estimated amount to be slashed by mid April 1986	c. 677 oz	c. 4,400
	c. 2277 oz	c. 28,000 yds^3
+15% nuggets	c. 400 oz	
Total	c. 2700 oz	

There may be more yardage produced than that estimated above; thus an estimate of 3000 oz for the 1985-1986 season is reasonable for the following reasons:

- All heading widths are taken as 15 feet unless otherwise noted.
- All heading heights are taken as 10 feet.
- Only 500 cubic yards are taken as having a grade of 31 gm (1 oz) per cubic yard; the next highest grade used in the estimate is 8 gm per cubic yard - undoubtedly there are grades between 8 and 31 gm per cubic yard in the area mined during the season.
- No bedrock samples were taken as grades, although they reportedly can be high, are usually very erratic.

The estimate of the gold mined during the season is based on the *sampling* and is probably a conservative estimate. It is possible that the yardage removed from the mine is more than that estimated above, as the height of 10 feet for the workings is certainly exceeded in many

places. If the height is taken as 12 feet then the yardage increases to 36,000 cubic yards. However, much of this extra two feet is in the silt layer or probably non-pay gravels; consequently it has not been included in the overall yardage.

If 28,000 cubic yards produce 2700 oz gold then the average grade is c.0.1 oz/cubic yard.

If only the mining since January 1986 is considered, then 16,800 cubic yards producing 2500 oz gold gives a grade of c. 0.15 oz/cubic yard or c. 4.7 gm/cubic yard.

3.4. Sampling of the Gravels

3.4.1. General Observations

As mentioned above, since the start of the 1985-1986 mining season a sampler has been employed to continually sample the headings and consequently assist in more selective mining. Without a doubt the work carried out by Tom Morgan has been invaluable. I have included a description of the methods he used in Appendix A; the description is taken from notes that he made prior to leaving the mine on 23.3.86.

To obtain a representative placer sample, particularly from an underground heading in a frozen gravel mine, is a difficult operation for several reasons:

a). The frozen nature of the ground.

b). The height to be reached by a six foot man in a 12 foot heading.

c). Sloughing and misfires frequently obscure and obstruct sampling.

d). The large particles to be dealt with; a representative sample should contain all the constituents of a face and in exactly the

same proportion in which they occur in the particular gravel. For logistical reasons the sample taken by Tom Morgan was approximately one-third of a cubic foot - obviously large cobbled gravel would be extremely difficult to sample representatively.

e). The high unit-value of gold results in any errors in mineral content of the sample being highly magnified in the end result.

f). The erratic distribution of gold both vertically and laterally within a gravel.

g). The variation within a single heading in gravel types and corresponding gold contents.

Bearing all the above points in mind, when a face in the mine was re-sampled, the result compared closely to the original samples; for this credit should be given to the sampler.

Perhaps the biggest shortcoming of the sampling during the season, apart from the relatively small size of each sample, was the inability of the system to allow for more sampling to be carried out and the subsequent processing of these samples. It was the limitations of the sampling system that prevented more run-of-mine samples to be taken for comparison with the face sampling.

From my short visit to the mine, it is obvious that for a full understanding of the distribution of gold within the mine generally and the gravels specifically, more detailed mapping of the gravel types should be carried out. With due respect to Tom Morgan, as he is not a geologist and makes no claim to be, his observations and notes are of limited use from an overall geological point of view. Notwithstanding this, his general observations as to the type of gravel

that contain gold were very useful. Most of my time spent at the mine sampling tended to be in the areas of higher pay and his observations were certainly confirmed by my work.

Before leaving Whitehorse on my return journey, I spent over an hour with Steve Morrison, a government geologist. I understand he is about to publish a paper on Miller Creek in which he classifies the non-mine gravels exposed in the Creek sedimentalogically; he informed me that it should be possible to identify individual gravels as gold-bearing or not. With this information, together with data obtained from sampling, the next mining season should see a marked increase in the understanding of the gravels.

3.4.2. The Mine Gravels

Appendix A describes the sampling method and the method of separation used during the 1985-1986 mining season; it also describes the simple observations that can be made of a gravel. However, most of the observations were qualitative and made at the time of sampling. For a fuller understanding more quantitative observations should be made, particularly when screening the sample and separating the heavy minerals and gold.

The structures and textures of placer gravels at Miller Creek suggest they can be classified as either alluvial-fan gravels, braided river gravels on a terrace, or gravels of the meandering Sixtymile River (R L Hughes, 1986). In the mine and at the mouth of Miller Creek, the palaeo-channel is separated from the modern Creek by a bedrock high. It is believed that this bedrock high was once part of the right-limit of the original valley; the area to the south of this has subsequently been eroded by the present creek (see Figure 7).

The gravels in the mine are very varied and range from having very coarse fine clasts. Generally the gravels are clast supported and matrix filled w sand, silt, silty-sand and clay. Frequently they are poorly sorted but a sometimes crudely stratified. A silt layer, varying from six inches to thr feet in thickness, occurs about eight feet above the gravel-bedrock contac often this layer is laminated and is sometimes overlain by a band of blue clay Where gravel is exposed above this silt layer, it is usually very clean, has little silty material and has a lot of ice in the matrix. The gravels generally have clasts that are usually sub-angular to sub-rounded and are commonly of graphitic schist, muscovite-quartz schist, quartzite and vein quartz. It can be assumed that the gravels exposed in the mine were deposited in a multi-channelled river environment.

The gravels rest on a variety of bedrock usually a relatively unweathered blocky quartzitic rock, a very weathered yellow-orange micaceous schist and extremely weathered or altered clayey igneous rock that is presumed to be andesite. In parts the contact is sharp as with the latter two rock-types, but the base of the gravel is extremely difficult to identify where it rests on the blocky quartzite. Frequently there is a mixed zone of several feet between the gravel and bedrock.

The gravel-bedrock contact is continually undulating with occasional large riffles or river bars. Where these occur at obtuse angles to the pay channels, enrichment occurs on the down stream side. Occasionally the bedrock forms hollows, with strange overhanging shapes, completely filled with the remains of a previous gravel that has been removed before the present basal gravel was deposited.

It is commonly reported that gold is concentrated in the lower gravels above the bedrock contact and also in the upper foot or two of the bedrock. In the areas mentioned above where a considerable overlap of gravel and bedrock occurs, it is most likely that gold is present in some quantity; the pay zone in heading E is just such an area.

From the evidence of the six months' sampling, the gold *is* found to occur in the lower gravels. However in heading D, between cross-cuts D2 and D4, the pay gold was not in the three feet of coarser and somewhat silty gravels immediately overlying bedrock; instead it was in the finer, more sandy gravels above.

As can be seen from Figure 2, all the gravels sampled in the mine contained some gold; many of the non-pay gravels had gold contents of between 0.5 and 1.0 gm per cubic yard. However, as mentioned above, two main pay channels occur. The gravels in these areas vary somewhat in type but have certain similarities. Grain size does not seem to be a particularly important parameter, nor does the pebble/cobble shape or stratification. Undoubtedly when more careful geological observations are made, hopefully next mining season, the information obtained will result in now apparent unimportant features of the gravels assuming far greater importance. However, it was found by Tom Morgan and myself, that the following 'types' of gravels yielded greater than 6 gm of gold per cubic yard:

1. Fine grained, grey-brown gravel with flat, rounded clasts having a mostly sandy-silty matrix.
2. Medium grained, orange-brown gravel with flat stratified clasts with a sandy matrix.

3. Coarse grained, beige disorganised gravel with a mostly silty but a somewhat sandy matrix.

4. Fine-to-medium-grained, beige to grey-brown gravel with rounded and flat clasts with a sandy-silty matrix.

If ice was present in the matrix, or if there was clay either as lenses or in the matrix itself, then very little gold was found in the gravel. Often the higher grade gravels tended to have cinnabar as a constituent of the heavy mineral fraction and occasionally small cinnabar nuggets up to 0.5 inch in diameter were found.

The gold from the gravels in the F2 and F2.2 area was coarser than that from the other pay areas and when the -4, +14 mesh material was panned from this area occasional small nuggets were produced. However, there was no obvious overall difference between these gravels and those which produced the finer gold; more work needs to be carried out to explain this.

It is obvious that the description of the 'pay' gravels are geologically wanting, but as rule-of-thumb parameters they were useful in the short time spent at the mine.

3.5. Survey Of The Bedrock-Gravel Contact

3.5.1. General

The surveying of the relative heights of the bedrock-gravel contact occupied over half the time spent at the mine. Figures 3 and 4 show respectively the relative heights of points throughout the mine and a contour map made from

these results. The surveying was carried out using a theodolite and distances were estimated to the nearest foot using tacheometry.

It should be noted that the contouring is an interpretation only, as the bedrock-gravel contact is continually undulating throughout the mine; to have surveyed more points was not possible due to the time factor. Also it should be noted that the heights are only relative - the height of the bedrock-gravel contact at the first station was arbitrarily taken as 100 feet.

As mentioned above, it is extremely difficult in many parts of the mine to accurately pinpoint the actual contact due to sloughing, muck on the faces and the varying bedrock-gravel transition zone. However, the contour map does give an overall picture but should not be taken as completely accurate for all the above reasons.

3.5.2. Interpretation Of The Results

The contour map (Figure 4) shows the following features:

1. The whole area of the mine appears to follow a channel; this channel is itself multi-channelled in nature.

   From the western end of heading E to the far eastern end of the mine, the bedrock-gravel contact drops approximately 45 feet in 1200 feet - a gradient of 1 in 27. Over this distance the general direction of the channel swings round from approximately southeast to east at the lower end of the mine.

2. It appears that headings A, B and C are almost at right-angles to the northern side of the channel and are rising at a gradient of 1 in 10.

Figure 5 is an interpretation of the courses that the multi-channelled stream(s) could take; the known areas of pay gravels from sampling are also marked. It is assumed that caved areas contained good pay gravels. Taken in conjunction with Figure 4, the following observations can be made:

3. The pay zones in headings E and D, F2 and F2.2, E2 and A2 appear to follow minor channels within the main channel (see Figure 6).

4. The gradients of these pay zones and some of the caved areas is approximately 1 in 30. However, the large caved area immediately to the east of the adit as it enters the mined area, has a gradient of 1 in 50 - the shallowest in the mine.

   It is interesting to note that the area in the older part of the mine between the two marked 'caved areas' has a gradient of 1 in 14, while at the far eastern end of the mine the gradient is 1 in 10. I understand from Messrs R Desgagne and A Hammond that neither of these areas had good pay gravels.

5. An interesting feature that becomes clear from Figures 4 and 5 is the narrowness of the area mined prior to the 1985-1986 season. I understand from Mr A Hammond that in several places along the south limit of the old mine good pay values have been recorded. It is therefore possible that pay channels exist to the south of the old mine, or perhaps to the north as it is unlikely that the main channel narrows so noticeably so close to the mouth of Miller Creek.

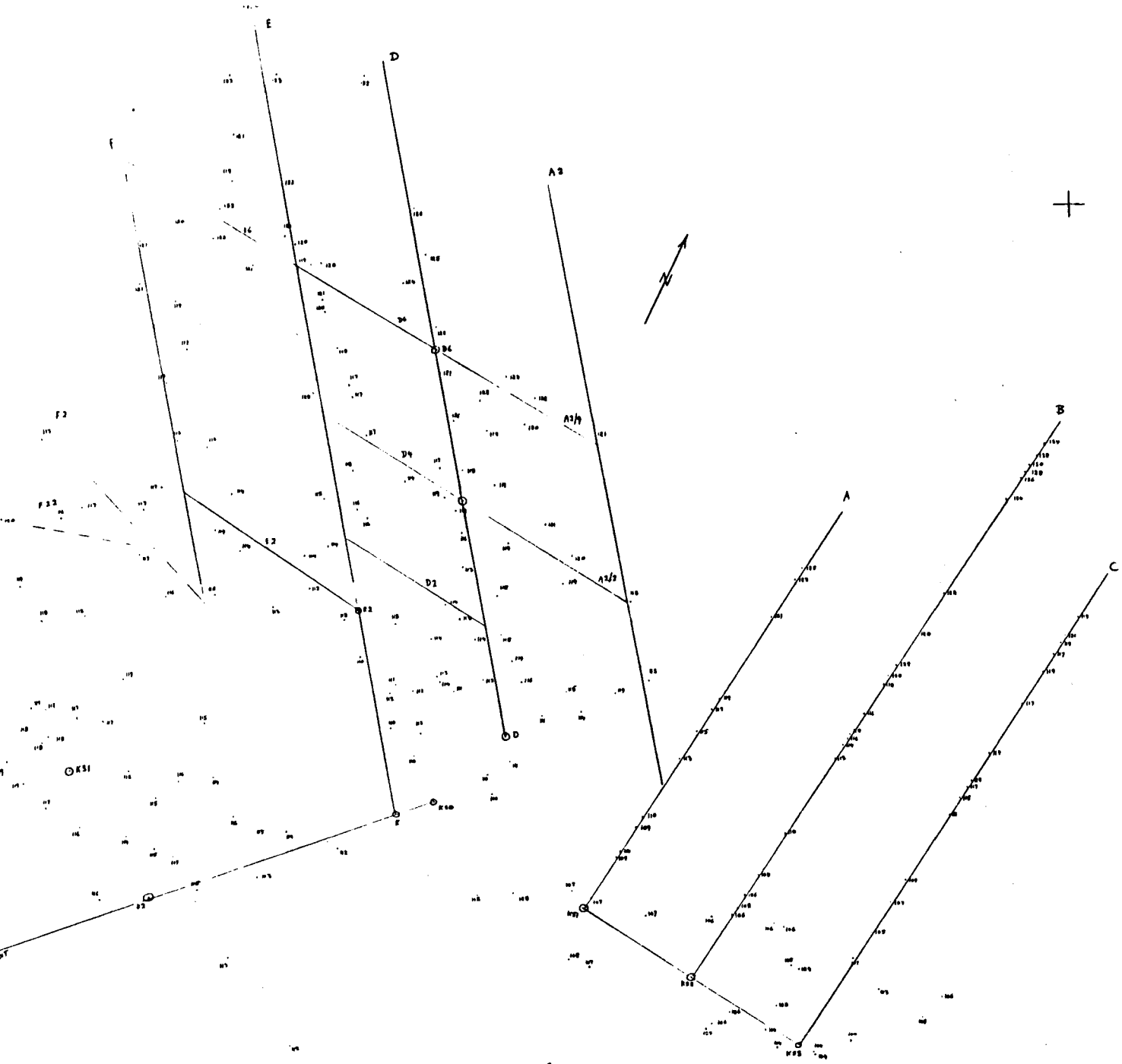


Fig 3

Relative Heights Of Bedrock - Gravel Contact

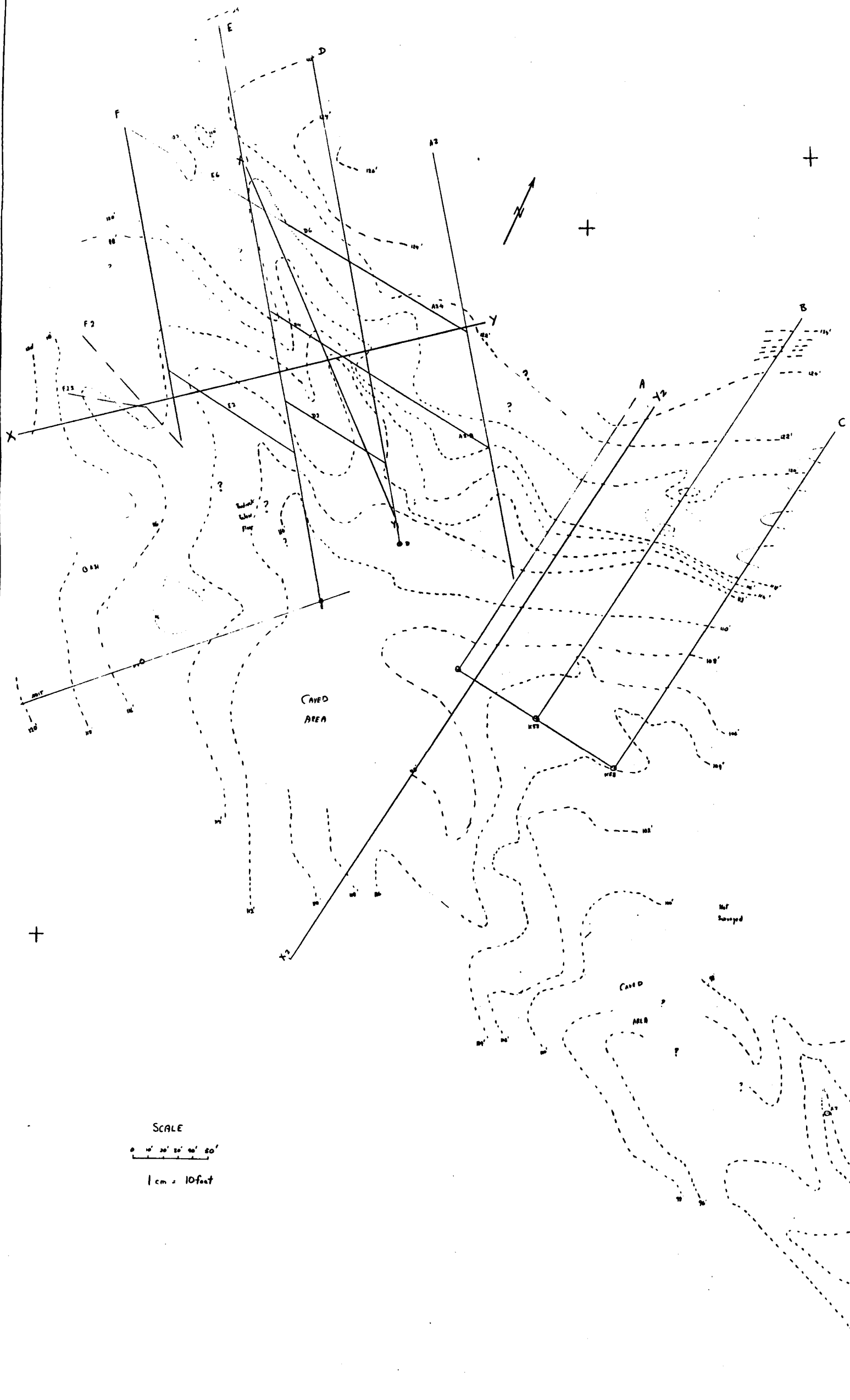


FIG 4

CONTOURS OF HEIGHTS OF BEDROCK-GRAVEL CONTACT

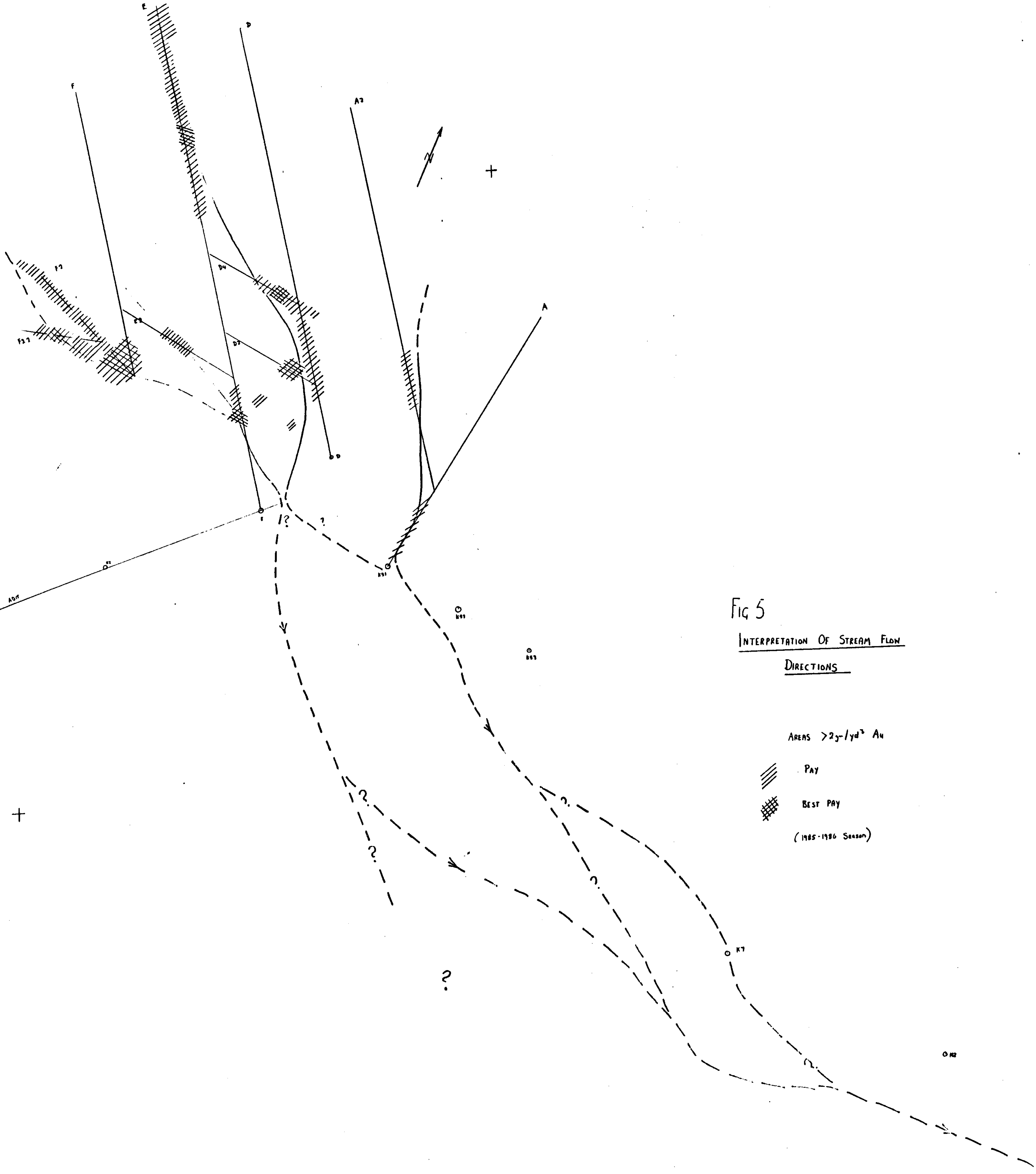


Fig 5

Interpretation Of Stream Flow Directions

3.5.3. Position Of Pay Channels In Relation To Miller Creek Valley

Figure 7 shows a cross section of Miller Creek valley approximately through the underground workings. The following observations can be made:

1. The steep south side of the valley with the present Miller Creek over against the right limit.
2. The gentle slope of the bench gravels on the south facing slope has been caused by slumping during thawing. This has forced the present Miller Creek to occupy its present position.
3. The approximate position of headings F2 and E show that they occupy a position roughly central in the original valley before the bench gravels were deposited.
4. The approximate position of the end of heading B shows that it is unlikely that the rising ground in the mine is due to an island; little room is left to the north for the originally hoped-for parallel channel *unless* the channel is at a higher stratigraphic position in the gravels!

Figure 8 shows the position of the 'Glory Hole', the line of shafts referred to in previous reports, and the mine portal. I believe the palaeo-channel mined in these workings is the same as that in the present underground workings in headings E and F2; it appears to have swung in a southeasterly direction, perhaps influenced by the pup shown in Figure 8, before eventually swinging eastwards again into Bench Discovery.

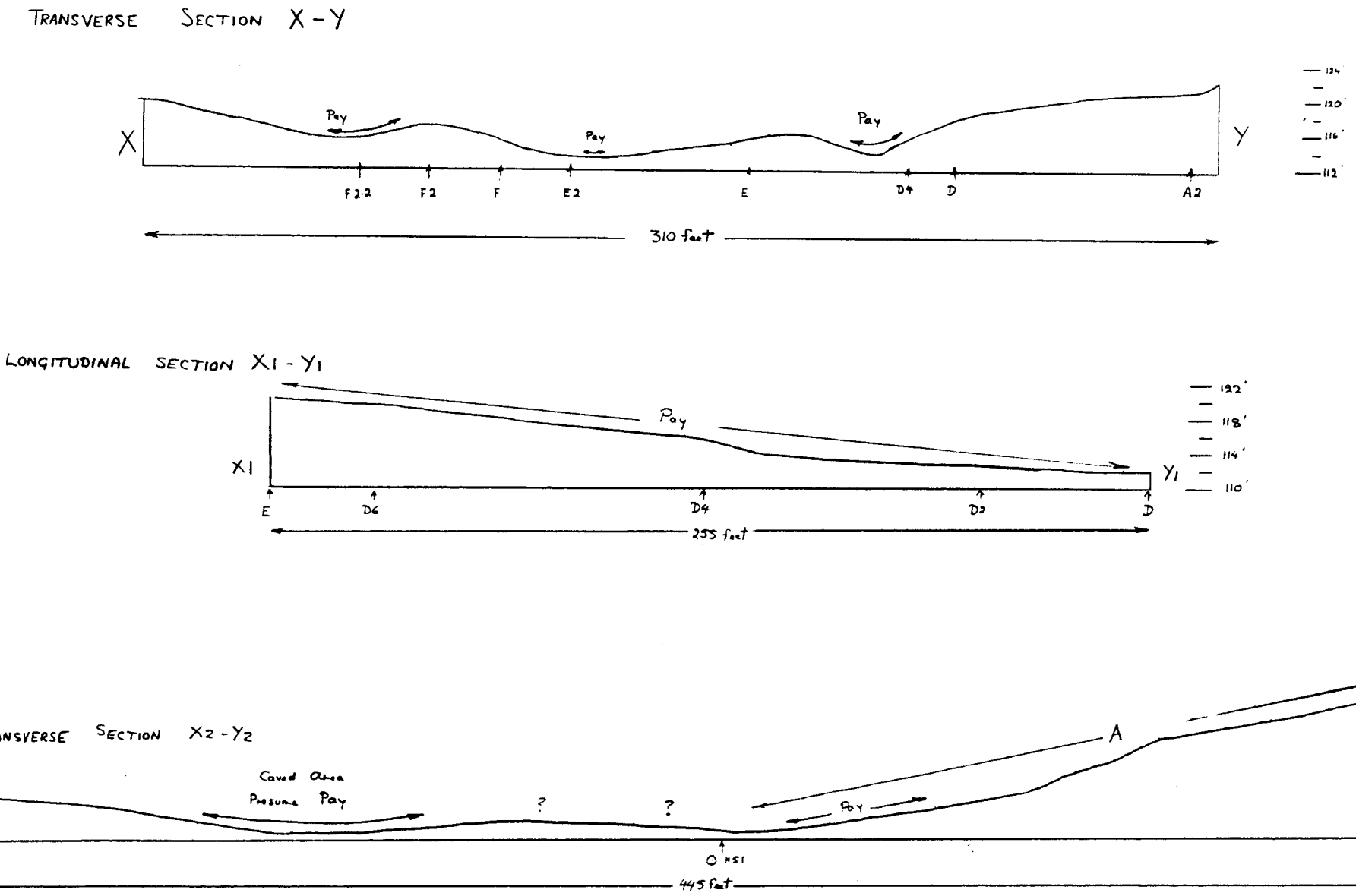
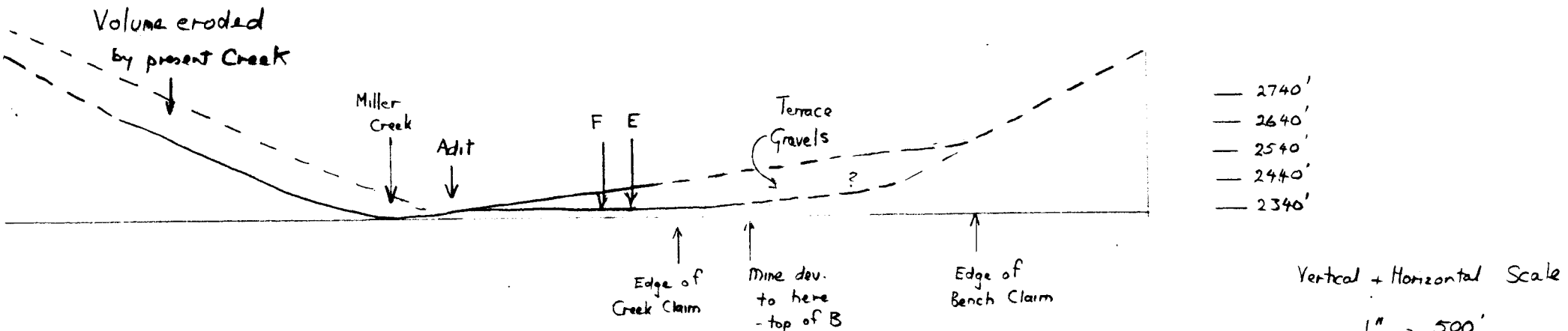


FIG 6: CROSS-SECTIONS OF CHANNELS



Vertical + Horizontal Scale

1" = 500'

(1:6000)

FIG 7

CROSS-SECTION OF MILLER CREEK VALLEY AT THE MINE

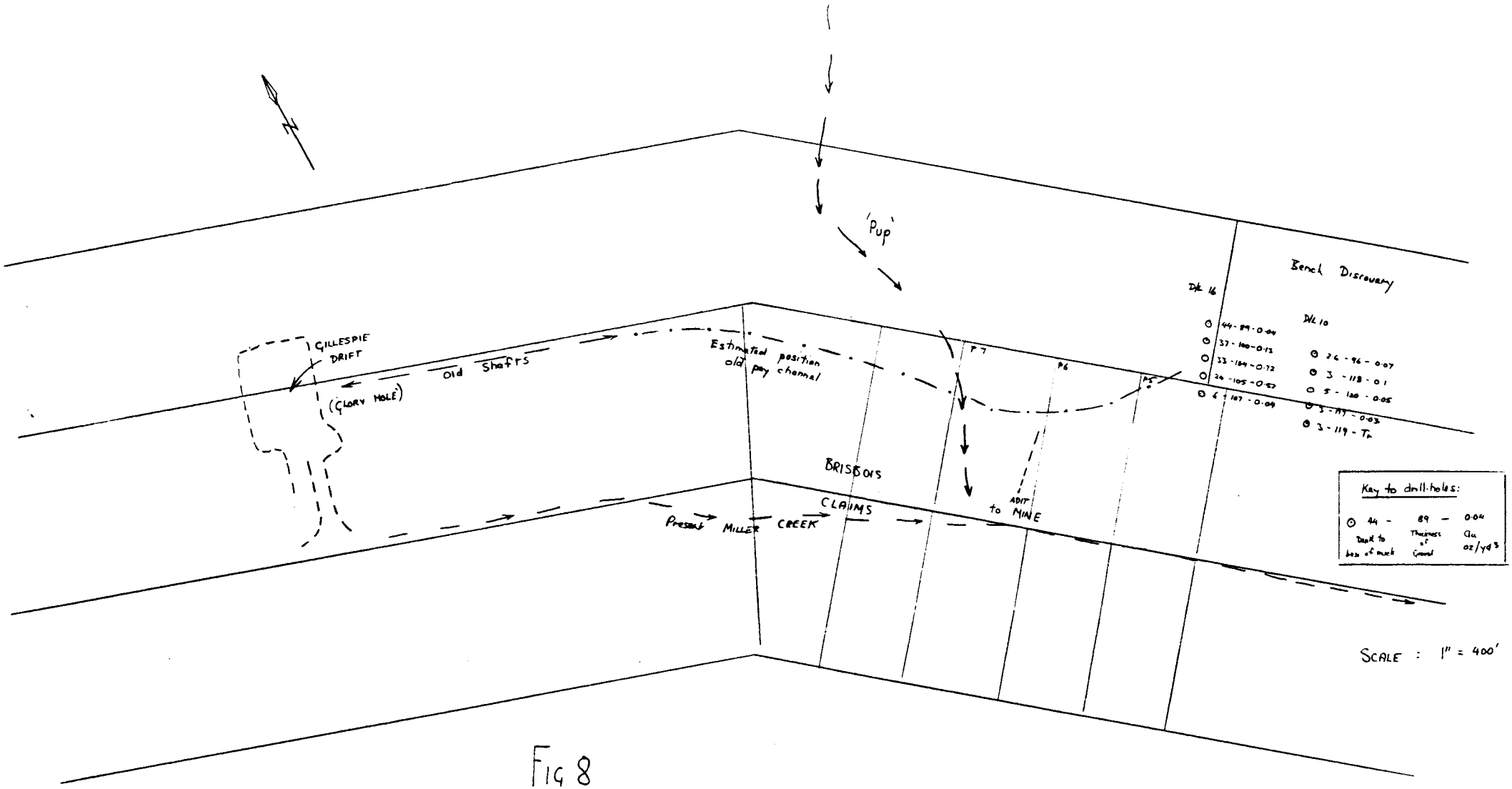


FIG 8

POSITION OF MINE RELATIVE TO ADJACENT CLAIMS GILLESPIE DRIFT AND GOVERNMENT DRILLING RESULTS

4. POTENTIAL UNDERGROUND RESERVES

4.1. Area West Of Present Workings And Adjacent To Brisbois Claim

It is not known how far mining proceeded by the end of the 1985-1986 season. It is assumed that heading E was still 100 feet short and it is estimated that heading F2 was in a similar position. Assuming the pay gravels are 50 feet wide and 10 feet high,

then total volume = c. 2 x (100 x 50 x 10)/27

= c. 4000 cubic yards

If estimated grade = 6.0 gm per cubic yard

Total potential gold = 4000 x 6.0 gm

= 24,000 gm

= c. 775 oz

or c. 900 oz (including 15% nuggets)

4.2. Area South Of Old Mine

It is possible that a parallel pay channel exists in this area (see above).

If the zone is taken from the western boundary of Patsy 6 to short of the government drill line 16 in Patsy 5, then the total length is 800 feet; if pay is 50 feet wide and 10 feet high,

then total volume = $\frac{800 \times 50 \times 10}{27}$ cubic yards

= 15,000 cubic yards

If grade is estimated
at 6.0 gm per cubic yard = c 3,000 oz gold

Then total potential gold = 90,000 gm

or c. 3,500 oz (including 15% nuggets)

4.3. Bench Discovery

Without doubt Bench Discovery has the most potential within the present claims held by KUM Limited. Several obvious factors point to this; they are:

1. Two lines of government drill holes show good grades with the claim over a distance of 300-400 feet.
2. At the eastern end of Discovery in the Sixtymile area, a great deal of gold has been recovered over a considerable width from gravels that adjoin the claim.
3. The underground workings of the present mine have had good grades and all the indications are that the pay channel has swung round and is heading directly towards Discovery through Patsy 5 and Patsy 10.
4. At the present eastern end of the mine, the gradient is steep: 1 in 10; the geomorphology of the palaeo-channel ensures that this must flatten out and in doing so gold will certainly have been deposited as the current slackened.
5. The valley is widening from this point down and the possibility exists that the stream or streams in slackening will have deposited much, particularly finer, gold in the resulting fan.

As the Discovery claim is 1500 feet long, and if the pay zone is taken as 350 feet - the width normal to the pay zone along the government drill hole line - then volume of pay gravels =

$$\text{c. } \frac{1500 \times 350 \times 10}{27} = \text{c. } 200{,}000 \text{ cubic yards}$$

Grade can be expected to average 0.15 oz per cubic yard (5 gm per cubic yard)

Therefore, gold in Bench Discovery = c. 30,000 oz

Whether nuggets will increase this figure by 15% is not known, but it is possible; if so then the total potential gold in Bench Discovery

= c. 35,300 oz.

4.4. Remaining Lease Area

Due to the lack of information, no estimate can be made of the potential gold reserves in the Patsy bench claims (10-16), or Patsy Creek claims (1-7) outside the adjacent area of the mine workings.

5. RECOMMENDATIONS

5.1. Mining Plan For 1986-1987

It is recommended that serious thought be given to mining Bench Discovery as soon as possible. The advantages are obvious as all indications point to good grades. By keeping to the south limit of the present workings and completing the parallel drive started in 1984-1985, a second tramming route can be established. If this tramming route is continued into Patsy 5 and then continued northwards approximately along the junction between Patsty 10 and Bench Discovery, a great deal of information will be gained. This will enable future mining to be planned with a view to selectively extracting high grade ore rather than just yardage. Less yardage but of a higher grade will significantly cut costs both underground and during summer sluicing. Even so, it should be possible to selectively mine 50,000 cubic yards having a grade of c. 5 gm per cubic yard next season.

The main disadvantage of this proposal is the long tramming route that will be necessary and the need for another ventilation raise. However, it is preferable at this stage to have a longer tramming route, with probably another truck and driver, than to open up a second adit.

To continue mining at the present western end, although superficially attractive, would have several obvious drawbacks as the area left to mine is relatively small. However, should a realistic arrangement over the adjoining Brisbois claims be concluded, the matter should be reviewed.

During the next season some exploration should be carried out to the north and south of the present mine workings as there is potential here. It could probably be tied in with the entry into Bench Discovery.

5.2. Employment Of A Geologist

As mentioned above, Tom Morgan, although doing a splendid job under the circumstances, is not a geologist. For a similar salary, a geologist could be employed; the advantages are obvious and have been discussed above; he could also follow up the findings in this report. I believe there are two possibilities, namely:

1. Employ a geologist with knowledge of mine geology, sedimentology and surveying for the mining season, or
2. Employ a student, preferably with similar knowledge, for the season; after this he could spend the next six months working at his University, correlating his work and working on collected samples and then write an M.Phil. or equivalent degree. Both men should be single and in their mid-twenties. The cost would be around £12,000 or less.

Should this idea seem attractive, the various possibilities can be discussed after the presentation of the report.

5.3. Drilling Programme - Summer 1987

The mining method employed by KUM Limited, although flexible, obviously has shortcomings when used initially as an exploration technique. With mining eventually to proceed into Bench Discovery, the nature of the pay zones may cause problems, especially as it is possible that an ancient alluvial fan may be encountered. It is therefore advised that underground exploration for pay

channels be complemented by surface exploration drilling. However, it is not considered necessary to implement this next mining season for several reasons; these are:

1. Two lines of government drill holes are known in advance of the workings.
2. The nature of the recommended mining plan is in itself exploratory.
3. There is sufficient ground immediately adjacent to the present workings than can best be explored quickly and cheaply by driving exploratory headings.

Before planning and costing a drilling programme, the results of next season's mining should be considered. It is recommended, therefore, that surface exploration drilling be considered prior to the 1987-1988 mining season.

5.4. Increasing Sampling Capacity and Facilities

The present method of processing samples at Miller Camp is inadequate (see Appendix A). For sampling to be more effective in directing mining the number of samples taken from the working faces should be increased at least three-fold; also check samples, run-of-mine, bedrock and upper gravel samples should also be taken.

Without going into details at this stage, the following basic improvements are essential:

1. A separate room or hut with its own water system.
2. A rubber-lined cement mixer (or equivalent) in which the cobbles can be tumbled clean.
3. A vibrating screen (screening the samples is the biggest

time consumer).

4. At least one, preferably two, more 'Gold Hounds' or equivalent.

It should also be mentioned here that the surveying and mapping of the mine was extremely basic during the last season. More pegs should be put in and help should be given for a few hours a week to survey in the headings on a regular basis. The sample laboratory should also have a large board that can be used as a drawing table; last season the top of the deep freeze was the only flat surface available!

Sometime in the near future the relative levels of the pay zone should be tied into the surface government survey in order that a three-dimensional picture can be made of the gold-bearing horizon(s).

6. REFERENCES

Daniell, E T	Appraisal of certain gold mining claims in the Dawson District of the Yukon, Canada. RRI International Limited, Report No 4030, September 1984.
Arthur, C	An appraisal of the potential reserves of Lower Miller Creek, Yukon Territory, Canada. RRI International Limited, Report No 4099, September 1985.
Scoretz, M G	Progress Report: Development programme of the KUM property, Miller Creek, Yukon Territory, Canada. January 1986.
Copeland, D J	Klondike Placer Project. January 1984.
Hughes, R L	Sedimentology of the Miller Creek Placer Gravels; Geological Survey, Whitehorse, Yukon. 1985.

APPENDIX A

The system used for the sampling, sample preparation and data recording during the 1985-1986 mining season is itemised below.

1. Sampling

In general, samples were taken as uniformly as possible from the area marked out. These samples were obtained from headings, walls, roof or floor. When possible, boulders were avoided within a sample area to prevent distortion of the final results.

Any changes in the type of gravels in a face were sampled separately to enable, if possible, identification of any particular higher grade zones or strata.

Each sample was identified by a sample number, a working face number, or part of working face, together with the distance of the sample from a specific reference point. This information was noted on site in a sample book. In addition, the characteristics of the gravels sampled (size of cobbles, angularity, colour, type of matrix, cobble rock type, etc) were noted, as were the bedrock type and characteristics.

The sampler felt that the bedrock samples taken (a relatively small number) were of too small a size. The gold in the gravels tended to be more uniformly

distributed when compared to the bedrock where cracks and soft spots tended to give high concentrations.

2. Separation

The samples obtained from underground were immersed in warm water to thaw frozen portions and to loosen any clays and silts adhering to the larger rocks. The samples were then screened at 4 and 14 mesh.

The -14 mesh fraction was treated by a Gold Hound rotating concentrator initially, to produce a rough black sand concentrate and later, by reduction of the water flow, to produce a high grade concentrate. The material was fed to the Gold Hound by a vibrating feeder.

The gold from this high grade concentrate was extracted either by careful (and time-consuming) panning or by amalgamation. After amalgamation the mercury was dissolved from the amalgam with nitric acid and the resulting gold rinsed carefully.

With either method used the final gold product was dried and weighed. If coarse gold was present or the total quantity exceed 0.04 gm, the -4 +14 mesh fraction was panned to check for small nuggets.

After weighing, the grade of the sample was calculated in gm/yd^3 using the initial weight of the sample. From practice it was determined that a weight of

25 kg was equal to $^1/_3$ ft^3 and that 20 kg equalled $^1/_4$ ft^3. Between these limits 0.017 ft^3 was added or subtracted per kg of sample.

The gold recovered from each sample was taped in a record book, together with the sample number, heading name, reference footage, actual gold weight and the calculated grade in gm/yd^3. The grade was also noted by colour coding on a 1 in to 10 ft scale plan of the workings. Both grade and mine advance were updated on the plan each day.

The colour codes used for the various grades are given below:

0 - >2 gm/yd^3	brown
2 - >4 gm/yd^3	orange
4 - >8 gm/yd^3	red
8 gm/yd^3 upwards	yellow