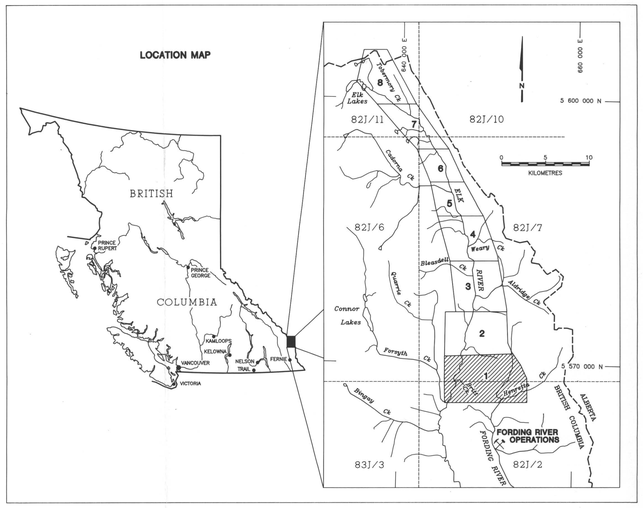

NOTES

Note 1 Most sandstones in the Elk Formation are omitted

Note 2 Poor exposure

Note 3 Small-scale deformation at this point

Note 4 Exposures of Triassic strata at this point

Note 5 Exposures of Pennsylvanian strata at this point

Note 6 Exposures of basal phosphorite of the Fernie Formation at this point

Note 7 Exposures of Mississippian or older limestone at this point

SYMBOLS

MAP

Contact; defined, approximate, gradational

Coal seam trace; defined, approximate, individual outcrop, coal bloom or spoil

Trace of sandstone; defined, approximate, individual outcrop

Trace of conglomerate; defined, approximate, individual outcrop

Occurrence of sapropelic Elk coal — EC

Thrust fault (teeth indicate direction of dip); defined, approximate, assumed

Transverse fault (arrows indicate direction of movement); approximate

Boundary of landslide block

Bedding: upright, overturned, vertical, horizontal

Syncline, upright, overturned (arrow indicates direction of plunge); defined, approximate

Anticline (arrow indicates direction of plunge); defined, approximate

$\bar{R}_r$max (mean maximum vitrinite reflectance) value at this point — 1.42

Limit of interpretation

Location of measured section — A B

SECTIONS

Predominantly sandstone

Interbedded sandstone and siltstone

Predominantly siltstone and finer

Interbedded coal and shale

Predominantly coal

Covered interval

Thickness of coal seams (metres) — 5.1

Approximate position of Elk–Mist Mountain contact

Approximate position of Mist Mountain–Morrissey contact

$\bar{R}_r$max (mean maximum vitrinite reflectance) — 1.42

TABLE OF FORMATIONS

LOWER CRETACEOUS

Kc CADOMIN FORMATION: Conglomerate

JURASSIC AND CRETACEOUS
KOOTENAY GROUP

JKe ELK FORMATION: Sandstone, siltstone, shale, coal, minor conglomerate

JKmm MIST MOUNTAIN FORMATION: Sandstone, siltstone, shale, coal, minor conglomerate

JKm MORRISSEY FORMATION: Sandstone, minor shale and coal

JURASSIC

Jf FERNIE FORMATION: Shale, interbedded sandstone in upper part

EXPLANATION

The study area extends from Henretta and Britt creeks in the south to the British Columbia – Alberta boundary in the north. Jurassic–Cretaceous Kootenay Group exposures throughout were mapped by R.J. Morris in 1987, with the exception of the Weary Ridge – Bleasdell Creek area and the Britt Creek area, which were mapped by D.A. Grieve in 1986. This study extends previous mapping by the Geological Survey Branch northward (Grieve and Pearson, 1983; Grieve and Fraser, 1985).

Most of the area is Crown land and includes all or part of three separate coal properties. The most southerly of these comprises the north end of the Fording Coal Ltd. Fording River property. The northern boundary of the Fording River property is in the vicinity of U.T.M. gridline 5 580 000 metres north, which is just north of Aldridge Creek. Adjacent to the north is the Elk River property in which Fording Coal held a 50 per cent interest at the time of writing (June 1989). The northern boundary of the Elk River property is in the vicinity of U.T.M. gridline 5 590 000 metres north, close to Cadorna Creek. Coal rights in the area north of Cadorna Creek, formerly known as the Vincent option, were reserved to the Crown at the time of writing.

Data presented are based on examination of surface outcrops, roadcuts and trenches, and are supplemented by air–photograph interpretation. In many cases poor exposure has limited the amount of data and has restricted the ability to correlate seams. Map Sheet 1 has moderate exposure in its eastern and southern portions, while the western areas have very limited outcrop. Only on the east side of Mount Tuxford and the south side of Henretta Ridge have coal seam traces been interpreted.

Stratigraphic sections were measured on Mount Veits and Tuxford, Henretta Ridge, Weary Ridge and at "Coal Creek", a tributary of Bleasdell Creek. Sections were measured using either pogo stick or compass and chain. They have been generalized for publication. Note that coal seams less than 1 metre thick are not indicated, nor are partings within seams that are less than 1 metre in thickness.

The basal unit of the Kootenay Group is the Morrissey Formation. The Morrissey is a resistant sandstone unit consisting of two members and ranging in thickness from 20 to 80 metres (Gibson, 1985). The upper member, the Moose Mountain member, is a distinctive marker unit consisting of medium–grained sandstone, which is utilized in all surface and subsurface studies of the Kootenay to demarcate the base of coal occurrences. Within the study area the Moose Mountain member was observed to be more variable than normal. For example, it includes one or more carbonaceous partings in the area between Weary Ridge and Mount Tuxford, and at two localities south of Aldridge Creek it was observed to include an unusual light grey to white–weathering, quartzose facies. The trace of the Morrissey Formation on the east limb of the Alexander Creek syncline is plotted with moderate confidence throughout Sheet 1.

The Mist Mountain Formation contains essentially all the coals of economic interest in southeastern British Columbia. Its thickness in the study area ranges between 450 and 550 metres. Coal forms between 8 and 12 per cent of the total thickness of the formation at most locations. Individual seams in the study area range from less than 1 to greater than 10 metres in thickness. Two sections of Mist Mountain Formation were measured in the area covered by Map Sheet 1, one on the east slope of Mount Tuxford (section C–D) and the other on Henretta Ridge (section A–B). The partial section of upper Mist Mountain Formation on the east side of Mount Tuxford is 181.6 metres thick and contains only two coal seams (totalling only 4.1 metres of coal or 2.3% of the section), although 31.3 metres of section are covered. The Henretta Ridge section represents the entire Mist Mountain Formation and is an anomalous 829.6 metres thick. However, one fault causing structural repetition was observed (see section A–B) and it is likely that other faults are obscured in covered intervals which represent 33.2% of the thickness of the section. The lowermost 433.1 metres of the section is relatively well exposed and hosts only 6.3 metres of coal, representing an anomalously low 2.0% of the true thickness of 312 metres. Other coal seams are probably contained in the covered intervals throughout the section.

The precise identification of the contact of the Mist Mountain Formation with the overlying Elk Formation in southeastern British Columbia is generally difficult (Grieve and Gierenshaw, 1989). The Elk is a coarser grained facies than the Mist Mountain and it generally lacks thick coal seams and contains unusual sapropelic coals known as "needle coals" (Kalkreuth, 1982). Occurrences of sapropelic coal are noted on the map by the symbol 'EC'. The thickness of the Elk Formation in the study area is inferred to range between 350 and 450 metres. The Elk – Mist Mountain contact on Sheet 1 was mapped on Henretta Ridge and on two spurs on the east side of Mount Tuxford.

The Kootenay Group is unconformably (?) overlain by the Lower Cretaceous Blairmore Group. The basal unit of the Blairmore Group is the Cadomin Formation, a distinctive cliff–forming conglomerate unit.

The study area lies in the Front Ranges of the Rocky Mountains and is part of the Lewis thrust sheet. The major structure in the coalfield is the Alexander Creek syncline, which extends throughout its entire 100–kilometre length. The northern extension of the Greenhills syncline, which is west of the Alexander Creek syncline, also influences the extreme southern end of the study area.

The Alexander Creek syncline is overturned in the central part of the study area, and open elsewhere. It generally plunges to the north.

The Bourgeau thrust fault, which marks the western boundary of the surface exposures of the Lewis thrust sheet, forms the western boundary of the Elk valley coalfield in the study area. The relative footwall stratigraphic position of the fault varies along its trace from the Fernie Formation to uppermost Kootenay. At the north end of the study area it is offset 2 kilometres to the northeast by a transverse fault (Leech, 1979).

Minor structures associated with the Bourgeau thrust are not generally observable because of poor exposure. The area known as "Coal Creek" on the west limb of the Alexander Creek syncline is one exception. See Sheet 3 for more detail.

Small scale folds affect the Mist Mountain Formation strata in three general areas: the extreme south end of the study area (see Sheet 1), the lower west–facing slopes of Mount Tuxford (see Sheet 2), and the small eastward–flowing creeks north of Cadorna Creek (see Sheets 6 and 7). These are mainly interpreted as minor folds associated with the Alexander Creek syncline, and, with few exceptions, are not attributed directly to thrusting.

In contrast with the south half of the coalfield (see Grieve and Fraser, 1985), thrust faults within the Kootenay Group are not a major feature of the study area. On Henretta Ridge at the extreme south end of the study area, however, two thrust faults are observed (see Sheet 1). One causes a repeat of the Morrissey Formation and lowermost part of the Mist Mountain Formation; the other occurs higher in the Mist Mountain Formation and is exposed on the south–facing slope of the ridge. A third thrust fault is inferred to occur in the east limb through part of the north end of the study area, based on sporadic occurrences of deformed strata (see Sheet 6 for example).

Late–stage, crosscutting normal faults are present in the Mount Tuxford and Mount Veits area. These appear to follow prominent joint orientations and have resulted in mass–wasting of the Morrissey Formation, forming both topographic steps and landslide blocks. A large landslide block of Morrissey Formation occurs on Weary Ridge (see Sheet 4).

The rank of the coals has been determined petrographically by measuring the mean maximum vitrinite reflectance ($\bar{R}_r$max) on grain samples. These values are plotted on the map. To convert reflectance values to ASTM rank equivalents use 1.12 per cent as the boundary between high–volatile and medium–volatile coals and 1.51 per cent as the boundary between medium–volatile and low–volatile rank. Coals of the Mist Mountain Formation vary in rank from low–volatile to high–volatile bituminous. The highest rank Mist Mountain Formation coals are found in the lower part of the formation on the east limb of the Alexander Creek syncline near Weary Creek. The lowest rank coals are exposed on the west limb of the Alexander Creek syncline near Bleasdell Creek, and on both limbs at the north end of the study area. Elk Formation coals are all of high–volatile bituminous rank in the study area. On Map Sheet 1 reflectance values in the Mist Mountain Formation vary from 1.50 to 1.00 per cent.

We wish to thank the following people for their contributions to the study. Staff of Fording Coal Ltd., especially Ken Komenac and Roger Berdusco, permitted and arranged access to the southern part of the study area and provided many useful ideas. Kevin Switzer and Jim Ryley provided excellent field assistance. Joanne Schwenger carried out all petrographic reflectance analyses. Margot McMechan of the Geological Survey of Canada and Ward Kilby of the British Columbia Geological Survey Branch reviewed an earlier version of the map and provided helpful suggestions and comments.

REFERENCES

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Ministry of
Energy, Mines and
Petroleum Resources

PRELIMINARY MAP 68

GEOLOGY OF THE ELK VALLEY COALFIELD NORTH HALF (HENRETTA CREEK TO ELK LAKES)

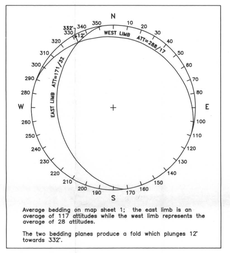
SHEET 1 OF 8

GEOLOGY BY
ROBERT J. MORRIS AND DAVID A. GRIEVE

SCALE 1:10 000

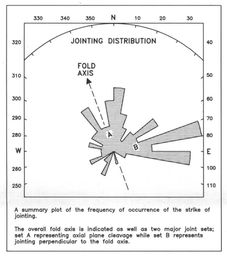
0 200 400 600 800 1000 KILOMETRES

This project is a contribution to the Canada/British Columbia Mineral Development Agreement 1985–1990.



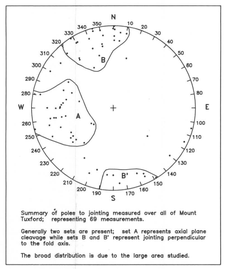
Average bedding on map sheet 1; the east limb is an average of 117 attitudes while the west limb represents the average of 28 attitudes.

The two bedding planes produce a fold which plunges 12° towards 332°.



A summary plot of the frequency of occurrence of the strike of jointing.

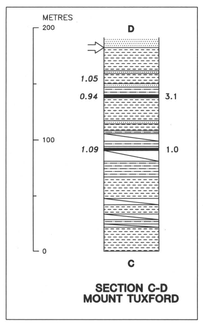
The overall fold axis is indicated as well as two major joint sets; set A representing axial plane cleavage while set B represents jointing perpendicular to the fold axis.



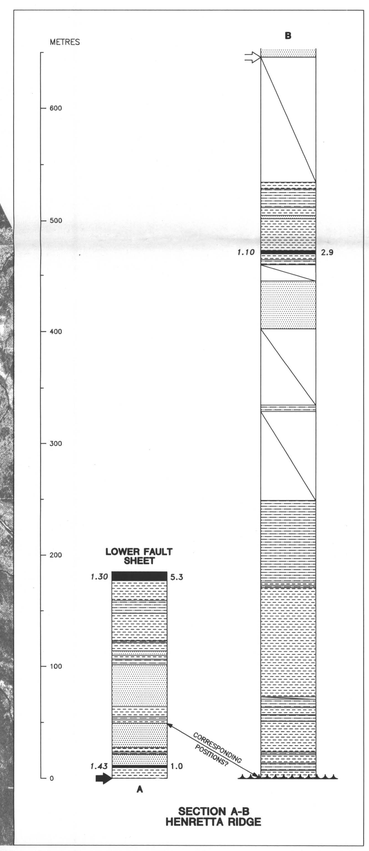
Summary of poles to jointing measured over all of Mount Tuxford; representing 69 measurements.

Generally two sets are present; set A represents axial plane cleavage while sets B and B' represent jointing perpendicular to the fold axis.

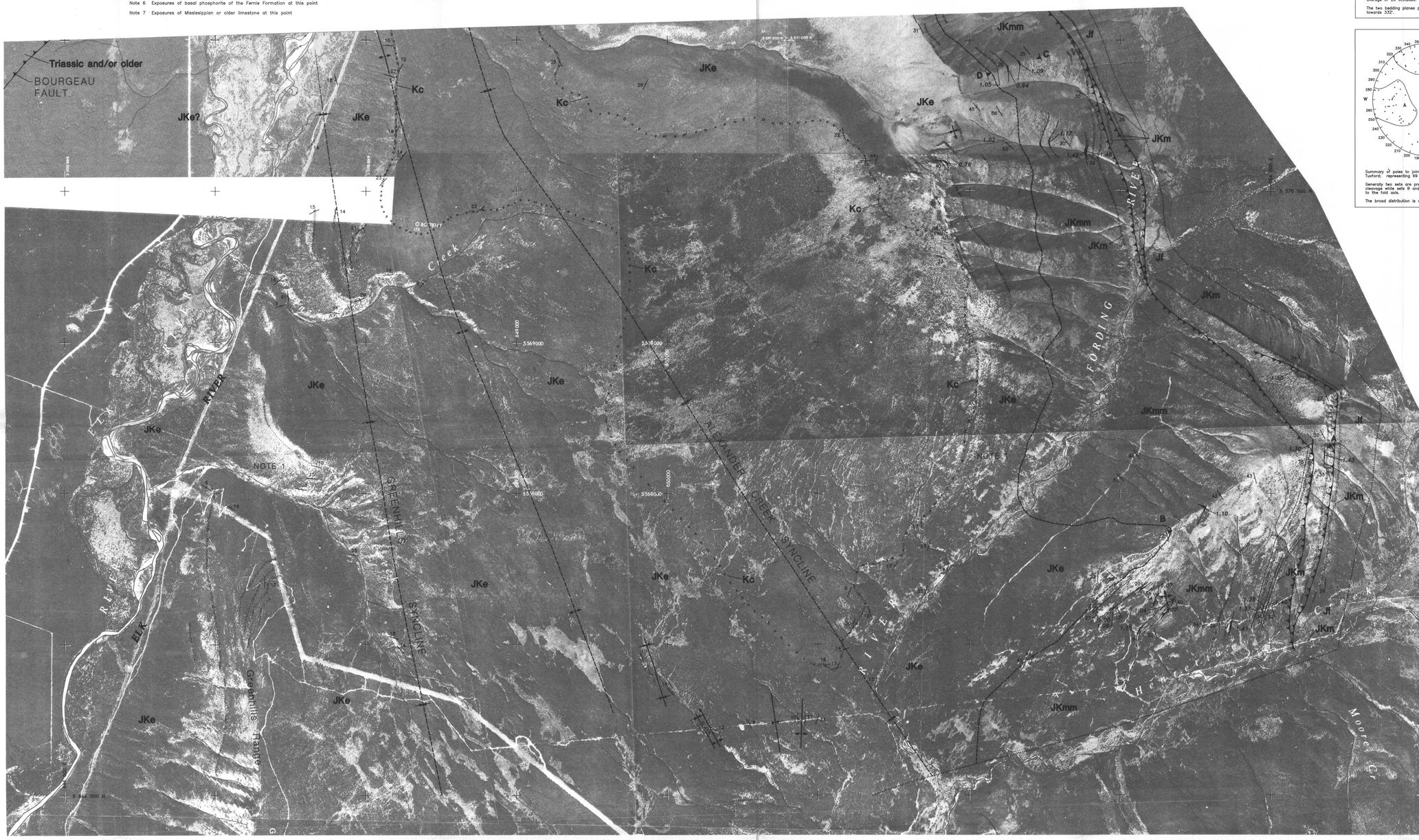
The broad distribution is due to the large area studied.



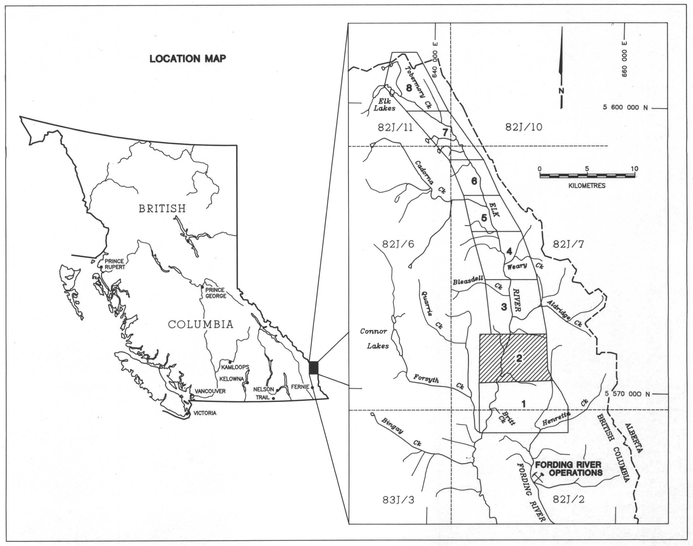
SECTION C-D
MOUNT TUXFORD



SECTION A-B
HENRETTA RIDGE



Cartography by P. Chicorelli



EXPLANATION

The study area extends from Henretta and Britt creeks in the south to the British Columbia – Alberta boundary in the north. Jurassic–Cretaceous Kootenay Group exposures throughout were mapped by R.J. Morris in 1987, with the exception of the Weary Ridge – Bleasdell Creek area and the Britt Creek area, which were mapped by D.A. Grieve in 1986. This study extends previous mapping by the Geological Survey Branch northward (Grieve and Pearson, 1983; Grieve and Fraser, 1985).

Most of the area is Crown land and includes all or part of three separate coal properties. The most southerly of these comprises the north end of the Fording Coal Ltd. Fording River property. The northern boundary of the Fording River property is in the vicinity of U.T.M. gridline 5 580 000 metres north, which is just north of Aldridge Creek. Adjacent to the north is the Elk River property in which Fording Coal held a 50 per cent interest at the time of writing (June 1989). The northern boundary of the Elk River property is in the vicinity of U.T.M. gridline 5 590 000 metres north, close to Cadorna Creek. Coal rights in the area north of Cadorna Creek, formerly known as the Vincent option, were reserved to the Crown at the time of writing.

Data presented are based on examination of surface outcrops, roadcuts and trenches, and are supplemented by air-photograph interpretation. In many cases poor exposure has limited the amount of data and has restricted the ability to correlate seams. Seams less than 1 metre thick have generally not been plotted. Exposure on Map Sheet 2 is quite variable, with Mount Tuxford on the east side of the Elk River valley having good exposure, while the west side is virtually devoid of outcrop. Coal seam traces have been interpreted only on Mount Tuxford.

Stratigraphic sections were measured on Mount Veits and Tuxford, Henretta Ridge, Weary Ridge and at "Coal Creek", a tributary of Bleasdell Creek. Sections were measured using either pogo stick or compass and chain. They have been generalized for publication. Note that coal seams less than 1 metre thick are not indicated, nor are partings within the seams that are less than 1 metre in thickness.

The basal unit of the Kootenay Group is the Morrissey Formation. The Morrissey is a resistant sandstone unit consisting of two members and ranging in thickness from 20 to 80 metres (Gibson, 1985). The upper member, the Moose Mountain member, is a distinctive marker unit consisting of medium–grained sandstone, which is utilized in all surface and subsurface studies of the Kootenay to demarcate the base of coal occurrences. Within the study area the Moose Mountain member was observed to be more variable than normal. For example, it includes one or more carbonaceous partings in the area between Weary Ridge and Mount Tuxford, and at two localities south of Aldridge Creek it was observed to include an unusual light grey to white–weathering, quartzose facies. The trace of the Morrissey Formation on the east limb of the Alexander Creek syncline is plotted with moderate confidence on Sheet 2.

The Mist Mountain Formation contains essentially all the coals of economic interest in southeastern British Columbia. Its thickness in the study area ranges between 450 and 550 metres. Coal forms between 8 and 12 per cent of the total thickness of the formation at most locations. Individual seams in the study area range from less than 1 to greater than 10 metres in thickness. In the area covered by Map Sheet 2, a section 550.0 metres thick comprising the complete Mist Mountain Formation was measured along the north ridge of Mount Tuxford (section E–F). It hosts 39.5 metres of coal, representing only 7.2 per cent of the total thickness of the formation. However, some 50.6 metres of this section is covered, a portion of which could contain coal.

The precise identification of the contact of the Mist Mountain Formation with the overlying Elk Formation in southeastern British Columbia is generally difficult (Grieve and Ollerenshaw, 1989). The Elk is a coarser grained facies than the Mist Mountain and it generally lacks thick coal seams and contains unusual sapropelic coals known as "needle coals" (Kalkreuth, 1982). Occurrences of sapropelic coal are noted on the map by the symbol "EC". The thickness of the Elk Formation in the study area is inferred to range between 350 and 450 metres. The Elk – Mist Mountain contact on Sheet 2 is located just below the peak of Mount Tuxford. It overlies a 2 metre–thick coal seam and is at the base of a thick sandstone sequence. This position also corresponds with a change in colour; the Elk Formation sandstones weather to a distinctive yellow or orange–brown colour compared with the predominantly grey weathering colour of the Mist Mountain Formation sandstones. A section of Elk Formation comprising the lowest 178 metres was measured (see upper part of section E–F). The lower two–thirds of the section consists of several stacked channel – sandstone units separated by thin, recessive, finer grained intervals, including a 1.0–metre thick coal seam. The upper third is a recessive interval including coal seams 1.0 and 1.6 metres thick. The section is overlain by a prominent cliff–forming sandstone which marks the base of another sequence of stacked sandstone units.

The Kootenay Group is unconformably (?) overlain by the Lower Cretaceous Blairmore Group. The basal unit of the Blairmore Group is the Cadomin Formation, a distinctive cliff–forming conglomerate unit.

The study area lies in the Front Ranges of the Rocky Mountains and is part of the Lewis thrust sheet. The major structure in the coalfield is the Alexander Creek synclne, which extends throughout its entire 100–kilometre length. The northern extension of the Greenhills syncline, which is west of the Alexander Creek syncline, also influences the extreme southern end of the study area.

The Alexander Creek syncline is overturned in the central part of the study area, and open elsewhere. It generally plunges to the north.

The Bourgeau thrust fault, which marks the western boundary of the surface exposures of the Lewis thrust sheet, forms the western boundary of the Elk valley coalfield in the study area. The relative footwall stratigraphic position of the fault varies along its trace from the Fernie Formation to uppermost Kootenay. At the north end of the study area it is offset 2 kilometres to the northeast by a transverse fault (Leech, 1979).

Minor structures associated with the Bourgeau thrust are not generally observable because of poor exposure. The area known as "Coal Creek" on the west limb of the Alexander Creek syncline is one exception. See Sheet 3 for more detail. The complex folding in the northern part of Map Sheet 2 is interpreted to be caused by the Bourgeau thrust ramping to the east at this point.

Small scale folds affect the Mist Mountain Formation strata in three general areas: the extreme south end of the study area (see Sheet 1), the lower west–facing slopes of Mount Tuxford (see Sheet 2), and the small eastward–flowing creeks north of Cadorna Creek (see Sheets 6 and 7). These are mainly interlocking minor folds associated with the Alexander Creek syncline, and, with few exceptions, are not attributed directly to thrusting.

In contrast with the south half of the coalfield (see Grieve and Fraser, 1985), thrust faults within the Kootenay Group are not a major feature of the study area. On Henretta Ridge at the extreme south end of the study area, however, two thrust faults are observed (see Sheet 1). One causes a repeat of the Morrissey Formation and lowermost part of the Mist Mountain Formation; the other occurs higher in the Mist Mountain Formation and is exposed on the south–facing slope of the ridge. A third thrust fault is inferred to occur in the east limb through part of the north end of the study area, based on sporadic occurrences of deformed strata (see Sheet 6 for example).

Late–stage, crosscutting normal faults are present in the Mount Tuxford and Mount Veits area. These appear to follow prominent joint orientations and have resulted in mass–wasting of the Morrissey Formation, forming both topographic steps and landslide blocks. A large landslide block of Morrissey Formation occurs on Weary Ridge (see Sheet 4). A set of two normal faults is shown at the north end of Mount Tuxford on Map Sheet 2. A combined 16 metres of normal displacement is estimated. A system of three faults, striking to the north and dipping steeply east, occurs approximately 400 metres due east of the peak of Mount Tuxford. The faults show a combined 8 metres of reverse displacement.

The rank of the coals has been determined petrographically by measuring the mean maximum vitrinite reflectance ($R_o$max) on grab samples. These values are plotted on the map. To convert reflectance values to ASTM rank equivalents use 1.12 per cent as the boundary between high–volatile and medium–volatile coals and 1.51 per cent as the boundary between medium–volatile and low–volatile rank. Coals of the Mist Mountain Formation vary in rank from low–volatile to high–volatile bituminous. The highest rank Mist Mountain Formation coals are found in the lower part of the formation on the east limb of the Alexander Creek syncline near Weary Creek. The lowest rank coals are exposed on the west limb of the Alexander Creek syncline near Bleasdell Creek, and on both limbs at the north end of the study area. Elk Formation coals are all of high–volatile bituminous rank in the study area. On Map Sheet 2 reflectance values in the Mist Mountain Formation vary from 1.57 to 1.02 per cent.

We wish to thank the following people for their contributions to the study. Staff of Fording Coal Ltd., especially Ken Komenac and Roger Berduzzi, permitted and arranged access to the southern part of the study area and provided many useful ideas. Kevin Smeltz and John Ryley provided excellent field assistance. Joanne Schwemler carried out all petrographic reflectance analyses. Margot McMechan of the Geological Survey of Canada and Ward Kilby of the British Columbia Geological Survey Branch reviewed an earlier version of the map and provided helpful suggestions and comments.

REFERENCES

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BC Ministry of Energy, Mines and Petroleum Resources

BRITISH COLUMBIA GEOLOGICAL SURVEY

PRELIMINARY MAP 68

GEOLOGY OF THE ELK VALLEY COALFIELD NORTH HALF (HENRETTA CREEK TO ELK LAKES)

SHEET 2 OF 8

GEOLOGY BY
ROBERT J. MORRIS AND DAVID A. GRIEVE

SCALE 1:10 000

0 200 400 600 800 1000 KILOMETRES

This project is a contribution to the Canada/British Columbia Mineral Development Agreement 1985–1990.

SYMBOLS

MAP

Contact; defined, approximate, gradational

Coal seam trace; defined, approximate, individual outcrop, coal incm or more

Trace of sandstone; defined, approximate, individual outcrop

Trace of conglomerate; defined, approximate, individual outcrop

Occurrence of sapropelic Elk coal — EC

Thrust fault (teeth indicate direction of dip); defined, approximate, assumed

Transverse fault (arrows indicate direction of movement); approximate

Boundary of landslide block

Bedding: upright, overturned, vertical, horizontal

Syncline, upright, overturned (arrow indicates direction of plunge); defined, approximate

Anticline (arrow indicates direction of plunge); defined, approximate

$\bar{R}_o$max (mean maximum vitrinite reflectance) value at this point — 1.42

Limit of interpretation

Location of measured section — A B

SECTIONS

Predominantly sandstone

Interbedded sandstone and siltstone

Predominantly siltstone and finer

Interbedded coal and shale

Predominantly coal

Covered interval

Thickness of coal seams (metres) — 5.1

Approximate position of Elk–Mist Mountain contact

Approximate position of Mist Mountain–Morrissey contact

$\bar{R}_o$max (mean maximum vitrinite reflectance) — 1.42

TABLE OF FORMATIONS

LOWER CRETACEOUS

Kc CADOMIN FORMATION: Conglomerate

JURASSIC AND CRETACEOUS
KOOTENAY GROUP

JKe ELK FORMATION: Sandstone, siltstone, shale, coal, minor conglomerate

JKmm MIST MOUNTAIN FORMATION: Sandstone, siltstone, shale, coal, minor conglomerate

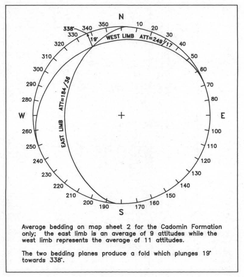
JKm MORRISSEY FORMATION: Sandstone, minor shale and coal

JURASSIC

Jf FERNIE FORMATION: Shale, interbedded sandstone in upper part

NOTES

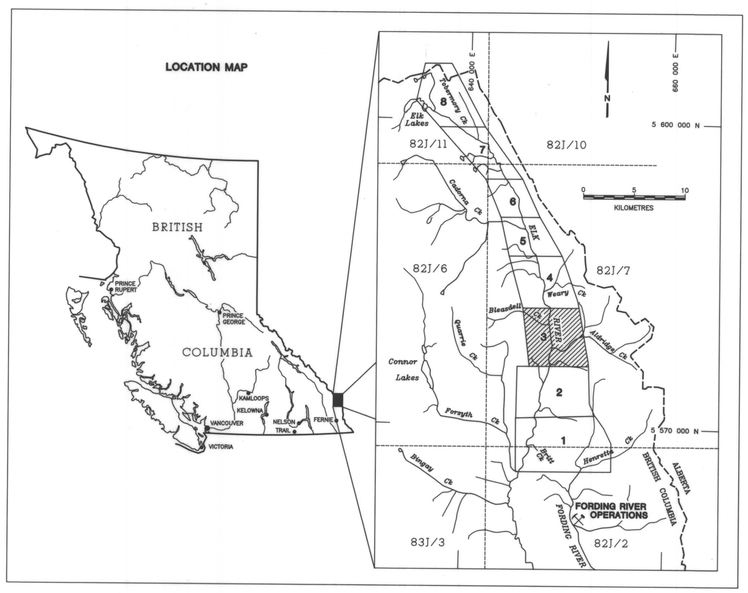
Note 1 Most sandstones in the Elk Formation are omitted
Note 2 Poor exposure
Note 3 Small–scale deformation at this point
Note 4 Exposures of Triassic strata at this point
Note 5 Exposures of Pennsylvanian strata at this point
Note 6 Exposures of basal phosphorite of the Fernie Formation at this point
Note 7 Exposures of Mississippian or older limestone at this point



Average bedding on map sheet 2 for the Cadomin Formation only: the east limb is an average of 9 attitudes while the west limb represents the average of 11 attitudes.

The two bedding planes produce a fold which plunges 19° towards 338°.

Cartography by P. Chicorelli



NOTES

Note 1 Most sandstones in the Elk Formation are omitted

Note 2 Poor exposure

Note 3 Small-scale deformation at this point

Note 4 Exposures of Triassic strata at this point

Note 5 Exposures of Pennsylvanian strata at this point

Note 6 Exposures of basal phosphorite of the Fernie Formation at this point

Note 7 Exposures of Mississippian or older limestone at this point

The study area extends from Henretta and Britt creeks in the south to the British Columbia – Alberta boundary in the north. Jurassic–Cretaceous Kootenay Group exposures throughout were mapped by R.J. Morris in 1987, with the exception of the Weary Ridge – Bleasdell Creek area and the Britt Creek area, which were mapped by D.A. Grieve in 1986. This study extends previous mapping by the Geological Survey Branch northward (Grieve and Pearson, 1983; Grieve and Fraser, 1985).

Most of the area is Crown land and includes all or part of three separate coal properties. The most southerly of these comprises the north end of the Fording Coal Ltd. Fording River property. The northern boundary of the Fording River property is in the vicinity of U.T.M. gridline 5 580 000 metres north, which is just north of Aldridge Creek. Adjacent to the north is the Elk River property in which Fording Coal held a 50 per cent interest at the time of writing (June 1989). The northern boundary of the Elk River property is in the vicinity of U.T.M. gridline 5 590 000 metres north, close to Cadorna Creek. Coal rights in the area north of Cadorna Creek, formerly known as the Vincent option, were reserved to the Crown at the time of writing.

Data presented are based on examination of surface outcrops, roadcuts and trenches, and are supplemented by air–photograph interpretation. In many cases, poor exposure has limited the amount of data and has restricted the ability to correlate seams. Seams less than 1 metre thick have generally not been plotted. Exposure on Map Sheet 3 is quite variable. Weary Ridge and Mount Veits on the east side of the Elk River valley have good exposure, while the west side has very little outcrop. Coal seam traces have been interpreted only on the east side of the valley.

Stratigraphic sections were measured on Mount Veits and Tuxford, Henretta Ridge, Weary Ridge and at "Coal Creek", a tributary of Bleasdell Creek. Sections were measured using either pogo stick or compass and chain. They have been generalized for publication. Note that coal seams less than 1 metre thick are not indicated, nor are partings within seams that are less than 1 metre in thickness.

The basal unit of the Kootenay Group is the Morrissey Formation. The Morrissey is a resistant sandstone unit consisting of two members and ranging in thickness from 20 to 80 metres (Gibson, 1985). The upper member, the Moose Mountain member, is a distinctive marker unit consisting of medium–grained sandstone, which is utilized in all surface and subsurface studies of the Kootenay to demarcate the base of coal occurrences. Within the study area the Moose Mountain member was observed to be more variable than normal. For example, it includes one or more carbonaceous partings in the area between Weary Ridge and Mount Tuxford, and at two localities south of Aldridge Creek it was observed to include an unusual light grey to white–weathering, quartzose facies. The trace of the Morrissey Formation is plotted with a good degree of confidence on the east limb of the Alexander Creek syncline throughout Sheet 3.

The Mist Mountain Formation contains essentially all the coals of economic interest in southeastern British Columbia. Its thickness in the study area ranges between 450 and 550 metres. Coal forms between 8 and 12 per cent of the total thickness of the formation at most locations.

EXPLANATION

Individual seams in the study area range from less than 1 to greater than 10 metres in thickness. Three stratigraphic sections of Mist Mountain Formation were measured in the area covered by Map Sheet 3. A partial Mist Mountain Formation section, 507 metres thick, was measured on Weary Ridge (section I–J), and other partial sections were measured on Mount Veits (section G–H, 127.7 metres thick) and at "Coal Creek" (section K–L, 304.2 metres thick). The bases of the Weary Ridge and Mount Veits sections are the base of the formation, while the base of the Coal Creek section is believed to be roughly 100 metres above the base of the formation. The Weary Ridge section hosts 63.8 metres of coal (12.6 per cent of the total thickness), the Mount Veits section hosts 7.6 metres of coal (6.0 per cent), while the Coal Creek section hosts 29.4 metres of coal (9.7 per cent).

The precise identification of the contact of the Mist Mountain Formation with the overlying Elk Formation in southeastern British Columbia is generally difficult (Grieve and Ollerenshaw,1989). The Elk is a coarser grained facies than the Mist Mountain and it generally lacks thick coal seams and contains unusual sapropelic coals known as "needle coals" (Kalkreuth, 1982). Occurrences of sapropelic coal are noted on the map by the symbol "EC". The thickness of the Elk Formation in the study area is inferred to range between 350 and 450 metres. The Elk – Mist Mountain contact on the east limb on Sheet 3 is placed at the base of a thick sandstone unit above the highest major coal seam on the south end of Weary Ridge. From this point the contact has been traced with moderate confidence southward onto the lower slopes of Mount Veits, and with a high degree of confidence northward along the lower slopes of Weary Ridge. In the Bleasdell Creek area, on the west limb, the contact is placed with moderate confidence, based on the apparent absence of thick seams higher in the stratigraphy. The contact has been projected southward from Bleasdell Creek with limited confidence, because of poor exposures.

The Kootenay Group is unconformably (?) overlain by the Lower Cretaceous Blairmore Group. The basal unit of the Blairmore Group is the Cadomin Formation, a distinctive cliff–forming conglomerate unit.

The study area lies in the Front Ranges of the Rocky Mountains and is part of the Lewis thrust sheet. The major structure in the coalfield is the Alexander Creek syncline, which extends throughout its entire 100–kilometre length. The northern extension of the Greenhills syncline, which is west of the Alexander Creek syncline, also influences the extreme southern end of the study area.

The Alexander Creek syncline is overturned in the central part of the study area, and open elsewhere. It generally plunges to the north. Zones of shallow–dipping strata on the east limb are present on the lower slopes of both Weary Ridge and Mount Veits on Sheet 3.

The Bourgeau thrust fault, which marks the western boundary of the surface exposures of the Lewis thrust sheet, forms the western boundary of the Elk valley coalfield in the study area. The relative footwall stratigraphic position of the fault varies along its trace from the Fernie Formation to uppermost Kootenay. At the north end of the study area it is offset 2 kilometres to the northeast by a transverse fault (Leech, 1979).

Minor structures associated with the Bourgeau thrust are not generally observable because of poor exposure. The area known as "Coal Creek" on the west limb of the Alexander Creek syncline is one exception. Along "Coal Creek" (Map Sheet 3) the stratigraphically lowest exposures of Mist Mountain Formation exposed in the footwall of the Bourgeau fault are severely deformed. Individual faults fall into two groups, those having average strikes of 340° and those with strikes of 030° to 040°. The former set appear to be parallel to the Bourgeau fault and are probably thrust faults, while the latter set are transverse in orientation and roughly parallel to the creek. The creek bed itself is believed to follow the trace of a transverse fault, because rocks on the southeast side of the creek are significantly more deformed than those on the northwest side at this point. In particular, the southeast bank of the creek contains exposures of a highly deformed coal seam, which has been severely affected by faulting, producing a zone of thickened coal. The individual thrust–repeated blocks of coal in the thickened zone, however, appear to be limited in volume by the transverse faults, and the economic enhancement produced by the deformation is believed to be slight.

Small scale folds affect the Mist Mountain Formation strata in three general areas: the extreme south end of the study area (see Sheet 1), the lower west–facing slopes of Mount Tuxford (see Sheet 2), and the small eastward–flowing creeks north of Cadorna Creek (see Sheets 6 and 7). These are mainly interpreted as minor folds associated with the Alexander Creek syncline, and, with few exceptions, are not attributed directly to thrusting.

In contrast with the south half of the coalfield (see Grieve and Fraser, 1985), thrust faults within the Kootenay Group are not a major feature of the study area. On Henretta Ridge at the extreme south end of the study area, however, two thrust faults are observed (see Sheet 1). One causes a repeat of the Morrissey Formation and lowermost part of the Mist Mountain Formation; the other occurs higher in the Mist Mountain Formation and is exposed on the south–facing slope of the ridge. A third thrust fault is inferred to occur in the east limb through part of the north end of the study area, based on sporadic occurrences of deformed strata (see Sheet 6 for example).

Late–stage, crosscutting normal faults are present in the Mount Tuxford and Mount Veits area. These appear to follow prominent joint orientations and have resulted in mass–wasting of the Morrissey Formation, forming both topographic steps and landslide blocks. A large landslide block of Morrissey Formation occurs on Weary Ridge (see Sheet 4). A set of four major normal faults is shown on the south side of Mount Veits. Up to 80 metres of combined normal displacement is estimated to have occurred along them. On the north side of Mount Veits the Moose Mountain member may have been down–dropped to the east by north–trending normal faults. Poor exposure in the area precluded finding field evidence.

The rank of the coals has been determined petrographically by measuring the mean maximum vitrinite reflectance ($\bar{R}_o$max) on grab samples. These values are plotted on the map. To convert reflectance values to ASTM rank equivalents use 1.12 per cent as the boundary between high–volatile and medium–volatile coals and 1.51 per cent as the boundary between medium–volatile and low–volatile rank. Coals of the Mist Mountain Formation vary in rank from low–volatile to high–volatile bituminous. The highest rank Mist Mountain Formation coals are found in the lower part of the formation on the east limb of the Alexander Creek syncline near Weary Creek. The lowest rank coals are exposed on the west limb of the Alexander Creek syncline near Bleasdell Creek, and on both limbs at the north end of the study area. Elk Formation coals are all of high–volatile bituminous rank in the study area. On the east limb of the Alexander Creek syncline on Map Sheet 3 reflectance values in the Mist Mountain Formation vary from 1.59 to 0.99 per cent. On the west limb the values are significantly lower, with a range of 1.00 to 0.75 per cent.

We wish to thank the following people for their contributions to the study. Staff of Fording Coal Ltd., especially Ken Komenac and Roger Berdusco, permitted and arranged access to the southern part of the study area and provided many useful ideas. Kevin Switzer and Jim Ryley provided excellent field assistance. Joanne Schwemler carried out all petrographic reflectance analyses. Margot McMechan of the Geological Survey of Canada and Ward Kilby of the British Columbia Geological Survey Branch reviewed an earlier version of the map and provided helpful suggestions and comments.

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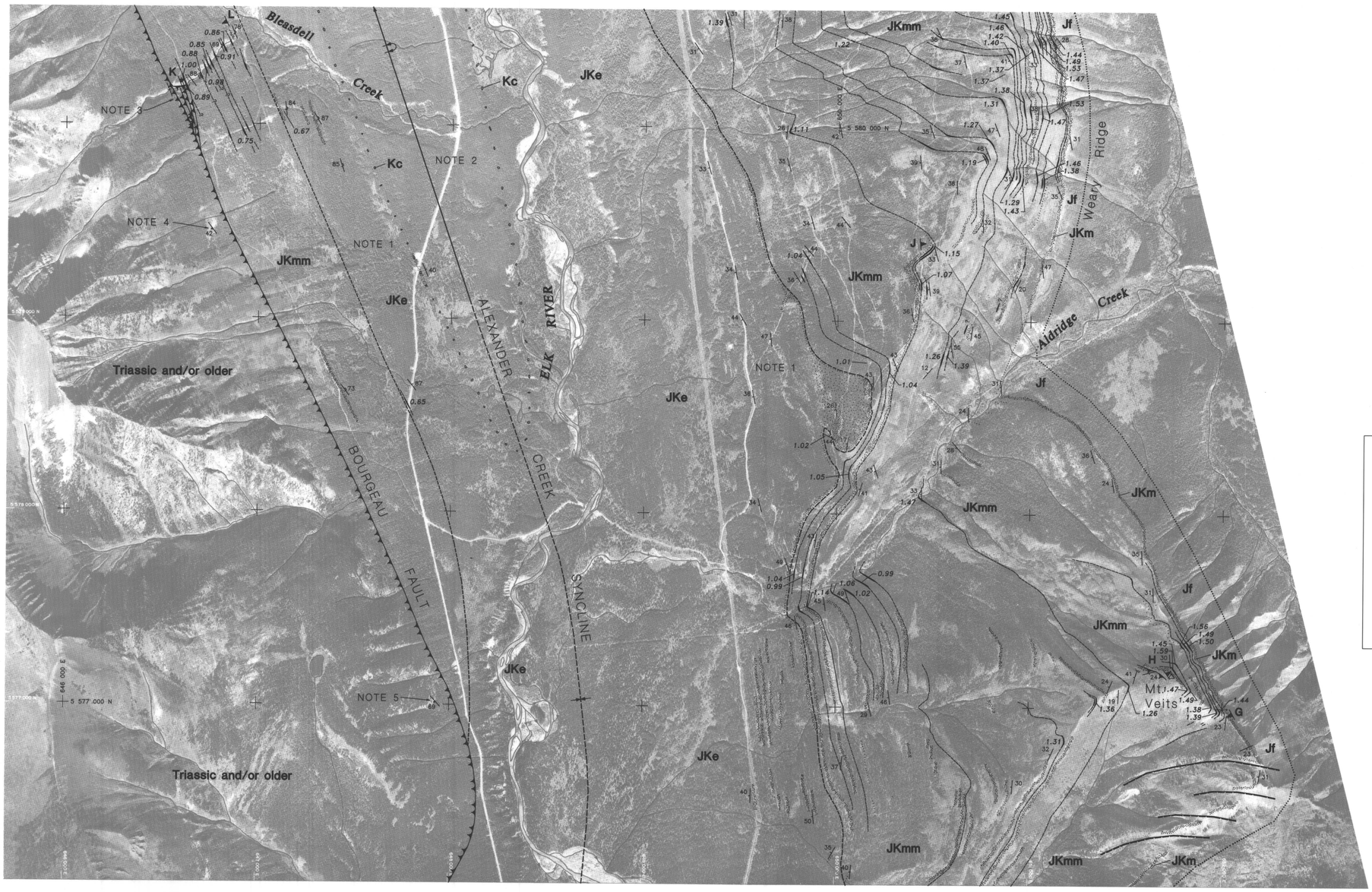
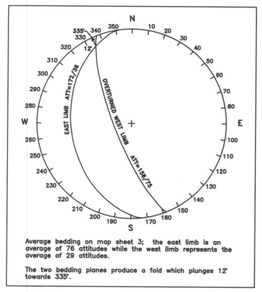
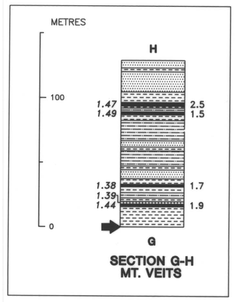
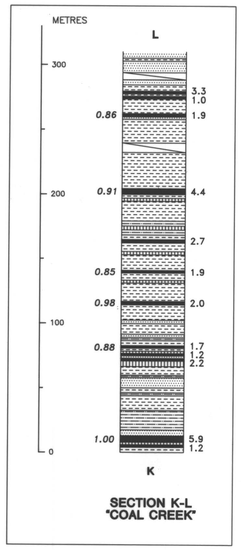




Average bedding on map sheet 3; the east limb is an average of 76 attitudes while the west limb represents the average of 29 attitudes.

The two bedding planes produce a fold which plunges 12° towards 335°.





Cartography by P. Chicorelli

Ministry of Energy, Mines and Petroleum Resources

PRELIMINARY MAP 68

GEOLOGY OF THE ELK VALLEY COALFIELD NORTH HALF (HENRETTA CREEK TO ELK LAKES)

SHEET 3 OF 8

GEOLOGY BY
ROBERT J. MORRIS AND DAVID A. GRIEVE

SCALE 1:10 000

0 200 400 600 800 1000

KILOMETRES KILOMETRES

This project is a contribution to the Canada/British Columbia Mineral Development Agreement 1985–1990.

SYMBOLS

MAP

Contact; defined, approximate, gradational

Coal seam trace; defined, approximate, individual outcrop, coal bloom or spoil

Trace of sandstone; defined, approximate, individual outcrop

Trace of conglomerate; defined, approximate, individual outcrop

Occurrence of sapropelic Elk coal — EC

Thrust fault (teeth indicate direction of dip); defined, approximate, assumed

Transverse fault (arrows indicate direction of movement); approximate

Boundary of landslide block

Bedding: upright, overturned, vertical, horizontal, tops unknown

Syncline, upright, overturned (arrow indicates direction of plunge); defined, approximate

Anticline (arrow indicates direction of plunge); defined, approximate

$\bar{R}_o$max (mean maximum vitrinite reflectance) value at this point — 1.42

Limit of interpretation

Location of measured section — A ▶ ◀ B

SECTIONS

Predominantly sandstone

Interbedded sandstone and siltstone

Predominantly siltstone and finer

Interbedded coal and shale

Predominantly coal

Covered interval

Thickness of coal seams (metres) — 5.1

Approximate position of Elk–Mist Mountain contact

Approximate position of Mist Mountain–Morrissey contact

$\bar{R}_o$max (mean maximum vitrinite reflectance) — 1.42

TABLE OF FORMATIONS

LOWER CRETACEOUS

Kc CADOMIN FORMATION: Conglomerate

JURASSIC AND CRETACEOUS
KOOTENAY GROUP

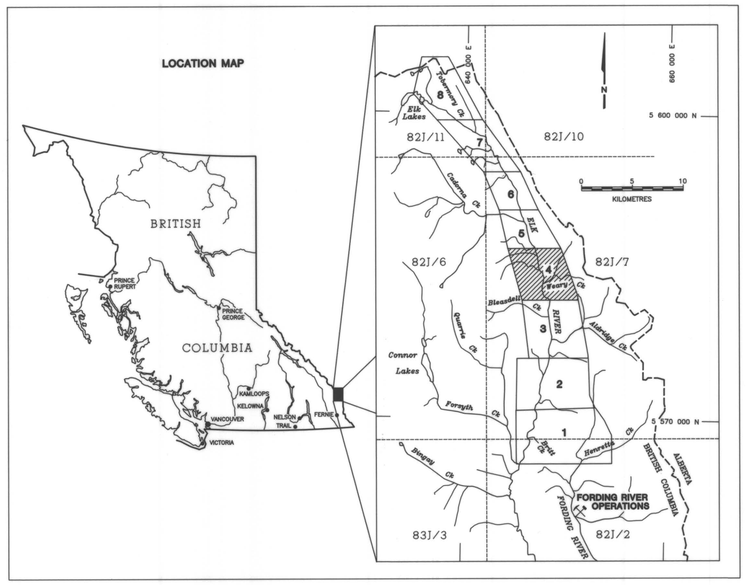
JKe ELK FORMATION: Sandstone, siltstone, shale, coal, minor conglomerate

JKmm MIST MOUNTAIN FORMATION: Sandstone, siltstone, shale, coal, minor conglomerate

JKm MORRISSEY FORMATION: Sandstone, minor shale and coal

JURASSIC

Jf FERNIE FORMATION: Shale, interbedded sandstone in upper part



EXPLANATION

The study area extends from Henretta and Britt creeks in the south to the British Columbia – Alberta boundary in the north. Jurassic–Cretaceous Kootenay Group exposures throughout were mapped by R.J. Morris in 1987, with the exception of the Weary Ridge – Bleasdell Creek area and the Britt Creek area, which were mapped by D.A. Grieve in 1986. This study extends previous mapping by the Geological Survey Branch northward (Grieve and Pearson, 1983; Grieve and Fraser, 1985).

Most of the area is Crown land and includes all or part of three separate coal properties. The most southerly of these comprises the north end of the Fording Coal Ltd. Fording River property. The northern boundary of the Fording River property is in the vicinity of U.T.M. gridline 5 580 000 metres north, which is just north of Aldridge Creek. Adjacent to the north is the Elk River property in which Fording Coal held a 50 per cent interest at the time of writing (June 1989). The northern boundary of the Elk River property is in the vicinity of U.T.M. gridline 5 590 000 metres north, close to Cadorna Creek. Coal rights in the area north of Cadorna Creek, formerly known as the Vincent option, were reserved to the Crown at the time of writing.

Data presented are based on examination of surface outcrops, roadcuts and trenches, and are supplemented by air–photograph interpretation. In many cases poor exposure has limited the amount of data and has restricted the ability to correlate seams. Seams less than 1 metre thick have generally not been plotted. Exposure on Map Sheet 4 is quite variable. Little Weary Ridge, Weary Creek and Weary Ridge, all on the east side of the Elk River valley, have good exposure, while the west side has very little outcrop. Coal seam traces have been interpreted only on the east side of the valley.

Stratigraphic sections were measured on Mount Veits and Tuxford, Henretta Ridge, Weary Ridge and at "Coal Creek", a tributary of Bleasdell Creek. Sections were measured using either pogo stick or compass and chain. They have been generalized for publication. Note that coal seams less than 1 metre thick are not indicated, nor are partings within seams that are less than 1 metre in thickness.

The basal unit of the Kootenay Group is the Morrissey Formation. The Morrissey is a resistant sandstone unit consisting of two members and ranging in thickness from 50 to 80 metres (Gibson, 1985). The upper member, the Moose Mountain member, is a distinctive marker unit consisting of medium–grained sandstone, which is utilized in all surface and subsurface studies of the Kootenay to demarcate the base of coal occurrences. Within the study area the Moose Mountain member was observed to be more variable than normal. For example, it includes one or more carbonaceous partings in the area between Weary Ridge and Mount Tuxford, and at two localities south of Aldridge Creek it was observed to include an unusual light grey to white–weathering, quartzose facies. The trace of the Morrissey Formation is plotted with moderate confidence on both limbs of the syncline on Sheet 4.

The Mist Mountain Formation contains essentially all the coals of economic interest in southeastern British Columbia. Its thickness in the study area ranges between 450 and 550 metres. Coal forms between 8 and 12 per cent of the total thickness of the formation at most locations. Individual seams in the study area range from less than 1 to greater than 10 metres in thickness. The lower part of the Weary Ridge measured section (section I–J) is located on Sheet 4, and the section is shown here. The sequence of strata on Weary Creek and Little Weary Ridge is similar to section I–J. Mist Mountain Formation strata exposed just north of Bleasdell Creek appear similar to those at Coal Creek (section K–L).

The precise identification of the contact of the Mist Mountain Formation with the overlying Elk Formation in southeastern British Columbia is generally difficult (Grieve and Ollerenshaw, 1989). The Elk is a coarser grained facies than the Mist Mountain and it generally lacks thick coal seams and contains unusual sapropelic coals known as "needle coals" (Kalkreuth, 1982). Occurrences of sapropelic coal are noted on the map by the symbol "EC". The thickness of the Elk Formation in the study area is inferred to range between 350 and 450 metres. The position of the Elk – Mist Mountain contact on the east limb on Map Sheet 4 has been extrapolated from Sheet 3. On the west limb, the position of the contact is placed with a high degree of confidence at the south end of the sheet, and is projected northward over the rest of the area.

The Kootenay Group is unconformably (?) overlain by the Lower Cretaceous Blairmore Group. The basal unit of the Blairmore Group is the Cadomin Formation, a distinctive cliff–forming conglomerate unit. At one locality on the west limb of the Elk River syncline on Map Sheet 4 the Cadomin Formation consists of two separate conglomerate horizons.

The study area lies in the Front Ranges of the Rocky Mountains and is part of the Lewis thrust sheet. The major structure in the coalfield is the Alexander Creek syncline, which extends throughout its entire 100–kilometre length. The northern extension of the Greenhills syncline, which is west of the Alexander Creek syncline, also influences the extreme southern end of the study area.

The Alexander Creek syncline is overturned in the central part of the study area, and open elsewhere. It generally plunges to the north. Zones of shallow–dipping strata on the east limb on Sheet 4 are present on the lower slopes of Little Weary Ridge. The thrust fault on the west limb on Sheet 4 has been incorporated to account for the extra thickness of section between the Cadomin and Morrissey formations.

The Bourgeau thrust fault, which marks the western boundary of the surface exposures of the Lewis thrust sheet, forms the western boundary of the Elk valley coalfield in the study area. The relative footwall stratigraphic position of the fault varies along its trace from the Fernie Formation to uppermost Kootenay. At the north end of the study area it is offset 2 kilometres to the northeast by a transverse fault (Leech, 1979).

Minor structures associated with the Bourgeau thrust are not generally observable because of poor exposure. The area known as "Coal Creek" on the west limb of the Alexander Creek syncline is one exception. See Sheet 3 for more detail.

Small scale folds affect the Mist Mountain Formation strata in three general areas: the extreme south end of the study area (see Sheet 1), the lower west–facing slopes of Mount Tuxford (see Sheet 2), and the small eastward–flowing creeks north of Cadorna Creek (see Sheets 6 and 7). These are mainly interpreted as minor folds associated with the Alexander Creek syncline, and, with few exceptions, are not attributed directly to thrusting.

In contrast with the south half of the coalfield (see Grieve and Fraser, 1985), thrust faults within the Kootenay Group are not a major feature of the study area. On Henretta Ridge at the extreme south end of the study area, however, two thrust faults are observed (see Sheet 1). One causes a repeat of the Morrissey Formation and lowermost part of the Mist Mountain Formation; the other occurs higher in the Mist Mountain Formation and is exposed on the south–facing slope of the ridge. A third thrust fault is inferred to occur in the east limb through part of the north end of the study area, based on sporadic occurrences of deformed strata (see Sheet 6 for example).

Late–stage, crosscutting normal faults are present in the Mount Tuxford and Mount Veits area. These appear to follow prominent joint orientations and have resulted in mass–wasting of the Morrissey Formation, forming both topographic steps and landslide blocks. A large landslide block of Morrissey Formation occurs on Weary Ridge

The rank of the coals has been determined petrographically by measuring the mean maximum vitrinite reflectance ($R_o$max) on grab samples. These values are plotted on the map. To convert reflectance values to ASTM rank equivalents use 1.12 per cent as the boundary between high–volatile and medium–volatile coals and 1.51 per cent as the boundary between medium–volatile and low–volatile rank. Coals of the Mist Mountain Formation vary in rank from low–volatile to high–volatile bituminous. The highest rank Mist Mountain Formation coals are found in the lower part of the formation on the east limb of the Alexander Creek syncline near Weary Creek. The lowest rank coals are exposed on the west limb of the Alexander Creek syncline near Bleasdell Creek, and on both limbs at the north end of the study area. Elk Formation coals are all of high–volatile bituminous rank in the study area. On the east limb of the Alexander Creek syncline on Map Sheet 4 reflectance values in the Mist Mountain Formation vary from 1.63 to 1.08 per cent, although the uppermost Mist Mountain Formation was not sampled due to lack of exposure. On the west limb the values are significantly lower, with a range of 0.91 to 0.63 per cent.

We wish to thank the following people for their contributions to the study. Staff of Fording Coal Ltd., especially Ken Komenac and Roger Berdusco, permitted and arranged access to the southern part of the study area and provided many useful ideas. Kevin Switzer and Jim Ryley provided excellent field assistance. Joanne Schwermler carried out all petrographic reflectance analyses. Margot McMechan of the Geological Survey of Canada and Ward Kilby of the British Columbia Geological Survey Branch reviewed an earlier version of the map and provided helpful suggestions and comments.

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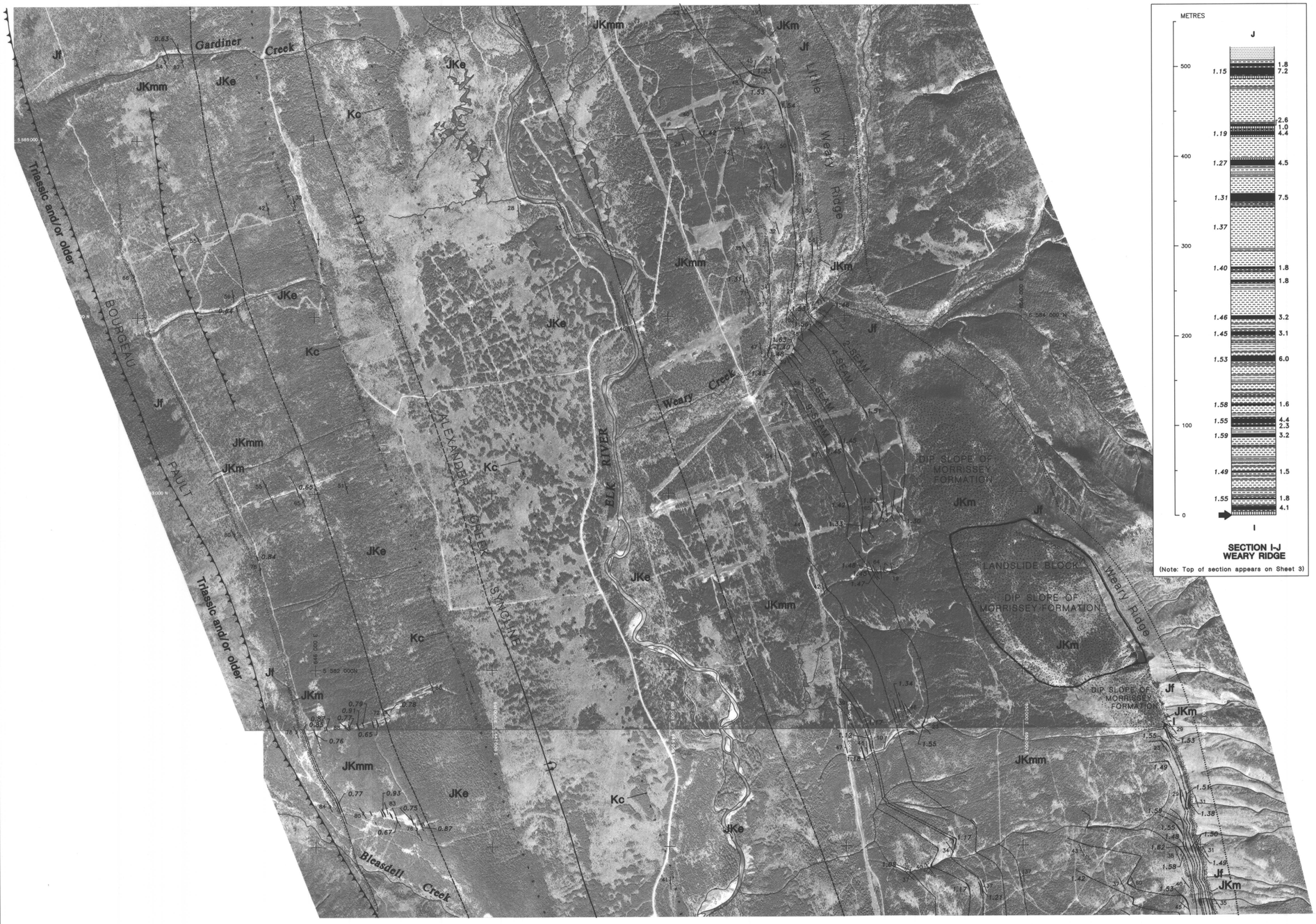


SECTION I–J WEARY RIDGE

(Note: Top of section appears on Sheet 3)

Ministry of Energy, Mines and Petroleum Resources

PRELIMINARY MAP 68

GEOLOGY OF THE ELK VALLEY COALFIELD NORTH HALF (HENRETTA CREEK TO ELK LAKES)

SHEET 4 OF 8

GEOLOGY BY
ROBERT J. MORRIS AND DAVID A. GRIEVE

SCALE 1:10 000

0 200 400 600 800 1000

KILOMETRES KILOMETRES

This project is a contribution to the Canada/British Columbia Mineral Development Agreement 1985–1990.

SYMBOLS

MAP

- Contact; defined, approximate, gradational
- Coal seam trace; defined, approximate, individual outcrop, coal bloom or spoil
- Trace of sandstone; defined, approximate, individual outcrop
- Trace of conglomerate; defined, approximate, individual outcrop
- Occurrence of sapropelic Elk coal — EC
- Thrust fault (teeth indicate direction of dip); defined, approximate, assumed
- Transverse fault (arrows indicate direction of movement); approximate
- Boundary of landslide block
- Bedding; upright, overturned, vertical, horizontal
- Syncline, upright, overturned (arrow indicates direction of plunge); defined, approximate
- Anticline (arrow indicates direction of plunge); defined, approximate
- $R_o$max (mean maximum vitrinite reflectance) value at this point — 1.42
- Limit of interpretation
- Location of measured section — A B

SECTIONS

- Predominantly sandstone
- Interbedded sandstone and siltstone
- Predominantly siltstone and finer
- Interbedded coal and shale
- Predominantly coal
- Covered interval
- Thickness of coal seams (metres) — 5.1
- Approximate position of Elk–Mist Mountain contact
- Approximate position of Mist Mountain–Morrissey contact
- $R_o$max (mean maximum vitrinite reflectance) — 1.42

TABLE OF FORMATIONS

LOWER CRETACEOUS

Kc CADOMIN FORMATION: Conglomerate

JURASSIC AND CRETACEOUS
KOOTENAY GROUP

JKe ELK FORMATION: Sandstone, siltstone, shale, coal, minor conglomerate

JKmm MIST MOUNTAIN FORMATION: Sandstone, siltstone, shale, coal, minor conglomerate

JKm MORRISSEY FORMATION: Sandstone, minor shale and coal

JURASSIC

Jf FERNIE FORMATION: Shale, interbedded sandstone in upper part

NOTES

Note 1 Most sandstones in the Elk Formation are omitted

Note 2 Poor exposure

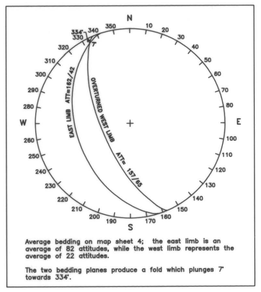
Note 3 Small–scale deformation at this point

Note 4 Exposures of Triassic strata at this point

Note 5 Exposures of Pennsylvanian strata at this point

Note 6 Exposures of basal phosphorite of the Fernie Formation at this point

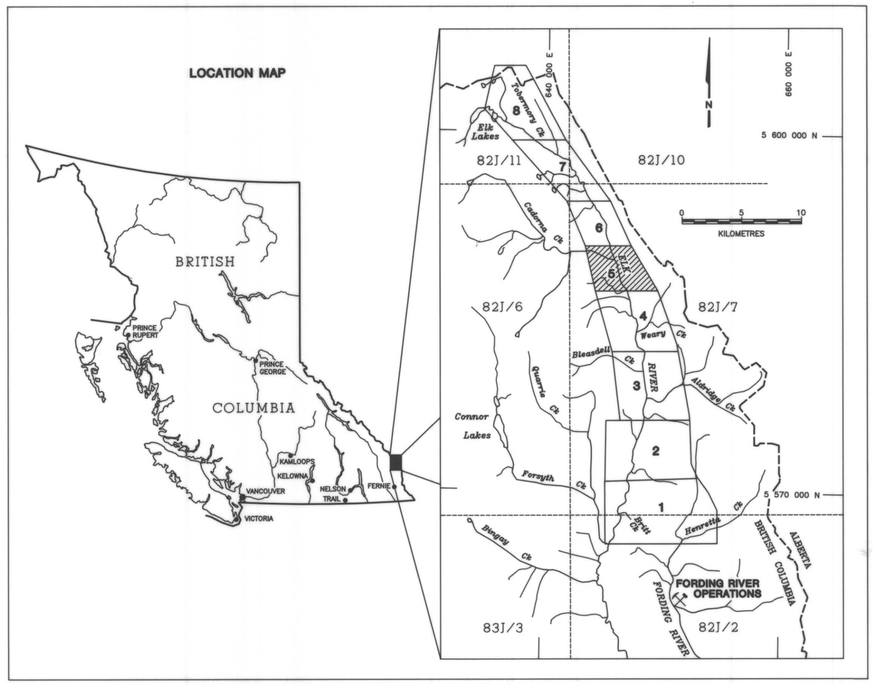
Note 7 Exposures of Mississippian or older limestone at this point



Average bedding on map sheet 4; the east limb is an average of 82 attitudes, while the west limb represents the average of 22 attitudes.

The two bedding planes produce a fold which plunges 7° towards 334°.

Cartography by P. Chicorelli



EXPLANATION

The study area extends from Henretta and Britt creeks in the south to the British Columbia – Alberta boundary in the north. Jurassic–Cretaceous Kootenay Group exposures throughout were mapped by R.J. Morris in 1987, with the exception of the Weary Ridge – Bleasdell Creek area and the Britt Creek area, which were mapped by D.A. Grieve in 1986. This study extends previous mapping by the Geological Survey Branch northward (Grieve and Pearson, 1983; Grieve and Fraser, 1985).

Most of the area is Crown land and includes all or part of three separate coal properties. The most southerly of these comprises the north end of the Fording Coal Ltd. Fording River property. The northern boundary of the Fording River property is in the vicinity of U.T.M. gridline 5 580 000 metres north, which is just north of Aldridge Creek. Adjacent to the north is the Elk River property in which Fording Coal held a 50 per cent interest at the time of writing (June 1989). The northern boundary of the Elk River property is in the vicinity of U.T.M. gridline 5 590 000 metres north, close to Cadorna Creek. Coal rights in the area north of Cadorna Creek, formerly known as the Vincent option, were reserved to the Crown at the time of writing.

Data presented are based on examination of surface outcrops, roadcuts and trenches, and are supplemented by air–photograph interpretation. In many cases poor exposure has limited the amount of data and has restricted the ability to correlate seams. Seams less than 1 metre thick have generally not been plotted. Exposure over all of Map Sheet 5 is poor. No attempt has been made to indicate the trace or correlations of the coal seams.

Stratigraphic sections were measured on Mount Veits and Tuxford, Henretta Ridge, Weary Ridge and at "Coal Creek", a tributary of Bleasdell Creek. Sections were measured using either pogo stick or compass and chain. They have been generalized for publication. Note that coal seams less than 1 metre thick are not indicated, nor are partings within seams that are less than 1 metre in thickness.

The basal unit of the Kootenay Group is the Morrissey Formation. The Morrissey is a resistant sandstone unit consisting of two members and ranging in thickness from 20 to 80 metres (Gibson, 1985). The upper member, the Moose Mountain member, is a distinctive marker unit consisting of medium–grained sandstone, which is utilized in all surface and subsurface studies of the Kootenay to demarcate the base of coal occurrences. Within the study area the Moose Mountain member was observed to be more variable than normal. For example, it includes one or more carbonaceous partings in the area between Weary Ridge and Mount Tuxford, and at two localities south of Aldridge Creek it was observed to include an unusual light grey to white–weathering, quartzose facies. The Morrissey Formation trace on Map Sheet 5 has been interpreted from air photographs and by extrapolation from its position on adjoining map sheets.

The Mist Mountain Formation contains essentially all the coals of economic interest in southeastern British Columbia. Its thickness in the study area ranges between 450 and 550 metres. Coal forms between 8 and 12 per cent of the total thickness of the formation at most locations. Individual seams in the study area range from less than 1 to greater than 10 metres in thickness.No attempt was made to measure a section of the Mist Mountain Formation on Map Sheet 5, due to poor exposure.

The precise identification of the contact of the Mist Mountain Formation with the overlying Elk Formation in southeastern British Columbia is generally difficult (Grieve and Ollerenshaw, 1989). The Elk is a coarser grained facies than the Mist Mountain and it generally lacks thick coal seams and contains unusual sapropelic coals known as "needle coals" (Kalkreuth, 1982). Occurrences of sapropelic coal are noted on the map by the symbol "EC". The thickness of the Elk Formation in the study area is inferred to range between 350 and 450 metres. The position of the Elk – Mist Mountain contact on Map Sheet 5 has been extrapolated from adjoining map sheets.

The Kootenay Group is unconformably (?) overlain by the Lower Cretaceous Blairmore Group. The basal unit of the Blairmore Group is the Cadomin Formation, a distinctive cliff–forming conglomerate unit. Along Cadorna Creek on Map Sheet 5 the Cadomin Formation is well exposed. On both limbs of the Alexander Creek syncline the formation consists of two separate conglomerate horizons.

The study area lies in the Front Ranges of the Rocky Mountains and is part of the Lewis thrust sheet. The major structure in the coalfield is the Alexander Creek syncline, which extends throughout its entire 100–kilometre length. The northern extension of the Greenhills syncline, which is west of the Alexander Creek syncline, also influences the extreme southern end of the study area.

The Alexander Creek syncline is overturned in the central part of the study area, and open elsewhere. It generally plunges to the north. The Alexander Creek syncline changes from overturned in the south part of Map Sheet 5, to upright in the north part.

The Bourgeau thrust fault, which marks the western boundary of the surface exposures of the Lewis thrust sheet, forms the western boundary of the Elk valley coalfield in the study area. Within Map Sheet 5 the Bourgeau thrust fault is seen to cut upsection to the north, from the Morrissey Formation to the upper Elk Formation. The relative footwall stratigraphic position of the fault varies along its trace from the Fernie Formation to uppermost Kootenay. At the north end of the study area it is offset 2 kilometres to the northeast by a transverse fault (Leech, 1979).

Minor structures associated with the Bourgeau thrust are not generally observable because of poor exposure. The area known as "Coal Creek" on the west limb of the Alexander Creek syncline is one exception. See Sheet 3 for more detail.

Small scale folds affect the Mist Mountain Formation strata in three general areas: the extreme south end of the study area (see Sheet 1), the lower west–facing slopes of Mount Tuxford (see Sheet 2), and the small eastward–flowing creeks north of Cadorna Creek (see Sheets 6 and 7). These are mainly interpreted as minor folds associated with the Alexander Creek syncline, and, with few exceptions, are not attributed directly to thrusting.

In contrast with the south half of the coalfield (see Grieve and Fraser, 1985), thrust faults within the Kootenay Group are not a major feature of the study area. On Henretta Ridge at the extreme south end of the study area, however, two thrust faults are observed (see Sheet 1). One causes a repeat of the Morrissey Formation and lowermost part of the Mist Mountain Formation; the other occurs higher in the Mist Mountain Formation and is exposed on the south–facing slope of the ridge. A third thrust fault is inferred to occur in the east limb through part of the north end of the study area, based on sporadic occurrences of deformed strata (see Sheet 6 for example).

Late–stage, crosscutting normal faults are present in the Mount Tuxford and Mount Veits area. These appear to follow prominent joint orientations and have resulted in mass–wasting of the Morrissey Formation, forming both topographic steps and landslide blocks. A large landslide block of Morrissey Formation occurs on Weary Ridge (see Sheet 4).

The rank of the coals has been determined petrographically by measuring the mean maximum vitrinite reflectance ($R_o$max) on grab samples. These values are plotted on the map. To convert reflectance values to ASTM rank equivalents use 1.12 per cent as the boundary between high–volatile and medium–volatile coals and 1.51 per cent as the boundary between medium–volatile and low–volatile rank. Coals of the Mist Mountain Formation vary in rank from low–volatile to high–volatile bituminous. The highest rank Mist Mountain Formation coals are found in the lower part of the formation on the east limb of the Alexander Creek syncline near Weary Creek. The lowest rank coals are exposed on the west limb of the Alexander Creek syncline near Bleasdell Creek, and on both limbs at the north end of the study area. Elk Formation coals are all of high–volatile bituminous rank in the study area. On the east limb of the Alexander Creek syncline on Map Sheet 5 reflectance values in the Mist Mountain Formation vary from 1.53 to 1.48 per cent, although this represents only a small number of exposures in the lower part of the formation on Little Weary Ridge. Similarly, very few coal exposures exist on the west limb in this area but, where sampled, values are significantly lower, with a range of 0.65 to 0.66 per cent.

We wish to thank the following people for their contributions to the study. Staff of Fording Coal Ltd., especially Ken Komenac and Roger Berdusco, permitted and arranged access to the southern part of the study area and provided many useful ideas. Kevin Switzer and Jim Ryley provided excellent field assistance. Joanne Schwemler carried out all petrographic reflectance analyses. Margot McMechan of the Geological Survey of Canada and Ward Kilby of the British Columbia Geological Survey Branch reviewed an earlier version of the map and provided helpful suggestions and comments.

REFERENCES

Gibson, D.W. (1985): Stratigraphy, Sedimentology and Depositional Environments of the Coal–bearing Jurassic–Cretaceous Kootenay Group, Alberta and British Columbia, Geological Survey of Canada, Bulletin 357, 108 pages.

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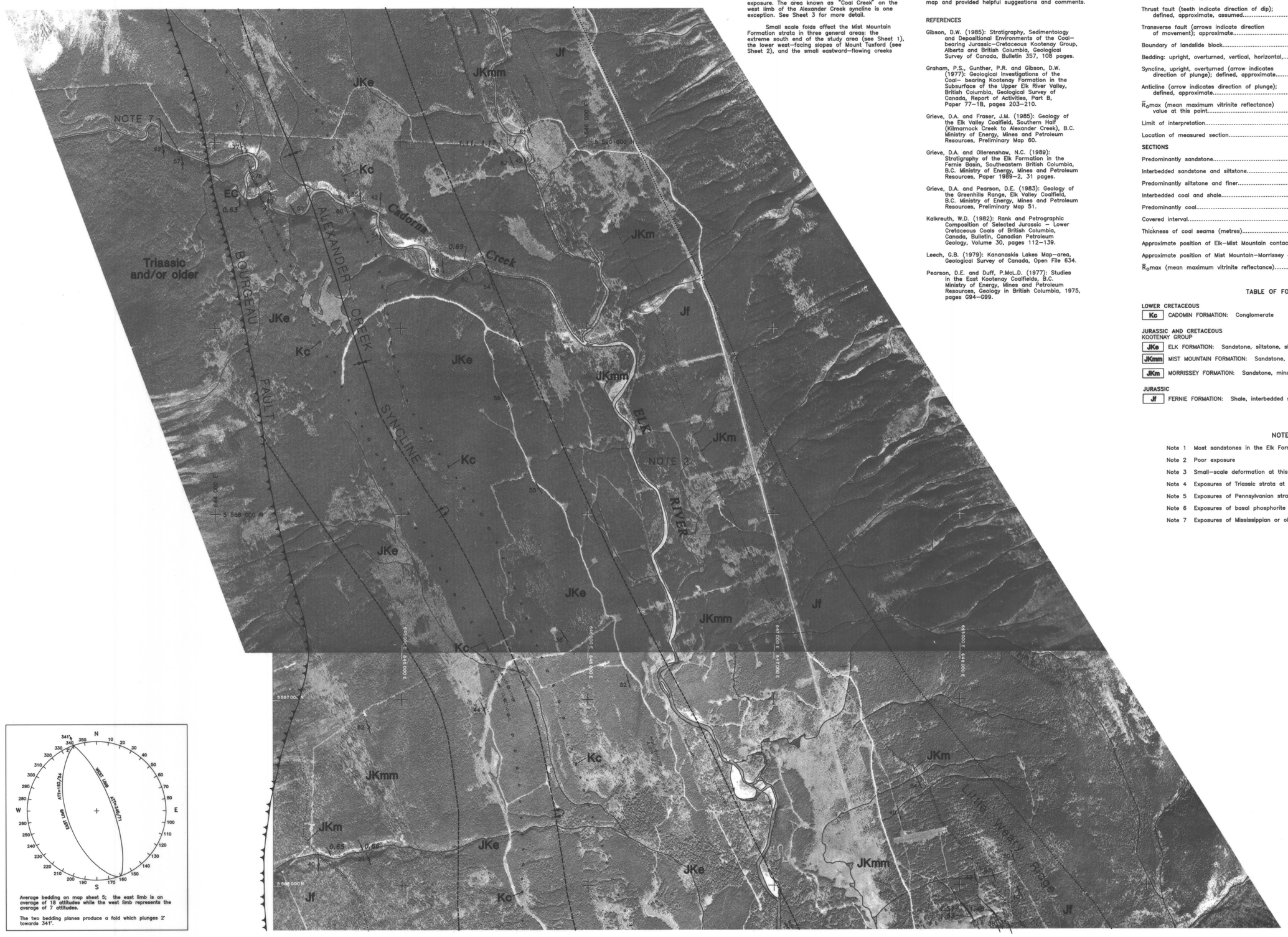


Average bedding on map sheet 5; the east limb is an average of 18 attitudes while the west limb represents the average of 7 attitudes.

The two bedding planes produce a fold which plunges 2° towards 341°.

Ministry of Energy, Mines and Petroleum Resources

BRITISH COLUMBIA GEOLOGICAL SURVEY

PRELIMINARY MAP 68

GEOLOGY OF THE ELK VALLEY COALFIELD NORTH HALF (HENRETTA CREEK TO ELK LAKES)

SHEET 5 OF 8

GEOLOGY BY ROBERT J. MORRIS AND DAVID A. GRIEVE

SCALE 1:10 000

0 200 400 600 800 1000 KILOMETRES

This project is a contribution to the Canada/British Columbia Mineral Development Agreement 1985–1990.

SYMBOLS

MAP

- Contact; defined, approximate, gradational
- Coal seam trace; defined, approximate, individual outcrop, coal bloom or spoil
- Trace of sandstone; defined, approximate, individual outcrop
- Trace of conglomerate; defined, approximate, individual outcrop
- Occurrence of sapropelic Elk coal — EC
- Thrust fault (teeth indicate direction of dip); defined, approximate, assumed
- Transverse fault (arrows indicate direction of movement); approximate
- Boundary of landslide block
- Bedding: upright, overturned, vertical, horizontal
- Syncline, upright, overturned (arrow indicates direction of plunge); defined, approximate
- Anticline (arrow indicates direction of plunge); defined, approximate
- $\overline{R}_o$max (mean maximum vitrinite reflectance) value at this point — 1.42
- Limit of interpretation
- Location of measured section — A ▸ ◂ B

SECTIONS

- Predominantly sandstone
- Interbedded sandstone and siltstone
- Predominantly siltstone and finer
- Interbedded coal and shale
- Predominantly coal
- Covered interval
- Thickness of coal seams (metres) — 5.1
- Approximate position of Elk–Mist Mountain contact
- Approximate position of Mist Mountain–Morrissey contact
- $\overline{R}_o$max (mean maximum vitrinite reflectance) — 1.42

TABLE OF FORMATIONS

LOWER CRETACEOUS

Kc CADOMIN FORMATION: Conglomerate

JURASSIC AND CRETACEOUS
KOOTENAY GROUP

JKe ELK FORMATION: Sandstone, siltstone, shale, coal, minor conglomerate

JKmm MIST MOUNTAIN FORMATION: Sandstone, siltstone, shale, coal, minor conglomerate

JKm MORRISSEY FORMATION: Sandstone, minor shale and coal

JURASSIC

Jf FERNIE FORMATION: Shale, interbedded sandstone in upper part

NOTES

Note 1 Most sandstones in the Elk Formation are omitted

Note 2 Poor exposure

Note 3 Small–scale deformation at this point

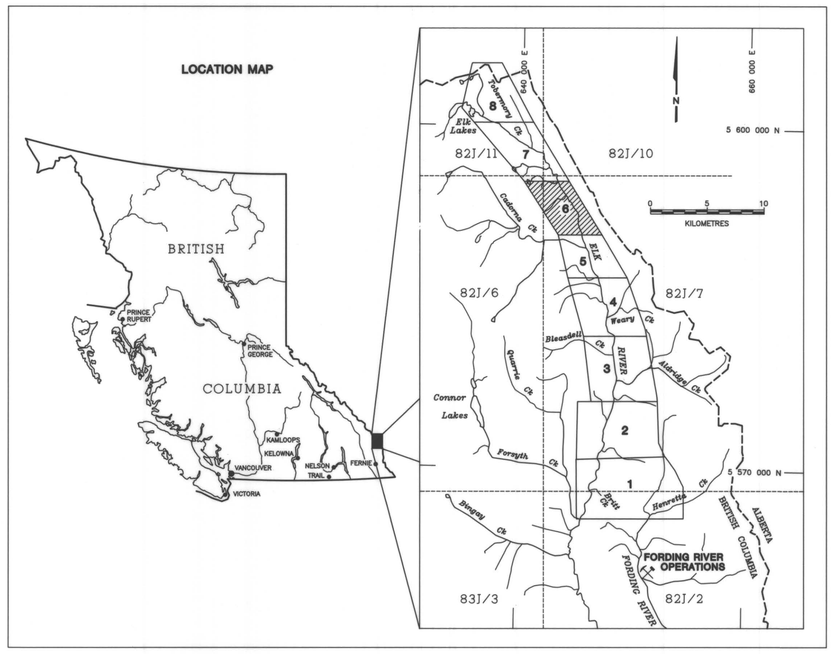
Note 4 Exposures of Triassic strata at this point

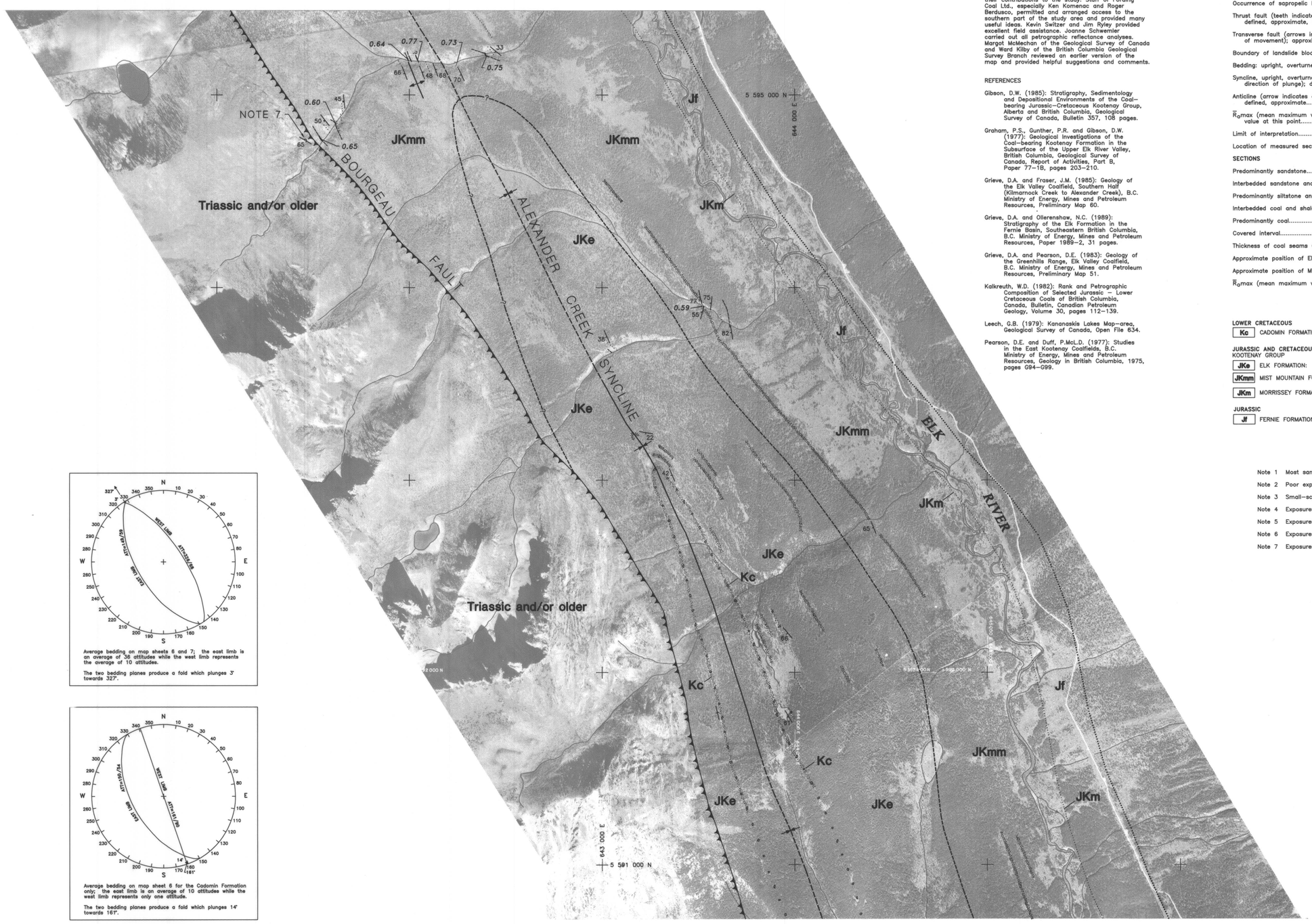
Note 5 Exposures of Pennsylvanian strata at this point

Note 6 Exposures of basal phosphorite of the Fernie Formation at this point

Note 7 Exposures of Mississippian or older limestone at this point

Cartography by P. Chicorelli





Average bedding on map sheets 6 and 7; the east limb is an average of 36 attitudes while the west limb represents the average of 10 attitudes.

The two bedding planes produce a fold which plunges 3° towards 327°.

Average bedding on map sheet 6 for the Cadomin Formation only; the east limb is an average of 10 attitudes while the west limb represents only one attitude.

The two bedding planes produce a fold which plunges 14° towards 161°.

EXPLANATION

The study area extends from Henretta and Britt creeks in the south to the British Columbia – Alberta boundary in the north. Jurassic–Cretaceous Kootenay Group exposures throughout were mapped by R.J. Morris in 1987, with the exception of the Weary Ridge – Bleasdell Creek area and the Britt Creek area, which were mapped by D.A. Grieve in 1986. This study extends previous mapping by the Geological Survey Branch northward (Grieve and Pearson, 1983; Grieve and Fraser, 1985).

Most of the area is Crown land and includes all or part of three separate coal properties. The most southerly of these comprises the north end of the Fording Coal Ltd. Fording River property. The northern boundary of the Fording River property is in the vicinity of U.T.M. gridline 5 580 000 metres north, which is just north of Aldridge Creek. Adjacent to the north is the Elk River property in which Fording Coal held a 50 per cent interest at the time of writing (June 1989). The northern boundary of the Elk River property is in the vicinity of U.T.M. gridline 5 590 000 metres north, close to Cadorna Creek. Coal rights in the area north of Cadorna Creek, formerly known as the Vincent option, were reserved to the Crown at the time of writing.

Data presented are based on examination of surface outcrops, roadcuts and trenches, and are supplemented by air–photograph interpretation. In many cases poor exposure has limited the amount of data and has restricted the ability to correlate seams. Seams less than 1 metre thick have generally not been plotted. Exposure over all of Map Sheet 6 is poor. No attempt has been made to indicate the trace or correlations of the coal seams.

Stratigraphic sections were measured on Mount Veits and Tuxford, Henretta Ridge, Weary Ridge and at "Coal Creek", a tributary of Bleasdell Creek. Sections were measured using either pogo stick or compass and chain. They have been generalized for publication. Note that coal seams less than 1 metre thick are not indicated, nor are partings within seams that are less than 1 metre in thickness.

The basal unit of the Kootenay Group is the Morrissey Formation. The Morrissey is a resistant sandstone unit consisting of two members and ranging in thickness from 20 to 80 metres (Gibson, 1985). The upper member, the Moose Mountain member, is a distinctive marker unit consisting of medium–grained sandstone, which is utilized in all surface and subsurface studies of the Kootenay to demarcate the base of coal occurrences. Within the study area the Moose Mountain member was observed to be more variable than normal. For example, it includes one or more carbonaceous partings in the area between Weary Ridge and Mount Tuxford, and at two localities south of Aldridge Creek it was observed to include an unusual light grey to white–weathering, quartzose facies. The trace of the Morrissey Formation on Map Sheet 6 has been interpreted from air photographs and by extrapolation from adjoining map sheets.

The Mist Mountain Formation contains essentially all the coals of economic interest in southeastern British Columbia. Its thickness in the study area ranges between 450 and 550 metres. Coal forms between 8 and 12 per cent of the total thickness of the formation at most locations. Individual seams in the study area range from less than 1 to greater than 10 metres in thickness. No attempt was made to measure a section of the Mist Mountain Formation on Map Sheet 6, due to poor exposure.

The precise identification of the contact of the Mist Mountain Formation with the overlying Elk Formation in southeastern British Columbia is generally difficult (Grieve and Ollerenshaw, 1989). The Elk is a coarser grained facies than the Mist Mountain and it generally lacks thick coal seams and contains unusual sapropelic coals known as "needle coals" (Kalkreuth, 1982). Occurrences of sapropelic coal are noted on the map by the symbol "EC". The thickness of the Elk Formation in the study area is inferred to range between 350 and 450 metres. The Elk – Mist Mountain contact on Map Sheet 6 has been extrapolated from adjoining map sheets.

The Kootenay Group is unconformably (?) overlain by the Lower Cretaceous Blairmore Group. The basal unit of the Blairmore Group is the Cadomin Formation, a distinctive cliff–forming conglomerate unit. The Cadomin Formation has been mapped at the south end of Map Sheet 6, where it is exposed on both limbs of the Alexander Creek syncline.

The study area lies in the Front Ranges of the Rocky Mountains and is part of the Lewis thrust sheet. The major structure in the coalfield is the Alexander Creek syncline, which extends throughout its entire 100–kilometre length. The northern extension of the Greenhills syncline, which is west of the Alexander Creek syncline, also influences the extreme southern end of the study area.

The Alexander Creek syncline is overturned in the central part of the study area, and open elsewhere. It generally plunges to the north. Zones of shallow–dipping strata on the east limb of the Alexander Creek syncline are present on Sheet 6.

The Bourgeau thrust fault, which marks the western boundary of the surface exposures of the Lewis thrust sheet, forms the western boundary of the Elk valley coalfield in the study area. The relative footwall stratigraphic position of the fault varies along its trace from the Fernie Formation to uppermost Kootenay. At the north end of the study area it is offset 2 kilometres to the northeast by a transverse fault (Leech, 1979).

Minor structures associated with the Bourgeau thrust are not generally observable because of poor exposure. The area known as "Coal Creek" on the west limb of the Alexander Creek syncline is one exception. See Sheet 3 for more detail.

Small scale folds affect the Mist Mountain Formation strata in three general areas: the extreme south end of the study area (see Sheet 1), the lower west–facing slopes of Mount Tuxford (see Sheet 2), and the small eastward–flowing creeks north of Cadorna Creek (see Sheets 6 and 7). These are mainly interpreted as minor folds associated with the Alexander Creek syncline, and, with few exceptions, are not attributed directly to thrusting.

In contrast with the south half of the coalfield (see Grieve and Fraser, 1985), thrust faults within the Kootenay Group are not a major feature of the study area. On Henretta Ridge at the extreme south end of the study area, however, two thrust faults are observed (see Sheet 1). One causes a repeat of the Morrissey Formation and lowermost part of the Mist Mountain Formation; the other occurs higher in the Mist Mountain Formation and is exposed on the south–facing slope of the ridge. A third thrust fault is inferred to occur in the east limb through part of the north end of the study area, based on sporadic occurrences of deformed strata.

Late–stage, crosscutting normal faults are present in the Mount Tuxford and Mount Veits area. These appear to follow prominent joint orientations and have resulted in mass–wasting of the Morrissey Formation, forming both topographic steps and landslide blocks. A large landslide block of Morrissey Formation occurs on Weary Ridge (see Sheet 4).

The rank of the coals has been determined petrographically by measuring the mean maximum vitrinite reflectance ($R_o$max) on grab samples. These values are plotted on the map. To convert reflectance values to ASTM rank equivalents use 1.12 per cent as the boundary between high–volatile and medium–volatile coals and 1.51 per cent as the boundary between medium–volatile and low–volatile rank. Coals of the Mist Mountain Formation vary in rank from low–volatile to high–volatile bituminous. The highest rank Mist Mountain Formation coals are found in the lower part of the formation on the east limb of the Alexander Creek syncline near Weary Creek. The lowest rank coals are exposed on the west limb of the Alexander Creek syncline near Bleasdell Creek, and on both limbs at the north end of the study area. Elk Formation coals are all of high–volatile bituminous rank in the study area. On Map Sheet 6 reflectance values on samples of the sparse coal exposures, believed to part of the Mist Mountain Formation, vary from 0.77 to 0.59 per cent, although the lower part of the formation is not represented.

We wish to thank the following people for their contributions to the study. Staff of Fording Coal Ltd., especially Ken Komenac and Roger Berdusco, permitted and arranged access to the southern part of the study area and provided many useful ideas. Kevin Switzer and Jim Ryley provided excellent field assistance. Joanne Schwemler carried out all petrographic reflectance analyses. Margot McMechan of the Geological Survey of Canada and Ward Kilby of the British Columbia Geological Survey Branch reviewed an earlier version of the map and provided helpful suggestions and comments.

REFERENCES

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BC Ministry of Energy, Mines and Petroleum Resources

BRITISH COLUMBIA GEOLOGICAL SURVEY

PRELIMINARY MAP 68

GEOLOGY OF THE ELK VALLEY COALFIELD NORTH HALF (HENRETTA CREEK TO ELK LAKES)

SHEET 6 OF 8

GEOLOGY BY ROBERT J. MORRIS AND DAVID A. GRIEVE

SCALE 1:10 000

0 200 400 600 800 1000

KILOMETRES KILOMETRES

This project is a contribution to the Canada/British Columbia Mineral Development Agreement 1985–1990.

SYMBOLS

MAP

Contact; defined, approximate, gradational

Coal seam trace; defined, approximate, individual outcrop, coal bloom or spoil

Trace of sandstone; defined, approximate, individual outcrop

Trace of conglomerate; defined, approximate, individual outcrop

Occurrence of sapropelic Elk coal — EC

Thrust fault (teeth indicate direction of dip); defined, approximate, assumed

Transverse fault (arrows indicate direction of movement); approximate

Boundary of landslide block

Bedding: upright, overturned, vertical, horizontal, tops unknown

Syncline, upright, overturned (arrow indicates direction of plunge); defined, approximate

Anticline (arrow indicates direction of plunge); defined, approximate

$\bar{R}_o$max (mean maximum vitrinite reflectance) value at this point — 1.42

Limit of interpretation

Location of measured section — A B

SECTIONS

Predominantly sandstone

Interbedded sandstone and siltstone

Predominantly siltstone and finer

Interbedded coal and shale

Predominantly coal

Covered interval

Thickness of coal seams (metres) — 5.1

Approximate position of Elk–Mist Mountain contact

Approximate position of Mist Mountain–Morrissey contact

$\bar{R}_o$max (mean maximum vitrinite reflectance) — 1.42

TABLE OF FORMATIONS

LOWER CRETACEOUS

Kc — CADOMIN FORMATION: Conglomerate

JURASSIC AND CRETACEOUS
KOOTENAY GROUP

JKe — ELK FORMATION: Sandstone, siltstone, shale, coal, minor conglomerate

JKmm — MIST MOUNTAIN FORMATION: Sandstone, siltstone, shale, coal, minor conglomerate

JKm — MORRISSEY FORMATION: Sandstone, minor shale and coal

JURASSIC

Jf — FERNIE FORMATION: Shale, interbedded sandstone in upper part

NOTES

Note 1 Most sandstones in the Elk Formation are omitted

Note 2 Poor exposure

Note 3 Small–scale deformation at this point

Note 4 Exposures of Triassic strata at this point

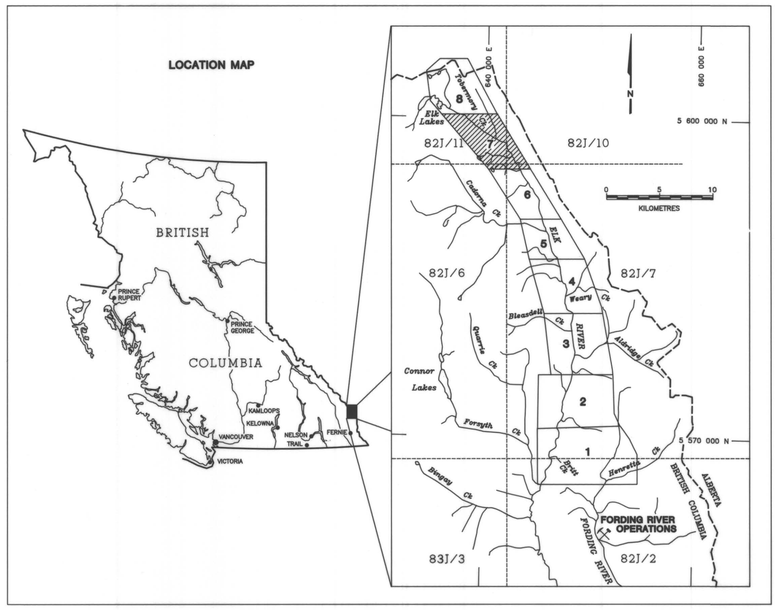
Note 5 Exposures of Pennsylvanian strata at this point

Note 6 Exposures of basal phosphorite of the Fernie Formation at this point

Note 7 Exposures of Mississippian or older limestone at this point

Cartography by P. Chicorelli

LOCATION MAP



SYMBOLS

MAP

- Contact; defined, approximate, gradational
- Coal seam trace; defined, approximate, individual outcrop, coal bloom or spoil
- Trace of sandstone; defined, approximate, individual outcrop
- Trace of conglomerate; defined, approximate, individual outcrop
- Occurrence of sapropelic Elk coal — EC
- Thrust fault (teeth indicate direction of dip); defined, approximate, assumed
- Transverse fault (arrows indicate direction of movement); approximate
- Boundary of landslide block
- Bedding: upright, overturned, vertical, horizontal,
- Syncline, upright, overturned (arrow indicates direction of plunge); defined, approximate
- Anticline (arrow indicates direction of plunge); defined, approximate
- $\bar{R}_o$max (mean maximum vitrinite reflectance) value at this point — 1.42
- Limit of interpretation
- Location of measured section — A ⊢ ⊣ B

SECTIONS

- Predominantly sandstone
- Interbedded sandstone and siltstone
- Predominantly siltstone and finer
- Interbedded coal and shale
- Predominantly coal
- Covered interval
- Thickness of coal seams (metres) — 5.1
- Approximate position of Elk–Mist Mountain contact
- Approximate position of Mist Mountain–Morrissey contact
- $\bar{R}_o$max (mean maximum vitrinite reflectance) — 1.42

TABLE OF FORMATIONS

LOWER CRETACEOUS

Kc CADOMIN FORMATION: Conglomerate

JURASSIC AND CRETACEOUS
KOOTENAY GROUP

JKe ELK FORMATION: Sandstone, siltstone, shale, coal, minor conglomerate

JKmm MIST MOUNTAIN FORMATION: Sandstone, siltstone, shale, coal, minor conglomerate

JKm MORRISSEY FORMATION: Sandstone, minor shale and coal

JURASSIC

Jf FERNIE FORMATION: Shale, interbedded sandstone in upper part

NOTES

Note 1 Most sandstones in the Elk Formation are omitted

Note 2 Poor exposure

Note 3 Small–scale deformation at this point

Note 4 Exposures of Triassic strata at this point

Note 5 Exposures of Pennsylvanian strata at this point

Note 6 Exposures of basal phosphorite of the Fernie Formation at this point

Note 7 Exposures of Mississippian or older limestone at this point

BC Ministry of Energy, Mines and Petroleum Resources

BRITISH COLUMBIA GEOLOGICAL SURVEY

PRELIMINARY MAP 68

GEOLOGY OF THE ELK VALLEY COALFIELD NORTH HALF (HENRETTA CREEK TO ELK LAKES)

SHEET 7 OF 8

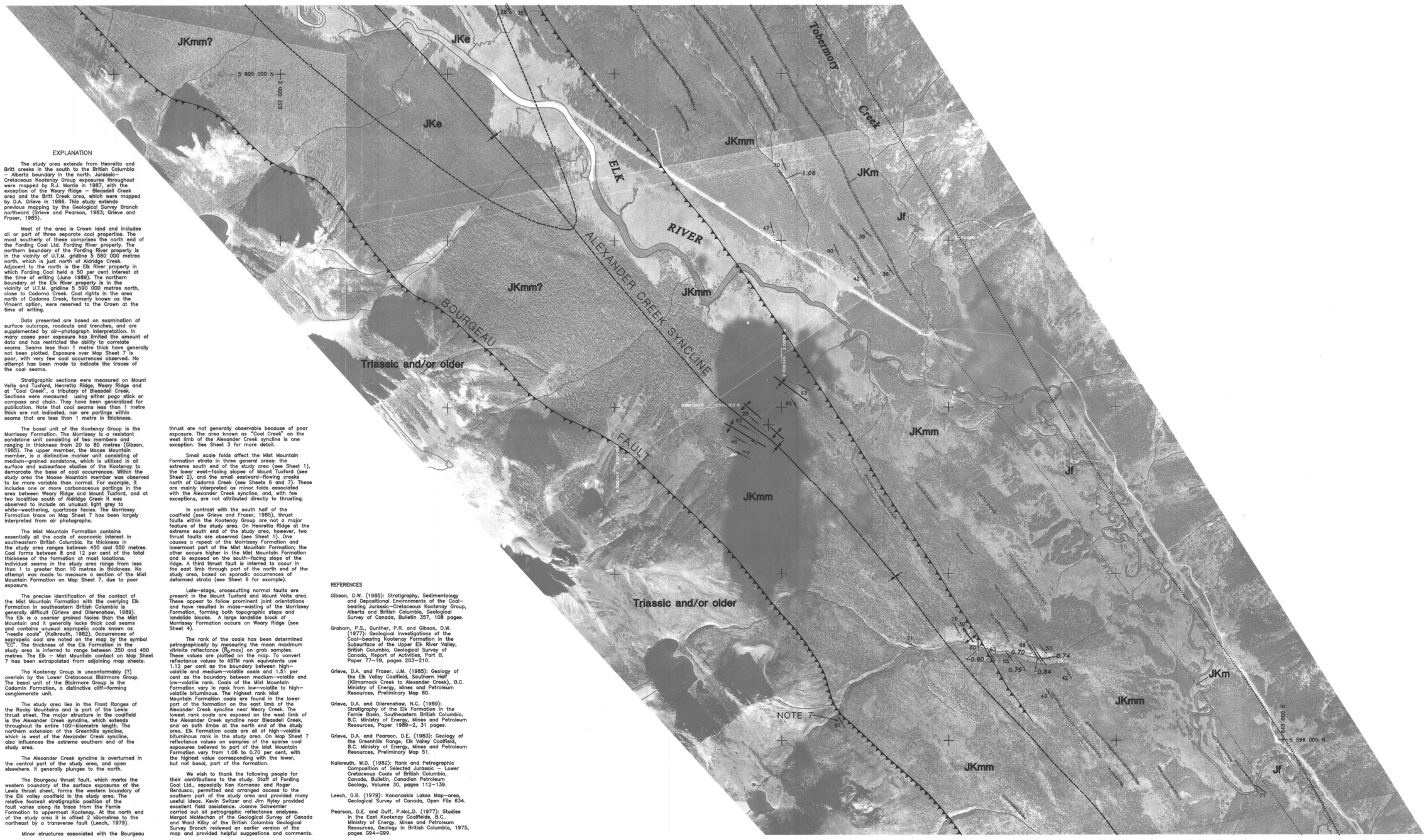
GEOLOGY BY
ROBERT J. MORRIS AND DAVID A. GRIEVE

SCALE 1:10 000

0 200 400 600 800 1000

KILOMETRES KILOMETRES

This project is a contribution to the Canada/British Columbia Mineral Development Agreement 1985–1990.



EXPLANATION

The study area extends from Henretta and Britt creeks in the south to the British Columbia – Alberta boundary in the north. Jurassic–Cretaceous Kootenay Group exposures throughout were mapped by R.J. Morris in 1987, with the exception of the Weary Ridge – Bleasdell Creek area and the Britt Creek area, which were mapped by D.A. Grieve in 1986. This study extends previous mapping by the Geological Survey Branch northward (Grieve and Pearson, 1983; Grieve and Fraser, 1985).

Most of the area is Crown land and includes all or part of three separate coal properties. The most southerly of these comprises the north end of the Fording Coal Ltd. Fording River property. The northern boundary of the Fording River property is in the vicinity of U.T.M. gridline 5 580 000 metres north, which is just north of Aldridge Creek. Adjacent to the north is the Elk River property in which Fording Coal held a 50 per cent interest at the time of writing (June 1989). The northern boundary of the Elk River property is in the vicinity of U.T.M. gridline 5 590 000 metres north, close to Cadorna Creek. Coal rights in the area north of Cadorna Creek, formerly known as the Vincent option, were reserved to the Crown at the time of writing.

Data presented are based on examination of surface outcrops, roadcuts and trenches, and are supplemented by air–photograph interpretation. In many cases poor exposure has limited the amount of data and has restricted the ability to correlate seams. Seams less than 1 metre thick have generally not been plotted. Exposure over Map Sheet 7 is poor, with very few coal occurrences observed. No attempt has been made to indicate the traces of the coal seams.

Stratigraphic sections were measured on Mount Veits and Tuxford, Henretta Ridge, Weary Ridge and at "Coal Creek", a tributary of Bleasdell Creek. Sections were measured using either pogo stick or compass and chain. They have been generalized for publication. Note that coal seams less than 1 metre thick are not indicated, nor are partings within seams that are less than 1 metre in thickness.

The basal unit of the Kootenay Group is the Morrissey Formation. The Morrissey is a resistant sandstone unit consisting of two members and ranging in thickness from 20 to 80 metres (Gibson, 1985). The upper member, the Moose Mountain member, is a distinctive marker unit consisting of medium–grained sandstone, which is utilized in all surface and subsurface studies of the Kootenay to demarcate the base of coal occurrences. Within the study area the Moose Mountain member was observed to be more variable than normal. For example, it includes one or more carbonaceous partings in the area between Weary Ridge and Mount Tuxford, and at two localities south of Aldridge Creek it was observed to include an unusual light grey to white–weathering, quartzose facies. The Morrissey Formation trace on Map Sheet 7 has been largely interpreted from air photographs.

The Mist Mountain Formation contains essentially all the coals of economic interest in southeastern British Columbia. Its thickness in the study area ranges between 450 and 550 metres. Coal forms between 8 and 12 per cent of the total thickness of the formation at most locations. Individual seams in the study area range from less than 1 to greater than 10 metres in thickness. No attempt was made to measure a section of the Mist Mountain Formation on Map Sheet 7, due to poor exposure.

The precise identification of the contact of the Mist Mountain Formation with the overlying Elk Formation in southeastern British Columbia is generally difficult (Grieve and Ollerenshaw, 1989). The Elk is a coarser grained facies than the Mist Mountain and it generally lacks thick coal seams and contains unusual sapropelic coals known as "needle coals" (Kalkreuth, 1982). Occurrences of sapropelic coal are noted on the map by the symbol "EC". The thickness of the Elk Formation in the study area is inferred to range between 350 and 450 metres. The Elk – Mist Mountain contact on Map Sheet 7 has been extrapolated from adjoining map sheets.

The Kootenay Group is unconformably (?) overlain by the Lower Cretaceous Blairmore Group. The basal unit of the Blairmore Group is the Cadomin Formation, a distinctive cliff–forming conglomerate unit.

The study area lies in the Front Ranges of the Rocky Mountains and is part of the Lewis thrust sheet. The major structure in the coalfield is the Alexander Creek syncline, which extends throughout its entire 100–kilometre length. The northern extension of the Greenhills syncline, which is west of the Alexander Creek syncline, also influences the extreme southern end of the study area.

The Alexander Creek syncline is overturned in the central part of the study area, and open elsewhere. It generally plunges to the north.

The Bourgeau thrust fault, which marks the western boundary of the surface exposures of the Lewis thrust sheet, forms the western boundary of the Elk valley coalfield in the study area. The relative footwall stratigraphic position of the fault varies along its trace from the Fernie Formation to uppermost Kootenay. At the north end of the study area it is offset 2 kilometres to the northeast by a transverse fault (Leech, 1979).

Minor structures associated with the Bourgeau thrust are not generally observable because of poor exposure. The area known as "Coal Creek" on the west limb of the Alexander Creek syncline is one exception. See Sheet 3 for more detail.

Small scale folds affect the Mist Mountain Formation strata in three general areas: the extreme south end of the study area (see Sheet 1), the lower west–facing slopes of Mount Tuxford (see Sheet 2), and the small eastward–flowing creeks north of Cadorna Creek (see Sheets 6 and 7). These are mainly interpreted as minor folds associated with the Alexander Creek syncline, and, with few exceptions, are not attributed directly to thrusting.

In contrast with the south half of the coalfield (see Grieve and Fraser, 1985), thrust faults within the Kootenay Group are not a major feature of the study area. On Henretta Ridge at the extreme south end of the study area, however, two thrust faults are observed (see Sheet 1). One causes a repeat of the Morrissey Formation and lowermost part of the Mist Mountain Formation; the other occurs higher in the Mist Mountain Formation and is exposed on the south–facing slope of the ridge. A third thrust fault is inferred to occur in the east limb through part of the north end of the study area, based on sporadic occurrences of deformed strata (see Sheet 6 for example).

Late–stage, crosscutting normal faults are present in the Mount Tuxford and Mount Veits area. These appear to follow prominent joint orientations and have resulted in mass–wasting of the Morrissey Formation, forming both topographic steps and landslide blocks. A large landslide block of Morrissey Formation occurs on Weary Ridge (see Sheet 4).

The rank of the coals has been determined petrographically by measuring the mean maximum vitrinite reflectance ($R_o$max) on grab samples. These values are plotted on the map. To convert reflectance values to ASTM rank equivalents use 1.12 per cent as the boundary between high–volatile and medium–volatile coals and 1.51 per cent as the boundary between medium–volatile and low–volatile rank. Coals of the Mist Mountain Formation vary in rank from low–volatile to high–volatile bituminous. The highest rank Mist Mountain Formation coals are found in the lower part of the formation on the east limb of the Alexander Creek syncline near Weary Creek. The lowest rank coals are exposed on the west limb of the Alexander Creek syncline near Bleasdell Creek, and on both limbs at the north end of the study area. Elk Formation coals are all of high–volatile bituminous rank in the study area. On Map Sheet 7 reflectance values on samples of the sparse coal exposures believed to part of the Mist Mountain Formation vary from 1.06 to 0.70 per cent, with the highest value corresponding with the lower, but not basal, part of the formation.

We wish to thank the following people for their contributions to the study. Staff of Fording Coal Ltd., especially Ken Komenac and Roger Berdusco, permitted and arranged access to the southern part of the study area and provided many useful ideas. Kevin Switzer and Jim Ryley provided excellent field assistance. Joanne Schwemler carried out all petrographic reflectance analyses. Margot McMechan of the Geological Survey of Canada and Ward Kilby of the British Columbia Geological Survey Branch reviewed an earlier version of the map and provided helpful suggestions and comments.

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Gibson, D.W. (1985): Stratigraphy, Sedimentology and Depositional Environments of the Coal–bearing Jurassic–Cretaceous Kootenay Group, Alberta and British Columbia, Geological Survey of Canada, Bulletin 357, 108 pages.

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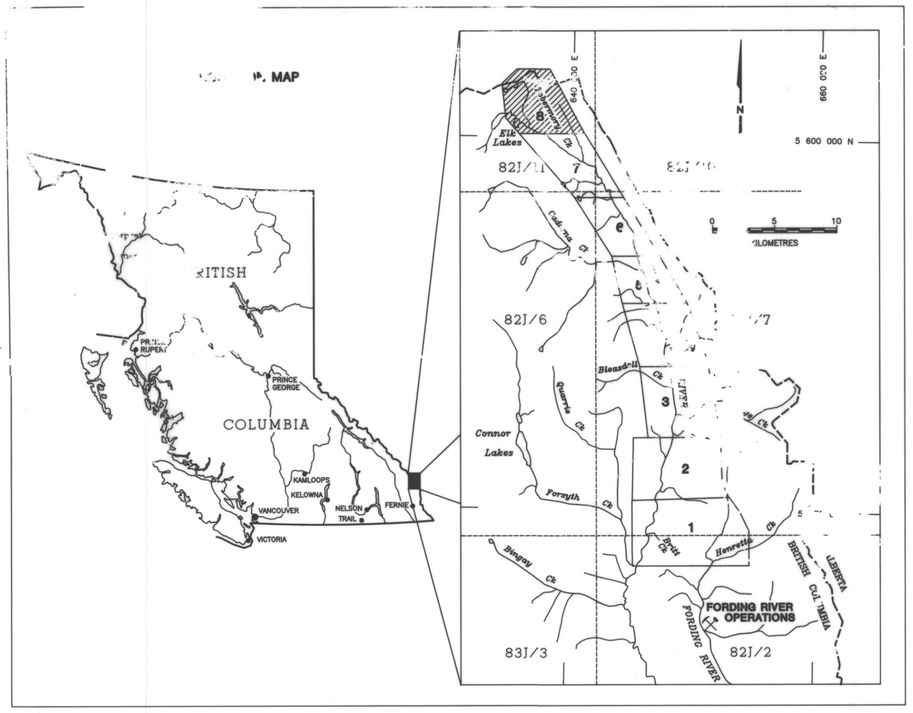
Cartography by P.Chicorelli



The study area extends from Henretta and Britt creeks in the south to the British Columbia – Alberta boundary in the north. Jurassic–Cretaceous Kootenay Group exposures throughout were mapped by R.J. Morris in 1987, with the exception of the Weary Ridge – Bleasdell Creek area and the Britt Creek area, which were mapped by D.A. Grieve in 1986. This study extends previous mapping by the Geological Survey Branch northward (Grieve and Pearson, 1983; Grieve and Fraser, 1985).

Most of the area is Crown land and includes all or part of three separate coal properties. The most southerly of these comprises the north end of the Fording Coal Ltd. Fording River property. The northern boundary of the Fording River property is in the vicinity of U.T.M. gridline 5 580 000 metres north, which is just north of Aldridge Creek. Adjacent to the north is the Elk River property in which Fording Coal held a 50 per cent interest at the time of writing (June 1989). The northern boundary of the Elk River property is in the vicinity of U.T.M. gridline 5 590 000 metres north, close to Cadorna Creek. Coal rights in the area north of Cadorna Creek, formerly known as the Vincent option, were reserved to the Crown at the time of writing.

Data presented are based on examination of surface outcrops, roadcuts and trenches, and are supplemented by air–photograph interpretation. In many cases poor exposure has limited the amount of data and has restricted the ability to correlate seams. Seams less than 1 metre thick have generally not been plotted. All of Map Sheet 8 has poor exposure, except for the main Elk valley access road and Elkan Creek. No attempt has been made to indicate coal seam traces.

Stratigraphic sections were measured on Mount Veits and Tuxford, Henretta Ridge, Weary Ridge and at "Coal Creek", a tributary of Bleasdell Creek. Sections were measured using either pogo stick or compass and chain. They have been generalized for publication. Note that coal seams less than 1 metre thick are not indicated, nor are partings within seams that are less than 1 metre in thickness.

The basal unit of the Kootenay Group is the Morrissey Formation. The Morrissey is a resistant sandstone unit consisting of two members and ranging in thickness from 20 to 80 metres (Gibson, 1985). The upper member, the Moose Mountain member, is a distinctive marker unit consisting of medium–grained sandstone, which is utilized in all surface and subsurface studies of the Kootenay to demarcate the base of coal occurrences. Within the study area the Moose Mountain member was observed to be more variable than normal. For example, it includes one or more carbonaceous partings in the area between Weary Ridge and Mount Tuxford, and at two localities south of Aldridge Creek it was observed to include an unusual light grey to white–weathering, quartzose facies. The trace of the Morrissey Formation on Map Sheet 8 has been plotted with a moderate degree of confidence on the east limb of the Alexander Creek syncline. The major sandstone horizon exposed west, and upsection, of the Morrissey Formation near Tobermory Creek has been interpreted as belonging to the Mist Mountain Formation. This is at variance with the interpretation of Graham et al. (1977) and Pearson and Duff (1977), who mapped it as a fault repeat of the Morrissey Formation. This unit is a less mature sandstone, however, containing more feldspar and lithic fragments than typical Morrissey Formation.

The Mist Mountain Formation contains essentially all the coals of economic interest in southeastern British Columbia. Its thickness in the study area ranges between 450 and 550 metres. Coal forms between 8 and 12 per cent of the total thickness of the formation at most locations. Individual seams in the study area range from less than 1 to greater than 10 metres in thickness. No attempt was made to measure a section of the Mist Mountain Formation on Map Sheet 8, due to poor exposure. Based on diamond drilling (Graham et al., 1977) the Mist Mountain Formation in this area is approximately 485 metres thick.

The precise identification of the contact of the Mist Mountain Formation with the overlying Elk Formation in southeastern British Columbia is generally difficult (Grieve and Ollerenshaw, 1989). The Elk is a coarser grained facies than the Mist Mountain and it generally lacks thick coal seams and contains unusual sapropelic coals known as "needle coals" (Kalkreuth, 1982). Occurrences of sapropelic coal are noted on the map by the symbol "EC". The thickness of the Elk Formation in the study area is inferred to range between 350 and 450 metres. The Elk Formation on Map Sheet 8 contains a series of thick conglomeratic units. The Elk – Mist Mountain contact has been interpreted using the presence of sapropelic coal ("EC") and conglomerate on the powerline access road.

The Kootenay Group is unconformably (?) overlain by the Lower Cretaceous Blairmore Group. The basal unit of the Blairmore Group is the Cadomin Formation, a distinctive cliff–forming conglomerate unit.

The study area lies in the Front Ranges of the Rocky Mountains and is part of the Lewis thrust sheet. The major structure in the coalfield is the Alexander Creek syncline, which extends throughout its entire 100–kilometre length. Map Sheet 8 covers the most northerly exposure of the Alexander Creek syncline in British Columbia. No exposures of strata on the west limb were observed, so the synclinal axis has been extrapolated from Sheet 7. The northern extension of the Greenhills syncline, which is west of the Alexander Creek syncline, also influences the extreme southern end of the study area.

The Alexander Creek syncline is overturned in the central part of the study area, and open elsewhere. It generally plunges to the north.

The Bourgeau thrust fault, which marks the western boundary of the surface exposures of the Lewis thrust sheet, forms the western boundary of the Elk valley coalfield in the study area. The relative footwall stratigraphic position of the fault varies along its trace from the Fernie Formation to uppermost Kootenay. At the north end of the study area it is offset 2 kilometres to the northeast by a transverse fault (Leech, 1979). Air–photograph analysis of this structure suggests a series of up to three faults, rather than one, produce the net offset. With no field evidence to support this interpretation only the single fault has been drawn.

Minor structures associated with the Bourgeau thrust are not generally observable because of poor exposure. The area known as "Coal Creek" on the west limb of the Alexander Creek syncline is one exception. See Sheet 3 for more detail.

Small scale folds affect the Mist Mountain Formation strata in three general areas: the extreme south end of the study area (see Sheet 1), the lower west–facing slopes of Mount Tuxford (see Sheet 2), and the small eastward–flowing creeks north of Cadorna Creek (see Sheets 6 and 7). These are mainly interpreted as minor folds associated with the Alexander Creek syncline, and, with few exceptions, are not attributed directly to thrusting.

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Late–stage, crosscutting normal faults are present in the Mount Tuxford and Mount Veits area. These appear to follow prominent joint orientations and have resulted in mass–wasting of the Morrissey Formation, forming both topographic steps and landslide blocks. A large landslide block of Morrissey Formation occurs on Weary Ridge (see Sheet 4).

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We wish to thank the following people for their contributions to the study. Staff of Fording Coal Ltd., especially Ken Komenac and Roger Berdusco, permitted and arranged access to the southern part of the study area and provided many useful ideas. Kevin Switzer and Jim Ryley provided excellent field assistance. Joanne Schwenker carried out all petrographic reflectance analyses. Margot McMechan of the Geological Survey of Canada and Ward Kilby of the British Columbia Geological Survey Branch reviewed an earlier version of the map and provided helpful suggestions and comments.

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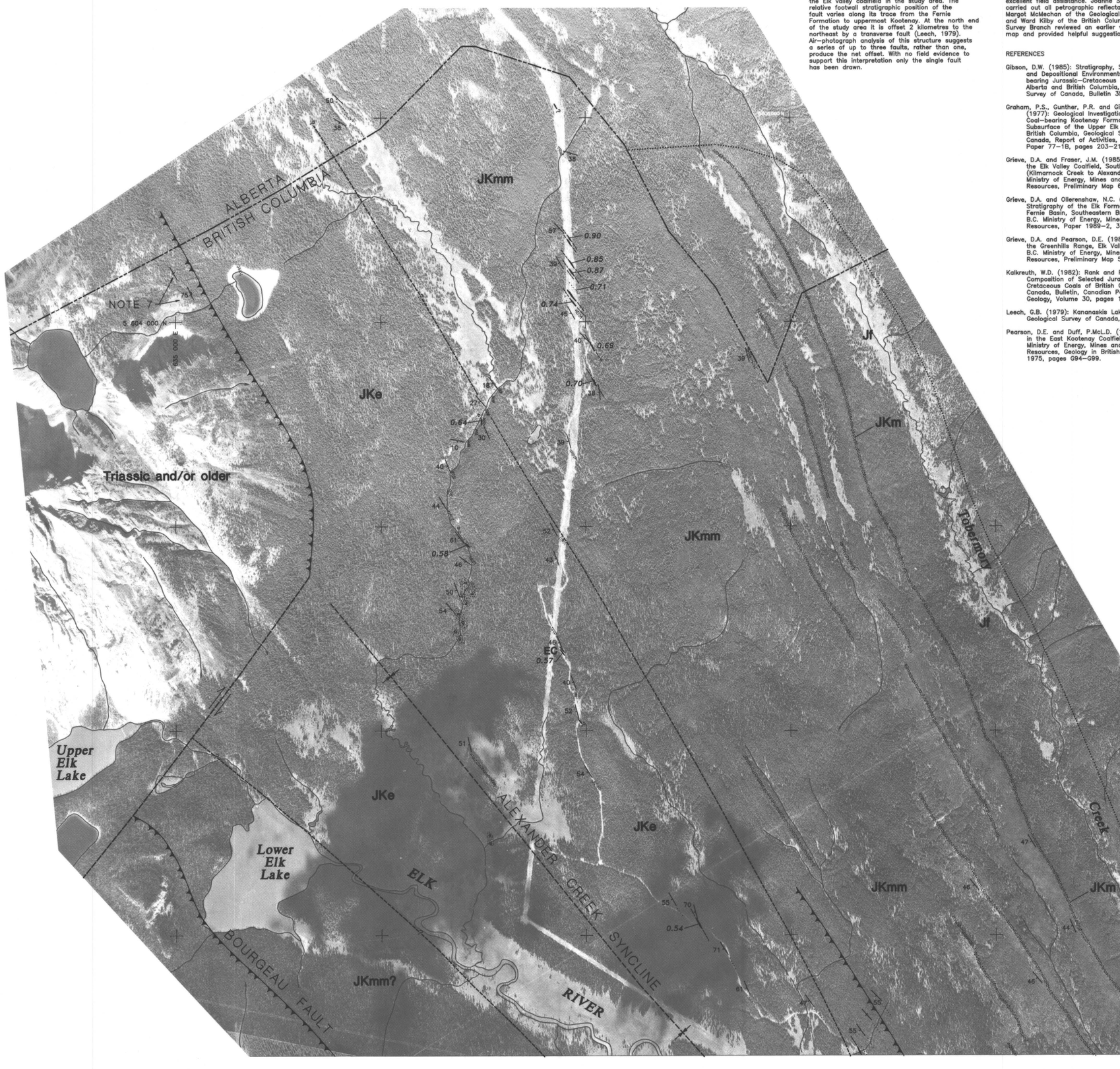

BC Ministry of Energy, Mines and Petroleum Resources

BRITISH COLUMBIA GEOLOGICAL SURVEY

PRELIMINARY MAP 68

GEOLOGY OF THE ELK VALLEY COALFIELD NORTH HALF (HENRETTA CREEK TO ELK LAKES)

SHEET 8 OF 8

GEOLOGY BY ROBERT J. MORRIS AND DAVID A. GRIEVE

SCALE 1:10 000

0 200 400 600 800 1000

KILOMETRES KILOMETRES

This project is a contribution to the Canada/British Columbia Mineral Development Agreement 1985–1990.

SYMBOLS

MAP

Contact; defined, approximate, gradational

Coal seam trace; defined, approximate, individual outcrop, coal bloom or spoil

Trace of sandstone; defined, approximate, individual outcrop

Trace of conglomerate; defined, approximate, individual outcrop

Occurrence of sapropelic Elk coal — EC

Thrust fault (teeth indicate direction of dip); defined, approximate, assumed

Transverse fault (arrows indicate direction of movement); approximate

Boundary of landslide block

Bedding: upright, overturned, vertical, horizontal

Syncline, upright, overturned (arrow indicates direction of plunge); defined, approximate

Anticline (arrow indicates direction of plunge); defined, approximate

$\bar{R}_o$max (mean maximum vitrinite reflectance) value at this point — 1.42

Limit of interpretation

Location of measured section — A B

SECTIONS

Predominantly sandstone

Interbedded sandstone and siltstone

Predominantly siltstone and finer

Interbedded coal and shale

Predominantly coal

Covered interval

Thickness of coal seams (metres) — 5.1

Approximate position of Elk–Mist Mountain contact

Approximate position of Mist Mountain–Morrissey contact

$\bar{R}_o$max (mean maximum vitrinite reflectance) — 1.42

TABLE OF FORMATIONS

LOWER CRETACEOUS

Kc CADOMIN FORMATION: Conglomerate

JURASSIC AND CRETACEOUS
KOOTENAY GROUP

JKe ELK FORMATION: Sandstone, siltstone, shale, coal, minor conglomerate

JKmm MIST MOUNTAIN FORMATION: Sandstone, siltstone, shale, coal, minor conglomerate

JKm MORRISSEY FORMATION: Sandstone, minor shale and coal

JURASSIC

Jf FERNIE FORMATION: Shale, interbedded sandstone in upper part

NOTES

Note 1 Most sandstones in the Elk Formation are omitted

Note 2 Poor exposure

Note 3 Small–scale deformation at this point

Note 4 Exposures of Triassic strata at this point

Note 5 Exposures of Pennsylvanian strata at this point

Note 6 Exposures of basal phosphorite of the Fernie Formation at this point

Note 7 Exposures of Mississippian or older limestone at this point

Cartography by P. Chicorelli