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REPORT ON

BUSH MOUNTAIN

GRAPHITIC ANTHRACITE PROSPECT

1971 FIELD SEASON

BY

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NORMAN H. URSEL ASSOCIATES LIMITED

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T A B L E S

F I G U R E S

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A P P E N D I X E S

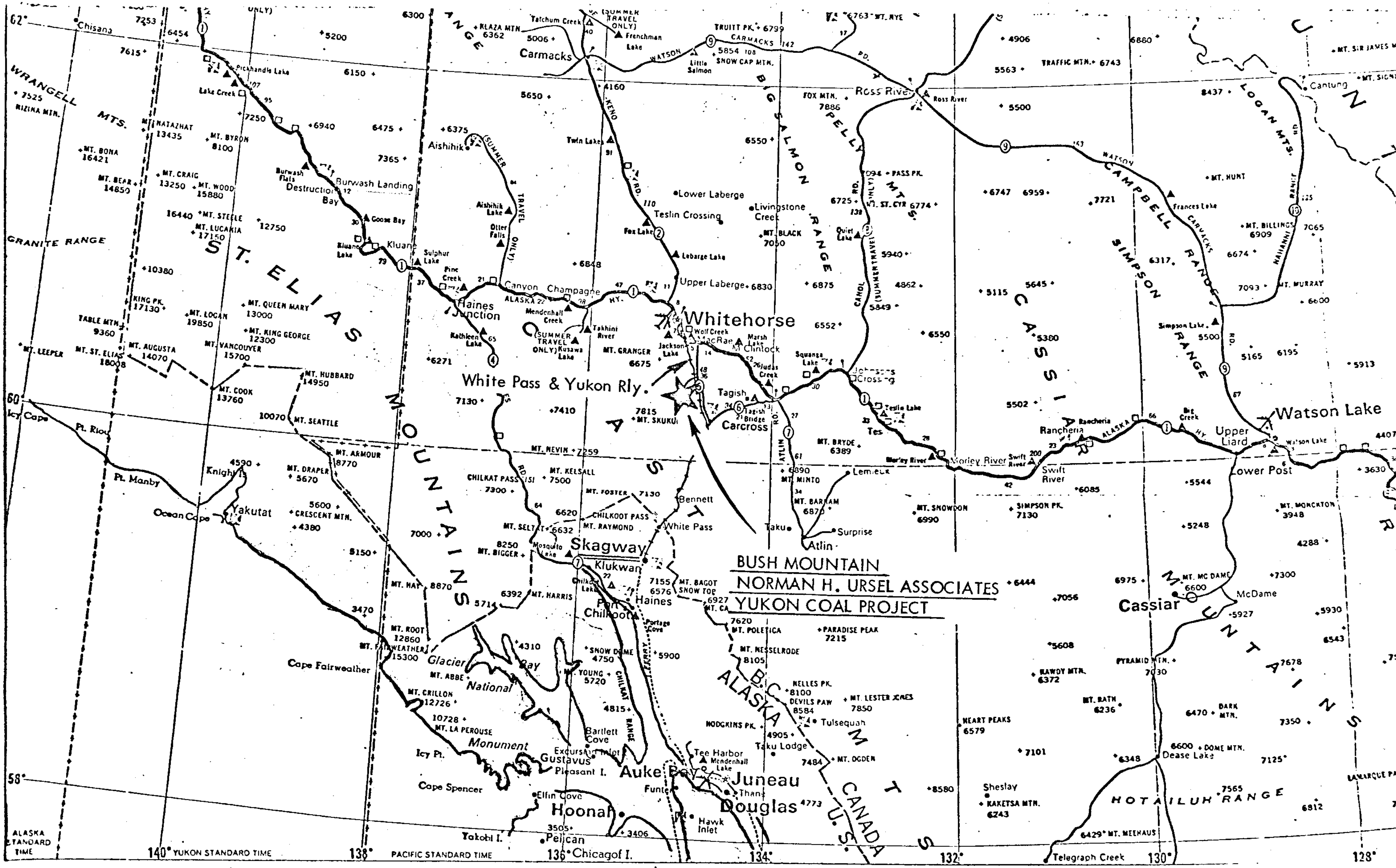

BUSH MOUNTAIN
NORMAN H. URSEL ASSOCIATES
YUKON COAL PROJECT

Figure 1

GENERAL

The Bush Mountain graphitic anthracite prospect is located about 28 miles south of Whitehorse, Yukon (Figure 1). The prospect area lies approximately mid-way between the summits of Bush Mountain, on the southwest, and Idaho Hill, on the northeast. It is centered approximately on longitude 135°03.95'W, latitude 60°18.97'N, at elevation 5900 a.s.l. (approximate), on the ridge-crest of Bush Mountain, along its northeasterly trend and descent to join the southwest upper slope of Idaho Hill. The area is covered by the Alligator Lake (105 D/6 East Half) and Whitehorse (105 D) sheets of the National Topographic Series (published on a scale of 1:50,000 and 1:250,000, respectively).

PREVIOUS PROSPECTING

The only reported previous coal prospecting activity is that of Cairnes (1908, in Bostock 1957, p.257,270; 1912, p.145-147) who discovered coal showings while doing reconnaissance geological mapping in the summer of 1906, and returned with assistants in July, 1909 to partly uncover 3 seams. Showings of other seams were also found. Frozen superficial material deeply covered the seams. Stripping was not completed to the hanging wall of 2 of the 3 seams uncovered. Exposed thicknesses measured were 18 inches, 6 feet or more, and 3 feet or more. A sample was taken from the frozen outcrop of the 6-foot showing. A proximate analysis indicated a high ash, "semi-anthracite": Moisture, 4.78%; Ash, 30.10%; Volatile combustible matter, 8.62%; Fixed carbon, 56.50%.

One to two miles to the east and southeast of the centre of the coal prospect there are several silver-lead showings in quartz and quartz-carbonate veins in argillites and greywackes of the Laberge Group. Through the years there has been considerable prospecting activity and some test shipments from shallow workings. Thomas Kerwin and two others in 1893 staked on the east side of Idaho Hill what are thought to be the first claims in the southern Yukon (Cairnes, 1908, in Bostock, 1957, p.257). It is reported that some $1200/ton ore was mined. During the period 1898 to 1907 ground in this vicinity was first staked and worked by W. F. Schnabel, then by Messrs. Schnabel, Folle and partners. Mr. Schnabel reported to Cairnes in 1907 that an ore shipment of ten tons returned over $20/ton, mainly in silver.

Most of the claims in the Idaho Hill area (reference C.S.S. 105 D-6) are now held by Whitehorse Silver Mines Ltd., which is a private company incorporated in 1969, with head office at 11838 103rd St., Edmonton, Alberta.

PRESENT PROSPECTING

The prospect occurs within the area SEQ 105 D-6 held under Territorial Coal Exploration Licence No. 20 (Figure 2). This is the first licencehold of this area, and the present report is the first submitted.

It was planned to prospect for seams in the area reported by Cairnes, expose seams by trenching, and obtain channel samples of sufficient size for both proximate analyses and washing tests.

The field work was carried out during a 17 day period in late July and early August, 1971 by one geologist, the writer, and one assistant, Mr. Scott Lyle. Time distribution during this period is given in Table 1.

Working first out of Whitehorse, a brief airborne (fixed wing aircraft) examination of the Bush Mountain area was undertaken to plan traverses, spot helicopter landing sites, and find a campsite. Possible landing sites were spotted in a few places near the Bush Mountain - Idaho Hill ridgecrest. Since this ridge is more or less normal to structural trend in the target-host Tantalus formation, and outcrop appeared to be more abundant along it than on lower slopes, it was decided that the first traverses should be

Figure 2 Scale 1:250,000

TABLE 1

Bush Mountain Field Work Time Distribution

17 days: July 23 - August 8, 1971

Total Days	Men	Description
1	1	Travel to Whitehorse
1	1	Hiring arrangements
1	1	Reconnaissance aerial examination of property and search of property records
$2\frac{1}{2}$	2	Mobilization, demobilization
$\frac{1}{2}$	2	Campsite selection, set-up, take-down
$8\frac{1}{2}$ ($5\frac{1}{2}$ work, 2 Lost to weather, 1 Lost to unavailable helicopter)	2	Ground traverse prospecting, Trenching, Sampling, Measurement of trench-exposed sections. Done in 3 periods: $\frac{1}{2}$ day, 5 days, 3 day
$2\frac{1}{2}$ ($1\frac{1}{2}$ work, 1 Lost to weather)	2	Reconnaissance inspection of ground access routes to property, and pick-up samples ferried to road by helicopter

near, and approximately parallel to the ridge. In addition, Cairnes' coal locality was reported to be near the ridge.

Access for first ground traverse field work was by helicopter set-out and same-day pick-up for return to Whitehorse. The Tantalus formation, as indicated on Map 1093A (Wheeler, 1961), was traversed from northeast to southwest along the northwest side of the ridge and up to a few hundred yards downslope from it. Return traverse essentially followed the ridgecrest. Coal outcrops were not found, but evidence of coal was found at several places across strike, concentrated in one general area lying immediately southwest of a large windgap occurring on the Bush Mountain ridgecrest.

The windgap provided a convenient campsite, with a small melt-water stream forming nearby from a snowbank located near the top of the northwestern mountainslope to the north of the windgap, named Campsite Windgap. From here, field work was carried out during two periods totalling 8½ days, of which a total of 2 were lost due to weather and 1 due to unavailability of helicopter for return after the first period. This field work consisted of further ground traverse reconnaissance prospecting, hand-trenching, measurement of trench-exposed sections, and channel sampling.

ACCESS

The coal exploration licence area (Figure 2) is accessible from Whitehorse, Yukon by helicopter (this work) or by road, and from the seaport of Skagway, Alaska by the combination of railroad and road as indicated on Figure 1. A road to the Idaho Hill silver prospects, extending west from the Annie Lake Road, enters the coal exploration licence area to the north of Schnabel Creek (Figure 2). As shown on Figure 3, the base map for which is a portion of Alligator Lake sheet, East Half, First Edition, the road ends approximately 1.7 miles east of the graphitic anthracite showings, but portions of a road or roads which were seen at a distance from a vantage point on Bush Mountain, indicated that road access extends further up Schnabel Creek than shown. The distance along the Annie Lake road to its intersection with the Whitehorse-Carcross Highway is about 12 miles. Robinson on the White Pass & Yukon Railway is near the latter intersection. Rail distance from Robinson to Skagway is about 90 miles.

The present work required 3 round trips by helicopter from Whitehorse to the prospect area, and one flight to ferry samples and equipment from the campsite to the Annie Lake road. Three different aircraft were chartered out of Whitehorse from Trans North Turbo Air Ltd.: One Bell 47G-3B-2 helicopter, piloted by Mr. Tom Kamiho; Two Bell 206-A Jet Ranger helicopters, one piloted by Mr. Gene Drzymala, and one by Mr. Tony Hanulik. A Cessna 172 fixed-wing aircraft, used for a preliminary examination of the prospect area, was chartered out of Whitehorse from Globe Air Services, and was piloted by Mr. Gavin Brown.

Upon completion of work based in the field camp, the material ferried to the Annie Lake road was picked up by automobile, and at this time Bush Mountain was examined at a distance (Plate 1), from the perspective of the Annie Lake Valley "floor" through which ground access passes.

TOPOGRAPHY, GLACIATION, AND SURFICIAL GEOLOGY

Plate 1 is an oblique view of the southeast side of Bush Mountain, and, as seen behind and above the summit of Idaho Hill, an end-on view of the section of the ridgecrest on which the field work centred. The latter is at about 5900 feet elevation, and Plate 1 was photographed from about 2600 feet elevation. Summit of Bush Mountain is about 6500+ feet elevation, that of Idaho Hill about 5500+ feet. The northeastern ridgecrest of Bush Mountain, as measured from its summit to the bottom of the saddle behind Idaho Hill, is about 1.3 miles in length. Schnabel Creek flows to the northeast along the base of the southeastern mountainslope, and Perkins Creek along the base of the northwestern slope.

The Bush Mountain area is part of the transitional zone between "two primary physiographic subdivisions of the Canadian Cordillera" - the Coast Mountains and the western Yukon Plateau. Wheeler (1961, p.6) states that this transitional zone

> "......is characterized by a relatively smooth, gently rolling upland surface, undulating between 5,000 and 7,000 feet, locally surmounted by roughly conical peaks or groups of peaks......This surface is dissected by U-shaped valleys not more than 3 miles wide, producing an average relief of 3,500 to 4,500 feet. It appears partly to merge with and partly to abut the rugged (jagged, alpine) terrain of the Coast Mountains."

The foreground in Plate 1 is the western side of a north-south trending U-shaped valley. Alpine glaciation has produced north-facing cirques in the uplands immediately west of Bush Mountain (Wheeler, 1961, Figure 1). The Bush Mountain ridge is slightly serrate. Another cirque, not mapped as such by Wheeler, forms a north-facing curving indentation of Bush Mountain ridge. It is located immediately west of Idaho Hill whose northwestern side forms part of the cirque (Figure 3). The ridgecrest coal sampling localities (ahead) are at the top of the headwall of this cirque.

The cirque is not "fresh"-looking as are those occurring at higher elevations to the west of Bush Mountain. It lacks fretted walls and serrated spurs, and on the basis of airphoto interpretation it holds little, if any, morainal debris. Its walls and surrounding ridges are smoothed and rounded in comparison with the "fresh" cirques.

Wheeler (1961, Plate X, p.18) identified a similar "old" cirque in occurrence $1\frac{1}{2}$ miles west of Coal Lake, located approximately 12 miles to the north-northwest of the Bush Mountain northeast cirque. Since there is evidence that ice of the last advance of the Cordilleran ice-sheet (Coast Mountain and Cassiar lobes) reached at least 6,500 feet elevation, Wheeler (p.18) points out that cirques whose floors were at lower elevations were occupied by the ice-sheet and subjected to rounding and smoothing erosive-action. Apparently the Coal Lake cirque and the Bush Mountain northeast cirque were not rejuvenated, whereas alpine glaciation was resumed in higher elevation cirques, e.g., those west of Bush Mountain.

The bounding spurs of the Coal Lake cirque are notched. In addition, an abandoned lateral (overflow) channel and a kame terrace are present along the back of this cirque. Wheeler interprets these landforms to indicate that streams marginal to an ice-sheet flowed through the cirque. Campsite Windgap is a throughgoing notch in the cirque headwall ridge of Bush Mountain northeast cirque. This bedrock notch is at the head of a dry stream channel trending directly down the south mountainslope, in back of the cirque. This notch/channel landform may be an abandoned direct overflow channel formed when the cirque was filled by the last ice sheet.

The ground in the prospect area shows considerable evidence of frost-heaving. In areas of outcrop or thin overburden, surface accumulations of jumbled angular boulders are common. In sloping, grassy areas of overburden cover, stone garlands and stone stripes occur. In the late July and early August period of observation, the ground was frozen near surface in the vicinity of the water-supply snowbank, but ice was encountered in only one prospecting trench, at a depth of about 4.5 feet. The other ice-free trenches reached to depths of up to 8.0 feet. In July, 1909, Cairnes (1910, in Bostock, 1957, p.336) found that frozen ground was general in this area. Beneath the active zone permafrost may be present, but no permafrost data is available. Pitted terrain occurs in unconsolidated valley-fill deposits to the north-east of Idaho Hill, from Annie Lake northward to the Watson River (Dept. of Energy, Mines, and Resources Airphoto A11524 23). This may represent thermal karst; i.e., slump due to thawing of permafrost.

PREVIOUS GEOLOGICAL WORK

Cairnes (1908, in Bostock, 1957) performed the first recorded geological work in the Bush Mountain coal area in 1906 while investigating the geology and mineral deposits of the Conrad and Whitehorse mining districts. He (ibid., p.270, 272, 273) observed "heavy" (massive) conglomerate beds, easily distinguished from all other conglomerates in these districts by their "....hard, well-rounded, generally small pebbles of slates, cherts, quartzites, etc., in a siliceous matrix - giving the rocks a very cherty, hard appearance". He recognized a lithologic similarity between these conglomerate beds and those occurring in coal measures lying in the valley south of Mount Granger, located about 14 miles northwest of the Bush Mountain coal area, and about 17 miles southwest of Whitehorse. The latter coal measures had been staked and opened up by a 60 foot long tunnel and a few open cuts, revealing 3 seams of anthracite coal, the whole referred to as "Whitehorse coal" (ibid., p.258).

After finding the conglomerate marker horizons in the Bush Mountain area, Cairnes in 1906 (as reported in Cairnes, 1912, p.145) searched for and found coal seams which were interlayered with the conglomerates and with black shales, both finely (thin) and coarsely (thick) bedded, and light-coloured, thinly bedded shales and some more coarsely (thickly) bedded shales, and light-coloured sandstones, plus some quartzites (Cairnes, 1908, in Bostock, 1957, p.270). Considerable folding and distortion of the rocks was reported and neither stratigraphic section nor seam thicknesses were measured.

In the course of geological mapping in the Wheaton District, the Bush Mountain coal area was again visited in 1909 by Cairnes (1910, in Bostock, 1957; 1912) and also in 1915 (Cairnes, 1916, in Bostock, 1957). In 1909 stripping carried out by Cairnes' party made some seam thickness measurements possible. By this time Cairnes (1906, 1908b, 1909, all in Bostock, 1957; 1910b) had also investigated coal-bearing Jura-Cretaceous sediments occurrring in the area of the Whitehorse Trough from Whitehorse northwards to Tantalus. Two major coal-bearing horizons were found to be associated with a distinctive "conglomerate formation" lithologically similar to that in which the Bush Mountain coal occurs (Cairnes, 1910, in Bostock, 1957, p.331). The coal then mined at Tantalus also occurs in this conglomerate, which was given the name "Tantalus conglomerate" (ibid., p.330, 331).

Another major coal horizon, e.g. the then producing seams at the Five Finger mine north of Tantalus, occurs in the upper part of the Laberge series (named by Cairnes, ibid.), interpretted to be overlain by Tantalus formation. Thus, when the latter formation is at all present, in succession with the Laberge series, it indicates that the favourable horizons of the latter have not been lost by erosion, and the "lower coal" may be present. This is the case in the Nordenskiold River area, on Division Mountain, although the coal-bearing horizon in the Tantalus formation itself, the "upper coal" of the Jurasso-Cretaceous section, appears to have been lost by erosion (Cairnes, 1909, in Bostock, 1957, p.278, 279).

Cairnes (1910, in Bostock, 1957, p.331), discussing the Wheaton District in which the Bush Mountain coal area occurs, stated that the Tantalus conglomerate conformably overlies the Laberge series. This conclusion must have been based on the field relationships observed north of Whitehorse beyond the Wheaton District because he had earlier suggested (1908, in Bostock, 1957, p.272, 273) concerning the Whitehorse coal area that the coal measures (the Tantalus formation) are apparently overlain by the other Jura-Cretaceous sediments (Laberge series), and later (1916, in Bostock, 1957, p.415) concerning the Wheaton District (Bush Mountain coal area) that "The conglomerate series.......appears to underlie the Laberge beds, but of this no absolute proof could be obtained, owing to the greatly disturbed condition of these sediments."

In the latter quoted report, which represents Cairnes' last published views on the geology of the area, the "conglomerate series" is no longer called "Tantalus conglomerate", rather in the Table of Formations (ibid., p.414) in the "Formation" column, beneath the entry "Laberge series", is the following entry: "Probably corresponds to the Kootenay". Thus Cairnes is suggesting that the Tantalus conglomerate correlates with the Kootenay formation, known for its occurrences in British Columbia.

Plant fossils collected up to this time in the Bush Mountain area indicated a Jurassic age for the Tantalus formation (ibid., p.415). W. A. Bell later re-studied the fossil collection, and his conclusions considered together with Tantalus/Laberge field relationships lead Wheeler (1961, p.74) to regard the age of the Tantalus formation as Upper Jurassic(?) and Lower Cretaceous. Summarizing studies by S.S. Buckman, H. Frebold, and F.H. McLean of fossil collections, including several from the Bush Mountain area, Wheeler (1961, p.54) states that ".....the Laberge group in Whitehorse map-area contains fossils ranging from lower Lias to early Middle Jurassic". Thus, the fossil evidence indicates that the Tantalus formation is younger than the Laberge group, in the Bush Mountain coal area.

The Bush Mountain coal area is included within the Whitehorse map-area of J.O. Wheeler (1961), who applied the names "Tantalus formation" and "Laberge group" to the "conglomerate formation" or "Tantalus conglomerate", and "Laberge series", respectively, of Cairnes (above).

The area of Tantalus formation is shown on Wheeler's Map 1093A to be about 1.75 miles long, and averaging 0.5 mile in width. Cairnes (1912, p.147) reported that "The Tantalus conglomerates extend down to near the creek bottoms on both sides of the ridge on which the coal was found, and also appear to the south, across Schnabel Creek, on Mt. Folle". Aggregate thickness of the Tantalus formation in this area was reported to be 1,700 to 1,800 feet (ibid., p.58).

In describing the petrography of rocks comprising the Tantalus formation, Wheeler (1961, p.72) makes some specific references to the Bush Mountain coal area (= west of Annie Lake):

> "The conglomerates are well sorted and generally contain well-rounded pebbles commonly 1 inch and rarely 2 inches across. These pebbles are composed of white and grey quartz, quartzite, black and grey chert, one fragment of which contains radiolaria(?), and minor argillite. Some subangular chert occurs west of Annie Lake.......(where also) the rocks....are well indurated and thoroughly cemented with silica. The matrix comprises finely comminated quartz, chert, quartzite, sodic plagioclase, and white mica.
>
> "The arenaceous rocks are pale grey, grey, or greyish-brown, and are commonly speckled with black chert grains. They contain subangular to subrounded grains of slightly sericitized sodic plagioclase, quartz, quartzite, minor feldspar porphyry, much chert, and siltstone in a matrix of finely comminated quartz, plagioclase, white mica, and biotite. The quartz occurs both as clear, unstrained grains and as mosaics of anhedral crystals showing strain shadows.
>
> "The arenites of the Tantalus formation differ from those of the.......Laberge group by containing much more quartz, no potash feldspar or mafic minerals except a little biotite, and some iron ore.

> "Poorly preserved plant fragments are common, particularly near seams of coal."

The considerably distorted and disturbed Tantalus beds have a generally northerly strike as does the trench of a fault along which the formation is in contact with volcanic rocks (age unknown) to the west (Cairnes, 1912, p.146-147). The nature of the east contact, with Laberge group sediments, has not been determined, but it appeared to Wheeler (1961, p.72) to be either a fault or unconformity.

RECONNAISSANCE PROSPECTING RESULTS

At no place in the area of ground traverse prospecting was solidly outcropping coal found. It was observed while traversing along or near the ridgecrest that coal float is present in most windgaps. The presence of bedrock coal beneath windgap overburden is indicated by frost-heave coal fragments, and also by chips of coaly shale and argillite which are associated with coal. Differential weathering of the coal measures has produced windgaps where coal and associated fine-grained clastic sediments are more rapidly down-weathering than are the conglomerate, conglomeratic sandstone, and greywacke units which outcrop along and near the ridgecrest. Some rock units with intermediate weathering-resistance, sufficient to yield outcrops within or at the sides of windgaps, are a fresh porphyritic dike, an altered dike, and a dark grey argillite (borderline slate).

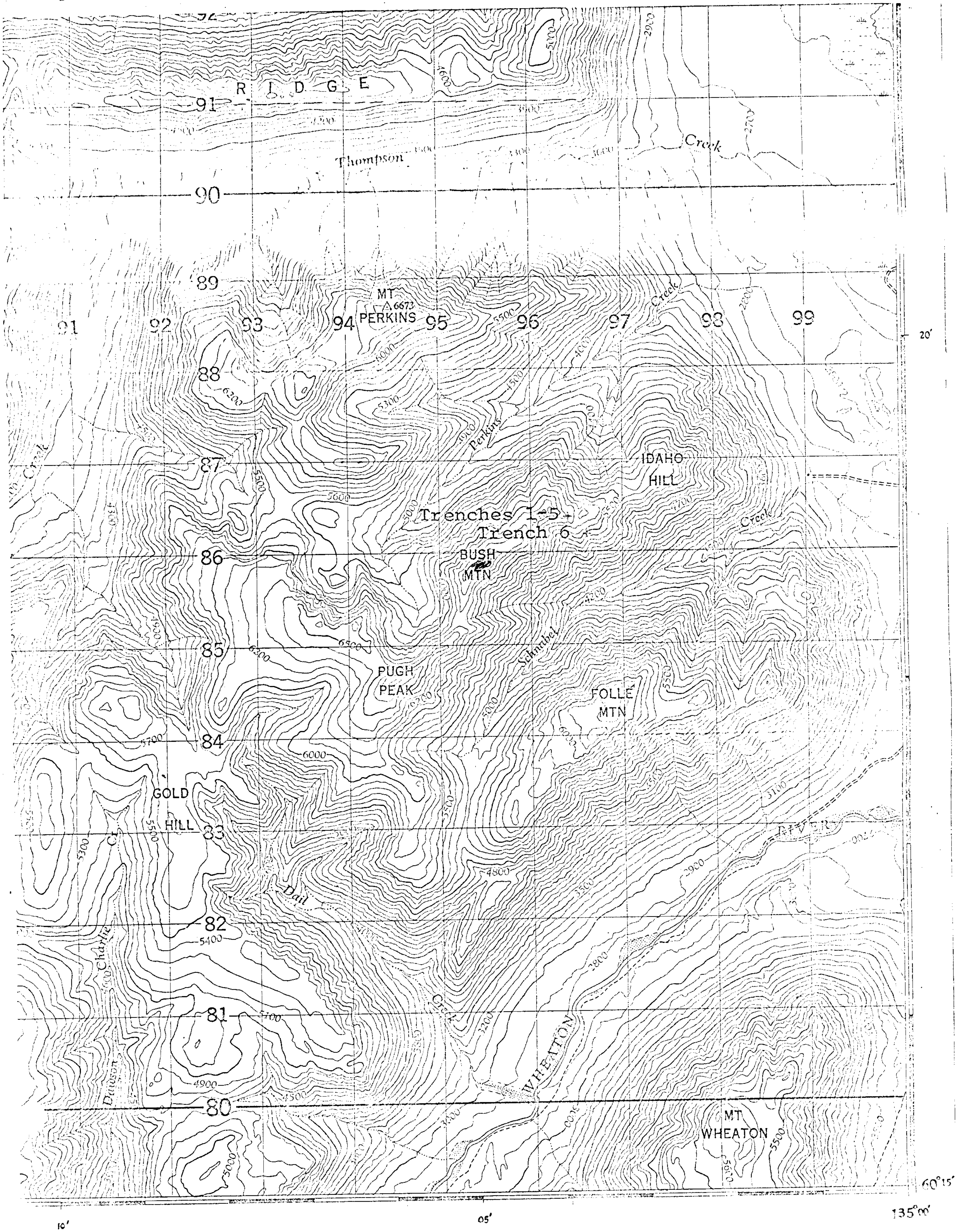
Windgaps vary in width from a few feet (Trench 4 locality) to a few yards (Trench 5 locality, see Plate 3), and the one in which Trenches 2 and 3 are located (see Plates 5 and 6) is roughly 150 feet wide if an outcropping porphyritic dike (Plate 5, left foreground) is taken as being within the windgap. The deepest, Campsite Windgap (Plates 2, 3, and 4), is roughly 100 feet deep, 100 feet wide across the bottom, and 350 feet wide across the top.

In the bottom of the latter large windgap, angular boulders and smaller scree form an apparently thick accumulation, up through which coal, if present in bedrock underlying the windgap, might not have reached surface by frost heaving. Bands of float consisting of graphitic coal, and coaly shale and argillite trend diagonally across the southwest side of Campsite Windgap (see Plates 2 and 3), and coal float which was found on the bottom of this side of the windgap may be scree which has moved downslope from these bands. The float (frost heave and talus) bands probably more or less overlie bedrock seams, and they trend toward that ridgecrest section, lying southwest of Campsite Windgap, where coal float in windgaps indicated the presence of several seams.

The latter ridgecrest sector was chosen for trenching and more detailed prospecting. Down the north slope from this sector, extensive coarse talus deposits, including large jumbled blocks, made prospecting for coal float difficult, and trenching virtually impossible. Down the southwest side of the ridge the surface of the regolith has much less coarse, blocky talus cover, and includes soil sufficiently fine, and on sufficiently stable slopes for the growth of grasses (see Plates 5, 2, and 8). Here bands of coal float were found for several hundred feet downslope of the ridge, and with detailed mapping could be useful in tracing seams. Some old caved pits or trenches, were found at downslope localities on these bands, and it appears that bedrock was reached in some cases. These may have been Cairnes' trenches.

For the present investigation it was decided to confine most trenching to near the ridgecrest (Figure 3) where depth to bedrock was found to be a few feet, and to also attempt to reach bedrock at one locality further downslope than the old trenches and on a different band of float to the east, at a locality approximately 950 feet southeast of the ridgecrest trenching localities.

The ridgecrest windgap (roughly 150 feet wide) in which Trenches 2 and 3 (Figure 4) were excavated, is on the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Trenches 1-5
Trench 6
BUSH MTN
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PUGH PEAK
FOLLE MTN
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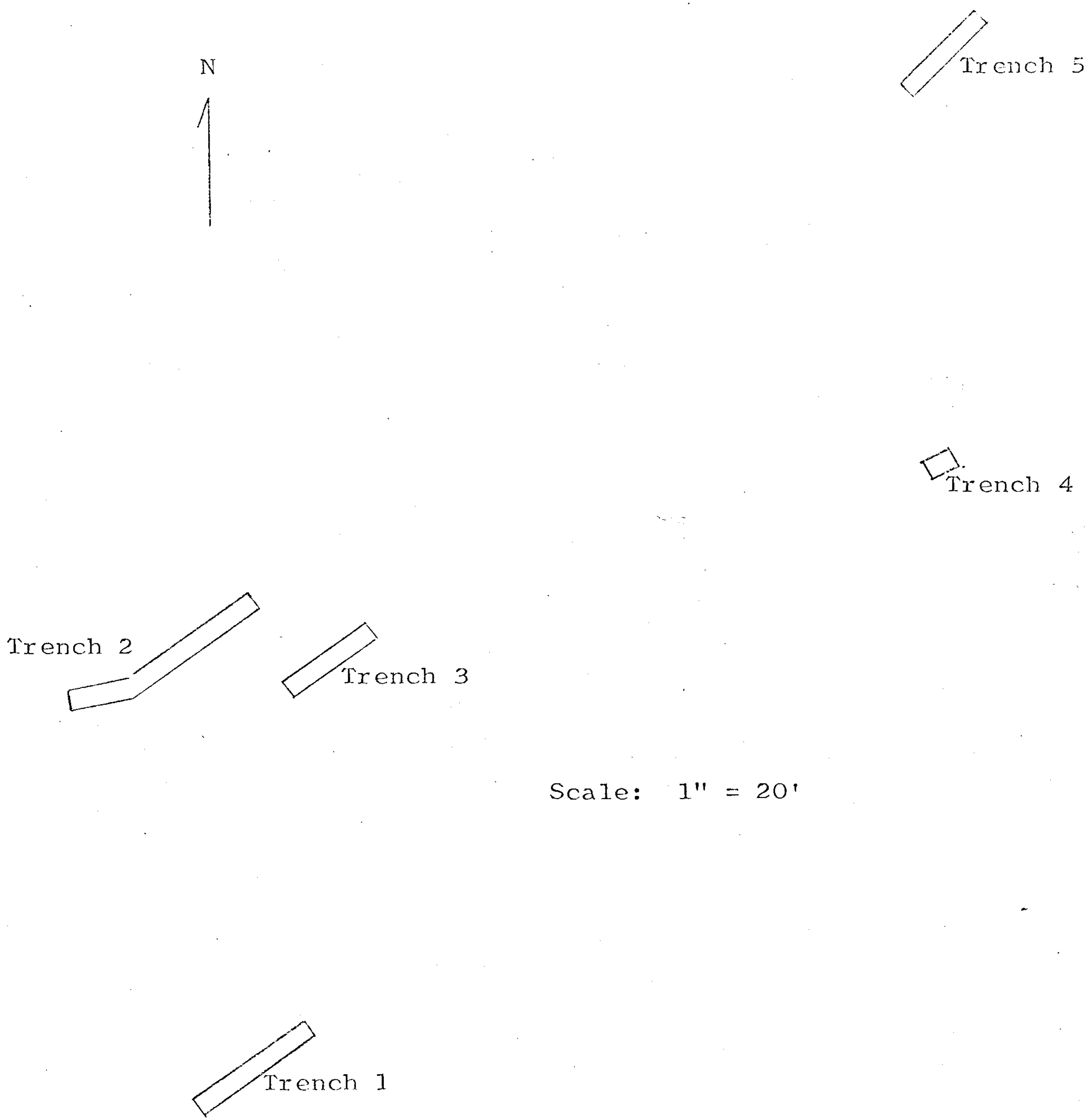

FIGURE 4. Sketch Map of Trenches

southwest bounded by a dark grey argillite (borderline slate) striking 342°, dipping 90°. This is the only unit which could be traced from this sector of the ridgecrest for any significant distance (several hundred feet) down the talus-covered northern mountainslope. It also persists to the south, and will probably be a useful marker horizon. Between this unit and Trenches 1 and 2, and with intervals without outcrop on either side, a northwest-trending, relatively fresh porphyritic dike outcrops (Plate 5, left foreground), which consists about 30% of light grey plagioclase phenocrysts from 1 mm up to 10 mm, in a fine- to medium-grained, medium greyish-green matrix, weathering light reddish-grey to buff.

Bounding the windgap on the northeast side of Trenches 2 and 3, is another outcropping dike, which is much altered, but is also porphyritic and may have been lithologically similar to the above dike. The dike is about 11 feet wide on surface, sends offshoots into coal exposed in Trench 3, and is in crosscutting contact with a conglomerate unit on its east side. From the latter contact northeastwards for about 100 feet along the ridgecrest, the sequence consists mainly of steeply east, then steeply west-dipping thick-bedded to massive conglomerate and conglomeratic sandstone, interrupted by a few small windgaps with faulted walls (on at least one side) and containing coal float. The faults are mainly vertical, mainly trending north-northwest with horizontal to mainly gently (north and south) plunging slickenside lineations, indicating that movement is largely strike-slip. Two of the windgaps, including the largest of these in this sector, were chosen for trenching work.

TRENCH PROSPECTING RESULTS

Six exploration trenches, oriented approximately perpendicular to strike of coal seams, were excavated by hand for an aggregate length of 93 feet. Their locations are indicated on Figures 3 and 4. Data sheets and measured sections for these trenches are given in Tables 2 through 9. Two trenches were not located precisely on the ridgecrest, and bedrock was not reached in either one. Trench 1 is approximately 50 feet southeast of the ridge. Only in this trench was frozen ground encountered. The overburden material, frozen at about 4.5 feet below surface, consists mainly of black shale and argillite, and some coal. Trench 6, located approximately 950 feet southeast of Trenches 1 - 5, was sunk to 8.0 feet. The exposed overburden material consists mainly of graphitic coal and coaly shale for the full trench length of 20 feet (see Plate 8).

TABLE 2

Trench 1 Data

Trench Co-ordinates: 60° 18.96'N (approximate, by map location)
135° 03.95'W

Trench Elevation: 5885 feet a.s.l. (approximate, by barometer)

Location Description: Approximately 50 feet southeast of Bush Mountain ridgecrest. Northeast end of trench roughly on strike (inferred) with southwest end of Trench 2.

Trench Orientation: 55°, approximate

Excavation Date: August 1, 1971

Length: 17 feet

Width: 2 feet

Depth: 3 to 4 feet, with trench bottom pits to 5 feet

Trench Geology: Bedrock not reached. Trench for entire length exposes rocky soil, at least 5 feet thick, derived mainly from black shale, argillite, and some coal. This regolith material was frozen in places in bottom of trench. The regolith is thought to be a mixture of frost heave and talus, probably including both residual and transported material.

Samples: None

TABLE 3

Trench 2 Data

Trench Co-ordinates: 60° 18.97'N (approximate, by map location)
135° 03.95'W

Trench Elevation: 5895 feet a.s.l. (approximate, by barometer)

Location Description: Northeastern margin of a windgap (roughly 150 feet wide) on northeast trending ridgecrest of Bush Mountain.

Trench Orientation: 55° (in main coal seam, northeastern portion)

Excavation Dates: July 27, 29, and 30, 1971

Length: 26 feet (Excavation toward the northeast ended due to talus deposit)

Width: 2 to 2.5 feet

Depth: 5 feet, average in main coal seam, northeastern portion of trench

3 feet, average in remainder, southwestern portion of trench

Trench Geology: Bedrock coal (graphitic anthracite) interbedded with fine-grained clastic sedimentary and metasedimentary rocks (see Table 4). Unconsolidated frost heave and talus for a few feet in southwest end of trench.

Coal: Six seams measured (see Table 4; from southwest to northeast): 0'2"; 0'1½"; 1'4"; 0'7"; 0'7"; 8'6" or more (trench ended in coal).

Channel Samples: NHUA 8/7/71-1, 1'4"; NHUA 8/6/71-1, 8'6". Former is a 2" x 3" (5 lbs.) channel sample taken on northwest sidewall of trench; latter is a 3" x 6" (88 lbs.) channel sample taken on bottom of trench.

TABLE 4

Measured Stratigraphic Section in Trench 2

Attitude (unit contacts and foliation in coal): Varies from southwest to northeast
325° to 315°
90° to 64° NE

Stratigraphic way-up unknown

Measurement and lithology description on north wall of trench

Thickness of Unit	Lithology
2' (approx., in trench)	In southwest end of trench: Unconsolidated talus
0'7"	(a) Shale, black, thinly intercalated fissile and chunky, and clay weathering yellow to yellowish-brown, unit coaly in eastern 2".
0'2"	*(b) Coal, very bright, crushed, maximum size of pieces is 3/8".
0'2½"	(c) Shale, both chunky and fissile chip, intermixed with clay, orange weathers reddish-orange, pulverulent.
0'1"	(d) Clay, yellowish-grey.
0'1½"	*(e) Coal, bright, moderately crushed, maximum size of pieces is 1".
0'4"	(f) Shale, black, fissile, very soft, intercalated with clay, black; both weather yellow to yellowish-brown.
1'0"	(g) Shale, dark grey, fissile to oblong chunky, medium induration (largest pieces easily snapped by hand), with coal laminae common, some yellow to orange-yellow weathered clayey coatings along partings.

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* One of the two thin coal seams, unit (b) or (e), may split since 3 thin seams (two about 3" thick) occur on south wall of trench.

0'8"	(h) Intercalated shale and clay, same as unit (f).
0'8"	(i) Shale, same as unit (g).
0'8"	(j) Argillite, dark grey, conchoidal fracture, unit is one bed, yellowish-brown coatings on some fracture surfaces.
0'7"	(k) Shale, same as unit (g), with yellow to orange-yellow clayey coatings along partings more pronounced and these are associated with coal laminae which constitute approximately 25% of the unit.
0'6"	(l) Argillite, same as unit (j), plus stockworks fracturing well developed.
0'9"	(m) Shale, black, coaly, medium to well indurated, fissile to chunky, with minor coaly claystone-siltstone, and with coal laminae and very thin layers constituting approximately 25% of the unit, yellow to orange-yellow clayey coatings less pronounced than in unit (k).
1'4"	(n) Coal, medium to mainly thin banded, pieces range from thin platy chips to hand size slabs with broadest surfaces irregular to curved, thin discontinuous coatings of green to white mineral matter common. Channel sample 8/7/71-1.
0'4"	(o) Shale, black, coaly, fissile, soft, with coal laminae constituting approximately 20% of the unit.
1'0"	(p) Claystone-siltstone or marginal argillite, dark grey, coaly, breaks both along graphitic partings and with irregular to conchoidal fractures.

0'7"	(q) Coal, shaly (black), thin banded, thin platy to slabby pieces.
1'4"	(r) Claystone-siltstone or marginal argillite, same as unit (p), medium to thinly <u>interbedded with</u> shale, black, coaly, fissile to oblong chunky, with coal laminae constituting from approximately 10 to 25% of the unit.
0'7"	(s) Coal, thin banded, thin platy chips.
0'6"	(t) Shale, black, chunky, medium to well indurated, with coal laminae constituting less than 10% of the unit.
8'6" (Trench ended in coal. Further excavation to the northeast limited by talus deposit.)	(u) Coal, mainly bright or graphitic lustre some duller material, crushed and sheared, pieces range from granules through platy chips to hand size slabs varying in general shape from discoid to oblong; foliation dipping 80 to 64° NE (decreasing to northeast) defined by aligned plates and slabs is moderately constant to locally irregular, with 1 to 3" thick lenses or dislocated partings of shale, black, coaly, fissile to oblong chunky, positioned at 42", 48", and 54" above (structurally) west contact of the unit; in northeastern end of trench exposure coal is intruded by altered dike with irregular cross-section, light greenish-grey, brown-altered margins, containing segregations of smoky quartz. Channel sample 8/6/71-1.

TABLE 5

Trench 3 Data

Trench Co-ordinates: Same as Trench 2

Trench Elevation: 5895 feet a.s.l. (approximate, by barometer)

Location Description: Approximately 12 feet southeast of Bush Mountain ridgecrest. Southwest end of trench overlaps strike projection of northeast end of Trench 2 by about 5 feet.

Trench Orientation: 55°, approximate

Excavation Date: July 31, 1971

Length: 13 feet (Excavation toward the northeast ended due to talus deposit)

Width: 2 to 2.5 feet

Depth: 3 to 4 feet

Trench Geology: Bedrock coal (graphitic anthracite) for full trench length, and both ends are in coal. Coal is extensively intruded by branching dike offshoots of intensely altered, light greenish-grey (chloritic) dike which outcrops approximately 5 feet east of the northeast end of the trench. The main outcropping dike is highly and irregularly fractured. It is fine-to medium-grained, slightly porphyritic (feldspar(?) phenocrysts composed of alteration products which appear to be mainly chlorite and sericite), and is either vesicular, or else altered phenocrysts have been removed to form solution cavities.

Coal: Seam not measured due to probable disturbance of thickness by intrusion. Note that approximately 5 feet of thickness would be overlap of main seam measured in Trench 2, and extent of coal beyond the northeast end of trench will be limited by main dike outcropping about 5 feetaway.

TABLE 6

Trench 4 Data

Trench Co-ordinates: 60° 18.97'N (approximate, by map location)
135° 03.92'W

Trench Elevation: 5895 feet a.s.l. (approximate, by barometer)

Location Description: Trench extends across bottom of a narrow, steep-walled windgap occurring on Bush Mountain ridgecrest.

Trench Orientation: 60°

Excavation Date: August 1, 1971

Length: 3.7 feet

Width: 2 to 2.5 feet

Depth: 3 feet

Trench Geology: Vertically dipping bedrock coal, claystone, and altered intrusive sill (see measured stratigraphic section in Table 7).

Coal: One seam: 1'7"

Channel Sample: NHUA 8/6/71-2, 1'7". A 3" x 6" (16 lbs.) channel sample taken on bottom of trench.

TABLE 7

Measured Stratigraphic Section in Trench 4

Attitude (Parallels attitude of fault which bounds northeast end of trench): 330°
90°

Stratigraphic way-up unknown

Thickness of Unit	Lithology
	Southwest end of trench: Conglomerate
1'10"	Intrusive sill, fine- to medium-grained, possibly slightly porphyritic, highly altered to chunky, soft argillaceous material, pale buff.
0'3"	Claystone, dark brown, poorly indurated.
1'4" to 1'7"	Coal, thin platy from centre to west of centre, crushed in western margin and eastern half.
	Northeast end of trench: Conglomerate, fault contact, scarp faces southwest

TABLE 8

Trench 5 Data

Trench Co-ordinates: 60° 18.98'N (approximate, by map location)
135° 03.92'W

Trench Elevation: 5880 feet a.s.l. (approximate, by barometer)

Location Description: Trench extends across bottom of a narrow, steep-walled windgap occurring on Bush Mountain ridgecrest.

Trench Orientation: 45°

Excavation Date: July 31, 1971

Length: 13.7 feet

Width: 2 feet

Depth: 3.5 to 4 feet

Trench Geology: Bedrock coal (graphitic anthracite) for full trench length, ending against a conglomerate to conglomeratic sandstone unit on northeast end of trench (fault contact), and ending in coal with abundant lenses of argillite on southwest end. While the middle portion of the seam consists largely of small pieces of crushed coal, both the northeastern and southwestern quarters of the seam exhibit a large proportion of plates and oblong slabs of sheared coal averaging a few inches and ranging up to several inches in large dimension. Some pieces exhibit a granular clastic or microbreccia texture. Steeply dipping (75°SW striking 325°, in southwest quarter of trench where preferential alignment of plates or slabs is well developed) to distrubed, indeterminate attitude. Within coal, some lenses of medium grey argillite, a few inches up to 1 foot long, occur in southwesternmost few feet of trench, becoming more abundant to the southwest. At random elsewhere along the trench there are small lenses or sheared partings of argillite which is dark grey, coaly, and fossiliferous, the fossils being black coaly matter and molds of an acicular form, less than 1/8" long, usually tapering, and resembling small conifer needles, e.g., the modern larch or tamarack. A few graphite coated, well founded, dark grey chert cobbles (or possibly concretions?) up to 3 inches were found in southwest portion of trench exposed coal. One uncoated cobble shows a pitted weathered surface (cellular texture) often typical of chert.

Coal: One seam: 13', coal unit ended on the southwest at contact (gradational, arbitrarily chosen) with a unit which is interstratified coal and argillite lenses. Thickness of latter unit will be limited by a greywacke unit, medium- to moderately coarse-grained, chloritic, medium grey, medium to thick bedded, 4.5 foot thick, dipping 74°SW, and outcropping within 4 feet of the southwest end of the trench.

Channel Sample: NHUA 8/1/71-1, 13'. A 3" x 6" (138 lbs.) channel sample taken on bottom of trench.

Grab Sample: NHUA 7/31/71-1. Several hand specimens of coal taken at random from southwestern quarter of the seam.

TABLE 9

Trench 6 Data

Trench Co-ordinates: 60° 18.86'N (approximate, by map location)
135° 03.71'W

Trench Elevation: 5490 feet a.s.l. (approximate, by barometer)

Location Description: On southeast slope of Bush Mountain, approximately 950 feet southeast of Trench 2, and roughly 4000 feet east-northeast of Bush Mountain summit.

Trench Orientation: Northeast

Excavation Date: August 7, 1971

Length: 20 feet

Width: 2.5 feet

Depth: 7.5 feet, with trench bottom pits to 8.0 feet

Trench Geology: Bedrock not reached. For the full trench length the exposed regolith predominantly consists of graphitic coal and coaly shale, in lumps, plates, chips, and finer material. The regolith is thought to be a mixture of frost heave and talus, probably including both residual and transported material.

Samples: None

In Trenches 2, 3, 4, and 5, located on the ridge-crest, bedrock was reached, and coal was found in all four. Trench 2, the southwesternmost of these (Plates 5 and 6; Figure 4), contains one seam at least 8.5 feet thick, one 16 inches thick, and four thinner seams. The coal is inter-layered with fine-grained clastic sedimentary and metasedimentary rocks, all steeply dipping (Table 4). Three shale"partings", 1 to 3 inches thick, were identified in the 8.5 foot seam (Table 4, unit u). More may have been present originally because the graphitic anthracite comprising this seam is sheared and crushed, and some isolated pieces of non-coal material occur.

Trench 3 is an offset to extend the investigation of bedrock to the northeast of Trench 2, which was ended in coal (unit u). Trench 3 is 13 feet long, overlapping the strike projected end of Trench 2 by about 5 feet. For the full trench length, graphitic anthracite is exposed (Table 5). It is extensively intruded by offshoots of an altered dike, which outcrops approximately 5 feet east of the northeast end of Trench 3.

Trench 4, which was excavated across the bottom of a narrow windgap, exposes from southwest to northeast a vertically-dipping altered sill, claystone, and a coal seam

1'4" to 1'7" thick (Table 6). The coal is platy to crushed, and in fault contact with a conglomerate which forms the northeast wall of the windgap (Table 7).

Trench 5, located in another narrow windgap, is the farthest northeast of the trenches which expose bedrock. The exposed bedrock is a steeply-dipping graphitic anthracite unit, 13 feet thick (Table 8). It is sheared to crushed, and in fault contact with a conglomerate to conglomeratic sandstone on the northeast end of the trench. Near the southwest end of the trench, the other contact is defined by appearance of argillite lenses up to 1 foot long. Some small lenses or sheared partings of argillite occur within the seam. The graphitic lustre of the seam is evident in Plate 7.

CHANNEL SAMPLING

The four thickest seams found in bedrock trenches were channel sampled. Channels were taken across units (n) and (u) described in Table 4 across the unit described in Table 7, and across the unit described in Table 8. Channel size and position within the trenches are described in Tables 3, 6, and 8, respectively. To obtain sufficient sample for both proximate analyses and washing tests, a larger than standard size of 3" x 6" was taken in the case of the two longest samples.

Upper column entries in Table 10 gather the data on channel lengths and identify host trenches.

The lenses or sheared partings of shale and argillite occurring in the two thickest seams were treated as partings in the sampling procedure. In accordance with standard coal channel sampling practice, partings exceeding 3/8" thickness were rejected from the sample. The amount rejected was small in the case of both seams. It is likely that some very mineral-matter-rich material, which should have been rejected, was not recognized due to graphitic coatings.

A sample selected from grab sample NHUA 7/31/71-1 (Table 8) was analyzed for ash by Technical Service Laboratories, giving a value (dry basis) of 17.04% which is approximately 2/7 the ash value (ahead) for full channel sample NHUA 8/1/71-1 of the same seam from which the grab sample was taken. The existence of this order of variation in ash content was not readily apparent in field examination done in preparation for channel sampling.

PROXIMATE ANALYSES

The results of proximate analyses of the channel samples, performed at the Fuels Research Centre, Ottawa, are reported by Mr. W. J. Montgomery (Appendix 1). Sentence 1, paragraph 6 on page 1 of Appendix 1, which was based on a

TABLE 10

Proximate Analyses of Channel Samples

SAMPLE NUMBER		NHUA 8/7/71-1		NHUA 8/6/71-1		NHUA 8/6/71-2		NHUA 8/1/71-1	
Trench Number		2		2		4		5	
Channel Length		1'4"		8'6"		1'7"		13'	
PROXIMATE ANALYSES		As Rec'd.	Dry	As Rec'd.	Dry	As Rec'd.	Dry	As Rec'd.	Dry
Moisture	%	17.4	0.0	13.5	0.0	15.9	0.0	7.5	0.0
Ash	%	39.7	48.0	43.9	50.8	57.3	68.1	53.7	58.1
Volatile Matter	%	7.4	9.0	7.3	8.4	7.5	8.9	7.4	8.0
Fixed Carbon	%	35.5	43.0	35.3	40.8	19.3	23.0	31.4	33.9
Sulphur	%	0.1	0.1	0.1	0.2	0.1	0.1	0.2	0.2
Calorific Value BTU/lb Gross		4880	5900	4920	5690	2830	3360	4090	4420
Caking Properties		Non-Agglomerate		Non-Agglomerate		Non-Agglomerate		Non-Agglomerate	
Volatile Matter D.M.M.F.*	%		1.9		1.9		3.6		2.2
ASTM Rank		Meta-Anthracite		Meta-Anthracite		Anthracite		Anthracite	
Carbonates Present		Nil		Nil		Nil		Nil	

*Dry Mineral Matter Free

preliminary report to Mr. Montgomery, from the writer, should be corrected to read "All four seams occur in a surface interval, normal to average strike, of less than 140 feet." The stratigraphic interval cannot be ascertained from the present data, due to the presence of intervening faults. The order of the columns in Table 1 of Appendix 1 has been rearranged in Table 10 to correspond with the positional order in the field of the sampled seams. Thus, left to right column order in Table 10 corresponds to southwest to northeast positional order in the field.

The results show a high ash content, which is common for high rank coals. The volatile matter content, recalculated on a dry-mineral-matter-free basis, is very low, and it is similar for all four samples, ranging from 1.9% to 3.6%. This small range of values precludes any significant correspondence between proximity of intrusive igneous bodies and recalculated volatile matter content of the channel samples. For the two samples taken from seams 4'4" apart in Trench 2, the same value of 1.9% is obtained, yet one seam is intruded on its northeast side by a dike comparable in width to itself, while the other seam occurs on the opposite side, away from the intrusive.

On the basis of these analyses and on preliminary reflectance petrography done at the Fuels Research Centre, these are the highest rank Canadian coals yet reported. The terminology for this type of carbonaceous material is not well-developed, but they can be described as graphitic anthracites. Dr. B. N. Nandi is undertaking studies to compare them with samples of Korean and Mexican graphite also derived from coal.

BENEFICIATION TESTS

Washability tests were performed on two channel samples at the Western Regional Laboratory, Clover Bar, Alberta. The results are reported by Mr. O. E. Humeniuk in Appendix 2. Washability is poor in both cases due to the high specific gravity of the carbonaceous matter.

One channel sample was tested in a new electrostatic separation apparatus at The University of Western Ontario, as reported in Appendix 3. Beneficiation was achieved in these preliminary tests. The apparatus has the potential not only for separating carbonaceous matter from mineral matter, but also for separating one carbonaceous material from another on the basis of differing volatile matter contents.

All of which is respectfully submitted
NORMAN H. URSEL ASSOCIATES LIMITED

Edwin L. Speelman

March 30, 1972 — Edwin L. Speelman, B.Sc.

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PLATE 1. Looking west at Bush Mountain, rising from behind Idaho Hill, on which roadcuts are visible.

PLATE 2

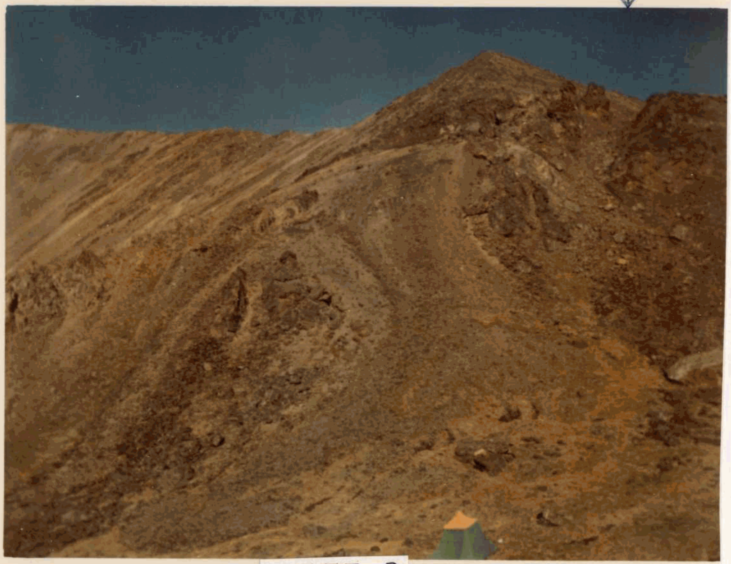

PLATE 3

PLATE 4

PLATE 2
(left)

PLATE 3
(middle)

PLATE 4
(right)

Plates 2 - 4

PLATES 2 through 4. Overlapping scan view of the skyline and upper southeastern slopes of Bush Mountain, with Campsite Windgap in the foreground. Looking west. Dark band of float consisting of graphitic coal and coaly shale and argillite visible in centre of Plate 2, and another band (arcuate) visible above and to the left of tent in Plate 3. Trench 5 location in small windgap beneath arrow in Plate 3.

PLATE 5. Looking east and downwards toward Annie Lake Valley (background) and Schnabel Creek Valley (on the right). Trenches 2 and 3, occurring on Bush Mountain ridgecrest in a windgap, are visible on the left. Trench 1 is visible in the centre. The top of the rock face forming the east side of Campsite Windgap, from which Plates 2, 3, and 4 are viewed, forms the "skyline" which extends from the left edge across the middle distance of Plate 5.

PLATE 6. A closer view of Trenches 2 and 3. Looking east. Mountains forming the east side of Annie Lake Valley visible in background.

PLATE 7. Trench 5, southwest end in shadow. Trench dump material exhibits high lustre typical of the trench-exposed graphitic anthracite bedrock.

PLATE 8. Trench 6, Mr. Scott Lyle stands in the northeast end. Excavated overburden material is graphitic coal and coaly shale. Bedrock not reached at this downslope locality which is about 950 feet southeast of Trenches 1 - 5.

APPENDIX 1

CANADA

DEPARTMENT OF ENERGY, MINES AND RESOURCES

MINES BRANCH

OTTAWA

Fuels Research Centre
Divisional Report FRC 71/63-SF

ANALYSES OF FOUR PROSPECT SAMPLES FROM MOUNT BUSH, YUKON TERRITORY

by

W. J. Montgomery

September 1971

ANALYSES OF FOUR PROSPECT SAMPLES
FROM MOUNT BUSH, YUKON TERRITORY

by

W. J. Montgomery

INTRODUCTION

As a continuation of coal prospecting in the Yukon Territory by Edwin ~~V~~ L. Speelman of Norman H. Urs~~a~~el Associates, started during 1970, a request for the analyses of four channel samples was made in August 1971.

DESCRIPTION OF SAMPLES

Four samples, in plastic bags inside 1 gallon paint cans were received on August 17, and designated as channel samples of coal taken from the crest of the east side of Mount Bush about 30 miles south of Whitehorse, Yukon in approximately the same location as samples taken in 1909 by Cairnes. That coal was reported to be high ash, semi-anthracite. The four samples were splits of 100 lb samples being sent to Clover Bar (W.R.L.) for float-sink determinations. Each sample was crushed to pass 1/2" by Bondar-Clegg and Company in Whitehorse prior to splitting and shipping.

The sample marked NHUA 8/1/71-1 represents a seam about 13 feet in thickness.

The sample marked NHUA 8/6/71-1 represents a seam about 8-1/2 feet in thickness.

The samples marked NHUA 8/6/71-2 and NHUA 8/7/71-1 represent seams 1-1/2 feet in thickness.

All four seams occur in a stratigraphic interval of less than 100 feet. Tectonic disturbance of the rocks and coal in this area is common and the thin seams may thicken elsewhere.

ANALYSES

After partial air-drying each sample was split and crushed to less than Number 8 sieve and two samples extracted from each for Equilibrium Moisture and Petrography. A portion of each sample was then further air-dried and prepared to minus Number 60 sieve for analyses.

The results of analyses and rank determination appear in Table 1.

TABLE 1

ANALYSES OF FOUR CHANNEL SAMPLES OF COAL FROM MOUNT BUSH YUKON TERRITORY
FOR N. H. URS~~A~~EL ASSOCIATES

SAMPLE NUMBER		2688-71		2689-71		2690-71		2691-71	
SAMPLE MARK		NHUA 8/1/71-1		NHUA 8/6/71-1		NHUA 8/6/71-2		NHUA 8/7/71-1	
PROXIMATE ANALYSES		As Rec'd.	Dry	As Rec'd.	Dry	As Rec'd.	Dry	As Rec'd.	Dry
Moisture	%	7.5	0.0	13.5	0.0	15.9	0.0	17.4	0.0
Ash	%	53.7	58.1	43.9	50.8	57.3	68.1	39.7	48.0
Volatile Matter	%	7.4	8.0	7.3	8.4	7.5	8.9	7.4	9.0
Fixed Carbon	%	31.4	33.9	35.3	40.8	19.3	23.0	35.5	43.0
Sulphur	%	0.2	0.2	0.1	0.2	0.1	0.1	0.1	0.1
Calorific Value BTU/lb Gross		4090	4420	4920	5690	2830	3360	4880	5900
Caking Properties		Non-Agglomerate		Non-Agglomerate		Non-Agglomerate		Non-Agglomerate	
Volatile Matter D.M.M.F.*	%		2.2		1.9		3.6		1.9
ASTM Rank		Anthracite		Meta-Anthracite		Anthracite		Meta-Anthracite	
Carbonates Present		Nil		Nil		Nil		Nil	

*Dry Mineral Matter Free

APPENDIX 2

CANADA

DEPARTMENT OF ENERGY, MINES AND RESOURCES

MINES BRANCH

OTTAWA

METALS REDUCTION AND ENERGY CENTRE

DIVISIONAL REPORT MREC 71/96 WRL

WASHABILITY DATA OF TWO SAMPLES OF COAL FROM A PROSPECT ON MOUNT BUSH, NEAR WHITEHORSE, Y. T.

by

O. E. Humeniuk

September, 1971

WASHABILITY DATA OF TWO SAMPLES OF COAL FROM A PROSPECT ON MOUNT BUSH, NEAR WHITEHORSE, Y. T.

by

O. E. Humeniuk*

SUMMARY

Two channel samples (~ 100 lbs. each) originating from two adjacent coal seams on Mt. Bush (approx. 30 mi. S. of Whitehorse) were received during August, 1971, from Mr. E. C. Speelman, acting on behalf of Norman H. Ursel and Associates, c/o Bondar & Clegg & Company Ltd., Box 299, Whitehorse, Yukon Territory.

The float-sink data obtained from both samples exhibit an unusual ash-density relationship indicating that the specific gravity of the carbonaceous matter of this coal resembles that of a coal found in the Hambeck field (Korea).

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* Research Technologist, Western Regional Laboratory, Mines Branch, Department of Energy, Mines and Resources, Edmonton, Alberta.

Weight-Ash Distribution

(Ash values of individual fractions in brackets)

Re: Norman H. Ursel & Associates' Samples

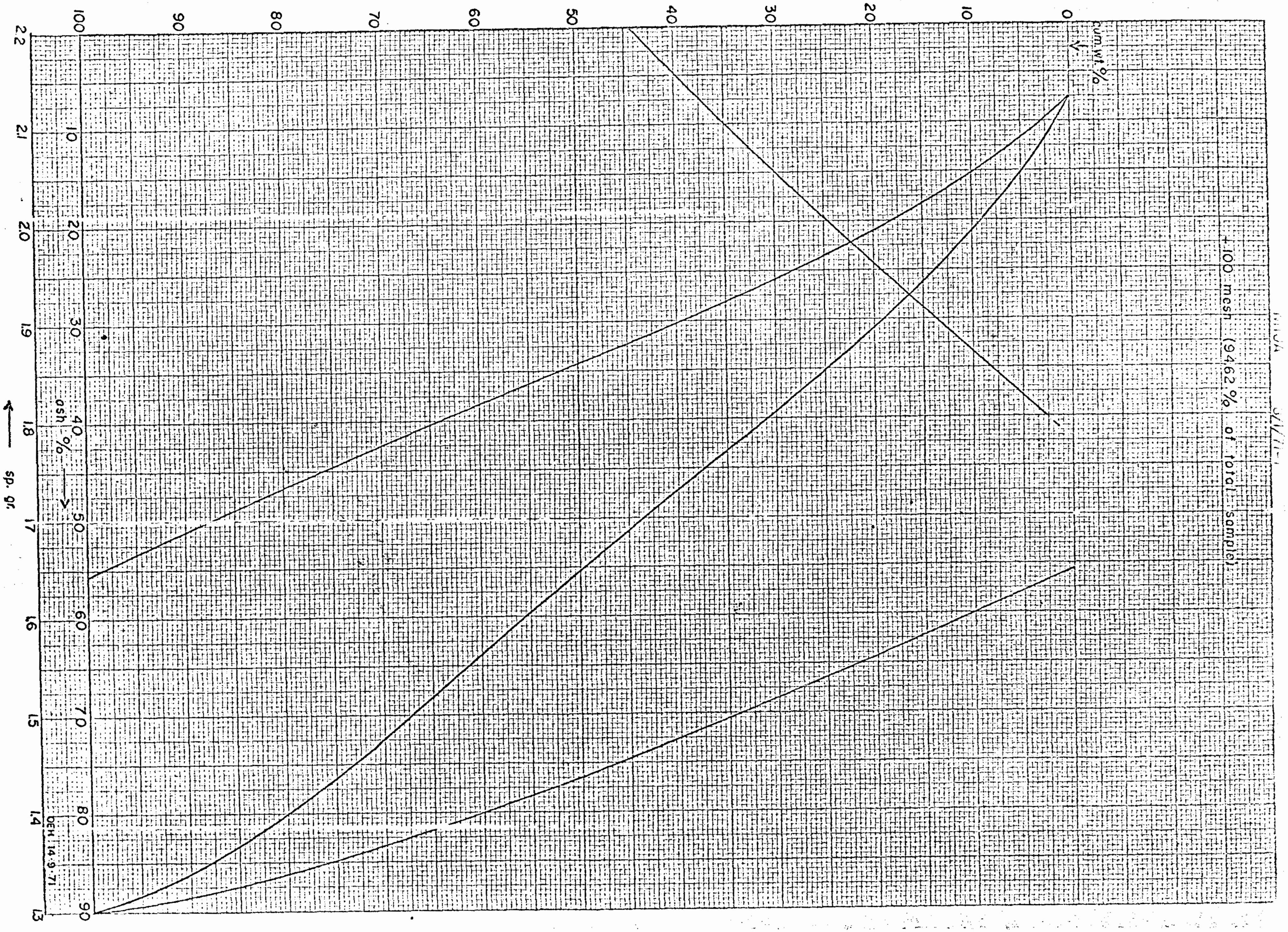
Sample 8/1/71-1

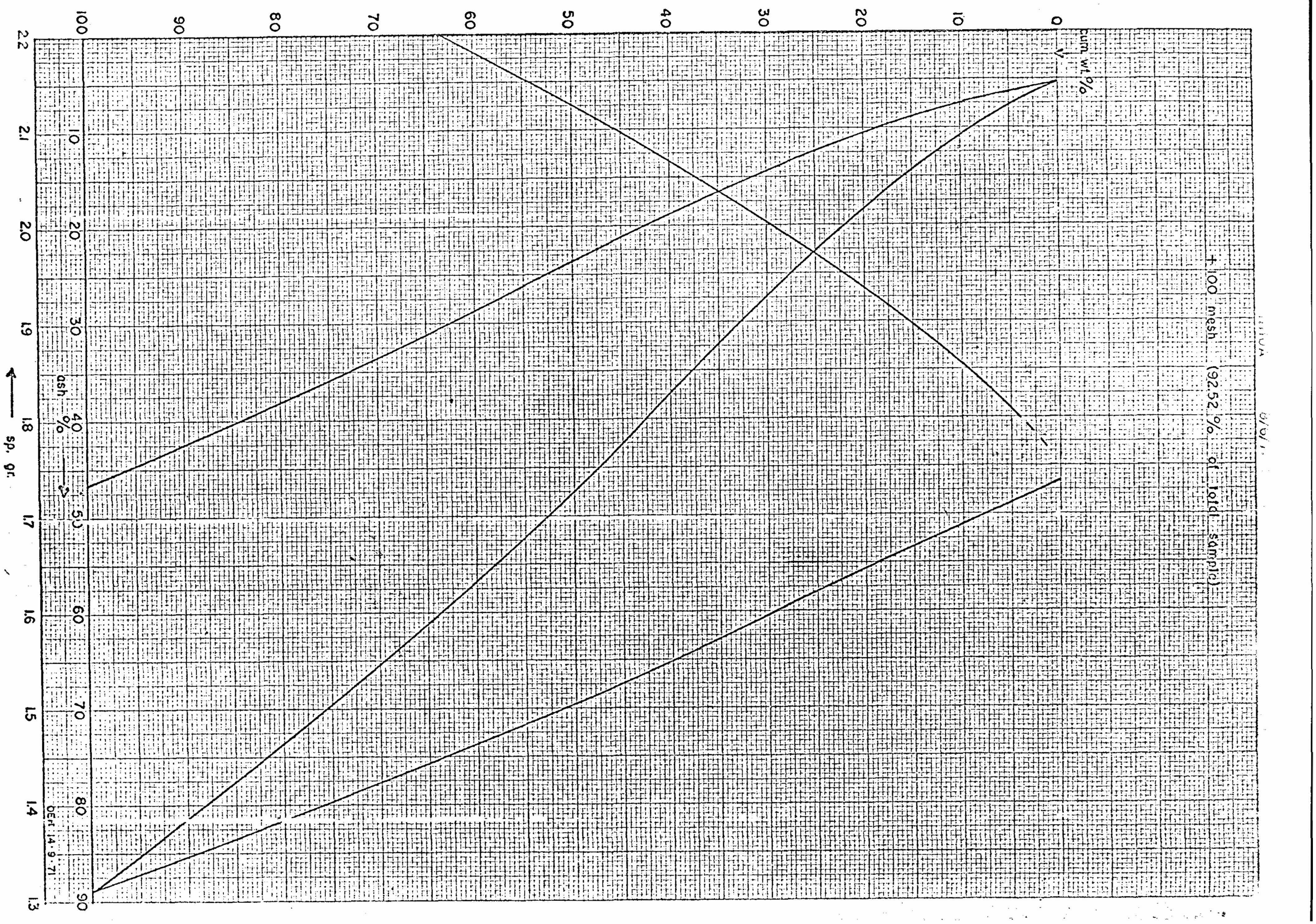
Size Fraction \ Spec. Gr.	1.6	1.8	2.0	2.17	Total
Plus 1/4 in.	0.07 (17.37)	10.06 (30.70)	3.94 (49.58)	23.10 (75.94)	37.17 (60.79)
1/4 in. to 28 mesh	2.33 (9.65)	8.37 (22.49)	9.89 (41.99)	27.11 (71.62)	47.70 (53.83)
28 to 100 mesh	0.02 n.d.	2.56 (11.01)	2.14 (26.44)	5.03 (69.05)	9.75 (44.32)
Total	2.42 (9.79)	20.99 (25.02)	15.97 (41.78)	55.24 (73.19)	94.62 (55.58)
Minus 100 mesh	This fraction forms 5.38% of total sample and has an ash content of 50.43%; ∴ overall ash content 55.30%				

Sample 8/6/71-1

Size Fraction \ Spec. Gr.	1.6	1.8	2.0	2.17	Total
Plus 1/4 in.	0.30 (13.12)	6.61 (21.90)	6.24 (38.68)	15.33 (76.22)	28.48 (54.72)
1/4 in. to 28 mesh	2.64 (5.53)	11.89 (14.77)	14.34 (46.41)	18.89 (71.42)	47.76 (46.17)
28 to 100 mesh	0.95 (5.78)	4.99 (9.49)	5.64 (31.65)	4.70 (67.78)	16.28 (33.78)
Total	3.89 (6.18)	23.49 (15.65)	26.22 (41.40)	38.92 (72.87)	92.52 (46.62)
Minus 100 mesh	This fraction forms 7.48% of total sample and has an ash content of 37.73%; ∴ overall ash content 45.95%				

Sample #	% Moisture	% V.M.
8/1/71-1	6.20	7.60
8/6/71-1	12.34	7.86


cum.wt.%
+100 mesh (94.62% of total sample)
ash %
sp. gr.
DFH 14.9.71
0
10
20
30
40
50
60
70
80
90
100
2.2
2.1
2.0
1.9
1.8
1.7
1.6
1.5
1.4
1.3


+ 100 mesh (92.52 % of total sample)
cum. wt %
0
10
20
30
40
50
60
70
80
90
100
ash %
sp. gr.
2.2
2.1
2.0
1.9
1.8
1.7
1.6
1.5
1.4
1.3
DEF 14-9-71

APPENDIX 3

Preliminary Electrostatic Beneficiation Tests on Bush Mountain (Yukon) Graphitic Anthracite

Introduction

For several end uses of graphite or graphitic anthracite, high fixed carbon and low ash is desirable. A sample from one of the Bush Mountain seams was subjected to preliminary beneficiation tests using a new, patented electrostatic apparatus developed and operated in the laboratories of Electrical Engineering, Faculty of Engineering Science, at The University of Western Ontario, London, Ontario. The apparatus, its operation, and its applicability to iron and other ores has been recently described (Inculet, Bergougnou, and Bauer, 1971). Its description, in abstract (*ibid.*, p. 185), is as follows:

> "The apparatus comprises a fluidized bed, an optional metallic screen electrode located above the bed, and a series of collecting U or V-shaped troughs. The troughs are moving horizontally below the screen. The vertical electric field traversing the fluid bed was produced by applying high voltage to a porous metallic plate on the floor of the bed and grounding the troughs and screen."

"The fluidized bed technique coupled with electrostatic sorting methods provides an ideal means for separating fine particles." (*ibid.*). Preliminary petrographic examination of Bush Mountain channel samples has revealed that a significant proportion of the disseminated mineral matter present is fine-grained (Dr. B. N. Nandi, pers. com., September, 1971), indicating that fine-particle beneficiation will be required if high recoveries are to be maintained in the production of a low-ash concentrate.

It was decided to first simply determine if a sample of Bush Mountain graphitic anthracite would show some separation response in the new electrostatic apparatus, in which graphite or graphitic material had not previously been tested.

Feed Material

The sample originates from channel sample NHUA 8/1/71-1 (thickest seam channeled), which was first crushed to minus ½" in the laboratories of Bondar-Clegg & Company Ltd. in Whitehorse, Yukon. From this total sample, sent to Western Regional Laboratory, Edmonton, Alberta, for conventional coal washing tests (Appendix 2), a split from the minus ¼" size fraction was sent to Technical Service Laboratories, Toronto, Ontario, who pulverized this material such that most of the sample passed 100 mesh. A partial proximate analysis of an aliquot of this material was performed by Technical Service Laboratories, and the remainder of the pulverized feed sample was sent to the laboratories of Electrical Engineering, at The University of Western Ontario. The feed for the tests was dried, sieved and elutriated. The range was between 45 and 200 mesh and the elutriation was simply to remove the very fine particles. This feed material, prepared as above, was identified as Sample No.P1 and was sent to the Technical Services Laboratories for analysis, together with the beneficiated materials. The two analyses (dry basis) of feed are given in Table 1.

TABLE 1

Graphitic Anthracite Feed

Lab. Sample No.	Remarks	Fixed Carbon %	Ash %
No Number	Aliquot taken at Tech. Ser. Labs.	37.33	53.08
P_1	Aliquot taken at labs. of Elec. Engr., Univ. of W. Ont. after sieving and elutriation	38.33	53.90

Analysis (dry basis) of the original channel sample NHUA 8/1/71-1 showed Fixed Carbon, 33.9%; Ash, 58.1% (see Appendix 1). Fixed carbon is about 4% lower in the original channel sample than in the present experimental feed. Thus, moderate but significant fixed carbon (and ash) compositional variation exists between the original channel sample material (all crushed to minus ½" size) and its minus ¼" size fraction from which the experimental feed sample was taken. In future experiments a split of a total channel sample will be pulverized to provide a feed more closely representative of the raw ore.

Test Variables and Results

The test variables were bed polarity and bed temperature. Analyses (dry basis) of products obtained in 3 test runs are given in Table 2.

TABLE 2

Beneficiation Products

Lab. Sample Number	Bed Polarity	Bed Temperature	Fixed Carbon %	Ash %
E_2	Negative	Room T	53.60	37.92
No number	Positive	Room T	58.38	33.92
Q_1	Positive	80°C	61.74	30.26

Beneficiation was achieved in each experimental run. Under the binocular microscope the products exhibited an overall increase in graphitic lustre over that of the feed (Prof. I. I. Inculet, pers. com., Feb. 24, 1972). At room temperature a positive bed polarity yields a better concentrate than a negative polarity. The best concentrate was obtained with a positive bed polarity and a bed temperature of 80°C. Dividing the fixed carbon figure of 61.74% achieved in the latter run by the feed fixed carbon figure in Table 1, 38.33%, gives a concentration ratio of 1.61.

Conclusion

The new electrostatic beneficiation apparatus is capable of concentrating graphitic anthracite, and the separations achieved in these preliminary experiments indicate to Prof. Inculet (pers. com., Feb. 24, 1972) that with sufficient experimentation it should be possible to obtain a product considerably higher in fixed carbon and lower in ash. In addition to determining optimum range of particle size and bed temperature, some other operational variables to be tested include crushing procedure as related to variation in particle surface characteristics, bed air pressure, and effects of re-circuiting. Development of a production-size apparatus may be prompted by bench scale testing, e.g., the present study, which is indicating the applicability of the apparatus to various types of ore.