



## COAL INVESTIGATIONS

### FLATHEAD COALFIELD (82G)

By D. A. Grieve

#### INTRODUCTION

Flathead Coalfield lies in the drainage of the Flathead River, approximately 35 to 55 kilometres southeast of Fernie, in the vicinity of the United States—Alberta—British Columbia boundary intersection (Fig. 20). It is southeast and east of the Crowsnest Coalfield (Fernie Basin) and is separated from it spatially and structurally. The coalfield consists of the Lillyburt, Harvey Creek, Sage Creek, and Cabin Creek properties, all of which are separate structural and/or erosional remnants of coal-bearing Kootenay Group strata. All are accessible from Fernie by a system of forestry access roads which originates at Morrissey.

Lillyburt, Harvey Creek, and Cabin Creek properties are currently held under coal licence by Crows Nest Resources Limited, while the Sage Creek property is licensed by Sage Creek Coal Limited.

#### PREVIOUS WORK

Outcrops of coal-bearing strata were examined in the first decade of the century in response to the successes of new coal mines at Coal Creek and Michel in the Crowsnest Coalfield. Dowling (1914) described occurrences of coal at the Lillyburt, Harvey Creek, and Sage Creek properties. MacKenzie (1916) mapped the Sage Creek property, especially exposures near Cabin Creek. Price (1961, 1965) conducted regional and detailed mapping in the Flathead map-area.

In the past decade considerable assessment of coal resources on all four properties has been carried out by exploration companies. Work has included geological mapping, trenching, diamond and rotary drilling, and adit development.

#### REGIONAL GEOLOGY

The Flathead region lies in the Front Ranges of the Rocky Mountains. It is underlain mainly by clastic and carbonate sedimentary rocks ranging in age from Precambrian to Late Cretaceous. Small Upper Cretaceous syenitic intrusions are also found in the region. Tertiary sedimentary rocks are exposed in the Flathead Valley, and many of the major valleys contain considerable thicknesses of unconsolidated Quaternary cover.

The study area has been influenced by two major structural events: the earlier corresponded to uplift of the Rocky Mountains with concomitant development of thrust faults and folds; the later characterized by normal (gravity) movement on listric surfaces. Faults formed in the later event include the west-dipping Flathead fault and a series of splay faults (Price, 1965) that includes the Harvey and Shepp faults (Fig. 20).

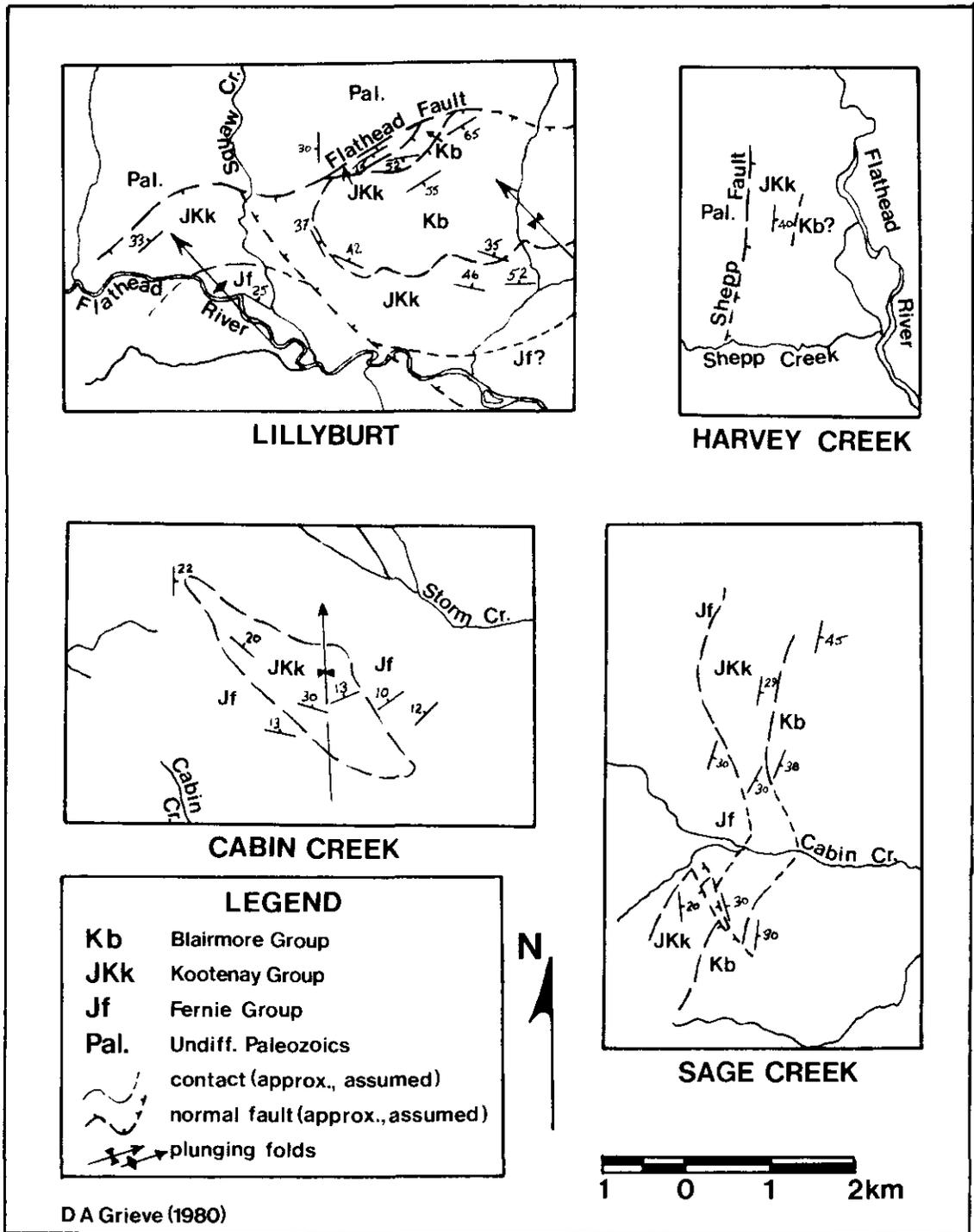


Figure 21. Geology of portions of the four properties that comprise the Flathead Coalfield.

The Flathead graben is bounded on the west by the east-dipping Shepp fault and on the east by the west-dipping Flathead fault (Fig. 20). Movement in the graben has been highly asymmetrical, with much more offset on the Flathead fault. All four coal properties lie within the Lewis thrust sheet, and are considered to be in approximately the same relative position to each other and the Crowsnest Coalfield as they were at the time of their deposition. In support of this, Price (1965) stated that Mesozoic stratigraphy on the Lillyburt property is very similar to that in the Crowsnest Coalfield, but considerably different to that exposed east of the trace of the Lewis thrust in southern Alberta.

## FIELD AND LABORATORY WORK

Six days were devoted to reconnaissance geological mapping of the Flathead Coalfield properties (Fig. 21). Topographic maps (1:50 000) were used, in conjunction with compass and altimeter. Outcrop coal samples were collected for determination of rank.

Coal ranks were determined by the vitrinite-reflectance-in-oil method by D. E. Pearson, project geologist with the Ministry.

Reflectance and geological data from the Crowsnest Coalfield are reproduced from previous reports (Pearson and Grieve, 1979, in press).

## GEOLOGY OF THE FLATHEAD COALFIELD PROPERTIES

### LILLYBURT

This property, located at 1 550 metres elevation adjacent to the confluence of Squaw Creek and Flathead River, is underlain by Mesozoic sedimentary rocks of the Fernie, Kootenay, and Blairmore Groups (Fig. 21). It comprises a northwest-plunging anticline-syncline pair, probably separated by a northeast-dipping normal fault. The deposit lies within the Flathead Valley graben, although the Shepp fault is not exposed here. However, it is clearly bounded on the north and east, by the Flathead fault, which has brought Paleozoic and Precambrian rocks into contact with the Mesozoic strata. Normal movement at this site was in the order of 1 200 metres (Price, 1965).

Bethune (*in* Price, 1965) calculated a total Kootenay Group thickness of 490 metres on the property. However, Fernie Group grey beds were observed at one location adjacent to the Flathead River (Fig. 21) so this probably represents some Fernie Group and perhaps some Blairmore Group strata. Two or more Kootenay Group coal seams are exposed on old trench and adit sites, and probably represent C and D seams in today's terminology. In all, four seams, ranging from 2 to 5 metres in thickness, were reported by Dowling (1914). Sandstones and shales comprise the other Kootenay Group rocks exposed. Neither the basal sandstone nor the Elk Formation are exposed. A prominent pebble to cobble conglomerate marks the contact between Kootenay and Blairmore Groups. Red and green shales, conglomerate, sandstone, and nodular limestone comprise the Blairmore Group.

### HARVEY CREEK

This property occurs at 1 500 metres elevation in a low relief area, in the Flathead Valley. Very little bedrock is exposed (Fig. 20). The strata observed dip eastward within the Flathead Valley graben. The

property is bounded by the Shepp fault and Paleozoic carbonate rocks are exposed to the west (Fig. 21). A thick coal zone that crops out in two road cuts is apparently the 12-metre seam described by Dowling (1914). Dowling also reported five other minor seams, ranging from 1 to 3 metres in thickness. Blairmore conglomerate forms a small north-south-trending ridge along the east side of the property.

#### CABIN CREEK

The two ridges above Storm Creek, near the headwaters of Cabin Creek, are underlain by Kootenay Group strata (Fig. 20). The more southerly ridge, which has maximum elevation of 2 200 metres, was mapped (Fig. 21). The contact between the basal sandstone of the Kootenay Group and the underlying Fernie Group outlines an open north-south-trending syncline in the ridge but probably it has no regional significance. Two coal seams of approximately 5 and 10-metre thickness are preserved within the 100-metre-thick erosional remnant of Kootenay Group strata. Two prominent sandstone bodies occur and, together with the basal sandstone, sandwich the two coal seams.

#### SAGE CREEK

The Sage Creek property straddles the lower part of Cabin Creek, at roughly 1 500 and 1 700 metres elevation and is cut off to the north by the Harvey fault. It comprises an east-dipping sequence of Fernie, Kootenay, and Blairmore Group rocks that are offset by small-scale southwest-dipping normal faults. Both the basal sandstone of the Kootenay Group and the basal conglomerate of the Blairmore Group are well exposed. The coal-bearing portion of the Kootenay Group comprises 328 metres (MacKenzie, 1916) of coal, shale, sandstone, and minor conglomerate. Immediately north and south of Cabin Creek there are three major coal seams (5, 4, and 2 seams), with thicknesses ranging from approximately 8 to 15 metres. The Blairmore Group consists of conglomerate, sandstone, and red and green shales. No Elk Formation strata are exposed.

This portion of the Sage Creek property is referred to as the North and South Hills in current production plans. Continuation of Kootenay Group strata southward beneath unconsolidated cover of the Flathead Valley may provide significant additional reserves.

#### COAL RANK

Figure 20 includes coal rank data (vitrinite reflectance in oil) from one seam at each of the four Flathead properties, as well as data from the highest and lowest exposed West Ridge seams on the Lodgepole property in Crowsnest Coalfield.

In the Crowsnest Coalfield, Pearson and Grieve (1979, in press) studied the relative timing of coalification in southeastern British Columbia with respect to thrust and later normal faulting. Apparently coalification largely postdated thrust faulting, but predated normal faulting. On the basis of this model, rank differences suggest approximately 1 260 metres of total normal movement has been calculated to have taken place on the East Crop fault 12 kilometres north of the Flathead River in the Crowsnest Coalfield. This quantity is very close to the 1 230-metre net normal movement suggested by Price (1965) for the Flathead fault adjacent to the Lillyburt property. The interpretation is corroborated by the rank on the highest seam at Lillyburt ( $\bar{R}_O = 1.25$ ) which is within the range of ranks of the coal seams exposed at the southeast corner of Crowsnest Coalfield ( $\bar{R}_O$  from 1.43 to 1.19) (Fig. 20). At Harvey Creek the rank of the exposed seam, which is in the middle portion of the succession, is in the same range ( $\bar{R}_O = 1.32$ ). This is unexpected

considering the large 6 000-metre displacement which Price (1965) has calculated on the Flathead fault in this area. Two possible explanations are proposed: either movement on the Flathead fault increases southward, although that on the Shepp Creek fault changes little along its length; or, the Harvey Creek property has experienced relatively high heat flow associated with emplacement of a small syenitic intrusion about a kilometre from the property (see Price, 1961, 1965).

Rank values of the lowest seams at the Sage Creek and Cabin Creek properties are nearly identical ( $\bar{R}_0 = 1.22$  and  $1.21$  respectively), slightly lower than at the other Flathead properties. This may reflect relatively greater normal movement southwest of the Harvey fault and a system of northwest-trending faults that splay off from the Flathead fault (Fig. 20). Sage Creek property in particular is bounded on the north by this fault system.

Vitrinite reflectance suggests that all the seams in the Flathead Coalfield consist of medium-volatile bituminous coals.

## ACKNOWLEDGMENTS

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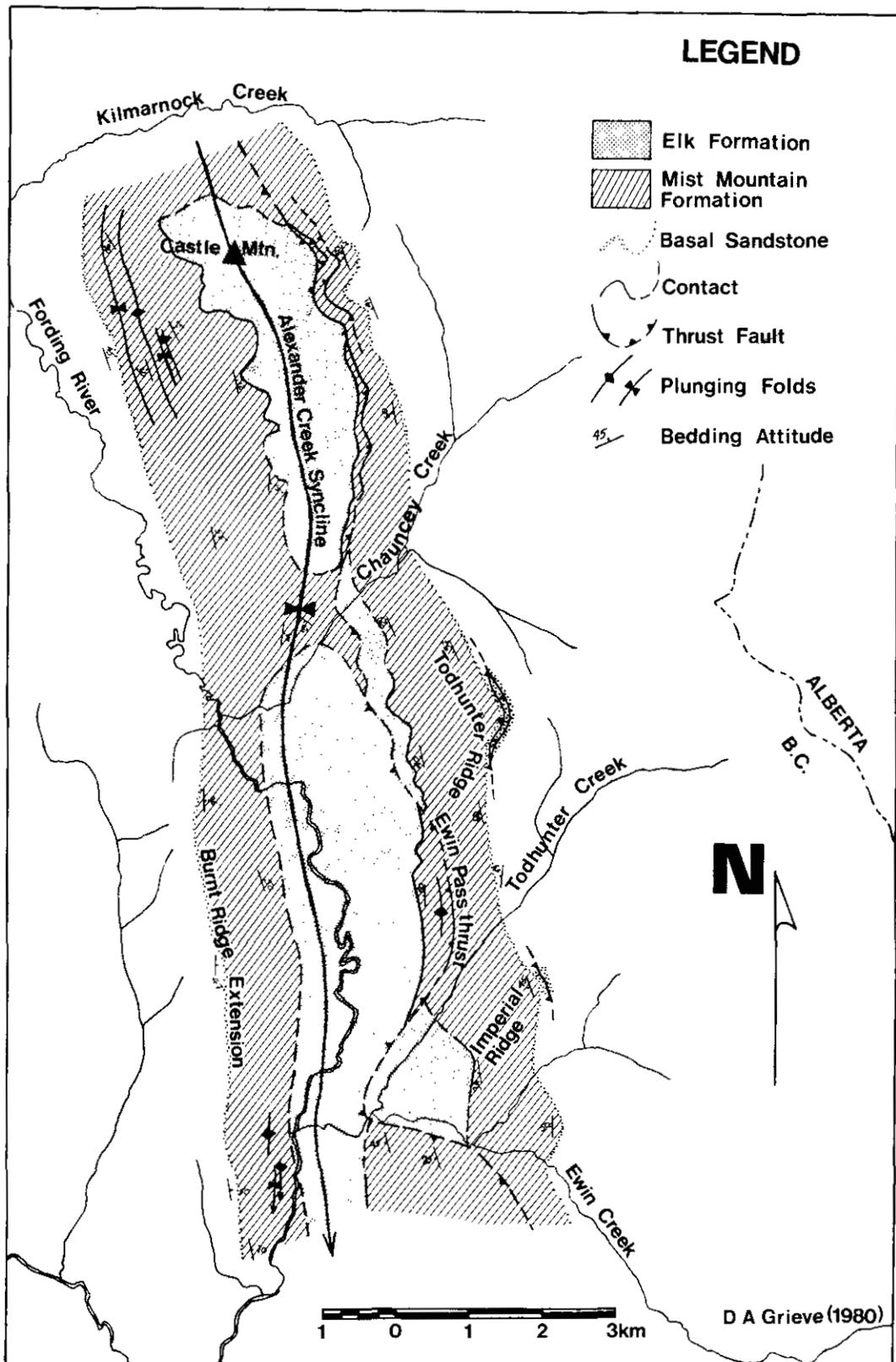


Figure 22. Geology of the Fording River area in the Elk Valley Coalfield.