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LONG.: 139°07'W

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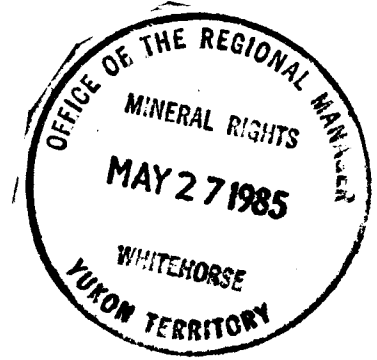
WORK DONE BY: M.W. Milner

WORK DONE FOR: Indian River Gold

DATE TO GOOD STANDING

REMARKS: PLACER PROSPECTUS REPORT


*Milner*



Placer Gold Potential of  
Central Indian River,  
Klondike Placer Goldfields,



a Review  
for  
Indian River Gold  
by  
M. W. Milner  
November 1984



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## Introduction

The segment of Indian River valley upstream from Quartz Creek to New Zealand Creek and downstream to Ruby Creek, about 13 km., is held in large part by Pete Risby and partners (Indian River Gold). Risby has been mining in the bench gravels (1981 and 1982) and in the creek ground (1983 and 1984) along with others who are working on that ground. Faced with a large area of possible ore beyond values encountered during mining and in 1941 and later drilling, and combating high costs of a small operation, the partners wish to gather support for a high volume-low cost mining system amenable to the shallow gravels of large areal extent.

Indian River has not had a recognised production from the early days of mining and prejudices have evolved related to recent unsuccessful mining, a presumed fine grain size, and, because of the lack of old workings, a presumed low grade.

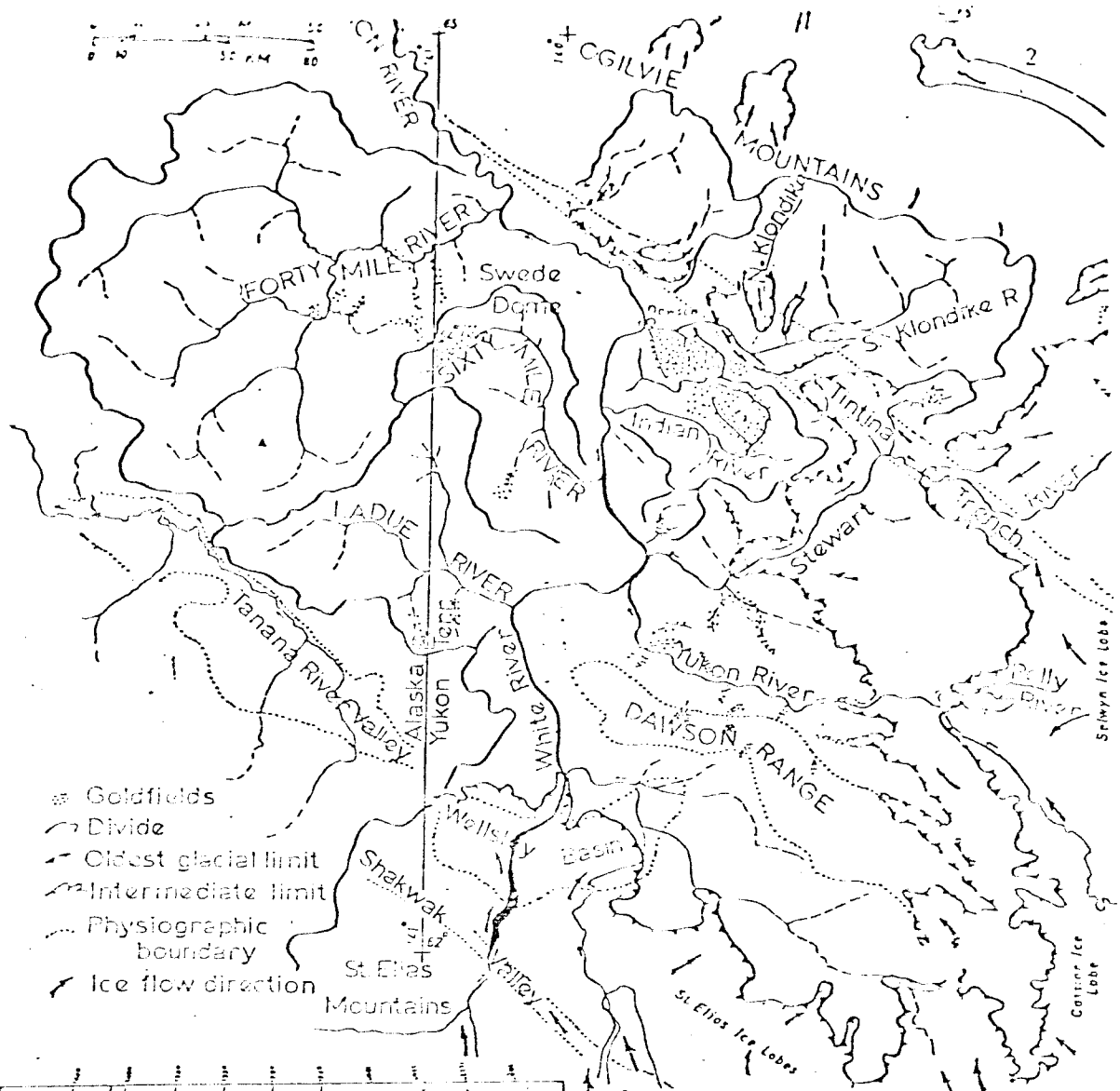
Lacking technical knowledge and themselves learning by trial and error, they attracted others to present technical data on the placer relevant to grade, volume and recovery, as well as exploration and development (see Steinke, 1984).

This author has had an ongoing interest in the area (see Milner, 1977) and since fieldwork in the Klondike goldfields during 1974 and 1975, visited the Indian River area briefly in September 1983 and in September and October 1984, during which time he became thoroughly familiar with the mining and geomorphology, gathering what data was available. It is his intention, as a consultant to Indian River Gold, to present data on the geomorphology, metallurgy and ultimately grade and possible volume that would lead to successful exploration development of a large volume, low grade ore body extending from present mining areas.

Location and Access

About 35 km. south of Dawson City at an elevation of about 500<sup>m</sup> ASL, the central zone of Indian River Gold's ground is served by the Quartz Creek road. Access is by Hunker Summit and the Quartz Creek turnoff near King Solomon's Dome. The upper part of the road is steep and four wheel drive or chains may be required during bad road conditions. Ford crossings are used on both Indian River and Quartz Creek.

An airstrip exists on lower Quartz Creek near the mouth of Calder Creek.



- ⊙ Goldfields
- Divide
- - - Oldest glacial limit
- · - Intermediate limit
- · · Physiographic boundary
- Ice flow direction

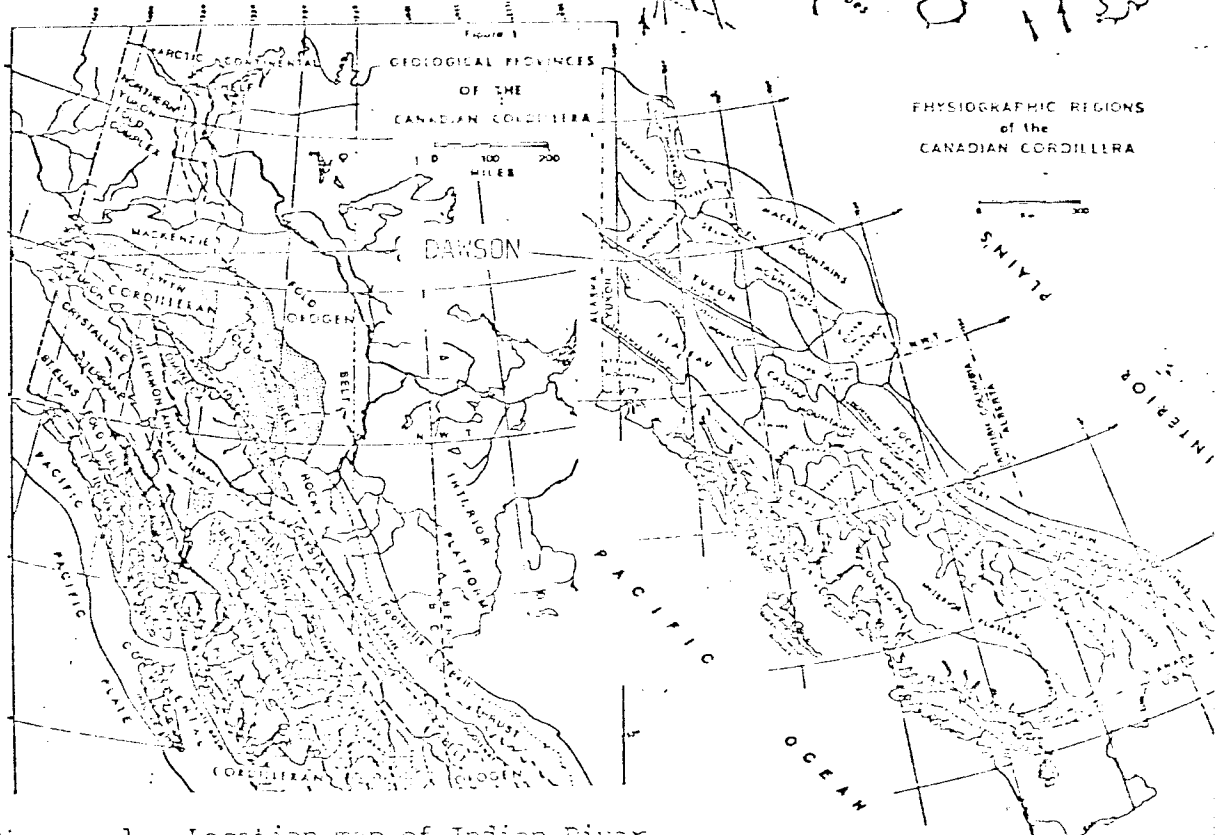


Figure 1 Location map of Indian River

092049 from Milner (1977)

### History of Mining

Early exploration prior to the discovery of the Klondike goldfields was done by Robert Henderson who explored Indian River and Quartz Creek, crossing the divide to Gold Bottom Creek. Following the discovery of gold on Bonanza Creek by George Carmacks in 1896, the area was rushed. The Quartz Creek watershed was fifth most important after Bonanza, Hunker, Dominion, and Sulphur (see Figure 2) and Indian River and all its tributaries were quickly claimed. Indian River, from its beginning at the confluence of Dominion and Sulphur, was held in good standing according to Y.C.G.C. (1934), downstream at least to the mouth of Quartz Creek. Eureka Creek has been extensively mined and Montana Creek has had recent, minor production.

Quartz Creek was mined by various mining methods. The most prominent was a right limit bench which was mined by underground methods in the early days and starting in the 1960's with open cuts by Ballarat Mines, Art Sailor, and later Norvan and others (see Debicki, 1984). Creek bottom gravels were mined in the early days with open cut methods in shallow ground of headwaters and underground methods in the lower reaches.

Dredges exploited the partially mined valley grounds from opposite the most extensive underground mining on the bench, starting upstream from the mouth of Calder Creek, continuing downstream to the mouth of Quartz Creek where the hull now rests (see Plate 2B).

The valley bottom ground of lower Quartz Creek would have been drilled, stripped and thawed prior to mining by the dredge. Part of the drilling program (Y.C.G.C., 1941) extended into the valley of Indian River and from notes on a drill plan (Y.C.G.C., 1950), some consideration was given to mining the valley floor gravels below the modern stream channel (see Map in back). Termination of dredge mining in the Klondike in 1966, for reasons

of economics and labour, ended consideration of reserves beyond the limits of dredging of that time that might have been identified for some higher gold price.

In 1981, Risby commenced on the right limit Quartz Creek/Indian River bench (see Plates 2A and 6A) because of the apparent advantage of elevation and natural drainage as well as ease of tailings disposal. About the same time, others were attracted to Risby's White Channel gravel on the right bank of Indian River upstream from the mouth of Quartz Creek. Greenwall is thought to have recovered 120 oz. in 1982 from the White Channel as well as other production later on the Right limit bench adjacent Risby. White Channel Gold Ltd. mined for a short time upstream from Greenwall without recording production (see Plate 5A).

In 1983, Risby moved onto the valley floor where gravels were thinner and richer, working in a recently abandoned meander loop where permafrost and overburden were minimal.

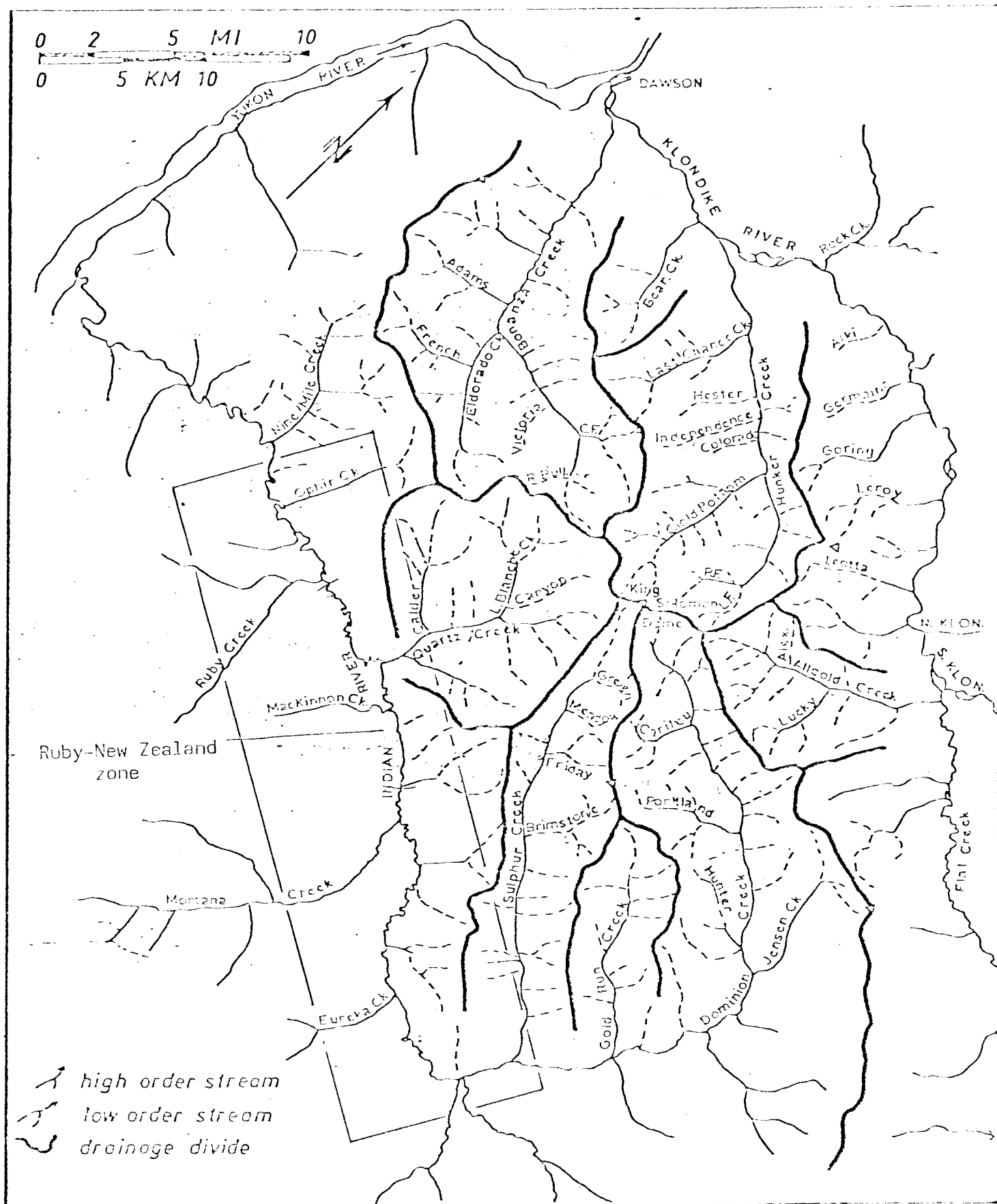


Figure 2 Klondike drainage patterns

from Milner (1977)

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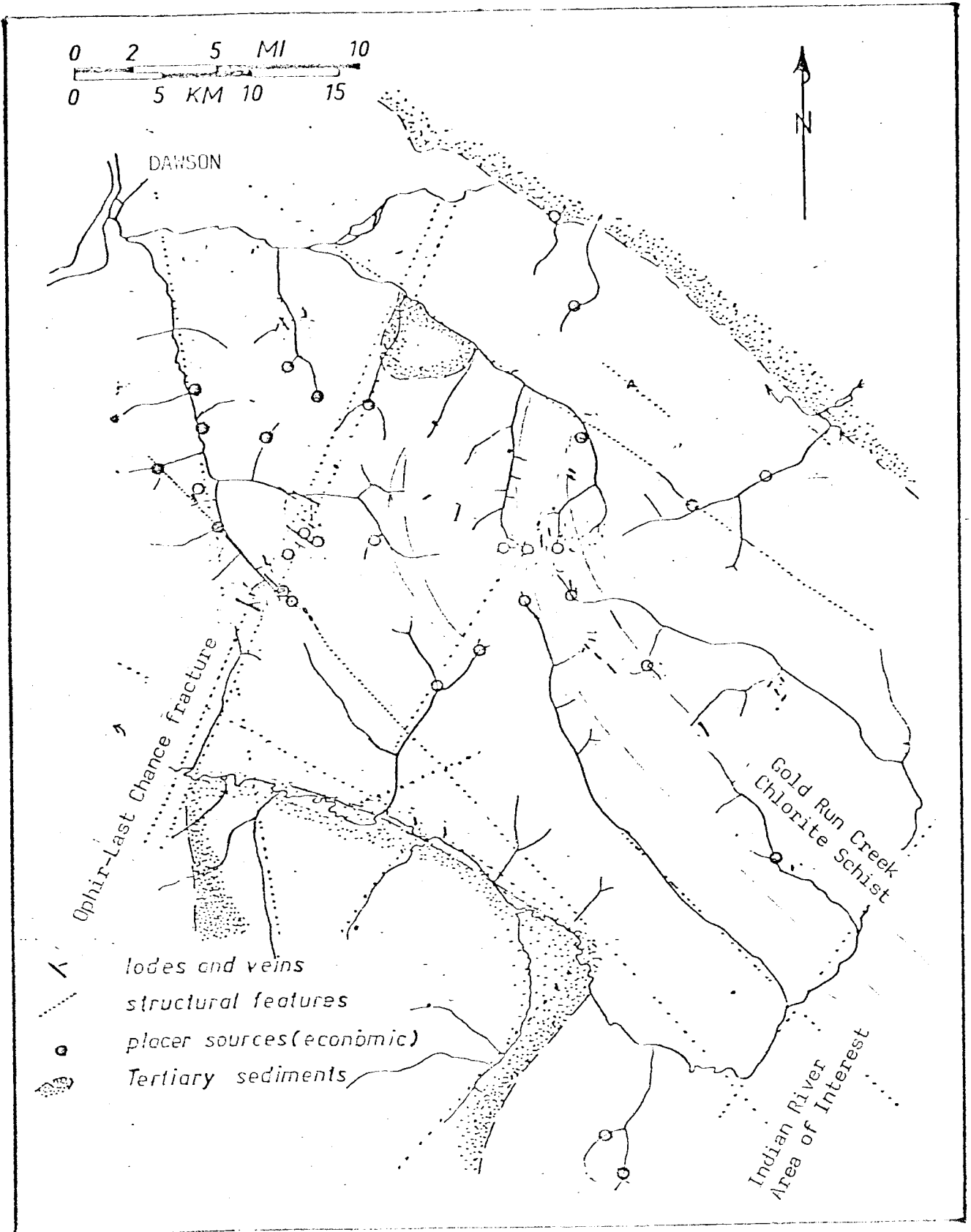


Figure 3 Lode gold occurrences and bedrock controls

from Milner (1977)

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## Bedrock Geology

Two ages of bedrock occur below the placer grounds. The basement, a quartz-feldspar variety of the Klondike Schist, is exposed in oversteepened northern limits of the meanderbelt as well as in some test pitting on the left margin of the valley. Younger sediments and volcanics occur under much of the Indian River valley floor and below the terraces on the south side of the valley. The younger rocks are comprised of quartz pebble conglomerates with quartz clasts that are much more physically and chemically mature than White Channel clasts, and intercalated sandstone and shale horizons. As well, there are igneous flow and intrusive rocks associated with the sediments.

The age and sedimentology of these rocks has implications for them as a source of gold to the Indian River terrace and valley floor gravels (if not as a fossil placer target); the conglomerate as a bedrock lithology is significant in that the nature of the roughness and relief as it relates to capacity for detaining heavy minerals, has implications for local placer concentrations on this bedrock type as well as in associated recessive beds (see Figure 9).

These sediments considered by McConnell (1901) and Bostock (1942) to be Eocene appear now to be older Lowrey (1983). Pollen grains in the sediments indicate Albian age for it. Microfossils indicate a marine environment of deposition in the uppermost of the otherwise fluvial-lacustrine sediment in the Indian River area. McConnell (1901) and McLean (1914) argued a beach environment based on the maturity of the sediment; Armstrong et al. (1968) were undecided on the environment of deposition. Based on microfossils in pebbles, the source of the chert pebbles in the lowermost "red conglomerate unit" is probably Triassic in age with a provenance to the southeast (Lowey, 1983).

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Thick sequences of sandstone contain conglomerate beds in which clasts are white vein quartz, Nasina Quartzite, Klondike Schist and chert pebbles of the Road River formation. The implicit paleocurrent is southward across the Klondike terrane from headwaters north of the Tintina Fault; braided river deposits grade upward to marine sediments (Lowey, 1983).

Four units are logged from drill core by Lowey: three conglomerate units identified as red, white and black and volcanic rocks.

The red conglomerate is the oldest known unit and is exposed only in the drillhole; the bottom is not known. The white conglomerate is the most widespread and is the highest stratigraphic unit. It contains 20% conglomerate, 60% sandstone, 15% siltstone and 5% claystone; it occurs in well defined sequences from coarse to thin. Beds are .3 to 3 m. thick.

Black conglomerate occurs commonly within the White unit and owes its colour to the graphite content of the matrix.

Volcanic flow rocks are intercalated with the sediments and dike rock is common.

The structure of the basin is not clear. The conglomerate in drill sections does not appear to have a significant dip if interpretations can be made from such data. Dips of  $45^{\circ}$  to the west are indicated in Britannia claim on McKinnon Creek (McLean, 1914). (These features, seen by the author, could represent cross bedding). Observations in the pit of Risby's 1984 operation are that stratification strikes southeast and dips north in the order of  $30^{\circ}$ . This implies a fault boundary at the contact identified to the north by testing. Slickensides occur in some locations in the conglomerate but do not appear to be significant. Debicki (1984) shows a fault along Toronto Creek extending out into Indian River valley, crossing the conglomerate. Tulley (1974) proposes a fault along McKinnon Creek and implies that silicification is associated with it.

Hydrothermal remobilization of the paleoplacer might be expected from analogues in South Africa and from claims by Mossman et al. (1983) that much of the gold in Huronian conglomerates of Ontario is hydrothermally remobilized. Supporting the concept of hydrothermal effects in the paleoplacer is anomalously high silver values in assays (see McLean, 1914, and Fothergill, 1919). Fineness values calculated for Risby's grab samples of from .007 to .026 oz/T Au, and trench samples of from .002 to .3 oz/T Au are from 014 to 302 fine and from 721 to 791 fine respectively (Bender-Clegg, Vancouver report 424-0371 and Whitehorse BV 424-0812, respectively). Similar values (Fothergill, 1919) for assays from tr to 48 oz/T Au are near 000 (22.1 oz/T Ag) to 749 fine respectively reflect variable remobilizations (Risby's placers have fineness variations  $\frac{\text{Au}}{\text{Au} + \text{Ag}} \times 1000$  from 800 to 818 for the valley and 812 to 835 for the bench). (See Table.)

The nature of lode gold occurrences in the Klondike placer goldfields is poorly known; probably, several types of sources exist.

The source bed concept first applied by Gleeson (1972) is a chloritic facies between Sulphur and Dominion Creeks passing through King Solomon's Dome and swinging eastward between Goldbottom and upper Hunker creeks. This is the oldest source for placer gold in both local paleodrainage in Tertiary streams but also to the older, regional paleodrainage of Albian streams that drained from the north across the Klondike Schist to the Indian River basin.

Fracture zones that may have been active through much of Tertiary time, create plumbing systems for hydrothermal gold which exist with the best example being along Last Chance-Ophir lineament (see Figure 3). This negative topographic lineament on either side of the goldfields projects through topographically positive mineralized areas such as Lone Star mine and Violette Shaft (see Milner, 1977). The age of this mineralization may

be Eocene or Later; if so, it could not contribute to Indian River conglomerate (except as physical, or chemical, contamination from a later placer surface down into bedrock). Numerous faults exist within the Indian River catchment and probable deep graben fractures that exist along Indian River in both Klondike Schist and later conglomerates at some time likely connected to volcanic heat sources. These must all be considered.

Larger watersheds that are auriferous such as Quartz, Sulphur, Dominion, and Eureka supplied gold in the classical sense (see Milner, 1977) with veinlets of gold in headwaters eroding into incising streams. The fine grained and flat gold particles from these watersheds tend to continue down the drainage system for many miles as float or bar gold. Certainly this type of supply exists for Indian River but, based on the large size of gold particles recovered, some gold must come from nearby, possibly completely consumed veins, as well as possible conglomerate sources. Both course nuggets, which are worn on all sides, and compound-character nuggets in which one aspect shows wear and the other shows the angular and shiny "lode surface", newly liberated surface, imply local sources rather than distant ones. "Let down" lode sources, as well as "piggy backing", within Indian River valley have to be considered.

The most modern hypothesis (see Tempelman-Kluit, 1982) of epithermal or, alternatively, deep circulating groundwater calls for precipitation of gold on nails as well as wire and fern gold and nuggets in creeks, as paint on boulders (and ultimately as cement in gravel and as petrification of wood).

## Geomorphology

The geomorphic development of Indian River valley calls upon regional events both of a glacial nature and of tectonic causes so that some attention must be given to regional history.

### Regional geomorphology.

The regional geomorphology logically begins in mid-Tertiary time when the warped and faulted Eocene erosion surface and related sedimentary and volcanic rocks were eroded and relief subdued to what might be considered a rolling Miocene terrain. Uplift of this terrain and entrenchment of drainage marks the real commencement of significant geomorphic history. Shallow gold occurrences in that topography as well as any lag or eluvial or residual placer occurrences from earlier sources including Albian, Maastrichtian or Eocene fossil placers were recycled to the bottom of valleys where they were "let down" or superposed with time into lower topographic levels together with newly liberated gold. Once fluvial equilibrium was attained, valleys widened their floors by meandering, consuming more gold occurrences. In this way, rich placers with high quality gold (high fineness) occurs in valley centres and low grade placers with low quality gold (low fineness) occurs beside them. This paystreak model, despite attempts to borrow aspects of it (see Tempelman Kluit, 1982) is the rule in most of the unglaciated placers of Yukon and Alaska.

### Tectonic complications.

Uplift or regional tilt has direct effects on fluvial systems. Increased stream gradient because of tilting results in erosion in the form of headward extension of the valley. Where decreased gradient occurs, the

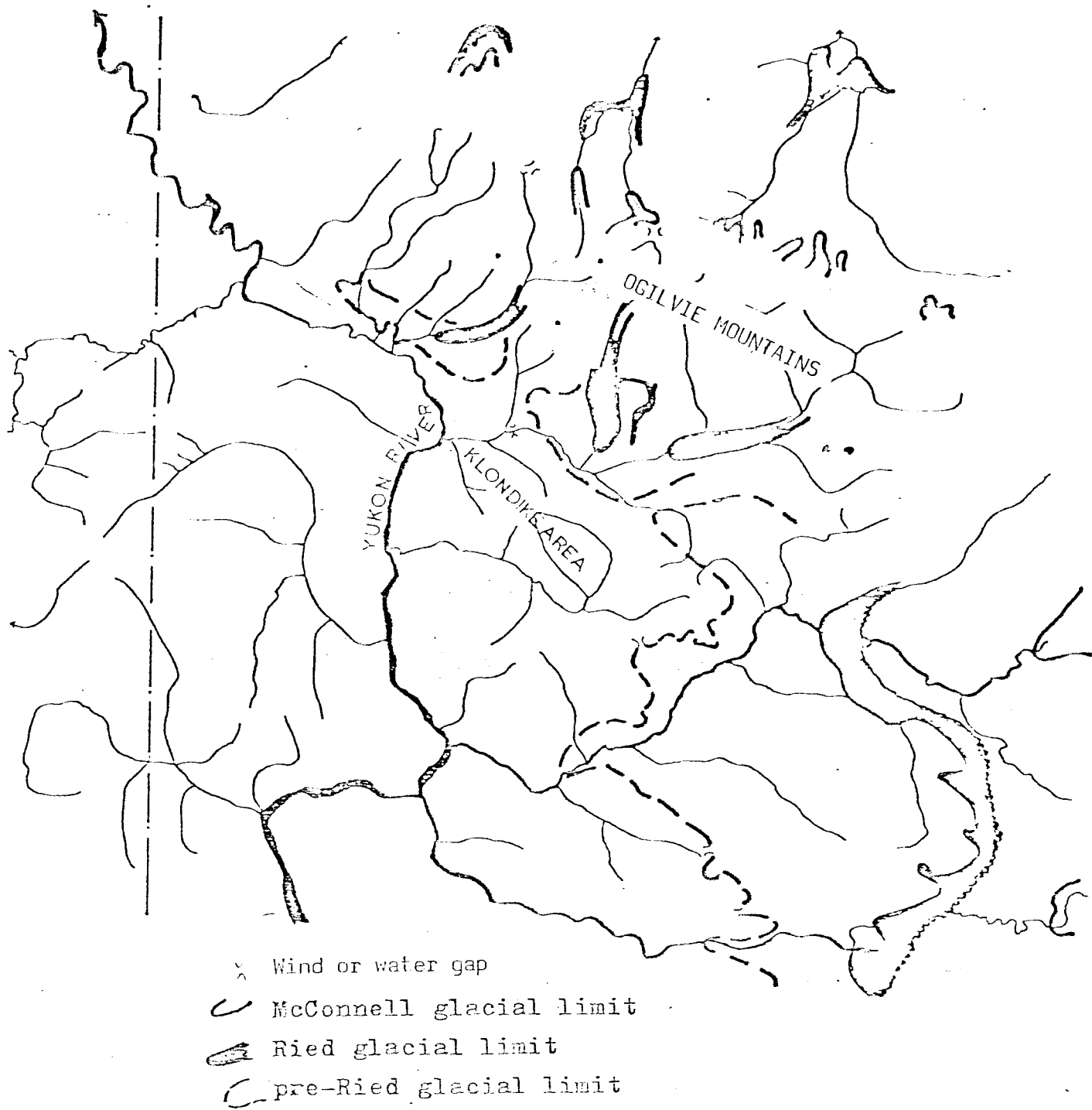
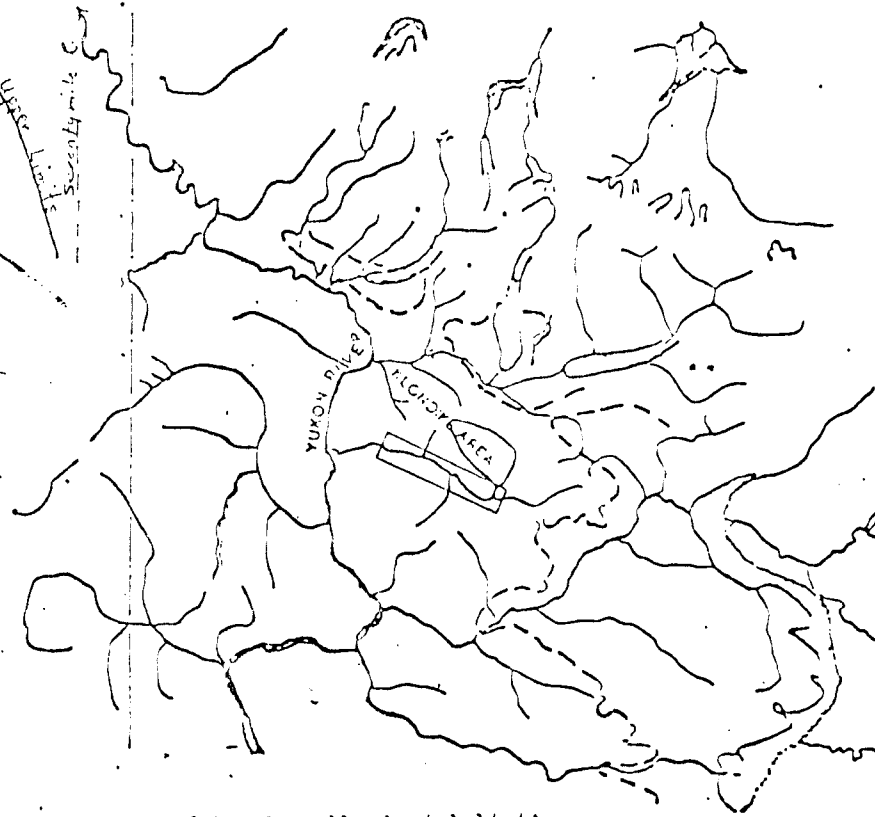
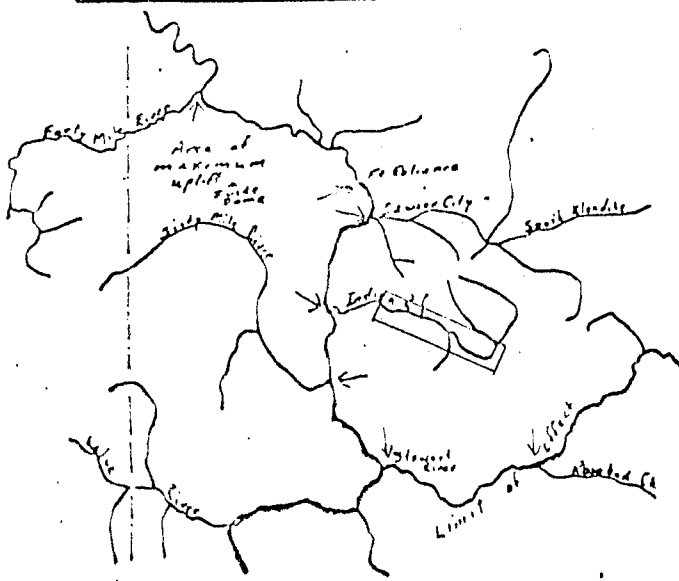
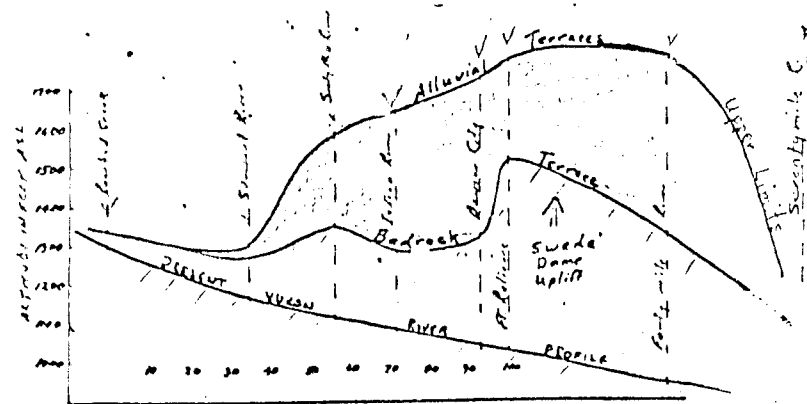


Figure 4 Glacial limits and spillways

from Milner (1977)

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- McDonnell glacial limit
- Ried glacial limit
- pre-Ried glacial limit

Figure 5 Swede Dome Uplift

From Milner (1977)

result is sedimentation. This has regional effects with local ramifications as well as local direct effects.

Upwarp near Swede Dome caused aggradations of a major segment of the Yukon River. This resulted in aggradation in all tributaries to this interval because of the raising of local base level at the mouths of tributaries. As well, valleys draining toward the uplift or in the "uptilt" direction such as Bonanza and Hunker creeks, underwent aggradation on their own account. Valleys draining away from the area of uplift or in the "downtilt" direction, such as Dominion and Sulphur creeks, underwent degradation. Their floors were scoured of sediment with strong basal placer development and these valleys were extended headward.

#### Glacial effects.

At about this time, outwash from the oldest recognised glacial advance entered both the Klondike and Indian watersheds. In the first, the outwash channel at Rock Creek became a diversion or point of capture; in the second, the outwash channel remains at the head of Australia Creek as a windgap. This outwash event in the Klondike valley was followed by entrenchment of the drainage during which an ash fall event occurred and is dated at 1.3 million years (Westgate et al., 1978). Ice wedge casts in the upper part of the White Channel gravels (Milner, 1977) probably mark the first glacial event of the Pleistocene. Two minor periods of aggradations occurred during the entrenchment which caused minor alterations in drainage positions.

Entrenchment of the regional drainage would evolve through migration of nick points, first along master streams and eventually into tributaries. Local obstructions such as hard dike rock tend to retard nick point migration; aggradational events, whether climatic or tectonic in cause, would tend to bury such features.

Part of the regional history involves superposition of streams from some alluvial surfaces; this applies to the entrenchment following the main aggradation event as well as the two minor, later ones. Streams tend to be shifted in the downstream direction at their confluence with master drainage. Prominent examples occur at the mouth of the Klondike River (Lousetown Bench), at the mouth of Bonanza Creek (Lovette Hill) and at the mouth of Hunker Creek (Australia Hill).

#### Geomorphology of Indian River.

The White Channel bedrock terrace is a prominent feature in the valley. The bedrock terrace is recorded 70<sup>m</sup> above the Yukon River at Indian River mouth, while the alluvial terrace is 144<sup>m</sup> above water level (332<sup>m</sup> ASL). The alluvial terrace is a prominent feature in the lower reaches of Indian River valley and is distinctive on the left side of the valley, downstream from Quartz Creek at 50<sup>m</sup> ARL and on the right side above Quartz Creek mouth. It is well displayed on the left bank near Eureka Creek. The White Channel terrace is exposed in Quartz Creek as a right limit bench with the bedrock 10<sup>m</sup> above the creek. The White Channel gravels underly the valley floor in lower Sulphur Creek where they are 8<sup>m</sup> deep and occur as a low bench on Goldrun Creek.

The outwash gravels which overly the White Channel gravels on the right bank alluvial terrace also appear further up the side of the valley implying that the prominent alluvial terrace is a later feature developed during incision of the valley fill. Minor low level alluvial terraces also occur.

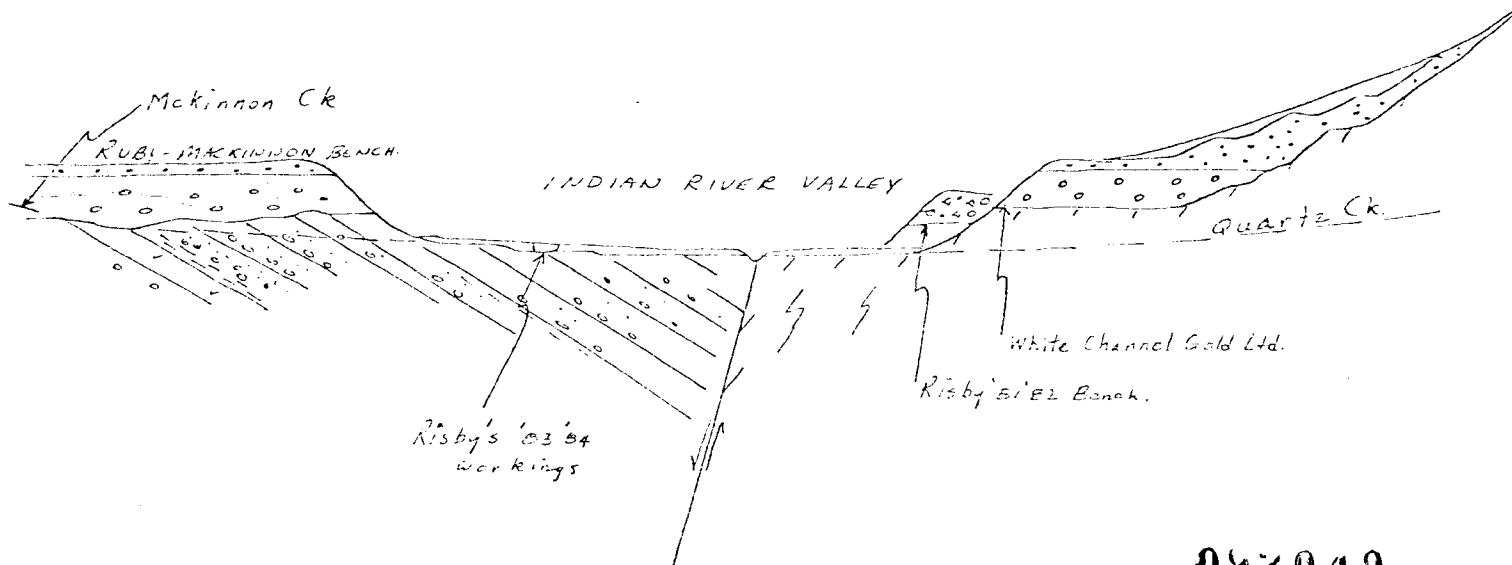
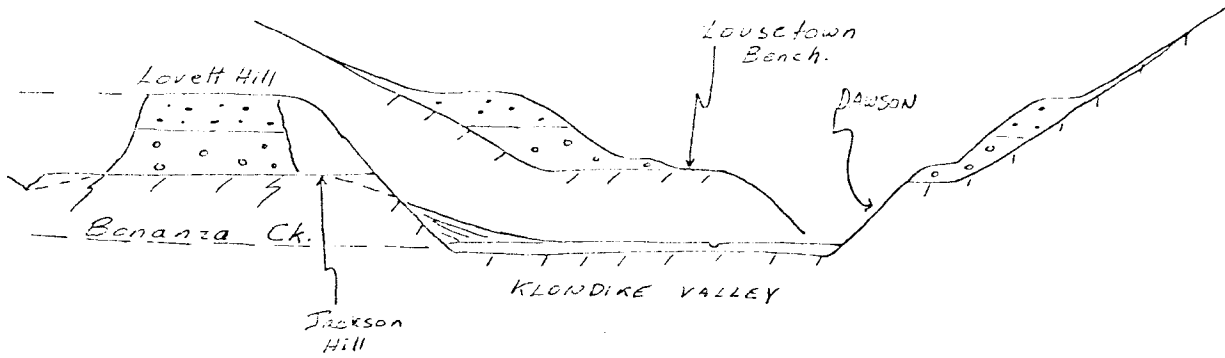
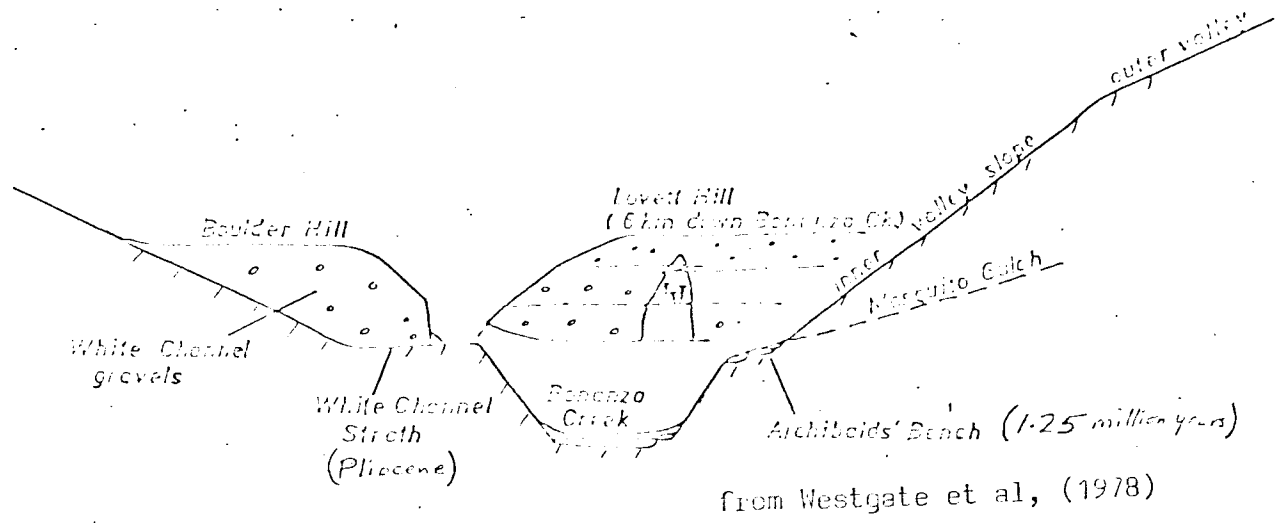
A prominent nick point occurs near Ophir Creek (see Plate 6C). Above this point, the floor of the valley is broad with a prominent meandering river; below Ophir Creek, the river is entrenched with prominent entrenched

meanders showing strong bedrock control in numerous reaches. Valley floor gravels are in the order of 2<sup>m</sup> deep on this strath (see Plate 4A).

Several prominent geomorphic features are relevant to the placer potential of Indian River. The White Channel bedrock surface is probably preserved in both valley centre positions, as near the Montana Creek superposition (see Plate 5A), and on the left bank terrace (see Plate 5B and 5C), where its presence is masked by glacial outwash gravels and colluvium. Tributary shift in the down valley direction during alluviation should have preserved White Channel bedrock and gravels in several points such as on the right bank of Eureka, Montana, McKinnon, and Ruby creeks where those valleys meet Indian River valley. Likewise, the left bank sites of this model have potential for New Zealand, Quartz, Ophir and Ninemile creeks.

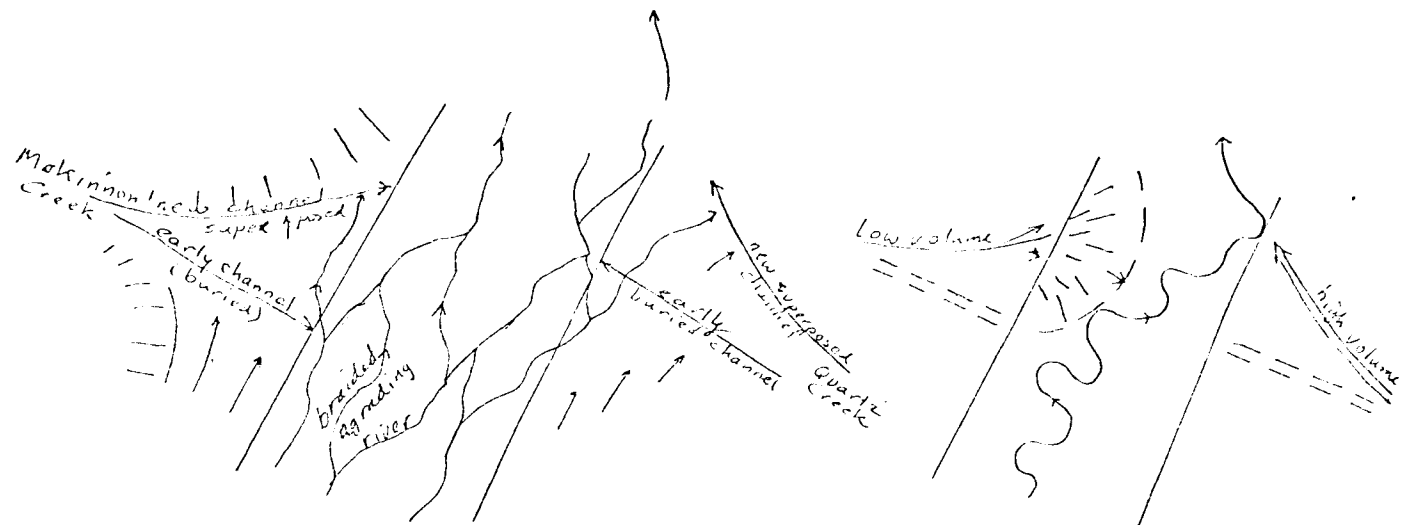
The consideration of bedrock sources should be combined with the broader geomorphic features in exploration. Faults and fracture systems may both control drainage patterns and provide gold to the controlled channel; in this respect, faults and fractures should be sought on favourable strath positions and evaluated specifically for both primary source and subsequent concentrations. Stratigraphic source rocks should receive consideration. Upper Australia Creek may have potential in this respect (if placers developed there were not destroyed by floodwaters from the glacial spillway upstream). Montana Creek and the tributary between it and Eureka, as well as Ruby Creek, are possible source zones, where basal auriferous conglomerates should outcrop. As well, the upper marine facies of these conglomerates (known only from drill data, Lowey, 1982) may supply marine placer gold to streams draining that facies or directly to the White Channel strath as well as the modern Indian River strath, where they cross that possible source.

Bedrock character as a surface of placer concentration has to be considered from the point of view of an exploration target as well as an evaluation factor in testing.



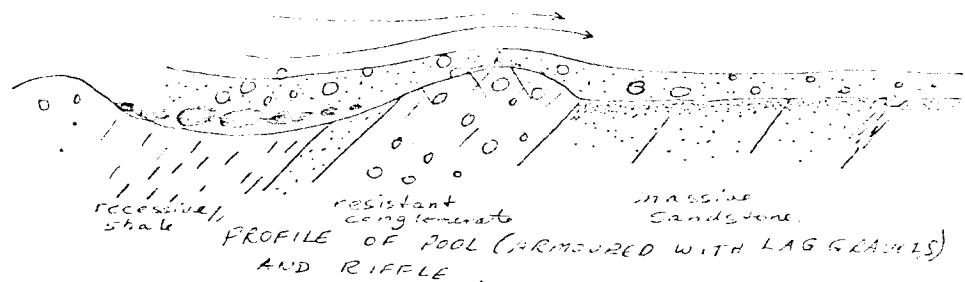
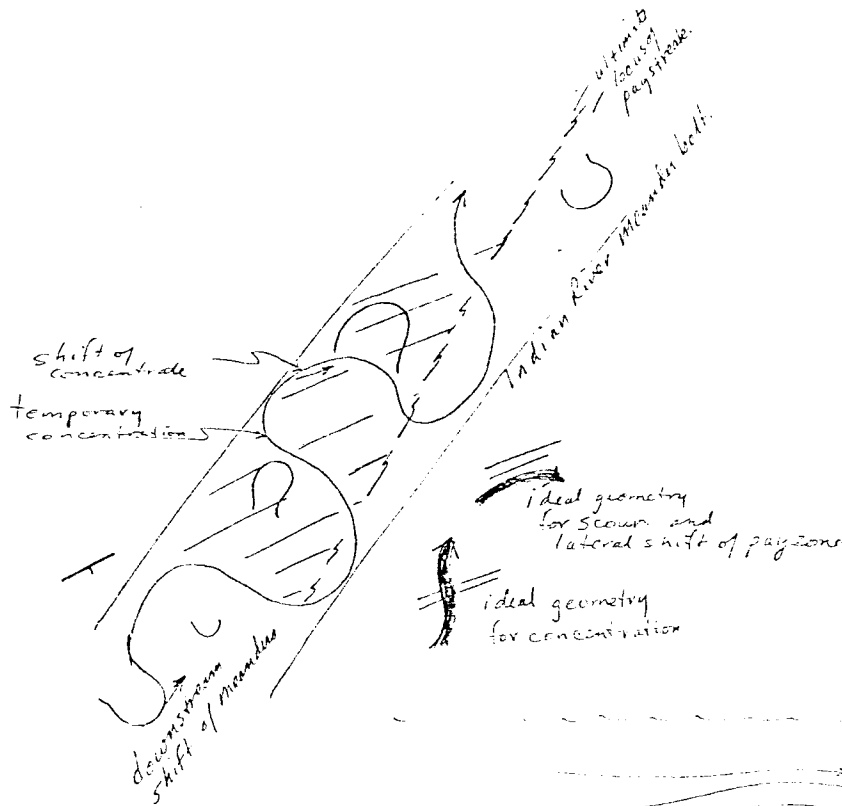
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Figure 6 Schematic sections of the Klondike and Indian valleys



AGGRADATION  
AND  
DOWN VALLEY SHIFT  
OF ALL TRIBUTARIES

DEGRADATION  
AND  
SHIFTING OF MASTER STREAM  
BY ALLUVIAL FAN CROWDING  
OF LESSER TRIBUTARIES  
AND ATTRACTION BY GREATER  
TRIBUTARIES



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Figure 9 Principles of placer concentration in Indian River valley

### Exploration Program

Three potential targets exist in this proposal: the valley floor of Indian River, which has the most immediate rewards; the bedrock terrace or remains of the White Channel placer system, which is less known and less accessible; and the Cretaceous conglomerates on which parts the previous targets have evolved, which is least known and which produces the greatest challenge if not the greatest potential and most distant rewards.

### Valley Floor Placers

The modern valley floor is the first priority for exploration and development for several reasons. The strath on which the gravel veneer lies is the most extensive, most obvious target (see Plates). It is the most homogeneous and most predictable in terms of overburden and gravel thickness. The cost of exploration, land preparation and mining are the lowest. The average grades are higher both in theory and from limited mining experience.

The logistics and economics of mining would argue that the valley floor be mined first. If it is higher in grade and easiest to explore; it would be the logical place to initiate development and mining, while more distant valley floor and bench reserves are developed and conglomerate targets identified. Further, the bottom ground adjacent to terrace mining sites should be mined early in order to provide sites for spoil piles and tailings dumps. The logistics of dumping off the edge of the terrace is the best solution to disposal of overburden and tailings from the point of view of both economics of mining and from the aspect of land reclamation. (The problems of hydraulic mining or stripping that arose in historic U.S. mining that outlawed hydraulic mining would not apply in this area because

of the broad valley floor, the low land value and the acceptability of smooth tailings fans as opposed to more offensive and apparent "push piles".) Metallurgy and recovery methods developed on low cost valley floor gravels would apply to the more difficult bench values and experience in the valley would aide evaluation on the bench.

Much is known about the valley floor. The section of Indian River opposite Quartz Creek was drilled (Y.C.G.C., 1940) along with similar targets near Montana Creek, Eureka Creek and the head of Indian River (Indian Creek) below Dominion and Sulphur creeks (Bostock, 1941?). Early exploration shafts occur near Quartz Creek as well as in a belt upstream from Ruby Creek (see Figure B and Map in pocket). Risby tested bedrock values along the active course of Indian River which, because of its sinuosity gives a reasonable distribution of the samples across the valley floor. The author took part in tests of this sort (see Plate 4A and Grade and Volume). Risby mined during the summers of 1983 and 1984 in a very recent meander cutoff on the valley floor, a site where he could mine with neither overburden nor permafrost. His grade, based on shipments of gold and payments made in gold, not allowing for sluicing losses, are in the order of 1 gram/cubic yard (see Distribution of gold... ).

#### Testing Program

Previous testing at best is semiquantitative. The drilling is an unknown entity done 50 years ago. This ground is atypical of most dredged ground in the Klondike. Normally, mining recovered from 115 to 135% of the grade indicated by drilling (see Hester 1970 and Nordale 1947). The inhomogeneity of bedrock here and local riffle effect make drill samples of the basal gravel uncertain.

Bulk samples taken by Risby with a loader below the active channel

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tend to give an underestimation of grade. First, there is a tendency for the low grade, higher level gravels to slough into the lower samples. Second, during the cleaning of bedrock on which the high grade basal gravel rests, the action of a toothed bucket in these wet gravels and on blocky bedrock tends to produce a loss into the blocky bedrock. Third, gravity classification occurs during the transportation of the wet sample by the frontend loader from the channel floor to the bar where it is dumped and where it tends to mix and again settle. Sampling this pile, taking a 20 litre (five gallon) sample with a hand shovel appears to underrate the gold content of the sample which has already undergone dilution.

The ideal sample should be from frozen ground so that there is no contamination by either sloughing from the wall of the pit, from flow of wet (or "quicksand") gravel near bedrock or from percolation transporting fine gold, the matrix of a wet gravel.

The sample should be large and the entire sample should be processed and measured for grain size of the gold and for gold content, considered in terms of the area of bedrock exposed and by the volume of gravel processed.

The sample should be cut across the grain or strike of the bedrock to obtain the best average grade across local high grade or low grade bands. Trenches should be in fences (see Map in pocket), spaced initially at 300<sup>m</sup> intervals along the valley, with samples taken initially at 100<sup>m</sup> intervals along the fence.

Trenches should be made by a backhoe capable of digging permafrost and sampling to depths of 5<sup>m</sup>.

The trenches should be about 1<sup>m</sup> wide and 4 or 6<sup>m</sup> long, and on the average 3<sup>m</sup> deep. All the material should be processed.

Other methods of exploration that could be considered but which should

not be necessary are seismic (Pullan and Hunter, 1983), ground radar sounding (Annan, 1982; Annon and Davies, 1976) and magnetic mapping.

An alternative method is drilling large diameter sonic holes in permafrost and using numerous holes at or near each site.

In all cases, a geologist should log the sample and make observations on grain size, stratigraphy, bedrock relief, and bedrock geology. Level profiles must be made to determine the topography of the bedrock for planning bedrock drains and mining patterns.

This work would be best done in late winter-early spring.

#### Bench placers.

Exploration of the White Channel gravel and bedrock surface should first use geomorphic interpretation extending from targets outlined here to field mapping and bulldozer trenching to identify subcrop of the bedrock terrace. This would be done by mapping upper limits of bedrock near the projected level of the buried terrace, as well as breaks in slope that might reflect the contact between the White Channel gravel and the bedrock. Trenching with a bulldozer equipped with a ripper capable of breaking permafrost on these sites would identify the contact and allow sampling at that point. Alternatively, a seismic survey or radar sounding may outline the horizontal bedrock-gravel interface and define its limits. Drilling or drifting would be required to determine the existence of the surface and the distribution of gold away from the margin of the buried terrace where overburden thickens.

Intense solifluction on south sides of valleys tends to bury alluvial terraces that might otherwise advertise the possible existence of a buried strath terrace.

Fossil Placers.

Available data on this target is limited. Near surface development of the MacKinnon Brothers ca. 1911 was done in areas which they found to be favourable in McKinnon Creek; minor pits occur in locations with exposed conglomerate. Cominco Ltd. performed work amounting to 11 years of assesment credit in 1968. Yukon Revenue drilled in 1973, the reporting of which is in Lowey (1982). The distribution of the conglomerate and related rocks is mapped by Bostock (1942) based mainly on float and pebble occurrences in colluvium; the structure is poorly known with the exception of features discussed earlier.

A reasonable beginning for new exploration of the conglomerates would involve compilation of existing data. Geological and sedimentological mapping should follow in mines and in test pits cut during exploration of the valley floor and the bench targets since the bedrock there has to be examined for other reasons. Consideration must be given to both placer gold values as well as hydrothermal mineralization and lateration. Trenching should be done to improve exposure and bulk sampling and sluicing and panning of the samples should be done to identify gold particles that will indicate the genetic type of the metal as well as allow semiquantitative prospecting. (The treatment of the samples should be done with consideration of the fine grained gold particles reported by MacKinnon (in McLean, 1914)).

Distribution of gold, metallurgy, grade and volume

The gold is richest in the basal gravels but values are found in the upper gravels exposed in cuts up to the interface of sandy gravel and overbank silts. Gold on the bars occurs without local high grade surface veneers and the gold occurs along the length of the bar, although better pans are had near the upstream crest.

Local high grade zones are recognised as false bottoms above clay horizons, but most significantly values in the basal gravel tend to be high on conglomerate reefs and in recessive shale zones where pyrite and gold tends to concentrate among coarser lag gravels there. The largest boulders are less than  $\frac{1}{2}$  m. and the normal maximum size is 20 cm. along the intermediate axis.

The gold ranges in size from nuggets of up to nine grams in size down to a cutoff about #230 mesh or 64 u. The size distribution of two samples are shown in Figure 11. Both samples have suffered losses in both sluicing and in cleanups but they demonstrate the size of gold recovered from near surface gravels (Osborne's sample) and from the lower gravels (Risby's sample).

Grade and volume figures are shown graphically in Figures 12 and 13.

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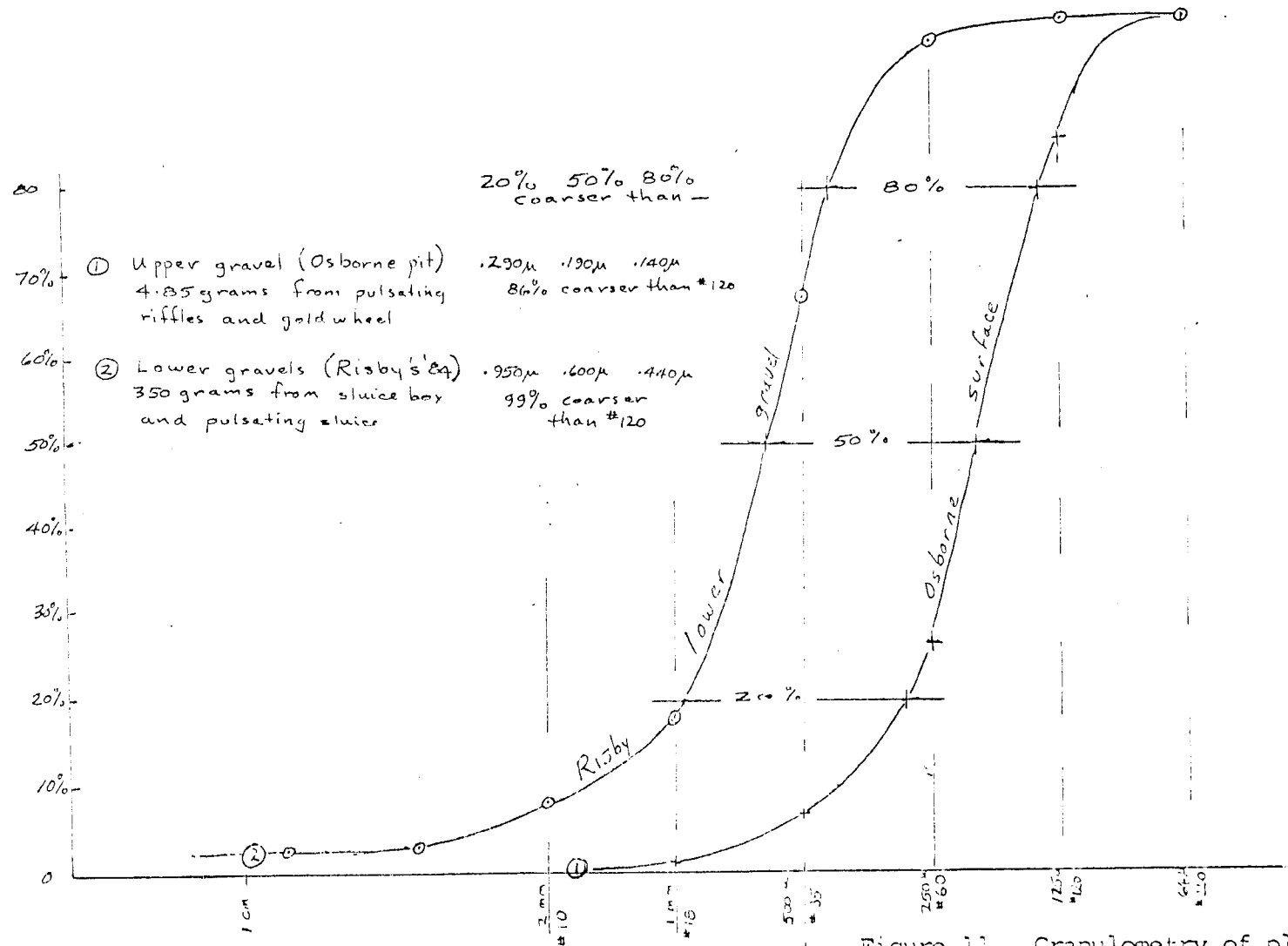
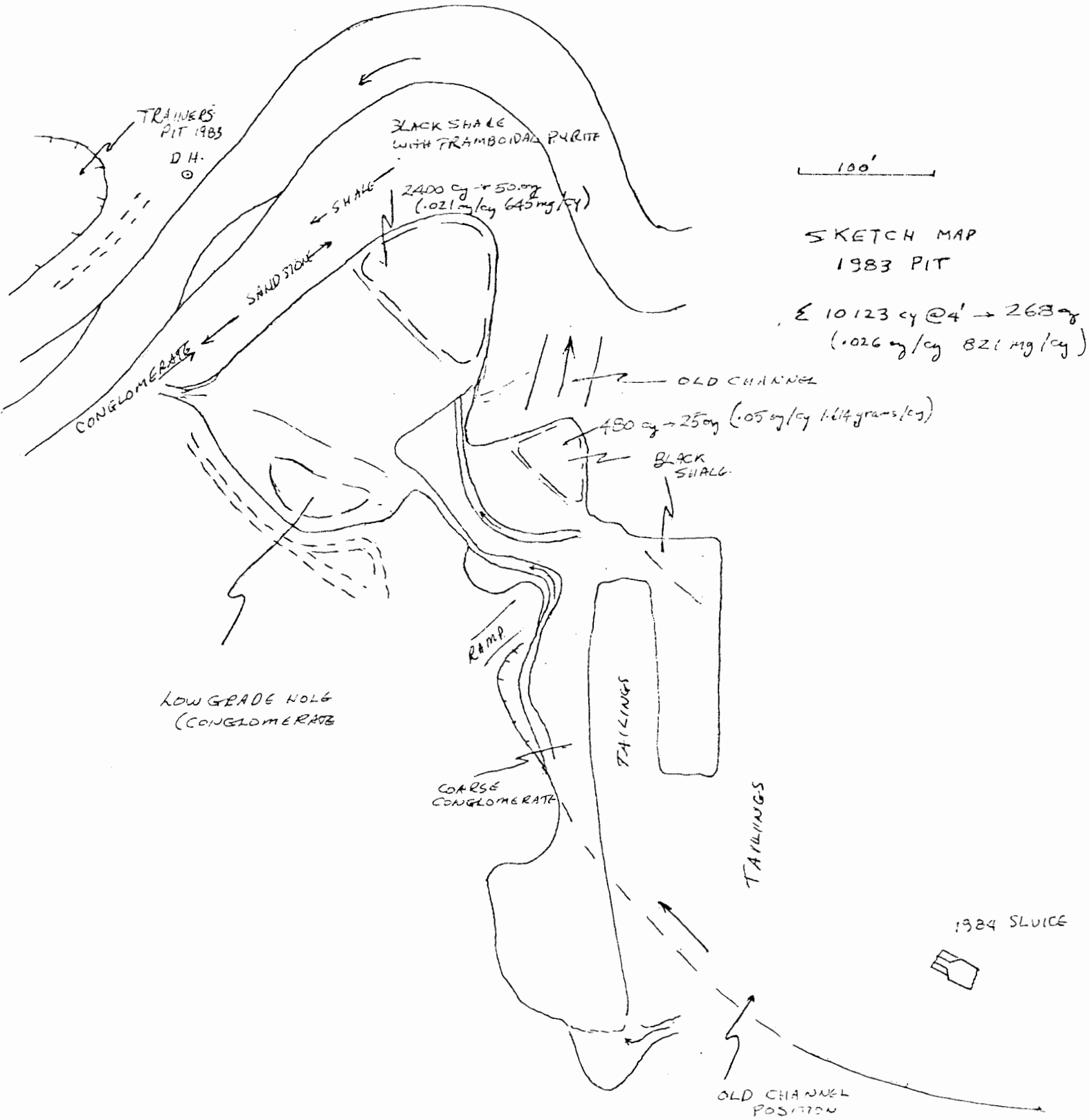


Figure 11 Granulometry of placer gold



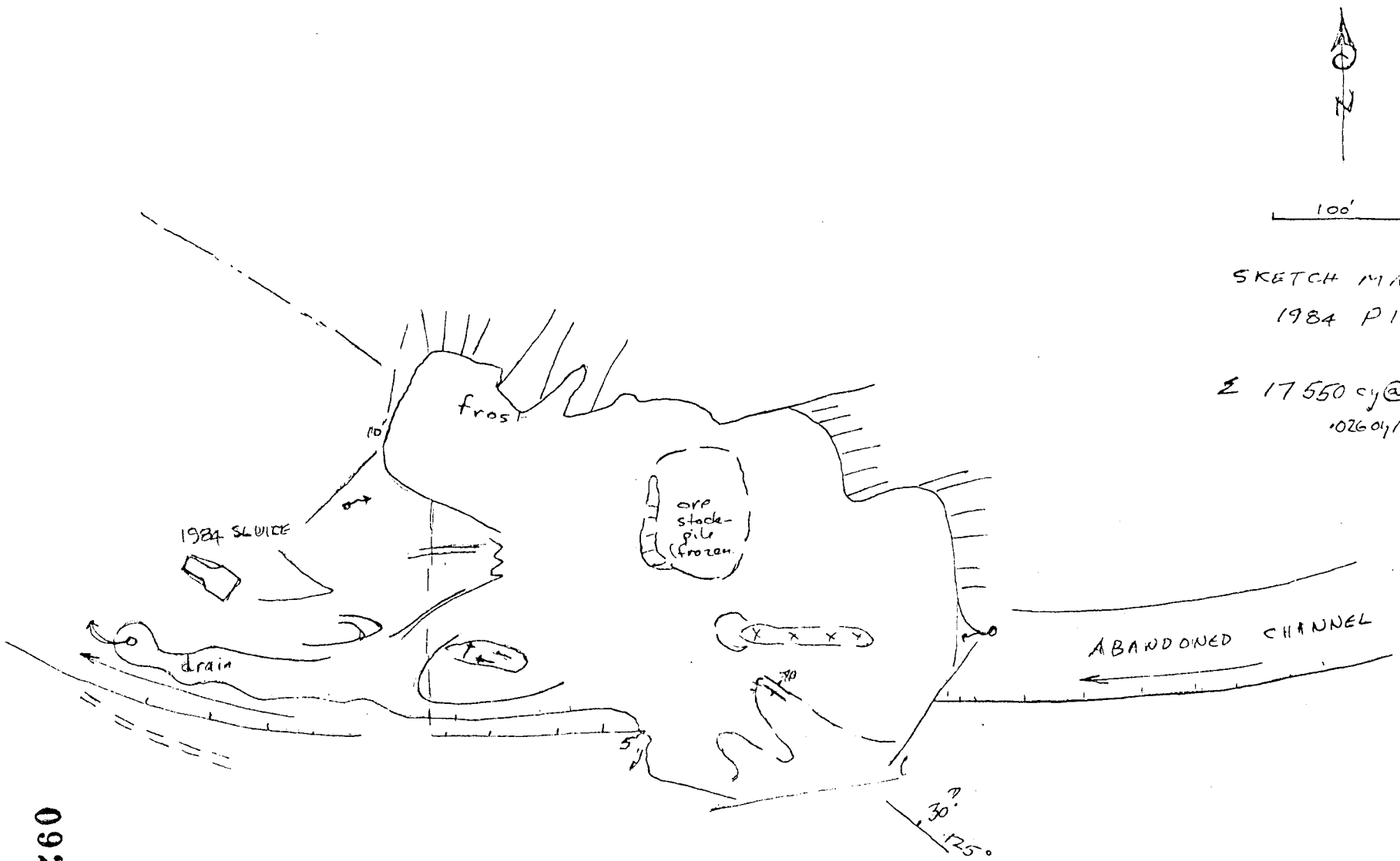
100'

SKETCH MAP  
1983 PIT

E 10123 cy @ 4' → 268g  
(.026 g/cy 821 mg/cy)

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Figure 12 Detailed sketch of recent mining areas



SKETCH MAP  
1984 PIT

± 17 550 cy @ 6' → 462 oy (R)  
1026 oy / cy (816 mg / cy)

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Figure 12 Detailed sketch of recent mining areas

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Standard-  
Schaufelradbagger  
S 400

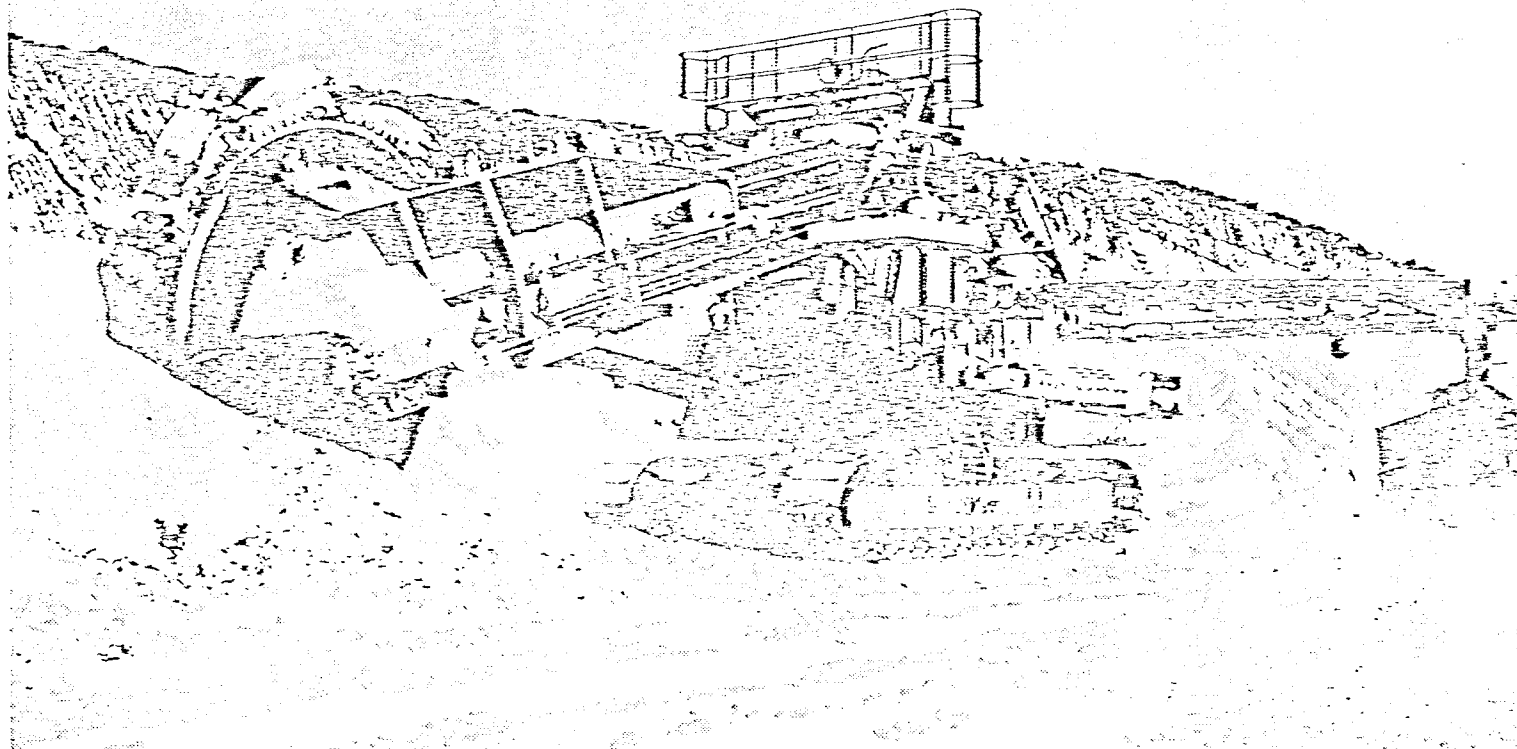
Standard  
Bucket Wheel  
Excavator S 400

Excavateur à roue-  
pelle de constructi-  
on standard S 400

Technische Daten

Technical Data

Caractéristiques  
techniques



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A	Abtragshöhe	11.0 m	A	Cutting height	11.0 m	A	Hauteur d'abatage	11
B	Aushöhe	6.5 m	B	Selective winning up to a height of	6.5 m	B	Hauteur de dégagement pour l'extraction sélective	6
C	Unterplanumschnitt	0.6 m	C	Cut below ground level	0.6 m	C	Excavation en rétro	0
D	Schaufelraddurchmesser	6.5 m	D	Bucket wheel diameter	6.5 m	D	Diamètre de la roue-pelle	6
E	Ausladung des Schaufelrades	11.0 m	E	Outreach of bucket wheel	11.0 m	E	Portée de la roue-pelle	11
F	Ausladung des Verladebandes	20.0 m	F	Outreach of discharge belt	20.0 m	F	Portée de la bande de déchargement	20
	Höhe bis Mitte Bandtrommel			Height to centre of belt pulley			Hauteur jusqu'à l'axe du tambour de bande	
G	max. über Planum	9.0 m	G	max. above ground level	9.0 m	G	- maxi. au dessus du niveau de déplacem.	9
H	min. über Planum	3.9 m	H	min. above ground level	3.9 m	H	- mini. au-dessus du niveau de déplacem.	3
J	Bandsteigungswinkel	15°		Angle of belt inclination upward	15°	J	Angle d'inclinaison ascendante de bande	
K	Bandneigungswinkel	0°	K	downward	0°	K	Angle d'inclinaison descendante de bande	
L	Ausladung des Oberbaues	8.2 m	L	Projection of the superstructure	8.2 m	L	Saillie de la superstructure	8
M	Lichte Höhe zwischen Oberbau und Planum	1.87 m	M	Clearance between superstructure and ground level	1.87 m	M	Hauteur libre entre superstructure et niveau de déplacem.	1.
N	Länge über Raupenkette	7.14 m	N	Length over crawlers	7.14 m	N	Longueur hors tout du train de chenille	7.
O	Bodenplattenbreite	1.4 m	O	Width of track plates	1.4 m	O	Largeur des patins	1
P	Breite über Bodenplatten	6.4 m	P	Width over track plates	6.4 m	P	Largeur hors tout des patins	6
Q	Bodenfreiheit des Unterwagens	0.75 m	Q	Ground clearance of undercarriage	0.75 m	Q	Dégagement au sol du chariot inférieur	0.
R	Durchfahrhöhe des Baggers	9.70 m	R	Clearance height of excavator	9.70 m	R	Hauteur de passage de la roue-pelle	9.
S	Seitliche Ausladung des Führerstandes	4.45 m	S	Lateral projection of operator's cabin	4.45 m	S	Saillie latérale du poste de conducteur	4.
T	Arbeitsschwenkbereich des Verladebandes	2 x ca. 90°	T	Slewing range of discharge belt	2 x approx. 90°	T	Angle d'orientation utile de bande de déchargement	2 x env
U	Bandbreiten	1.2 m	U	Width of belts	1.2 m	U	Largeurs de bande	1

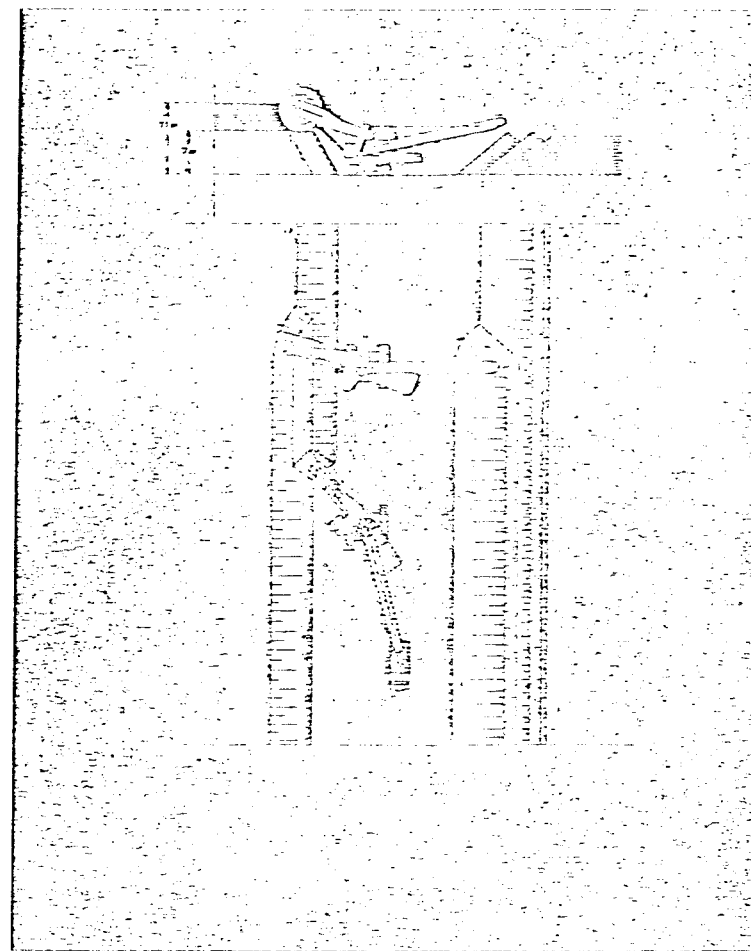
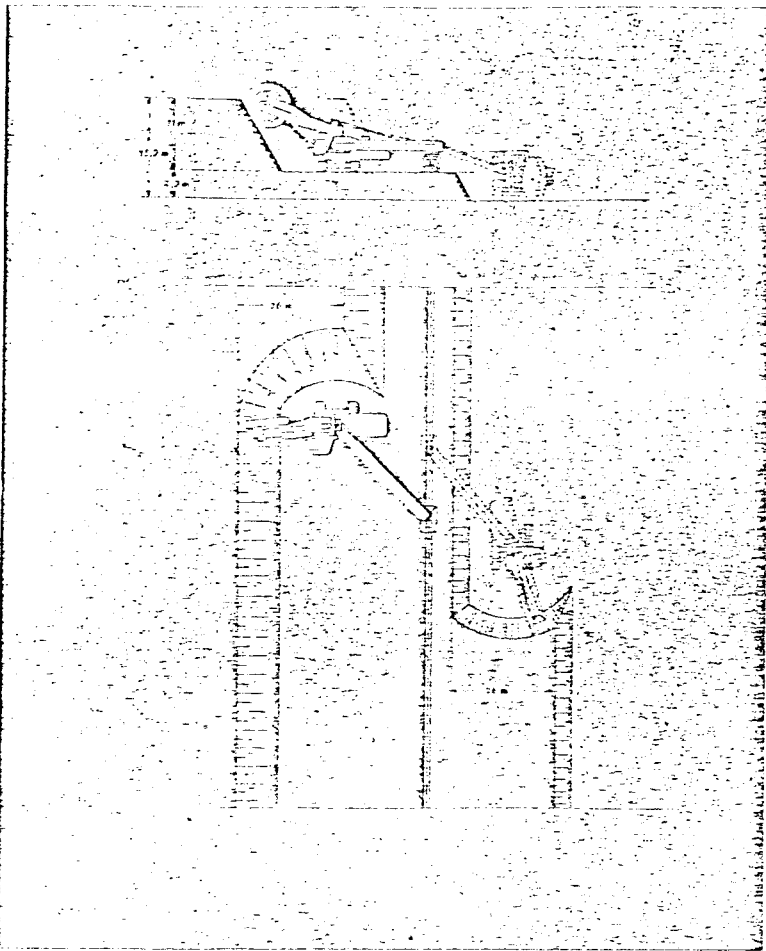
Schaufelnenninhalt	400 l	Nom. bucket capacity	400 litres	Capacité nominale de godet	
Anzahl der Schaufeln	10	Number of buckets	10	Nombre de godets	
Schüttungszahlen/min	60-83	Bucket discharges/min.	60-83	Déversements/minute	6
Theor. Förderleistung	2000 m³/h lose	Theoretical output	2000 loose m³/h	Débit théorique	
Effekt. Förderleistung je nach Bodenbeschaffenheit	500-1000 m³/h fest	Effective output depending on type of ground	500-1000 bank m³	Débit effectif (suivant nature du sol)	
Bandgeschwindigkeit	4.0 m/sec.	Speed of bucket wheel belt	4.0 m/s	500 à 1000 m³/h en p	
Schaufelradband	4.0 m/sec.	Speed of discharge belt	4.0 m/s	Vitesse de bande	
Bandgeschwindigkeit	4.0 m/s	Slewing speed at bucket wheel	6.9- 27.6 m/min	- bande de la roue-pelle	4.0 m.
Schwenkgeschwindigkeit am Sch.-Rad	von 6.9- 27.6 m/min	Superstructure slewable through	360°	- bande de déchargement	4.0 m.
Schwenkbarkeit des Oberbaues	360°	Slewability of discharge belt in relation to superstructure	2 x approx. 90°	Vitesse d'orientation mesurée à la roue	6.9 à 27.6 m
Schwenkbarkeit des Verladebandes zum Oberbau	2 x ca. 90°	Lifting and lowering of bucket wheel (hydraulic)	3.4 m/min.	Orientabilité de la superstructure	
Schaufelrad-Heben- und -Senken, hydraulisch	3.4 m/min	Travel speed	0-10 m/min.	Orientabilité de la bande de décharger par rapport à la superstructure	2 x env
Fahrtgeschwindigkeit	0-10 m/min	Max. permissible inclination at work	1:20	Relevage et abaissement hydraulique de la roue-pelle	3.4 m
Steigungsfahrt beim Baggern	1:20	in transit	1:10	Vitesse de déplacement	0-10 m
Steigungsfahrt beim Ortswechsel	1:10	Average specific ground pressure	approx. 130 kPa	Rampes que l'engin peut prendre - pendant le travail	
mittl. Bodendruck	ca. 130 kPa	Bucket wheel drive	200 kW	- lors du déplacement	

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**Gewinnungs-  
betrieb**

**Mining  
operation**

**Service  
d'exploitation**



Blockbetrieb mit Bandabförderung  
 Block operation with conveyor transport  
 Extraction en pleins blocs successifs  
 avec évacuation des matériaux par  
 convoyeur à bande

Getrennte Materialgewinnung  
 Abraumdirektverstoß und Mineral-  
 förderung durch Lkw  
 Selective mining of material  
 Direct overthrow of overburden  
 and transport of mineral with trucks  
 Extraction sélective des matériaux  
 Rejet direct des morts-terrains et  
 transport de mineral par camion

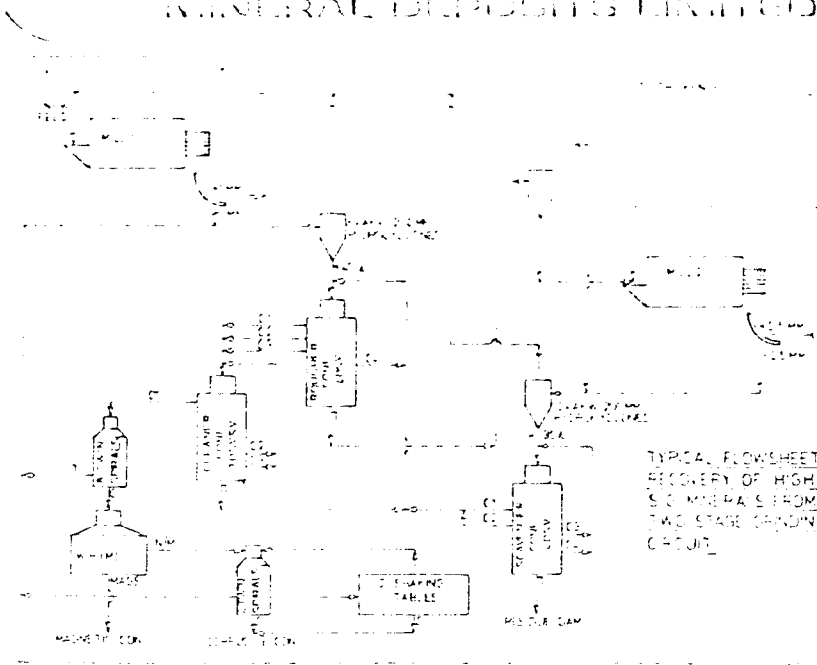




- high capacity, simple feed and product systems.
- high densities of feed slurries minimise pump, pipeline and launder sizes.
- low volume per ton of capacity minimises housing requirements.

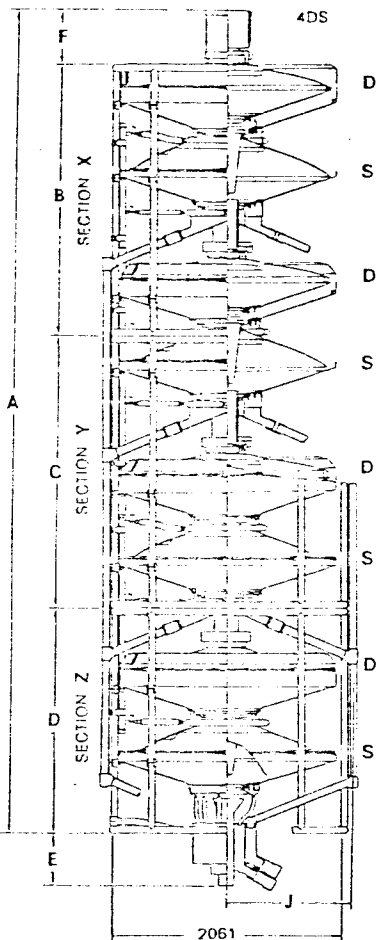
the concentrator is a static device; energy consumption is minimised due to high density/low volume feed slurries and no drives within the concentrator; no reagents are required; maintenance costs are minimised due to construction from non corrosive materials with polyurethane elastomers employed at potential wear areas. The low energy consumption and lack of moving parts also contribute.

cone concentrator circuits are in successful operation in a wide range of applications; the flexible internal flowsheet permits optimising of specification for particular applications; Mineral Deposits has developed the associated technology, including computer simulation of complete metallurgical circuits and the engineering design of related plant; test facilities are available in Australia, Sweden, USA, UK and South Africa. Low feed rate pilot systems are available for open and closed circuit operations.



Primary concentration of rutile, zircon, monazite, titanomagnetite and ilmenite in mineral sand deposits.  
pre-concentration of heavy minerals in grinding circuits e.g. cassiterite, scheelite, gold, lead/zinc oxides etc.  
beneficiation of iron ore fines  
supplement or replace high cost oxide and sulphide flotation stages

beneficiation of glass sands  
scavenging of heavy minerals from flotation tailings streams e.g. gold, uraninite, scheelite  
recovery of heavy minerals from placer (alluvial and eluvial) deposits.  
recovery of valuable heavy minerals from tailings dumps e.g. gold, cassiterite, chromite  
concrete sand/pulver separation



60-90 TPH of solids depending on application and test results.  
60-65% solids w/w.  
0.30-1mm optimum, up to 3mm particles can be tolerated.  
50-100m<sup>3</sup>/hr depending on application and solids S.G.

Up to 25TPH solids per cons outlet depending on application.  
65-70% solids w/w  
Up to 7.0m<sup>3</sup>/hr per single cone i.e. 28.0m<sup>3</sup>/hr for 4DS unit.  
minimum of 25 kPa at top of gallery.

CONE CONCENTRATOR TYPE	DIMENSIONS (SEE NOTE)							INSTALLED WEIGHT (kgs)
	A	B	C	D	E	F	G	
DSV	2378	—	—	1676	—	700	1080	480
2DSV	4010	—	1676	2006	90	330	1080	1140
3DSV	6005	1676	2006	2006	209	317	1080	1420
4DSV	7290	2438	2438	2006	240	500	1080	1810
DSVSV	2999	—	—	2286	—	713	1080	570
2DSVSV	6310	1676	2438	2006	—	180	1080	1350
3DSVSV	7862	2438	2438	2286	399	700	1080	1541
DSVSE DSV	4413	—	2006	2006	406	423	1080	1290
2DSVSE DSV	6970	2006	2438	2006	150	510	1080	1575
2DSVSV DSV	6970	2006	2438	2006	150	510	1080	1530

Type Designation:  
D = Double Cone  
S = Single Cone  
V = Variable Insert  
Prefix Numerals = Groups Repeated  
Suffix Numerals = No. of Trays  
This designation is descriptive of the cones configuration from the top stage of a cone concentrator to the bottom. e.g. DSVS6 DSV cone concentrator comprises 1-Double Cone, 1-Single Cone with a Variable Insert, 1-Single Cone with 6 Trays, 1-Double Cone, 1-Single Cone with a Variable Insert.

DIMENSIONS  
Use dimensions as guide only. Certified drawings will be provided on receipt of order. All dimensions in millimetres.  
SHIP PACKING TABLE  
Each cone concentrator section may be packed separately for shipment and bolted to a wooden pallet 2.18m (7' 1 1/2") square x 0.1m (4") high. Each section can also be completely enclosed within a corrugated metal cover if requested by the customer. Alternatively, cone concentrators can be packed in a knockdown condition to half the shipping volume.

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- 1A. Looking west in the 1984 pit. Willows and the embankment mark the left limit of the recently abandoned meanderloop in which the mining was concentrated. The sluice at the downstream end of the pit is above the 10 foot long rod in Risby's hand. The ice level in the pit represents the level of the bedrock gravel contact there. Mining has gone deeper than the water level to recover values in the top of the bedrock. The snow covered peninsula in the centre-left is a bedrock high of harder conglomerate, a thin veneer of which has been mined. The spruce on the slope in the distant left marks the left limit of the Indian River meander belt.

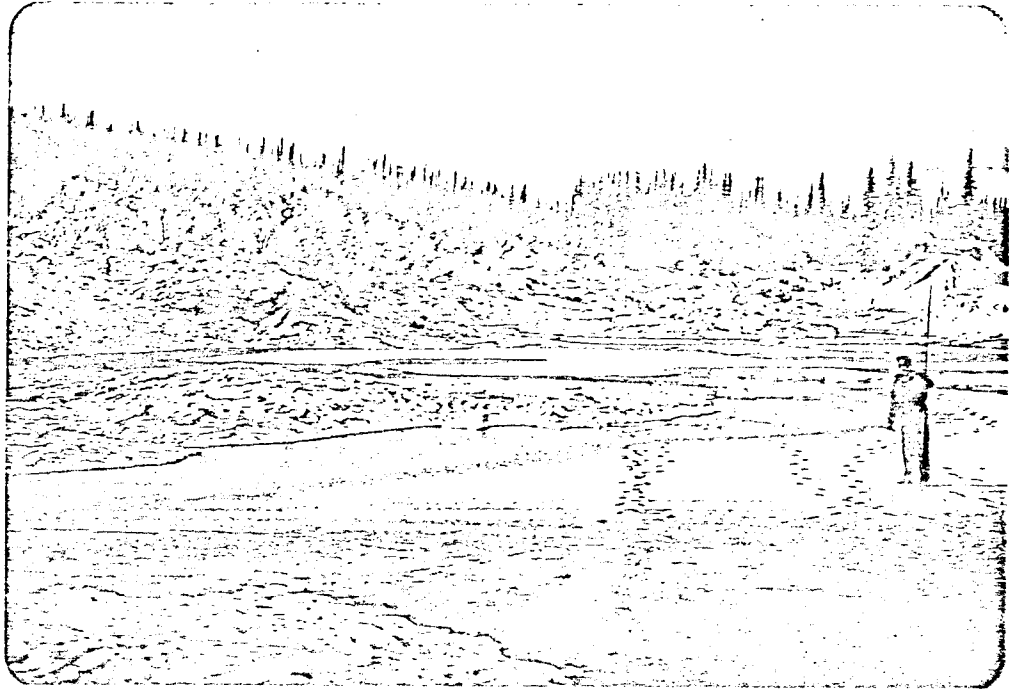


Plate 1A

2A. View in fall 1981, south from Risby 1981-82 bench across Indian River toward McKinnon Creek and Haystack Mountain.

2B. View from helicopter in fall 1981, southwest across the abandoned dredge at the mouth of Quartz Creek towards Ruby Creek. The buried White Channel terrace cut on Indian River conglomerates is highlighted by snow on the far side of the spruce covered floor of Indian River valley.

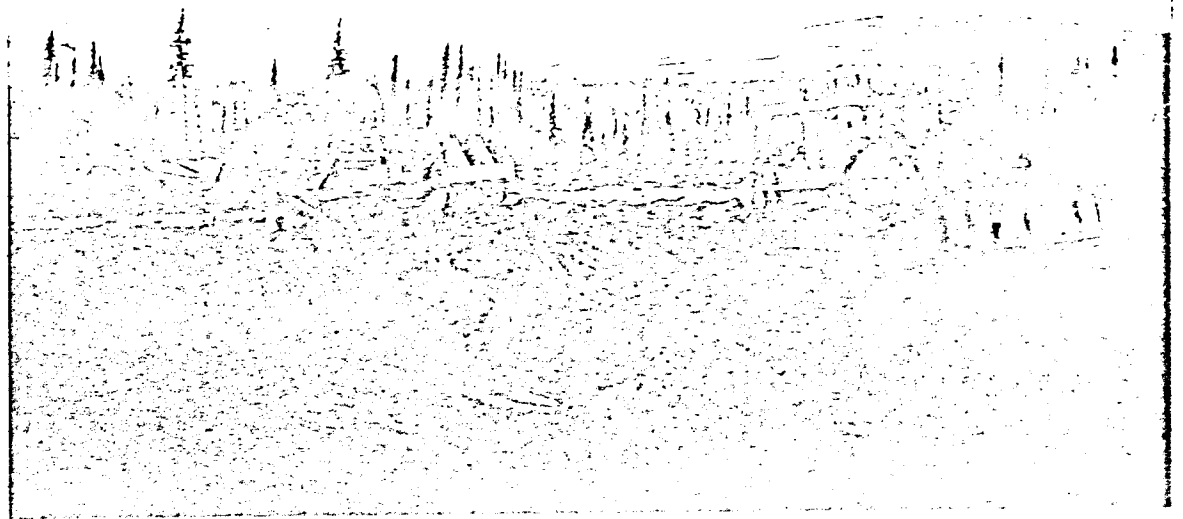


Plate 2A

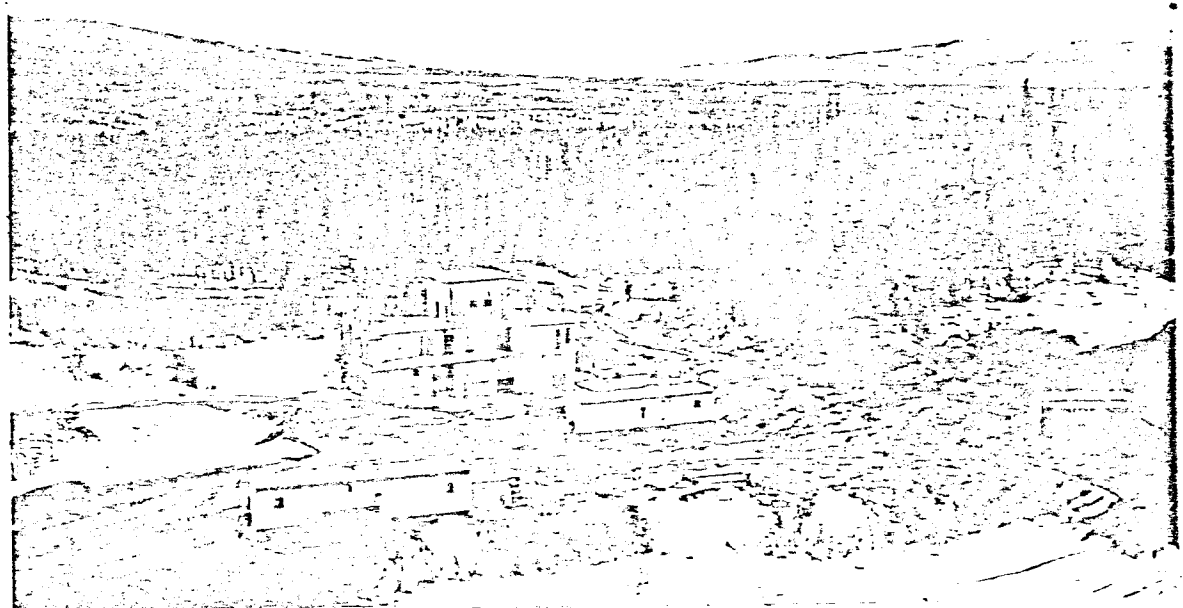


Plate 2B

3A. View from 1984 northeast across the abandoned meanderloop towards the mouth of Quartz Creek and up the valley of Toronto Creek.

3B. Looking east up the valley of Indian River, the channel of the abandoned meander is preserved from the distant centre upstream, to the left in this view, the shadow marking the undercut bank.

3C. View southwest across the sluice effluent, the internal water supply and prepared ground, towards the conglomerate slope below the White Channel bench.

Plate 3A



Plate 3B

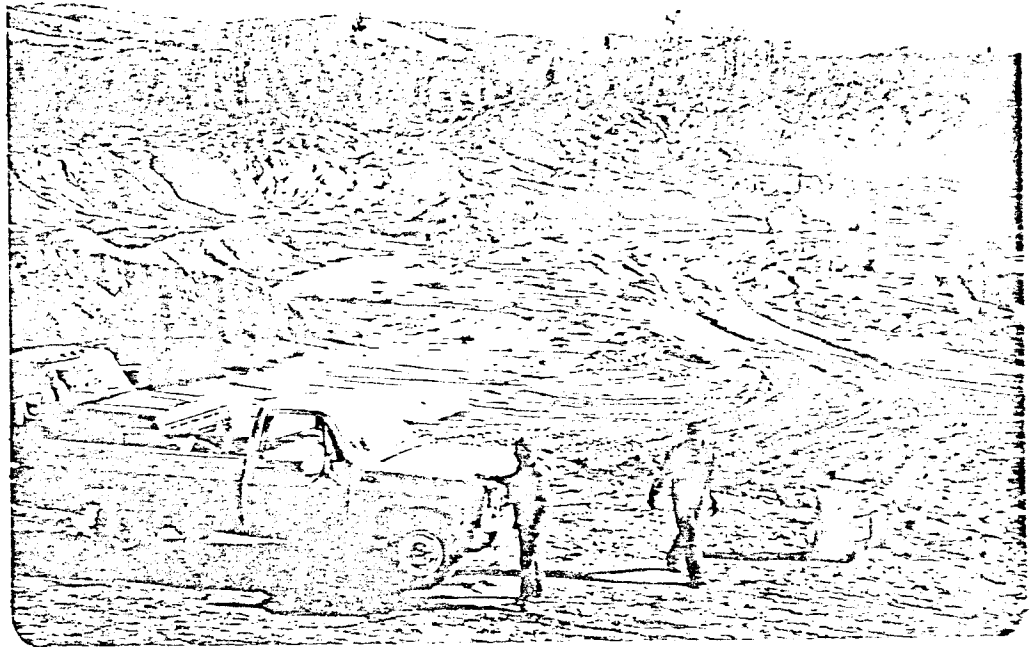


Plate 3C



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4A. Diving for basal gravels beneath the modern channel at  
October '84 pit #4 upstream from the mouth of Quartz Creek.

4B. Sampling gravel bars, September 1984, downstream from  
Quartz Creek near the end of the road.

4C. A high bar downstream from a conglomerate outcrop near the  
left limit of the meander belt below the mining area.

010800



Plate 4A



Plate 4B

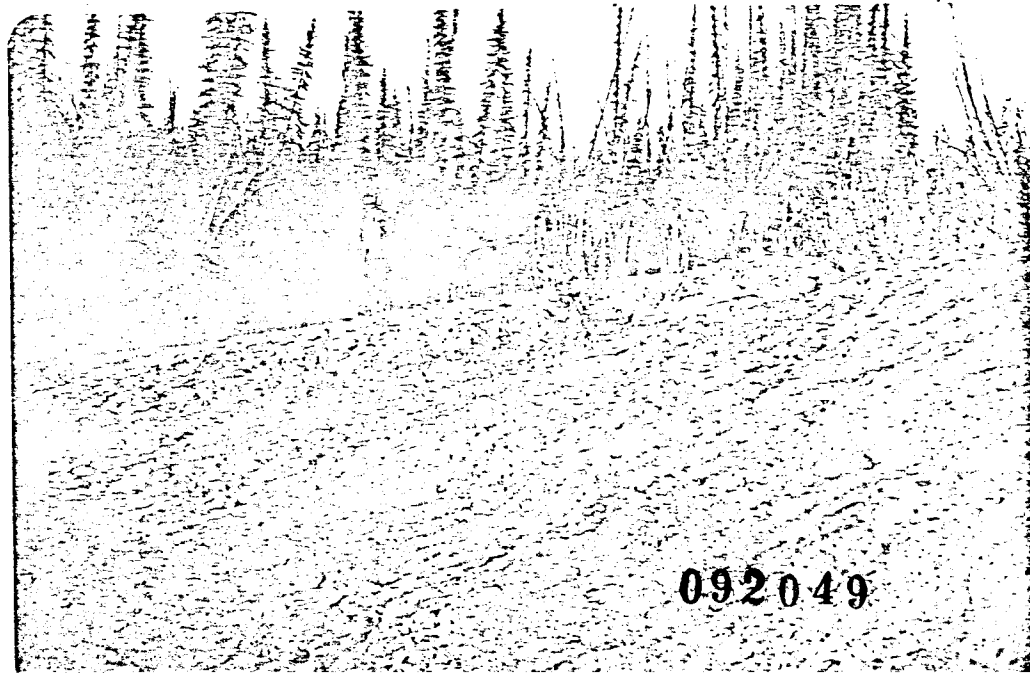


Plate 4C

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- 5A. View upstream, southeast, across the oxbow lake and the workings at Shell Gulch, across the upper swamp, and towards the superposed segment of Indian River marked by the spruce covered knob in the centre distance. Montana Creek joins Indian River downstream from the superposed segment and Eureka Creek joins it above. The cat trail trending diagonally across the swamp towards the spruce knob is the second tier base line. A low alluvial terrace near the contact of White Channel gravel with the foreign, Selwyn Mountain gravels occurs at the top of the poplar slope in the near left.
- 5B. View southeast (clockwise from previous view) across the oxbow lake towards the gentle, spruce covered slope below the projected level of the White Channel bedrock terrace, upstream from the mouth of McKinnon Creek.
- 5C. View across Indian River valley, southwest, from the low alluvial terrace of 5A, across the oxbow lake to the White Channel bedrock terrace cut on conglomerate and across the overlying alluvial terrace toward Ruby Creek. The 1983-1984 workings are visible in the distant right.

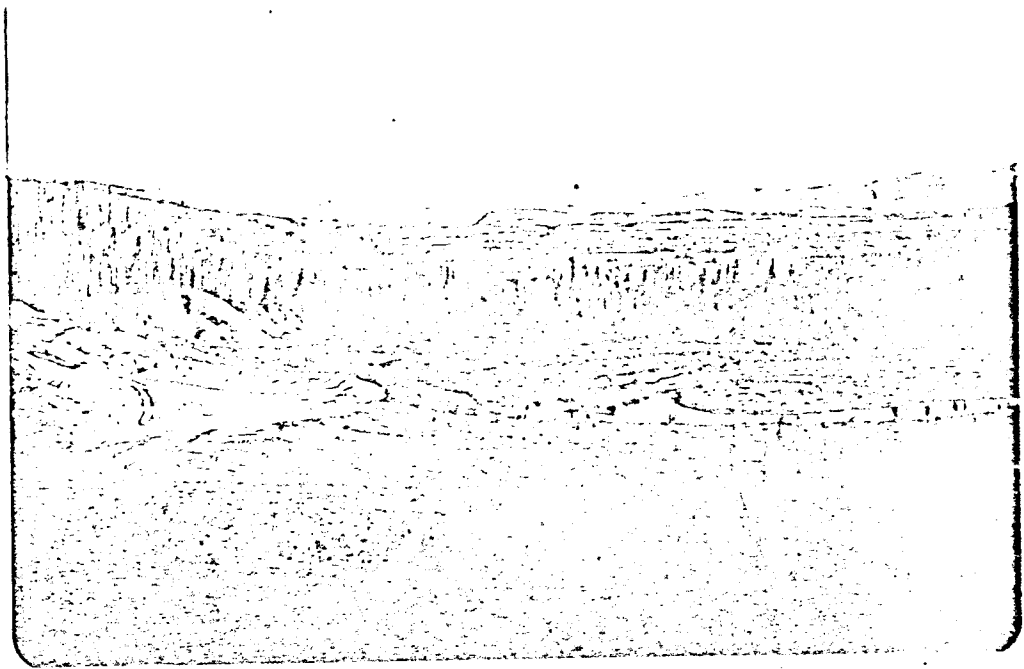


Plate 5A

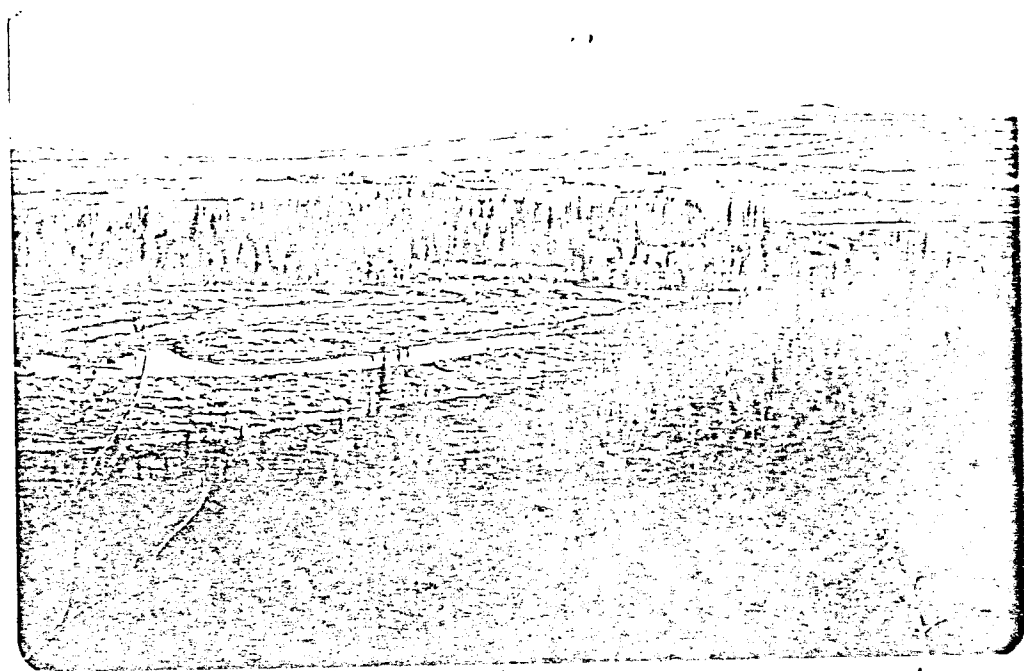


Plate 5B

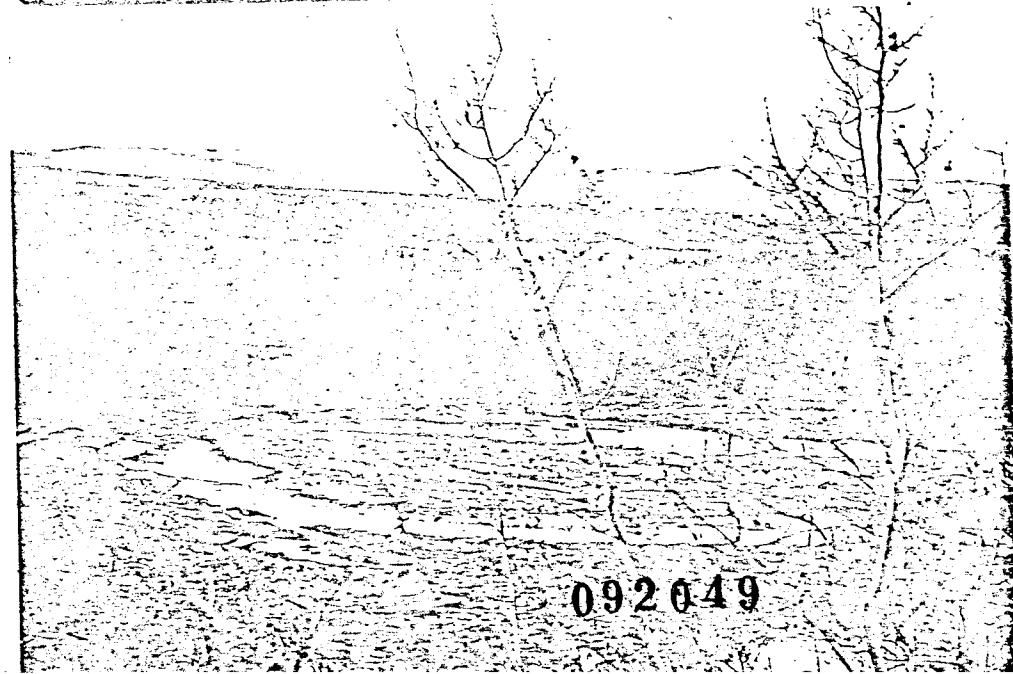


Plate 5C

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6A. View northeast from the left bank White Channel bench, towards the 1981-1982 bench of Risby. The valley of Toronto Creek in the distant left joins Quartz Creek and passes behind the workings before joining Indian River.

6B. View northwest from location of 6A across the lower swamp and the over steepened right wall of Indian River valley. Risby is sitting on a test pit near the level of the White Channel/conglomerate contact.

6C. View up Indian River valley, October 1975, from near the nick point between Ophir and Ninemile creeks.

Plate 6A

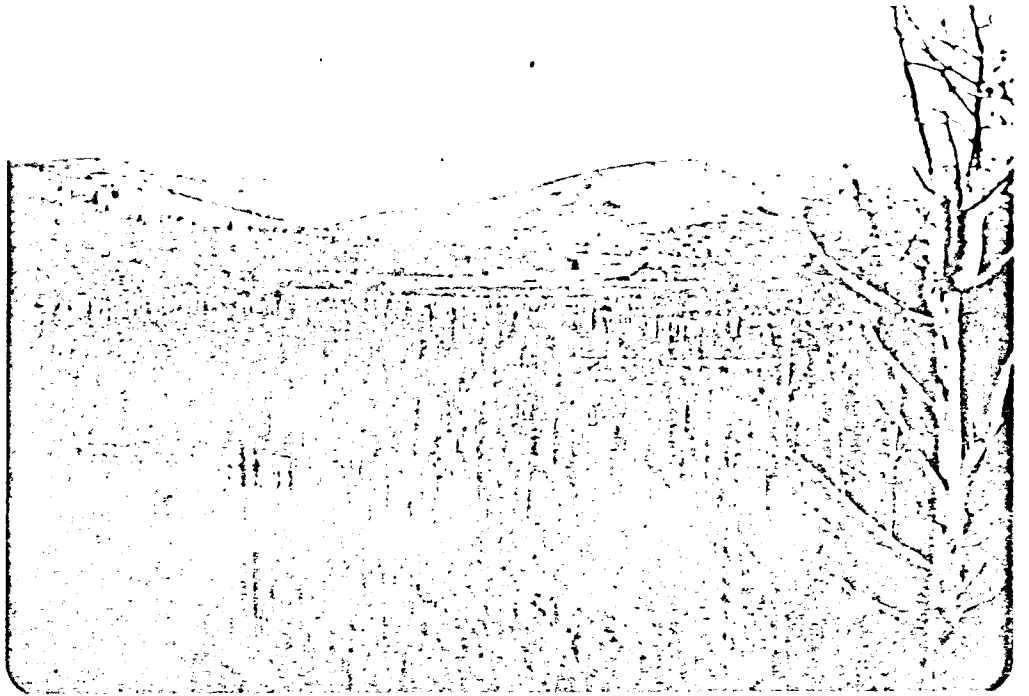


Plate 6B



Plate 6C



7A. Risby's 1984 operation, feeding dump box.

7B. Removing tailings from end of sluice.

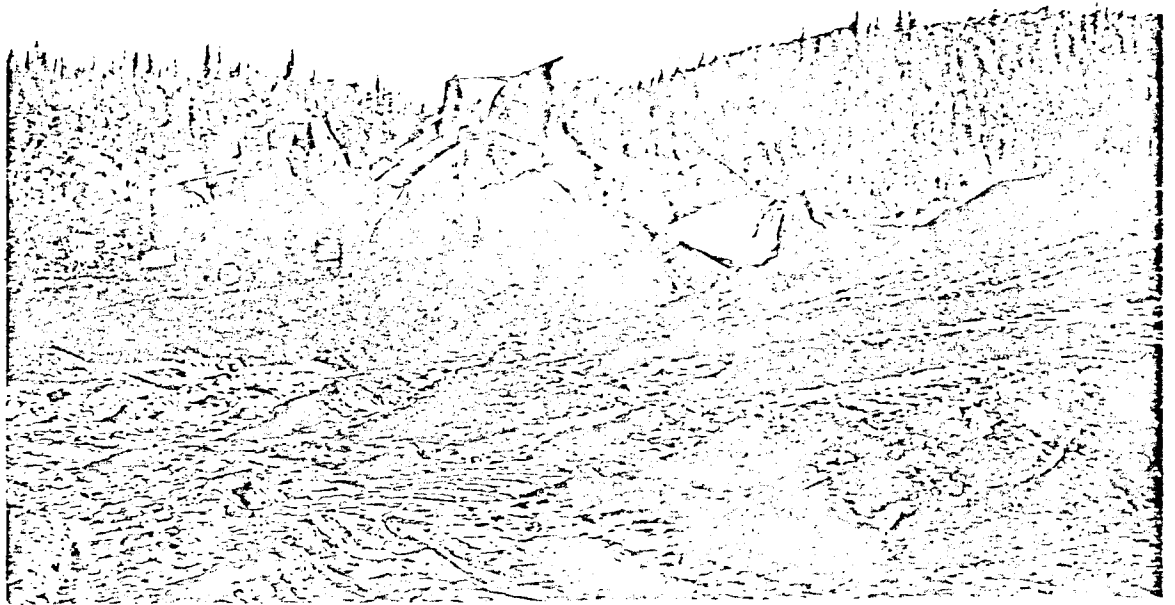


Plate 7A



Plate 7B

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8A. Risby's custom sluices in operation.

8B. Water spray on load in dump box.

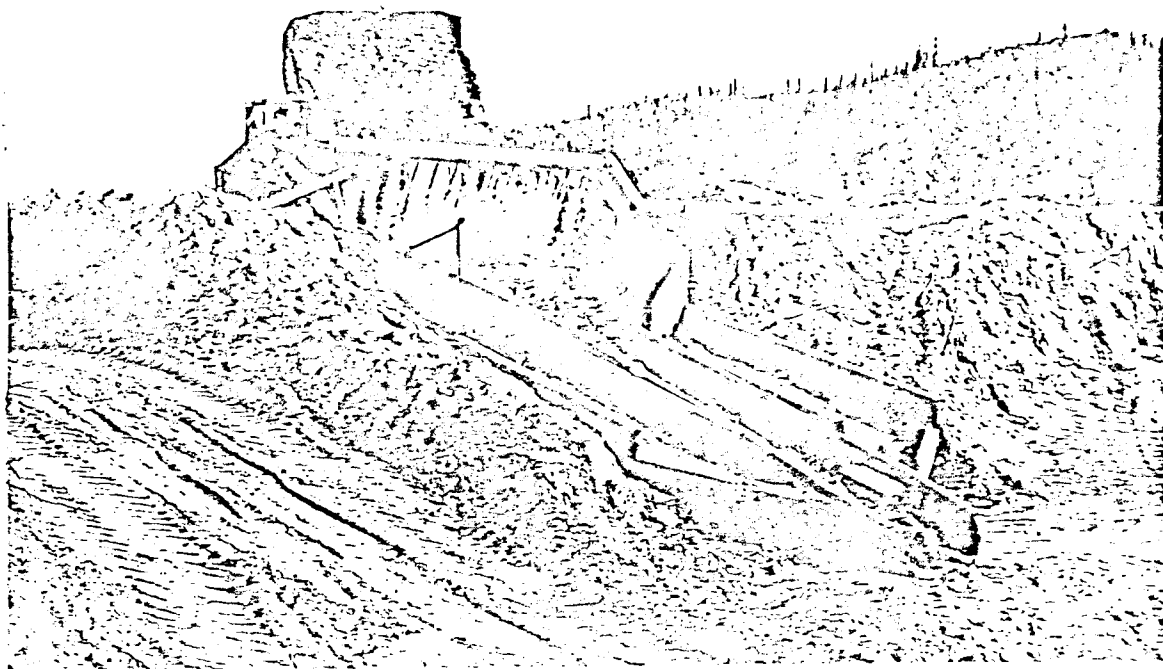


Plate 8A

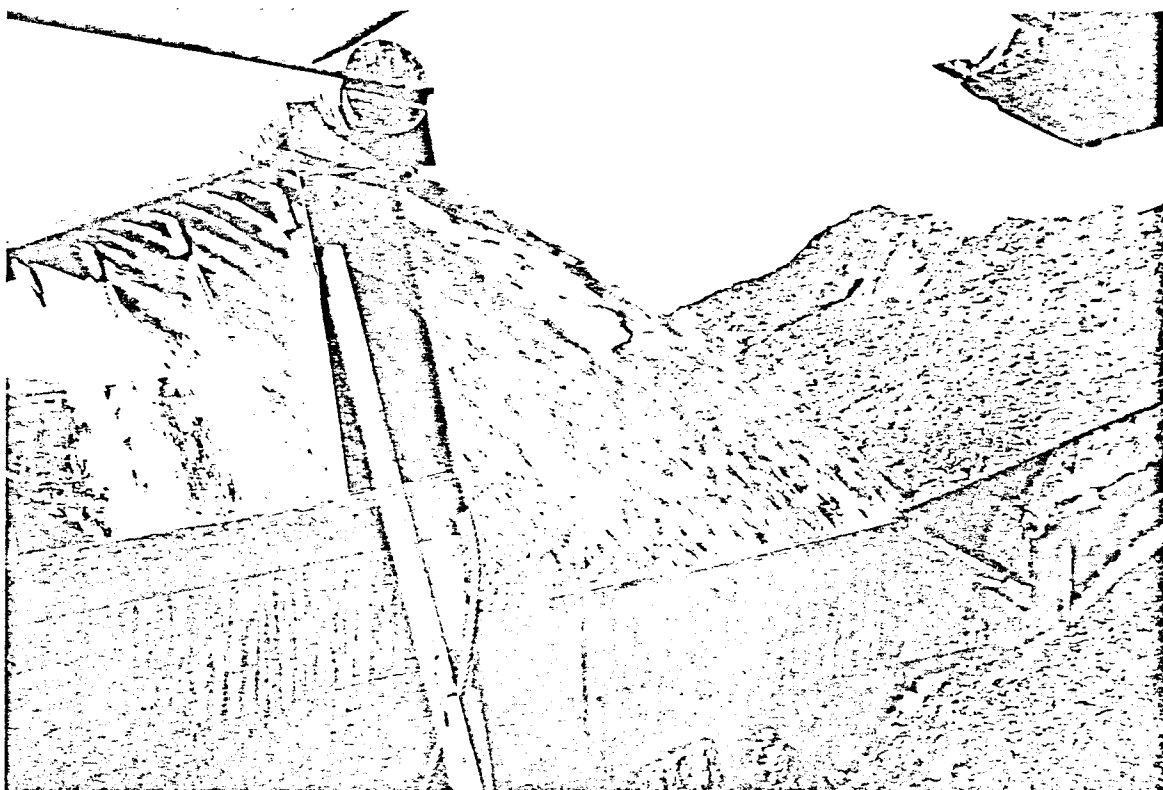


Plate 8B

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