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SUBSURFACE THERMAL COAL SAMPLING SURVEY, MERRITT COAL DEPOSITS, SOUTH-CENTRAL BRITISH COLUMBIA (92I/2)

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KEYWORDS: Coal geology, Merritt, diamond drilling, core sampling, coal quality, coalbed methane.

INTRODUCTION

The province-wide subsurface coal-sampling survey started in 1988 in the Comox coalfield. In 1989 the program was cosponsored by the Institute of Sedimentary and Petroleum Geology and focused on the Telkwa coalfield. This was followed by drilling in the Bowron River coal deposit in 1990. The focus of the 1991 drilling was the Merritt coal deposit (Figure 4-5-1). A total of 354 metres was drilled, with a core diameter of 3.5 centimetres. Two holes were spudded in the Coal Gully area, one on Coldwater Hill, one at Diamond Vale and another at Normandale, for a total of five diamond-drill holes (Figure 4-5-2). The drilling program was conducted, as in previous years, by Neills Mining Company using a Prospector 89 drill manufactured by Hydrocore Drill Ltd.

Several coal exposures had been sampled and analyzed in 1987, under the direction of Dr. Fari Goddarzi of the Institute of Sedimentary and Petroleum Geology. The coal seams and bands recovered from the drill cores are being prepared for analysis.

LOCATION OF THE STUDY AREA

The Merritt coal deposits are located 90 kilometres south of Kamloops on the Coquihalla Highway. Situated in the Nicola Valley, south-central British Columbia (Figure 4-5-1), the occurrences surround the town of Merritt stretching 8 kilometres east-west and 5 kilometres north-south. The locations of the mined areas are indicated on Figure 4-5-2. The Quilchena deposit was not sampled in this study due to financial constraints.

EXPLORATION AND PRODUCTION HISTORY

The earliest reference to coal in the Nicola Valley area, near the present town of Merritt, appeared in the "British Colonist", Victoria, British Columbia, on August 20, 1896, reporting on its use for a forge in Victoria. The coal was generally mined by the local inhabitants for domestic purposes. Regular production from the Middlesboro Collieries on Coal Gully Hill began in 1906. A total of 2.93 million tonnes was produced underground from the Merritt coal deposits until mining ceased in 1963. Middlesboro Collieries mined 92 per cent of the total, from the Coal Gully area and a large area of Coldwater Hill. Other colleries mined the Diamond Vale (mining ceased in 1912, after an explosion resulted in the deaths of seven men), Normandale and Sunshine areas. A very small amount was taken out of Quilchena by a local rancher for domestic purposes.

At present Imperial Metals Corporation holds the freehold coal rights to the Coal Gully Hill and Coldwater areas. Renewed interest in coal in 1980 and 1981 resulted in Crows Nest Resources Ltd. taking up coal licences and options on freehold lands in the area. Mapping was carried out from the Coal Gully Hill deposit to Quilchena, 27 holes were drilled and a trench excavated at Quilchena. Due to rapid weathering and the character of the rocks in the area, nearly all the adits have caved and trenches have filled with rubble. No further exploration has been carried out since that time.

GEOLOGICAL SETTING

The Tertiary (Eocene) coal measures of the Coldwater Formation overlie and are bounded by volcanic rocks of the Upper Triassic Nicola Group. A tongue of younger Pliocene valley basalt outcrops in the northeast corner of the study area, covering the Nicola volcanics, and runs southwestwards, covering a portion of the Coldwater Formation. Pleistocene and Recent unconsolidated sediments, both glacial and fluvial, cover much of the valley floor (White, 1946).

The Coldwater Formation is a sequence of nonmarine conglomerate, sandstone, shale and coal. It occupies one of several early Tertiary basins in the Cordilleran Intermontane Belt. The lake in which deposition occurred was part of a drowned valley system, probably conforming with the present topography. The coal formed in the early stages of lake development.

The conglomerate, grit and sandstone are largely composed of quartz and feldspar, derived mainly from local granitic sources. The shales are thinly bedded and are associated with the coal horizons of the sequence. The basal conglomerate is composed mainly of Nicola rock fragments. Calcareous horizons occur throughout the sedimentary sequence.

Due to the thick Pleistocene cover in the valley, the structural pattern of the underlying sediments is unclear. In the west, where the geology is better known as a result of the mining and exploration activity, there are moderately tight northwest-trending folds, offset by numerous strike faults. To the east, the dips become more gentle and the coal deeper. In the centre of the basin the sediments appear to have been less disturbed by tectonic activity. In the southeast sector, near the eastern boundary, the beds strike northeast and the folds are more open. The eastern boundary of the Coldwater sediments is a fault contact with the Nicola volcanics. (Read, 1988; Figure 4-5-2)

COAL MEASURES

The thickness of the coal measures varies up to 300 metres at the western rim of the basin where the coal

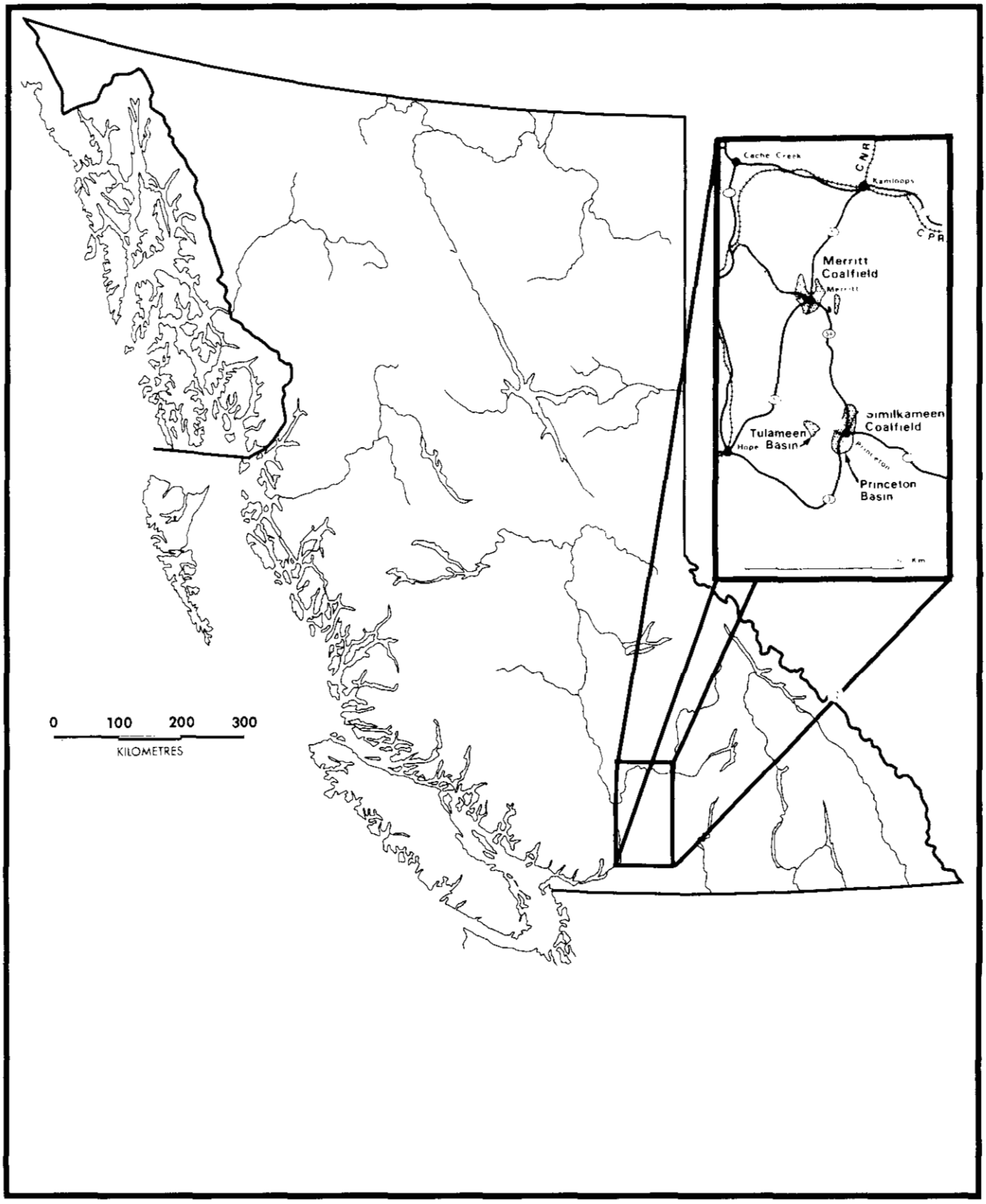

Figure 4-5-1. Location map showing the Merritt and Similkameen coalfields and the Tulameen and Princeton basins.

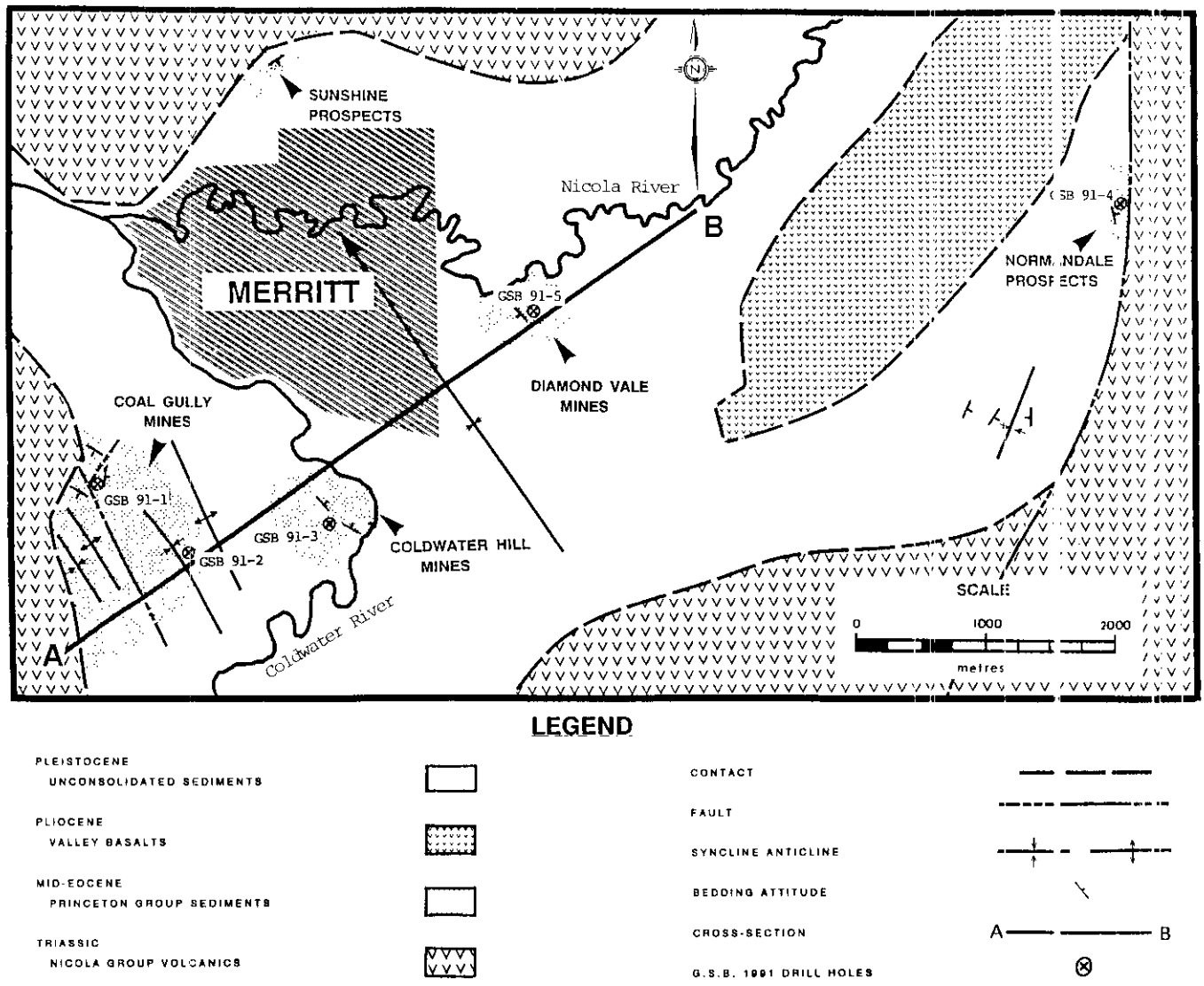

Figure 4-5-2. Detailed geology of the Merritt area showing drill-hole locations.

zones tend to be thicker and more numerous than in the eastern part of the basin. In the Coal Gully area, where the strata are quite steeply folded, seven coal zones have been reported. Starting from the lowest in the succession, the thicknesses of the zones are as follows: No. 1 is 7.9 metres, No. 5 is 1.5 metres, No. 4 is 7.6 metres, No. 8 is 2.44 metres, No. 6 is 1.8 metres, No. 3 is 0.76 metre and No. 2 is 1.8 metres (Swaren, 1977).

To the east and the south, the coal zones generally diminish in thickness, however, No. 5 zone increases to 3 metres and 2.2 metres respectively and the No. 3 zone increases to 1.3 metres. The zones pinch and swell, and the intervals between them may vary up to 30 metres.

Drilling in the Coldwater Hill area in 1991 confirmed that No. 6 zone, previously reported absent in this area, does occur, but thins to about 1.1 metres. The beds form the southwest limb of a broad symmetrical syncline, striking northwestwards and dipping to the northeast at an average of 35° at outcrop.

In the Diamond Vale mine, zones 2, 3 and 6 were mined. The lower zones, 8, 4, 5 and 1 were not exploited due to depth. The mine is on the northeast limb of the syncline and coal seams dip to the southwest at an average of 40° at outcrop. East of the Diamond Vale mine, two strike-slip faults have been identified by drilling (Figure 4-5-3 and 4), but little more is known about this area.

The coal is interbedded with shale and rooted quartz arenite, in parts calcareous, with coalspar and horizons exhibiting burrowing and bioturbation. The typical depositional environment ranged from back-barrier lagoons to mixed sand and mud flats, corresponding to areas of low to moderate energy, and subject to variable current velocities.

COAL QUALITY

The coal is reported to vary form high-volatile C to A bituminous in rank. A typical proximate analysis, on an as-received basis, is: moisture, 5 per cent; ash, 9 per cent;

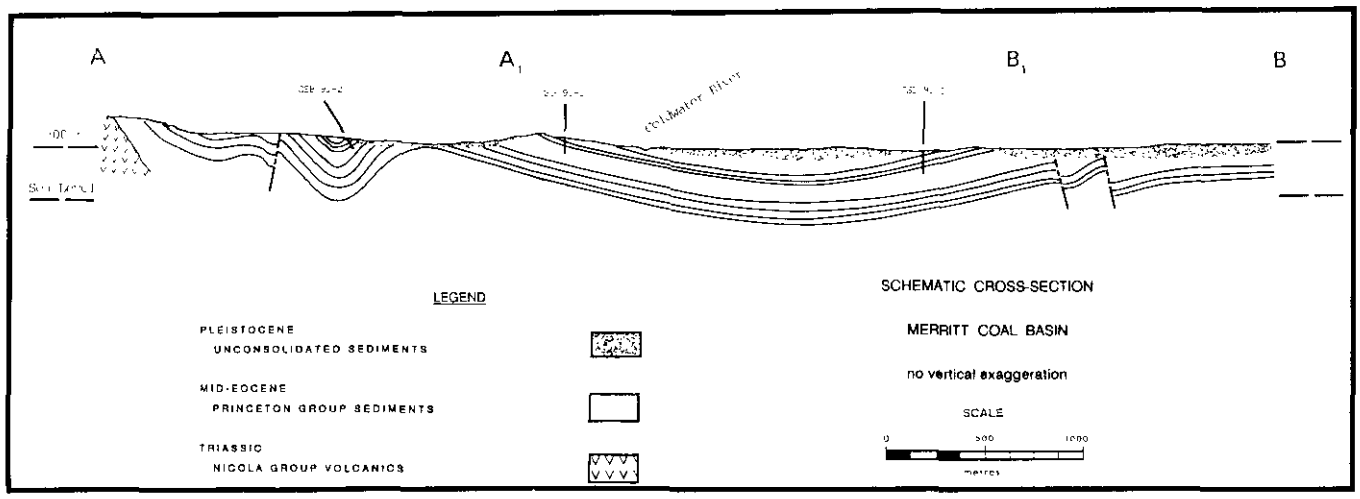

Figure 4-5-3. Schematic cross-section of the Merritt coal basin.

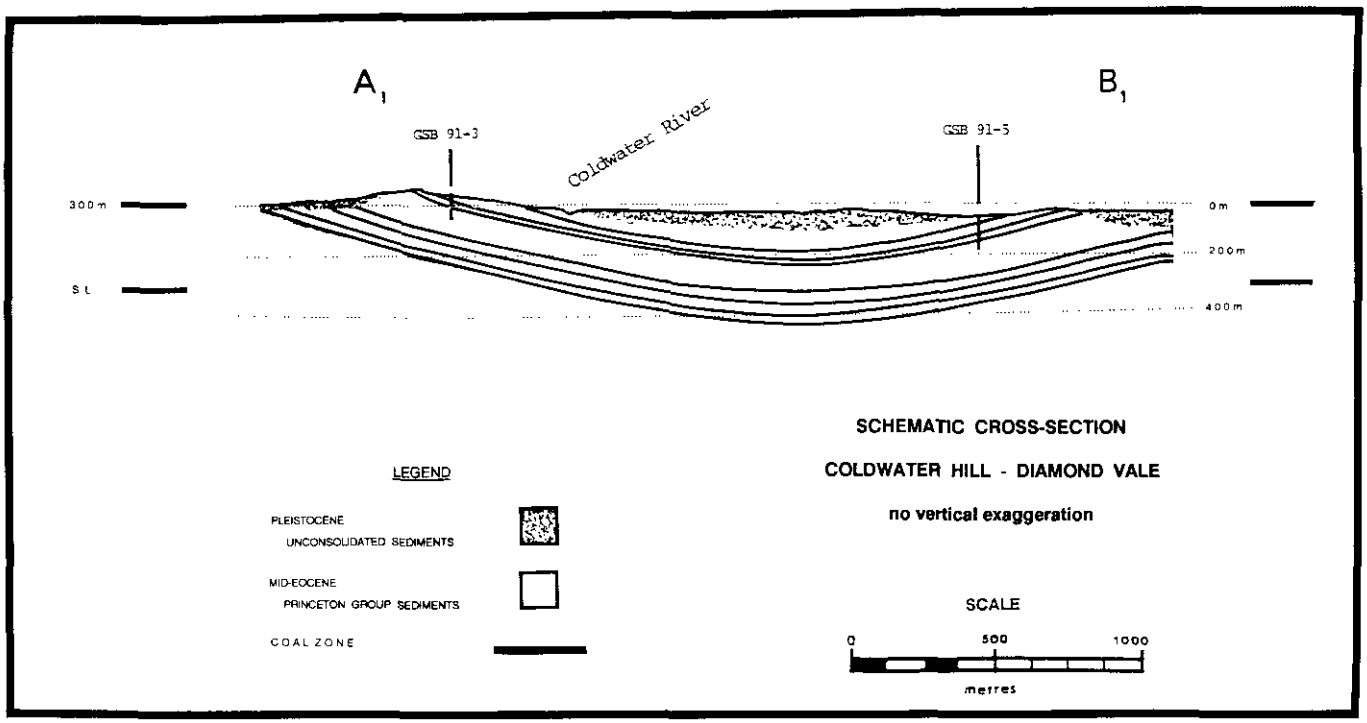

Figure 4-5-4. Schematic cross-section of a portion of the Merritt coal basin in the vicinity of Coldwater River. Location of drill-holes GSB91-3 and 5 indicated. *See* Figures 4-5-3 for complete section.

volatile matter, 34 per cent; fixed carbon 52 per cent; (*B.C. Ministry of Energy, Mines and Petroleum Resources*, Information Circular 1990-5).

Sulphur at 0.6 per cent is low. The heating value is about 30 000 kilojoules per kilogram. The Hardgrove grindability index is about 57. Amber is often present but is not abundant.

Friability may be higher than suggested by the Hardgrove index and rank, probably due to the effects of tectonism.

DRILLING AND SAMPLING

There were several major constraints in selecting drilling sites. Water was not readily available and in several cases had to be pumped from a source over 800 metres away. The water required for drilling at Normandale had to be brought in by truck from Nicola Lake 6 kilometres away. There are no accurate mine plans available, and as a result drill sites had to be carefully selected to avoid any break through into

old workings. Finally, burning coal of unknown extent at Coldwater Hill had to be avoided.

The sandstone is poorly consolidated and cavities occur as a result of dissolution (Plate 4-5-1). Consequently there was frequent caving and loss of water circulation while drilling. Hole GSB-91-4 at Normandale had to be abandoned at 60 metres due to constant caving jamming the drill rods.

Two holes were collared on Coal Gully Hill. A vertical hole (GSB-91-1; total depth 83.2 metres) intersected the No. 4 zone (Plate 4-5-2). Due to the very broken character of the coal in the core, only 4.25 metres (true thickness) of core was recovered from the zone measuring 8 metres (true thickness) at outcrop. Hole GSB-91-2, was angled at 60° from the horizontal at an azimuth of 220. Number 2, 3 and 6 zones were intersected before the hole was stopped at 60.2 metres. A vertical hole on Coldwater Hill, GSB-91-3 (depth 45 metres), intersected the No. 3 and No. 6 zones. The final hole, GSB-91-5, drilled at Diamond Vale (depth 91.3 m), intersected coal zones Nos. 2, 3 and 6. Most previous reports on this area indicate the existence of only six coal zones, however, No. 6 zone has been intersected in three holes and though it may not be continuous, it does bring the total to seven zones.

SAMPLE ANALYSIS

All coal samples will be crushed to −20 mesh. Petrographic rank determinations will be carried out in-house by the vitrinite reflectance method. Mineralogy of low-temperature ash samples will be determined using x-ray defraction. The following analyses will be carried out by a private laboratory under the joint auspices of the Geological Survey Branch and the Institute of Sedimentary and Petroleum Geology: proximate; ultimate; sulphur forms; calorific value; ash analysis; chlorine, fluorine and mercury contents; and ash fusion.

Dr. Fari Goodarzi sampled the remainder of the core, after the coal had been removed, and these samples were sent to the Institute of Sedimentary and Petroleum Geology

Plate 4-5-1. Poorly consolidated sandstone with cavities due to dissolution.

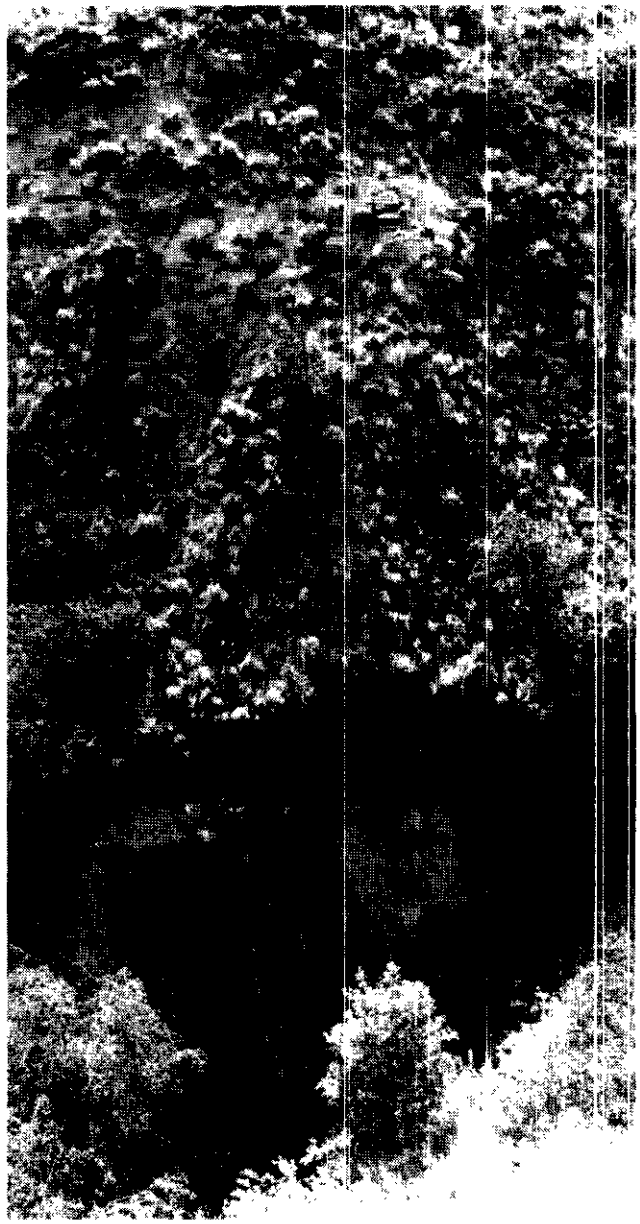

Plate 4-5-2. No. 4 zone at Gully Hill intersected by drill hole GSB-91-1.

in Calgary, primarily for petrographic examination of the carbonaceous material in the siltstones and shales, and for trace element determination, which will be done on the coal, using primarily neutron activitation.

METHANE POTENTIAL

Methane is inherent in all coals and is desorbed when the gas pressure exceeds that of the hydrostatic head. Blocky coals, which desorb 60 per cent of their total gas, have less than 57 per cent fixed carbon and have an average Hardgrove index of less than 70. Friable coals, which desorb 94 per cent of their total gas, have greater than 57 per cent fixed carbon and have an average Hardgrove index greater than 70 (McCullough *et al.*, 1980). Further analysis is necessary to resolve the nature of the Merritt coals.

As a general rule, retention of methane in coal seams increases with the rank and depth of the coal (Ryan, 1991)

The Merritt basin, underlain by coal measures, covers an area of about 40 square kilometres. An area of 15 square kilometres was selected for the examination of coalbed methane potential, from Coldwater Hill to Diamond Vale. The coal measures form a symmetrical open syncline, 3 kilometres wide, which plunges to the northwest for about 5 kilometres. All seven seams are present. The average thicknesses of the coal zones recorded from drill logs are as follows: No. 1 is 2.5 metres, No. 5 is 2.8 metres, No. 4 is 2.4 metres, No. 8 is 0.6 metre, No. 6 is 0.7 metre, No. 3 is 1.3 metres and No. 2 is 1.1 metres.

Calculations are based on the mean cross-section A1-B1 (Figure 4-5-3) and the graph showing methane retention by rank and depth (Eddy *et al.*, in Ryan, 1991). The total potential volume of this particular area amounts to about 31 billion cubic feet of gas (Table 4-5-1). It is not possible to calculate the gas potential of the remaining 60 per cent of the field due to lack of geological data.

CONCLUSION

Badly broken core, abundant slickensiding and cavities in the sandstone created by solution, resulted in an overall core loss of 12 per cent, considerably greater than that of previous years. The core loss was highest in the coal zones, where it averaged 18 per cent. Methane desorption tests were not possible due to the broken nature of the core. Further drilling, north, northeast and east of the Diamond Vale mine, would resolve the structure, identify the coal measures and delineate the resources.

It is improbable that the Merritt coal deposits would be capable of supporting a viable mining operation in the future, but an interesting alternative energy resource may be the extraction of methane from the coal measures, providing a valuable source of fuel for the inhabitants of Merritt and the surrounding countryside.

TABLE 4-5-1
MERRITT COAL DEPOSITS COLDWATER HILL – DIAMOND VALE COAL RESOURCES AND POTENTIAL COALBED METHANE RESOURCES

	DEPTH IN METRES			TOTALS
FROM	0	200	400	0
TO	200	400	500	500
TOTAL COAL (million tonnes)	77.39	123.27	28.34	229
TOTAL METHANE (million cubic feet)	10 835	16 025	3 968	30 828
REFLECTANCE	.75			

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