



**COAL RANK DISTRIBUTION  
FLATHEAD COALFIELD  
SOUTHEASTERN BRITISH COLUMBIA  
(82G/2, 82G/7)**

By D. A. Grieve

## INTRODUCTION

The Flathead Coalfield in southeastern British Columbia consists of four outliers of Kootenay Group rocks in the Flathead River basin, southeast of the Crowsnest Coalfield (Figure 5-3-1; see also Figure 5-1-1, this paper). The author carried out reconnaissance geological mapping and coal sampling on the four properties in 1980 (Grieve, 1981). At that time only three of eighteen coal samples were analysed petrographically for rank. This article presents a summary of complete data from the project, supplemented by results from drill core samples collected from two of the four properties, and three deep subsurface coal samples provided by Shell Canada Ltd. from the Shell Middlepass b-94-L/82-G-01 well (Figure 5-3-1).

The Flathead Coalfield is situated in the extreme southeast corner of British Columbia, 35 to 50 kilometres southeast of Fernie. Good access is provided by logging roads from Morrissey, 15 kilometres south of Fernie, via both the Lodgepole-Harvey Creek route and Bighorn-Cabin Creek route to the Flathead River road (Figure 5-3-1). The Lillyburt and Harvey Creek properties, two of the four properties which comprise the coalfield, are adjacent to the Flathead River road. The Cabin Creek road bisects the Sage Creek property and passes south of the Cabin Creek property.

Coal rights to the Lillyburt and Cabin Creek properties are held by Crows Nest Resources Ltd. Sage Creek Coal Ltd. owns the rights at Sage Creek and is awaiting a decision on an application to develop a surface thermal coal mine on the property. Coal rights to the Harvey Creek property are not presently held.

## METHODS

Grab samples of coal were collected in the field for petrographic rank determinations. In all cases, bloom and other highly degraded coal was avoided, usually by sampling from fresh-looking cuts or by digging through softer material. In a few cases spoil piles adjacent to adits were sampled and samples of coal were also taken from drill core. As almost all coal seams had been removed from core boxes for analysis, it was necessary to sample very thin seams and coal bands.

Petrographic rank was determined by the  $\bar{R}_o$  max method (mean maximum vitrinite reflectance in oil). Maximum readings on 50 grains per sample were measured and then averaged. Coals are classified into ASTM rank categories as follows: high volatile bituminous,  $\bar{R}_o$  max < 1.12 per cent; medium volatile bituminous, 1.12 per cent <  $\bar{R}_o$  max < 1.51 per cent.

## GEOLOGICAL SETTING

Coal in southeastern British Columbia is contained in the Jurassic-Cretaceous Kootenay Group. In ascending order, the Kootenay Group consists of the Morrissey, Mist Mountain and Elk Formations. The Mist Mountain Formation is the major coal-bearing unit and the Elk Formation contains sporadic thin seams.

The Kootenay Group in Flathead Coalfield is anomalously thin. While this is a result of both the Mist Mountain and Elk Formations being relatively thin, the most notable contrast is between the Mist Mountain Formation in the Flathead Coalfield and in other areas. Its average thickness at the Lillyburt, Harvey Creek and Sage Creek properties is 150 metres, compared with roughly 500 metres in the other two coalfields of southeastern British Columbia. Consequently only three or four major coal seams or zones are present. The Cabin Creek property covers an erosional remnant of 75 metres of Mist Mountain Formation containing two coal seams.

In common with all coal deposits in southeastern British Columbia, the Flathead Coalfield is part of the Lewis (and possibly higher) thrust sheets. The Lillyburt and Harvey Creek properties lie in the immediate hangingwall of the Flathead normal fault (Figure 5-3-1, Price, 1962).

## RESULTS

A summary of petrographic rank values of samples from the Flathead Coalfield is presented in Table 5-3-1. A depth-reflectance profile of samples from drill hole LB-301 is shown in Figure 5-3-2.

### LILLYBURT

Values of  $\bar{R}_o$  max on coal samples from the Lillyburt property range from 1.05 per cent to 1.30 per cent (Table 5-3-1).

The lowest value corresponds with an outcrop sample from relatively high in the section. Coals from the basal portion of the Mist Mountain Formation, sampled only in core from drill hole LB-301, have values of 1.16 and 1.21 per cent. Curiously, higher reflectance values were obtained higher in the Mist Mountain section, both in field and core samples. Elk Formation samples from the core have similar reflectance values to the basal Mist Mountain sample. In fact, the reflectance-depth profile in hole LB-301 is distinctive both in terms of the wide scatter of the data and the apparent lack of dependence of rank on stratigraphic position (Figure 5-3-2).

### HARVEY CREEK

The single sample collected from the Harvey Creek property has a reflectance of 1.33 per cent (Table 5-3-1). Its exact stratigraphic position is unknown, but it is believed to be from the lower portion of the Mist Mountain Formation.

### SAGE CREEK

Samples collected from the Sage Creek property exhibit a range of reflectance values from 1.03 to 1.20 per cent (Table 5-3-1). The highest value corresponds with the basal seam of the Mist Mountain Formation. A value of 1.12 per cent was obtained on samples from the middle and upper portions of the formation. A single core sample representing a thin coal in the Elk Formation gave a value of 1.03 per cent.

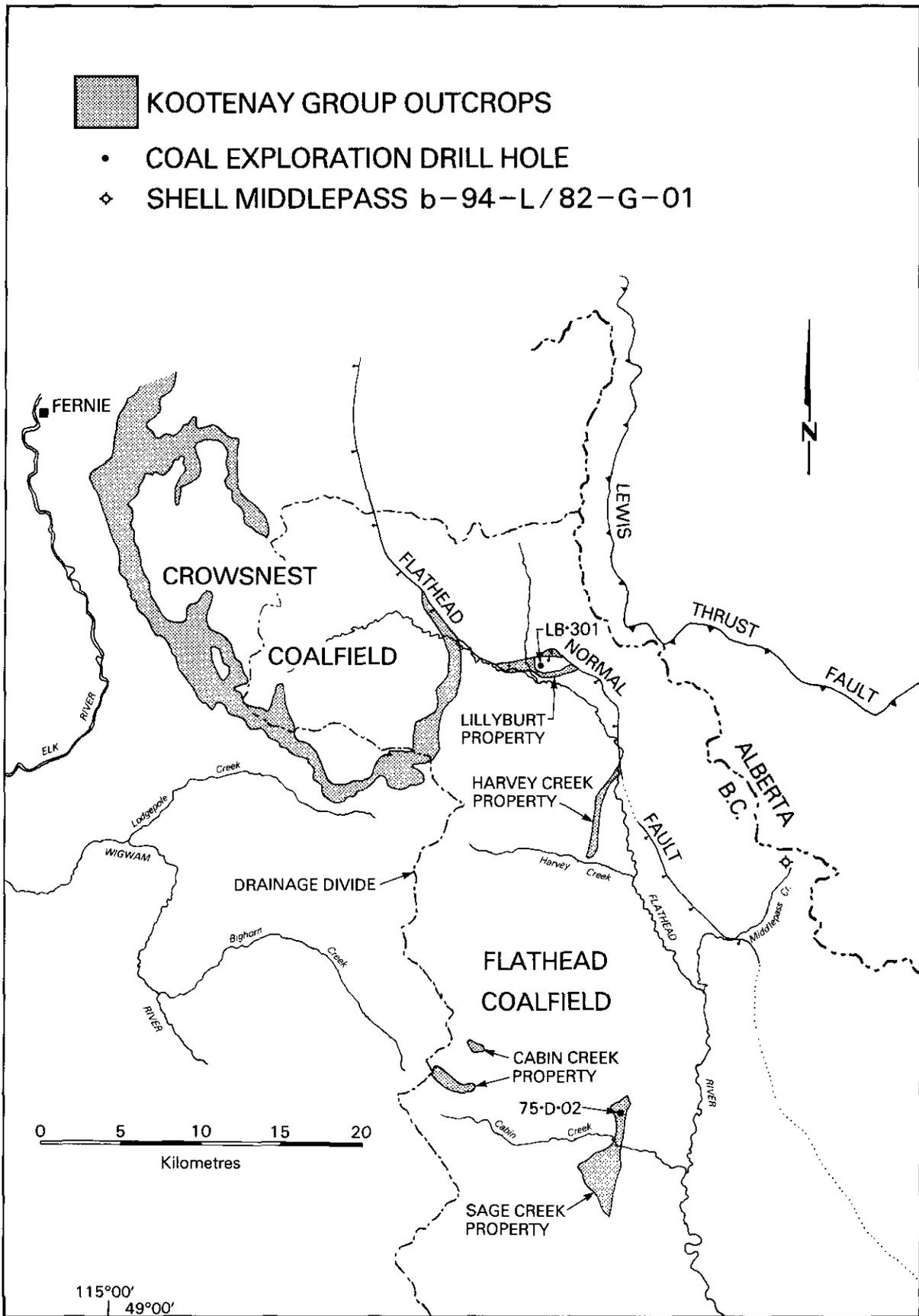


Figure 5-3-1. Location map of Flathead Coalfield properties.

**TABLE 5-3-1**  
**COAL RANK DATA SUMMARY, FLATHEAD COALFIELD**

Property	Range ( $\bar{R}_o$ max) (Standard deviation)	Comments
Lillyburt	1.05–1.26 (.069) (.050) 1.11–1.30 (.041) (.049)	Surface samples; lower part of Mist Mountain Formation not exposed; exact stratigraphic position of lowest $\bar{R}_o$ max value not known (upper Mist Mountain or Elk). Drill hole LB-301; Mist Mountain and Elk Formations; see Figure 5-3-2.
Harvey Creek	1.33 (one sample) (.035)	Surface sample; exact stratigraphic position not known (lower Mist Mountain Formation).
Sage Creek (North Hill)	1.12–1.20 (.057) (.063) 1.03 (one sample) (.040)	Surface samples; Mist Mountain Formation; highest $\bar{R}_o$ max value corresponds with basal seam. Drill hole 75-D-02; 13 metres depth; Elk Formation.
Sage Creek (South Hill)	1.16–1.17 (.057) (.063)	Surface samples; Mist Mountain Formation; exact stratigraphic positions unknown.
Cabin Creek	1.17–1.22 (.048) (.033)	Surface samples; lower portion of Mist Mountain Formation; highest $\bar{R}_o$ max value corresponds with basal seam.
Shell Middlepass b-94-L/82-G-01 (below Lewis thrust)	1.11 (.047) 1.17 (.065) 1.16 (.057)	2475–2480 metres 2550–2555 metres* 2600–2605 metres* Base of Mist Mountain Formation at approximately 2537 metres.

\* Possibly caved material.

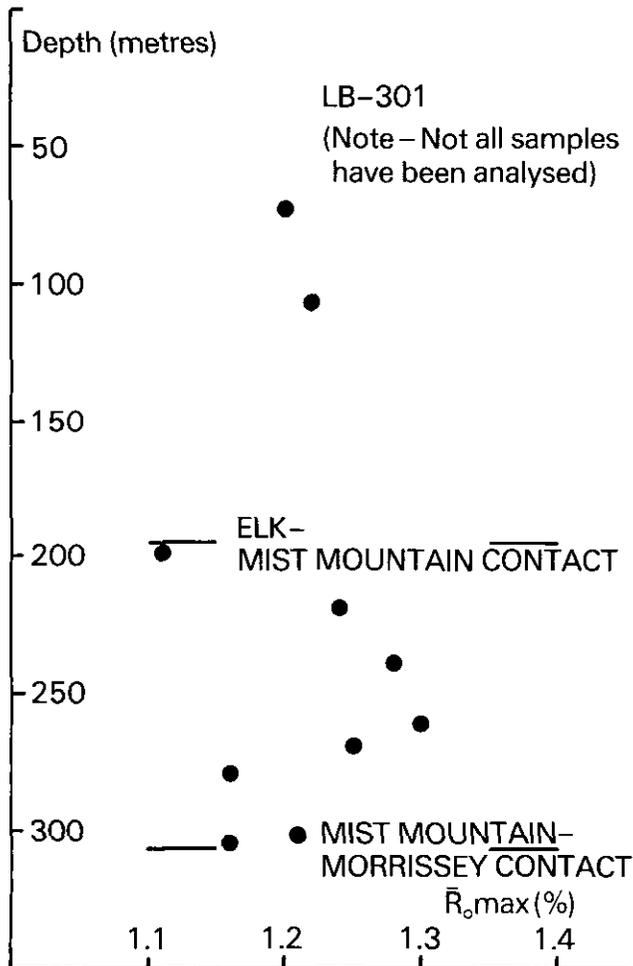


Figure 5-3-2. Reflectance-depth profile of drill hole LB-301.

#### CABIN CREEK

The two seams on the Cabin Creek property occur in the lower half of the Mist Mountain Formation. Samples analysed have reflectances of 1.17 to 1.22 per cent; the highest value represents a sample from the basal portion of the formation (Table 5-3-1).

#### MIDDLEPASS WELL

The three samples from below the Lewis thrust have reflectance values of 1.11, 1.17 and 1.16 per cent, increasing with depth (Table 5-3-1). The two deeper samples were apparently taken from below the base of the Mist Mountain Formation (Table 5-3-1), and thus possibly represent caved material.

#### DISCUSSION

Based on limited sampling, the majority of Mist Mountain Formation coals from the Flathead Coalfield are medium volatile bituminous, a somewhat lower rank than coals from the adjacent Crowsnest Coalfield (Pearson and Grieve, 1985).

Although the rank ranges for the four coal properties are not remarkably different, they can be divided into two groups. On average the Sage Creek and Cabin Creek properties have slightly lower rank coals than the Lillyburt and Harvey Creek properties. What, if any, influence proximity to the Flathead normal fault may have had on this contrast is not known.

The most intriguing results are from drill hole LB-301. They suggest that coal rank is independent of both stratigraphic position and present elevation, but the pronounced scatter of the data may be masking a more typical rank gradient. Possible reasons for scatter of this kind are discussed in another article in this volume.

Samples of Kootenay Group coals from beneath the Lewis thrust have rank values which are no higher than those found at the surface, despite the extra depth of burial represented by the thickness of the Lewis thrust sheet. This may imply that coalification was complete before thrusting took place. Alternatively, some post-thrusting enhancement of coal rank could have occurred if the coals below the Lewis thrust were previously at a lower rank than their counterparts.

in the Flathead Coalfield. This would imply a greater thickness of covering strata overlying the Mist Mountain Formation in the Flathead Coalfield. This does not seem unreasonable given the tens of kilometres of lateral distance which separated strata above and below the Lewis thrust prior to tectonic movements (for example, Bally *et al.*, 1966).

#### ACKNOWLEDGMENTS

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