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WASHABILITY OF PEACE RIVER AND EAST KOOTENAY COALS

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KEYWORDS: Coal geology, coal quality, washability, degree of washing, washability number, liberation characteristics, coal petrography, mineral matter, lithotypes.

INTRODUCTION

This study is concerned with the washability characteristics of British Columbia coals from different seams, geological formations, coalfields and regions. In the initial stage of the project, compilation of washability data from all over the province was completed. Analysis of the data and relating it to known geological conditions as well as seam characteristics became the major task of the project. Classical washability parameters were used together with the washability number and degree-of-washing parameters. A comparison of coal washability from different regions was also a part of the washability analysis process. Special emphasis was put on comparing the washability numbers between coal seams, as this parameter appears to be a better indicator of ease of washing of a coal seam. It defines the boundary between free mineral matter and mineral matter intergrown with coal. It also gives a scale of difficulties associated with cleaning, to a specific clean-coal product.

Coals discussed in this paper are from two major British Columbia coalfields: the northeast or Peace River area and the southeast or East Kootenay area (Figures 4-3-1 and 2). Due to complex geological conditions in both regions, local changes in coal quality are quite common. Variations are not only within the formations, but also among the individual seams. Therefore, using washability numbers for comparison is even more desirable, as they provide a single numeric measure of the variation.

BACKGROUND

The washability of any particular coal seam is directly related to the amount and type of mineral matter associated with the coal matter (macerals). The mode of association is a result of the sedimentation conditions that prevailed during formation of the coal seam.

Coal seams have their origin in peat-forming swamps and marshes. These swamps and marshes are formed from different plant communities, each having its own set of biological and geochemical conditions. Mixtures of macerals and minerals are formed in these environmentally distinct areas. The individual ecosystems control the formation and composition of different layers within the coal seam, referred to as lithotypes.

The compositional characteristics of lithotypes control the coal quality within the seams. Many physical, chemical and mechanical properties of coal are governed by the lithotype composition (Jeremic, 1980; Falcon and Falcon, 1987; Hower *et al.*, 1987; Hower, 1988; Hower and Lineberry, 1988). Stratigraphically, each seam represents a separate sequence of lithotypes, with specific coal quality in terms of type and grade.

From the washability point of view, the important aspects of coal quality are the amount and type of mineral matter found within the coal seam. The variation in mineral matter content is not only due to the association of macerals with minerals (lithotypes), but also due to mining methods, which may result in out-of-seam dilution. This effect, however, is reflected in a lower yield of clean product from a given seam.

An important factor in coal quality variability is folding and faulting of seams, resulting in shearing of coal. Shearing leads to increased friability of coals and results in a disproportionate amount of fines and poor washability characteristics (Bustin, 1982), as is the case in many of the coal-bearing formations in western Canada. The poor washability of sheared coals is especially evident when the shearing plane is close to the contact of a seam. This results in dissemination of comminuted floor or roof rock through the coal, as pointed out by Bustin, and difficulty arises in distinguishing and separating sheared rock from the coal seam.

The ease of washing, as traditionally measured by yield of clean coal, amount of near-gravity material and other washability parameters, is not always the best measure of the intrinsic character of a particular coal seam (Sarkar and Das, 1974; Sarkar *et al.*, 1977; Sanders and Brooks, 1986; Holuszko and Grieve, 1990). For example, clean coal yield is strongly influenced by the amount of out-of-seam dilution. Furthermore, yield-ash and density-yield relationships are coal dependent, and cannot be reliably used to compare washability of various coal seams, especially if the coals are of different origin.

The introduction of washability number by Sarkar and Das (1974) made it possible to classify and correlate coal seams in accordance with their inherent washability characteristics. The washability number appears to be the only parameter not affected appreciably by any large increase in extraneous mineral matter in the raw coal. When used in conjunction with other washability parameters it becomes a very useful tool to assess the ease of washing of coal.

OBJECTIVES

The aims of the project are threefold:

- To compile available washability data and create a computer database file for future use.
- To analyze the data in order to look for relationships between the washability characteristics and other inherent properties of coal, such as its rank and type.
- To accommodate washability parameters such as washability number and degree of washing into the new classification system (Alpern *et al.*, 1989) as an alternative to the yield of clean coal at preselected ash levels. Yield of clean coal is a purely technical term used to describe the final product and does not reflect the natural characteristics of coal.

PEACE RIVER COALFIELD

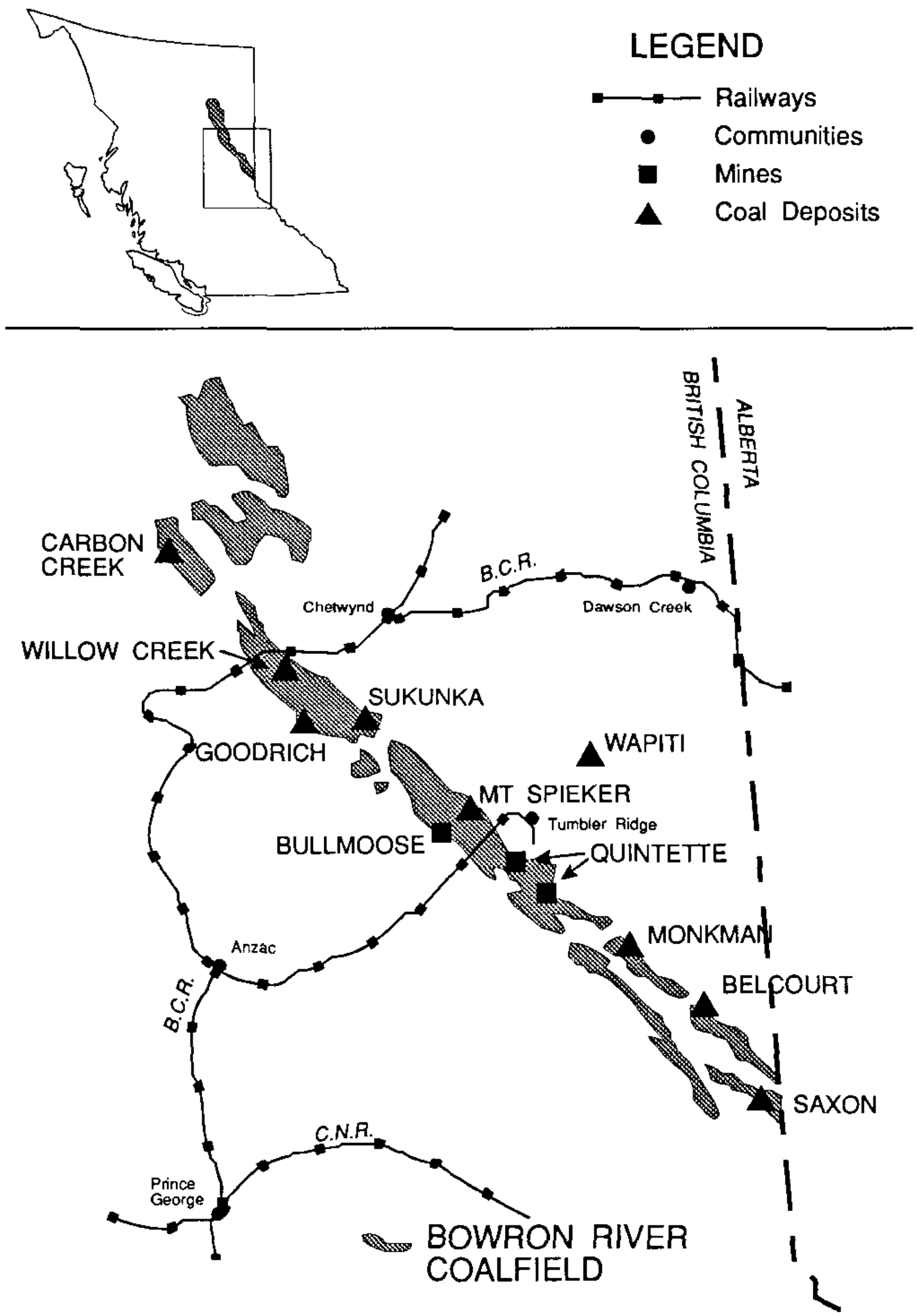

Figure 4-3-1. Coal deposits and location of mines in the study area; Peace River coalfield of northeast British Columbia.

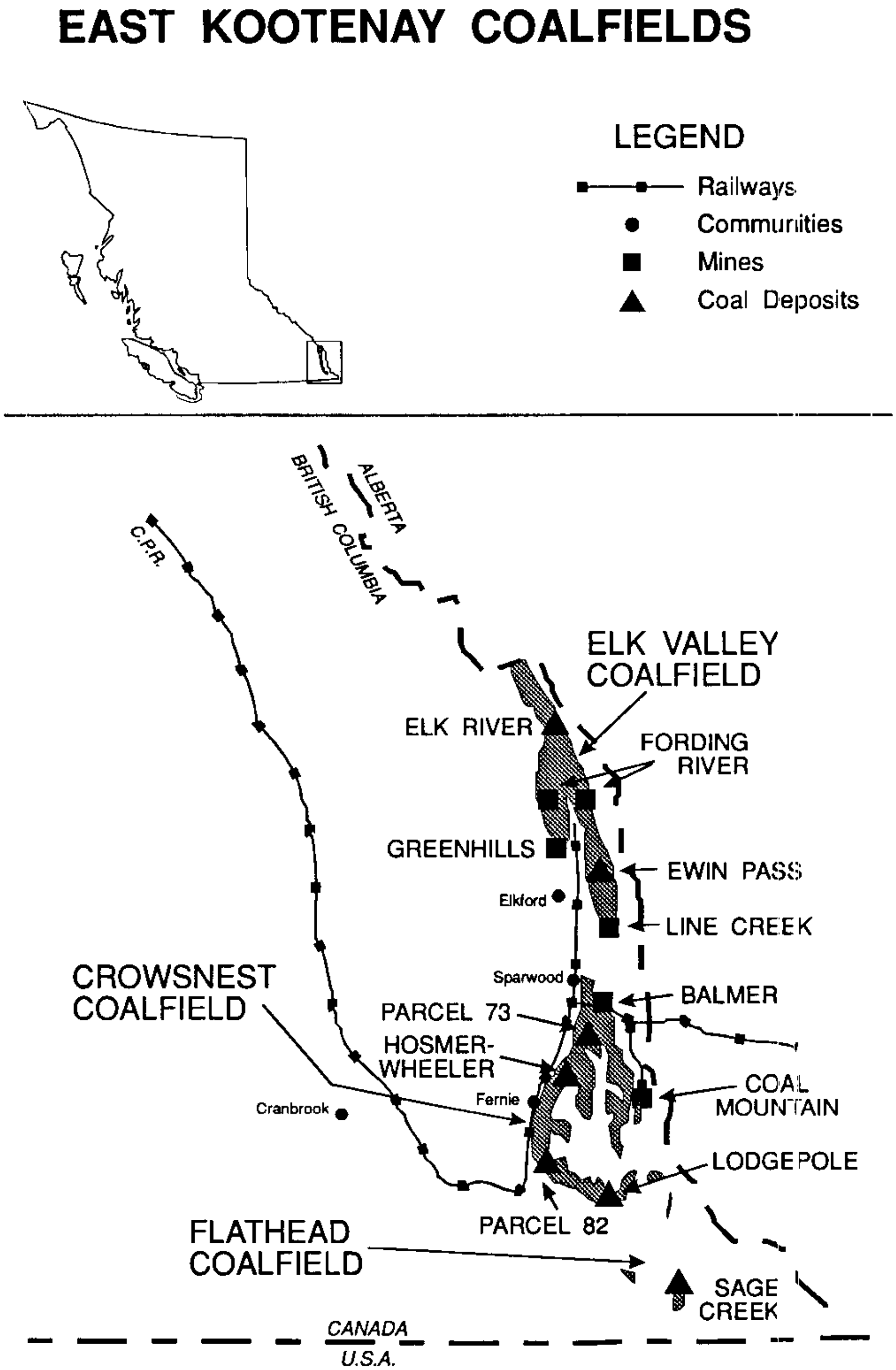

Figure 4-3-2. Coal deposits and locations of mines in the study area; East Kootenay coalfield of southeast British Columbia.

After compiling washability data from various British Columbia coalfields it became possible to compare washability characteristics of coal seams from different regions. The comparison of the two major coal-producing coalfields, Peace River and East Kootenay, is the subject of this paper.

GEOLOGICAL SETTINGS

Coal deposits in the Peace River and East Kootenay regions produce all of the metallurgical coal in the province. The coal measures lie within the Rocky Mountain Front Ranges and Foothills of British Columbia. The northeast British Columbia (Peace River) coalfield contains coals of Early and Late Cretaceous age, whereas the coal deposits in the southeast (East Kootenay) are of Jurassic-Cretaceous age. Coal-bearing strata throughout the region were deposited in deltaic and alluvial plain environments. Tectonism associated with mountain building has resulted in strongly faulted and folded coal measures. The coals are mainly medium to low-volatile bituminous in rank, and are generally very suitable for good quality coke (Smith, 1989).

PEACE RIVER COALFIELD

Coal deposits of the Peace River coalfield are found within the northern inner Foothills belt, which extends northwestwards for more than 300 kilometres from the Alberta - British Columbia border east of Prince George (Figure 4-3-1). The coal deposits occur in four different geological formations, but the major coal measures of the region are in the Early Cretaceous Gething Formation of the Bullhead Group and Early Cretaceous Gates Formation of the Fort St. John Group. The Gates Formation contains 70 per cent of commercially attractive coal measures (Smith, 1989). Coals of the Jurassic-Cretaceous Minnes Group and the Late Cretaceous Wapiti Formation are generally considered to be economically unattractive.

Structurally, the area is characterized by folding and thrust faulting, resulting in thickening of some of the coal seams. The least structural deformation is observed in the coal seam in the Wapiti Formation. In terms of coal quality, most of the seams in the region are classified as medium volatile with excellent coking characteristics and low sulphur, usually less than 1 per cent. The rank of coals in the Gates and Gething formations is in the range from high-volatile A to low-volatile, whereas the Wapiti Formation coal is of much lower rank, high-volatile C.

Early Cretaceous Gates Formation seams are characterized by relatively low vitrinite and high inertinite contents with negligible liptinite (Lamberson *et al.*, 1991; Marchioni and Kalkreuth, 1991). The lithotype composition of coal seams is highly variable, reflecting various depositional conditions during peat formation. In some seams banded lithotypes are predominant, in others brighter lithotypes are the most abundant, but generally banded lithotypes are characteristic of the Gates coals. The dull appearance of some lithotypes is due either to the presence of mineral matter, or an abundance of inertodetrinite and mineral matter, particularly quartz (Marchioni and Kalkreuth, 1991) or close proximity to clastic partings. According to Lamberson *et al.* (1991) differences in lithotype stratigraphy are due to variations in ground-water level as well as differences between wetland types. These lithotypes represent a continuous change in depositional environment from forest swamps (dry and wet) to dry herbaceous or shrubby marshes.

Coal seams from the upper part of Gething Formation are in general composed predominantly of bright lithotypes. The reported maceral analysis for these seams has shown that they are rather low (66%) in vitrinite content and high in inertinite macerals, mainly semifusinite and micrinite. The mineral matter content is exceptionally low. The carbonate minerals (mostly calcite) occur in cleats and fill cavities in semifusinite and fusinite; clays occur more rarely and are associated with massive vitrinite (Cook, 1972).

The coal at the base of the Late Cretaceous Wapiti Formation is the only seam in this formation with possible economic potential. It contains a great deal of mineral matter both from the dirt bands (partings) and inherent in the coal.

EAST KOOTNEY COALFIELD

The coal-bearing strata in southeast British Columbia are confined to the Mist Mountain Formation of the Jurassic-Cretaceous Kootenay Group. Mist Mountain coals are between high and low-volatile bituminous rank (Smith, 1989). Coal beds comprise 8 to 12 per cent of the stratigraphic thickness of the formation (Grieve, 1985). Coal seams in the lower part of the formation tend to be thicker and more continuous, and in some instances structural deformation has resulted in substantial thickening of seams (Grieve, 1985; Smith, 1989).

Structural deformation of coals in the Mist Mountain Formation has tremendous impact not only on the mining methods used but also on the coal quality. Faulting and folding have created many problems in terms of correlation of the seams, and in many cases discontinuity of the seams has complicated mine planning and development. The quality of coal has been deteriorated as a result of shearing (Bustin, 1982).

Petrographic composition of the Mist Mountain coals varies from inertinite-rich to vitrinite-rich, from the base to the top of the formation (Cameron, 1972; Grieve, 1985). This reflects a systematic variation in depositional environments, changing from an upper to a lower delta plain (Cameron, 1972). In terms of lithotype composition this is reflected by a brightening-upward (increasing in bright lithotypes) tendency in these coals.

SAMPLE SELECTION FOR WASHABILITY STUDY

Washability data for bulk samples from across the province were compiled from the Ministry's collection of coal exploration assessment reports. Data from the southeast and northeast coalfields were chosen for comparison here, as the majority of commercially producing seams are found in these two coalfields. Economically, the most significant coal seams are in the Gates and Mist Mountain formations, therefore, the study was limited to seams in these formations. For a list of samples see Table 4-3-1. The following criteria for sample selection were applied:

- Only bulk samples representing run-of-mine coal were used.
- A limit was imposed on ash content of raw coal to avoid biases caused by out-of-seam dilution; only samples with ash content of less than 35 per cent were considered.
- The washability data of attritted samples were preferred to the data on crushed samples (the non-attritted sample data were used when in accordance with the particular coal preparation plant practice).
- Samples do not necessarily represent the whole coalfield; they are rather considered to be representative of the seams which are contributing to coal production within the studied regions.
- A restriction was also imposed on the top-size of the samples; the upper limit of the top-size was restricted to maxima of 150 and 50 millimetres; a lower size limit of 0.50 millimetre was uniform for all the samples.
- *Crushed samples were used for the liberation studies;* in these tests the washability of the coal at a larger top-size was compared with the same coal crushed to significantly lower sizes.

METHODS

To compare washability characteristics of different coal seams, the following **washability parameters** were used: yield of clean coal curve, corresponding yield of rejects, and the near-gravity material-distribution curve. For convenience of comparison seams from both coalfields were assigned to categories according to the yield of their clean coal product at 10 per cent ash. These categories were as follows: yield of clean coal in the range of **90 to 100** per cent; **70 to 90** per cent; and **less than 70** per cent.

A statistical approach was used to determine the number of seams from each of the coalfields falling into the different categories.

The degree of washing (N) and washability number (Wn) were also used to further examine the inherent washability characteristics of coal seams. The degree of washing at any specific gravity cut-point is expressed as follows:

$$N = \frac{w(a-b)}{a}$$

where:

a = the ash content of the raw coal (feed)

b = the ash content of the clean coal at a given density of separation

w = the yield of clean coal at a given density of separation

For a given coal, depending on the rank, type and mineral matter associated with it, there will always be a density of separation which will maximize the yield of the cleanest product possible. The optimum degree of washing (N_{opt}) is then obtained by plotting degree-of-washing values (N) versus the density of separation, and finding the maximum value. Degree-of-washing plots were constructed for three yield-of-clean-coal ranges.

The ash content of the clean coal at the optimum degree of washing has specific significance in characterizing the coal. Therefore, it is advisable to express the washability number as the ratio of the degree of washing to the clean-coal ash at the optimum level (Sarkar and Das, 1974; Sarkar *et al.*, 1977; Sanders and Brooks, 1986). The washability number can be expressed as follows:

$$Wn = 10\left(\frac{N_{opt}}{b_{opt}}\right)$$

where:

b_{opt} = ash content at N_{opt}.

The degree of washing and washability number take into account not only the ash content of the raw coal but also yield and ash of clean coal. The washability number describes the inherent washability characteristics of a coal far better than any of the classical washability parameters. The washability index was first introduced by Sarkar and Das (1974) to outline patterns of depositional conditions of Indian coal seams. In other studies, using the washability number as the comparative measure was recommended (Sarkar *et al.*, 1977; Sanders and Brooks, 1986).

For the present study, the washability numbers were calculated for the arbitrarily devised yield-of-clean-coal categories. This allowed comparison of the coal seams falling into the same range in terms of yield of clean coal at the selected ash level (10% ash) from different regions.

RESULTS

The washability results discussed in this paper are not considered to represent the final coal product quality from the studied areas. They are an attempt to make meaningful comparisons between various coal seams and find a way of predicting the changes in washability characteristics in relation to various geological conditions.

YIELD OF CLEAN COAL AND QUALITY OF REJECTS

The clean-coal curve plotted as cumulative ash content at any given density of separation, versus cumulative yield, predicts the theoretical yield of clean coal at a given ash level. This is a strictly technical parameter which has a major influence on the economics of the mined seam. However, comparable yields of clean coal at a preselected ash level may be obtained with varying degrees of diffi-

TABLE 4-3-1
LIST OF PROPERTIES REPRESENTING PEACE RIVER AND EAST KOOTENAY COALFIELDS

PEACE RIVER	EAST KOOTENAY
Bullmoose	Balmer
Belcourt	Elk River
Quintette	Ewin Pass
Mount Spieker	Ewin Creek
Sukunka	Fording
Wapiti	Greenhills
	Horseshoe Ridge
	Line Creek

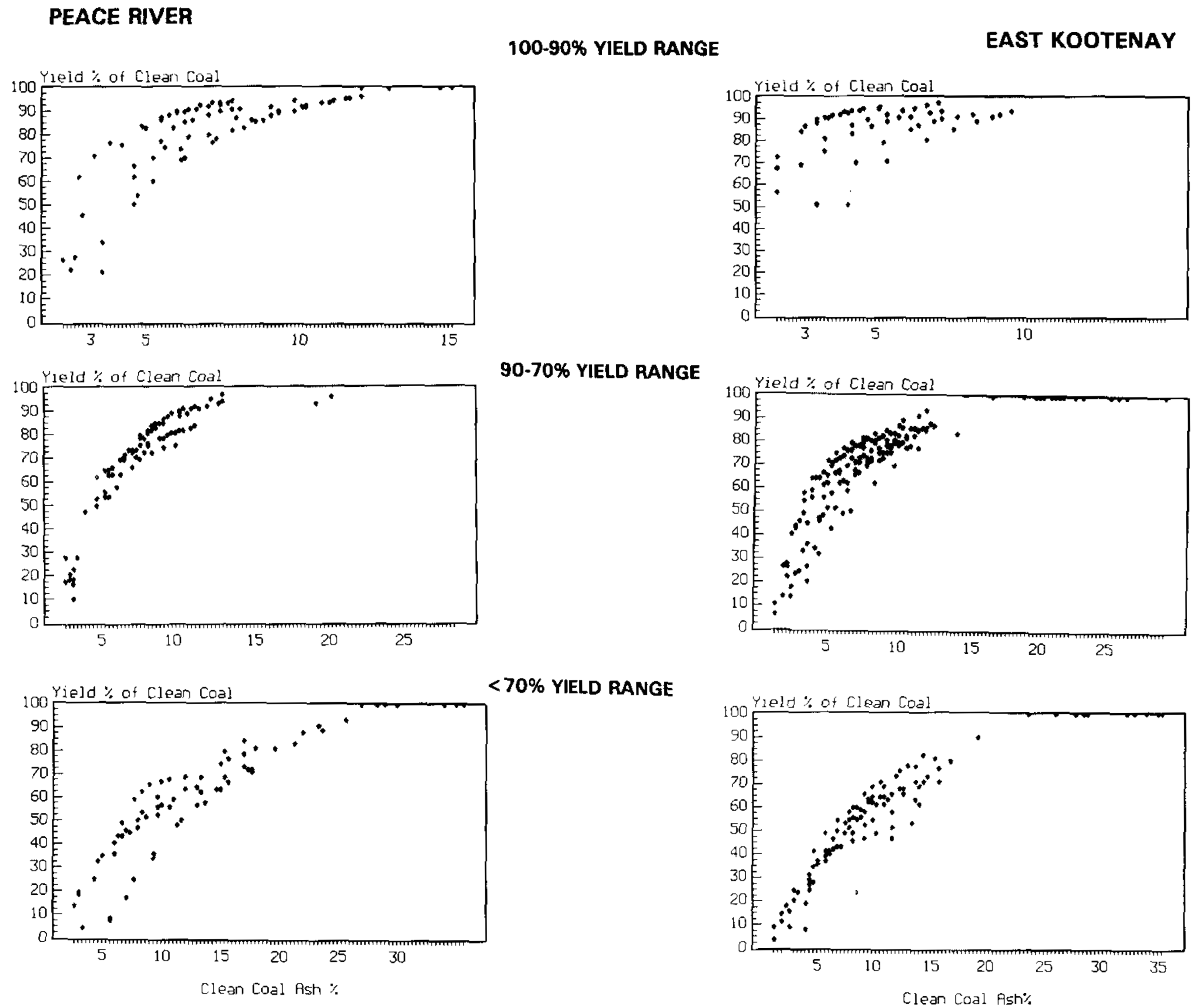

Figure 4-3-3. The ranges of variation for cumulative clean-coal curves for seams falling within specified yield ranges from Peace River coalfield and East Kootenay coalfield.

culty, due to different inherent coal characteristics. Clean-coal curves were plotted for a number of seams from the two coalfields. The Peace River coalfield was represented by 24 seams from three geological formations. The majority of seams, however. are from the Gates Formation. The East Kootenay coalfield was represented by 35 seams. These seams were assigned to different categories according to their yield of coal product at 10 per cent ash, and clean-coal curves were plotted in the corresponding ranges for seams from both coalfields (Figure 4-3-3).

For coals from the Peace River coalfield, eight seams out of twenty-four were in the range of 100 to 90 per cent yield at 10 per cent ash, nine seams were in the second highest range, 90 to 70 per cent yield at 10 per cent ash, and the remaining were assigned to the lowest range. The raw ash as well as the top-size of the samples from both coalfields is reported in Table 4-3-2.

For the seams representing East Kootenay coalfield only six out of thirty-five examined fell into the high-yield category, eighteen were in the middle range, and eleven were in the lowest yield range. The ranges of ash content and top-size of the raw coal samples from both coalfields are also given in Table 4-3-2.

The clean-coal curves within three ranges of yields for both regions, show quite a wide range of coal characteristics. This is particularly noticeable for the high-yield range for both formations. Similarly, the quality of rejects varies significantly for seams in the same yield category. The cumulative-reject curves for different categories of clean-coal yield for seams from the two coalfields are shown in Figure 4-3-4.

There is no consistent trend between the yield categories of the seams studied and their stratigraphic position in the Gates Formation sequence. For the Mist Mountain Formation, seams from the upper part of the formation appear to have somewhat higher yields of clean coal at 10 per cent ash as compared to those in the middle and lower part of the formation.

A comparison of the washability characteristics using the clean-coal curve is quite difficult, as the yield-ash relationship is very much coal dependent, and suffers from many drawbacks. Above all, it is not a quantitive measure.

Near-Gravity Material as a Measure of "Ease of Washing"

The amount of material in the range ±0.1 of density of separation is considered to be a more quantitive measure for comparing the "ease of washing". Difficulties of washing are categorized on the basis of the amount of near-gravity material at the density of separation for the desired clean-coal product (Leonard, 1979). The ±0.1 specific gravity range approach assumes that all material lying within this range contributes to difficulties in washing. However, this assumption may not be accurate for washing in more efficient separators, operating within much narrower ranges (*e.g.*, ±0.05 s.g.). Figure 4-3-5 depicts the amount of near-gravity material (±0.1 s.g.) for seams from both studied coalfields.

The amount of near-gravity material close to the density of separation rates coal seams from Peace River as moderately difficult to very difficult to wash. The designation "moderately difficult" was assigned to the two highest clean-coal ranges and "very difficult" to the lowest range. The coal seams from East Kootenay coalfield are classified as "simple" for the highest yield range (Figure 4-3-5), moderately difficult for the second highest range and difficult for the coal seams in the lowest yield category.

Degree of Washing and Washability Number

Degree-of-washing plots were derived for the designated ranges of yield of clean coal for seams from the Peace River and East Kootenay coalfields (Figure 4-3-6). Very similar ranges of optimum degree of washing were found for the same yields of clean coal from both coalfields. Table 4-3-3 lists optimum degree-of-washing values, and washability

TABLE 4-3-2
DISTRIBUTION OF COAL SEAMS FROM PEACE RIVER AND EAST KOOTENAY ACCORDING TO THEIR YIELD OF CLEAN-COAL PRODUCT AT 10 PER CENT ASH REPORTED WITH RAW ASH AND TOP-SIZE RANGES

	PEACE RIVER COALFIELD			EAST KOOTENAY COALFIELD		
RANGE of YIELD at 10% ASH	NUMBER of SAMPLES	RAW COAL ASH RANGE	TOP SIZE mm	NUMBER of SAMPLES	RAW COAL ASH RANGE	TOP SIZE mm
100 - 90	8(24)	11.82-14.85	100(4) 75(3) 50(1)	6(35)	8.37-13.42	100(6)
90-70	9(24)	15.42-28.41	150(4) 100(4) 75(1)	18(35)	16.21-28.45	100(8) 50(10)
<70	7(24)	21.11-35.00	100(6) 75(1)	11(35)	23.57-35.00	100(6) 50(5)

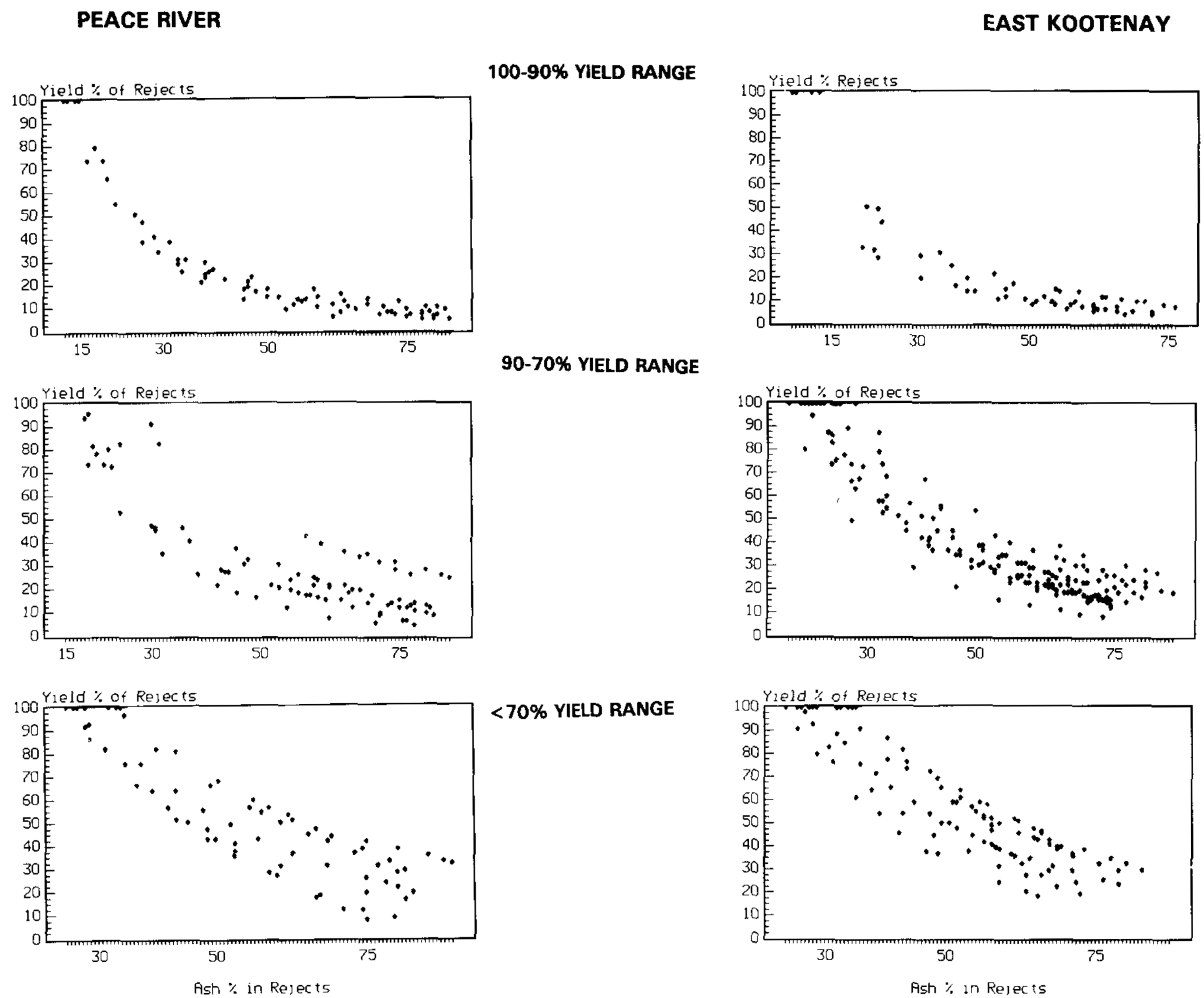

Figure 4-3-4. The ranges of variation for cumulative reject curves for seams falling within specified yield ranges from Peace River coalfield and East Kootenay coalfield.

numbers with the corresponding ash of clean coal and rejects, and the density at the optimum cut points.

The optimum cut point for the Peace River seams with highest yield of clean coal appears to be at a slightly higher density than for East Kootenay coal seams. The washability numbers associated with the various clean-coal yield ranges imply that Peace River coals are much more difficult to wash to the same clean-coal product levels than the East Kootenay coals. The average washability number for Peace River coals is 88 compared to 136 for East Kootenay coals. For the second range 64 compares with 71. For the third range the washability numbers are not significantly different.

The important conclusion to be drawn from the data in Table 4-3-3 is that even when the clean coal products at narrow yield ranges are compared within the same coalfield, the washability characteristics vary greatly. In other words, the difficulties in achieving the same coal product vary tremendously between different seams. This is evident from the wide range of washability numbers within designated yield ranges of clean coal.

The variation in washability numbers within the same geological formation varies from 39 to 185, with no consistency or relation to stratigraphic position. The washability number of two adjacent seams can be just as variable (72 to 142).

Liberation Patterns

The washability of any coal seam is very much dependent on the top-size of its representative sample. Liberation of coal from mineral matter is usually achieved by reducing the size of coal by breaking or crushing. During breakage coal particles separate from inclusive minerals, usually along the bedding planes. The way in which coal separates from ash-forming impurities depends on the type and mode of occurrence of minerals as well as the type of coal. The easiest to separate are the epigenetic minerals, whereas epiclastic and syngenetic minerals are more difficult to remove by physical methods (Cook, 1981; Falcon and Falcon, 1983; Holuszko and Grieve, 1990).

For coals with epigenetic minerals concentrated along the cleats, reducing the size will lead to an easy physical separation of liberated minerals, and result in an increase in the yield of clean coal. For minerals of epiclastic origin (chiefly clays and quartz) liberation-separation may be difficult, as coarse crushing will not liberate the coal from associated minerals.

Figure 4-3-7 illustrates liberation patterns for four different coal seams from the Peace River coal field. All four coals are from the Gates Formation. A reduction in the top-size of the run-of-mine sample resulted in a substantial increase in the yield of clean coal (a); some increase in the yield of clean coal (b); almost no increase in the yield of clean coal (c); and no increase in the yield of clean coal (d). This is reflected in the increase of the washability number, for coals a, b, and c, and a slight decrease in value for the fourth coal.

The liberation characteristics of the four coals are quite different, indicating wide variations in the mode of occurrence of mineral matter in these seams. From the analysis of washability numbers, it is seen that only in the case of seams (a) and (b) can the ease of washing and recovery of clean coal be improved by size reduction. For seam (c) the reduction in size has almost no positive effect on the washability number. An interesting trend is observed in seam (d), where crushing to a smaller size leads to a decrease in ease of washing. However, there is no indication of a decrease in the yield of clean coal. This implies that the washability number detects changes in ease of washing better than the clean-coal curve does.

Systematic computation of washability numbers at various levels of crushing will aid in assessing the mode of association of mineral matter with coal, and the extent of liberation of mineral matter from coal.

SUMMARY AND CONCLUSIONS

This comparative study of washability of coal samples from two major British Columbia coalfields resulted in the following conclusions:

TABLE 4-3-3
CHARACTERISTICS AT OPTIMUM "DEGREE OF WASHING" FOR SEAMS FROM THE PEACE RIVER AND EAST KOOTENAY COALFIELDS

RANGE of YIELD at 10% ASH	DEGREE of WASHING		ASH in CLEAN COAL at Nopt		ASH in REJECTS		DENSITY of SEPARATION	WASHABILITY NUMBER	
	MIN - MAX	*AVG*	MIN - MAX	*AVG*	MIN - MAX	*AVG*		MIN-MAX	*AVG*
PEACE RIVER COALFIELD									
100-90	40.4-56.7	***47.3***	3.5-6.2	***5***	16.5-46.7	***32.1***	1.42	48-163	***83***
90-70	40.8-51.9	***45.8***	5.7-8.5	***7.3***	25.6-73.91	***51.3***	1.48	54-90	***64***
<70	30.3-47.5	***37.5***	9.3-14.5	***11.5***	45.01-75.9	***56.8***	1.57	21-51	***33***
EAST KOOTENAY COALFIELD									
100-90	41.3-55.0	***49.9***	2.9-5.4	***4***	20.9-34.4	***24.7***	1.36	76-185	***136***
90-70	39.6-54.2	***48***	5.4-9.4	***7.1***	27.5-76.8	***52.6***	1.49	45-10	***71***
<70	29.6-44.3	***39.3***	8.6-13.8	***10.4***	38.8-68.1	***56.9***	1.55	22-51	***39***

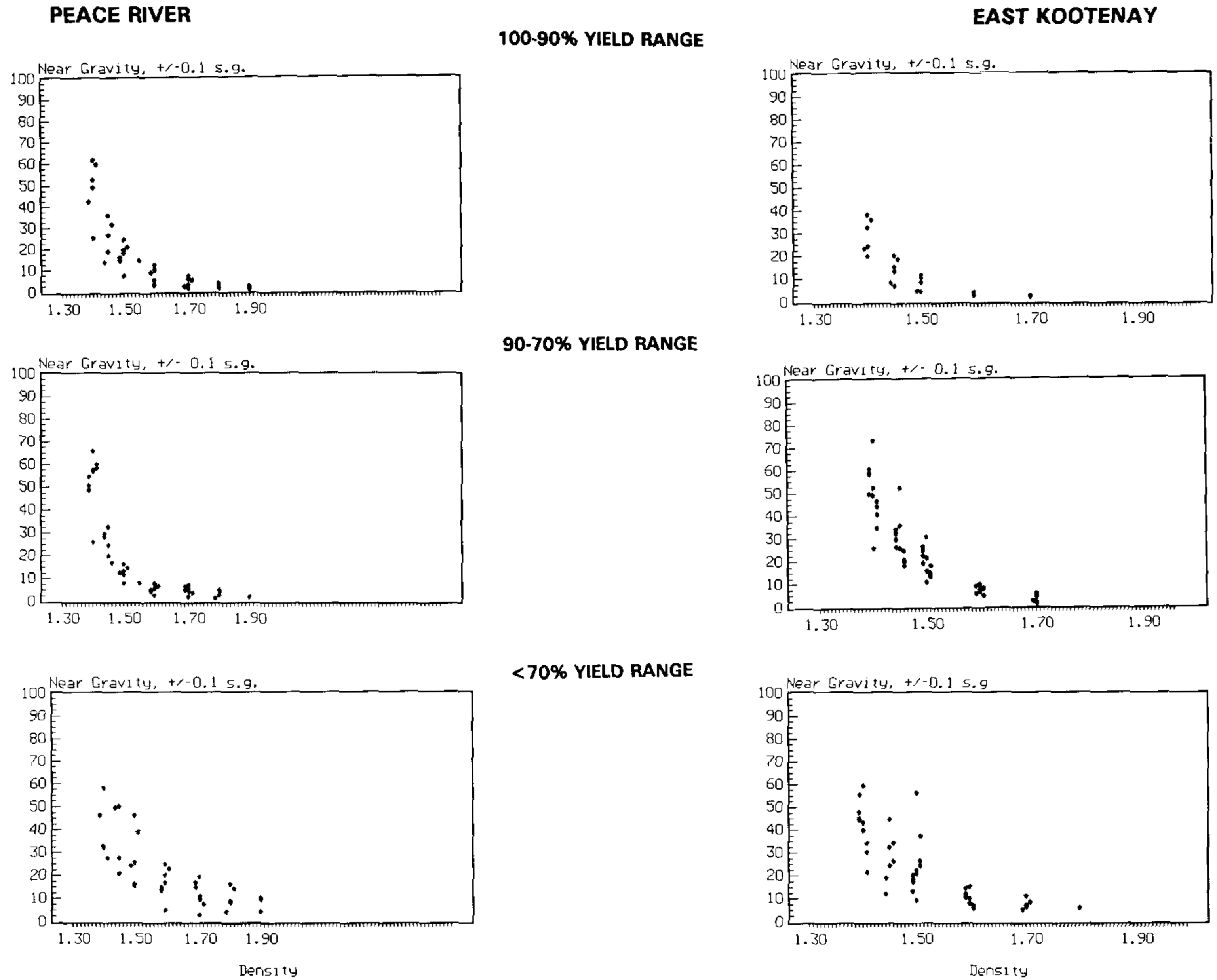

Figure 4-3-5. The range of variation for the amount of near-gravity material (±0.1 s.g.) for specified yield of clean coal ranges in Peace River and East Kootenay coals.

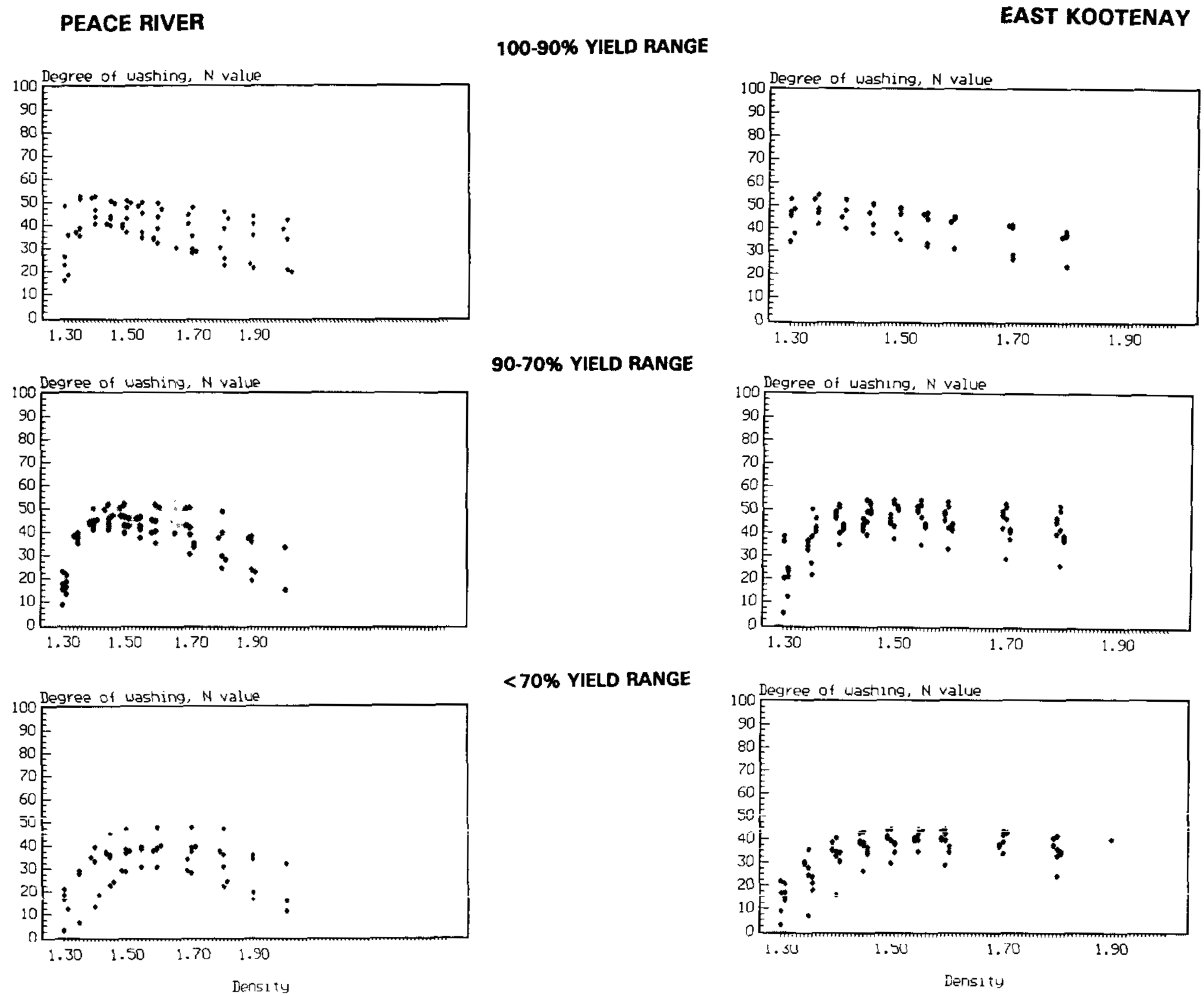

Figure 4-3-6. The range of variation for the degree of washing, for specified yield of clean coal ranges in Peace River and East Kootenay coals.

- Washability characteristics of seams from both the Peace River and East Kootenay coalfields are variable to the same extent. Seventeen out of twenty-four samples from the Peace River coalfield yielded more than 70 per cent of clean-coal product at 10 per cent ash, as compared to twenty-four out of thirty-five from East Kootenay.
- The quality of rejects is highly variable for samples falling into the three different ranges of clean-coal yield at 10 per cent ash, in both coalfields.
- From the amount of near-gravity material (±10 s.g.) at the density of separation required for good quality clean coal, the East Kootenay seams yielding the most clean-coal product were classified as simple to wash, whereas the seams from Peace River falling into the same category were found to be moderately difficult to wash.
- The "optimum degree of washing" and the ash content of clean coal were found to be very similar for seams from both coalfields, however, washability numbers obtained for different ranges of yield of clean coal were found to be much greater for the East Kootenay coalfield than for Peace River. This was especially true for the seams yielding the most clean coal (100–90% yield range), which were from the upper half of the Mist Mountain Formation. The higher washability numbers for the East Kootenay seams implies that these seams can be washed much more easily to the same clean coal product than their counterparts from Peace River.
- There is no significant trend or correlation between the washability number and stratigraphic position in the Gates Formation coals.
- The great variation in washability numbers within both coalfields indicates diversity in ease of washing among these seams.
- Examples of different liberation patterns of coal during size reduction confirms significant variation in washing characteristics; the washability number is a better indicator of the liberation characteristics of coal than the clean-coal curve derived from classical washability parameters.

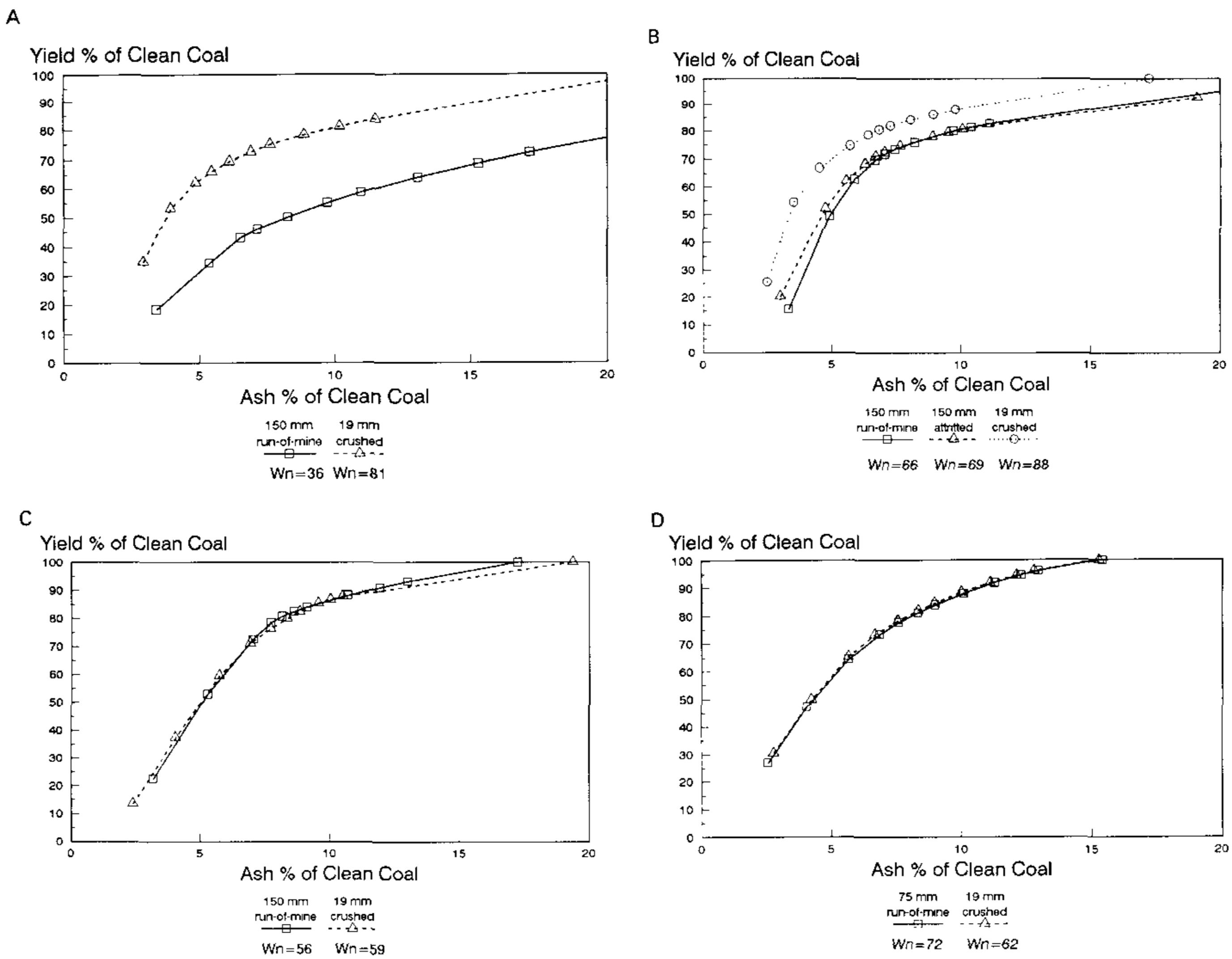

Figure 4-3-7. Liberation patterns for four coals from the Peace River coalfield.

FUTURE PLANS

The quality of any seam is very closely related to its lithotype composition. Lithotypes are useful indicators not only of the original environment of coal formation, but also of the physical and mechanical properties of coal. It is important to examine the extent to which lithotypes can be indicative of the washability characteristics of a given coal seam.

In the future this study will focus on lithotype and petrographic analyses of various coal seams in order to elucidate their influence on washability characteristics. To this end, a number of lithotype samples were collected from the East Kootenay coalfield during 1991. The sampling program was arranged in cooperation with Dr. Alex Cameron of the Institute of Sedimentary Petroleum and Geology in Calgary. Lithotype sampling of Peace River coal seams is planned for next year. The emphasis will be on finding a way of predicting the ease of washing from lithotype composition. A further aim of this project is to investigate the viability of adopting the washability number for use in the new International Coal Classification System (Alpern *et al.*, 1989).

Systematic analysis of the possible applications of the degree of washing and washability number to the improvement of various technical procedures (e.g. sampling, blending) and coal preparation technologies will also be a part of this project.

ACKNOWLEDGMENTS

I wish to express my gratitude to the geology staff at all the province's coal mines for their cooperation, especially the staff of Greenhills and Line Creek mines for their assistance in this year's sampling program and supplying additional coal quality data. A special thanks is also due to David Grieve and Ward Kilby, who read an earlier version of this paper and contributed to its improvement.

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