SOUTHEAST	
BRITISH COLUMBIA	
LODGEPOLE	
GEOLOGICAL REPORT	
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1981	
C.H. LANGILL	

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February 28, 1982

Ministry of Energy, Mines and Petroleum Resources Victoria, British Columbia

Dear Sirs:

Please find enclosed our 1981 report on the Lodgepole area coal licences. This report has been prepared by Ms. Cathy Langill, under the supervision of Mr. Brian McKinstry, both of whom are employed by Crows Nest Resources as geologists.

Ms. C. Langill, B.Sc., graduated in Geology from the University of Calgary in 1980. Prior to graduation Ms. Langill worked as an assistant for a coal exploration project in north-central British Columbia, and after graduation worked as a geologist for a major coal exploration company in Alberta. Ms. Langill has been employed by Crows Nest Resources Limited as a geologist since March, 1981.

Mr. B. McKinstry, M.Sc., graduated in Geology from Carleton University, Ottawa in 1971. Prior to graduation, Mr. McKinstry worked as an assistant for a major mining firm and after graduation as a geologist with a mining firm, a research assistant at Carleton University and as a geologist with a consulting firm. Mr. McKinstry has been employed by Crows Nest Resources Limited as a Senior Geologist since 1981.

This work was carried out under the over-all supervision of Mr. Frank Martonhegyi, our District Manager, British Columbia.

In my opinion, all of these personnel are fully qualified by training and experience to prepare this report and this account of work done under their direct supervision.

Yours very truly,

LOGICAL BRANCH SSMENE SPORT H. G. Rushton, P.Geol. OGICAL BRANCH Vice-President -A ploration Enc.

LODGERGPEN FILE PROJECT

KOOTENAY DISTRICT B.C.

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SUMMARY

The Lodgepole property is comprised of 13 B.C. Coal Licences (numbered 490 to 495 and 4729 to 4735) which are held under Group #245 and cover 2962 hectares of land. The Licences are held by Shell Canada Resources Limited and operated by its wholly owned subsidiary Crows Nest Resources Limited.

The property is located in southeastern British Columbia near the headwaters of the Flathead River. It is 32 km southeast of Fernie B.C. and approximately 1200 km by rail from Vancouver area coal ports.

Exploration work from 1975 to 1980 includes 16 continuous core (diamond) drill holes, 11 air-flush rotary drill holes, 4 adits, numerous back-hoe and hand trenches, photo grammetric mapping, location surveys, geological mapping and reclamation. Only supplementary reclamation and geological mapping was done in 1981.

Lodgepole licences cover part of the Fernie Basin Coalfield and include strata of the Jurrasic-Cretaceous age Kootenay Group which are exposed on the east limb of McEvoy Syncline. The coal-bearing Mist Mountain Formation of the Kootenay Group is exposed in a dip-slope situation on the west side of McLatchie Ridge. At this site the Mist Mountain averages 250 meters thick and the 8 major coal seams in it have an aggregate thickness of 34 meters. Seam 1, the lowest seam in the succession is 14 meters thick and accounts for 57% of the total coal reserves.

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Total geological in place reserves are calculated to be 81 million tonnes at an overburden ratio of 3.7:1 cubic meters waste per tonne of coal. In addition, other potential open pit and underground mine sites have been identified on the property. The coal is at the upper end of the low volatile bituminous rank and mostly of thermal grade.

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TABLE OF CONTENTS

PROFESSIONAL VERIFICATION OF THE REPORT (letter)

- i -

- ...

SUMMARY

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(

 $\left(\begin{array}{c} \end{array} \right)$

ii

iii

iv

1

4

4

8

10

15

18

20

24

25

28

40

LIST	OF FIG	URES
LIST	OF PHO	TOGRAPHS
LIST	OF ENC	LOSURES
1.0	INTRO	DUCTION
	1.1	LOCATION
	1.2	ACCESS
	1.3	PROPERTY DEFINITION (and Tenure Standing)
	1.4	WORK DONE PRIOR TO 1981
	1.5	WORK DONE IN 1981
	1.6	APPLICATION TO EXTEND TERM OF LICENCE (Cost Statement: types of work, licences covered)
2.0	GEOL O	GY
	2.1	REGIONAL GEOLOGY
	2.2	LODGEPOLE STRATIGRAPHY
	2.3	LODGEPOLE STRUCTURE
	2.4	ACCESS ROADS
	2.5	McLATCHIE RIDGE CLIFF FACE
3.0	BIBLI	OGRAPHY
2/CPa	a.1	

LIST OF FIGURES

Figure	1	Location Map	1:250,000	2
Figure	2	Licence Index Map	1:50,000	3
Figure	3	Access Map	1:50,000	5
Figure	4	Cliff Face Photograph Location Map	1:50,000	12
Figure	5	Regional Stratigraphy		19
Figure	6	Geological Compilation Map	1:50,000	21
Figure	7	Lodgepole Stratigraphic Columr	1:2,500	22

2/CPaa.5

 $\left(\right)$

(

 $\left(\right)$

PAGE

ر.

- 111 -

LIST OF PHOTOGRAPHS

		PAGE
Photo 1	View of McLatchie Ridge Cliff Face looking north from the southern portion of the cliff	13
Photo 2	Small scale thrust within a roadside exposure of Kootenay Group strata.	27
Photo 3	Seam 1 Coal Zone on Southern Part of McLatchie Ridge Cliff Face	29
Photo 4	Fold in the Strata of Unit 3, overlying Seam 1 Coal Zone on McLatchie Ridge Cliff Face	31

С.

 \mathbb{C}

(

LIST OF ENGLOSURES

Enclosure	1	Geological Traverse Map. North Sheet	1:2,000	Following	Text
Enclosure	2	Geological Traverse Map, South Sheet	1:2,000	Following	Text
Enclosure	3	Cliff Face Photograph with Geology	1:600	Following	Text

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1.0 INTRODUCTION

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1.1 Location

The Lodgepole property is in southeast British Columbia between latitudes 49° 18' and 49° 22' north, and longitudes 114° 13' and 114° 47' west. It is approximately 36 km north of the United States border, 14 km west of the Alberta border and 32 km southeast of Fernie, B.C. (see Figure 1: Location Map and Figure 2: Licence Index Map)

Located in the Front Ranges of the Rocky Mountains near the headwaters of the Flathead River, the Lodgepole property has a rugged topography with relief ranging from 1625 m in creek valleys to 2265 m on McLatchie Ridge.

The property is bounded on the northwest and north by the Flathead River, on the east by McLatchie Creek (a tributary of the Flathead) and on the southwest and south by Lodgepole Creek (which flows to the Wigwam and then to the Elk River). Foisey Creek flows north to the Flathead from the central portion of the property.





1.2 Access

The Lodgepole property is approximately 57 km by road from the nearest town, Fernie, B.C. It is reached by travelling 13 km south from Fernie on B.C. Highway No. 3 to the locality of Morrissey station; then east on the Lodgepole Forestry Road to kilometre 38.5. From this road junction one can follow a forestry access road northward approximately 7 km to the southern portion of the licence area. This road is shown on Figure 3: Access Map.

1.3 Property Definition

The Lodgepole property presently consists of thirteen B.C. Coal Licences held under Group #245. These licences cover an area of 2962 hectares of land and their boundaries are shown in Figure 2.

Licences 490 to 495 were issued to Crows Nest Industries Limited (CNI) of Fernie, B.C. in May, 1975 and were held under Group #104. In January 1976 these licences were assigned to CNI's wholly owned subsidiary The Crows Nest Pass Oil and Gas Co. Ltd. After the February 1978 acquisition of CNI by Shell Canada Resources Ltd. (SCRL) the licences were transferred to SCRL.

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Licences numbered 4729 to 4735 were acquired by SCRL in 1979 bringing the Lodgepole property to its present size. The entire thirteen licences are now held under Group #245. Crows Nest Resources Limited, SCRL's wholly owned subsidiary, has operated the licences since its its formation in 1978.

The property includes very significant volumes of low (the upper end) volatile bituminous coal, mostly of thermal grade. Eighty-one million tonnes of geological in place reserve has been delineated on the west slope of McLatchie Ridge. It is amenable for open pit mining due to low (3.7:1 cubic metres waste per tonne of coal) overburden ratio. Further open pit possibilities have also been identified. Even larger volumes of coal occur under heavier cover which may be mineable underground in the more distant future.

- 6 -



1.4 Work Done Prior to 1981

Geological work has been done at Lodgepole each year since 1975. The following is a brief summary of these efforts.

1975

- 7 hand trenches
- photogrammetric mapping at scale 1" = 1000' by Kenting
 Limited using existing photography

1976

23 hand trenches

1977

- 19 hand trenches, 1,000 potholes
- aerial photography and photogrammetric mapping at scales
 1:5000, and 1:10,000 by Burnette Resources Limited

1978

- 2 inclined continuous core (diamond) drill holes: 1,625 m
- 4.5 km of new exploration road
- aerial photography, ground control survey and photogrammetric mapping at scales 1:2000 and 1:5,000 by North West Surveys Corp. Ltd.

reclamation

1979

- I diamond drill hole: 166 m
- 6 air-flush rotary drill holes: 1,264 m
- 6.9 km of new exploration roads
- 29 roadside backhoe trenches: 255 m
- location survey (drillsites, outcrops, roads)
- geological mapping
- reclamation

1980

- 4 adits
- 13 diamond drill holes: 2,350 m
- 5 air-flush rotary drill holes: 279 m
- 4.37 km of new exploration roads
- 24 roadside backhoe trenches: 620 m
- location survey (drill sites, trenches, adits, roads)
- geological mapping
- reclamation

This work is outlined in the reports by Crabb (1976, 1977), Marsh (1978), Horachek and Fietz (1979), Cole (1980) and McKinstry (1981). These reports are all listed in the bibliography.

1.5 Work Done in 1981

The purpose of this year's work at Lodgepole was to do some of the geological mapping that could not be done during the previous exploration programs. In 1979 and 1980 the constraints of an active drilling and adit driving program hindered geological mapping.

Geological work consisted of two separate projects:

1 - to map at a scale of 1:2,000 the road cut exposures:

Since 1978, 16 kilometres of new roads have been cut to provide access to adit and drill sites. These exposures had been mapped only sporadically over the years. In 1981 therefore, a single mapping project was designed to cover the entire road network. Because this work was done when the roads were as much as three years old, the exposure was not as good as it had been during the original mapping. In those areas where the old and new mapping overlap, the attitude measurements will be more dependable on the original maps, and therefore little emphasis was placed on attitude measurements.

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The results of this mapping are shown on the Geological Traverse Map North and South sheets in Enclosures 1 and 2. These maps are discussed in Section 2.4: Geology - Access Roads.

2 - to examine one particularly good cliff-face exposure of the lower Kootenay Group on McLatchie Ridge.

The site, (shown on the location map Figure 4) may provide a "window" to the local geology. The area is steep and almost vegetation-free (see Photograph 1) and a nearly complete section from the basal sandstone to Seam 3 is exposed. The results of mapping this site are shown in Enclosure 3: The Cliff Face Photograph.

The steep terrain did impede mobility on the cliff, but each map unit was traversed at least once. Where the faults could not be mapped by direct traverse, they were checked by viewing from a number of different angles. Thus, even though it is possible for a photograph to show an illusion of faulted blocks (created by erosion on an exposure that is sub-parallel to strike), the faults shown on Enclosure 3 have each been verified.

- 11 -

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CROWS NEST RESOURCES LIMITED (Exploration)

B.C. COAL LICENCESBLOCK:LODGEPOLEPROJECT:YEAR:1981 - 82TENURE STANDINGGROUP:245LODGEPOLEDATE:FEBRUARY 1982

[LICENCE		AC	Q/ADM	REN	TALS		6	EQUIRE	MENT	WORK		BU	DGET	EXP	POTL	
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Photo #1 A view of McLatchie Ridge Cliff Face looking north from the southern portion of the cliff

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1.6 Application to Extend Term of Licence

(Cost Statement: types of work, licences covered)

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The geology section of this report is brief because it is meant only to provide background to these two mapping projects. More full descriptions of Lodgepole geology are available in previous reports (McKinstry, 1981; Cole, 1980).

As well as these two geological projects, work this summer at Lodgepole included the following:

new air photographs:

black and white at approximately 1:40,000 produced by Geographic Air Surveys Ltd. of Edmonton.

- an orthophoto:

produced by the Orthophoto Shop Ltd., Calgary, covering the area shown on the Geological Traverse Map, North and South sheets. (Enclosures 1 & 2)

- corrections to the 1979 topographic map:

the Orthophoto Shop Ltd., Calgary was contracted to correct the contour errors on the Lodgepole base map (only that area shown in Enclosures 1 & 2).

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Province of British Columbia Ministry of Energy, Mines and Petroleum Resources

APPLICATION TO EXTEND TERM OF LICENCE

I, Leslie Gramantik	agent for _ Shell Car	ada Resources Limited
P.O. Box 100 (Address)	Calç	(Address)
Alberta		2H5 244642
bereby apply to the Minister to extend	the term of Coal Licence(s) No(s)490	1-495, 4729-4735
13 Coal Licences, Gro	up #245, 2962 Hectares	
for a further period of one year.		
2. Property name Lodgepole,	Kootenay Land District	
3. I am allowing the following Coal Licen	ce(s) No(s), to forfeit	
4. I have performed, or caused to be perfo	ormed, during the period	ruary. 27th 1981
February 28th		at least \$ 63,319.00
on the location of coal licence(s) as fol	lows:	
CATEGORY OF WORK		
	Licence(s) No(s).	Apportioned Cost
Geological mapping	-	•
Surveys: Geophysical	••••••	
Geochemicat		
Other		
Road construction		
Surface work		
Underground work	••••••••••••••••••••••••••••••••••••••	••••••••••••••••••••••••••••••••••••••
Drilling		
Logging, sampling, and testing	A0G_A03 A730 A731	18 635
Reclamation	tos 490-495, 4729-4735	2.528
Other work (specify)		
Off-property costs Geolog	ical Reports	490-495
5. I wish to apply \$	of this value of work on Coal Licence(s) No(s)
6. I wish to pay cash in lieu of work in th	e amount of \$	on Cost Licence(s) No(s).
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7. The work performed on the location(s) is detailed in the attached report entitle	d
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Assistant Landman

(FORMS AND REPORT TO BE SUBMITTED IN DUPLICATE)

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*A full explanation of other work is to be included.

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2.1 Regional Geology

The coal on the Lodgepole property is part of a prograding delta sequence of Jurassic-Cretaceous age. A typical stratigraphic column for the region (after Gibson, 1981) is presented in Figure 5. Coal is found in the Mist Mountain Formation with only minor occurrences in the overlying Elk Formation and in the Moose Mountain Member of the Morrissey Formation. These three formations comprise the Kootenay Group.

The Kootenay Group conformably overlies the durassic age marine siltstones and shales of the Fernie Formation and is overlain by the Cretaceous age fluvial conglomerates and conglomeratic sandstones of the Cadomin Formation (Blairmore Group). The Kootenay Group forms a westward thickening wedge of sediments with a source to the southwest and south and a paleo-shoreline to the northeast.

The combined effects of the Columbian (Jurassic-Cretaceous) and Laramide (Cretaceous-Tertiary) orogenies produced tremendous compression and shortening of the basin sediments resulting in thrust faults, folds and some later extensional normal faults. These structures and the subsequent erosion of the area produced north-south trending zones of Kootenay outcrop between the high-relief Paleozoic mountain ranges.



GEOLOGICAL LEGEND

CRETACEOUS

Bisimore Group

(KPI)

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JURASSIC - CRETACEOUS

Kootenary Group

Elk Formation

Mist Mountain Formation

Morrisony Formation

Moose Mountain Member Weary Ridge Member

JURASSIC

Famile Formation

TRIASSIC

Spray River Group

PENNSYLVANIAN

Rocky Mountain Formation

MISSISSIPPIAN

Rundle Group and Banff Formation

geological contact

thrust fault (teeth on up thrust side)

Normal Pault

Axial Trace: Synchine,



The local geology is summarized in Figure 6: Geological Compilation Map and the stratigraphy at Lodgepole is summarized in Figure 7: Typical Stratigraphic Column.

The Kootenay Group (Gibson, 1979) is present throughout most of the Lodgepole property with an average thickness of 500 m. The underlying Fernie Formation is exposed on the east slopes of McLatchie Ridge and the overlying Cadomin Formation outcrops along Foisey Ridge (on the boundary between licences CL 4731 and CL 492).

Morrissey Formation

This basal unit of the Kootenay is a massive, cliff-forming, coarsening upward 100 m thick sequence of sandstone with occasional mudstone, siltstone and coal which abruptly and conformably overlies the Fernie Formation. Gibson's 1979 nomenclature divides this formation into an upper Moose Mountain and a lower Weary Ridge Member. The Moose Mountain Member is composed of medium to coarse grained, grey, massive, cliff-forming sandstone and was referred to by the same name in previous reports. Medium grained, grey, orange-weathering sandstone interbedded with mudstone and siltstone comprises the Weary Ridge Member. Previous nomenclatures include this unit as "Passage Beds" in the Fernie Formation. These sediments are thought to

REGIONAL STRATIGRAPHY



Nomenclature of the Koolenay Group, and its relationship to previous terminology (from Gibson, 1981)

FIGURE 5

LODGEPOLE





represent a pro-delta environment in a rapidly prograding sequence.

Mist Mountain Formation

Previous nomenclatures referred to this unit as the "Coal Bearing Member" as coal comprises more than 10% of this unit including all seams of economic importance. Siltstone, sandstone, mudstone and conglomerate comprise the rest of the 250 m sequence representing the sub-aerial portion of a delta and it's floodplains.

The Elk Formation

The youngest formation of the Kootenay is a 150 m thick non-marine sequence of interbedded sandstone, siltstone, mudstone, conglomerate and thin coal seams. The Elk has an interfingering contact with the underlying Mist Mountain and an abrupt, possibly unconformable contact with the overlying Cadomin Formation of the Blairmore Group. It is thought to represent deposition in the proximal part of a flood plain and distal parts of alluvial fans.

Coal Stratigraphy

The coal at Lodgepole lies mostly within the Mist Mountain Formation. Drilling records (summarized by McKinstry, 1981) show nine correlatable coal seams, eight of which are more than one

2/CPaa.30

meter thick. There is a total aggregate coal thickness of 23 meters within the 250 m Mist Mountain. The two thickest seams are near the base of the formation: Seam 1 is 14 m and Seam 2 is 6.5 m thick. In addition, the Morrissey Formation contains one 4.5 m thick coal and shale "marker" 50 to 80 m below the Mist Mountain contact and the Elk Formation (in the north part of Lodgepole) contains four thin seams totalling 5 m of shaley coal.

2.3 Lodgepole Structure

The Lodgepole property is located in the Front Ranges of the Rocky Mountains within the Lewis thrust sheet. It is in the southeastern part of the Fernie Basin which is a doubly plunging syclinorium with strata of Fernie, Kootenay, Blairmore and younger rocks.

A secondary feature of this Basin is the McEvoy syncline, a north-south trending structure with its axis running through the western licences of the Lodgepole property. In the area west of McLatchie Ridge the strata dip into the hinge of McEvoy syncline at 24° to the west-northwest (305°).

Normal faults bound the north and south extent of Kootenay strata in the vicinity of Lodgepole. To the north lies the Flathead normal fault, (a major structural feature that can be traced for 150 km south of Lodgepole) and to the south of the property is the Harvey Creek normal fault which has a stratigraphic separation of 330 m (Price, 1965). These, and similar structures shown in Figure 4 (the Geologic Compilation Map) separate Jurassic-Cretaceous Kootenay strata from Paleozoic carbonates.

Smaller scale faulting and associated deformation is discussed in section 3.4 below, and also has been indicated by previous mapping and drilling programs (Cole 1980, McKinstry 1981).

2.4 Access Roads

Enclosures 1 & 2: Geology Traverse Map (Access Road) show a highly variable stratigraphic section of sandstone, siltstone, claystone, coal and conglomerate dipping at an average $20 - 30^{\circ}$ to the west northwest. The rocks are exposed in the road cuts made during construction of the 1978-80 drill site access roads. The section is interpreted as being entirely within the Kootenay Group (using the stratigraphic nomenclature of Gibson, 1979).

The oldest strata mapped are exposed on the south-eastern road and consist of massive, resistant, medium to coarse grained grey sandstones. These are interpreted as being part of the Moose Mountain Member of the Morrissey Formation. The underlying Weary Ridge Member is not exposed on the access roads. Overlying the Moose Mountain sandstone is the succession of sandstone, siltstone, claystone and abundant coal seams of the Mist Mountain Formation. This unit comprises most of the outcrop shown in the Geology Traverse Map.

The abundance of coal within the Mist Mountain is obvious, but the true thickness of individual outcrops is difficult to determine due to the slumping of road bank exposures. Correlation of coal seams and of other lithologic units is hindered by the highly interbedded nature of the strata, the slumping and the incomplete road cut exposures. These correlations can be done at some future date though, with the proper integration of the surface data provided in the Geology Traverse Map with the drill hole data of previous years.

The Mist Mountain outcrops also show some anomalous attitude measurements. These are probably results of small scale folds and faults but such structures could not be mapped with confidence. An example of a small scale thrust fault is shown in Photograph 2.

Previous exploration showed that the Mist Mountain Formation in this area is overlain by the Elk Formation of interbedded sandstone and siltstone with only minor coal occurrences (McKinstry, 1980). If so, this contact probably exists in the last few tens of meters of the road to drill sites LP-D-303 and LP-D-306. On the most northerly access road a considerable section of the Elk formation probably is present north of, and



Photograph #2

Small scale thrust fault within Kootenay strata. This exposure (2 m. wide) is located at the switchback on the southern access road. stratigraphically above, the two coal outcrops on this road. The base of the Elk Formation then, would be at the hard grey sandstone north of the two coal outcrops.

The contact of the Elk Formation with the overlying Blairmore rocks is indicated by the presence of a very resistant band of conglomerate and sandstone immediately above the northern road (as it crosses over the crest of McLatchie Ridge) These massive rocks were previously mapped as Cadomin Formation (McKinstry, 1980).

The outcrop shown on the Geology Traverse Map then, is interpreted to be of the Kootenay Group. Further correlation of units within the Kootenay Group and more detailed analysis of the local structure await proper intergration of this information with sub-surface bore hole data.

2.5 McLatchie Ridge Cliff Face

The results of mapping of the south McLatchie Ridge cliff face are presented here in Enclosure 3: Cliff Face Photograph. It shows very massive resistant beds of sandstone (Units 1 and 2) overlain by a slightly less resistant, thick sequence of interbedded sandstone, siltstone, claystone and coal.

A closer view of the Seam 1 coal zone is shown in Photograph 3. Due to the steep terrain, this zone could not be traversed from the south past the point at which the coal pinches out and only a



Photograph #3

McLatchie Ridge Cliff Face, southern portion, showing the seam 1 coal zone, Unit 3 above and Unit 2 below. small thickness (2-3 m) of the zone remains. The reason for this pinch-out is not clear, but it occurs near the meeting point of two faults.

In many places across the face this fairly simple stratigraphy is disrupted by faults, the most obvious of which are the high angle normal faults traced in black on the Cliff Face Photograph. Displacement on these faults may vary up to a few tens of meters but there is also an abundance of smaller-scale features. These are located within Unit 3 (the sandstone above the Seam 1 coal zone) and consist of low angle normal and reverse faults as well as the 5 m amplitude fold pair shown in Photograph 4.

Normal faultiny within the lower part of the section (i.e. below Seam 1) has produced a series of horst and graben-like blocks. The upper part of the section though, is cut by only one north-dipping fault and a few south-dipping sub-parallel normal faults.

The most significant aspect of this pattern is that faults appear in two sets (one set in the upper and one in the lower portion of the face) and neither penetrates through the seam 1 coal zone and Unit 3 (with the possible exception of the fault on the the far north side of the cliff). This observation, and the evidence of abundant deformation within Unit 3, suggests the possibility of a low angle fault of considerable displacement running almost

2/CPaa.37



Photograph #4

A small fold in Unit 3 above the seam 1 coal zone on McLatchie Ridge Coal Face.

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parallel to stratigraphy near the contact between these two strata. This fault is probably normal in sense, as suggested by the lack of stratigraphic repetition in the cruz, and the possible loss of section from south to north (left to right) within this 3. Such a structure would certainly influence mine planeing for the area.

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KEY TO ENCLOSURE 3 CLIFF FACE PHOTOGRAPH

UHIT 1

sandstane

fine to medium grained, light grey, salt and pepper textured, thick bedded with trough cross beds, and plant fragments: weathers to rust brown

Marker

claystone, siltstone

Interbedded with minor sandstone; claystone can be concretionary weathering to rusty brown or shaley and dark grey weathering to grey; siltstone is dark to medium grey and laminated

Unit 2

sandstone

medium grained, medium grey, salt and pepper textured, vague laminations, minor concretionary bands, weathers rust brown or dark grey; abundant plant fragments, tree and root casts, minor interbeds of fine grained sandstone and siltstone

Sean 1

claystone, siltstone, coal

claystone and siltstone are dark grey to black. laminated, flaggy, weathering recessively to dark grey and have minor interbeds of fine grained orange weathering sandstone. These are overlain by a sean of crumbled to flakey coal, about 5 to 8 m thick across most parts of the cliff-face

Unit 3

sandstone

fine to medium grained, light grey with laminations of dark grey or rusty brown siltstone, weathering to buff yellow; fining upwards. [Especially on the southern portion of the cliff-face, this unit displays tectonic structures such as numerous low and high angle normal faults and a 5 m amplitude fold pair.]

Unit 4

conglumerate, landstone

a 4 m thick band of grey weathering chert and quartz pebble conglomerate with sub-rounded clasts, up to 2 cm and some sandstone interbeds is overlain by sandstone. This sandstone is medium grained, medium grey, thinly bedded and weathers to rusty brown

Sean 2

claystone, coal

coal is weathered and crumbly, interbedded with claystone. The seam is medium grey to black, laminated, silty and poorly exposed.

Unit 5

sandstone

very fine to fine grained, medium to dark grey, finely bedded (but massive in top 3 m) hard and rusty-brown weathering

Seam 3

siltstone, coal

siltstone: medium to dark grey, clayrich, laminated with claystone bands. It is overlain by 3 m of coal: flakey and weathered.

Unit 6

sandstone

fine grained, medium grey-brown, with siltstone laminations, buff weathering. The unit contains one band, approximately 2 m thick of dark grey to black. claystone, possibly with some coal.

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