THE SUQUASH COALFIELD, VANCOUVER ISLAND (92L/11)

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KEYWORDS: Coal geology, Vancouver Island, Suquash, sub-basin, vitrinite reflectance, coalbed methane.

INTRODUCTION

This report is part of an ongoing project, begun in 1987, to update knowledge of the coal basins of Vancouver Island. Limited information exists pertaining to coalmeasures of the Suquash coalfield or sub-basin (the terms coalfield and sub-basin are used interchangeably here). Geological descriptions by G.M. Dawson (1886) and Charles H. Clapp (1912) are contained in Geological Survey of Canada papers and a few unpublished reports are on file in Victoria with the B.C. Ministry of Energy, Mines and Petroleum Resources. The Buckham Collection, at the Provincial Archives of British Columbia, contains lithologic descriptions for some of the old boreholes. Due to recent industry interest in this area, this paper will summarize past activities and discuss recent coal-sampling results.

The coalfield is an isolated basin which covers 120 square kilometres near the northeast end of Vancouver Island (Figure 5-4-1). Access is possible by water, the Island Highway (No. 19), and secondary and logging roads. It is an area of predominantly low relief, with gently rolling hills. It is heavily forested with cedar, fir and hemlock, and has many swampy areas, which hamper access. The Keogh and Cluxewe rivers flowing to the Queen Charlotte Strait drain the district. Most of the coalfield is covered by till which limits exposures to the shoreline, rivers and roadcuts. Climate is fairly mild and wet, and snowfall is common during the winter months.

GEOLOGICAL SETTING

The coal measures of eastern Vancouver Island are contained in Nanaimo Group rocks, which occupy the western erosional margin of the Late Cretaceous Georgia basin, which is largely concealed beneath the waters of Georgia Strait. The Suquash is a coal-bearing sub-basin within the Georgia basin. Crystalline basement rocks of Triassic and Jurassic age unconformably underlie the coal measures.

Sediments generally dip 5 to 10° to the northeast and consist mainly of sandstone, some shale, and minor amounts of conglomerate and coal. The total thickness of the sediments is unknown, but a borehole (BH 1), drilled in 1908, intersected weathered volcanics at a depth of 369 metres (Figure 5-4-1). Drilling has provided very little information concerning the paleotopography and how it affects sediment

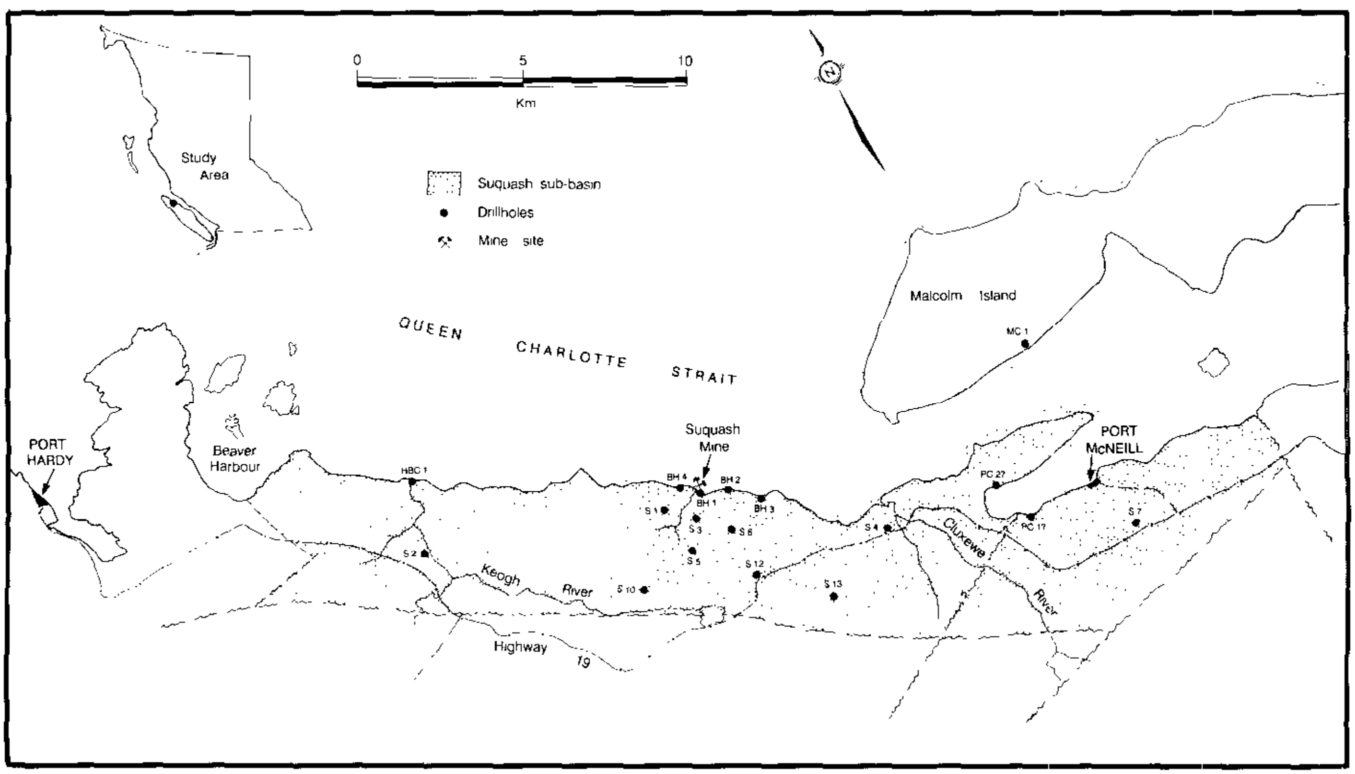

Figure 5-4-1. Location map, Suquash sub-basin.

distribution. There is also very little structural information available, but Clapp (1912) indicated that sediments in the coalfield are essentially flat-lying in what appears to be a broad, open syncline plunging at a low angle to the northeast. There are small intrusions of granitic and other igneous rocks along the coastline. Some localized folding has taken place, and there is probably localized faulting.

There are several coal zones in the Suquash coalfield, but individual seam thicknesses rarely exceed 1 metre. Eighteen drilling logs indicate coal or coaly material in all but two holes, S-2 and S-7. It cannot be described as clean coal because of multiple shale and mudstone partings in the zones. It appears that some zones may be laterally extensive. The coal in Hole MC 1, intersected at 166 metres, is thought to be the same zone as that worked at the Suquash mine.

HISTORY

The first samples of coal, from Beaver Harbour, were shown to the Hudson's Bay Company by native Indians in 1835. An exploration crew was sent to investigate the area and when fuel demands multiplied due to increased steamship fleets working on the west coast, it was decided to mine the deposit. In 1849, the company brought a party of workers from Scotland to operate the Suquash mine which was in production from 1849 to 1852. Three holes were drilled in 1852-1853, but only one location is known (HBC hole, Figure 5-4-1). When a richer deposit was discovered in the Nanaimo area, the company relocated its mining activities to the south.

There is evidence that a hole was drilled in 1890 and another in 1898, but unfortunately there are no logs or locations for these holes (Buckham, 1953).

Pacific Coast Coal Mines Ltd. drilled four exploratory holes in the old Suquash mine area in 1908 (BH holes). On the basis of the drilling results, it decided to work the property. At some time between 1908 and 1917, two holes were drilled on Malcolm Island. Only one is shown on Figure 5-4-1 (MC 1), the other is off the map. Two holes were drilled in the Port McNeill area (PC holes), but locations of these are vague. The outbreak of World War I and litigation regarding finances caused a shutdown of the mine in 1914 (Freeman, 1952). Following the war, small areas were mined until the closure in 1922. Total production from the coalfield, during the two mining stages was 23 600 tonnes.

Suquash Collieries Limited re-evaluated the underground mining potential in 1952 and dewatered an area of the old workings for a feasibility study of the deposit (Saunders, 1975). This was completed, but there were no mining operations to follow.

From October to November 1974, British Columbia Hydro and Power Authority drilled ten exploratory holes in the Suquash coalfield totalling 1910 metres (S holes). A total of 68 coal samples were taken from the drill core for proximate analysis. Geophysical logs were not run. Exploration activity ended as it appeared that the deposit was not economic for an underground coal mine at that time, due to relatively low calorific values.

RECENT WORK

In 1989, B.C. Hydro informed the Ministry of Energy, Mines and Petroleum Resources that it intended to dispose of the core from the 1974 drilling program (T. McCullough, personal communication). Hydro indicated that any core of interest to the ministry would be re-boxed and sent to Charlie Lake for storage. Only two of the holes (S-2 and S-5, Figure 5-4-1) were salvageable, as much of the core had deteriorated. Core from these two holes was sent for permanent storage. Coal in this core provided samples for the first vitrinite reflectance study of the Suquash coalfield.

Borehole S-2 did not contain any coal intervals, but ten coal samples were taken from S-5. The best possible samples were selected for vitrinite reflectance tests; in some intervals, much of the coal had already been removed for proximate analysis tests. Samples were crushed using a mortar and pestle. The -20 mesh fraction was combined with a mounting medium and pellitized. A Leitz MPV-3 reflecting microscope with an automated stage was used to determine the reflectance of the polished coal surfaces. On each sample, 50 randomly oriented vitrinite particles were measured for maximum and minimum apparent reflectance. A computer program developed by Kilby (1988) was used to produce on-screen crossplots for determining reflectance values.

RESULTS

Proximate analysis run on the B.C. Hydro samples (on an as-received basis), resulted in the following averaged values: moisture, 5.98 per cent; volatile matter, 23.31 per cent; fixed carbon, 25.38 per cent; ash, 45.34 per cent; sulphur, 2.21 per cent; and calorific value, 5969 Btu/lb. (Saunders, 1975).

A summary of the reflectance data from Borehole S-5 is presented in Table 5-4-1. Vitrinite reflectance values ranged from .63 to .81 per cent mean maximum and .60 to .80 per cent mean random. An examination of the coal pellets indicated that vitrinite was the predominant maceral, except for the uppermost sample in which the predominant maceral group was liptinite.

TABLE 5-4-1
VITRINITE REFLECTANCE DATA, BOREHOLE S-5

SAMPLE NUMBER	SAMPLE DEPTH (m)	MEAN MAXIMUM REFLECTANCE %	MEAN RANDOM REFLECTANCE %
1	19.8	.63	.60
2	48.6	.75	.73
3	66.8	.77	.76
4	74.7	.77	.73
5	84.4	.79	.78
6	106.4	.77	.76
7	190.2	.77	.76
8	214.9	.81	.80
9	216.1	.80	.79
10	234.7	.80	.79

DISCUSSION

There is limited distribution of exploration holes in this coalfield, and with the exception of one hole, none intersect basement rocks. There do not appear to be any useful horizons for correlating the coal zones from the available borehole information, with the exception of those close to the old mine site. Consequently, there are not enough data available to provide a clear picture of the stratigraphy, structure, thickness and areal extent of the coal measures.

Vitrinite reflectance values and maceral content determined by this year's study indicate that the coal in the Suquash coalfield straddles the boundary between high volatile A and B bituminous rank (Figure 5-4-2). The moist ash-free calorific value places the coal in a high volatile C bituminous category based on B.C. Hydro's average values using A.S.T.M. standards (Saunders, 1975).

The area does not hold promise for development of an underground coal mine. When compared to other deposits, the dirty nature of the coal, due to multiple partings, and the relatively thin seams, do not make this an attractive venture.

An accurate estimate of reserves is difficult without sufficient data. B.C Hydro calculated mineable reserves, from its 1974 drilling program, of 45 million tonnes of coal. The quality parameters used to determine this number were 6000 Btu/lb minimum and 50 per cent ash maximum (Saunders, 1975).

The recent vitrinite reflectance work places the coals of the Suquash sub-basin in the window of coalbed methane generation (Figure 5-4-2). Freeman (1952) stated, "I am certain when the mine has been cleared of gas, you will not be bothered with gas providing you have sufficient ventilation." This area deserves investigation of its coalbed methane potential. Certainly, more work is necessary.

ACKNOWLEDGMENTS

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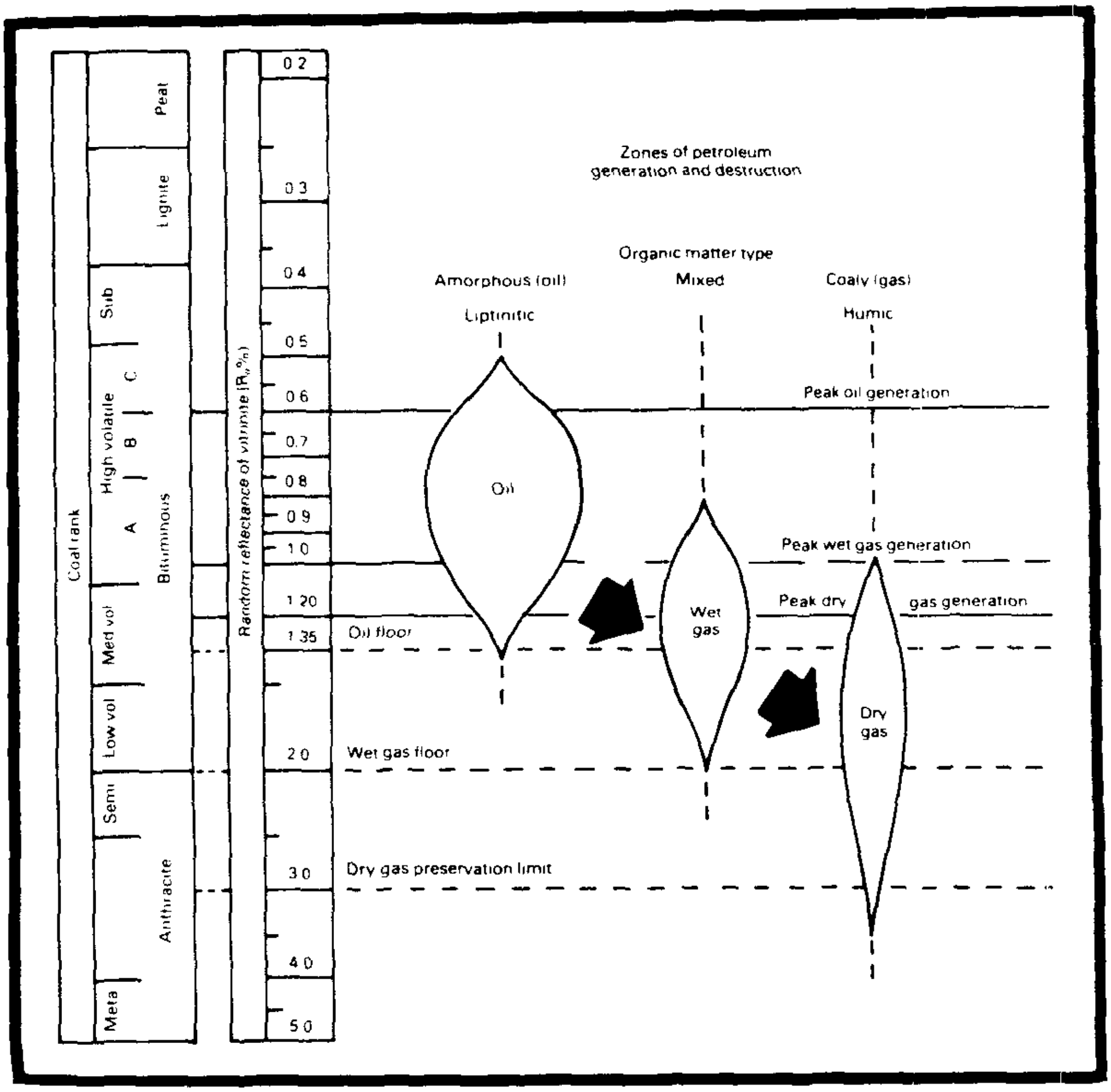

Figure 5-4-2. Correlation of coal rank scale with zones of petroleum generation (modified after Dow, 1977).

boxes, and to B.C. Hydro for re-boxing and shipping the core to Charlie Lake. Special thanks to Joanne Schwemler for her vitrinite reflectance work, and to Maria Holuszko for maceral identification.

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