

Information Series 58

COLORADO COAL QUALITY DATA

Compiled by
Carol M. Tremain Ambrose, Wynn Eakins,
Janet E. Schultz, and Bruce S. Kelso

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Colorado Geological Survey
Division of Minerals and Geology
Department of Natural Resources
Denver, Colorado

FOREWORD

The purpose of Colorado Geological Survey Information Series 58, *Colorado Coal Quality Data* is to provide the verified coal quality data that has been collected by the Colorado Geological Survey as part of the National Coal Resources Data System (NCRDS). The report contains five separate databases of coal chemical and petrographic data. Carol M. Tremain Ambrose, Wynn Eakins, Janet E. Schultz, and Bruce S. Kelso, all formerly of the Mineral Resources Section of the Colorado Geological Survey are listed as compilers of this report. Janet Schultz completed the final compilation of the databases and wrote the descriptions of the databases for this report. The objective of this publication is to provide geological information to resource developers, government planners, and interested citizens.

Funding for this project came from the United States Geological Survey-NCRDS program and the Colorado Department of Natural Resources Severance Tax Operational Fund. Severance taxes are derived from the production of gas, oil, coal, and minerals.

James A. Cappa
Chief, Mineral Resources Section

Vicki Cowart
State Geologist and Director

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OVERVIEW OF DATA BASES

The data in this zip file are provided in both Microsoft Access 97, and Microsoft Excel 97 formats to allow ease of access for a wide range of users. The data are stored in five separate tables in a single Access database file, and five separate worksheets in a single Excel workbook file. Each file contains a total of 6080 records of data pertaining to the quality of Colorado coal.

Both files can be found in the root folder of the zip file and are named IS-58.mdb and IS-58.xls respectively. The names of the tables or worksheets found in the Access or Excel files correspond to the data descriptions provided below, which are: BMALYT, CHEMALYT, MINEALYT, PETALYT and USALYT.

Only published and non-proprietary data are used in this report. Some of the databases already exist in digital form, while some are available in hardcopy only. There is some overlap of data between the databases. CGS collected some of the samples found in several of the databases, but has also supplemented existing data where possible with such information as locations, formation names, references, sample type, etc. CGS also verified data in all databases.

These databases are listed below with a brief description of their contents.

ORGANIZATION OF DATABASES

Each database is sorted first by County, then by Range and then by Township. Each database also contains the 7.5-minute quadrangle name, locations in latitude and longitude in degrees, minutes, seconds and decimal. The negative sign on the longitude indicates the longitude is west of the Greenwich meridian (Western Hemisphere). Longitude and latitude were calculated from the geographic locations given in the referenced publications.

Each record has a Lab ID number that is unique to that record.

Information specific to a mine, drill hole, or sample are grouped together. Analyses are grouped together, as are geology and geographic information. References and the name of the database file are at the end of the Excel spreadsheet and Access menu. See the Data Dictionary for the details included in each database.

DISCLAIMER

All of the data contained in this publication are public information and span a period of 95 years. Although the Colorado Geological Survey has compiled this data over a period of years, the CGS is not responsible for variations of analytical results in the databases which have resulted from differences in analytical methods.

The methods of sampling, handling and storing samples, as well as the technology for analyzing a given sample, have changed and been refined through technological advances and analytical procedures over the past 95 years. Therefore, there is no guarantee that a sample taken from a specific location shown in the database will have the same analytical results as one taken from the same location today.

Locations of the samples reported in the literature have been used in good faith. Where a question of the actual location was suspect, the location was checked using old mine maps, geologic maps and 7.5-minute topographic maps. If no information could be obtained or verified, the location of the sample was shown as the center of the section.

HOW TO PROCEED

To work with the data in *Access format*, you must have MS Access 97 or later loaded on your computer. Locate the file named IS-58.mdb in your file browser and double click on the file to open. You will see the five tables listed in alphabetical order and can view, browse, and query the tables using the standard Access features.

To work with the data in *Excel format*, you must have MS Excel 97 or later loaded on your computer. Locate the file named IS-58.xls in your file browser and double click on the file to open. You will see the five worksheets listed in alphabetical order along the bottom of the window. You can then choose the worksheet of interest and view, browse, and query the worksheets using the standard Excel features.

BRIEF EXPLANATION OF CONTENTS OF EACH DATABASE

BMALYT

This database contains standard American Society for Testing and Materials (ASTM) and U.S. Bureau of Mines (USBM) and Energy Information Administration (EIA) chemical analyses (proximate, ultimate, calorific value, ash-softening temperature, free-swelling indices, and Hardgrove grindability indices) by county, bed names, mine and nearest town. These analyses were performed in accordance with ASTM or USBM standards and methods. Samples can either be raw coal or washed coal. This database includes analyses from the early 1900s through 1978. All analyses are on an “as received” basis unless otherwise indicated.

CHEMALYT

This database contains descriptive, geological, geographical, and geochemical results for coal and associated rock samples analyzed by the U.S. Geological Survey for the major and minor-oxides and trace elements. Analyses by outside contractors were also used. Trace elements method of analysis, and not the actual process are described in the EXPLANATION. More than one method of analysis was used in some cases; therefore, it is suggested the user consult the “References” for the source and the basis on which the analyses were run.

MINEALYT

This database contains 787 proximate and some ultimate analyses collected from 365 mines and published in the 1937 USBM Technical Paper 574. USBM Technical Paper 574 is a compilation of analyses from previously published USBM Bulletins 85, 123, 193, selected representative analyses from USBM Bulletin 22, and analyses from a mine inspection program conducted in 1936 and 1937. This data collection includes samples from 1904 through 1937.

PETALYT

This database contains petrographic analyses, including maceral analyses in white light, reflectance analyses, and v-types, on 454 samples of Colorado coal. Samples were collected by CGS geologists and analyzed at Southern Illinois University (SIU). Others came from publications listed in the references, such as Law, 1990. Formation names attributed to samples from Law (1990) were the “best estimates” of CGS geologists. Additional petrographic analyses of Colorado coals are maintained in a database at Pennsylvania State University. This database does not contain proximate and ultimate analyses.

USALYT

This database contains selected analyses, predominately of coal drill core samples, although some analyses of mine samples are included. The database began with cores sampled for coal gas content; later additional analyses were added. Standard ASTM analyses are reported with locations, formation name, well name or other sample name, and other pertinent data. This database also contains data on core samples of carbonaceous shale and oil shale on which gas content (desorption) tests were run.

EXPLANATION OF U.S.BUREAU OF MINES DATABASE (BMALYT)

This database contains standard American Society for Testing and Materials (ASTM) and U.S. Bureau of Mines (USBM) and Energy Information Administration (EIA) chemical analyses (proximate, ultimate, calorific value, ash-softening temperature, free-swelling indices, and Hardgrove grindability indices) by county, bed names, mine and nearest town. These analyses were performed in accordance with ASTM or USBM standards and methods. Samples can either be raw coal or washed coal. This database includes analyses from the early 1900s through 1978. EIA took over the database from the USBM in 1995. CGS added data such as locations to the database. All analyses are on an “as received” basis unless otherwise indicated.

Data source is U.S. Bureau of Mines (USBM) and the U.S. Energy Information Administration (EIA) database.

Number of data records is 3767.

DATA DICTIONARY (BMALYT)

Field Name	Explanation
COUNTY	County name
QTR 1	¼ of Qtr 2
QTR 2	¼ of Qtr 3
QTR 3	¼ of Qtr 4
QTR 4	¼ of a section
SECTION	Section number
TOWNSHIP	Township number
N_S	Township direction (N = North or S = South).
RANGE	Range number
E_W	Range direction (E = East or W = West)
QUADRANGLE	Name of 7.5-minute quadrangle from which sample was collected.
MINE NAME	Name of mine from which sample was collected.
COMPANY	Name of company operating the mine from which sample was taken.
NEAREST TOWN	Nearest town to the mine from which sample was taken.
COAL BED	Name of coal bed from which sample was taken.
MINE TYPE	Underground or Surface mine
TYPE SAMPLE	Sample type: Core, Delivered, Face (mine), Raw, Tipple, Washed, Unknown [All are dry (moisture-free)]
BED THICK_FT	Bed thickness (feet and tenths of feet)
SAMPLE THICK_FT	Sample thickness (feet and tenths of feet)
SURF ELEV_FT	Surface elevation (feet)
SAMPLE DEPTH_FT	Depth from the surface to the top of coal (feet)
SIZE CODE	Numerical code based on the size of coal sampled. Refer to table below for an explanation of the size codes.
TONNAGE	Number of tons of coal sampled
PREP	Type of sample preparation
NO SAMPLES	Number of coal samples used in averaging for the analysis
LAT DEG	Degrees of latitude.
LAT MIN	Minutes of latitude.
LAT SEC	Seconds of latitude.
LAT DEC	Latitude in decimals
LON DEG	Degrees of longitude.

Field Name	Explanation
LON MIN	Minutes of longitude.
LON SEC	Seconds of longitude.
LON DEC	Latitude in decimals.
DATE SAMPLED	Sampling date.
EIA ID NO	Sample identification number assigned in the EIA database.
LAB ID	Laboratory identification number provided for non-EIA labs.
LAB	<ul style="list-style-type: none"> • Agency that performed the analysis • USBM = U.S. Bureau of Mines • EIA = Energy Information Administration • USGS = U.S. Geological Survey
ESTIMATED RANK	Rank reported by sampler.
CALCULATED RANK	Rank calculated by analytical labs
BTU_LB	As-received heat of combustion (Btu/lb)
MF BTU_LB	Moisture-free heat of combustion (Btu/lb)
MAF BTU_LB	Moisture and ash-free heat of combustion (Btu/lb)
MMMFBTU_LB	Moist mineral matter-free heat of combustion (British thermal units per pound or Btu/lb)
ASH DEF	Ash deformation temperature, in degrees Fahrenheit.
ASH SOF	Ash softening temperature, in degrees Fahrenheit.
ASH FLD	Ash fluid temperature, in degrees Fahrenheit.
FSI	Value of all FSI (free-swelling index) analyses. The FSI is indicative of the coking characteristics of bituminous coal (ASTM Standard D-720-67).
HGI	Value of all HGI (Hardgrove grindability index) analyses. The HGI indicates the relative grindability or ease of pulverizing coals in comparison with a coal chosen as standard, having an HGI of 100 (ASTM Standard D-409-710).
VOLATILE MATTER	As-received volatile matter (percent)
DMMF VM	Dry mineral matter-free volatile matter
FIXED CARBON	As-received fixed carbon (percent)
MF FC	Moisture-free fixed carbon (percent)
DMMF FC	Dry mineral matter-free fixed carbon (percent)
ASH	As-received ash (percent)
MF ASH	Moisture-free ash (percent)
SULFUR	As-received sulfur (percent)
MF SULFUR	Moisture-free sulfur (percent)
MF HYDROGEN	Moisture-free hydrogen (percent)
MF CARBON	Moisture-free carbon (percent)
MF NITROGEN	Moisture-free nitrogen (percent)
MF OXYGEN	Moisture-free oxygen (percent)
REFERENCES	Author(s) and year(s) of publication, which can be used to obtain the complete reference.
SPREADSHEET	BMALYT = Name of database in Excel spreadsheet format.

SIZE CODES

<u>Code</u>	<u>Explanation</u>
1	Run-of-Mine or Crushed Run-of-Mine
2–9	Single screened lump coal with defined minimum size limit. Examples: 8 in. lump, 5 in. lump, ½ ft lump, etc.
10	N/A
11–20	Double screened egg coal. Examples: 10 in. x 2½ in., 8 in. x 4 in., 7 in. x 3 in., 6 in. x 1 in., etc.
21–30	Double screened stove coal. Examples: 5 in. x 2 in., 4½ in. x 2½ in., 4 in. x 1½ in., 3 in. x 1⅝ in., etc.
31–43	Double screened nut coal. Examples: 2½ in. x 1⅛ in., 2 in. x ¾ in., 1¼ in. x ¾ in., 1½ in. x ½ in., etc.
44–51	Double screened stoker coal. 49: 1¼ in. x ¼ in. Examples: 1⅝ in. x ¾ in., 1 ½ in. x ⅜ in., 1⅛ in. x ¾ in., 1 in. x ½ in., etc.
52	1 in. x ⅜ in.
53	1 in. x ¼ in.
54	1 in. x ⅜ in.
55–63	Smaller sized double screened stoker coal. Examples: ⅞ in. x ¾ in., ¾ in. x ¼ in., etc. Stoker coal with mesh as a minimum size limit. Examples: 1½ in. x 10 mesh, 1¼ in. x 28 mesh, 1 in. x 10 mesh, ¾ in. x 28 mesh.
64–69	Generally single screened slack coal with larger max size limits. 68: 3 in. x 0. Examples: 7 in. x 0, 5 in. x 0, 2¾ in. x 0, etc. Some smaller stoker coal. Examples: ½ in. x ⅜ in., 1¼ in. x ⅜ in., 1⅛ in. x 28 mesh, etc.
70	2½ in. x 0
71–73	Single screened slack coal. Examples: 2¼ in. x 0, 2 in. x 0, 1⅝ in. x 0, etc. Modified slack coal. Examples: Modified 2 in. x 0, Modified 1 in. x 0, etc.
74	1½ in. x 0
75	Single screened slack coal. Modified slack coal. (See 71–73 for examples).
76	1¼ in. x 0
77	1 in. x 0
78	⅞ in. x 0
79	Single screened slack coal. Modified slack coal. (See 71–73 for examples).
80	N/A
81	¾ in. x 0
82	⅝ in. x 0
83–84	Single screened slack coal with smaller maximum size limits. Examples: ⅞ in. x 0, ⅜ in. x 0, etc.
85	½ in. x 0
86–87	Single screened slack coal with smaller maximum size limits. (See 83–84 for examples).
88	⅜ in. x 0
89	NA
90	¼ in. x 0
91	Single screened slack coal with smaller maximum size limits. (See 83–84 for examples).
92	⅛ in. x 0
93–97	N/A
98	Middlings
99	Face or Channel Sample

Notes: Most inch designations are based on round hole or round hole equivalent screening. Some codes (49, 52–54, 68, 70, 74, 76–78, 81, 82, 85 88, 90, and 92) are used exclusively for only one size of coal at all mines. All other numbers represent the same size at a particular mine, but represent different size definitions at different mines. For an exact size definition of any listed number at a given mine, contact the Energy Information Administration.

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EXPLANATION OF GEOCHEMISTRY DATABASE (CHEMALYT)

This database contains descriptive, geological, geographical, and geochemical data for coal and associated rock samples analyzed by the USGS in the 1970s and 1980s.

Analyses were also acquired from outside contractors. Analyses for proximate and ultimate analyses are on an “as-received” basis unless otherwise indicated.

Analytical techniques used to determine oxides, major and trace elements, in some cases, were determined using more than one method. In some cases elements were analyzed by the same method at different times (e.g. SPEC:SPEC). Caution is urged when comparing the numbers of lower detection limits of elements, as those results are not necessarily equivalent due to different techniques being used. The methods are shown next to the oxide or elements in this explanation. The reader should verify any particular analytical results of interest for specific samples from either the “Source” or “References” listed at the end of the Excel spreadsheet.

Consistency in sample collection and handling using USGS and USBM guidelines are assumed, but unknown conditions are possible and could result in differences in the analytical results. The CGS is not responsible for the analytical results, or differences of analytical results from samples included in this report. Results of tests run today on samples taken at the same location given in this report can differ from earlier results because of refinements in methodologies or use of different techniques.

Number of data records is 372.

DATA DICTIONARY (CHEMALYT)

Field Name	Explanation
COUNTY	County from which sample was collected
QTR 1	¼ of Qtr 2
QTR 2	¼ of Qtr 3
QTR 3	¼ of Qtr 4
QTR 4	¼ of a section
SECTION	Section number
TOWNSHIP	Township number
N/S	Township direction (N = North or S = South)
RANGE	Range number
E/W	Range direction (E = East or W = West) All are West
MERIDIAN	Principal meridian. 6 represent 6 th Principal Meridian. 21 represent the 21 st Principal New Mexico (NM) Meridian.
QUADRANGLE	7.5-minute quadrangle in which sample was collected.
MINE NAME	Name of mine from which sample was collected.
DRILL HOLE	Number of drill hole from which sample was collected.
SAMPLE DEPTH_FT	Depth to top of coal (in feet and tenths of feet)
SAMPLE THICK_FT	Sample thickness (in feet and tenths of feet)
TYPE SAMPLE	Type sample (i.e. core, mine, channel, etc.)
NO SAMPLES	Number of samples. ‘AVG 2’ indicates that two samples are being averaged. ‘AVG 3’ = three samples averaged, etc.
COAL BED	Coal bed name from which sample was taken.
COAL ZONE	Coal zone
COALFORMATION	Formation from which coal was collected.
COAL FIELD	Coal field
COAL DISTRICT	Coal district

Field Name	Explanation
COAL REGION	Coal region
COAL GROUP	Coal group
SERIES	Geologic time series. (All are either Paleocene, Eocene, Upper or No Data Entered.)
SYSTEM	Geologic time system. (All are Cretaceous or Tertiary.)
LAT DEG	Degrees of latitude
LAT MIN	Minutes of latitude
LAT SEC	Seconds of latitude
LAT DEC	Latitude in decimals to 6 decimal places
LON DEG	Degrees of longitude
LON MIN	Minutes of longitude
LON SEC	Seconds of longitude
LON DEC	Longitude in decimals to 6 decimal places (Negative symbol indicates west of Greenwich line).
COLLECTOR	Agency, individual and agency, or company that collected sample.
POINTID	Location identification, assigned by collector/submitter.
LAB LOC	Lab location. Analyses performed at either Denver or Washington locations.
LAB CODE	<ul style="list-style-type: none"> • 5 = U.S. Geological Survey (USGS) • 15 = USBM AND USGS • 65 = USGS and Geochemical Testing Co. • 765 = USGS, Geochemical Testing Co. and Dickenson Laboratories, Inc.
LAB ID	Sample number assigned by laboratory
DATE SAMPLED	Date of sample taken. (Yr/Mo/Day)
ESTIMATED RANK	Rank reported by sampler
CALCULATED RANK	Coal rank as calculated by Parr Formula, ASTM Method D388-77.
BTU/LB	Heat of combustion, in British thermal units per pound (Btu/lb).
MMFBTU/LB	Mineral matter free Btu per pound.
ASHDEF	Ash deformation temperature (degrees Fahrenheit) as determined by ASTM method D1857-87 in a reducing atmosphere.
ASHSOF	Ash softening temperature (degrees Fahrenheit) as determined by ASTM method D1857-87 in a reducing atmosphere.
ASHFLD	Ash fluid temperature (degrees Fahrenheit) as determined by ASTM method D1857-87 in a reducing atmosphere.
FRESWL	Free-swelling index as determined by ASTM method D-720.
MOISTURE	Moisture value in percent as determined by ASTM method D-3183.
VOLATILE MATTER	Volatile matter value in percent as determined by ASTM method D-3175.
FIXED CARBON	Fixed carbon value in percent as determined by ASTM method D-3172.
ASH	Ash value in percent as determined by ASTM method D-3174 (ash obtained at 750 degrees F.)
HYDROGEN	Hydrogen value in percent as determined by ASTM method D-3178.
CARBON	Carbon value in percent as determined by ASTM method D-3178 or other USGS methods.
NITROGEN	Nitrogen value in percent as determined by ASTM method D-3179.
OXYGEN	Oxygen value in percent as determined by ASTM method D-3176.
TOTAL SULFUR	Total sulfur value in percent as determined by ASTM method D-3177.
SULFATE	Sulfate value in percent as determined by ASTM method D-2492.
PYRITIC SULFUR	Pyritic sulfur value in percent as determined by ASTM method D-2492.
ORGANIC SULFUR	Organic sulfur value in percent as determined by ASTM method D-2492.
AIR DRIED LOSS	Air dried loss in percent as determined by ASTM method D-2013.
HGI	Hardgrove grindability index as determined by ASTM method D-409.
GSASH	Ash value in percent, as determined by USGS laboratories (ash obtained at 525 degrees C.)

Major Oxides	Analysis of Oxides in Ash Obtained at 525 Degrees C
SiO ₂	SiO ₂ (silicon dioxide) value in percent (SPEC, XRF:XRF)
Al ₂ O ₃	Al ₂ O ₃ (aluminum oxide) value in percent (SPEC, XRF:XRF)
CaO	CaO (calcium oxide) value in percent (SPEC, XRF:XRF)
MgO	MgO (magnesium oxide) value in percent (WETCHEM:WETCHEM)
MnO	MnO (manganese oxide) value in percent (SPEC, WETCHEM:SPEC, WETCHEM)
Na ₂ O	Na ₂ O (sodium oxide) value in percent (WETCHEM,INAA:WETCHEM)
K ₂ O	K ₂ O (potassium oxide) value in percent (SPEC, XRF:XRF)
Fe ₂ O ₃	Fe ₂ O ₃ (ferric oxide) value in percent (SPEC, XRF:XRF)
TiO ₂	TiO ₂ (titanium oxide) value in percent (SPEC, XRF:XRF)
P ₂ O ₅	P ₂ O ₅ (phosphorous pentoxide) value in percent (SPEC, XRF:XRF)
SO ₃	SO ₃ (sulfur trioxide) value in percent (SPEC, XRF:XRF)

Major Elements	
SI_E	Silicon value in percent
AL_E	Aluminum in percent
CA_E	Calcium in percent
MG_E	Magnesium in percent
NA_E	Sodium in percent
K_E	Potassium in percent
FE_E	Iron in percent
TI_E	Titanium in percent
S_E	Sulfur in percent

Trace Elements	
AG_E	Silver (SPEC:SPEC)
AS_E	Arsenic WC (INAA:WETCHEM)
AU_E	Gold (SPEC:SPEC)
BA_E	Barium (SPEC:SPEC)
BE_E	Beryllium (SPEC:SPEC)
BI_E	Bismuth (SPEC:SPEC)
BR_E	Bromine WC (INAA)
CD_E	Cadmium (SPEC:SPEC)
CL_E	Chlorine WC (XRF:XRF)
CO_E	Cobalt Ash, WC (SPEC,INAA-750528:SPEC,INAA-760820)
CS_E	Cesium Ash, WC (SPEC,INAA-750528:SPEC)
CU_E	Copper (WETCHEM:WETCHEM)
DY_E	Dyprosium (SPEC:SPEC)
ER_E	Erbium (SPEC:SPEC)
EU_E	Europium Ash, WC
F_E	Fluorine WC (WETCHEM:WETCHEM)
GA_E	Gallium (SPEC:SPEC)
GD_E	Gadolinium (SPEC:SPEC)
GE_E	Germanium (SPEC:SPEC)
HF_E	Hafnium Ash, WC
HG_E	Mercury (WETCHEM:WETCHEM)
HO_E	Holmium (SPEC:SPEC)
IN_E	Indium (SPEC:SPEC)
IR_E	Iridium (SPEC:SPEC)
LA_E	Lanthanum Ash, WC (SPEC,INAA-750528:SPEC)
LI_E	Lithium (WETCHEM:WETCHEM)

LU_E	Lutetium Ash, WC (SPEC,INAA-750528:SPEC)
Trace Elements	
MN_E	Manganese (SPEC,WETCHEM:SPEC,WETCHEM)
MO_E	Molybdenum (SPEC:SPEC)
NB_E	Niobium (SPEC:SPEC)
ND_E	Neodymium (SPEC:SPEC)
NI_E	Nickel (SPEC:SPEC)
OS_E	Osmium (SPEC:SPEC)
P_E	Phosphorus (SPEC:SPEC)
PB_E	Lead (WETCHEM:WETCHEM)
PD_E	Palladium (SPEC:SPEC)
PR_E	Praseodymium (SPEC:SPEC)
PT_E	Platinum (SPEC:SPEC)
RB_E	Rubidium Ash, WC (SPEC,INAA-750528:SPEC)
RE_E	Rhenium (SPEC:SPEC)
RH_E	Rhodium (SPEC:SPEC)
RU_E	Ruthenium (SPEC:SPEC)
SB_E	Antimony (SPEC:SPEC)
SC_E	Scandium Ash, WC (SPEC,INAA-750528:SPEC)
SE_E	Selenium WC (XRF,INAA-750601:XRF,INAA-780105)
SM_E	Samarium Ash, WC (SPEC,INAA-750701:SPEC)
SN_E	Tin (SPEC)
SR_E	Strontium (SPEC:SPEC)
TA_E	Tantalum Ash, WC
TB_E	Terbium Ash, WC (SPEC,INAA-750528:SPEC)
TE_E	Tellurium (SPEC:SPEC)
TH_E	Thorium WC (DNA,INAA:DNA,INAA)
TL_E	Thallium (SPEC:SPEC)
TM_E	Thulium (SPEC:SPEC)
U_E	Uranium WC (DNA:DNA)
W_E	Tungsten WC, ash (INAA:SPEC)
Y_E	Yttrium (SPEC:SPEC)
ZN_E	Zinc (WETCHEM:WETCHEM)
ZR_E	Zirconium (SPEC:SPEC)

SOURCE	Name of report(s) from which data was obtained. Most of this data is published on this CD-ROM USGS OF Report 94-205.
REFERENCE	Author(s) and year(s) of publication, which can be used to access the complete reference.
SPREADSHEET	CHEMALYT = Name of database in Excel spreadsheet format

Abbreviations Not Defined in the Table

ASTMAmerican Society for Testing and Materials
 DMG.....Colorado Division of Minerals and Geology
 DNA.....Delayed neutron activation analysis
 NDE.....Not determined
 SPEC.....Spectrographic analysis
 WETCHEM or WC.....Wet chemical analysis
 XRF.....X-ray fluorescence

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EXPLANATION OF HISTORIC MINES DATABASE (MINEALYT)

This database contains 787 proximate and some ultimate analyses collected from 365 mines and published in the 1937 USBM Technical Paper 574. All analyses were performed by the Bureau of Mines Labs using ASTM or USBM standards in effect at that time. The CGS cannot guarantee the analytical results as methods of storing samples during that time period would probably result in loss of moisture. All results in the database are on an “as-received” basis unless otherwise indicated.

With the exception of the Hughes Mine located in Gunnison County, in Technical Paper 574, but actually located in Pitkin County, and a discrepancy in the location of the Oak Creek Mine, Moffat County, all geographic locations of the mines at the time of sampling have been verified from old mine maps, topographic maps and other literature. Exact and detailed descriptions of the coal seams are contained in USBM TP 574. Today some of the nearest towns and railroads used as location references no longer exist, nor do any remnants of the mines.

USBM Technical Paper 574 is a compilation of previously published USBM Bulletins 85, 123, 193, selected representative analyses from USBM Bulletin 22, and a mine inspection program conducted in 1936 and 1937.

Number of data records is 787.

DATA DICTIONARY (MINEALYT)

Field Name	Explanation
COUNTY	County from which sample was collected.
QTR 2	¼ of Qtr 3
QTR 3	¼ of Qtr 4
QTR 4	¼ of a section
SECTION	Section from which sample was collected
TOWNSHIP	Township number
N_S	Township direction (N = North or S = South)
RANGE	Range number
MERIDIAN	Principal Meridians. 6 represent 6 th Principal Meridian. 21 represents the 21 st Principal New Mexico (NM) Meridian
QUADRANGLE	7.5-minute quadrangle in which sample was collected.
MINE NAME	Name of mine from which sample was collected.
NEAREST TOWN	Name of closest town
COAL BED	Name of coal bed from which sample was taken.
FORMATION	Comments regarding the formation
COAL FIELD	Coal Field from which sample was collected
DISTRICT	District where mine was located.
REGION	Comments regarding the coal region
SURF ELEV_FT	Surface elevation in feet
DEPTH_FT	Depth to top of sampled coal bed, in feet
STRIKE	Direction of strike of coal bed sampled
DIP DEGREES	Dip of coal bed sampled, in degrees
BED THICK_FT	Coal bed thickness (feet and tenths of feet)
SAMPLE THICK_FT	Sample thickness (in feet and tenths of feet)
LAT DEG	Degrees of latitude
LAT MIN	Minutes of latitude

Field Name	Explanation
LAT SEC	Seconds of latitude
LAT DEC	Latitude in decimals to 6 decimal places.
LON DEG	Degrees of longitude
LON MIN	Minutes of longitude
LON SEC	Seconds of longitude
LON DEC	Longitude in decimals to 6 decimal places.
DATE SAMPLED	Date sample was taken in the field.
COLLECTOR	Agency or individual taking the sample
LAB	Laboratory where analysis was conducted
TYPE SAMPLE	Type of sample taken
ESTIMATED RANK	Reported rank. These ranks are abbreviated: Bit = bituminous, Med Vol Bit = medium volatile bituminous, Sub-Bit = subbituminous
CALCULATED RANK	Rank as calculated by the Colorado Geological Survey
BTU_LB	As received heat of combustion, in British thermal units per pound (Btu/lb)
MMMF BTU	Moist mineral matter-free heat of combustion, in British thermal units per pound (Btu/lb).
ASHSOF	Ash softening temperature in degrees Fahrenheit
MOISTURE	As-received moisture (percent)
VOLATILE MATTER	As-received volatile matter (percent)
DMMF VOLATILE MATTER	Dry mineral matter-free volatile matter in percent
FIXED CARBON	As-received fixed carbon (percent)
DMMF FIXED CARBON	Dry mineral matter-free fixed carbon value in percent
ASH	As-received ash (percent)
TOTAL SULFUR	Total sulfur value (percent)
HYDROGEN	As received hydrogen (percent)
CARBON	As-received carbon (percent)
NITROGEN	As received nitrogen (percent)
OXYGEN	As received oxygen (percent)
SOURCE	Source of data used in database
REFERENCE	References used in USBM TP 574
SPREADSHEET	MINEALYT = Name of database in Excel spreadsheet format.

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EXPLANATION OF PETROGRAPHIC DATABASE (PETALYT)

This database contains petrographic analyses, including maceral analyses in white light, reflectance analyses, and v-types, on 454 samples of Colorado coal. Some samples were collected by CGS geologists and analyzed at Southern Illinois University (SIU). Others came from publications listed in the references, such as Law, 1990. Formation names attributed to samples from Law (1990) were the “best estimates” of CGS geologists. Additional petrographic analyses of Colorado coals are maintained in a database at Pennsylvania State University.

Number of data records is 451.

DATA DICTIONARY (PETALYT)

Field Name	Explanation
COUNTY	County name
QTR 2	¼ of Qtr 3
QTR 3	¼ of Qtr 4
QTR 4	¼ of a section
SECTION	Section number
TOWNSHIP	Township number
N_S	Township direction (N = North or S = South)
RANGE	Range number
E_W	Range direction (East or West)
MERIDIAN	Principal Meridian. 6 represents 6 th Principal Meridian. 21 represents the 21 st Principal New Mexico (NM) Meridian.
QUADRANGLE	7.5-minute quadrangle in which sample was collected
MINE NAME	Mine name from which sample was collected.
DRILL HOLE	Drill hole number from which sample was collected
TYPE SAMPLE	Type sample (i.e. core, mine, etc.)
SAMPLE DEPTH_FT	Depth to top of coal (in feet and tenths of feet)
COAL BED	Coal bed from which sample was taken
FORMATION	Formation in which coal is present
GROUP	Coal group
SYSTEM	Geologic time system (All are either Cretaceous or Tertiary)
LAT DEG	Degrees of latitude
LAT MIN	Minutes of latitude
LAT SEC	Seconds of latitude
LAT DEC	Latitude in decimals to 6 decimal places
LON DEG	Degrees of longitude
LON MIN	Minutes of longitude
LON SEC	Seconds of longitude
LON DEC	Longitude in decimals to 6 decimal places (Negative symbol indicates west of Greenwich line)
LAB ID	USGS or USBM Sample Identification Number (Analyses can be found in USALY database by Lab ID number)
CGS ID	CGS Identification No. (desorption samples)
PET NO	Petrographic analysis number
PET LAB NO	Number given sample by Petrography Lab
VIT GRP	Vitrinite Maceral Group Volume Percent
VIT MAC	Vitrinite Maceral Volume Percent
PSEUDOVIT	Pseudovitrinite Maceral Volume Percent
COLLINITE	Collinite Maceral Volume Percent

Field Name	Explanation
TELINITE	Telinite Maceral Volume Percent
EX LIP GRP	Exinite (Liptinite) Maceral Group Volume Percent
EXINITE	Exinite Maceral Volume Percent
SPORINITE	Sporinite Maceral Volume Percent
CUTINITE	Cutinite Maceral Volume Percent
ALGINITE	Alginite Maceral Volume Percent
RESINITE	Resinite Maceral Volume Percent
FLUORINITE	Flourinite Maceral Volume Percent
BITUMINITE	Bituminite Maceral Volume Percent
EXSUDATINI	Exsudatinite Maceral Volume Percent
LIPTODETRI	Liptodetrinite Maceral Volume Percent
INERT GRP	Inertinite Maceral Group Volume Percent
INERTODETR	Inertodetrinite Maceral Volume Percent
FUSINITE	Fusinite Maceral Volume Percent
SEMI FUS	Semi-Fusinite Maceral Volume Percent
MICRINITE	Micrinite Maceral Volume Percent
SCLEROTINI	Sclerotinite Maceral Volume Percent
MACRINITE	Macrinite Maceral Volume Percent
SEMI MACRI	Semimacrinite Maceral Volume Percent
MINERALS	Minerals
MMVIT REFL	Mean-Maximum Vitrinite Reflectance
MMPVIT REF	Mean-Maximum Pseudovitrinite Reflectance
MMCVIT REF	Mean-Maximum Combined Vitrinite Reflectance. Values of 2 indicate 2 or more.
MRNVIT REF	Mean Random Vitrinite Reflectance
VTTYPE2	V-Type 2 Percentage
VTTYPE3	V-Type 3 Percentage
VTTYPE4	V-Type 4 Percentage
VTTYPE5	V-Type 5 Percentage
VTTYPE6	V-Type 6 Percentage
VTTYPE7	V-Type 7 Percentage
VTTYPE8	V-Type 8 Percentage
VTTYPE9	V-Type 9 Percentage
VTTYPE10	V-Type 10 Percentage
VTTYPE11	V-Type 11 Percentage
VTTYPE12	V-Type 12 Percentage
VTTYPE13	V-Type 13 Percentage
VTTYPE14	V-type 14 Percentage
VTTYPE15	V-type 15 Percentage
VTTYPE16	V-type 16 Percentage
VTTYPE17	V-type 17 Percentage
VTTYPE18	V-type 18 Percentage
VTTYPE19	V-type 19 Percentage
REFERENCE	Reference (see database reference list)
SPREADSHEET	PETALYT = Name of database in Excel spreadsheet format

Abbreviations in Database

ABD.....abandoned
 BULL.....Bulletin
 CGS.....Colorado Geological Survey
 CSMRI.....Colorado School of Mines Research Institute
 CTE.....Commercial Testing and Engineering Co.
 IS.....Information Series report
 MF.....Mineral Fuels report
 OC.....Outcrop

OFR.....Open file report
 RS.....Resource Series report
 SIU.....Southern Illinois University
 WAL.....Wyoming Analytical Laboratories

Note: ASTM D2796-88 is the standard that defines the terms used in the microscopical analysis of coal by reflected light technique. (This standard also defines terms used in macroscopic observation of coal seams.)

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EXPLANATION OF USALYT DATA BASE (USALYT)

This database contains selected analyses, predominantly of coal core samples, although some analyses of mine samples are included. The database began with cores sampled for coal gas content; later additional analyses were added. The database contains standard ASTM analyses (proximate, ultimate, calorific value, ash-softening temperature, free-swelling indices, and Hardgrove grindability indices) with county, formation name, well name or other sample name, township and range. Rank is calculated by ASTM Parr formula. The database also contains data on core samples of carbonaceous shale and other rock material surrounding coal beds. All analyses are "as-received" basis unless otherwise indicated.

Primary contributors: Carol M. Tremain Ambrose and Bruce S. Kelso, Colorado Geological Survey

Number of data records is 703.

DATA DICTIONARY (USALYT)

Field Name	Explanation
COUNTY	County name
QTR 1	¼ of Quarter 2
QTR 2	¼ of Quarter 3
QTR 3	¼ of Quarter 4
QTR 4	¼ of a section
SECTION	Section number = 1 square mile
TOWNSHIP	Township number
N_S	Direction of township (N = North or S = South)
RANGE	Range number
E_W	Direction of range (E = East or W = West)
QUADRANGLE	7.5-minute topographic quadrangle from which sample was collected.
SURF ELEV_FT	Surface elevation of drill hole, (feet and tenths of feet)
SAMPLE DEPTH_FT	Depth of top of sample(feet and tenths of feet)
TYPE SAMPLE	Sample type
NO SAMPLES	Single sample, composite (average of more than one sample, partial seam, partial upper split, partial lower split, upper split, lower split, middle split, and not defined.
COMMENT 1	Further description of sample
COAL BED	Coal bed or lithologic horizon name
FORMATION	Geologic formation name
FIELD	Coal field name
REGION	Coal region name
GROUP	Geologic group name
SERIES	Geologic series name
SYSTEM	Geologic system name
LAT DEG	Latitude = degrees
LAT MIN	Latitude = minutes
LAT SEC	Latitude = seconds
LAT DEC	Latitude in degrees and decimal degrees
LON DEG	Longitude = degrees
LON MIN	Longitude = minutes
LON SEC	Longitude = seconds
LON DEC	Longitude in degrees and decimal degrees
COLLECTOR	Name of individual who collected sample

Field Name	Explanation
LAB NAME	Name of laboratory performing analysis
LAB ID	Sample number assigned by laboratory
ANALYSIS TYPE	Analysis type code: AR = as received DMMF = dry mineral matter free MMMF = moisture mineral matter free MAF = moisture and ash free
ANALYSIS DATE	Date of analysis
ESTIMATED RANK	Estimated rank of coal.
CALCULATED RANK	Calculated rank of coal.
BTU/LB	Heat of combustion in British thermal units per pound (Btu/lb)
MMMF BTU	Moist mineral matter free heat of combustion in British thermal units per pound (Btu/lb)
ASHDEF_RED	Ash initial deformation temperature in degrees Fahrenheit (reducing basis)
ASHSOF_RED	Ash softening temperature in degrees Fahrenheit (reducing basis)
ASHFLD_RED	Ash fluidizing temperature in degrees Fahrenheit (reducing basis)
ASHDEF_OXY	Ash initial deformation temperature in degrees Fahrenheit (oxidizing basis)
ASHSOF_OXY	Ash softening temperature in degrees Fahrenheit (oxidizing basis)
ASHFLD_OXY	Ash fluidizing temperature in degrees Fahrenheit (oxidizing basis)
FRESWL	Free swelling index value. (0 = non-agglomerating; 1–9 = ASTM index values)
HGI	Hardgrove grindability index value
MOISTURE	Air Received moisture value in percent
VOLATILE MATTER	As Received volatile matter value in percent
DMMFVM	Dry mineral matter free volatile matter
FIXED CARBON	As Received fixed carbon value in percent
ASH	As Received ash value in percent. (Ashing temperature of 750 degrees C).
HYDROGEN	Hydrogen value in percent
CARBON	Carbon value in percent
NITROGEN	Nitrogen value in percent
OXYGEN	Oxygen value in percent
TOTAL SULFUR	Total sulfur value in percent
SULFATE	Sulfate value in percent
PYRITIC SULFUR	Pyritic sulfur value in percent
ORGANIC SULFUR	Organic sulfur value in percent
CHLORINE	Chlorine value in percent
GAS CF_TON	Results of coal bed methane desorption in cubic feet per ton
SOURCE 1	Source of data and sample collection description
SOURCE 2	Source of data (publication, company, agency or individual)
REFERENCE	Publication source of data and authors
SPREADSHEET	USALYT = Name of spreadsheet in Excel format

For all ash deformation, ash softening and ash fluidizing temperatures, 2700 represents temperatures exceeding 2700 degrees Fahrenheit, 2800 represents temperatures exceeding 2800 degrees Fahrenheit, and 2910 represents temperatures exceeding 2910 degrees Fahrenheit.

EXPLANATION OF ABBREVIATIONS USED, BY FIELD

Field (Name/Designation)	Abbreviation	Explanation
GENERAL ABBREVIATIONS (may apply to any field)	CGS	Colorado Geological Survey
	NMBM	New Mexico Bureau of Mines and Mineral Resources
	USGS	U.S. Geological Survey
POINTID	EFN	Energy Fuels Nuclear
SOURCE	BULL	Bulletin
	CIRC	Circular
	DOE	Department of Energy
	EMPIRE ELEC RPT	Report from Empire Electric Association
	OF	Open file report (with year and number)
	USBM	U.S. Bureau of Mines
	US BUR REC	U.S. Bureau of Reclamation
	TP	Technical paper
SAMPLE TYPE	OCC	Occurrence
LAB NAME	COPC	Charles O. Parker & Co., Denver, CO
	CTE	Commercial Testing and Engineering
	DOE	Department of Energy
	EFL	Energy Fuels Lab
	GJL	Grand Junction Labs
	ITL	Industrial Testing Laboratory, Kansas City, MO
	USBM	U.S. Bureau of Mines
	WAY	Wyoming Analytical Laboratories
ESTRANK & RANK	Bit	Bituminous
	Hv	High volatile
	Lig	Lignite
	Lv	Low volatile
	Mv	Medium volatile
	Subbit	Subbituminous

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