

REPORT ON 1977 RECONNAISSANCE OF
YUKON COAL OCCURRENCES

By:

Roderic P. Hill

CYPRUS ANVIL MINING CORPORATION

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REPORT ON 1977 RECONNAISSANCE OF
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1. INTRODUCTION

Coal Measures occur at four distinct horizons within the Yukon Territory. These are:

1. Upper part of the Laberge Group of Lower to Middle Jurassic age in the Whitehorse Trough.
2. Tantalus Formation of Uppermost Jurassic and Lowermost Cretaceous Age in the Whitehorse Trough.
3. Lower Cretaceous to Palaeocene Bonnet Plume Formation and equivalent rocks in the Northern and Central Yukon.
4. Eocene or younger deposits in intermontane basins, now preserved as pockets at the base of Plateau Basalt sequences.

The principal coal areas are shown on Figure 1.

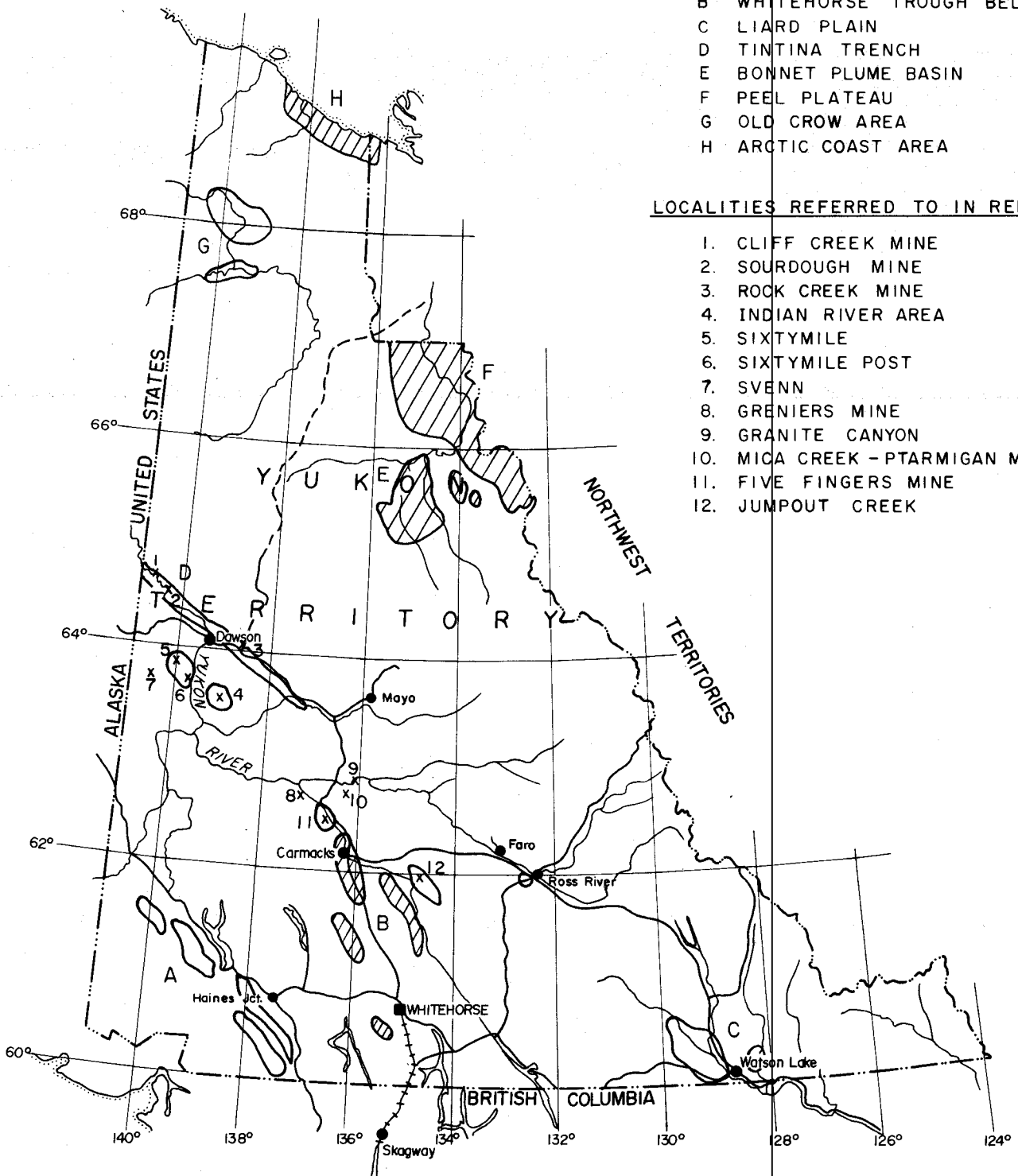
During the summer of 1977, three weeks were spent in reconnaissance of many reported coal occurrences. Local helicopters were used for much of the work, although some locations near roads were examined by vehicle. This report describes the Tertiary deposits visited in the central Yukon.



COAL AREAS

- A SAINT ELIAS BELT
- B WHITEHORSE TROUGH BELT
- C LIARD PLAIN
- D TINTINA TRENCH
- E BONNET PLUME BASIN
- F PEEL PLATEAU
- G OLD CROW AREA
- H ARCTIC COAST AREA

LOCALITIES REFERRED TO IN REPORT

- 1. CLIFF CREEK MINE
- 2. SOURDOUGH MINE
- 3. ROCK CREEK MINE
- 4. INDIAN RIVER AREA
- 5. SIXTYMILE
- 6. SIXTYMILE POST
- 7. SVENN
- 8. GRENIERS MINE
- 9. GRANITE CANYON
- 10. MICA CREEK - PTARMIGAN MTN. AREA
- 11. FIVE FINGERS MINE
- 12. JUMPOUT CREEK



 AREAS CONTAINING MESOZOIC COAL MEASURES
 " " " " TERTIARY " "

CYPRUS ANVIL MINING CORPORATION

YUKON COAL PROJECT

FIGURE I. YUKON COAL AREAS

PROPERTY LOCATION MAP

YUKON

SCALE : 1" = 100 MILES

2. TERTIARY COAL DEPOSITS IN TINTINA TRENCH

2.1 INTRODUCTION

Tertiary beds, consisting of poorly-consolidated conglomerates, sandstones and shales containing coal seams, occur within Tintina Trench in the Dawson area (see Figure 1). They form a sedimentary basin up to 10 miles wide and at least 200 miles long. The Yukon portion of this basin probably extends for at least 120 miles, to as far south as McQuesten River (Bostock, 1950), and the Alaska portion for at least 80 miles (Mertie, 1937; pp 172-180).

The trench in this area is at a low elevation, has subdued topography, locally is floored by Pleistocene and recent sands and gravels, and is blanketed by heavy moss and stunted spruce, typical of permafrost regions. As a result, there are very few exposures; most are in the cutbanks of creeks crossing the trench, and it is often difficult to distinguish between the poorly-consolidated Tertiary sediments and overlying unconsolidated material (Green, 1972).

During and after the Klondike Gold Rush, large amounts of fuel were needed for domestic heating, for thawing frozen ground and for riverboats. Wood soon became scarce in the area, and attempts were made to utilize the coal deposits found in the Trench. At least three mines were established in the Dawson area, and numerous other localities were staked and prospected. An attempt was made to revitalize one of the mines during the Second World War. At least

two mines were also operated at various times in the Alaska portion of the basin.

Most early reports refer to this coal as "lignite", however it is likely that most is subbituminous coal according to contemporary terminology.

2.2 DESCRIPTIONS OF OCCURRENCES

(a) Cliff Creek Mine

Location:

N.T.S. 116-C/9; Approximately $64^{\circ}33'N$, $140^{\circ}25'W$.

Located on Cliff Creek, about 1-3/4 miles from the Yukon River.

History:

Staked in September 1895 by W. F. Cornellin as coal lease 215. North American Trading and Transportation Company Ltd. began development about 1899; they drove two adits and a number of exploratory drifts and raises over a total lateral interval of 2,800 feet. A narrow-gauge railway was built to transport the coal to the Yukon River; it is reported that "a considerable quantity" was shipped to Dawson, and some had been tried on river steamers with satisfactory results. Work had ceased by 1903. In 1968, the coal rights were held by North American Trading and Transportation (lots 13, 16 and 22) and by J. H. Watson (lots 17 and 18). In January 1968, Selwyn Exploration Ltd. took out Coal Exploration Licence #1 (116-B/9, SW $\frac{1}{4}$), but they are

believed to have been chiefly concerned with Pre-cambrian iron formations in the area and did no work on the coal.

Description:

In 1896, Wm. Ogilvie described a seam 5.3 feet thick. Later McConnell (1901) described the workings. The upper tunnel, on the left bank of the creek, had been driven mostly in lignite for 800 feet, with a seam at least 40 feet thick (including partings) in which individual lignite lenses varied from a few inches to 5 feet thick. The beds were found to dip 50 to 75° to the south, and had locally been faulted. The lower working, on the right bank, followed two seams; the upper was 9 feet thick and the lower 3 feet thick, separated by 24 feet of clays and shales, and dips were gentle. McConnell gave the following analyses:

	<u>Upper Working</u>	<u>Lower Working</u>
Moisture	8.57%	10.58%
Ash	3.62	2.58
Volatiles	42.04	40.10
Fixed Carbon	45.77	46.74

Milner and Craig (1973) noted that little remained. A lower portal was found and a seam at least 6 feet thick dipping 35° north was recognised; the upper workings had sluffed in.

This study:

The writer visited the location in 1977. No suitable landing place for the helicopter could be found nearby

because of thick brush in the valley bottom. From the air, no trace of railway, buildings, workings, coal or any rock outcrop could be seen anywhere along the creek. Outcrop was found in cliffs along the north bank of the Yukon River at the mouth of Cliff Creek, and it appeared to comprise a thick sequence of poorly-consolidated sandstones and conglomerates with dips of up to 45° .

References:

McConnell (1901, 1906)
Milner and Craig (1973)
Archer and Cathro (1972)

(b) Sourdough (Coal Creek) Mine

Location:

N.T.S. 116-C/8; Approximately $64^{\circ}28'N$, $140^{\circ}07'W$.
Located on south fork of Coal Creek, about 11 miles east of, and 960 feet above, the Yukon River.

History:

Wm. Ogilvie found coal float at the mouth of the creek in 1887; in 1895 he found a coal outcrop which, in March 1896, he staked as coal lease 245 on behalf of North American Trading and Transportation Company Ltd. Development work, which included two adits and a narrow-gauge railway $11\text{-}3/4$ miles long to the Yukon River, was carried out by Coal Creek Mining Company Ltd. from 1903. Initially all production was shipped by barge to Dawson or used in riverboats. In 1906, the property was sold

to Sourdough Coal Company Ltd. A thermal generating plant and a transmission line to Dawson were built in 1907, and the operation supplied electricity for a short time to the City, and to the power dredges in the Klondike, until development of hydroelectric power on Little Twelve Mile River and (a couple of years later) on Klondike River. Production is reported as 22,000 tons in 1906, 10,000 tons in 1907 and 5,000 tons in 1908. The mine and power plant were in operation intermittently until about 1913 (at which time they were owned by Northern Light, Power and Coal Company Ltd.). The property was later held as ten Crown-granted lots by B. Levielle.

Description:

Collier (1903) described three showings; the most easterly consisted of a 100 foot-long adit. A quarter mile to the west, a decline had been driven at 33° dip to 240° azimuth into a seam consisting of 6" coal, 2' clay and 4'6" coal on the south bank of the creek. Another half mile to the west, an outcrop on the north bank exposed 14 feet of coal. McConnell (1906) reported that in 1903 the main working consisted of an incline 490 feet long driven in at the base of a cliff. The seam worked was 4 to 11 feet thick, dipping 45° to the southeast for the first 210 feet, then bending round to dip gently southwest.

This study:

When visited in 1977, the rights-of-way for both railway and transmission line, and the foundations and remains of several buildings, were clearly visible from the air. An old, solidly-built concrete structure, presumably the old power-house, proved an excellent helicopter pad. A number of old steam boilers were lying around, and one collapsed adit was located. Much coaly material was present in waste dumps and in the soil downstream. Coal was mostly banded, was dull black with some bright bands, and contained resin globules (samples somewhat resembled coal from the Tulameen basin in southern B.C.). Very thick brush covers the valley bottom, and outcrops are scarce. One outcrop in the creek near the buildings consisted of poorly consolidated sandstone and pebble conglomerates which had slumped. Several hundred feet downstream, other small outcrops of unconsolidated sands and shales were found along the north bank.

References:

Collier, A. J. (1903)
McConnell, R. G. (1906)
Green, L. H. (1972)
Archer and Cathro (1972)

(c) Rock Creek Mine

Location:

N.T.S. 116-B/2; Approximately $64^{\circ}08'N$, $138^{\circ}55'W$.
Located on Coal Creek, a tributary of Rock Creek,

about 8 miles upstream from the Klondike River.

History:

Staked as coal lease 209 in August 1898 by M. J. Gates. Development was commenced about 1899 by Alaska Exploration Company Ltd. In 1900, the working consisted of a 400-foot decline, descending at 25° to the southeast for the first 200 feet, beyond which the angle gradually reduced to about 4° . At 225 feet from the mouth a short drift to the northeast was driven following the seam. Some coal was shipped to Dawson, but the mine had closed by 1903. In 1937, the mine was reactivated by J. D. Simpson and associates; part of the entry was dug out and retimbered and some development work undertaken. The property was idle in 1938, but was worked during late 1939 and 1940 by D. W. Ballentine, who sold a few tons in Dawson.

Description:

According to McConnell (1901), lignite outcrops occurred in the face of a low, rounded hill, part of which had been cut away by the stream, but he noted the absence of outcrops nearby. He considered that the hill was due to "recent uplift", as the dips of the strata approximately followed its slopes. Two seams were present in the decline and drift - an upper 3-foot seam and a lower seam 2 to 3 feet thick, separated by 1 foot of clay, dipping 3 to 10° to the northeast. The lignite was locally disrupted by

faulting. McConnell provided two analyses:

	<u>Upper Seam</u>	<u>Lower Seam</u>
Moisture	18.31%	19.37%
Ash	5.85	9.33
Volatiles	34.96	33.85
Fixed Carbon	40.88	37.45

When the mine re-opened in 1937 Bostock obtained the following analyses:

Upper Seam

Sample No.	<u>18,595</u>	<u>18,597</u>
Moisture	31.1	30.5
Ash	13.1	12.5
Volatiles	25.4	26.0
Fixed Carbon	30.4	31.0

Lower Seam

Sample No.	<u>18,596</u>	<u>18,598</u>	<u>18,599</u>	<u>18,600</u>
Moisture	29.3	33.6	25.1	30.7
Ash	11.4	10.2	9.6	9.6
Volatiles	28.1	25.8	28.8	28.1
Fixed Carbon	31.2	30.4	36.5	31.6
Sulphur	0.5	0.5	0.6	0.5
B.T.U./lb. (raw)	7,430	7,220	8,150	7,540

This study:

The location was easy to find since several wooden buildings, a steam boiler and the remains of mine equipment were found nearby. Apart from the low, rounded hill described by McConnell, the creek valley is rather flat and covered with thick brush, and no outcrops were seen. Some burnt red shale and coaly material in the soil was found.

References:

McConnell (1901, 1906)
Bostock (1937, 1941)
Green (1972)
Archer and Cathro (1972)

(d) Chandindu River

Location:

N.T.S. 116-B/5; Approximately $64^{\circ}17'N$, $138^{\circ}31'W$.
Located on Chandindu (formerly Twelve Mile) River,
near the mouth of Alder Creek.

History:

Float was discovered in Twelve Mile River, prior to
1896. A six-foot seam was found in 1896, and coal
lots 26 and 27 were staked in March, 1900. No
further details are available.

This study:

The writer was unable to locate the occurrence; no
outcrop was seen in the vicinity.

References:

McConnell (1900)
Archer and Cathro (1972)

(e) Other Occurrences

Several other occurrences, most of them presumably
coal float in creeks, have been reported on Fifteen
Mile River, Ballarat Creek, Shell Creek and Thane
Creek (Archer and Cathro, 1972). The writer made

a brief helicopter reconnaissance along each of these creeks, but outcrops were very scarce, and no coal was seen at any of the locations.

2.3 CONCLUSIONS

Not enough information is available to assess the mining potential of the coal deposits in Tintina Trench. It is certain that the reserves are very large; the Yukon part of the basin is at least 1,000 square miles in area, and many coal occurrences have been reported over a distance of at least 80 miles along the Trench. In purely hypothetical terms, a six-foot seam which underlies half of an area 80 miles long and ten miles wide represents approximately 2.5 billion short tons of coal in place. More realistically, the Royal Commission on Coal "..... estimated 112 million tons of probable and possible lignite for one-tenth of its conservatively estimated area" (Bostock, 1953).

The structural geology of the Tintina Trench is not well known in this area; elsewhere transcurrent displacement of more than a hundred miles on the main Tintina Fault and vertical displacements on other faults in the system have been reported. The Tertiary deposits cover the floor of a fault-bounded valley and, although precise thicknesses have never been determined, available geological reports and maps suggest the thickness above the level of the Yukon River locally exceeds 900 feet.

It is also known that the deposits are locally disrupted by recent movement along faults in the Tintina system. Therefore the potential exists for the development of thick, graben-filling deposits similar to those developed in the Hat Creek Valley in south-central British Columbia. To the writer's knowledge, this potential has never seriously been explored.

Available data indicate a good-quality, low-sulphur subbituminous coal with less than 15% ash. This coal would be ideal for on-site thermal electricity generation. A characteristic of Tertiary coals in the Circum-Pacific region is their very high (>90%) vitrinite contents, which makes these coals very suitable for conversion to liquid or gaseous fuels.

The development prospects of these deposits may be summarised in the following list of advantages and disadvantages:

Advantages

1. Relatively accessible area - previous mining activity (placer, coal, asbestos) has resulted in some good roads and a network of trails.
2. Large reserves, hence long mine life.
3. Good quality, low-sulphur coal.

4. Close to Yukon River for cheap summer barge transportation - either to power/conversion plant, or even to tidewater for export.
5. Abundant supply of water and close to established power network, should preparation facilities be required.
6. Closure of the Clinton Creek asbestos mine in 1978 will have strong adverse economic and social impact on local communities, hence proposals for alternative industrial development would likely receive support at both Government and local levels.
7. A new power plant will be required in the Yukon within the next decade; if thermal generation using this coal proved to be the best alternative, substantial government financial assistance for development would probably be forthcoming.

Disadvantages

1. Tremendous acquisition and maintenance costs of such a large area, either as Coal Exploration Licences or as Coal Mining Leases, without some prior exploration to delineate the most attractive areas.
2. Lack of information - exploration programmes in such a large area would be very expensive.

3. Local steep dips of coal seams and structural complications resulting from faulting would render mining rather difficult and relatively expensive.

2.4 RECOMMENDATIONS

The potential for a "Hat Creek type" deposit, however remote, should be tested without delay. The pronounced negative gravity anomaly over the Hat Creek Valley is well known, and a similar anomaly would be expected if a similar thickened sequence were present in Tintina Trench. Tests undertaken at Carmacks in 1977 showed no gravity response over seams up to 30 feet thick, but it should be possible for a geophysical consultant to construct a model defining the minimum thickness of coal which could be detected by a gravity survey. If such a survey were conducted at (say) three localities 20 miles apart, with two lines 10 miles long and 1 mile apart across the trench at each locality, the presence or absence of very thick coal sequences could be confirmed. Such a survey would have to be conducted in winter since lines would cross the Yukon River, and would cost of the order of \$60,000, but the presence of negative gravity anomalies would define good drill targets.

An alternative approach would be "wildcat" drilling at one or more of the known coal occurrences.

The presence of thick deposits of Hat Creek type would certainly mean the development within the next couple of decades of a major energy project. Even without such

thickening, the known coal reserves are very large, and are sufficiently interesting to warrant further investigation.

3. TERTIARY DEPOSITS AT THE BASE OF THE CARMACKS GROUP

3.1 INTRODUCTION

Throughout the Central Yukon Plateau many small deposits or poorly-consolidated conglomerates, sandstones and volcaniclastics are found immediately below, or intercalated within the basal layers of, the Carmacks Volcanics and equivalents of Eocene or younger age (Tempelman-Kluit, 1974a). In earlier literature, these sediments are referred to as the "Kenai Series". The remnants of these sediments are the fragmentary record of what may have been a widespread, discontinuous blanket or a series of channel deposits. They are believed to have been formed by rapid erosion caused by sudden uplift of the Yukon Plateau. This rejuvenation took place immediately before extrusion of the Carmacks Volcanics. Unlike the earlier Mount Nansen Volcanics, which were erupted from local explosive centres onto a peneplane surface, the Carmacks Group was laid down upon an irregular topography in which the present Yukon River valley and some of its tributaries had already been formed. They are of tholeiitic affinity and include mafic and felsic lavas, tuffs and breccias.

In many places the sediments are several hundred feet thick, and most are known or suspected to contain coal or carbonaceous material (see Figure 1). Several deposits which have previously been included in the upper part of the Laberge Group or in the Tantalus Formation are now known to be Tertiary.

3.2 DESCRIPTION OF OCCURRENCES

(a) Haystack Mine - Indian River Area

Location:

N.T.S. 115-0/11; Approximately $63^{\circ}40'N$, $139^{\circ}07'W$.

History:

Coal was reported at three localities in this area; on Indian River opposite the mouth of Quartz Creek, along McKinnon Creek, and on Ruby Creek. Coal lease 1212 was staked on McKinnon Creek by Stephen Cord in 1900; he drove a short adit which had caved by the time of McConnell's visit in 1903. The area was re-staked as coal lease 9466 in September, 1903 by D. McKinnon, who held it at least until 1908.

Description:

One large and several small areas (total area at least 50 square miles) of Tertiary sediments, partly overlain by Carmacks Volcanics. When the Haystack Mine was visited by MacLean in 1912, a 7-foot seam dipping 10° to the north was exposed in an open cut. According to Bostock, over 500 feet of conglomerates with intercalations of sandstone and carbonaceous shale are exposed along McKinnon Creek, with dips up to 35° .

This study:

The area was examined by helicopter reconnaissance. Haystack Mountain consists of rocks resembling

Carmacks Group volcanics seen elsewhere. No outcrops of sediments below the volcanics were seen owing to their highly recessive nature, and no trace of coal was seen anywhere in this area. McKinnon Creek is a very small creek which threads across a flat, broad valley, and no outcrops were seen along it.

References:

McConnell (1901, 1904)
MacLean (1914)
Bostock (1942)
Archer & Cathro (1972)

(b) Sixtymile

Location:

N.T.S. 116-C/2; Approximately $64^{\circ}02'N$, $140^{\circ}45'W$.
Located at the junction of Little Gold and Big Gold Creeks, close to the abandoned settlement of Sixtymile.

History and Description:

Several occurrences of coal float and of coal in place in Tertiary sediments were reported during placer mining or road construction during the early 1900's. No other information is available.

This study:

No outcrops nor any trace of coal were found by the writer at this location.

Reference:

Cockfield (1921)

(c) Sixtymile Post

Location:

N.T.S. 115-0/12; Approximately $63^{\circ}34'N$, $139^{\circ}45'W$.
Located at the "first rock bluff" on the west side of the Yukon River upstream from Sixtymile River, close to the abandoned settlement of Sixtymile Post.

History and Description:

Staked as coal exploration licence 28159 in July, 1912 by L. C. Cruikshank. No other information available.

This study:

No outcrops of Tertiary beds nor any trace of coal were found by the writer.

Reference:

Archer & Cathro (1972).

(d) Svenn

Location:

N.T.S. 115-N/9; Approximately $63^{\circ}32'N$, $140^{\circ}25'W$.

History and Description:

Pebbles of lignite were reported in gravels on Matson Creek by placer miners. The location is shown on Tempelman-Kluit's map (1974a, Figure 17) as a mineral property without reference, and no other information is available.

This study:

No outcrops of sediments nor any trace of coal were found anywhere in the area. At the supposed location nothing but muscovite schist float was found. It is possible that a small occurrence of Tertiary beds is present, but a coal-bearing glacial erratic is more likely.

References:

Archer & Cathro (1972)
Tempelman-Kluit (1974a)

(e) Grenier's Mine

Location:

N.T.S. 115-I-11; Approximately $62^{\circ}44'N$, $137^{\circ}19'W$.
Located on the west bank of Yukon River, 5 miles above Fort Selkirk.

History:

Staked as coal lease 26391 in April 1910 by G. Minchin and lease 27418 in December 1911 by G. Grenier, who explored the occurrence with a 30-foot shaft and a short adit. The coal was reported by Cairnes in a 1913 Canadian Government Guidebook to be bituminous coal of good quality.

Description:

Bostock examined the location in 1933 and described a shaft 20 to 30 feet deep, filled with water, and a collapsed adit at the water's edge. Dumps containing

lumps of coaly shale or dirty coal occurred nearby. A nearby outcrop of conglomerate contained plant fragments which were not identified. Bostock correlated these rocks with the upper part of the Laberge Group, and noted that they probably extended some distance beneath the overlying Selkirk Volcanics (Quaternary). Milner and Craig reported no sign of the occurrence in 1973.

This study:

Carmacks helicopter pilot George Mackay reported that he has taken several parties of geologists to examine this occurrence and none has found any trace, and the writer fared no better. The location as described is close to river level beneath a cliff of columnar basalt. Any coal is almost certainly Eocene or younger, possibly as young as Quaternary. The occurrence is analagous to the Granite Canyon occurrence (q.v.).

References:

Bostock (1936)
Archer and Cathro (1972)
Milner and Craig (1973)

(f) Granite Canyon

Location:

N.T.S. 115-I/16; Approximately 62°49'N, 136°10'W.

History and Description:

McConnell reported a thin seam of "carbonaceous shale or impure lignite" in Granite Canyon, associated with

andesites he believed to be Cretaceous in age. On Tempelman-Kluit's revised map of the Carmacks district the occurrence is shown as a small pocket of Tertiary sediments beneath Carmacks Volcanics.

This study:

The writer found the walls of the Canyon near the supposed location consisted of columnar basalts, which are more likely equivalent to the Selkirk Volcanics and Miles Canyon Volcanics of Quaternary age. Therefore, any coal beneath or associated with these volcanics is probably Eocene or younger, and the occurrence appears to be analagous to that at Grenier's mine (q.v.).

References:

McConnell (1903)
Tempelman-Kluit (1974b)

(g) Mica Creek - Ptarmigan Mountain Area

Location:

N.T.S. 115-I/9; Approximately $62^{\circ}45'N$, $136^{\circ}25'W$

History and Description:

McConnell reported that a shaft sunk by placer miners on an easterly branch of Mica Creek, about 8 miles from Pelly River, passed through several thin seams of lignite, and that drift lignite had been found in Mica Creek. He suggested that lignite-bearing beds underlie the surrounding area, although none was

exposed. Bostock reported finding remains of buildings and fragments of black carbonaceous shales, a fossilized tree-trunk and some coal float along Ptarmigan Creek, a branch of Mica Creek. He considered that the coal was from erratics of Laberge Series rocks in glacial drift, since the surrounding area was underlain by Yukon Group shists. Another occurrence on Ptarmigan Creek was reported by Mr. G. Simms of Pelly Crossing (personal communication, 1977). He described how, while fighting a fire, a bulldozer became bogged down and the tracks churned up lumps of lignite.

This study:

The writer spent some time in aerial reconnaissance of the area, but was unable to locate any of these occurrences. No outcrop and no trace of coal could be seen. Any coal in the area is likely to be either from glacial erratics, or from a pocket of Carmacks Group sediments, or possibly from even younger rocks by analogy with Granite Canyon and Grenier's Mine occurrences (q.v.).

References:

McConnell (1903)
Bostock (1936)

(h) Five Fingers Mine

Location:

N.T.S. 115-I/1; Approximately $62^{\circ}12'N$, $136^{\circ}20'W$.

Situated on the east side of the Yukon River 8 miles north of Carmacks, about 5½ miles upstream from Five Fingers Rapids.

History:

Coal was first reported by G. M. Dawson in 1887. Lease 214 was staked in March 1898 by W. T. Edmonds. The area was re-staked as leases 256 and 258 in November 1899 by J. Cameron and C. E. Miller who, by 1904, had mined several hundred tons from close to surface. George J. Miller of Pittsburgh, Pa., acquired the property in 1905 and formed Five Fingers Coal Company, which unsuccessfully attempted diamond drilling. Their first decline was dangerously situated on a steep clay and sand bank beside the river, and after several slides a second decline was started some distance to the north on safer ground. By 1907, only a few hundred tons had been mined, and the workings were abandoned in 1908 in favour of the Tantalus Mine. In 1947, the assets of Five Fingers Coal Company were acquired by Yukon Coal Company, a subsidiary of Territorial Supply Company of Whitehorse (which was jointly owned by Cassiar Asbestos Corporation and United Keno Hills Mines and managed by the latter). These assets were in turn acquired by Anvil Mining Corporation Ltd. in 1969, although the bill of sale was not completed until January 11, 1972. Some exploratory work was done in 1970 by Norman Ursel and Associates, who blasted open the earlier workings. In

1971, Teslin Exploration Ltd. acquired the surrounding area as exploration licence #16. They did geological mapping and drilled one hole in 1971 and, in 1973, staked coal lease 2964. This lease was optioned by Cyprus Anvil in 1976 along with Teslin's other leases in the Carmacks area.

Description:

Cairnes (1908) described the earlier working of Five Fingers Coal Company as a slope extending about 350 feet with rooms off it, the seam in the lower rooms being 3.5 to 4 feet wide. The newer working, when visited in 1906, was started in a seam higher in the measures, dipping 16° to the east, and was down to about 525 feet. At the bottom, the seam was 2 feet wide and apparently getting wider, and gave the following analysis:

Moisture	4.26%
Ash	10.81
Volatiles	40.26
Fixed Carbon	44.67

In 1907, a 26-foot winze was sunk 450 feet down the newer slope to a seam 4.5 feet thick, apparently the seam mined in the earlier working, and the slope was extended to 783 feet. Two samples were analysed, one from the bottom of the slope (A) and one from the bottom of the 26-foot winze (B), as follows:

Sample	<u>A</u>	<u>B</u>
Moisture	5.95	5.29
Ash	8.43	18.45
Volatiles	40.46	36.14
Fixed Carbon	45.16	40.12

Cairnes mapped the area as Laberge Group, noting that there is almost continuous exposure of Laberge conglomerates along the right bank of the river from just north of Tantalus Butte to Five Finger Rapids. Bostock re-mapped the area, and quoted Cairnes' descriptions of the workings in his memoir. He noted that 1,500 feet above the Laberge conglomerates at Five Finger Rapids the rocks change from "light-coloured types" to darker coloured materials derived from basic and intermediate rocks, particularly basic volcanics, including tuffaceous greywackes and fine-grained andesitic and acid tuffs and sills of dioritic composition. He considered that the rocks in the vicinity of the mine were from this horizon because they contained volcanic material, and that the horizon was about 500 feet thick. Birch (1943) remarked that the old workings were below river level and were filled with water. Milner and Craig visited the property in 1972, and found several seams and timbers exposed 30 feet above river level, the result of blasting by Normal Ursel and Assoc. The company report of 1970 described the seam at three places measuring between 3 and 4 feet in thickness with partings. In 1971, Teslin Explorations' drill hole

was collared about 200 feet above river level, approximately 4,000 feet south of the old workings; the hole penetrated "strongly fractured sandstone" from 118 to 188 feet and was abandoned in bad ground. After visiting the area, Tempelman-Kluit suggested the occurrence was Tertiary in age and lies within a pocket of sediments and volcanoclastics at the base ? of the Carmacks Group (personal communication, 1977).

Note: Carmacks GP is OK (Upper Cret.)

This study:

The property was visited by the writer and Dr. J. G. Simpson in 1977. The remains of what may be the later workings were found by the riverbank. An outcrop of thin coal, shale and sandstone was found at water level. The cliffs above the mine are poorly exposed, but appear to consist of unconsolidated sands and gravels, which resemble Tertiary sediments seen elsewhere in the Yukon. A sample of the coal was sent to Robertson Research (North America) Ltd. for a petrographic analysis, the results of which are outlined below:

Vitrinite	83%
Exinite	2
Resinite	5
Fusinite	trace
Semifusinite	4
Micrinite	3
Mineral Matter	3
R_o max	0.51

On a mineral-matter-free basis Vitrinite+Exinite is 93%. The very high vitrinite content, which is characteristic

of Uppermost Cretaceous (Senonian) and Tertiary coals of the circum-Pacific region, and the low vitrinite reflectivity, indicating low rank, confirm the age of this occurrence as Tertiary. For comparison, Laberge coal from Carmacks South contains 50 to 70% vitrinite and has mean maximum vitrinite reflectance of the order of 1.20%.

References:

Cairnes (1907, 1908, 1910)
Bostock (1936)
Birch (1943)
Archer and Cathro (1972)
Milner and Craig (1973)
Tempelman-Kluit (1974b)

(i) Jumpout Creek

Location:

N.T.S. 105-E/15; Approximately 62°00'N, 134°45'W.

History and Description:

Bostock and Lees reported sporadic outcrops of Tantalus Formation in the middle of a large area of glacial and recent deposits. According to them, sandstones and conglomerates were well-exposed along the second tributary up Walsh Creek (now called Jumpout Creek), with fragments of shale and coal locally and abundant coal float in gravels along Walsh Creek and Big Salmon River. Atlas Explorations Ltd. staked Coal Exploration Licences #6, 7 and 8 over this area in April 1970, and J. F. George spent 2½ months mapping the area. He described tuffaceous conglomerates,

sandstones and volcanoclastic rocks containing carbonaceous plant remains along Jumpout Creek and south of Walsh Creek, and noted that these beds were overlain by light-coloured volcanic flows (Carmacks Group). George also noted that a different lithology was present on the southern end of the ridge between Walsh and Illusion Creeks - a "conglomerate of light grey chert pebbles in a cherty cemented sandstone matrix, interbedded with sandstone, was overlain by white cherty siltstone". Kerr Addison Mines Ltd. obtained an exploration licence over the area in 1977, and mapped the area.

This study:

The deposits along Walsh and Jumpout Creeks are very poorly exposed, but where seen near the head of Jumpout Creek they consist of partially frozen, poorly consolidated material which flows on thawing. This material consists of light grey mudstone containing much carbonaceous plant material and coaly partings, and pebbles and cobbles of volcanic breccia and agglomerate. "Hoodoo"-like landforms are present, formed in thickly-bedded, poorly-consolidated conglomerate containing rounded igneous rock pebbles and cobbles, rounded tuffaceous and volcanic pebbles and angular mudstone clasts. Fragments are up to 6" in diameter and are embedded in a tuffaceous clay matrix. These sediments resemble Tertiary sediments seen elsewhere in the Yukon. A sample of coaly material was sent to Robertson

Research for petrographic analysis, and the results are summarized below:

Vitrinite	59%
Exinite	1
Resinite	6
Fusinite	1
Semifusinite	3
Micrinite	1
Mineral Matter	29
R_o max	0.48

Recalculated on a mineral-matter-free basis, the Vitrinite+Exinite content is 93%. These data confirm the Tertiary age of these rocks, and the setting is analagous to the Five Fingers deposit and other deposits at the base of the Carmacks Group. The "different lithology" described by George between Walsh and Illusion Creeks was not investigated by the writer, but is evidently Tantalus Formation.

References:

Bostock and Lees (1938)
George (1970)

3.3 CONCLUSIONS

Not enough information is available to assess the mining potential of the coal deposits at the base of the Carmacks Group. These areas are invariably very poorly exposed, and known coal seams tend to be thin and discontinuous.

The geological setting and age of these deposits is indentical to the Tulameen coalfield of southern B.C. Therefore, the potential exists for deposits of similar thickness and lateral extent within some of the restricted Tertiary basins

described in the preceding paragraphs. In particular, the Indian River basin seems attractive since a seven-foot seam has been mined there, and the basin is relatively large. At many of the other known deposits, exposure is so limited that the presence of thick coal seams cannot be ruled out, and there may be additional areas completely covered by volcanics or more recent deposits which have yet to be discovered. While at the present none of these deposits appear to host large tonnages of coal, further exploratory work may prove otherwise.

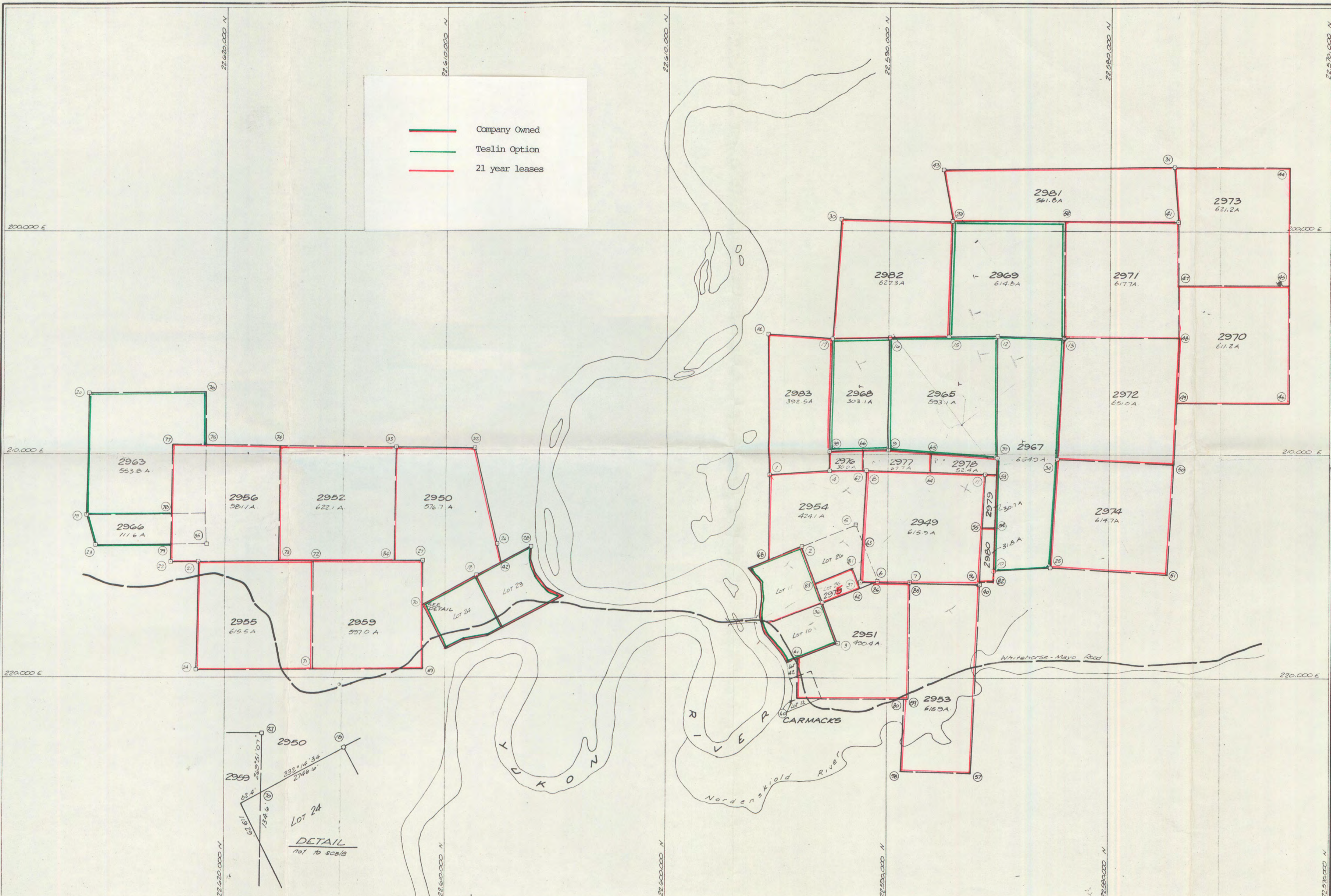
3.4 RECOMMENDATIONS

Three of the deposits outlined above appear sufficiently attractive to warrant limited exploration work. These are: Indian River Area, Mica Creek Area and Jumpout Creek Area. All the others are either too small to be of interest or else present adverse mining situations. Neither geological mapping nor geophysics is likely to provide much additional information in these areas, and so selective trenching and/or diamond drilling on a "wildcat" basis, based upon what limited outcrop information there is, is suggested.

4. REFERENCES

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— Company Owned
— Teslin Option
— 21 year leases

TERRITORIAL PLANE COORDINATES

PT. NO.	NORTHING	EASTING	PT. NO.	NORTHING	EASTING
1	22595347.11	-210990.01	44	22571808.75	-197111.29
2	22593893.43	-214168.15	45	22571808.75	-202391.29
3	22592229.89	-218441.10	46	22571808.75	-207671.29
4	22592626.55	-210753.48	47	22576850.30	-202391.29
5	22591464.18	-211185.59	48	22576850.30	-204866.01
6	22590490.16	-215671.83	49	22576944.23	-207671.29
7	22588980.87	-215736.31	50	22577069.56	-210139.21
8	22590534.72	-210721.12	51	22577356.40	-215411.41
9	22590001.17	-209789.15	52	22581916.43	-199567.37
10	22585200.26	-215210.51	53	22585063.20	-210920.67
11	22585609.21	-210902.11	54	22585139.83	-213319.45
12	22585053.49	-204699.50	55	22585706.21	-213301.35
13	22582080.46	-204747.80	56	22585803.16	-215699.48
14	22594557.37	-204613.96	57	22586058.19	-224325.90
15	22587263.57	-204752.27	58	22589336.78	-224229.52
16	22589947.41	-204796.55	59	22589900.87	-221016.31
17	22592537.04	-204866.38	60	22594060.87	-221016.31
18	22608583.17	-215456.41	61	22594060.87	-219194.53
19	22626262.38	-212731.18	62	22591196.50	-215948.50
20	22626162.01	-207251.76	63	22591196.50	-214020.94
21	22621224.13	-214818.17	64	22587928.60	-210823.27
22	22622466.67	-214833.76	65	22587928.60	-209963.73
23	22625888.70	-214074.12	66	22591181.22	-209842.24
24	22621261.97	-219645.69	67	22591126.82	-210724.85
25	22582626.24	-215084.10	68	22595586.94	-214865.59
26	22607605.09	-214079.48	69	22611005.11	-220073.34
27	22611018.75	-214793.36	70	22611013.73	-216735.58
28	22606144.17	-214172.80	71	22615930.50	-220086.06
29	22587098.75	-199547.02	72	22615944.15	-214806.08
30	22592168.87	-199488.26	73	22617585.99	-214810.32
31	22577088.75	-197111.29	74	22617549.19	-209652.70
32	22608881.45	-209715.97	75	22620857.56	-209629.09
33	22612269.32	-209690.38	76	22620882.50	-207350.49
34	22582348.99	-210216.63	77	22622429.45	-209617.87
35	22620808.33	-214058.04	78	22622451.66	-212731.18
36	22592934.44	-216629.23	79	22622461.25	-214074.12
37	22591244.32	-215756.40	80	22589242.32	-221016.31
38	22592680.22	-209897.07	81	22591536.85	-215028.58
39	22585039.77	-210187.44	82	22585216.48	-215718.22
40	22585808.42	-215829.57	83	22593273.26	-215759.71
41	22586905.30	-199595.02	84	22613305.76	-214796.69
42	22607416.54	-214842.43	85	22586990.87	-215794.87
43	22587527.75	-197282.63	86	22590723.96	-215763.41

PLAN SHOWING
COAL MINING LEASES
CARMACKS AREA
YUKON TERRITORY
 MAP SHEET 115 I/1
 FOR
CYPRUS ANIL MINING CORPORATION

LEGEND
 Targets are shown thus
 Lease boundaries determined from targets
 Theoretical lease boundaries

SCALE: 1" = 1/2 MILE

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 Box 4418
 WHITEHORSE, YUKON TERRITORY