COAL RESOURCE DATA IN THE PLAINS AREA OF ALBERTA (DISKETTE AND MAP)

G.B. Mandryk and R.J.H. Richardson

Open File Report 1988-07

Alberta Research Council
Alberta Geological Survey

To obtain copies of this report or any other Alberta Research Council publications, please contact the Publication Sales Office.

Publication Sales Office
Alberta Research Council
250 Karl Clark Road
Edmonton, Alberta
(403) 450-5390

Alberta Geological Survey
4445 Calgary Trail South
Terrace Plaza, 7th Floor
Edmonton, Alberta
(403) 438-7676
(403) 438-7555

Mailing address:
Alberta Research Council
P.O. Box 8330, Station F
Edmonton, Alberta
T6H 5X2

LICENCE AGREEMENT

The data files contained on the enclosed diskette and the written material attached thereto are a result of work jointly funded by the Government of Alberta, Department of Energy and Natural Resources, the Office of Coal Research and Technology, the Alberta Research Council ("ARC") and other agencies, departments and organizations (collectively referred to as the "Funding Organizations").

BY OPENING THIS PACKAGE YOU ARE AGREEING TO BECOME BOUND BY THE TERMS AND CONDITIONS OF THIS AGREEMENT. IF YOU DO NOT AGREE TO THE TERMS AND CONDITIONS OF THIS AGREEMENT, DO NOT OPEN THIS PACKAGE, RETURN THE ENVELOPE TO THE ARC, P.O. Box 8330, Postal Station F, Edmonton, Alberta, Canada, T6H 5X2.

1. GRANT OF LICENCE - The ARC as Licensor grants to you as Licencee a non-exclusive right to use and display the data files contained on the enclosed diskette ("Data") on a single computer at a single location. If the single computer on which you use the Data is a multi-user system, this Licence includes all users on that single system. The ARC reserves all rights not expressly granted to you by this licence.

2. OWNERSHIP OF DATA - As Licencee, you own the magnetic or other physical media on which the Data is originally or subsequently recorded or fixed, but the ARC retains title and ownership of the Data recorded on the original diskette and all subsequent copies of the Data, regardless of the form or media in or on which the original and other copies may exist. This Licence is not a sale of the original Data or any copy thereof.

3. COPY RESTRICTIONS - The Data and the accompanying written materials are copyrighted. You shall not copy by any process all or any part of the Data or written materials without the prior written consent of the Licencor.

4. USE RESTRICTIONS - As Licencee, you may physically transfer the Data from one computer to another provided that the Data is used only on one computer at a time. You may electronically transfer the Data from one computer to another over a network. You shall not distribute copies of the Data or the accompanying written materials to others.

5. TRANSFER RESTRICTIONS - This Data is licenced only to you, the Licencee and shall not be transferred to anyone without the prior written consent of the ARC. Any authorized transferee of the Data shall be bound by the terms and conditions of this Agreement. In no event shall you transfer, assign, rent, lease, sell or otherwise dispose of the Data on a temporary or permanent basis except as expressly provided herein.

6. TERMINATION - This Licence is effective until terminated. This Licence will terminate automatically without notice from the ARC if you fail to comply with any provision of this Licence. Upon termination you shall destroy the written materials and all copies of the Data you have in your possession.

7. GOVERNING LAW - This Agreement is governed by the laws of the Province of Alberta.

8. NO WARRANTY - The Funding Organizations, their employees and directors make no warranty, guarantee, representation, expressed or implied or assume any legal liability:

a. Regarding the correctness, accuracy, completeness, reliability, usefulness or fitness for purpose of any information, apparatus, product or process disclosed in the Data;

b. Regarding the costs incurred by you for the conversion, installation, or improvement of the Data;

c. That the information contained in the Data will not infringe any patent, copyright, trade secret or any other proprietary or intellectual property right of any person.

9. NO ENDORSEMENT - Any reference made in the data to any specific commercial product, process or service by trade name, trade mark, manufacturer or otherwise, does not constitute or imply the endorsement, recommendation or favouring by the Funding Organizations.

10. ACKNOWLEDGMENT - You the end user, shall acknowledge the Funding Organizations in verbal or written reports, papers, maps or interpretations based on the data.

DATA DESCRIPTION REPORT

This report accompanies two Alberta Geological Survey Coal Geology ASCII data files, GEOL.AGS and QUAL1.AGS.

DATA INTRODUCTION

This diskette contains coal geology data produced by the Alberta Geological Survey during an evaluation of the coal resources of the plains region of Alberta, as reported in Nurkowski (1985), Macdonald et al. (1987), McCabe et al. (1988), Richardson et al. (1988) and Strobl et al. (1987). The reports cited are based on subsets of this data file.

These studies evaluated the coal resources over a large portion of the plains region of Alberta from the outcrop edge of the Scollard and Horseshoe Canyon Formations, and Belly River Group to a depth of approximately 400 m, see enclosed map (Richardson and Mandryk 1987).

LOADING DATA FROM DISKETTE TO YOUR MICROCOMPUTER

The following contains the instructions which must be followed to dearchive the data from the diskette onto your computer's hard disk. To save space the data was compressed using PKARC compression software from PKWARE. In order to use the data it must be decompressed first; this is made possible by providing the decompression software in executable form with the data diskette.

- make sure the c: drive has at least 2.5 MBytes free space and a subdirectory called AGS does not exist
- place the diskette in the a: drive
- at the DOS c: prompt, type...

  a:AGS

- strike enter

- a subdirectory called \AGS was just created and the following files were just added to c:\AGS

  REPORT.TXT
  GEOL.AGS
  QUAL1.AGS

DATA DESCRIPTION

Two kinds of data are present in two main files.

File: GEOL.AGS

This file contains picks of geological boundaries, such as formation boundaries, coal seams, and sand units. The picks are depth to a boundary as measured off of a geophysical well log. The maps and cross sections in (Macdonald et al. 1987, Macdonald et al. 1986, McCabe et al. 1988, McCabe et al. 1986, Richardson et al. 1988, Richardson et al. 1986) are based on this data.

Strobl et al. (1987) discuss the criteria used to determine the lithologic boundaries, in particular coal, using geophysical logs. A very brief summary of data collection methods used in the plains coal evaluation studies will be presented based on Strobl et al. (1987)

Geophysical logs were examined from mainly oil and gas wells (4569 wells), supplemented by shallow coal holes (556 holes) drilled by the Alberta Research Council. Coals were identified using sonic, natural gamma ray, and normal resistivity logs. Coal picks, as recorded on the data diskette, were made on the inflection point of the gamma ray log for oil and gas wells and on the inflection point of the sonic curve in the case of Alberta Research Council holes. Because of differences in bed resolution between the deeper oil and gas geophysical well logs and the shallower Alberta Research Council logs coal picks made on the gamma trace of oil and gas wells were found to be more accurate than the density trace. Information derived from oil and gas wells have a SITID less than 150000, or are equal to 999998. Alberta Research Council holes have a SITID of 999999.

Coal seams less than 0.5 m were ignored as were partings less than 0.5 m thick. An exception to this are coals from the Belly River study where coals thinner than 0.5 m were picked. Depending on the log scale, picks were estimated to the nearest 0.33 m or 1 foot.

Summary statistics of the geology file, GEOL.AGS

Number of holes drilled by Alberta Research Council:	556
Number of oil and gas holes:	4569
Total number of holes:	5125
Number of coal seam picks:	24976
Number of Battle formation picks:	1612
Number of marker horizon picks:	8770
Number of sand picks:	14213
Number of gas-bearing sands picked:	38
Total number of picks:	49609
Holes that intersect only Ardley coal zone (A):	1698
Holes that intersect only Horseshoe Canyon coal zone(HSC):	1115

Holes that intersect only Belly River Group coal zones(BR):	2153
Holes that intersect all three coal-bearing units:	0
Holes that intersect A and HSC:	3
Holes that intersect A and BR:	0
Holes that intersect HSC and BR:	156
Total number of holes in Ardley coal zone with at least one coal seam thicker than 1.99 m:	1064
Total number of holes in Horseshoe Canyon coal zones with at least one coal seam thicker than 1.99 m:	457
Total number of holes in Belly River coal zones with at least one coal seam thicker than 1.99 m:	47
Average number of seams per hole:	4.9
Average number of Ardley seams per exclusively Ardley hole:	5.5
Average number of Horseshoe Canyon seams per exclusively Horseshoe Canyon hole:	9.0
Average number of Belly River seams per exclusively Belly River hole:	2.6
Average number of Battle formation picks per hole:	0.3
Average number of marker picks per hole:	1.7
Average number of sand picks per hole:	2.8

File: QUAL1.AGS

This file contains coal quality data. That is, laboratory analyses of coal-cores and -cuttings from Alberta Research Council drillholes. Most of this quality data is also listed in Nurkowski (1985). Note that the file QUAL1.AGS has duplicate or replicate entries for some intervals where the sample was split and analyzed twice.

Summary statistics of the coal quality file, QUAL1.AGS

Number of holes with quality data from Scollard fm:	75
Number of holes with quality data from HSC fm:	86
Number of holes with quality data from Wapiti Group:	22
Number of holes with quality data from BR Group:	19
Number of holes with quality data from unknown units:	3
Total number of holes with quality data:	205
Number of unique quality samples from Scollard fm:	293
Number of unique quality samples from HSC fm:	310
Number of unique quality samples from Wapiti Group:	48
Number of unique quality samples from BR Group:	35
Number of unique quality samples from unknown units:	4
Total number of unique quality samples:	690
Number of replicate samples:	47
Total number of quality samples:	737

Average number of unique quality samples per coal bearing geologic unit:

Scollard fm:	3.9 samples per Scollard hole
HSC fm:	3.6 samples per HSC hole
Wapiti Gp:	2.2 samples per Wapiti hole
Belly R. Gp:	1.8 samples per Belly River Gp hole

DATA FORMAT

The following lists the format of the data elements found in the two files (GEOL.AGS and QUAL1.AGS). The locations of the various studies and sub-study areas can be found in Macdonald et al. (1987), McCabe et al. (1988), Richardson et al. (1988). All depths and elevations are in meters. A table of codes follows the format list.

FILE: GEOL.AGS (Geology data)

The numbers listed below the attributes (i.e., 3-12) are the column positions of the particular data in the file GEOL.AGS.

HEADER LINE (1), (1) is the line code in the master file.

	id of header line	* srcid *	study code *
Columns:	1-1	3-12	14-15

* kb	* case	* sitid *	test hole	* year *
17-22	24-29	31-36	38-40	42-43

Id of header line is 1; fm is 101 for Scollard, etc.; study code is "ar", etc.

SRCID is the land location of the coal hole. i.e. 5035091213 is 13-12-35-9 W5M. A hole's location can be resolved to only within a LSD.

SITID is a unique well identifier number used in the Alberta Geological Survey well databases; exceptions: sitid=999999 is an A.G.S. coal hole without an unique number, sitid=999998 means unknown sitid of an oil/gas hole.

FORMATION LINE (2)

* id of fm line *	srcid *	study code *	top depth *	bot depth *	name of fm *
1-1	3-12	14-15	17-22	24-29	31-34

* battle code *
36

Battle code is a code for the quality of the Battle fm pick; 0=excellent, 1=good, 9=not quantified.

MARKER HORIZONS (3)

* id of marker line *	srcid *	study code *	depth of pick *	marker code *
1-1	3-12	14-15	17-22	24-29

COAL SEAMS (4)

```
* id of coal line * srcid * study code * top depth * bot depth * seam name
      1-1           3-12      14-15        17-22       24-29       31-33

coal unit # *
    35-38
```

Coal unit # only applies to some wells in Drumheller area and some wells in Belly study.

SAND BODIES (5)

```
id of sand line * srcid * study code * top depth * bot depth * name *
     1-1           3-12      14-15        17-22       24-29       31-33

 * sand zone *
    35-37
```

Sand zone data field is only recognized in Drumheller area.

GAS ZONES (6)

```
* id of gas line * srcid * study code * top depth *  bot depth * name *
     1-1           3-12      14-15        17-22        24-29      31-33
```

FILE: QUAL1.AGS (Coal quality data)

Format of file: This file has one sample per line. Note that some sample intervals are replicates.

Attribute abbreviation	Attribute name	Column position	Units
srcid	DLS location	1-10	-
fm	formation, group, etc.	12-14	-
test hole	ARC coal test hole #	16-18	-
grnd elev	ground elevation of datum. depths are reported from this number	20-23	meters
top depth	depth to top of interval	26-30	meters
bot depth	depth to base of interval	33-37	meters

status	code for analysis based on core or cuttings 0=cuttings, 1=core	39	-
adm	as determined moisture	41-44	%
meq	equilibrium moisture	46-49	%
rank	coal rank (see below)	51	-
vm, dry	volatile matter, dry basis	53-56	%
vm, dmmf	volatile matter, dry mineral matter-free	59-62	%
cv, dry	calorific value, dry basis	65-69	kJ/kg
cv, mmmf	calorific value, moist mineral matter-free	71-75	kJ/kg
C	carbon, dry basis	77-81	%
H	hydrogen, dry basis	84-87	%
O	oxygen, dry basis	90-93	%
N	nitrogen, dry basis	96-99	%
S	sulfur, dry basis	102-105	%
ash, dry	ash, dry basis	107-110	%
fxc, dry	fixed carbon, dry basis	113-116	%
fxc, dmmf	fixed carbon, dry mineral matter-free	119-122	%

Rank based on ASTM calorific value. See Nurkowski (1985).

Rank: 0 = insufficient data available
1 = no records
2 = subbituminous-c
3 = subbituminous-b
4 = subbituminous-a
5 = high volatile bituminous-c

Geologic codes used in GEOL.AGS and QUAL1.AGS

Codes were assigned to identifiable picks. The code definitions are listed below.

Study code - signifies the A.R.C. study area where the data originated.

Ardley - regional - AR
Medicine - AM
Alix - AA

H.S.C. - regional study - HR
Drumheller oil and gas - HO
Drumheller A.R.C. holes - HD
Buffalo Lake study - HB
Horseshoe Canyon study - HH

Belly R. - regional study - BR

Geological pick (listed stratigraphically)	Code number given in master file
unknown formation	905
Scollard mbr./fm.	101
Battle top, Ardley coal zone base	199
Battle fm	200
Battle base	299
Horseshoe Canyon fm	302
M marker	305
L marker	306
K marker	307
bulk of Drumheller coal zone	346
unit 5 (H.S.C. fm)	345
E top, E marker	350
E bottom	352
unit 4 (in Drum. area)	365
unit 3.5 (")	364
unit 3 (")	363
unit 2 (")	362
Bearpaw gas-bearing sands	371
B top	370
Wapiti fm.	304
unit 1 (in Drum. area)	361
H.S.C. fm base, A top	399
Lethbridge coal zone	410
Belly River group	403
Oldman fm gas-sands	435
Lethbridge-Taber coal	430
Oldman base, Foremost top	449
Taber coal	450
Foremost gas-bearing sand	455
Taber-Mckay coal	470
Basal Belly River gas sand	475
Mckay coal	480
Belly R. base, Pakowki and Lea Park top	499
Pakowki and Lea Park base, Milk River top	599
Milk R. gas-bearing sand	695
Milk River coal	690
Milk R. base, Colorado top	699

ACKNOWLEDGMENTS

Don Macdonald identified the data items in the raw data files. Desmond Wynne and Dennis Chao provided computer assistance. Roman Krzanowski is thanked for locating some of the data files. Funding to support this report came from the Alberta Research Council and the Department of Energy's Office of Coal Research and Technology.

REFERENCES

Macdonald, D.E., Ross, T.C., McCabe, P.J., Bosman, A. 1987. An evaluation of the coal resources of the Belly River Group, to a depth of 400 m in the Alberta Plains. Alberta Research Council, open file report 1987-8.

Macdonald, D.E., McCabe, P.J., Bosman, A. 1986. An evaluation of the coal resources of the Belly River Group to a depth of 400., in the Alberta plains area. Volume II: Maps and cross sections. Alberta Research Council.

McCabe, P.J., Strobl, R.S., Macdonald, D.E., Nurkowski, J.R., Bosman, A. 1988. Coal resource evaluation of the lower Horseshoe Canyon Formation and laterally equivalent strata, to a depth of 400 m, in the Alberta plains area. Alberta Research Council, open file report 1988-03.

McCabe, P.J., Strobl, R.S., Macdonald, D.E., Nurkowski, J.R., Bosman, A. 1986. An evaluation of the coal resources of the Horseshoe Canyon Formation and laterally equivalent strata, to a depth of 400 m, in the Alberta plains area. Volume II: Maps and cross sections. Alberta Research Council.

Nurkowski, J.R., 1985. Coal quality and rank variation within Upper Cretaceous and Tertiary sediments, Alberta plains region. Alberta Research Council, Earth Science Report 85-1.

Richardson, R.J.H, Strobl, R.S., Macdonald, D.E., Nurkowski, J.R., McCabe, P.J., Bosman, A. 1986. An evaluation of the coal resources of the Ardley coal zone to a depth of 400 m, in the Alberta plains area. Volume II: Maps and cross sections. Alberta Research Council.

Richardson, R.J.H. and Mandryk G.B. 1987. Coal Resource Data Locations Plains Area, Alberta. Alberta Research Council map.

Richardson, R.J.H, Strobl, R.S., Macdonald, D.E., Nurkowski, J.R., McCabe, P.J., Bosman, A. 1988. An evaluation of the coal resources of the Ardley coal zone to a depth of 400 m, in the Alberta plains area. Alberta Research Council, open file report 1988-02.

Strobl, R.S., McCabe, P.J., Macdonald, D.E., Richardson, R.J.H. 1987. Estimate of inferred resources of coal in the plains region of Alberta to a depth of 400 metres. Alberta Research Council, open file report 1987-05.