S U Q U A S H   C O A L F I E L D

NORTHERN VANCOUVER ISLAND, BRITISH COLUMBIA

AN INFORMATION SUMMARY

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COAL GROUP

IMPERIAL OIL LIMITED

CALGARY, ALBERTA

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SUMMARY

The Suquash Coalfield is located on the north-eastern coast of Vancouver Island. Coal has been known to occur in the upper Cretaceous Suquash Formation since 1835 and was mined in the mid-1800's. Underground development was begun again from 1908 to 1914, however no more production occurred.

A recent exploratory drill program has defined 9 very variable coal zones in the area which contain limited amounts of high volatile C bituminous coal. It is estimated there are 300 million short tons of coal with an average calorific value of 4500 BTU/lb. and 60% ash. The quality is so poor because of numerous partings and the thinness of seams which necessitates the inclusion of waste material in mining widths. The clean coal has an ash of 11% to 21% and an average calorific value of 11,000 BTU/lb.

Only one zone seems to be of substantial thickness. The 2 zone, in one area, has a thickness of 5.1 feet to 7.8 feet with 15% to 40% of that being partings. The coal thickness of this zone seems to decline away from the old mine workings.

The Suquash area is an underground prospect for thermal coal. The quality could be increased by washing, however this

would be uneconomical.

It is recommended that no further work be done presently on this field.

INTRODUCTION

The Suquash coalfield contains the area from which came the first reports of coal on Vancouver Island in 1835 and was the site of limited operations in the mid-1800's and early in this century. The area is located along the Queen Charlotte Strait near the northern end of Vancouver Island.

An attempt will be made here to compile the available information about the Suquash field including history, general geology, and coal geology. A preliminary evaluation about the area will be made.

LOCATION AND ACCESS

The Suquash coalfield is located on the north-eastern coast of Vancouver Island between Beaver Harbour (Fort Rupert) and Port McNeill, a distance of about 20 miles (Figure 1).

Access is by paved road from Campbell River to Gold River and then by restricted private roads to Beaver Harbour. Alternatively, daily car-ferry service is available between Kelsey Bay and Beaver Cove from which a paved public road leads to Port McNeill and Port Hardy. Port Hardy is serviced daily by scheduled airline flights from Vancouver. Logging roads and 6.3 miles of access built for a 1974 drilling program (Dolmage Campbell, 1975) provide the only other access in the area.

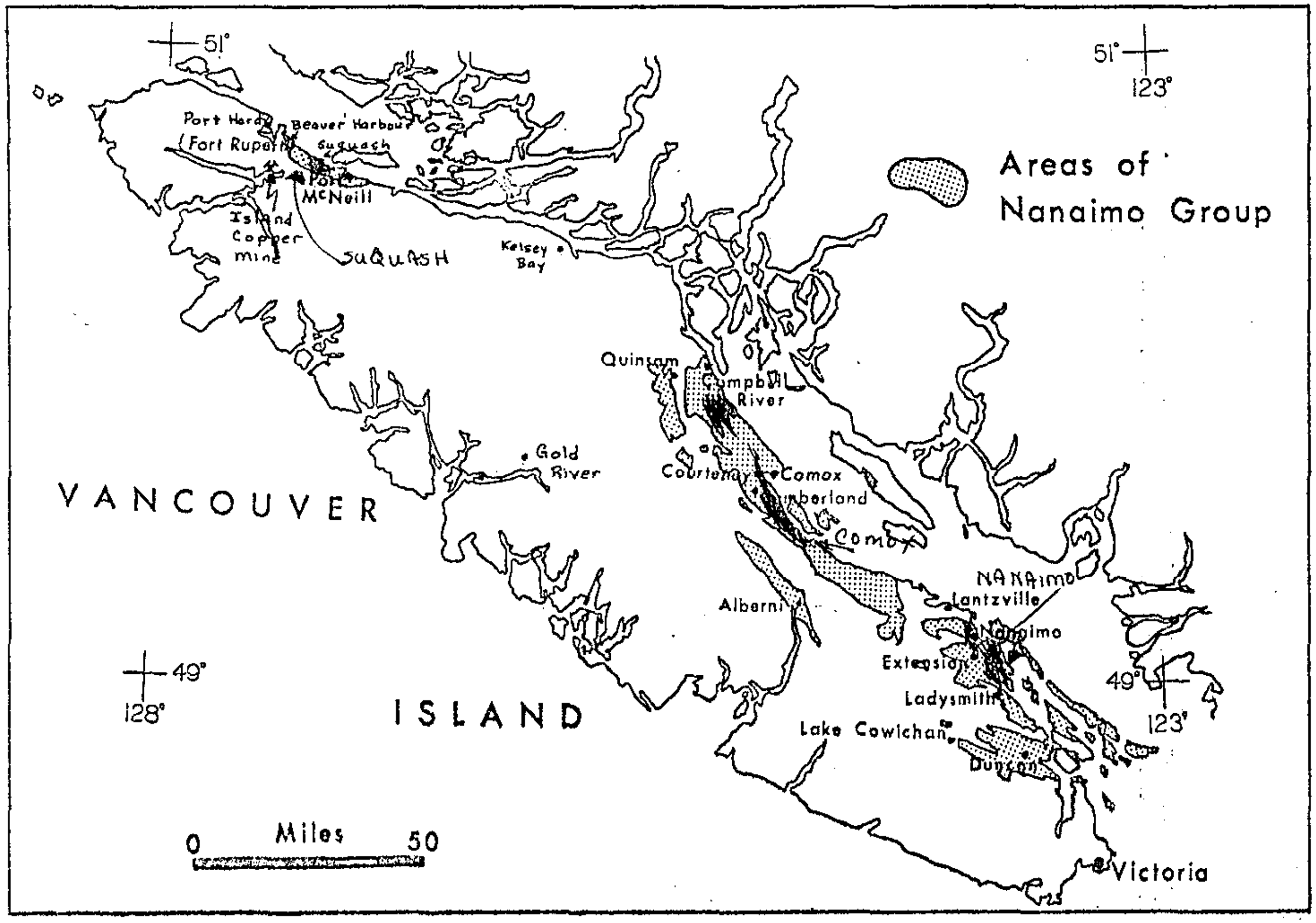


FIGURE 1

Location map of the Suquash and other coalfields, Vancouver Island.

Port facilities have been developed on the west side of Vancouver Island, 10 miles west of Suquash. The Island Copper mine, situated on Rupert Inlet (Quatsino Sound), ships its refined ore by ocean-going vessels from near the mine site.

GEOGRAPHY

The coalfield underlies a heavily-forested coastal plain of low relief. Over most of the area the maximum elevation is 300 feet but increases near the southern extremity. Two peaks near the southern boundary of the field reach 1100 feet (Cluxene Mountain) and 1000 feet and are topped with resistant Tertiary volcanic rocks.

The climate is mild and wet with an average annual precipitation of 95 inches. Because of the climate and the low relief of the area, nearly impenetrable cedar swamps and thick forests cover the coastal plain.

HISTORY

Coal was first reported from Vancouver Island in 1835 when Indians showed samples from the Suquash area to officers of the Hudson's Bay Company. Over 100 miners were brought from England and commenced production in 1849 at Suquash in order to supply steamships with bunker fuel. A total of 10,000 tons were mined until production ceased in 1852 after discovery of the

Nanaimo coalfields. The miners had also complained of poor working conditions and occasional Indian raids (James, 1969; Muller et al., 1974).

In 1908, Pacific Coast Coal Mines Limited sank their No. 1 shaft to a depth of 173 feet and proceeded to drive 10,000 feet of development slopes. Work began on the No. 2 shaft however, operations terminated at the beginning of World War I. Between 1907 and 1914, 12,000 to 16,000 tons of coal were extracted. The same company renewed operations in 1920 but closed in 1922 with no further production (Muller et al., 1974).

Suquash Colleries Limited pumped out the main shaft and examined some of the old workings in 1952. Engineering studies and coal analysis were conducted but no production was accomplished (Muller and Atchison, 1971; Muller et al., 1974).

Dolmage, Campbell and Associates (1975) mapped the Suquash area in detail and drilled 9 core holes for B.C. Hydro in 1974. It appears that all leases in the area have been dropped since then.

GENERAL GEOLOGY

The coal in the Suquash area is in the Suquash Formation of the Upper Cretaceous Nanaimo Group. The coal-bearing strata of the Comox and Nanaimo fields are stratigraphically lower (older) but are also in the Nanaimo Group. See Figure 2 for the stratigraphy.

On Vancouver Island the Nanaimo Group consists of five transgressive sedimentary cycles which record progressive changes upward from flurial deposition through deltaic or lagoonal to marine conditions. In the Comox field the coal is present in the lowest or first depositional cycle while the Nanaimo coal occurs in the second cycle. In the Suquash field, coal is present in what appears to be the third cycle (Muller and Jeletzky, 1970; Muller et al., 1974) (Figure 2).

In the Suquash area the Nanaimo Group is present in a northwesterly-trending area extending for about 20 miles along the coast from south of Port McNeill to Beaver Harbour (Fort Rupert). The basin extends 2 to 2½ miles inland to where it is bounded by faults. Nanaimo sediments may also extend up to 4 miles to the northeast under the Queen Charlotte and Broughton Straits to the postulated position of the Goleta and Johnstone Strait faults (Muller et al., 1974). See Figures 3 and 4 for the geology.

To the northwest, the Nanaimo Group unconformably overlies the Upper Triassic Karmutsen Group volcanics. Two outcrop areas of Tertiary volcanic rocks occur within the Suquash basin superimposed on the Suquash Formation.

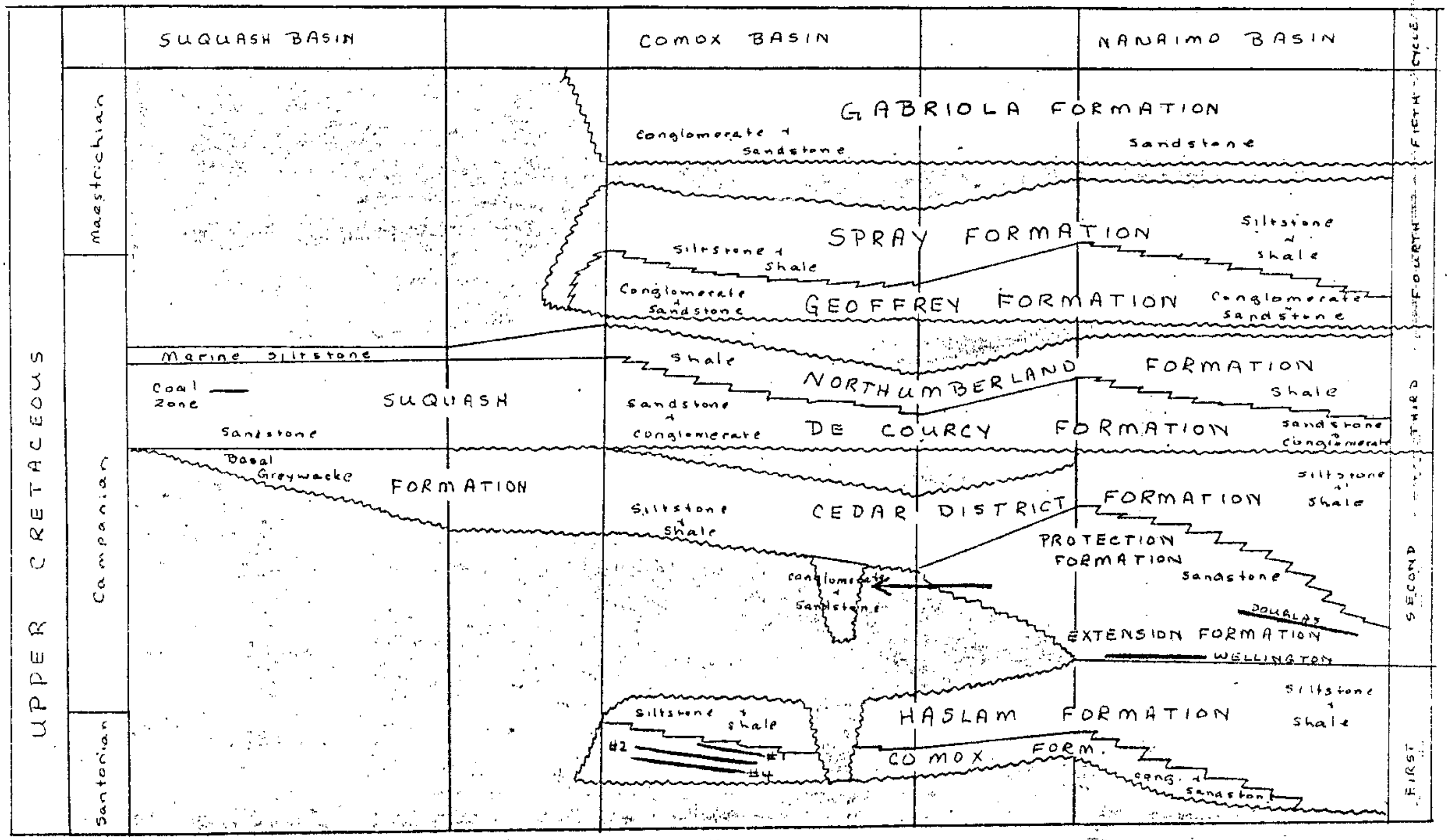


FIGURE 2.

Stratigraphy and correlation of the Nanaimo Group, Vancouver Island (modified after Muller and Jeletzky, 1970).

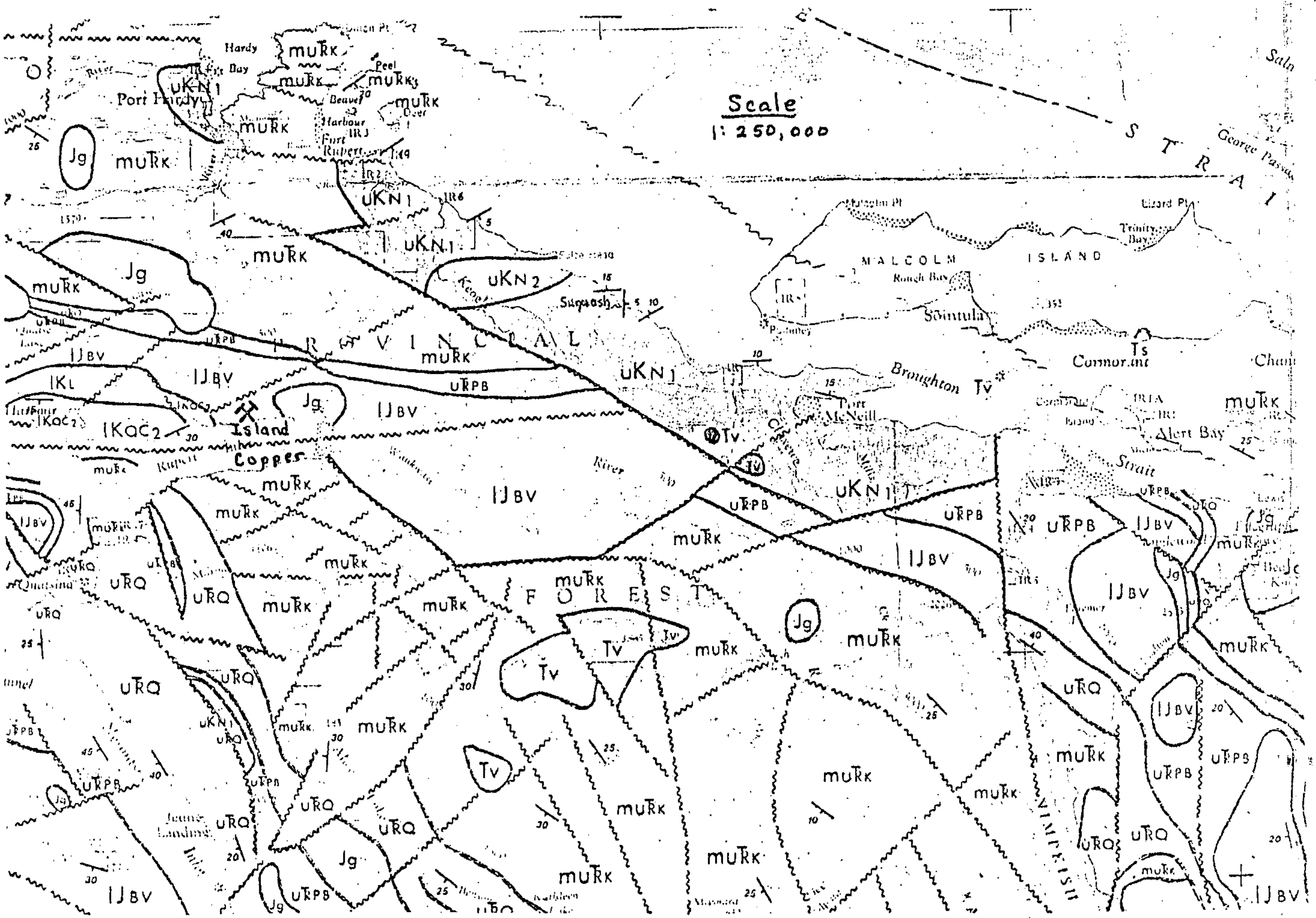


FIGURE 3.

Regional geology of the Port Hardy - Port McNeill area of Vancouver Island. For detailed geology of the Suquash area see Figure 4 (From Muller et al., 1974).

The lower portion of the Suquash Formation, the "Basal Greywacke", consists of coarse to medium grained, intensively cross-bedded, locally calcareous greywacke. There are lenticular interbeds and lenses of fine to coarse grit and pebble conglomerate as well as some locally carbonaceous to coaly greywacke. The "Basal Greywacke" has been interpreted as a nearshore-marine deposit.

The upper portion of the formation is made up of greywacke interbedded with bright coloured, well sorted and rounded, fine to medium grained sandstone which is cross-bedded, ripple marked, and laminated. The coal zones which are discussed below are included in this upper portion (Muller et al., 1974).

Estimated thicknesses for the Suquash Formation have ranged between 300 and 400 feet, however the total thicknesses are greater. Overlying the Suquash is a marine siltstone unit which has a maximum thickness of 50 feet (Muller and Jeletzky, 1970).

On a regional scale it has been suggested the strata dip gently to the east and northeast (up to 15 degrees). In more detail, the strata have been deformed into a few open folds with limbs dipping between 5° and 15° (Dolmage, Campbell and Associates, 1975). The basin has been broken into three blocks by normal faults and more minor faults may be expected (James, 1969; Muller et al., 1974).

COAL ZONES

The presence of coal in the Suquash area has been known since 1835. Dowling (1915) included the Suquash field in his survey of British Columbia coal.

Until 1974, only three seams were recognized and discussed. From the highest to lowest they were the No. 1, No. 2, and No. 3 (Hope Engineering, 1952; James, 1969; Muller et al, 1974). Dolmage, Campbell and Associates (1975) recognized nine coal zones numbering them 0, 1, 1A, 2, 2A, 2B, 3, 4, and 5 with the 1, 2, and 3 corresponding to the previously discovered No. 1, No. 2, and No. 3 seams.

The coal zones consist of varying proportions of coal, shaly coal, coaly shale, carbonaceous shale, shale, fireclay, and occasional sandy shale or sandstone. The proportion of clean coal in a specific zone may vary drastically from location to location (Dolmage Campbell, 1975).

The correlation of the zones in the basin was generally difficult because of great lateral variability of the zones and the lack of distinctive markers. Zone 1 correlation was generally good and locally excellent, Zone 2 correlation was excellent to moderate, and the others correlated with low to moderate degrees of confidence. A problem in correlation also arose because of other coaly intersections which were limited to one drill hole.

The zone with the most potential is still the No. 2, the zone developed in the early part of this century. Figure 5 shows the plan of the development workings as of 1922 and the

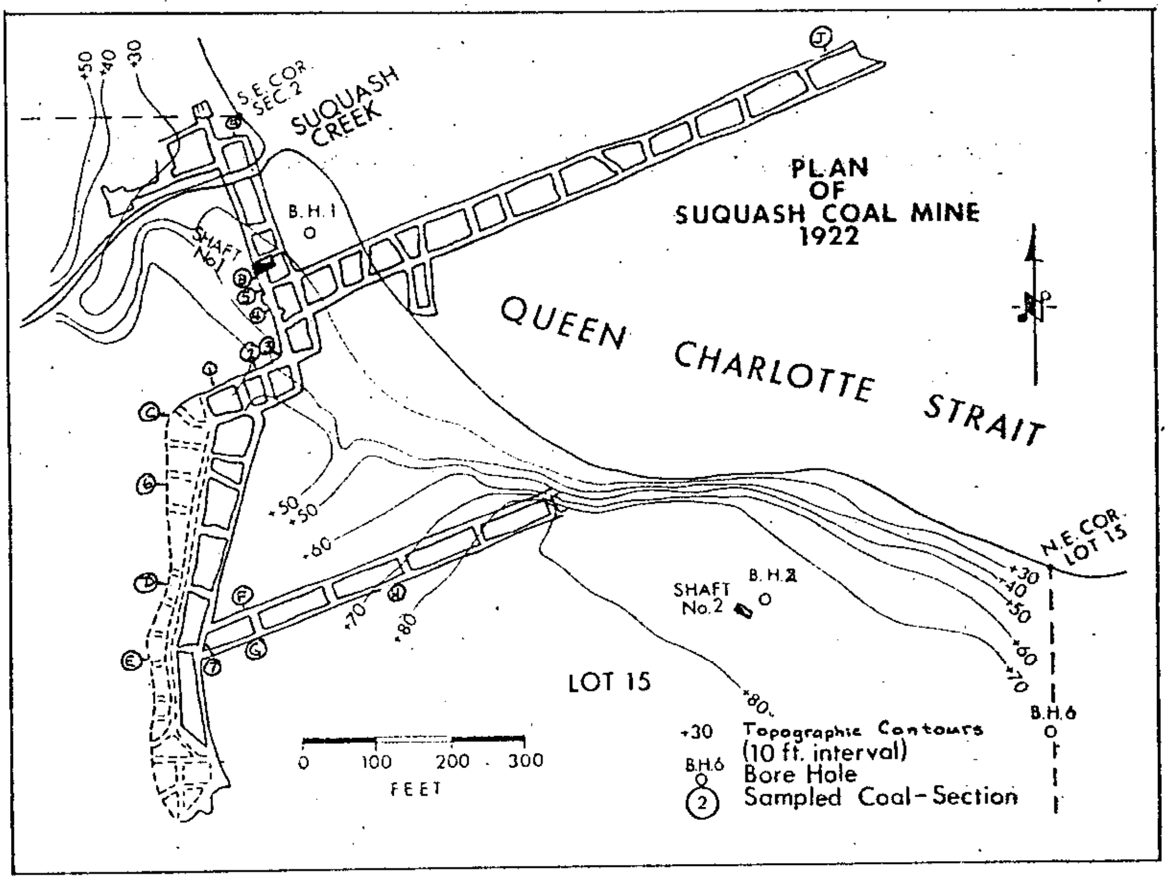


FIGURE 5.

Plan of underground mine development at Suquash in 1922 with locations of coal sections graphically presented in Figure 6.

locations of the graphic sections in Figure 6. The lateral variability of the zone is obvious in these sections showing it varies between 5.1 and 7.8 feet with 15 to 40% of the thickness being rock or impure coal. The descriptive logs of the drill holes in the vicinity of the workings show the seam has similar characteristics near the mine, however the amount of clean coal in the 2 zone appears to decrease away from the old underground workings (Dolmage Campbell, 1975).

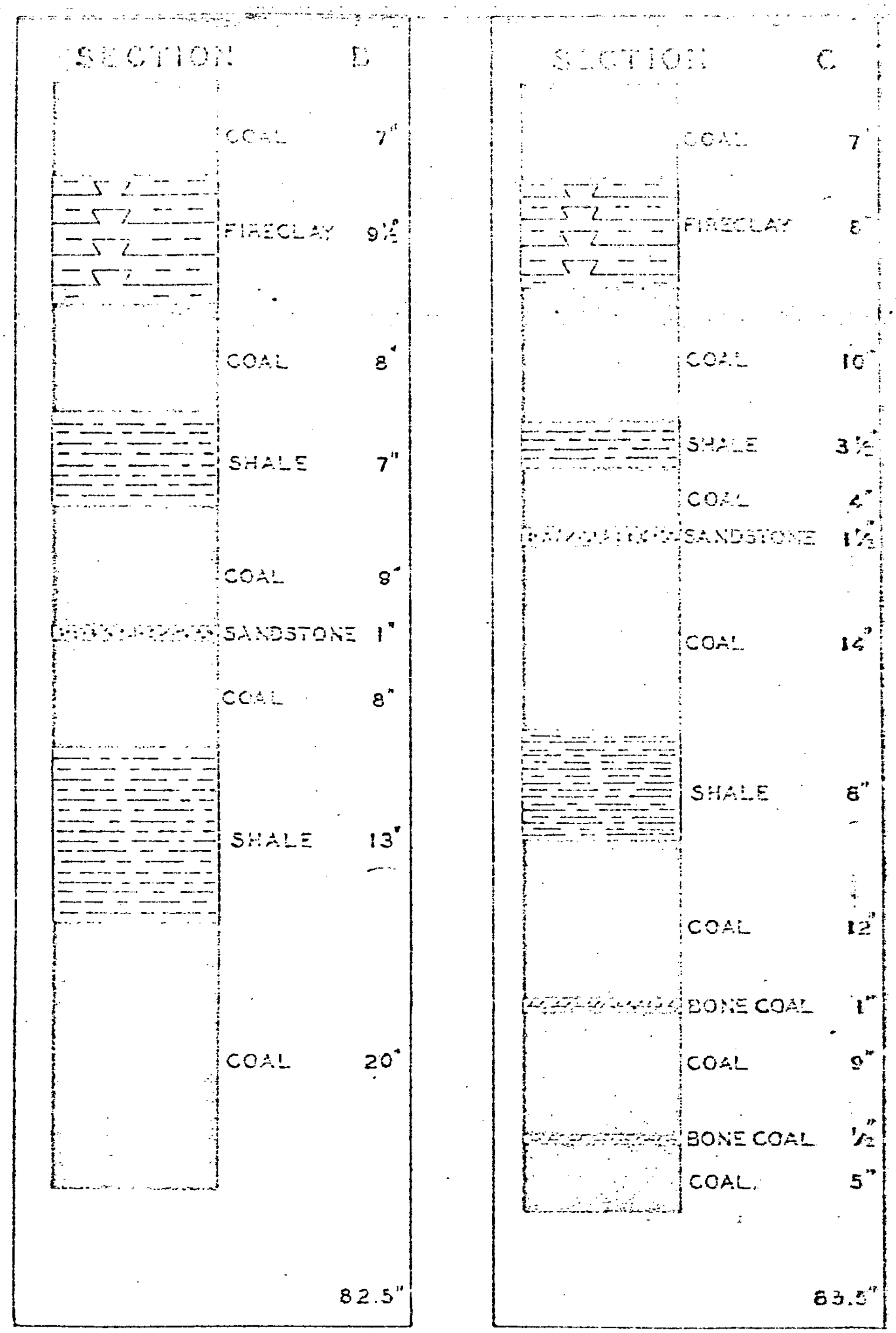
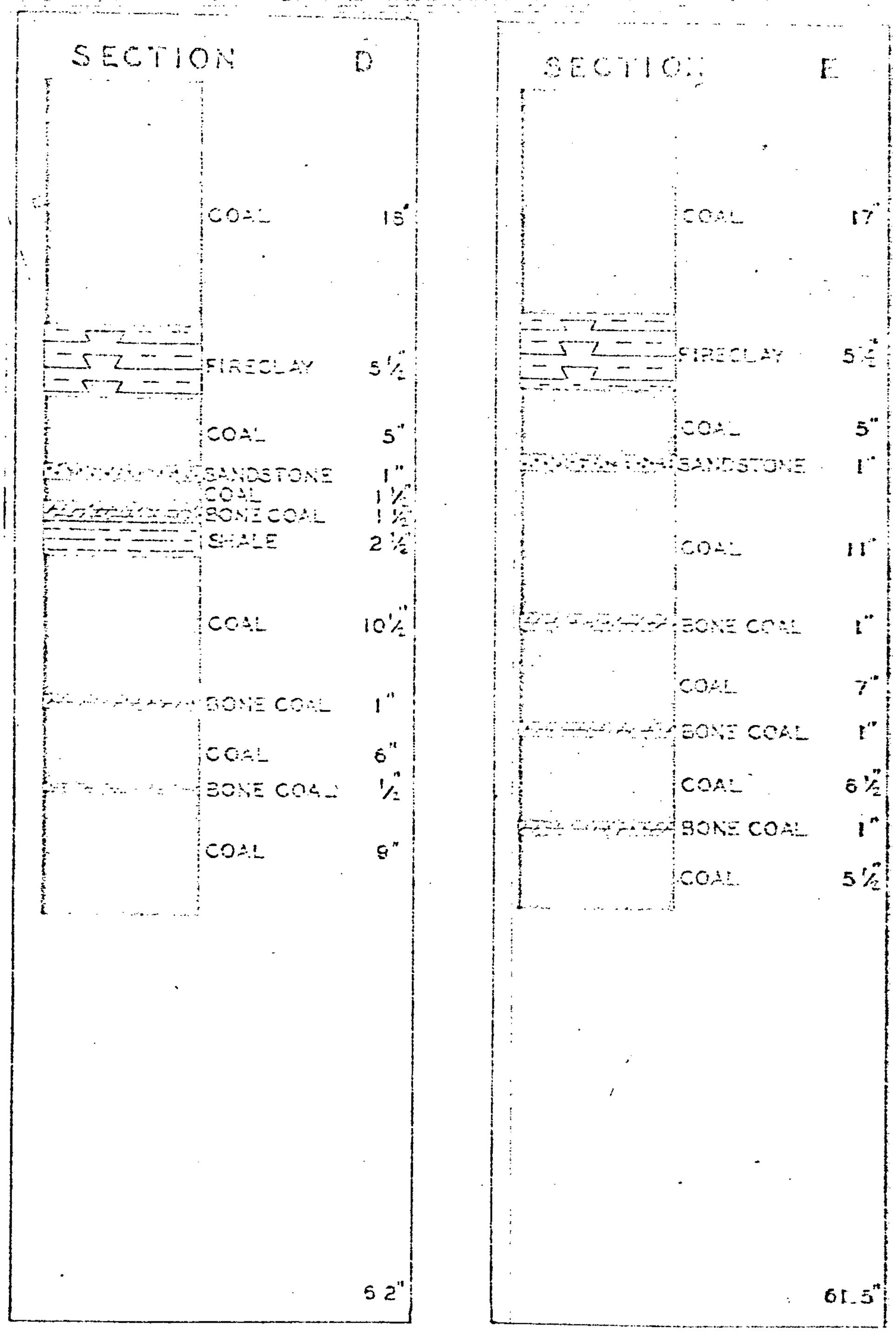


FIGURE 6.

Graphic sections through the No. 2 zone from the under - ground workings, Suquash. Sections B to J cut in 1922, sections 1 to 7 in 1952 (From Hope Engineering, 1952).



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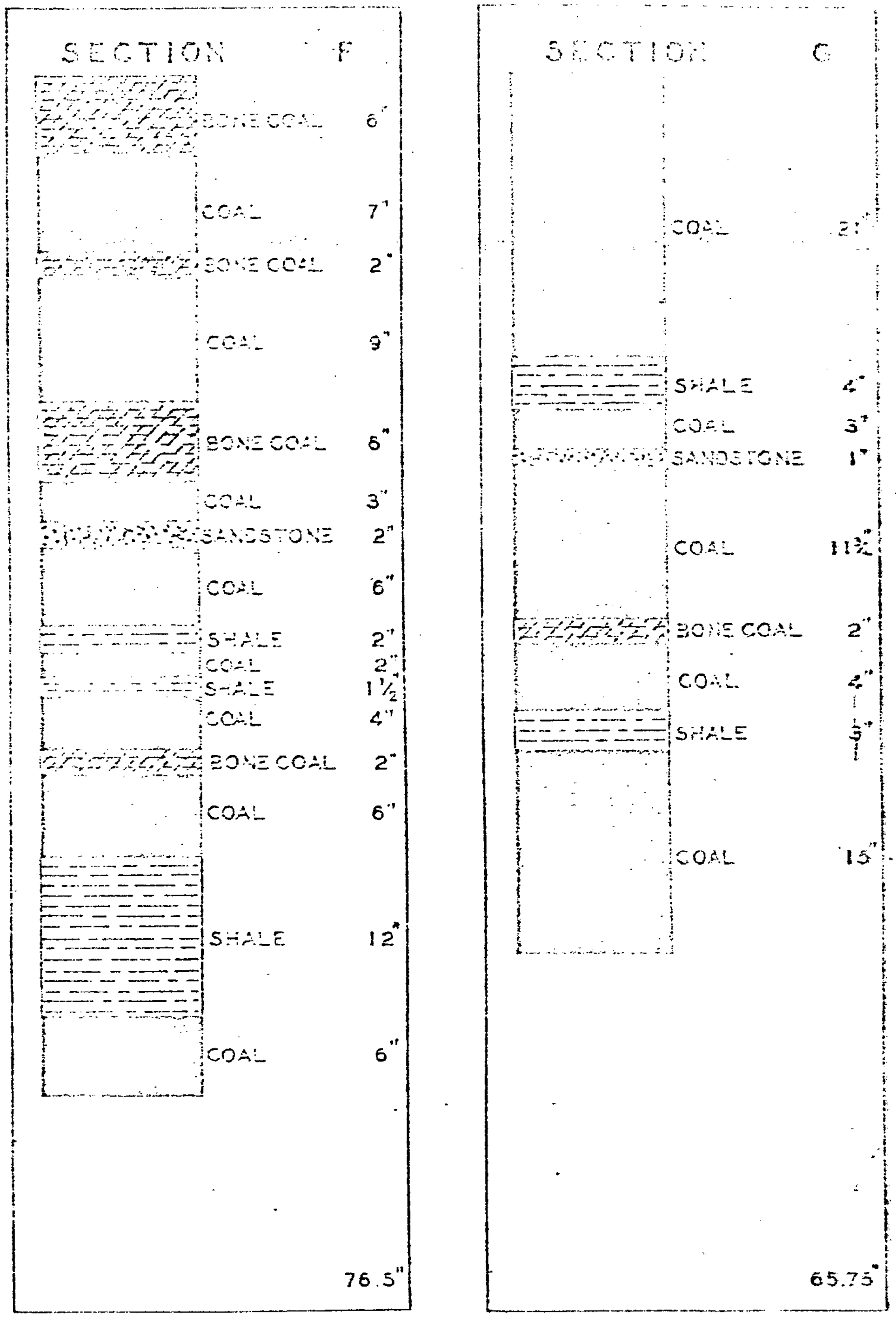

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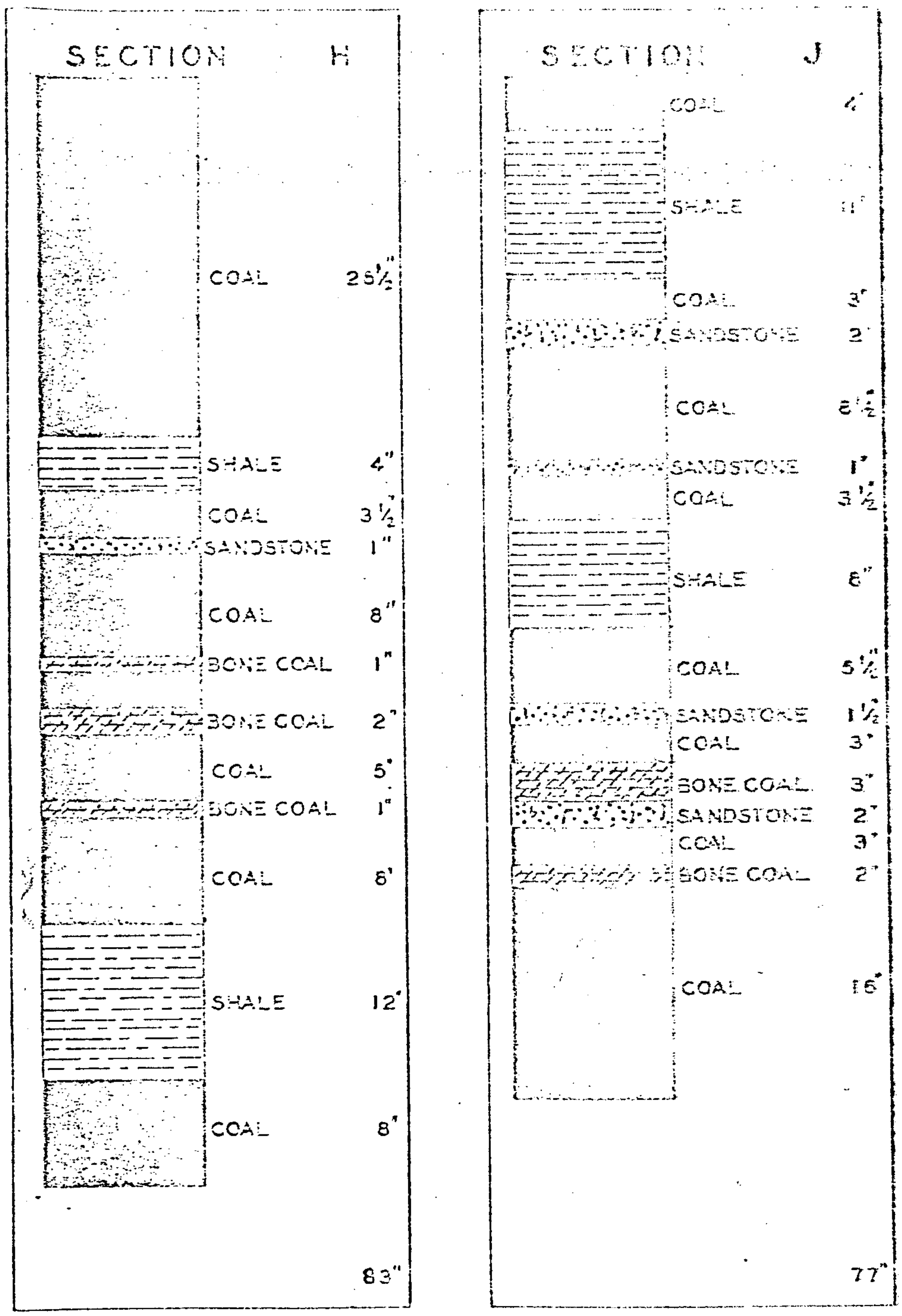

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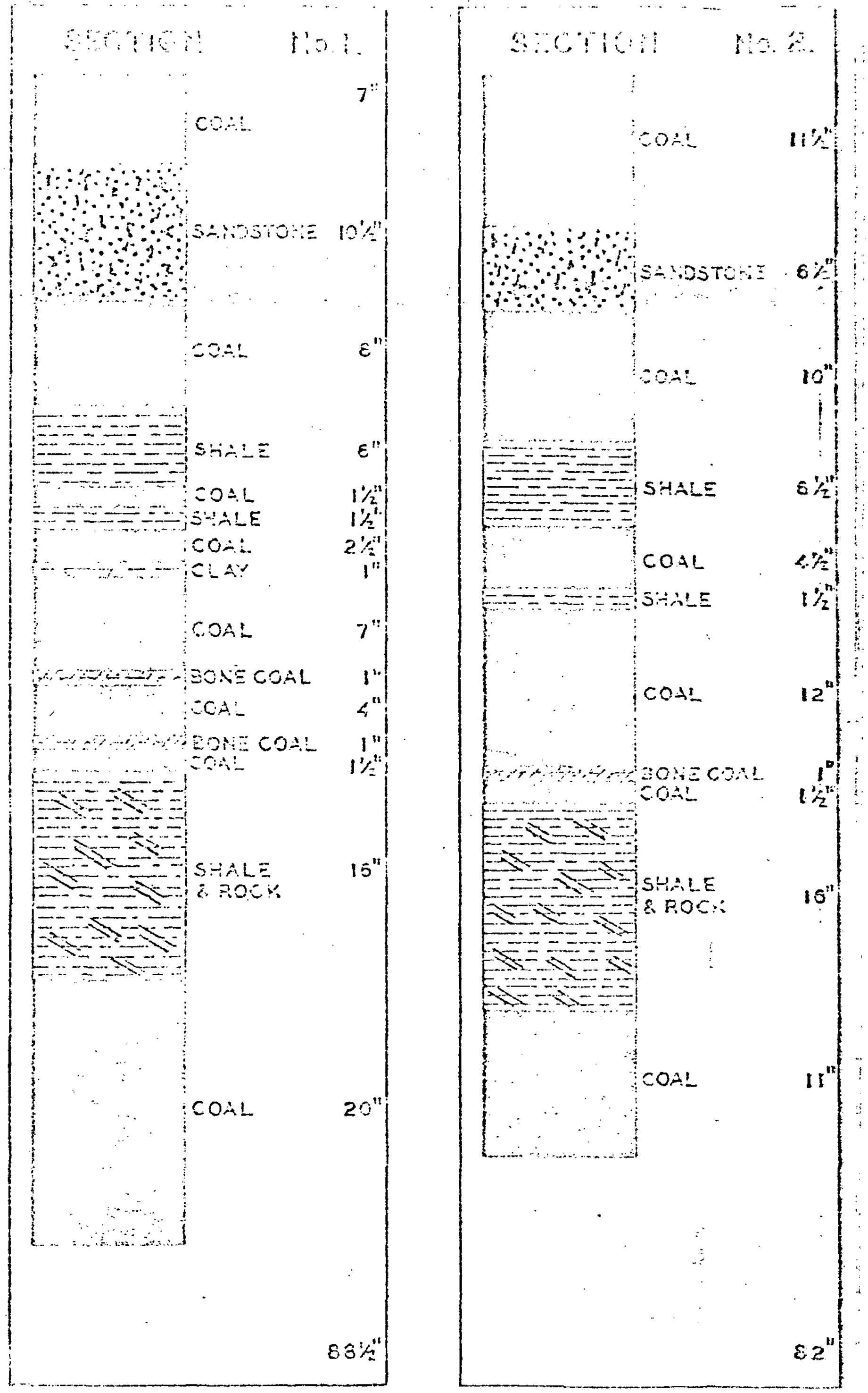

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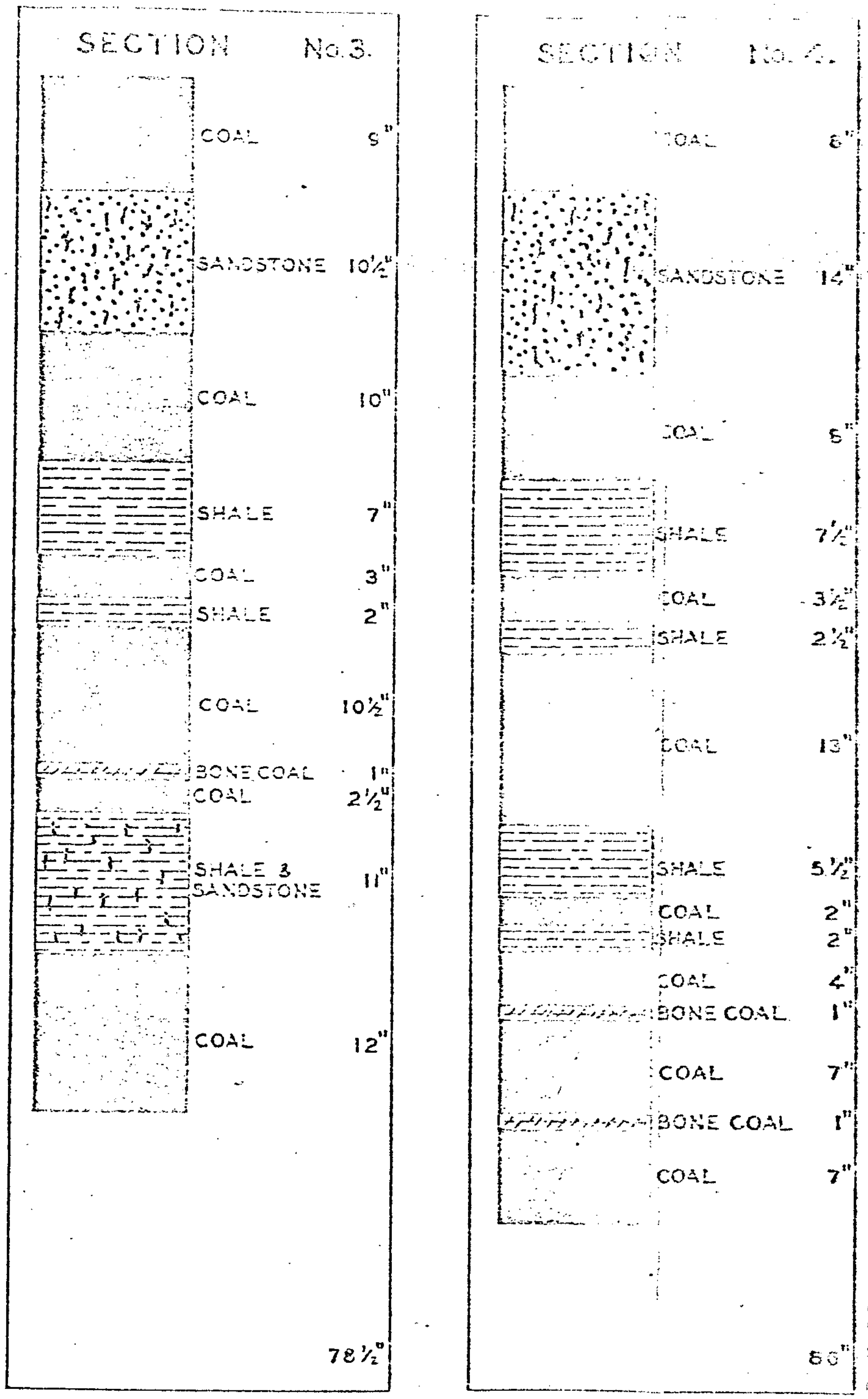

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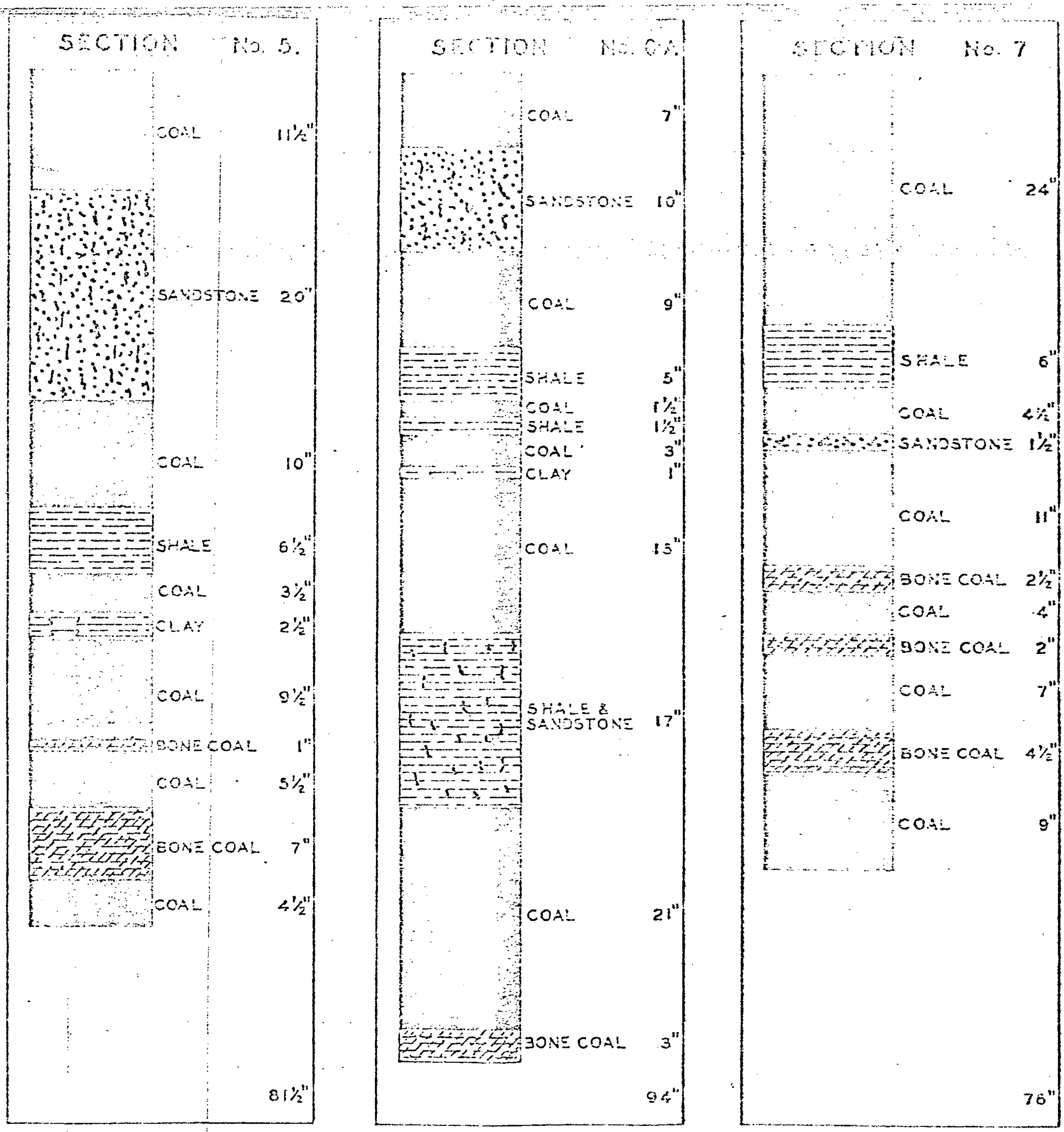

FIGURE 6 continued.

COAL QUALITY

Overall, there is very little clean coal in the nine zones defined by Dolmage Campbell. Using 68 samples taken from 7 of 9 drill cores, Dolmage Campbell was able to present a summary of proximate analyses as listed in Table 1. Table 2 contains the average ash and calorific value for the samples taken by zone.

The samples included rock and dirty coal with some of the rock being removed by hand. Using a minimum mining thickness of 3 feet (where some zones are less than 3 feet), the average calorific value is 4500 BTU/lb. (ranging from 4000 to 8000) and the average ash is 59% (locally 35 to 45%). The rank is high volatile C bituminuous. If the reader wishes to compare the analyses of the specific samples he is referred to Dolmage and Campbell's 1975 report to B.C. Hydro which is in Imperial's possession.

Compared with analyses done previously, Dolmage Campbell's results are very poor but probably realistic. Table 3 shows analyses done in 1909 and 1952 which show a calorific value of 11,100 BTU/lb. and an ash of 11% to 21%. These analyses do not contain as much non-coal material as Dolmage Campbell's samples and should give an indication of coal quality if the Suquash coals were run through a preparation plant. In order to obtain this higher degree of quality, the plant recovery would probably be low, thereby decreasing reserves.

ITEM	HIGH	LOW	AVERAGE
Zone thickness - feet	21.0	1.0	4.7
Aggregate clean coal - feet	7.1	0	0.6
Sample length - feet	12.1	1.0	3.6
Moisture - %	9.25	3.67	6.15
Ash - %	74.59	8.26	47.92
Volatile matter - %	41.17	13.57	22.64
Fixed carbon - %	54.00	48.15	23.29
Sulpher - %	6.15	0.16	2.01
Calorific value - BTU/lb.	11,840.0	1,348.0	5,564.0

TABLE 1. Summary of proximate analyses done on 68 samples from drill core by Dolmage, Campbell and Associates.

ZONE	SAMPLE THICKNESS			MINIMUM 3 FT. THICKNESS		
	Average thickness (feet)	% Ash	BTU/lb.	Average thickness (feet)	% Ash	BTU/lb.
0	1.4	32.66	8092	3.0	67.82	3866
1	2.2	39.75	6941	3.4	61.03	4489
1A	6.9	60.53	4086	7.3	62.69	3862
2	5.4	59.94	4331	5.5	61.28	4194
2A	3.6	51.03	5788	4.1	56.33	5161
2B	2.2	40.18	6697	3.2	57.81	4723
3	5.6	51.90	5599	6.0	54.59	5286
4	4.6	49.43	5361	4.6	49.43	5361
5	6.8	53.04	4634	6.8	53.04	4634
Average	4.3	52.33	5201	4.9	57.79	4608

TABLE 2. Summary of proximate analyses of Suquash coal samples arranged by coal zone (Dolmage Campbell, 1975).

Sample Description		Pacific Coast Coal Company, 1909 Suquash; 5' - 5.5' seam, 6-ton sample sampled by C.H. Clapp				Suquash Collieries Limited, 1952. Underground No. 2 seam, 5.5' thick
Moisture Condition		As rec'd.	Dry	Washed	?	?
Proximate Analysis						
Moisture	%	7.0		5.3		5.7
Ash	%	21.4	23.0	15.1	13.85	11.0
Volatile Matter	%	31.9	34.3	36.7	37.27	36.2
Fixed Carbon	%	39.7	42.7	48.2	42.07	47.1
Ultimate Analysis						
Ash	%	-	-	-	13.85	-
Sulphur	%	0.9	1.0	0.9	1.18	0.98
Carbon	%	-	-	-	60.73	-
Hydrogen	%	-	-	-	4.67	-
Oxygen	%	-	-	-	18.30	-
Nitrogen	%	-	-	-	1.18	-
Calorific Value						
BTU/pound		10,300	11,100	11,560	-	11,580
Reference		Nicolls, 1952		Muller *et al.*, 1974		James, 1969

TABLE 3. Summary of coal analyses of the No. 2 seam at the Suquash Coalfield.

COAL RESERVES

The reserve figures quoted in this report are Dolmage Campbell's estimates which are for underground extraction only. There appears to be minimal surface mineable reserves and the figures are considered to be conservative.

In Table 4 probable reserves were calculated where coal was projected no more than 1600 feet from a drill hole or with three or more holes were less than 3200 feet apart. Possible reserves were calculated from projections of coal to a maximum of 3200 feet, for isolated holes, and where correlations were tenuous.

The reserves were calculated for a minimum 3-foot mining thickness and where the clean coal was less than 3 feet thick the rest of the zone was assigned a 100% ash content and zero calorific value.

The coal reserves for the Suquash basin, in rounded-off figures, are:

A) All correlated zones regardless of grade - 300 million short tons at 4500 BTU/lb. and 60% ash.

B) Correlated zones with over 4500 BTU/lb. and under 60% ash - 150 million short tons at 5500 BTU/lb. and 50% ash.

C) Correlated zones with over 6000 BTU/lb. and under 50% ash - 50 million short tons at 6900 BTU/lb. and 44% ash.

Table 4 contains the reserve estimates for each zone. The best reserves appear to be in the vicinity of the old mine workings and very detailed exploration would be needed before any development.

Zone	A) ALL COAL ZONE Tonnage	A) Calorific Value	A) Ash	B) >4000 Btu; <60% ASH Tonnage	B) Calorific Value	B) Ash	C) > 6000 Btu; <50% ASH Tonnage	C) Calorific Value	C) Ash
PROBABLE									
1	9,360,000	5620	54.8	7,570,000	6410	48.5	4,010,000	6930	44.2
POSSIBLE									
0	18,490,000	4200	64.9	5,870,000	5350	53.2	-	-	-
1	38,840,000	4100	53.2	24,920,000	4420	58.2	1,930,000	6930	44.2
1A	54,570,000	3860	62.4	34,400,000	4680	55.3	-	-	-
2	42,690,000	4160	61.8	21,330,000	5210	50.4	-	-	-
2A	24,930,000	5340	56.2	11,780,000	6300	46.1	11,780,000	6300	46.1
2B	23,540,000	5090	53.4	6,460,000	6560	41.2	6,460,000	6560	41.2
3	32,310,000	4830	56.6	17,310,000	6880	47.4	15,420,000	7030	46.7
4	15,080,000	5040	51.1	15,080,000	5040	51.1	7,310,000	6240	44.9
5	38,130,000	4420	54.4	7,630,000	8080	33.3	7,630,000	8080	33.3
Sub-Total	288,580,000	4430	59.0	144,780,000	5440	51.1	50,530,000	6840	43.5
PROBABLE + POSSIBLE									
Total	297,940,000	4470	58.9	152,350,000	5490	50.9	54,540,000	6850	43.5

TABLE 4.

Summary of Suquash coal reserves by coal zones (from Dolmage Campbell, 1975).

SUMMARY AND CONCLUSIONS

The exploration summary prepared by Dolmage Campbell (1975) gives a very pessimistic view of the Suquash coalfield. There may be 300 million tons of poor coal in the basin with very low calorific values and ash contents excessively high. The mineable reserves may be considerably less and those estimated are for underground extraction only.

The coal is high volatile C bituminous in rank. The run-of-mine coal would have, because of partings, an average calorific value of 4500 BTU/lb. and 59% ash. The clean coal has about 16% ash and has a calorific value of 11,100 BTU/lb. This quality could be achieved by washing the coal, however a preparation plant would not be economically feasible.

The poor quality of the coal, the necessity of underground mining, and the necessity of washing the coal does not make the Suquash coal basin economically attractive at the present time. Further exploration will also be difficult because of dense underbrush and thick cedar swamps in the area.

It is recommended that no furthur work be done on this prospect.

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Figure 4. Geologic map of the Suquash coal area (enlarged from Muller et al., 1974).