INFORMATION SERIES 7

COLORADO COAL ANALYSES, 1975

[ANALYSES OF 64 SAMPLES COLLECTED IN 1975]

by

Donna L. Boreck, David C. Jones, D. Keith Murray,
Janet E. Schultz, and Denise C. Suek

COLORADO GEOLOGICAL SURVEY

DEPARTMENT OF NATURAL RESOURCES

STATE OF COLORADO

DENVER , COLORADO

1977

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[A N A L Y S E S O F 6 4 S A M P L E S C O L L E C T E D I N 1 9 7 5)

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COLORADO GEOLOGICAL
SURVEY DEPARTMENT OF NATURAL
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DENVER, COLORADO

1977

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"Promote economic development of mineral resources."

"Evaluate the physical features of Colorado, with reference to present and potential human ancLanima-l use."'

"Conduct studies to develop geological information."

"Inventory the State's mineral resources."

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"Promulgate model geologic hazard area control regulation."

"Provide technical assistance to local governments concerning designation of and guidelines for matters of State interest in geologic hazard areas and the identification of mineral resource areas."

"To provide other governmental agencies with technical assistance regarding geothermal resources."

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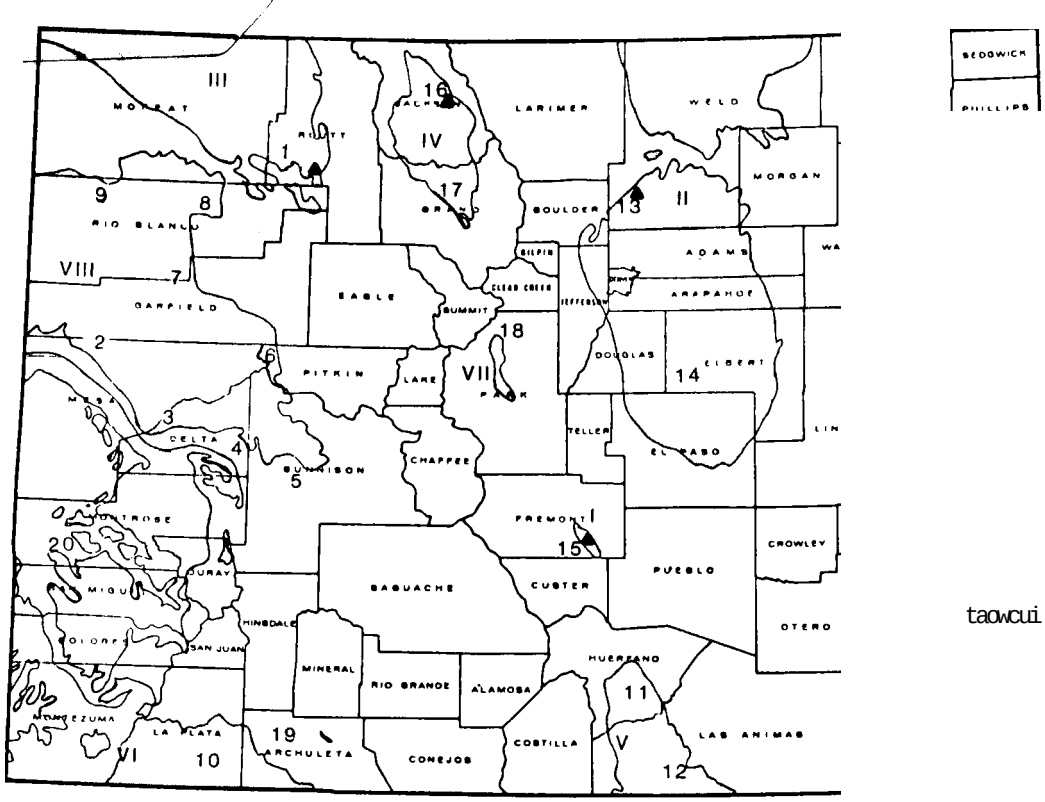
ABSTRACT

During 1975, the Colorado Geological Survey collected 6*t samples from mines in four of the coal-bearing regions in the State as part of a grant program funded by the U. S. Geological Survey. The samples obtained included coal, partings within coal beds, and associated roof-rock and floor-rock from eight surface and two underground mines located in the Boulder-Weld (Denver basin region), Canon City, North Park, and Yampa (Green River region) coal fields. Seven different coal beds, ranging in age from Late Cretaceous to early Tertiary, were sampled; all consisted of channel samples from working faces of mines. This chemical overview provides an accurate assessment of the quality, rank, and geochemical profile of the main coal beds presently being mined in four of the most important coal-producing regions in Colorado.

Tables included in the report display for each sample the results of analyses made by the U. S. Bureau of Mines (ultimate and proximate analyses, heat values, forms of sulfur, etc.) and the U. S. Geological Survey (major, minor, and trace element concentrations in both the whole coal and the ash, etc.). Ranges, arithmetic and geometric means, and geometric deviations have been calculated for much of the data presented. Average values of some of the analyses of coals from the North Park and Yampa fields are compared with average values for the same sequence of analyses for the Interior, Northern Great Plains, and Rocky Mountain coal provinces. Coals from the North Park and Yampa fields exhibit enrichment in certain elements and deficiencies in others, when compared to averages for coals from the three provinces. However, none of the Colorado coals sampled during 1975 exhibits significant enrichment in toxic or radioactive elements (arsenic, mercury, selenium, strontium, uranium, thorium, etc.).

Data sheets and accompanying maps are presented in the appendix for each sample, giving sample locations and a brief description of the coal and associated rocks.



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COAL REGIONS AND FIELDS IN COLORADO

Coal Regions		Coal Fields	
1	Canon Ci ty	1 Yampa	11.Walsenburg
11	Denver Basin	2 Book CIiffs	12.Trinidad
111	Green River	3 Grand Mesa	13.Boulder-Weld
IV	North Park	4 Somerset	14.Colorado Springs
V	Raton Basin	5 Crested Butte	15-Canon City
VI	San Juan	6 Carbondale	16.North Park
VI 1	South Park	7 Grand Hogback	17.Middle Park
VI 1 1	Uinta	8 Danforth Hills	18.South Park
		9 Lower Wh i te R- ver	19-Pagosa Springs
		10 Durango	20.Nucla-Naturita

Figure 1.-Index map showing major coal regions and fields in Colorado. (Taken from Hornbaker and Holt, 1973. 1972 Summary of Coal Resources in Colorado: See Murray (1976). A Approximate location of sampling

INTRODUCTION

In 1975. Colorado ranked 14th in the nation in terms of annual production of bituminous coal. The State's remaining identified bituminous coal resources are the second largest in the United States, and its remaining identified subbituminous resources the fifth largest (Averitt, 1975). Even though coal mining has been an established industry in Colorado since Territorial times (the mid-lROO's), information regarding the quality, composition, and mineability of the coal of the State is still far from complete. Work is now being conducted by both State and Federal agencies to expand both the scope and reliability of available data and to obtain additional information that should result in improved knowledge of the coal resources of Colorado.

During 1975, the Colorado Geological Survey, through a cooperative grant awarded by the U. S. Geological Survey, collected 64 samples from four coal-bearing regions in Colorado (Fig. 1). These samples were obtained from coal and associated rocks ranging from Late Cretaceous to early Tertiary in age (Fig. 2). Most of these samples were analyzed by both the U. S. Geological Survey and U. S. Bureau of Mines. This grant-funded sampling program continued during 1976 and has included both mine samples and cores from evaluation boreholes. The sampling is scheduled to continue into 1977. Although the data presented in this report represent only a small but significant portion of Colorado's immense coal resource, they do provide an accurate assessment of the grade and geochemical profile of the deposits from which they were collected. The contributors to and compilers of this study trust that their efforts will assist both planners and decision-makers in government and industry in achieving maximum efficiency in developing and utilizing Colorado's valuable coal resources.

GEOLOGIC AGE YEARS AGO
CENOZOIC
MESOZOIC
PLIOCENE
11
MIOCENE
25
OLIGOCENE
40
EOCENE
60
PALEOCENE
70±2
UPPER CRETACEOUS
LOWER CRETACEOUS
135±5
JURASSIC
180±5
TRIASSIC
? LOWER
?225±5
SOUTHWEST
CREEDE FORMATION
UNNAMED VOLCANIC ROCKS
SAN JOSE FORMATION
ANIMAS FORMATION
FARMINGTON SS MBR
OJO ALAMO SS.
KIRTLAND SHALE
FRUITLAND FORMATION
PICTURE CLIFFS SS
LEWIS SH
MESAVERDE FM
CLIFF HOUSE SS
MESA VERDE GROUP
PT LOOKOUT SS
CREVASSE CANYON FM
UPPER MANCOS SH
DILCO MBR
GALLUP SS
LOWER MANCOS SHALE
JUANA LOPEZ SS MBR
GREENHORN LS MBR
DAKOTA SANDSTONE
BURRO CANYON FM
CEDAR MOUNTAIN FM
BRUSHY BASIN MBR
MORRISON FORMATION
WESTWATER CANYON MBR
RECAPTURE CREEK MBR
SALT WASH MBR
BLUFF SANDSTONE
SUMMERVILLE FORMATION
TODILTO FORMATION
ENTRADA SANDSTONE
GLEN CANYON GROUP
NAVAJO SS
KAYENTA FM
WINGATE SS
DOLORES FM
CHINLE FM
SHINARUMP
MOENKOPI FORMATION
NORTHWEST
BROWNS PARK FM
BASAL CONGLOMERATE
UINTA FORMATION
GREEN RIVER FORMATION
WASATCH FORMATION
FT UNION FM
OHIO CREEK CGL
LANCE FM
FOX HILLS SS
LEWIS SH
MESAVERDE GROUP
WILLIAMS FORK FM
ILES FM
CASTLEGATE SS
LLOYD SS
SEGO SS
MORAPOS SS
MEEKER SS MBR
MANCOS SHALE
FRONTIER SS
MOWRY SH
DAKOTA SANDSTONE
CEDAR MOUNTAIN FM
BRUSHY BASIN MBR
MORRISON FORMATION
SALT WASH MBR
SUMMERVILLE FM
CURTIS FM
ENTRADA SS
CARMEL FM
GLEN CANYON GROUP
NAVAJO SS OR NUGGET SS
CHINLE FORMATION
SHINARUMP
MAHOGANY
THAINES LS
WOODSIDE FM
MOENKOPI FM
STATE BRIDGE FM
CENTRAL
UNNAMED ROCKS
GROUSE MOUNTAIN BASALT
TROUBLE SOME FM
NORTH PARK FM
TRUMP CGL
WAGON TONGUE FM.
UNNAMED ROCKS
RABBIT EARS VOL
WHITE RV FMS
THIRTY NINE MILE VOL
ANTERO FM
AGATE CREEK
UNNAMED ROCKS
COALMONT FORMATION
MIDDLE PARK FM
PIERRE SHALE
NIOBRARA FORMATION
MANCOS SHALE
GREENHORN LS
DAKOTA GROUP
MORRISON FORMATION
BRUSHY BASIN MBR
SALT WASH MBR
SUMMERVILLE FORMATION
ENTRADA SS.
SAN RAFAEL GROUP
GLEN CANYON SS.
CHINLE FORMATION
MOENKOPI FORMATION
STATE BRIDGE FM (UP PART)
FRONT RANGE
CASTLE ROCK FORMATION
UNNAMED RHYOLITE
DENVER-DAWSON FORMATION
ARAPAHOE FORMATION
LARAMIE FORMATION
FOX HILLS SS
PIERRE SHALE
HYGIENE MBR
SHARON SPGS MBR
NIOBRARA FORMATION
SMOKY HILL MBR
FT HAYS LS MBR
CARLILE SHALE
CODELL SS.
BENTON GROUP
GREENHORN LS
GRANEROS SH
DAKOTA GROUP
SOUTH PLATTE FM
LYTLE FM
MORRISON FORMATION
RALSTON CREEK FORMATION
ENTRADA SANDSTONE
JELM FORMATION
LYKINS FORMATION
NORTHEAST
OGALLALA FORMATION
ARIKAREE GROUP
WHITE RIVER FORMATION
HYGIENE MBR
SHARON SPGS MBR
NIOBRARA FORMATION
SMOKY HILL MBR
FT HAYS LS MBR
CARLILE SHALE
CODELL SS.
BENTON GROUP
GREENHORN LS
GRANEROS SH
'D' SANDSTONE
DAKOTA GROUP
HUNTSMAN SHALE
'J' SANDSTONE
SKULL CR FM
LAKOTA FM
MORRISON FORMATION
RALSTON CREEK FORMATION
LYKINS FORMATION
SOUTHEAST
OGALLALA FORMATION
DEVILS HOLE FORMATION
FARISITA FORMATION
HUERFANO - CUCHARA FORMATION
POISON CANYON FORMATION
BATON FORMATION
VERMEJO FORMATION
TRINIDAD FORMATION
PIERRE SHALE
ROCKY FORD MBR
NIOBRARA FORM
SMOKY HILL MBR
FT HAYS LS MBR
BENTON GROUP
CARLILE SHALE
CODELL SS
GREENHORN LS
GRANEROS SH
DAKOTA SANDSTONE
KIOWA SH
PURGATOIRE FM
CHEYENNE SS
MORRISON FORMATION
RALSTON CREEK FORMATION
DOCKUM GROUP

ACKNOWLEDGMENTS

The U. S. Geological Survey kindly provided major-and minor-oxide and trace-element analyses of the samples collected by the Colorado Geological Survey. The U. S. Bureau of Mines, Pittsburgh, Pa., provided the ultimate and proximate analyses, Btu, forms of sulfur, ash-fusion temperatures, and free-swelling index determinations.

The compilers acknowledge the helpful assistance of the following individuals: Joseph R. Hatch and Vernon E. Swanson, U. S. Geological Survey, Denver, for providing competent overall guidance and coordination of this project since its inception and for greatly assisting both in the field collection of samples and in the preparation of this report; Rick T. Hi 1debrand and Scott D. Woodruff, also of the U. S. Geological Survey, for their able assistance in field work, sample processing, and data compi lat ion; and Dawn Hill Madden, U. S. Geological Survey, for her assistance in coal sampling in North Park. Robert Gast, draftsman with the Colorado Geological Survey, provided advice regarding graphic presentation and organization of the report. Barbara Winter Fillmore and Meredith Y.Curtin of the Colorado Survey aided in the drafting and setup of the publication.

Special recognition is extended to the companies that provided access to their mines for sampling visits and to those that gave permission for the publication of the resulting analyses: GEC Minerals, Inc. (Corley Strip mine), Imperial Coal Company (Eagle mine); Kerr Coal Company (Marr No. 1 Strip mine); Energy Fuels Corporation (Energy Strip mines 1,2, and 3); Pittsburgh and Midway Coal Mining Company (Edna Strip mine); Sunflower Energy Corporat ion i,Grizzly Creek Strip mine); Seneca Coals Limited (Seneca No. 2 Strip mine), Sunland Mining Corporation (Apex No. 2 mine), and Messrs. B. Fazzino and J. Carpine (Twin Pines mine). Without the cooperation of these firms and individuals, this report could not have been published.

SITES SAMPLED

The coal deposits of Colorado are located in eight coal-bearing regions (Fig. 1). The coal region and field terminology employed in the present report is that employed on the new Energy Resources Map of Colorado (U. S. Geological Survey and Colorado Geological Survey, 1977, Map 1-1039, in press). Coal mines in four of these regions--in the Canon City, Boulder-Weld, Yampa, and North Park fields—were sampled by the Colorado Geological Survey, providing the basis for the analyses contained in this report. A total of 64 samples (48 coal, 6 roof-rock, 7 floor-rock, and 3 partings within the coal beds) were collected, as follows: four from Canon City, five from Boulder-Weld, 29 from Yampa, and 24 from North Park fields. A total of eight surface (strip) and two underground mines were sampled during 1975. The 29 samples from the Yampa coal field were obtained from one underground and five surface mines; the 20 samples from the North Park field came from three surface mines; the five samples collected in the Canon City field were obtained from one surface and one underground mine; and the five samples obtained from the Boulder-Weld field came from one underground mine. Index maps showing the exact location of each site sampled and pertinent descriptive material for each sample collected are presented in the Appendix.

COAL BEDS SAMPLED

The 64 samples collected during 1975 represent coal, partings, floor-and roof-rock associated with eight coal beds from the four coal regions sampled. Table 1 summarized the location, stratigraphic and lithologic data, and laboratory numbers for each sample collected and analyzed. Although only seven coal beds were sampled during 1975, the information thus obtained does present an overview of the quality, rank, and chemical variations that characterize the main coal beds presently being mined in four of the most important coal-producing regions in Colorado.

SAMPLING AND PREPARATION TECHNIQUES EMPLOYED

All samples collected during 1975 are channel samples and were collected from working faces of mines. Face-channel sampling is a widely used technique in which a vertical channel is cut the full thickness (or height) of a coal bed and representative samples taken along the entire channel cut. Where practicable, the entire coal bed plus approximately one-half foot of both the roof- and floor-rock are sampled. In cases where the entire coal bed was not exposed, or where the upper portion of the bed was left as an integral part of the roof, only a partial channel sample could be obta ined.

The first operations conducted by the geologist upon arrival at the site to be sampled include measuring the stratigraphic thickness of the coal bed and describing the fresh surface of the channel just cut. The characteristics of the coal noted include: presence and relative abundance of the macerals (vitrinite, fus--ainite, and attritus); textural relationships of the macerals; occurrence of pyrite, calcite, and other minerals; and occurrence and lithology of any partings within the coal bed. In addition, other important related observations, such as condition and lithology of roof- and floor-rock, are made at this time (see Schopf, I960; Swanson and Hoffman, 1976).

After collection, each sample is sealed in a polyethylene bag (samples are double-bagged when necessary to prevent splitting of the plastic bag), sealed, and numbered. Rock samples are bagged separately from the coal samples. Coal sample data sheets are then filled out with pertinent identifying information regarding the site, together with a brief description of the coal and associated rocks sampled.

COAL ANALYSES AND PHYSICAL TESTS CONDUCTED

Analyses of the collected samples were carried out by the U. S„ Bureau of Mines in Pittsburgh, Pennsylvania, and the U. S. Geological Survey in Denver, Colorado. Figure 3 shows, in the form of a flow chart, the sequences of sample preparation and chemical analyses conducted by these two facilities.

The U. S. Bureau of Mines ran proximate and ultimate analyses and determined the heat content (Btu's/lb), ash-fusibility temperatures, forms of sulfur, and free-swelling indices. The analytical methods they used are described in detail in Staff, Office of the Director of Coal Research (1967).

The U. S. Geological Survey analyzes both the whole coal and residual ash for certain trace elements.

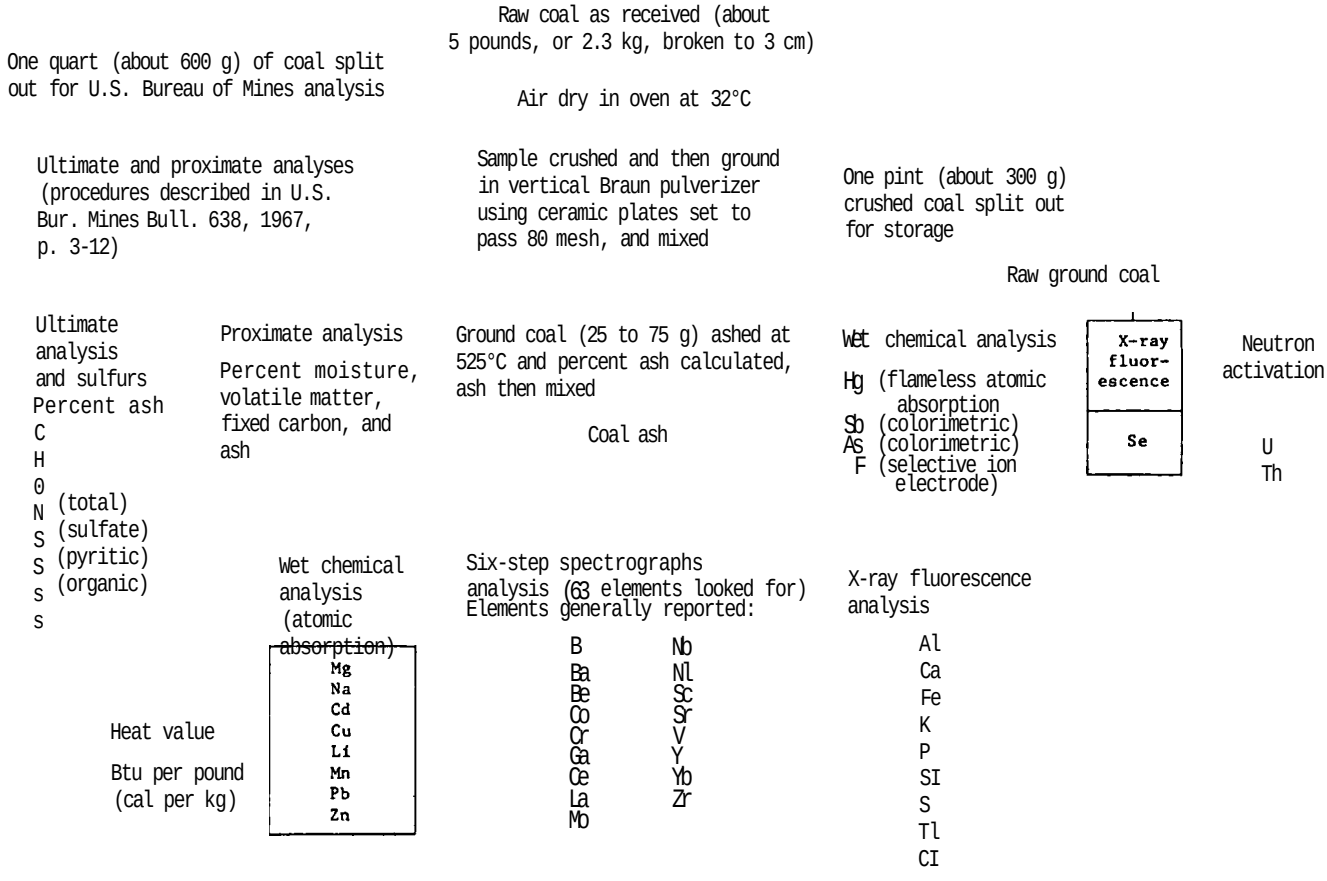

Figure 3-"Flow chart showing sequence of sample preparation and chemical analysis for coal samples analyzed by the U.S.Geological Survey Branch of Analytical Laboratories and U.S.Bureau of Mines Coal Analysis Section.(From U.S.Geological Survey Circular #735, 1976,P.5.).

Concentrations of the volatile elements Se, As, F, Hg, and Sb are determined on the whole coal by either X-ray fluorescence or wet-chemical methods. A neutron activation method is used on whole coal to determine the concentrations of U and Th. The concentrations of the remaining major, minor, and trace elements of interest are determined using a split of the original sample that has been ashed at 525°C. The resulting ash is analyzed for Al, S, CI, Ca, Si, P, Ti, and Fe using X-ray fluorescence. Determinations of Mg, Na, Cd, Cu, Li, Mn, Pb, and Zn concentrations are made by wet-chemical methods. Twenty to thirty other elements are determined by using a semiquantitative 6-step spectrographic method. Details of the analytical methods used are contained in Swanson and Huffman (1976).

ANALYTICAL RESULTS

Results of the analyses of the 64 samples collected are presented below. Table 1 groups all of the samples by coal region (Fig. 1), listing the location, stratigraphic unit, sample numbers, and sample type (channel, tipple, or grab sample) and general lithology (coal, parting, roof-rock, or floor-rock) for each sample.

Additional tables were compiled from the resulting analytical data, as follows:

Table 2 - Ultimate and proximate analyses, heat values, and forms of sulfur.

Table 3 - Ash-fusibility temperatures and free-swel1ing ind ices.

Table 4 and 5 " Major, minor, and trace element analyses of the laboratory ash.

Table 6 - Major, minor, and trace element analyses on, a whole-coal basis.

Tables 7, 8, 9, 10, and 11 - Statistics on the ranges, arithmetic means, geometric means, and geometric deviations of samples from a given coal region, together with comparisons of similar statistics for coals from other coal provinces (Rocky Mountain, Northern Great Plains, and Interior).

The data in these tables are grouped according to coal region, by coal field, and by U. S. Geological Survey laboratory number, in that order.

Complete analyses were run on most of the collected samples. Exceptions include samples considered not to be truly representative. Grab samples and samples taken from previously sampled cuts were not analyzed by the Bureau of Mines. Some samples from the same cut were combined and analyzed by the U. S. Bureau of Mines as composite samples (see Canon City and North Park fields).

Ultimate and proximate analyses, forms of sulfur determinations, and Btu values were not run on samples D176381 and DI76382 (Yampa field); D175953 (Canon City field); and D174487, D174488, DI7636O, and D176361 (North Park field).

Ash-fusibility and free-swelling index determination were not run on the samples, listed above nor on samples D170627 through D17063l (North Park fVe™) D173488 through D173490 (Denver region), and D17qqq7 (Canon City field).

were determined for each sample.

Major, m^nor, and trace element concentrations

Analytical data are

TABLE 1: LOCATION, AGE, GENERAL STRATIGRAPHIC POSITION, BED NAME, SAMPLE NUMBERS AND SAMPLE DESCRIPTION FOR 63 SAMPLES TAKEN FROM FOUR COLORADO COAL FIELDS.

REGION	COUNTY	FIELD	Sec	Twp	Rge				Age	C.G.S. FIELD NO.	U.S.G.S. NUMBER	U.S.B.M NUMBER	SAMPLE TYPE AND
CANON CITY	Fremont	Canon City	18	T.20 S.	R.69 W.	Corley	Strip	uncorrelated	Vermejo Fm.	Upper Cretaceous	75-M-l 75-M-2 75-M-3	D-175952 D-175953 DISSS'*	K56762	Face Channel C Grab C Grab R
			2	T.20 S.	R.70 W.	Twin Pines	Under-ground	Brookside	Vermejo Fm.	Upper Cretaceous	75-M-<t 75-DJ-2 75-DJ-4	D-175955 D-177<<96 Z39 D-177<<97	K56763 Z39	Tipple C Face Channel C Face Channel C
DENVER	Weld	Boulder-Weld	15		68 W.	Eagle	Under-ground	Laramie #3	Laramie Fm.	Upper Cretaceous	75-1 75-2 75-3 75-<t 75-5	D-173'188 D-173'189 D-173<i9l d-173492 D-l73490		Face Channel C Face Channel C Grab F Grab R Channel C
GREEN RIVER	Routt	Yampa	22	T. k N.	R. 86 W.	Apex No. 2	Under-ground		Iles Fm.,Upper Mesaverde Gp.	Upper Cretaceous	75-A-l 75-A-2 75-A-3 75-A-i)	D-176381 D-176382 D-176367 D-176368	K59615	Face Channel C Face Channel C Face Channel F Face Channel R
			7	T. 1t N.	R.85 W.	Edna Strip	Strip	Wadge and Lennox	Williams Fork Fm. , Upper Mesaverde Gp.	Upper Cretaceous	75-W-I0 75-y-i, 75-W-5 75-W-6 75-W-7	D-176366 D-176362 D-176363 D-176379 D-176380	K59616 K59616 K596I4 K59614	Tipple C Face Channel C Face Channel c Face Channel R Face Channel F
			32	T. 5 N.	R.86 W.	Energy No. I A	Strip	Wadge	Williams Fork Fm., Upper Mesaverde Gp.	Upper Cretaceous	75-W-8 75-W-9 75-W-H 75-W-15 75-W-I6 75-W-17	D-176364 0-176365 •176372 •176385 D-176373 D-176374 D-176386	K59618 K596I8 K59619 K59619	Face Channel C Face Channel C Face Channel R Face Channel C Face Channel C Face Channel F
			33	T. 5 N.	R.86 W.	Energy No. 1	Strip							
			30	T. 5 N.	R.87 W.	Energy No. 2	Strip		Williams Fork Fm., Upper Mesaverde Gp.	Upper Cretaceous	75-W-I8 75-W-19 75-W-20	D-176369 D-176370 D-l 76383	K59617 K59617	Face Channel C Face Channel C Face Channel P
			I	T. 5 N.	R.86 W.	Energy No. 3	Strip	Wadge	Williams Fork Fm., Upper Mesaverde Gp.	Upper Cretaceous	75-W-ll 75-W-12 75-W-13	D-176387 D-176375 D-l76376	K59620 K59620	Face Channel C Face Channel C Face Channel F
			35	T. 6 N.	R.87 w.	Seneca No. 2	Strip	Wadge	Williams Fork Fm., Upper Mesaverde Gp.	Upper Cretaceous	75-W-21 75-W-22 75-W-23 75-w-2ii	D-l76388 0-176377 D-176378 D-l76389	K59621 K59621	Face Channel F Face Channel C Face Channel C Face Channel R
NORTH PARK	Jackson	North Park	32	T. 7 N.	R.80 W.	Grizzly Creek	Strip	Riach	Coalmont Fm.	Paleocene-Eocene	75-W-25 75-W-26 75-W-27 75-W-28	D-l76390 0-176359 D-l76360 D-l76361	K59613 K56764	Face Channel C Face Channel C Face Channel F Face Channel P
			2b	T. 9 N.	R.78 W.	Marr No. I	Strip	Sudduth	Coalmont Fm.	Paleocene-Eocene	75-W-l 75-W-2 75-W-3 75-H-ll 75-H-I1A 75-H-1IB 75-H-12 75-H-I2A 75-H-I3 75-H-U 75-H-I5	D-174487 D-17M82 D-l7^483 D-17M88 D-174484 D-l 7i*/t85 D-l 7'«'t86 D-172052 D-l72053 D-l72054 D-172055	K56765 K56766 K56767 K56768 K52662 K52663 K52664 K52665 K52666 K52667 K52668	Face Channel C Grab C Grab C Face Channel C Face Channel C Face Channel P Face Channel C Face Channel 1: Face Channel C Do. C Do.
			2-	T. 8 N.	R.78 W.	Canadian	Strip	Sudduth	Coalmont Fm.	Paleocene-Eocene	75-H-l 75-H-2 75-H-3 75-H-it 75-H-5 75-H-6 75-H-7 75-H-I0 7J»-H-27 7<t-H-28 74-H-29 74-H-30	D-l72056 D-l72057 D-172058 D-172059 D-170627 0-170628 D-l70629 D-170630 D-170631	K5266" K50383 K50384 K50385 K50386 K50387	Grab C Grab C Face Channel C Face Channel C Face Channel C Face Channel C Face Channel C Grab C Face Channel C Face Channel C Face Channel C,P Face Channel C

Under the heading of Sample Type and Lithology, C = coal, F = floor rock, R = roof rock, P = parting.

reported both on ash and whole-coal bases. Most major elements are reported as oxides in the ash and as elements in the whole coal.

Comparative statistical analyses were made only for samples from the North Park and Yampa fields. Samples from the Denver region and Canon City field were omitted from this type of breakdown due to their limited number. Statistical values for ash-fusibility and free-swelling index data also were not computed.

These and future chemical analyses of Colorado coals are scheduled to be entered into the records of the National Coal Resources Data System located in the U. S. Geological Survey's National Center, Reston, Virginia.

EXPLANATION OF STATISTICAL TERMS USED

The ranges, arithmetic means, geometric means, and geometric deviations have been calculated for much of the data contained in this report.

The range gives the maximum and minimun values for coal samples collected in several fields; it does not deal with the distribution or density of the sample values.

The arithmetic mean, as used in this study, is the average of the various analytical values within a given coal reaion. It does not take into account possible skewness of values within the area sampled.

The geometric mean (the antilog of the log of the concentration) gives an estimate of the most probable concentration (mode) in the sampled population. The geometric mean considers the common tendency for trace element concentrations in natural materials to exhibit positively skewed frequency distributions, and normalizes the data on a logarithmic basis. The geometric deviation as used in this report is a measure of scatter about the mode in a population.

CONCLUSIONS

Table 10 gives the average values for ultimate and proximate analyses, Btu's/lb, and forms of sulfur as determined on an as-received basis for the Yampa and North Park fields. For comparative purposes, Table 10 also lists the average values for the same sequence of analyses for the Interior province (Michigan, Indiana, Iowa, Nebraska, Missouri, Kansas, Oklahoma, and Arkansas), the Northern Great Plains province (North Dakota, eastern Montana, and northeastern Wyoming), and the Rocky Mountain province (Wyoming.Colorado, Utah, Arizona, and New Mexico). Province designations are those used in Trumbull (I960).

Data from the Yampa and North Park fields have been listed with those from the Rocky Mountain province to show differences between the mean values in the fields and the average mean of the provinces in which the fields are located.

Comparisons of the data from the Yampa field and those from the Interior province generally reveal no appreciable differences in the concentrations of the elements for which determinations were made liable l"^ One notable exception is in sulfur content: The Bureau of Mines analyses show that coals of the Interior province contain six times more sulfur than do coals of the Yampa field.

Both the North Park field and Northern Great Plains province coals are lower Tertiary '" a9«« North Park coals are subbi luminous A in rank, ^ereas those from the Northern Great Plains province are sub bituminous C to lignite A in rank. North Park coal as might be expected, is higher in both Btu s/lb and in carbon content, and lower in moisture and sultur contents than is Northern Great Plains coal. Volatile matter, ash, hydrogen, oxygen, and nitrogen contents are approximately equal in both areas.

Table 11 lists the arithmetic means of the elemental concentrations of coal from the Yampa and North Park.fields compared with coals from the Rocky Mountain Northern Great Plains, and Interior provinces (reported on a whole-coal basis). Also included on Table 11 for comparison purposes is the composition of average shale as listed by Turekian and Wedepohl (1961).

A comparison of element contents in Yampa and North Park field coals and average values in coal from the entire Rocky Mountain province demonstrates that only slight variations exist. Yampa field coal exhibits a slight enrichment in fluorine (108 ppm vs. 70) and boron (100 ppm vs. 70), while North Park field coal shows a threefold increase in uranium content (4„6 ppm vs. 1.6). Overall, however, the concentration of most elements in coals from the Yampa and North Park fields is only slightly less than the mean value for coals in the entire Rocky Mountain province.

Coals from the Yampa field contain a much lower concentration of sulfide-forming elements than do coals from the Interior province. In the Interior province coals, As is enriched by a factor of 18, Fe by a factor of 13, Mn by 10, Pb by 13, and Zn by a factor of 74 =

These results correlate closely with the sulfur-content data listed on Table 10. Yampa field coals, when compared with those of the Interior province, tend to be higher in both Ba and Sr content by a factor of three.

Comparisons of the average concentrations of elements contained in coals from the North Park field and those from the Northern Great Plains province reveal that the Northern Great Plains coals are enriched in Na by a factor of 20 and in Ba by a factor of 2.6,, However, North Park coals are higher in F by a factor of 2, in Th by a factor of 2, in U by 5, and in V by a factor of 2 when compared with coals of the Northern Great Plains province.

Comparing mean values of element content given on Table 11 of average shale (Turekian and Wedepohl, 1961) with those of coals from the Yampa and North Park fields shows that the coals are deficient in concentration of most elements (Si, Al, Ca, Mg, Na, K, Fe, Mn, Ti, As, Cu, Hg, Li, Pb, Sb, Th, Zn, Ba, Cr, Ga, Sc, Sr, V, Y, Yb, and Zr). The values for Cr, Mn, Fe, K, Na, and Mg are deficient by a factor greater than ten. The coals in these two regions, however, generally contain higher amounts of Cu, Se, and U and are either equal to or enriched in Cd, F, Se, U, B, and Mo when compared with the trace element composition of average shale. Trace element average values were not given for North Park and Yampa field coals for the following elements: Be, Co, Nb, and Ni.

In summary, coals from the Yampa and North Park fields, when compared with the Rocky Mountain, Northern Great Plains, and Interior provinces, generally exhibit the following chemical characteristics-

1. Lower content of Fe, Se, Mn, Cu, Pb^ and Zn.

2. Higher content of Ba and Sr.
3. Enrichment in F in Green River Coals, and in U in North Park coals appear to be regional characteristics and are not reflected in the overall mean values within the Rocky Mountain province.

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TABLE 2: PROXIMATE, ULTIMATE, HEAT VALUE, AND FORMS OF SULFUR ANALYSES OF SAMPLES FROM FOUR COLORADO COAL FIELDS.

SAMPLE NUMBER	LAB NUMBER	PROXIMATE ANALYSIS (PERCENT) Moisture	Volatile Matter	Fixed C		ULTIMATE ANALYSIS (PERCENT)					FORMS OF SULFUR (PERCENT) Sulfate	Pyritic	Organic	HEAT VALUE Btu/lb.	Air Dried Loss
CANON CITY FIELD															
75-M-l	D-l75952	7.5	37.5	44.6	10.4	5.2	64.0	1.1	18.2	1.1	0.01	0.39	0.67	11160	0.55
			40.6	48.5	11.2	4.7	69.3	1.2	12.4	1.2	0.01	0.42	0.72	12070	
75-M-4	D-175955	8.2	45.7	54.3	9.5	5.3	78.0	1.3	14.1	1.3	0.01	0.47	0.81	I 3600	0.87
			36.8	45.5	10.3	5.3	64.0	1.1	19.3	0.8	0.01	0.15	0.59	11260	
75-DJ-2	D-1774963	8.9	40.2	49.5	8.9	4.8	70.0	1.2	12.9	0.8	0.01	0.16	0.65	12270	1.2
			44.8	55.2	9.8	5.4	77.8	1.4	14.5	0.9	0.01	0.18	0.72	13680	
			36.9	45.3		5.1	64.6	0.9	20.0	0.5	0.01	0.13	0.37	11100	
DENVER REGION		BOULDER - WELD FIELD	40.5	49.7		4.5	70.9	1.0	13.3	0.5	0.01	0.14	0.41	12180	
			44.9	55.1		5.0	78.6	1.1	14.7	0.6	0.01	0.16	0.45	13500	
75-1	D-l73488	22.3			4.3	6.3	56.0	1.2	31.8	0.4	0.01	0.13	0.23	9700	
					5.6	4.9	72.0	1.6	15.4	-	0.01	0.17	0.30	12480	
75-2	D-l73489	23.0			4.3	5.2	76.3	1.7	16.3	0.3	0.01	0.18	0.31	13200	8.13
					5.6	6.3	55.7	1.3	32.1	0.4		0.04	0.27	9640	
75-5	D-173490	19.5				4.9	72.4	1.6	15.1	0.4		0.05	0.35	12530	7.55
						5.2	76.7	1.7	16.0	0.3		0.05	0.37	13270	
						5.4	47.5	1.1	27.8	0.3		0.06	0.18	10180	
						4.0	59.0	1.3	13.2	0.4		0.08	0.22	13080	
GREEN RIVER REGION - - YAMPA FIELD						5.2	75.9	1.7	16.8			0.10	0.28		
75-W-4	D-1763623	1 6.4	38.3	52.3	3.0	5.5	71.0	1.6	18.3	0.6	0.01	0.01	0.60	12440	2.04
		2	41.0	55.8	3.2	5.1	75.9	1.7	13.4	0.7	0.01	0.01	0.64	13290	
		3 ~	42.3	57.7	–	5.3	78.4	1.8	13.8	0.7	0.01	0.01	0.66	13730	
75-W-8	D-1763643	1 7.7	37.6	44.8	9.9	5.3	61.8	1.5	20.8	0.7	0.02	0.14	0.53	10850	2.51
		2 –	40.7	48.5	10.8	4.8	67.0	1.7	15.0	0.7	0.02	0.15	0.57	11760	
		3 –	45.6	54.4	--	5.4	75.1	1.9	16.8	0.8	0.02	0.17	0.64	13180	
75-W-10	D-l76366	1 7.8	37.6	43.5	11.1	5.3	61.5	1.5	19.9	0.7	0.01	0.09	0.58	10820	2.45
		2 –	40.8	47.1	12.1	4.8	66.7	1.6	14.1	0.7	0.01	0.10	0.62	11730	
		3 –	46.4	53.6	–	5.5	75.9	1.8	16.0	0.8	0.01	0.11	0.71	13350	
75-W-ll	D-1763693	1 10.4	39.0	46.5	41	5.6	66.5	1.9	21.4	0.5	0.01	0.02	0.43	11590	4.64
		2 –	43.5	52.0	45	5.0	74.3	2.1	13.6	0.5	0.01	0.02	0.48	12940	
		3 –	45.6	54.4	--	5.2	77.8	2.2	14.3	0.5	0.01	0.02	0.50	13550	
75-W-15	D-1763713	1 7.0	38.1	47.3	7.6	5.4	66.1	1.7	18.6	0.6	0.01	0.05	0.53	11560	2.20
		2 –	41.0	50.8	8.2	5.0	71.1	1.8	13.3	0.6	0.01	0.05	0.57	12430	
		3 –	44.6	55.4	–	5.4	77.4	1.9	14.6	0.7	0.01	0.06	0.62	13530	
75-W-18	D-1763733	1 5.7	35.2	41.3	17.8	4.9	59.2	1.5	16.0	0.6	0.01	0.01	0.56	10400	1.58
		2 –	37.3	43.8	18.9	4.5	62.7	1.6	11.7	0.6	0.01	0.01	0.59	11030	
		3 –	46.0	54.0	–	5.6	77.3	2.0	14.3	0.8	0.01	0.01	0.73	13590	
75-W-22	D-1763753	1 10.9	36.7	45.2	7.2	5.6	61.9	1.5	23.3	0.5	0.03	0.03	0.49	10820	4.00
		2 –	41.2	50.7	8.1	4.9	69.5	1.7	15.2	0.6	0.03	0.03	0.55	12140	
		3 –	46.3	55.2	--	5.4	75.6	1.9	16.4	0.7	0.04	0.04	0.60	13200	
75-W-25	D-1763773	1 8.0	38.9	46.0	9.4	5.4	63.4	1.6	19.7	0.5	0.03	0.06	0.45	11130	2.56
		2 –	41.3	50.0	10.2	4.9	68.9	1.7	13.7	0.6	0.03	0.06	0.49	12090	
		3 –	46.0	55.7	--	5.4	76.7	1.9	15.4	0.6	0.04	0.07	0.54	13460	
NORTH PARK FIELD			36.7												
74-H-27	D-170627	14.5	41.2	47.2	6.4	5.8	61.5	1.0	25.1	0.2	0.00	0.08	.16	10730	7.64
			37.8	55.2	7.5	4.8	72.0	1.2	14.2	0.3	0.00	0.10	.18	12390	
74-H-28	D-170628	15.4	40.5	59.7	3.2	5.2	77.8	1.6	15.4	0.3	0.00	0.11	,20	13400	7.49
			32.9	48.5	3.8	5.9	63.5	1.1	26.2	0.2	0.01	0.09	,06	10990	
74-H-29	D-170629	16.1	38.9	57.3	9.5	5.0	75.0	1.2	14.9	0.2	0.01	0. II	.07	12990	9.65
			40.4	59.6	11.3	5.2	78.0	0.8	15.4	0.2	0.01	0.11	07	13500	
74-H-30	D-l70630	14.6	31.4	43.0	3.7	5.7	57.0	1.0	26.8	0.2	0.02	0.05	09	9900	6.90
			37.5	51.2	4.3	4.6	67.9	1.1	15.0	0.2	0.02	0.06	0.11	11800	
74-H-31	D-170631	14.5	42.3	57.7	19.2	5.2	76.6	0.9	I6.9	0.2	0.02	0.07	0.12	13310	8.45
			32.6	49.1	22.4	5.8	63.1	1.0	26.3	0.2	0.00	0.04	0.16	10890	
75-H-l	D-l72052	14.2	38.2	57.5	2.1	4.9	73.8	1.1	15.8	0.2	0.00	0.04	0.12	12750	6.89
			39.9	60.1	2.5	5.1	77.2	0.6	16.4	0.2	0.00	0.05	0.15	13330	
75-H-2	D-172053	14. 4	27.4	38.9	3.3	5.0	49.9	0.7	25.1	0.2	0.00	0.07	0.13	8580	7.54
			32.1	45.5	3.8	4.0	58.4	0.9	14.3	0.2	0.00	0.09	0.15	10040	
75-H-3	D-l72054	13.0	41.3	58.7	4.2	5.2	75.2	1.0	18.4	0.3	0.00	0.11	0.16	12940	6.36
			35.4	48.3	4.9	5.9	64.3	1.2	26.5	0.2	0.00	0.08	0.08	11280	
75-H-5	D-172055	12.4	41.3	56.2	10.8	5.0	74.8	1.2	16.3	0.2	0.00	0.10	0.10	12960	5.02
			42.3	57.7	12.3	5.1	76.8	0.9	16.6	0.3	a 00	0.10	0.10	13290	
			34.4	47.9		5.8	62.8	1.1	27.0	0.2	a 00	0.13	0.11	I0830	
			40.2	56.0		4.9	73.4	1.1	16.6	0.2	0.00	0.15	0.13	12650	
			41.8	58.2		5.1	76.3	0.8	17.2	0.3	0.00	0.16	0.14	13150	
			35.0	47.8		5.7	63.1	1.0	25.9	0.3	0.00	0.16	0.12	10900	
			40.3	54.8		4.9	72.5	1.0	16.4	0.3	0.00	0.18	0.14	12530	
			42.3	57.7		5.2	76.3	0.7	17.2	6.3	0.00	0.19	0.16	13170	
			39.0	54.0		5.4	68.9	0.8	25.8	0.2	0.00	0.18		12040	

TABLE 2: PROXIMATE, ULTIMATE, HEAT VALUE, AND FORMS OF SULFUR ANALYSES OF SAMPLES FROM FOUR COLORADO COAL FIELD (CONTINUED)

SAMPLE NUMBER	LAB NUMBER	BASIS	PROXIMATE ANALYSIS (PERCENT) Moisture	Volatile Matter	Fixed C	Ash	ULTIMATE ANALYSIS (PERCENT) H	C	N	0	S	FORMS OF SULFUR (PERCENT) Sulfate	Pyritic	Organic	HEAT VALUE Btu/lb.	Air Dried Loss
NORTH PARK FIELD (CONTINUED)																
75-H-6	D-l72057		12.0	36.0	45.5	6.5	5.7	61.7	0.9	24.9	0.3	0.02	0.10	0.14	10790	4.57
		2	—	40.9	51.7	7.4	4.9	70.1	1.0	16.3	0.3	0.02	0.11	0.16	12260	—
		3	--	44.2	55.8	--	5.3	75.7	1.1	17.6	0.3	0.02	0.12	0.18	13240	--
75-H-7	D-172058		12.0	38.3	46.0	3.7	5.9	63.8	0.9	25.4	0.3	0.02	0.08	0.19	11160	4.59
		2	—	43.5	52.3	4.2	5.1	72.5	1.1	16.8	0.3	0.02	0.09	0.22	12670	--
		3	—	45.4	54.6	—	5.4	75.7	1.1	17.5	0.3	0.02	0.09	0.23	13220	—
75-H-10	D-l72059		12.8	37.3	44.8	5.1	5.9	62.9	1.0	24.4	0.7	0.02	0.21	0.43	11160	6.46
		2	—	42.8	51.3	5.9	5.1	72.1	1.2	14.9	0.8	0.02	0.24	0.49	12800	—
		3	—	45.4	54.6	—	5.4	76.6	1.3	15.9	0.8	0.02	0.25	0.52	13600	--
75-H-ll	D-l74481		14.5	29.3	24.7	31.5	4.6	37.8	0.5	25.0	0.6	0.03	0.16	0.39	6520	2.67
		2	—	34.3	28.8	36.9	3.5	44.2	0.6	14.1	0.7	0.03	0.18	0.46	7620	
		3	—	54.3	45.7	—	5.5	70.0	1.0	22.4	1.1	0.05	0.29	0.72	12080	—
75-H-12	D-174483		17.2	37.3	36.9	8.6	6.0	54.3	0.7	29.8	0.6	0.01	0.15	0.42	9520	2.49
		2	--	45.0	44.6	10.4	4.9	65.6	0.9	17.5	0.7	0.01	0.18	0.51	11490	—
		3	—	50.2	49.8	—	5.4	73.1	1.0	19.7	0.8	0.01	0.20	0.56	12820	—
75-H-13	D-l74484		17.8	32.0	37.1	13.1	5.6	50.0	0.7	29.6	1.0	0.09	0.36	0.52	8600	2.44
		2	--	38.9	45.2	15.9	4.4	60.8	0.8	16.9	1.2	0.11	0.44	0.63	10460	--
		3	—	46.3	53.7	—	5.2	72.3	1.0	20.1	1.4	0.13	0.52	0.75	12440	—
75-H-14	D-l74485		19.4	33.7	41.4	5.5	6.0	55.3	0.8	31.7	0.7	0.04	0.24	0.46	9570	3.84
		2	~	41.9	51.3	6.8	4.8	68.6	0.9	18.0	0.9	0.05	0.30	0.57	11880	—
		3	—	44.9	55.1	—	5.1	73.6	1.0	19.3	1.0	0.05	0.32	0.61	12740	—
75-H-15	D-l74486		20.2	34.5	34.1	11.2	5.8	49.8	0.8	31.5	0.9	0.07	0.39	0.44	8630	4.77
		2	—	43.3	42.7	14.0	4.5	62.4	1.0	17.0	1.1	0.08	0.49	0.55	10810	
		3	"-	50.4	49.6	--	5.2	72.6	1.2	19.7	1.3	0.10	0.57	0.64	12580	—

Original moisture content may be slightly more than shown because samples were collected and transported in plastic bags to avoid metal contamination.
Forms of analyses: lt as-received; 2, moisture-free; 3, moisture - and ash - free.
2 u
Air Dried Loss is percent of weight lost in drying the sample at 30-35
^Analysis run on composite of two samples;!.e. in Canon City field, sample D-177^96 is a composite of D-17796 and D-17797.
L
Because of variation in sampling and the resultant difference in proximate analyses between tipple sample 75-W-1Q and average run-of-mine samples, test results run by owners of the Apex No. 2 mine are published separately on page 52.

TABLE 3: FUSIBILITY AND FREE-SWELLING INDICES OF COAL SAMPLES FROM THREE COLORADO COAL FIELDS.

SAMPLE NUMBER	LAB NUMBER	FUSIBILITY OF ASH (°F)			FREE-SWELLING INDEX NUMBER
		Initial Deformation	Softening	Fluid	
CANON CITY FIELD2					
75-M-l	D-l75952	21)20	2520	2650	
75-M-4	D-175955	21)00	2500	2650	
75-DJ-2	D-l77496				
75-DJ-4	D-l 77497	2230	2280	2380	
GREEN RIVER REGION - - YAMPA FIELD2					
75-W-4	D-l 76362				
75-W-5	D-l76363	2140	2190	2260	
75-W-8	D-176364				
75-W-9	D-l76365	2330	2380	2430	
75-W-10	D-176366	2530	2580	2680	
75-W-ll	D-176369				
75-W-12	D-l76370	2090	2140	2190	
75-W-15	D-176371				
75-W-16	D-176372	2360	2420	2530	
75-W-18	D-l76373				
75-W-19	D-176374	2360	2460	2600	
75-W-22	D-l76375				
75-W-23	D-176376	2730	2780	2890	
75-W-25	D-l76377				
75-W-26	D-l76378	2640	2740	2860	
NORTH PARK FIELD					
75-W-1	D-l76359	2040	2090	2140	
75-H-1	D-l72052	2050	2100	2150	
75-H-2	D-l 72053	2050	2100	2150	
75-H-3	0-17205*1	2420	2470	2520	
75-H-4	D-172055	2910+	--	—	
75-H-5	D-l72056	2910+	—	--	
75-H-6	D-l72057	2320	2360	2400	
75-H-7	D-l72058	2200	2260	2360	
75-H-10	D-172059	2250	2300	2380	
75-H-ll	D-174481	2910+	—	—	
75-H-12	D-174483	2250	2350	2450	
75-H-13	D-174484	2460	2520	2570	
75-H-14	D-174485	2060	2100	2140	
75-H-I5	D-174486	2280	2320	2360	

Fusibility and free-swelling indices were not run for samples in the Denver region Boulder - Weld field and 75-H-27 through 75-H-31 in the North Park field.

Fusibility and free-swellinq index were run on composite samples in the Canon City and Yampa fields

TABLE 41 MA.luR JUiUJ-*WKm~-0)H*r AND CHLORINE COMPOSITION OF THE LABORATORY ASH OF SAMPLES FROM FOUR COLORADO COAL FIELDS.

SAMPLE NO.	LAB NO.	ASH	MAJOR AND MINOR OXIDES AND CHLORINE AS PERCENT OF ASH											
			Si02	Al203	CaO	MgO	Na20	K20	Fe203	MnO	Ti02	P2°5	SO3	Cl
	CAN ON CITY FIELD													
75-M-l	D-l75952	10.0	49	23	4.9	0.46	0.22	0.20	7.1	0.062	0.58	0.16	6.9	0.10L
75-M-2	D-175953	9.1	59	22	5.5	.60	0.18	0.37	6.6	.074	.76	.18	3.7	.10L
75-M-3	D-l75954	41.1	68	20	1.9	.75	0.99	1.40	6.2	.042	.54	. 10L	1.1	.IOL
75-M-4	D-175955	10.1	56	17	4.3	.81	0.47	0.90	5.9	.043	.83	.13	6.0	.10L
75-DJ-2	D-177496	11.0	40	21	17	.80	0.74	0.16	6.4	.130	.58	. 10L	6.9	—
75-DJ-4	D-l77497	9.1	42	19	13	.90	1 .13	0.04	8.2	.260	.88	.10L	9.1	--
	DEN VER REGION - - BOULDER - WELD FIELD													
75-1	D-173488	5.1	33	13	13	2.46	5 .36	0.35	5.4	0.028	0.76	0.29	17	0.10L
75-2	D-l73489	5.0	36	11	13	2.39	5 .41	0.16	5.7	.029	.63	.25	18	.IOL
75-5	D-l73490	16.3	67	11	3.8	1.05	1 .82	1.30	2.5	.020L	.52	. 10	4.3	.IOL
	GRE EN RIVER REGIO J - - YAMPA FIELD (COAL)													
75-W-4	D-l76362	8.2	41	21	7.1	1.88	0 .26	1.10	6.6	0.028	0.98	2.1	7.1	0.20L
75-W-5	D-176363	12.0	53	23	4.2	1.16	0 .61	0.85	2.7	.014	0.69	1.0 L	3.3	.20L
75-W-8	D-176364	5.6	32	25	9.3	1.68	0 .23	0.53	6.9	.029	II	3.3	10	.20L
75-W-9	D-l76365	16.6	55	26	3.3	1.26	1 .60	1.10	2.0	.007	0.67	1.0 L	1.9	.20L
75-W-10	D-l76366	3.3	35	28	8.0	1.11	2 .35	0.61	9.0	.012	12	3.6	6.5	.20L
75-W-ll	D-l76369	5.5	39	17	14	2.36	0 .49	0.54	8.0	.110	0.88	3.2	9.9	.20L
75-W-12	D-l76370	3.9	31	18	14	3.10	0 .49	0.28	10	.150	0.78	16	13	.20L
75-W-15	D-l76371	10.3	53	23	5.8	1.41	0 .57	0.83	2.9	.012	0.86	1.0 L	3.7	.20L
75-W-16	D-l76372	7.4	46	26	6.3	1.36	0 .26	0.81	4.0	.014	0.99	1.0 L	4.6	.20L
75-W-18	D-l76373	10.1	52	21	5.7	1.53	1 .46	0.83	2.9	.012	0.84	1.3	4.0	.20L
75-W-19	D-l76374	28.2	71	14	2.4	0.81	0 .84	1.50	1.8	.008	0.55	1.C L	1.4	.20L
75-W-22	D-l76375	11.9	48	31	3.2	0.98	0 .15	0.66	2.5	.012	0.80	1.0 -	3.1	.20L
75-W-23	D-l76376	6.2	43	29	6.7	1.44	0 .18	0.48	3.9	.023	10	1.0 L	6.5	.20L
75-W-25	D-176377	11.2	32	39	2.8	1.20	0 .35	1.00	3.1	.010	10	1.0 L	2.1	.20L
75-W-26	D-l76378	9.7	55	27	4.1	0.71	0 .51	1.10	3.0	.009	0.92	1.1	3.0	.20L
75-A-l	D-176381	5.0	48	21	6.4	1.18	1 .59	0.98	7.7	.010	0.84	1.5	6.4	.20L
75-A-2	D-l76382	5.9	42	27	6.8	0.88	1 .42	0.67	6.6	.009	0.95	2.2	4.7	.20L
	(PARTINGS AND ROCKS 1													
75-A-3	D-176367	''	22	6.7	0.07	0.24	0 .16	0.97	0.68	0.002	0.25	0.32L	—	0.064 L
75-A-4	D-l76368	--	39	8.2	11	.39	59	1.30	1.4	.004	.28	.46L	--	0.091L
75-A-6	D-l76379	-	55	8.6	30	.47	56	1.40	12	.004	51	.67L		.13 L
75-A-7	D-l76380	—	55	9.2	38	.72	34	1.40	6.5	.022	.46	.77L	--	.15 L
75-A-l3	D-l76383	--	55	4.8	20	.18	13	0.97	0.5	.009	.44	.65L		.13 L
75-A-l4	D-176384	--	63	9.5	34	.69	54	1.80	15	.007	52	.87L	--	.17 L
75-A-l7	D-l76385	--	66	8.7	20	.35	67	1.60	0.9	.004	.49	.78L		.16 L
75-A-20	D-l76386	--	25	3.6	29	.12	18	0.43	0.28	.001	.17	.30L	--	.06 L
75-A-21	D-176387	--	49	9.1	22	.54	33	1.70	11	.005	.41	.66L	--	.13 L
75-A-24	D-l76388	--	60	9.5	25	.80	44	1.80	18	.005	.38	.88L		.18 L
75-A-27	D-l76389	--	56	8.8	14	.33	60	1.70	0.91	.004	.47	.67L	--	.13 L
75-A-28	D-l76390	'''	28	18	.24	.25	27	0.67	0.87	.004	.38	.49L	~	.098L
	NOR TH PARK FIELD													
74-H-27	D-l70627	8.0	47	22	5.5	0.63	0 .12	0.39	6.4	0.020L	0.59	1.6	3.4	0.10L
74-H-28	D-l70628	3.8	43	17	9.6	1.03	15	0.0S	12	.096	11	1.4	7.1	.IOL
74-H-29	D-l70629	11.4	54	27	3.0	0.93	16	1.40	3.7	.020L	0.83	0.48	2.5	.IOL
74-H-30	D-1 70630	4.1	47	18	8.7	1.48	11	0.10	7.9	.029	0.86	0.31	7.2	.IOL
74-H-31	D-170631	9.8	51	26	4.2	0.93	16	1.10	5.1	.020L	0.57	1.1	3.2	.IOL
75-H-l	D-l72052	2.7	26	15	21	1.39	29	0.13	7.1	.020L	0.81	16	14	.IOL
75-H-2	0-172053	2.7	16	18	22	1.81	27	0.21	7.0	.080	0.74	0.52	8.1	.IOL
75-H-3	D-172054	5.4	25	26	13	1.28	18	0.16	4.6	.020L	16	1.1	5.4	.IOL
75-H-4	D-172055	9.5	41	30	7.3	0.56	11	0.14	2.2	.020L	16	0.93	5.2	.IOL
75-H-5	D-l72056	9.2	46	24	7.4	0.76	09	0.13	3.2	.020L	18	0.53	5.1	.IOL
75-H-6	D-l72057	8.1	44	26	8.3	0.78	14	0.31	3.7	.020L	1.4.	0.35	6.0	.IOL
75-H-7	D-l72058	3.9	30	18	15	1.20	16	0.13	6.9	.099	0.98	0.13	11	.IOL
75-H-IO	D-l72059	6.1	34	24	8.3	1.20	27	0.15	7.5	.020L	0.85	0.1 OL	8.5	.IOL
75-H-l1	D-174481	21.5	48	2x	3.1	1.18	11	1.80	5.4	.035	10	0.22	4.8	.IOL
75-H-l1B	D-l74482	88.2	56	27	0.3	1.43	11	2.40	4.1	.020L	10	0.1 OL	0.30	.IOL
75-H-l2	D-174483	8.9	32	22	11	1.53	12	0.91	6.3	.140	0.96	0.58	14	.IOL
75-H-l3	D-174484	12.9	37	22	7.0	1.10	09	0.66	9.5	.071	0.93	0.25	11	.IOL
75-H-14	D-174485	6.2	21	15	16	2.12	11	0.40	12	.140	0.72	0.31	24	.IOL
75-H-l5	D-174486	12.9	32	22	7.8	1.49	12	1.20	11	.110	0.95	0.16	13	.IOL
75-H-l1A	D-l74487	13.9	42	24	6.0	1.91	14	1.80	6.2	.076	0.92	0.15	6.3	.IOL
75-H-l2A	D-l74488	21.0	50	25	4.0	1.16	12	1.60	5.4	.024	1.0	0.21	6.6	.IOL

*The coal samples were ashed at 525°C. L after a value means less than the value shown.

TABLE 5: TRACE ELEMENT COMPOSITION OF THE LABORATORY ASH OF COAL SAMPLES AND PARTING, ROOF AND FLOOR ROCKS[1] FROM FOUR COLORADO COAL FIELDS.

TRACE ELEMENT CONCENTRATION IN PARTS PER MILLION OF THE ASH

														Ge-S	Hg	La-S	
CANON CITY FIELD																	
75-M-l	0-175952	10.		300	700	7	l.OL	N	15	20	50		30			N	99
75-M-2	D-175953	9.1		300	700	10	l.OL	500L	20	20	58		30			100L	72
75-M-3	D-l75954	41.1		70	500	3	l.OL	500L	10L	15	36		30			N	45
75-M-4	0-175955	10.		500	1000	10	l.OL	500L	50	20	66		20			100L	32
75-DJ-2	D-177496	11.		200	1500	15	l.OL	500L	70	30	51		30			150	21
75-DJ-4	D-177497	9.1		200	2000	15	l.OL	500L	30	30	56		30			150	23
DENVER REGION BOULDER - WELD FIELD																	
75-1	D-173488	5.1		1500	1500	3	l.OL		15	70	70		30	N		N	40
75-2	D-l73489	5.0		1500	2000	7	l.OL		15	30	68		30	20L		100L	33
75-5	D-173490	16.3		500	700	N	l.OL		10L	30	26		15	N		N	27
GREEN RIVER REGION (COAL) YAMPA FIELD																	
75-W-4	D-l76362	8.2		1500	2000	3	1.5	500L	15	30	74		30	N		100	98
75-W-5	D-l76363	12.0		700	1000	3	l.OL	500L	IOL	15	57		30	N		100L	78
75-W-8	0-176364	5.6		1500	3000	10	l.OL	500L	15	20	91		50	N		100	124
75-W-9	D-l76365	15.0		700	1000	3	l.OL	500L	10	10	63		30	N		100L	76
75-w-lO	D-l76366	3.3		3000	5000	15	1.5	N	20	50	108		30	N		100L	118
75-W-ll	D-l76369	5.5		2000	1500	N	l.OL	500L	15	30	77		30	70 N		100	87
75-W-12	D-176370	3.9		1500	1500	N	l.OL	500L	15	30	77		30	N		IOOL	99
75-W-15	0-176371	10.3		3000	1500	10	l.OL	500L	50	70	162		50	0		100L	75
75-W-16	D-176372	7.4		700	2000	3	l.OL	N	15	15	67		30	N		IOOL	94
75-W-18	D-176373	10.1		1500	3000	7	l.OL	500L	15	15	57		30	N		100	51
75-W-19	D-l76374	28.2		1000	3000	3L	1.0	500L	10	15	36		30	N		IOOL	47
75-W-22	0-176375	11.9		700	700	7	l.OL	500L	10	10	57		50	N		100	97
75-W-23	D-176376	6.2		2000	1500	7	l.OL	500L	15	20	77		30	N		100	100
75-W-25	D-l76377	10.2		700	2000	10	l.OL	500L	15	15	50		50	30		100	82
75-W-26	D-l76378	9.7		700	1500	7	1.0	500L	15	15	77		30	N		IOOL	103
75-A-l	D-l76381	5.0		2000	5000	7	l.OL	500L	20	70	126		30	N		IOOL	109
75-A-2	D-176382	5.9		1500	5000	10	l.OL	500L	15	50	80		30	N		IOOL	167
(ROOF AND FLOOR ROCK)																	
75-A-3	D-l76367		1	100	200	2	0.3L	N	5	20	13	180	10		.0.03	30L	37
75-A-4	D-176368		8	70	300	3	0.5L	N	5	30	90	275	15		0.15	N	56
75-W-6	D-l76379		2	70	1500	2	0.7L	N	7L	20	15	275	10		0.11	70L	26
75-W-7	D-l76380		3J	50	200	2L	0.8L	N	10	20	26	455	10		0.42	N	34
75-W-13	D-176383		3	50	200	10	0.7L	N	10	100	13 L	115	10		0.10	N	78
75-W-14	D-176384		12	70	500	N	0.9L	N	15	70	35	565	15		0.23	IOOL	33
75-W-17	D-l76385		2	50	500	N	0.8L	500L	7L	20	19	330	15		0.06	70L	30
75-W-20	0-176386		2	100	300	1	0.3L	N	3L	10	12	65	5		fi.02	N	15
75-W-21	D-l76387		2	100	500	5	0.7L	N	7L	30	30	330	10		0.05	70L	25
75-W-24	D-l76388		8	70	700	3	0.9L	500L	15	50	38	755	15		0.13	IOOL	39
75-W-27	D-l76389		2	70	500	2	0.7L	300L	7L	20	27	330	15		0.06	70L	28
75-W-28	D-l76390		2	70	500	N	0. 5L	N	5L	15	15	208	20		0.02	50L	52
NORTH PARK FIELD																	
74-H-27	D-l70627	8.		500	3000		l.OL		7	15	44		20				
74-H-28	D-170628	3.8		700	5000		l.OL		7	20	98		15				
74-H-29	D-l70629	11.4		300	2000		l.OL	N	10	30	76		15				
74-H-30	D-l70630	4.1		1000	5000	N	l.OL	N	15	20	112		15				
74-H-31	D-l70631	9.8		500	2000	N	l.OL	N	7	10	33		15		...	IOOL	34
75-H-l	D-172052	2.7		1000	7000	3	l.OL	N	15	30	150		20			150	70
75-H-2	D-172053	2.7		700	5000	3	l.OL	500L	15	20	110		30			100	133
75-H-3	D-l72054	5.4		300	3000	3	l.OL	500L	15	20	126		30			100	175
75-H-4	D-172055	9.5		200	1500	N	l.OL	N	15	15	68		50			IOOL	68
75-H-5	D-l72056	9.2		200	1000	N	l.OL	N	IOL	15	106		30			IOOL	63
75-H-6	D-172057	8.1		300	1500	3	l.OL	N	15	15	102		50			IOOL	37
75-H-7	D-172058	3.9		700	3000	7	l.OL	500L	20	30	176		30			100	37
75-H-10	D-172059	6.1		1000	1500	7	l.OL	500L	10	30	132		30			IOOL	72
75-H-ll	D-174481	21.5		300	1500	3	l.OL	500L	30	150	216		50			IOOL	94
75-H-lIB	D-174482	88.2		50L	300	7	l.OL	500L	10	70	114		30			100	50
75-H-12	D-174483	8.9		500	5000	5	l.OL	500L	30	150	246		30			IOOL	66
75-H-l3	D-174484	12.9		300	1500	7	l.OL	500L	30	100	214		30			100	20
75-H-14	D-174485	6.2		700	2000	7	l.OL	500L	30	150	284		30			100	50
75-H-15	D-174486	12.9		300	1000	7	2.5	500L	30	150	386		30			IOOL	72
75-H-l1A	D-174487	13.9		500	1000	7	l.OL	500L	20	150	178		30			IOOL	78
75-H-l2A	D-174488	21.0		300	1500		l.OL	500L	20	150	266		50				

LAB NUMBER						Sc-S									
CANON CITY FIELD															
D-l75952	15	20		15	55	15		700			50	70	7	26	200
D-l75953	10	20		20	45	15		1000			70	70	7	26	150
D-175954	N	20L		15	30	10		300			70	30	3	64	150
D-155955	15	20L		30	25 L	15		1000			100	50	5	30	200
D-177496	7	20L		20	30	15		300			150	100	7	20L	200
D-l77497	7	20		30	45	15		500			70	70	7	20L	300
DENVER REGION BOULDER - WELD FIELD															
D-173488	15	30		20	35	15		1000			50	30	3	20	150
D-l73489	7	20		30	25	15		1000			60	70	5	31	150
D-173490					25 L	10L		500			70	20	2	30	200
GREEN RIVER REGION (COAL) YAMPA FIELD															
D-l76;,:;.	7	20	I50L	30	35	15	–	3000			70	50	5	83	200
D-l76363	7	20	150L	15	40	10	–	700			50	30	3	85	200
D-176364	10	50	150L	15	45	30	–	5000			100	70	7	56	300
D-l76365	N	20	N	15	30	10L	–	700			50	30	2	74	200
D-l76366	30	50	150	70	50	30	–	5000			150	70	7	81	300
D-l76369		20	N	30	40	15	–	1500			70	30	3	38	200
D-176370	7	20	N	30	40	15	–	2000			70	30	3	37	200
D-l76371	7	30	I50L	70	60	50	–	3000			150	70	7	56	200
D-176372	N	20	I50L	15	60	10	–	1000			70	30	3	38	200
D-176373	10	30	150L	30	40	15	–	1500			50	70	5	48	300
D-176374	10	20	150	15	25	10L	–	1500			50	30	3	39	200
D-176375	7	20L	150L	10	50	10	–	700			70	30	3	35	200
D-176376	30	30	150	15	70	15	–	1500			70	70	7	37	300
D-176377	20	50	150L	15	60	15	–	700			70	50	7	44	300
0-176378		20	150	20	50	15	–	1000			70	30	3	58	300
0-176381		30	150L	50	60	20	–	3000			150	70	7	58	200
D-176382		30	N	50	50	30	–	5000			150	70	7	47	300
(PARTINGS AND ROOF AND FLOOR ROCKS)															
0-176367	N	15		10	19	2.0	7	.9	70	6.8	1.8	30	10	1.5	10	70
D-176368	N	16		16	28	4.0	10	3.4	100	12.2	7.3	70	15	1.5	48	100
D-l76379	N	15		20	17 L	.3	7 L	1.5	100	18.8	3.0	50	20	2	70	150
D-l76380	5	15		50	19 L	.8	7	2.5	100	21.1	7.2	50	20	2	69	150
D-l76383	N	15		15	16 L	1.2	20	1.3	70	14.5	1.4	200	20	3	27	200
D-l76384	N	15		30	22 L	1.1	10	1.8	100	19.9	4.4	70	30	3	107	150
D-l76385	20	15		10	20 L	.4	7 L	1.1	100	14.4	3.0	50	20	2	31	150
D-l76386	N	10		3L	9	.4	3 L	1.6	100	7.5	1.3	10	10	1	9	70
D-l76387	N	20		15	16 L	1.3	10	1.0	70	13.2	2.2	100	20	2	40	200
D-l76388	N	30		30	22 L	.7	15	1.4	70	16.2	4.6	70	30	3	96	150
D-l76389	15	20		10	17 L	1.9	7	.9	100	13.0	2.5	70	20	2	38	200
D-l76390	3	10L		5L	20	.3	N	1.3	70	15.1	4.0	15	10L	1L	15	150
NORTH PARK FIELD															
D-l70627	5	N	B	15	25	10		2000			50	20		60	150
D-l70628	5	N	B	15	25	10		2000			70	30		90	200
D-l70629	5	N	B	10	65	10		700			100	20		62	150
D-170630	10	7	N	20	40	15		1500			100	30		94	200
D-170631	7	7	B	7	55	7		1000			50	30		80	150
D-172052	10	20	150L	30	35	15		1500			100	50		70	200
D-l72053	7	20L	N	30	40	15		1000			100	30		70	N
0-172054	7	20L	N	15	50	15		700			70	30		52	N
0-172055	7	30	150L	10L	60	15		1000			100	30		44	N
D-172056	7	30	N	10L	50	10		700			150	20		46	N
D-l72057	7	50	150L	15	35	15		1000			100	30		58	N
D-172058	7	20L	150L	30	40	15		700			150	30		92	N
D-172059	20	20	150L	30	50	15		500			150	50		34	N
D-174481	30	30	150L	50	40	20		1000			300	50		150	70
D-l74482	15	30	150L	20	25 L	15		150			70	30		147	50
D-174483	50	20	150	70	30	30		3000			300	70		100	70
D-174484	30	20L	150L	100	30	20		1500			200	30		55	70
D-174485	70	20	150	70	40	30		3000			300	70		97	70
D-174486	70	20	150	70	45	30		1000			300	70		304	70
0-174487	30	20	150L	50	40	20		700			150	50		172	70
D-174488	30	20	N	50	45	20		1000			300	30		110	70

As received.

1L' after a value means less than the value shown, 'N' means not detected, and '8' means not determined. 'S' after the element title means that the values listed were determined by semiquantitative spectrographic analysis. The spectrograph^ results are to be identified with geometric brackets whose boundaries are 1.2, 0.83, 0.56, 0.38, 0.26, 0.18, 0.12, etc., but are reported arbitrarily as mid-points of those brackets, 1.0, 0.7, 0.5, 0.3, 0.2, 0.15, 0.1, etc. The precision of the spectrographc data is approximately one bracketat 68 percent, or two brackets at 95 percent confidence

TABLE 6: MAJOR, MINOR, AND TRACE-ELEMENT COMPOSITION OF COAL SAMPLES FROM FOUR COLORADO COAL FIELDS, REPORTED ON WHOLE COAL BASIS.

SAMPLE NUMBER	LAB NUMBER	Al [%]	As (ppm)	B (jpm-Sl	Ba ppm-S]	Be ppm-S)	Ca 1*)	Ce ppm-S)	Cd ppm)	CI (*)	Co (ppm-S)	Cr (ppm-S)	Cu (ppm)	F (ppm)	Fe «	Ga (ppm-S)	je (apm-S	Hg ppm)	K %)	La (ppm-S)	Li (ppm)	Mg (%)
	CANON CITY FIELD																					
75-M-l	D-l75952	1.20	1.0	30	70	0.7	C .35	N	0.1L	0.010L	1.5	2	5.0	30	0.50	3	N	0.01	0.017	N	9.9	0.028
75-M-2	0-175953	1.00	1.0	30	70	1.0	C .36	50L	.1L	.009L	2.0	2	5.3	50	0.42	3	N	.02	.028	10L	6.6	.033
75-M-3	D-l75954	4.40	4.0	30	200	1.5	C .56	200L	.4L	.041 l	5.0L	7	14.8	100	1.80	5	N	.06	.480	N	18.5	.185
75-M-4	D-175955	0.80	1.0	50	100	1.0	C .31	50L	.1L	.010L	5.0	2	6.6	45	0.41	2	N	.01	.075	IOL	3.2	.049
75-DJ2	0-177496	1.20	0.5	20	150	1.5	.30	30L	.1 1L		7.0	3	5.6	25	0.49	3	N	.02	.010	15	2.3	.049
75-DJ-4	D-l77497	0.90	0.5	20	200	1.5	0.87	50L	.09L	—	3.0	3	5.1	20	0.52	3	N	.02	.003	15	2.1	.053
																						.049
	DENVER RE GION - - BOULDER WELD FIELD																					
75-1	D-l73488	0.35	1.0	70	70	0.15	3.48		0.IL	0.005L	0.7	3	3.6	20L	0.19	1.5	1 L	0.01	0.015	N	2.0	0.075
75-2	D-173489	0.30	l.0L	70	100	.3	.47		.1L	.005L	0.7	1.5	3.4	20L	.20	1.5	1L	.01	.007	5	1.6	.072
75-5	D-l 73490	0.95	1.0	70	100	N	.45		.2L	.016L	1.5L	5	4.2	60	.28	2	1L	.02	.180	N	4.4	.103
	GREEN RU ER REGION - - YAMPA FIELD																					
75-W-4	D-l76362	0.91	3.0	150	150	0.2	0.42	50L	0.12	0.016L	1.5	2	6.1	115	0.38	2	N	0.10	0.074	7	8.0	0.093
75-W-5	D-176363	1.50	l.0L	70	100	0.3	.36	70L	.I2L	• 024L	l.0L	1.5	6.8	105	.22	3	N	.02	.085	10L	9.4	.084
75-W-8	D-l76364	0.74	1.0	70	150	0.5	.37	30L	.06L	.01 1 L	0.7	1	5.1	75	.27	3	N	.03	.025	5	6.9	.057
75-W-9	D-l 763651	2.30	l.0L	100	150	0.5	.39	70L	.17L	.033L	1.5	1.5	10.5	35	.23	5	N	.03	.150	15	12.6	.126
75-W-10	D-l 763661	0.41	4.0	100	150	0.5	.19	N	.05	.007L	0.7	1.5	3.6	100	.21	1	N	.02	.017	3	3.9	.022
75-W-ll	D-176369	0.50	l.0L	100	70	N	.55	30L	.05L	.01 IL	0.7	1.5	4.2	190	.31	1.5	N	.02	.025	5	4.8	.078
75-W-12	D-176370	0.36	l.0L	70	70	N	.39	20L	.04L	.008L	0.7	1	3.0	120	.27	1	N	.01	.009	5	3.5	.073
75-W-15	D-176371	1.30	l.0L	300	150	1.0	.43	50L	.IOL	.021L	5.0	7	16.7	80	.21	5	7	.02	.071	10L	7.7	.088
75-W-I6	D-176372	1.00	l.0L	50	150	0.2	.33	N	.07L	.01 5L	1.0	1	5.0	100	.21	2	N	.02	.050	7	7.0	.061
75-W-I8	D-176373	1.10	l.0L	150	300	0.7	.41	50L	.IOL	.020L	1.5	1.5	5.8	105	.21	3	N	.04	.070	10	5.2	.093
75-W-I9	D-176374	2.00	l.0L	300	700	0.7L	.48	150L	.28	.056L	3.0	5	10.2	150	.36	7	N	.04	.350	30L	13.3	.138
75-W-22	D-l 76375	2.00	l.0L	70	70	0.7	.27	70L	.12L	.024L	1.0	1	6.8	50	.21	7	N	.02	.065	10	11.5	.070
75-W-23	D-176376	0.95	l.0L	150	100	0.5	.30	30L	.06L	. 01 2L	1.0	1.5	4.8	75	.17	2	N	.02	.025	7	6.2	.054
75-W-25	D-176377	1.80	1.0	70	200	1.0	.22	50L	. 1 1 L	.022L	1.5	1.5	5.6	115	.25	5	3	.05	.097	10	9.2	.081
75-W-26	D-176378	1.40	l.0L	70	150	0.7	.28	50L	.IOL	.01 9L	1.5	1.5	7.5	140	.20	3	N	.03	.091	10L	10.5	.042
75-A-l	D-l76381	0.55	2.0	100	200	0.3	.23	20L	.05L	.010L	1.0	3	6.3	105	.27	1.5	N	.03	.041	5	5.5	.035
75-A-2	D-l76382	0.83	4.0	100	300	0.7	.29	30L	.06L	. 01 2L	1.0	3	4.7	150	.27	3	N	.04	.033	7L	9.9	.031
	NORTH PA IK FIELD																					
75-H-27	D-170627	0.95	1.0	50	200	N	0.32	N	0.10L	0.008L	0.5	1	3.5	115	0.36	1.5	N	0.04	0.026	N	3.0	0.030
75-H-28	D-170628	0.34	1.0	30	200	N	.26	N	.04L	.004L	0.3	0.7	3.7	40	• 32	0.7	N	.04	0.003	N	1.3	.024
75-H-29	D-170629	1.60	3.0	30	200	N	.24	N	.IOL	.OUL	1.0	3	8.7	80.	.29	1.5	N	.07	0.140	N	3.6	.064
75-H-30	D-170630	0.40	1.0	50	200	0.15	.25	N	.04L	.004L	0.7	0.7	4.6	30	.23	0.7	N	.04	0.003	3	1.2	.036
75-H-3I	0-170631	1.40	2.0	50	200	N	.29	N	.IOL	.010L	0.7	1	3.2	130	.35	1.5	N	.04	0.089	N	2.0	.055
75-H-l	D-l72052	0.21	2.0	30	200	N	.40	N	.03L	.003L	0.5	0.7	4.0	30	.13	0.5	N	.02	0.003	3	0.9	.023
75-H-2	D-l72053	0.26	2.0	20	150	0.07	.42	15	.03L	.003L	0.5	0.5	3.0	25	.13	0.7	N	.02	0.005	5	1.9	.029
75-H-3	D-l72054	0.74	2.0	15	150	0.15	.51	30L	.IOL	.005L	0.7	1	6.8	30	.17	1.5	N	.01	0.007	5	7.5	.042
75-H-4	D-l 72055	1.50	2.0	20	150	0.3	.50	N	.IOL	.009L	1.5	1.5	6.5	35	.14	5	N	.02	0.011	10	16.6	.032
75-H-5	D-172056	1.20	2.0	20	100	N	.48	N	.IOL	.009L	l.0L	1.5	9.8	30	.26	3	N	.05	0.010	10L	6.3	.042
75-H-6	D-172057	1.10	2.0	20	150	N	.48	N	.IOL	.008L	1.5	1.5	8.3	30	.21	5	N	.03	0.021	7	5.6	.038
75-H-7	D-172058	0.37	2.0	30	100	0.1	.42	20L	.04L	.004L	0.7	1	6.9	25	.19	1	N	.02	0.004	5L	1.4	.028
75-H-lO	D-172059	0.76	1.0	70	100	0.5	.36	30L	.IOL	.006L	0.7	2	8.1	30	.32	2	N	.05	0.007	7	2.3	.044
75-H-l1	D-174481	2.90	2.0	70	300	1.5	.48	IOOL	.20L	.022L	7	30	46.4	185	.81	10	N	.04	0.320	20	15.5	.153
75-H-l1A	D-l74487	1.80	1.0	70	150	1	.60	70L	.IOL	.014L	3	20	24.7	105	.60	5	N	.02	0.200	15	10.0	.160
75-H-lIB	0-174482	13.0	1.0	50	300	3	.20	500L	.90L	.088L	10	70	101.0	920	.60	30	N	.05	1.700	IOOL	82.9	.759
75-H-12	D-174483	1.00	1.0	50	500	0.7	.70	50L	.IOL	.009L	3	15	21.9	75	.39	3	N	.03	0.067	10	4.5	.082
75-H-l2A	D-174488	2.80	3.0	70	300	1.5	.80	IOOL	.20L	.021L	5	30	55.9	150	.79	10	N	.06	0.270	20	16.4	.147
75-H-13	D-174484	1.50	4.0	50	200	0.7	.65	70L	.IOL	.01 3L	5	15	27.6	65	.86	5	N	.21		I5L	8.5	.085
75-H-14	D-174485	0.48	2.0	50	150	0.5	.69	30L	.IOL	.006L	2	10	17.6	35	.53	2	N	.04	0.070	7	1.2	.079
75-H-15	D-174486	1-50	3.0	50	150	1	.72	70L	.30L	.01 3L	5	20	49.8	55	.36	5	N	100	0.021	15	6.5	.116
																			0. 130			

Al, Ca, Mg, Na, F, Fe, Mn, Ti CI, Cd, Cu, Li, Pb, and Zn values were calculated from values represenfinn ?v,,, = ,1 * , ,
Hg, Sb, Se, Th, and U values are from direct determination on air dried (32°C) coal. The coals were ashed a? 525°r • *" laboratory ash. As, means less than the value shown, N means not detected, and B means not determined. S after the element titlo m==„= -u '" L"°St cases> L after a value by semiquantitative spectrographic analysis. rnS that the val"es listed were determined

LAB NUMBER	Mn (ppm)	Mo (ppm-S)	Na (%)	Nb (ppm-S)	Nd ppm-S)	Ni ppm-S)	P ppm)	Pb (ppm)	Sb (ppm)	Sc (ppm-S)	Se (ppm)	Si U)	Sr (ppm-S)	Th (ppm)	Ti in	U (ppm)	V (ppm-Sl	Y ppm-Sj	Yb ppm-S)	Zn (ppm)	Zr (ppm-S)
	CANON CITY FIELD																				
D-l75952	48.0	1.5	0.016	2		1.5	71	5.5	0.4	1.5	1.6	2.3	70	4.8	0.035	1.5	5	7	0.7	2.6	20
D-175953	52.0	1	0.012	2		2	71	4.1	0.3	1.5	1.7	2.5	100	3.0L	0.041	1.0	7	7	0.7	2.4	15
D-l75954	130.0	N	0.300	7 L	...	7	180L	12.3	0.6	5.0	1.8	13	150	10.8	0.130	2.9	30	15	1.5	26.3	70
0-175955	34.0	1.5	0.035	2 L		3	58	2.5L	0.2	1.5	1	2.6	100	3.0L	0.049	0.5	10	5	0.5	3.0	20
D-l77496	110.0	0.7	0.060	2 L	15	2	48L	3.3	0.4	1.5	0.8	2.1	30	4.0	0.038	0.9	15	10	0.7	2.2L	20
D-l77497	180.0	0.7	0.076	2	15	3	41	4.1	0.5	1.5	1.6	1.8	50	3.0L	0.048	1.3	7	7	0.7	1.8L	30
	DENVER REGION - - BOULDER - WELD FIELD																				
D-l 73488	11.0	0.7	0.202	1.5		1	64	1.8	0.2	0.7	3.3	0.78	50	3.0L	0.023	0.4	7	1.5	0.15	1.0	7
D-173489	11.0	0.3	0.200	1		1.5	55	1.2	0.3	0.7	0.7	0.85	50	3.0L	0.019	0.4	5	3	0.2	1.5	7
D-I7349C	25.0	N	0.220	3 L		3	72	4.1L	0.2	I.5L	0.7	5.1	70	3.0L	0.051	0.7	10	3	0.3	4.9	30
	GREEN RIVER REGION - - YAMPA FIELD																				
D-l 76362	18.0	0.7	0.016	1.5	15L	2	770	2.9	0.2	1.5	1.2	1.6	200	3.0L	0.048	0.8	7	5		6.8	
D-l76363	13.0	0.7	0.054	2	15L	1.5	520 L	4.8	0.1	1.0	0.9	3	70	3.0L	0 .049	0.8	7	3		10.2	
D-176364	13.0	0.5	0.010	3	7L	0.7	800	2.5	0.2	1.5	1	0.84	300	3.0L	0.037	0.9	5	5		3.1	
D-l76365	9.1	N	0.134	3	N	2	720 L	5.0	0.1L	1.5L	0.8	4.1	100	10.2	0.067	0.8	7	5		12.3	
D-l76366	3.1	1	0.058	1.5	5	2	510	1.7	0.5	1.0	0.4	0.54	150	3.0L	0.023	1.6	5	2		2.7	
D-l76369	46.0	N	0.020	1	N	1.5	760	2.2	0.3	0.7	0.9	1	70	3.0L	0.029	0.2L	5	1.5	---	2. 1	
D-l76370	44.0	N	0.014	0.7	N	1	270	1.6	0.2	0.7	0.9	0.57	70	3.0L	0.018	0.4	3	1		1.4	
D-176371	9.3	0.7	0.043	3	15L	7	450 L	6.2	0.2	5.0	0.9	2.5	300	3.0L	0.053	0.9	15	7		5.8	
D-176372	7.8	N	0.014	1.5	10L	1	320 L	4.4	0.1	0.7	0.9	1.6	70	3.0L	0.044	0.9	5	2		2.8	
D-176373	9.6	0.7	0.109	3	15L	3	570	4.0	0.1	1.5	0.9	2.4	150	3.0L	0.051	0.7	5	7		4.8	
D-176374	18.0	2	0.175	7	50	5	1200 L	7.1	0.3	3-0L	1.4	9.3	500	9.7	0.094	1.5	15	7		11.0	
D-176375	11.0	N	0.013	2 L	15L	1 L	520 L	6.0	0.2	1.0	1	2.7	70	5.1	0.057	0.6	7	3		4.2	
D-176376	11.0	0.7	0.008	2	10	1	270 L	4.3	0.3	1.0	1.4	1.2	100	3.0L	0.038	1.1	5	5		2.3	
D-l76377	8.4	1	0.029	5	15L	1.5	490 L	6.7	0.5	1.5	1.3	2.7	70	8.7	0.068	1.3	7	5		4.9	
D-l76378	6.8	0.7	0.037	2	15	2	490	4.9	0.3	1.5	0.9	2.5	100	3.0L	0.053	0.7	7	3		5.6	
D-176381	4.0	1.5	0.059	1.5	7L	2	330	3.0	0.7	1.0	1.1	1.1	150	3.0L	0.025	2.3	7	3		2.9	
D-176382	4.1	1	0.062	1.5	N	3	560	2.9	0.5	1.5	1	1.1	300	3.0L	0.034	1.0	10	5		2.8	
	NORTH PARK FIELD																				
D-l70627	12.0L	0.5	0.007	N	B	1	570	2.0	0.1	0.7	0.5	1.8	150	3.0L	0.028	0.6	5	1.5	0.15	4.8	10
D-l70628	28.0	0.2	0.004	N	B	0.7	230	1.0	0.1L	0.3	0.3	0.77	70	3.0L	0.025	0.4	3	1	0.1	3.4	7
D-l70629	18.0L	0.7	0.014	N	B	1	240	7.4	0.2	10	1.3	2.9	70	3.3	0.057	1.0	10	2	0.2	7.1	
D-170630	9.2	0.5	0.003	0.3	N	0.7	56	1.6	0.1	0.7	0.3	0.90	70	3.0L	0.021	0.4	5	1.5	0.15	3.9	15
D-170631	15.0L	0.7	0.012	0.7	B	0.7	450	5.4	0.1L	0.7	0.3	2.4	100	3.0L	0.034	1.1	5	3	0.2	7.8	15
D-l72052	4.2L	0.3	0.004	0.5	5L	0.7	190	0.9	0.2	0.5	1.9	0.33	50	3.0L	0.013	0.2L	3	1.5	0.07	1.9	
D-l72053	17.0	0.2	0.005	0.5L	N	0.7	62	1.1	0.2	0.5	0.8	0.20	30	3.0L	0.012	0.3	3	0.7	0.07	1.9	5
D-172054	8.4L	0.3	0.007	1 L	N	0.7	260	2.7	0.1	0.7	0.3	0.63	30	3.0L	0.052	0.6	3	1.5	0.15	2.8	
D-172055	15. 0L	0.7	0.008	3	15L	1 L	390	5.7	0.2	1.5	1	1.8	100	4.4	0.089	0.8	10	3	0.3	4.2	
D-l72056	14.0L	0.7	0.006	3	N	1 L	210	4.6	0.2	1.0	1	2	70	3.8	0.099	1.0	15	2	0.2	4.2	
D-172057	13.0L	0.7	0.008	5	15L	1.5	120	2.8	0.9	1.5	0.4	1.6	70	4.6	0.066	1.3	7	2	0.2	4.7	
D-172058	30.0	0.3	0.005	0.7L	7L	1	21	1.6	0.2	0.7	0.2	0.55	30	3.0L	0.023	0.2L	7	1	0.1	2.6	
D-172059	9.4L	1.5	0.012	1.5	10	2	27 L	3.1	0.3	1.0	0.4	0.97	30	3.4	0.031	0.6	10	3	0.2	2.1	
D-174481	58.0	7	0.017	7	30	10	210	8.6	0.2	5.0	2.4	4.8	200	16.1	0.130	12.5	70	10	1	32.3	15
D-174487	82.0	5	0.014	3	20	7	99	5.6	0.1	3.0	0.7	2.7	100	7.5	0.077	5.4	20	7	0.7		
D-174482	140.0L	15	0.071	30	150L	15	380 L	22.0L	0. 1	15-0	0.1L	23	150	34.8	0.540	23.7	70	30	1.5	23.9	50
D-174483	97.0	5	0.008	1.5	15	7	220	2.7	0.2	3.0	0.7	1.3	300	3.0L	0.051	5.8	30	7	0.7	130.0	7
D-174488	46.0	7	0.019	5	N	10	190	11.6	0.3	5.0	2.2	4.3	200	13.2	0.130	11.4	70	7	1.	8.9	
D-174484	71.0	5	0.009	2 L	20	15	140	3.9	0.2	2.0	5.7	2.3	200	9.9	0.072	4.6	20	5	0.7	23.1	15
D-174485	69.0	5	0.005	1.5	10	5	84	2.5	0.1	2.0	1.6	0.60	200	9.0	0.027	3.5	20	5	0.5		10
D-174486	1 10.0	10	0.012	2	20	10	88	5.8	0.2	5.0	2.4	1.9	150	3.0L	0.073	10.5	50	10	1	39.2	
																				7.2	10
																				6.0	

Si, Al, Ca, Mg Na, F Fe, Mn, Ti, P CI, Cd, Cu, Li, Pb, and Zn values were calculated from values representing the analyses of the laboratory ash. As

t Hg, Sb, Se, Th, and U values are from direct determination on air dried (32°C) coal. The coals were ashed at 525°C " most cases. L after a value means less than the value shown, N means not detected, and B means not determined. the element title means that the values listed were determined by semiquantitative spectrographic analysis.

2Sample ashed at 750°C.

TABLE 7: ARITHMETIC MEAN, OBSERVED RANGE, AND GEOMETRIC MEAN AND DEVIATION OF PROXIMATE, ULTIMATE, HEAT VALUE, AND FORMS OF SULFUR ANALYSES FOR SAMPLES FROM THE GREEN RIVER REGION - - YAMPA FIELD AND NORTH PARK FIELD.

	ARITHMETIC MEAN (abundance)	OBSERVED RANGE (minimum)	(maximum)	GEOMETRIC MEAN (expected value)	GEOMETRIC DEVIATION
PROXIMATE AND ULTIMATE ANALYSES					
RIVER REGION - - YAMP/\ FIELD					
MOISTURE	8.0	5.7	10.9	7.8	1.2
VOLATILE MATTER	37.4	35.2	39.0	37.4	1.0
FIXED CARBON	45.9	41.3	52.3	45.8	I.I
ASH	9.0	3.0	17.8	7.7	1.7
HYDROGEN	5.4	4.9	5.6	5.4	1.0
CARBON	63.9	59.2	71.0	63.8	1.0
NITROGEN	1.6	1.5	1.9	1.6	I.I
OXYGEN	19.8	16.0	23.3	19.6	1.1
SULFUR	0.59	0.5	0.7	0.58	1.1
HEAT VALUE (Btu/lb.)	11203	10400	12440	11186	I.I
A.D. LOSS2	2.8	1.58	4.64	2.6	1.4
FORMS OF SULFUR					
SULFATE	0.02	0.01	0.03	0.014	1.7
PYRITIC	0.05	0.01	0.14	0.035	2.7
ORGANIC	0.52	0.43	0.60	0.520	I.I
PROXIMATE AND ULTIMATE ANALYSES					
NORTH PARK FIELD					
MOISTURE	14 9	11.0	20.2	14.6	1.2
VOLATILE MATTER	34 0	29.3	38.3	35.0	1.1
FIXED CARBON	41 5	24.7	48.3	40.8	1.2
ASH	3 6	2.1	31.5	6.8	2.0
HYDROGEN	5 7	4.6	6.0	5.7	I.I
CARBON	57 1	37.8	64.3	56.5	1.1
NITROGEN	0 8	0.5	1.0	0.8	1.2
OXYGEN	27 3	23.9	31.8	27.1	1.1
SULFUR	0 49	0.2	1.0	0.41	1.8
HEAT VALUE (Btu/I b.)	9930	6520	11280	9820	1.2
A.D. LOSS2	5 1	2.4	9.4	4.7	1.5
FORMS OF SULFUR					
SULFATE	0.03	0.01	0.09	0.01	4.4
PYRITIC	0.17	0.08	0.39	0.15	1.7
ORGANIC	0.29	0.08	0.52	0.23	1.9

All values except heat value (BtuMb.) are reported in percent on an "as received" basis.

2 Air Dried Loss. Percent weight loss of samples dried at 30-35 C.

TABLE 8: ARITHMETIC MEAN, OBSERVED RANGE, AND GEOMETRIC MEAN AND DEVIATION OF 15 MAJOR AND MINOR OXIDES AND TRACE ELEMENTS IN THE LABORATORY ASH OF SAMPLES FROM THE GREEN RIVER REGION - - YAMPA AND NORTH PARK LUrtL rIELDS,

		OBSERVED RANGE			
	ARITHMETIC MEAN	Mi n imum	Maximum	GEOMETRIC MEAN	GEOMETRIC DEVIATION
GREEN RIVER REGION - - YAMPA FIELD					
Ash (SO	9.4	3.3	28.2	8.2	1.7
SIO 2 {%)	47	31	70	46	1.2
Al2 o3 {%)	24	13.6	31	23	1.2
CaO (Z)	6.5	2.4	14	5.7	1.7
MgO «)	1.4	0.7	3.1	1.3	1.4
Na2 0 (Z)	0.77	0.15	2.4	0.55	2.3
K20 (Z)	0.82	0.28	1.5	0.76	1.5
Fe2 o3 (%)	5.0	1.8	10	4.2	1.7
MnO (%)	0.02	0.007	0.15	0.02	2.4
TiO 2 {%)	0.89	0.55	1.2	0.90	1.2
SO3 (Z)	5.5	1.4	13	4.5	1.8
Cd (ppm)	0.80	l.OL	1.5	0.74	1.5
Cu (ppm)	78.7	36	162	73.9	1.4
Li (ppm)	94.6	47	167	90.3	1.3
Pb (ppm)	47.5	25	70	45.8	1.3
Zn (ppm)	53.8	35	85	51.3	1.4
NORTH PARK FIELD					
Ash (I)	9.1	2.7	21.5	7.6	1.8
sio2 (Z)	33	16	50	31	1.5
A1203 (%)	22	15	30	21	1.2
CaO (%)	12	3.1	22	10	1.7
MgO U)	1.5	0.56	3.0	1.4	1.5
Na 0 {%)	0.16	0.09	0.30	0.15	1.4
K20 {%)	0.72	0.12	1.8	0.43	2.8
Fe„0, (Z)	7.4	2.2	12.3	6.6	1.6
MnO (%)	0.08	0.02	0.17	0.04	3.3
Ti02 {%)	1.0	0.65	1.8	1.0	1.3
so3 (%)	11	4.8	24	9.6	1.7
Cd (ppm)	-	l.OL	2.5	-	
Cu (ppm)	183.5	68	386	168	1.5
Li (ppm)	63	20	175	54	1.7
Pb (ppm)	40	25L	60	38	1.3
Zn (ppm)	127	34	417	99	2.0

TABLE 9: AR'™ETIC MEAN, OBSERVED RANGE, AND GEOMETRIC MEAN AND DEVIATION OF THIRTY-VlX LLLMLNIb kepukiTP- A WHOLE COAL BASIS FOR THE GREEN RIVER REGION - - YAMPA FIELD AND NORTH PARK FIELD.

ELEMENT	ARITHMETIC MEAN	OBSERVED RANGE Minimum	Maximum	GEOMETRIC MEAN	GEOMETRIC DEVIATION
GREEN RIVER REGION - - YAMPA FIELD					
Si *	2.3	0.54	9.3	1.7	2. 1
Al I	1.2	0.36	2.3	1.0	1.7
Ca %	0.35	0.18	0.55	0.33	1.3
Mg %	0 07	0.02	0.14	0.06	1.6
Na %	0 05	0.008	0.17	0.03	2.6
K %	0 07	0.009	0.35	0.05	2.4
Fe %	0 25	0.17	0.38	0.24	1.2
Mn	13 7	31	45.6	10.6	2. I
Ti %	0 05	0.02	0.09	0.04	1.5
As	1 2	l.0L	4.0	0.64	3.2
Cd	0 99	.04L	0.30	0.48	3.2
Cu	6 6	3.0	16.7	6.05	1.5
F	108	35	190	99.1	1.5
Hg	0 63	0.01	0.10	0.03	1.8
Li	8 0	3.5	13.2	7.4	1.5
P	4 2	1.6	7.0	3.7	1.6
S	0.3	0.1L	0.70	0.23	1.9
Se	1.0	0.43	1.4	0.97	1.3
Th	2.7	3.0L	10.2	1.1	1.8
U	1.0	0.2L	2.3	0.85	1.8
Zn	5.1	1.4	12.3	4.2	1.5
B	150	50	300	100	1.6
Ba	200	70	1000	150	1.7
Be		.20	1.0	0.23	1.9
Co		.70	5.0	0.97	1.3
Cr	2	1.0	7.0	1.1	1.8
Ga	3	1.0	10.0	0.85	1.8
Mo		0.50	2.0	4.2	1.8
Ni		0.7	7.0	1.5	1.6
Sc		l.0L	7.0	100	1.7
Sr	1.	0.7	5.0	150	1.9
V	150	70	500.0	150	1.8
Y	7	3.0	15.0	7	1.5
Yb	5	1.0	10.0	3	1.8
Zr	0.	0.1	1.0	0.3	1.8
	20	7.0	70.0	20	1.7
NORTH PARK FIELD					
Si %	1.6	0.20	4.9	1.1	2.5
Al %	1.1	0.21	2.9	0.85	2.1
Ca %	0.56	0.36	0.80	0.54	1.3
Mg *	0.08	0.02	0.16	0.06	1.9
Na %	0.009	0.004	0.02	0.008	1.6
K %	0.08	0.003	0.32	0.03	4.4
Fe Z	0.44	0.13	0.95	0.35	2.0
Mn	---	4.2	110	---	2.1
Ti %	0.06	.01	0.13	0.04	2.5
As	1.9	1.0	4.0	1.7	1.9
Cd	---	0.03L	0.3	---	2.1
Cu	18.3	3.0	55.9	12.7	2.6
F	59.4	25	185	48.7	1.8
Hg	0.04	0.01	0.2	0.03	2.3
Li	6.4	0.92	16.6	4.1	2.2
P	---	0.94	11.5	---	4.4
S	0.21	0.10L	0.9	0.20	2.7
Se	1.3	0.20	5.7	0.94	1.7
Th	6.1	3.0L	16	4.5	1.5
U	4.6	0.2L	12.5	1.6	
Zn	12.3	1.9	39	7.5	
B	50.	5.0	70	50	
Ba	200	100	500	150	
Be	---	0.07	1.5	---	
Co	---	0.50	7.0	---	
Cr	15	0.50	30.0	5	4.
Ga	3.	0.50	10.0	3	23
Mo	5.	0.20	10.0	2	3.7
Ni	---	0.5L	7.0	---	
Sc	---	0.70	15.0	---	
Sr	2.1	0.50	5.0	1.5	2. 1
V	100	30	300	100	2. 1
Y	20	3.0	70	15	2.6
Yb	5	0.7	10.0	3	2.2
Zr	0.5	0.07	1.0	0.3	2.5
	---	3.0	15.0	---	

i i• f»H were determined by semiquantitive spectographic 'S' following the element symbol means that the values isted etr(c brackets whose boundaries are 1.2, analysis. The spectrographic results are to be ^a" arbitrarily as mid-points of those brackets, 1.0, 0 83 0.56, 0.38, 0.26, 0.13, 0.12, etc., b^ ^YoTthe spectrogra^ic data is approximately one bracket 0.'7, 0.5, -8.3. 0.2, 0.15. 0.1, etc The Precis » at 68 percent, or two brackets at 95 percent con

TfiBLT'lb: ARITHMETIC MEAN OF PROXIMATE, ULTIMATE AND HEAT VALUE ANALYSES FOR THE GREEN RIVER REGION - - YAMPA FIELD AND NORTH PARK FIELD COMPARED WITH THE ARITHMETIC MEANS FOR THE ROCKY MOUNTAIN, INTERIOR, AND NORTHERN GREAT PLAINS PROVINCES.

	GREEN RIVER REGION — YAMPA FIELD	NORTH PARK FIELD	ROCKY MOUNTAIN PROVINCE	INTERIOR PROVINCE	NORTHERN GREAT PLAINS PROVINCE
MOISTURE {%)	8.0	14.9	12.9	7.2	24.5
VOLATILE MATTER {%)	37.4	35.0	36.0	32.2	31.7
FIXED CARBON {%)	45.9	41.5	42.0	48.0	35.4
ASH {%)	9.0	8.6	9.1	12.6	8.3
HYDROGEN (*)	5.4	5.7	5.6	4.9	6.2
CARBON {%)	63.9	57.1	59.7	65.2	49.2
NITROGEN (*)	1.6	0.8	1.2	1.2	0.9
OXYGEN (%)	19.8	27.3	23.8	12.2	34.2
SULFUR W	0.5	0.4	0.6	3.9	1.2
HEAT VALUE (Btu/lb.)	11,203	9,930	10,480	11,580	8,480

TABLE 11: ARITHMETIC MEAn'oF THE MAJOR, MINOR, AND TRACE ELEMENT COMPOSITION FOR THE GREEN RIVER REGION - - YAMPA FIELD AND NORTH COMPARED WITH THE ARITHMETIC MEANS FOR THE ROCKY MOUNTAIN, INTERIOR, AND NORTHERN GREAT PLAINS PROVINCES AND AVERAGE SHALE.[2]

	GREEN RIVER REGION - - YAMPA FIELD	NORTH PARK FIELD	ROCKY MOUNTAIN PROVINCE	INTERIOR PROVINCE	NORTHERN GREAT PLAINS PROVINCE	AVERAGE SHALE'
Si	2.3	1.6	2.5	2.0	1.4	7.3
Al	1.2		1.2	97	.69	8.0
Ca	.35	.56	.59	1 2	.97	2.21
Mg	.073	.078	.104	089	.255	1.55
Na	.052	.009	.102	035	.182	.96
K	.075	.079	.076	16	.040	2.66
Fe	.25	.42	.45	3 3	.75	4.72
Mn	13.7		36	138	51	850
Ti	.047	.059	.061	052	.042	.46
As	1.2	1.9	2	21	3	13
Cd	.87		.5	7 1	.2	.3
Cu	6.6	18.3	9.1	20 2	8.3	45
F	108	59	70	71	45	740
Hg	.03	.04	.06	14	.09	.4
Li	8.0	6.4	9.2	11	6.0	66
Pb	4.2		5.5	55	5.3	20
Sb	.29	.21	.4	1 7	.6	1.5
Se	1.0	1.3	1.6	4 6	1.0	.6
Th	2.7	6.1	3.6	5 2	2.7	12
U	1.0	4.6	1.6	3 3	.90	3.7
Zn	5. 1	12.3	9.9	373	25.6	95
B-S	150	50	70	199	70	100
Ba-S	200.	200	200	70	500	580
Be-S			.7	3	.5	3
Co-S			2	7	2	19
Cr-S		15	5	15	5	90
Ga-S		3	3	5	3	19
Mo-S		5	1.5	5	2	2.6
Nb-S			5	1.5	5	II
Ni-S			3	39	3	68
Sc-S	1.5	2	2	3	2	13
Sr-S	150	100	100	59	150	300
V-S	7	20	15	20	19	130
Y-S	5	5	5	19	5	26
Yb-S	.5		.5	.7	.3	2.6
Zr-S	20		20.0	15	15	160

Values are calculated as the arithmetic mean of values determined on a whole coal basis.
'"(Turekian and Wedepohl, 1961)

APPENDIX

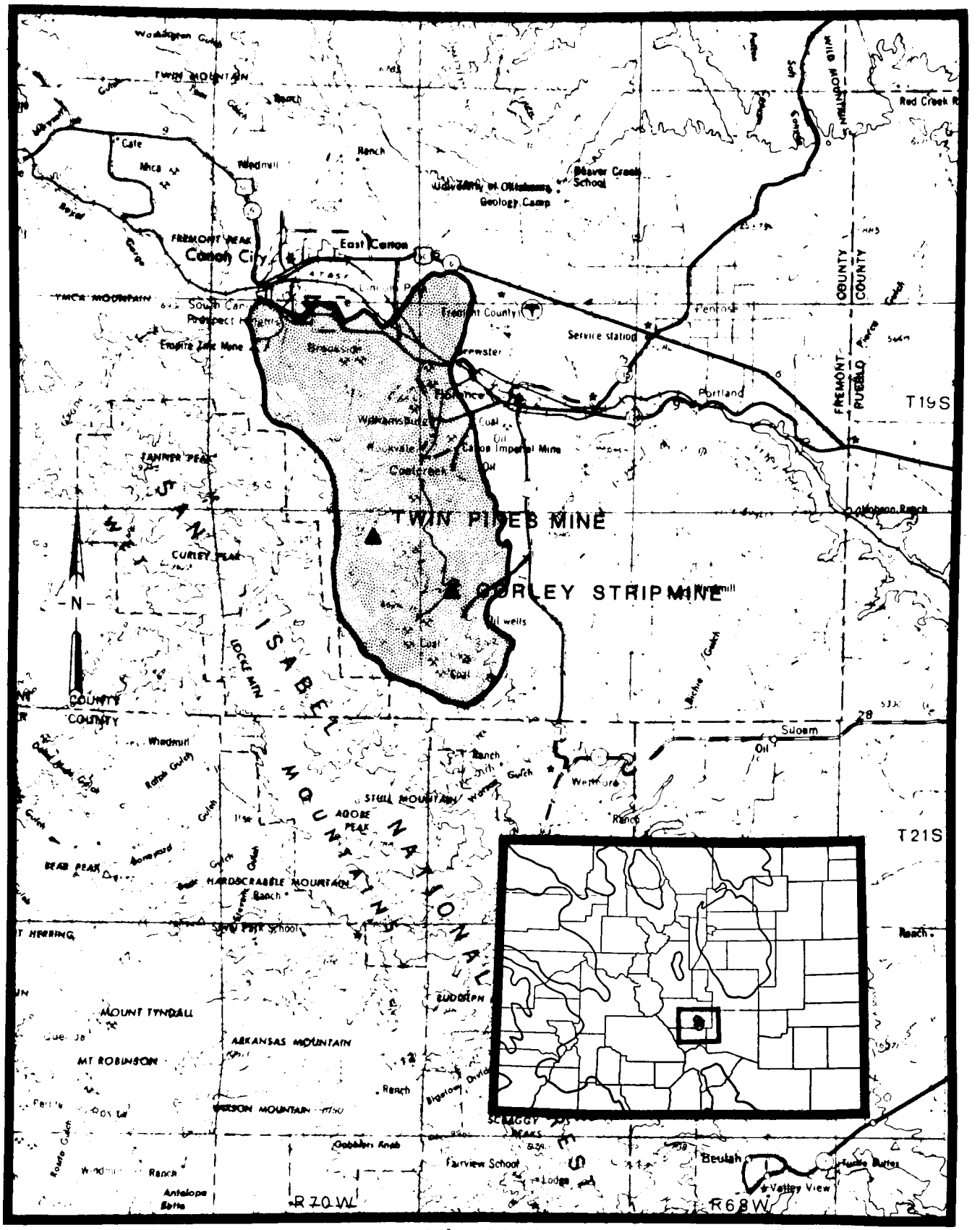
INTRODUCTION

The four areas studied are listed alphabetically by field and then by mine as sampled. Each section includes an index map of ihe general area of interest with sample locations marked, a columnar section giving the name and stratigraphic location of coal beds in the area, a detailed map showing the precise location of each mine sampled with individual sample sites marked, and a descriptive section for each channel cut sampled. Included for each sample is a sheet giving the location, attitude, and characteristics of the coal bed, date of sampling, and the names of the sample collectors. The apparent rank of coal is determined from sample values on a moist, mineral-matter-free basis.

CANON CITY FIELD

Samples from the Canon City field were taken from the Vermejo Formation of Late Cretaceous age. This formation contains approximately 16 coal beds, only seven of which are considered economically mineable. Samples 75-M-l through 75-M-4 were taken from an uncorrelated coal bed in the Corley Strip mine. Samples 75-DJ-2 and 75-DJ-4 were taken from the Brookside coal bed in the Twin Pines underground mine.

Table 1 contains a listing of sample location and type of sample.



Field *4.-Index map of the Canon City field showing mine locations. Coal-bearing region is shaded. Base map modified from U.S.Geological Survey Pueblo 1° x 2° quadrangle(l95it; revised 1962)

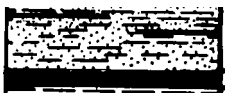
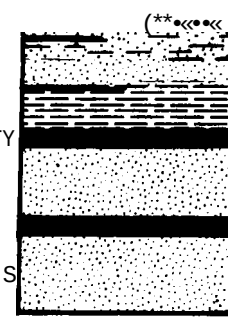
Rock Units	Lithology	Thickness (ft.I	Descriptions
			Unconformity at base; arkosic sandstone, siltstone, and shale.
			Sandstone, resistant.
		• 200- 500	
			Soft sandstone and shale, with thin coal beds.
BROOKSIDE	PlMHfeMHN	H E	Coat
		75-165	Sandstone, thin coal beds.
CHANDLER (LITTEL)		2Z33I	Coal
	rtrzi.'* ,.ii:ip'rnirffli	95-135'	Sandstone, shaley sandstone, shale, and coal.
ROYAL GORGE (BAVtICK)			Coat
		70	Sandstone, shale, and coal.
RADIANT (JACK-0 LANTERN)		a-a-i-«'	Coal
		75- 100'	Shale and sandstone.
MAGNET	IMBH^IPSPVH	33=	Coal
	JMiii\w*'^a^ftrit		
		100-115'	Sandstone, shale, thin coat bed
CANON CITY		1-7 3'	Coat
		30-50'	Sandstone, coarse white.
BOCKVALC			Coal
TRINIDAD SS			Sandstone, massive yellow.

Figure 5--Generalized columnar section of coal-bearing rocks of the Canon City field (after Washburne, 1905; Tweto, 1976; and Hornbaker and others, 1976).

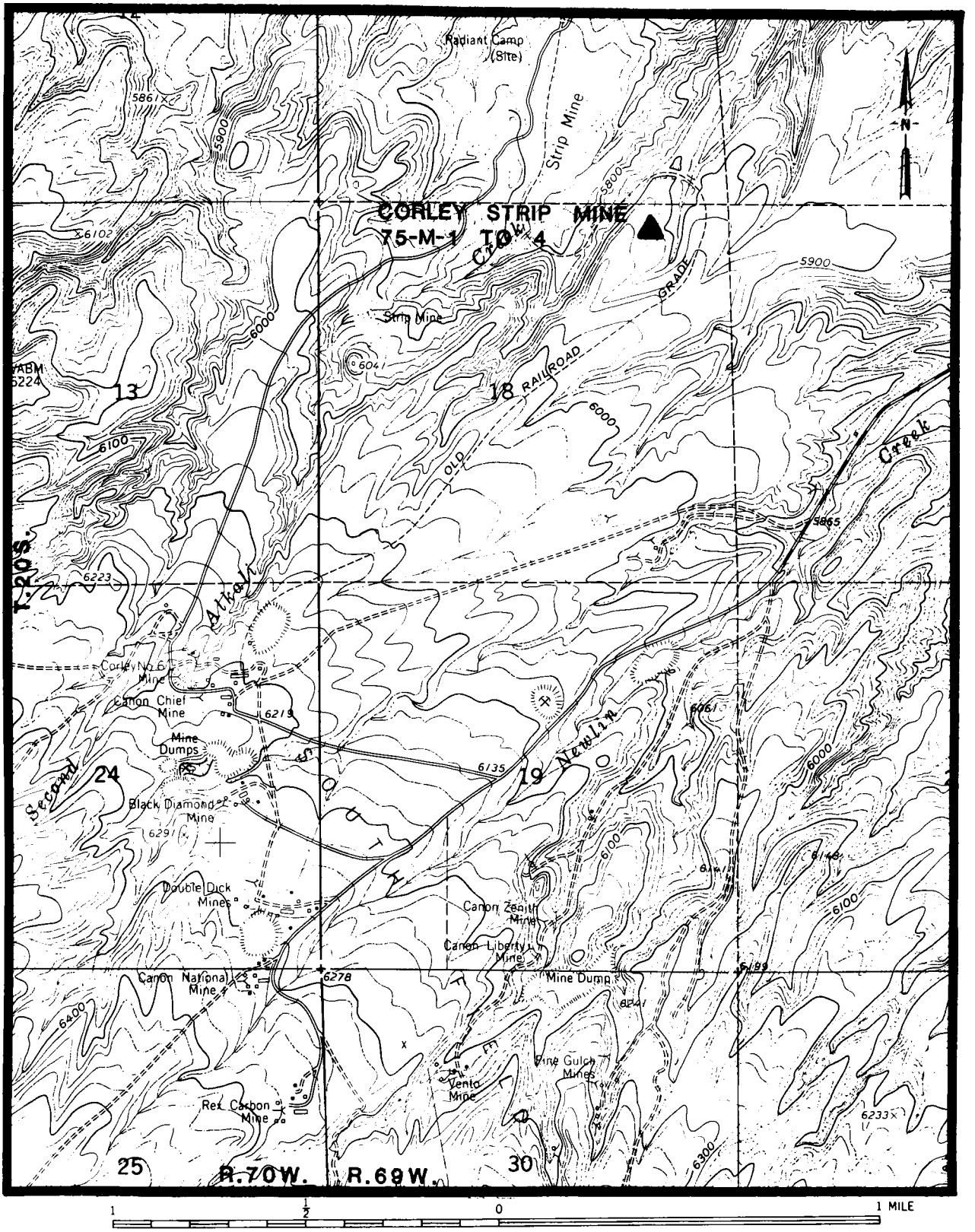
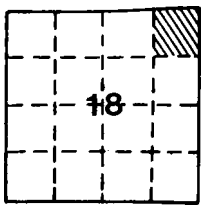


Figure 6.-Detailed location map of coal samples 75-M-l to 75-M-l* from the Corley Strip Mine; Canon City field, Fremont County, Colorado. Base map modified from U.S.Geological Survey Rockvale 7]/2' quadrangle (1959)

SAMPLE NO.: 75-M-l

STATE: Colorado

LOCATION IN SECTION



COAL BED NAME: Uncorrelated

COUNTY: Fremont

GEOLOGIC ROCK UNIT: Vermejo Formation

SECTION: 18

AGE: Upper Cretaceous

TOWNSHIP: T.20S.

COAL FIELD: Canon City

RANGE: R.69W.

COAL-BEARING REGION: Canon City

U.S.G.S. TOPOGRAPHIC QUADRANGLE: Rockvale 7-5' (1959)

TOTAL SECTION MEASURED (FEET): 3.0

OVERBURDEN AT SAMPLING POINT (FEET): 55-60

ELEVATION TOP OF SAMPLED COAL(Feet) 6,0'tO

STRIKE: Est N 25° E

DIP: 70 NW

MAJOR CLEAT ORIENTATION IN COAL:

THICKNESS OF COAL (FEET): 3.0

THICKNESS SAMPLED (FEET): 3#"0

TYPE OF SAMPLE: Face-channel

CONDITION OF SAMPLE: Fresh

TYPE OF EXPOSURE: Strip mine

MINE NAME: Cor ley Strip

MINE OPERATOR: q.E.C. Minerals, Inc.

DATE OF SAMPLING: 9/2V75

SAMPLE COLLECTOR: Colorado Geological Survey

COMPLETION DATE OF ANALYSES

U.S. Bureau of Mines; 12/8/75

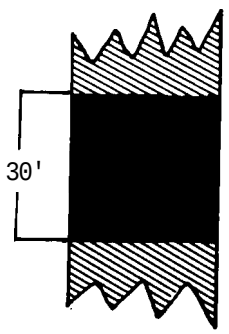
U.S. Geological Survey:10/17/75

LABORATORY NUMBERS

K-56762

D-l75952

APPARENT RANK OF COAL: Subbiturninous A



ROOF ROCK - NO DESCRIPTION (Sample 75-M-3)

-3.0' COAL (Sample 75-M-l)

SAMPLE NO.: 75"M-2

STATE: Colorado

LOCATION IN SECTION

COAL BED NAME: Uncorrelated

COUNTY: Fremont

GEOLOGIC ROCK UNIT: Vermejo Formation

SECTION: 18

AGE: Upper Cretaceous

TOWNSHIP: T.20S.

COAL FIELD: Canon City

RANGE: R.69W.

COAL-BEARING REGION: Canon City

U.S.G.S. TOPOGRAPHIC QUADRANGLE: Rockvale 7.5' (1959)

TOTAL SECTION MEASURED (FEET): 3.0
OVERBURDEN AT SAMPLING POINT (FEET): 55~60
ELEVATION TOP OF SAMPLED COAL:(Feet) 6,0^0
STRIKE:Est N 25° E
DIP: 7° NW
MAJOR CLEAT ORIENTATION IN COAL:

THICKNESS OF COAL (FEET): 3.0
THICKNESS SAMPLED (FEET): 3.0
TYPE OF SAMPLE: Face-grab
CONDITION OF SAMPLE: Fresh
TYPE OF EXPOSURE: Strip mine
MINE NAME: Cor ley Strip
MINE OPERATOR: G.E.C. Minerals, Inc.

DATE OF SAMPLING: 9/24/75
SAMPLE COLLECTOR: Colorado Geological Survey

COMPLETION DATE OF ANALYSES
U.S. Bureau of Mines;
U.S. Geological Survey: 10/17/75

LABORATORY NUMBERS
D-175953

APPARENT RANK OF COAL: Subbituminous A

SAMPLE NO.: 75-M-3

STATE: Colorado

LOCATION IN SECTION

COAL BED NAME: Uncorrelated

COUNTY: Fremont

GEOLOGIC ROCK UNIT: Vermejo Formation

SECTION: 18

AGE: Upper Cretaceous

TOWNSHIP: T.20S.

COAL FIELD: Canon City

RANGE: R.69W.

COAL-BEARING REGION: Canon City

U.S.G.S. TOPOGRAPHIC QUADRANGLE: Rockvale 7-5' (1959)

TOTAL SECTION MEASURED (FEET): 3.0
OVERBURDEN AT SAMPLING POINT (FEET): 55~60
ELEVATION TOP OF SAMPLED COAL:(Feet) 6,040
STRIKEEst N 25° E
DIP: 7° NW
MAJOR CLEAT ORIENTATION IN COAL:

THICKNESS OF COAL (FEET): 3.0
THICKNESS SAMPLED (FEET): 3.0
TYPE OF SAMPLE: Roof rock -grab
CONDITION OF SAMPLE: Fresh
TYPE OF EXPOSURE: Strip mine
MINE NAME: Cor ley Strip
MINE OPERATOR: G.E.C. Minerals, Inc.

DATE OF SAMPLING: 9/24/75
SAMPLE COLLECTOR: Colorado Geological Survey
COMPLETION DATE OF ANALYSES
U.S. Bureau of Mines;
U.S. Geological Survey:10/17/75

LABORATORY NUMBERS

D-l75954

APPARENT RANK OF COAL:

SAMPLE NO.: 75-M-4

COAL BED NAME: Uncorrelated

GEOLOGIC ROCK UNIT: Vermejo Formation

AGE: Upper Cretaceous

COAL FIELD: Canon City

COAL-BEARING REGION: Canon City

STATE: Colorado

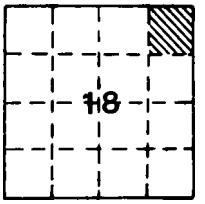
COUNTY: Fremont

SECTION: 18

TOWNSHIP: T.20S.

RANGE: R.69W.

LOCATION IN SECTION



U.S.G.S. TOPOGRAPHIC QUADRANGLE: Rockvale 7.5' (1959)

TOTAL SECTION MEASURED (FEET): 3.0
OVERBURDEN AT SAMPLING POINT (FEET):55-60
ELEVATION TOP OF SAMPLED COAL: (Feet) 6,040
STRIKE:Est N 25° E
DIP: 7° NW
MAJOR CLEAT ORIENTATION IN COAL:

THICKNESS OF COAL (FEET): 3.0
THICKNESS SAMPLED (FEET): 3[0
TYPE OF SAMPLE: Tipple
CONDITION OF SAMPLE: Fresh
TYPE OF EXPOSURE: Strip mine
MINE NAME: Corley Strip
MINE OPERATOR: G.E.C. Minerals, Inc.

DATE OF SAMPLING: 9/24/75
SAMPLE COLLECTOR: Colorado Geological Survey

COMPLETION DATE OF ANALYSES		LABORATORY NUMBERS
U.S. Bureau of Mines;	12/8/75	K-56763
U.S. Geological Survey:	10/17/75	D-175955

APPARENT RANK OF COAL: Subbituminous A

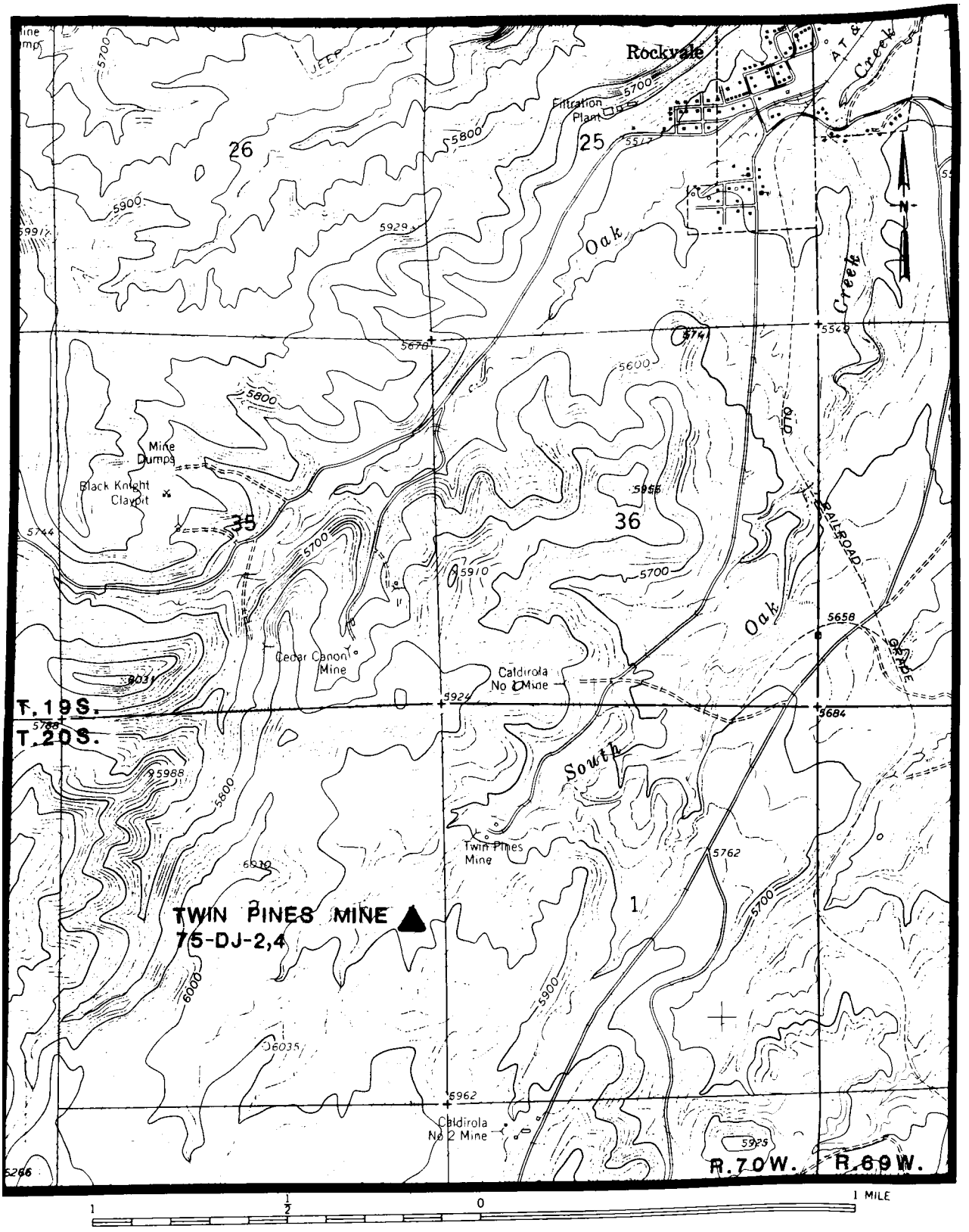


Figure 7.-Detailed location map of the c ° a] * ™ p £ > Colorado. Base map r „u „~,i camnles 75"DJ-2 and 4 from the Twin Pines Mine, Canon City f [*™ ./?™nL%™%l Survey Rockvale quadrangle, 1959)
modified from U.S.Geologica r 1/2' 12

SAMPLE NO.: 75-DJ-2

COAL BED NAME:Brookside

GEOLOGIC ROCK UNIT: Vermejo Formation

AGE: Upper Cretaceous-Paleocene

COAL FIELD: Canon City

COAL-BEARING REGION: Canon City

STATE: Colorado

COUNTY: Fremont

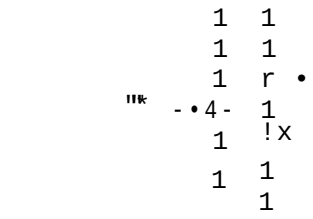
SECTION: 2

TOWNSHIP: T.20S.

RANGE: R.70W.

U.S.G.S. TOPOGRAPHIC
QUADRANGLE: Rockvale 7-5' (1959)

LOCATION IN SECTION



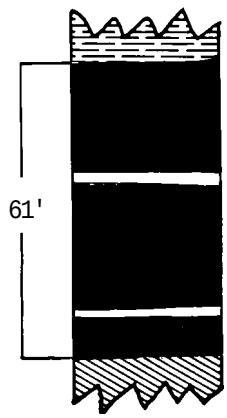
TOTAL SECTION MEASURED (FEET): 6.8
OVERBURDEN AT SAMPLING POINT (FEET):6.5
ELEVATION TOP OF SAMPLED COAL:(Feet) 5,848
STRIKE: N 65°E
DIP: 2-3° NW
MAJOR CLEAT ORIENTATION IN COAL:
N 30 E; nearly vertical
N 52 W; nearly vertical

THICKNESS OF COAL (FEET): 6.3
THICKNESS SAMPLED (FEET): 6.8
TYPE OF SAMPLE: Face-channel
CONDITION OF SAMPLE: Fresh
TYPE OF EXPOSURE: Underground mine
MINE NAME: Twin Pines
MINE OPERATOR: Twin Pines Coal Co.

DATE OF SAMPLING: 9/4/75
SAMPLE COLLECTOR: Colorado Geological Survey

COMPLETION DATE OF ANALYSES		LABORATORY NUMBERS
U.S. Bureau of Mines;	6/1/76	Z-39
U.S. Geological Survey:	6/14/76	D-177496

APPARENT RANK OF COAL: Subbiturninous A



SHALE: Carbonaceous dark grey shale or mudstone; some pyrite and minor calcite in fractures.

-24' COAL (Sample 75-DJ-2) : Granular, attri tal with bright, thin, lenti vitrain; normal bright banding overall.

-°7' CLAYSTONE (possible tuff): Light brown, massive with coaly streaks.

-W COAL (Sample 75-DJ-4): Same as upper coal section except contains less vitrain.

-or CLAYSTONE: Light grey, massive, discontinuous.

-0.9' COAL

FLOOR ROCK - NO DESCRIPTION

SAMPLE NO.: 75-DJ-4

STATE: Colorado

LOCATION IN SECTION

COAL BED NAME: Brookside

COUNTY: Fremont

GEOLOGIC ROCK UNIT:Vermejo Formation

SECTION: 2

1 1 i

AGE: Upper Cretaceous-Paleocene

TOWNSHIP: T.20S.

- i - M x -

COAL FIELD: Canon City

RANGE: R.70W.

COAL-BEARING REGION: Canon City

U.S.G.S. TOPOGRAPHIC QUADRANGLE: Rockvale 7-5' (1959)

TOTAL SECTION MEASURED (FEET): 6.8
OVERBURDEN AT SAMPLING POINT (FEET):65
ELEVATION TgP OF SAMPLED COAL:(Feet) 5,848
STRIKE:N 65 E
DIP: 2°-3° NW
MAJOR CLEAJ ORIENTATION IN COAL:
N 30o E; nearly vertical
N 52 W; nearly vertical

THICKNESS OF COAL (FEET): 6.3
THICKNESS SAMPLED (FEET): 6.8
TYPE OF SAMPLE: Face-channel
CONDITION OF SAMPLE: Fresh
TYPE OF EXPOSURE: Underground mine
MINE NAME: Twin Pines
MINE OPERATOR: Twin Pines Coal Co.

DATE OF SAMPLING: 9/4/75
SAMPLE COLLECTOR:Colorado Geological Survey
COMPLETION DATE OF ANALYSES
U.S. Bureau of Mines;
U.S. Geological Survey:

LABORATORY NUMBERS
Z-39
D-177496

APPARENT RANK OF COAL: Subbituminous A

PUBLISHED ANALYSES

Range of analyses of coal samples from the Brookside bed of the Vermejo Formation in the Twin Pines mine. Samples were variously sized tipple samples collected between 1958- and i960. Analyses are from U. S. Bureau of Mines data bank compilation, Coal Analyses Data for the State of Colorado (1973).

Moisture (%): 10.6-11.7
Volatile matter (%): 36.2-37.5
Fixed carbon (%): 50.7-53.1
Ash {%): 7-3-12.8
Sulfur (%): 0.6

Heat value (Btu/lb):

As - received: 10,560-11,310
Moisture-free: 11,810-12,810
Moisture- and ash-free: 13,510-13,820

DENVER REGION, BOULDER-WELD FIELD

Five samples (75"1 through 75_5) were collected from the Laramie #3 bed, the main coal bed of seven located in the lower part of the Laramie Formation, which is of Cretaceous age. The Eagle mine was the only mine sampled in the Denver region.

Table 1 contains a listing of sample location and type of sample.

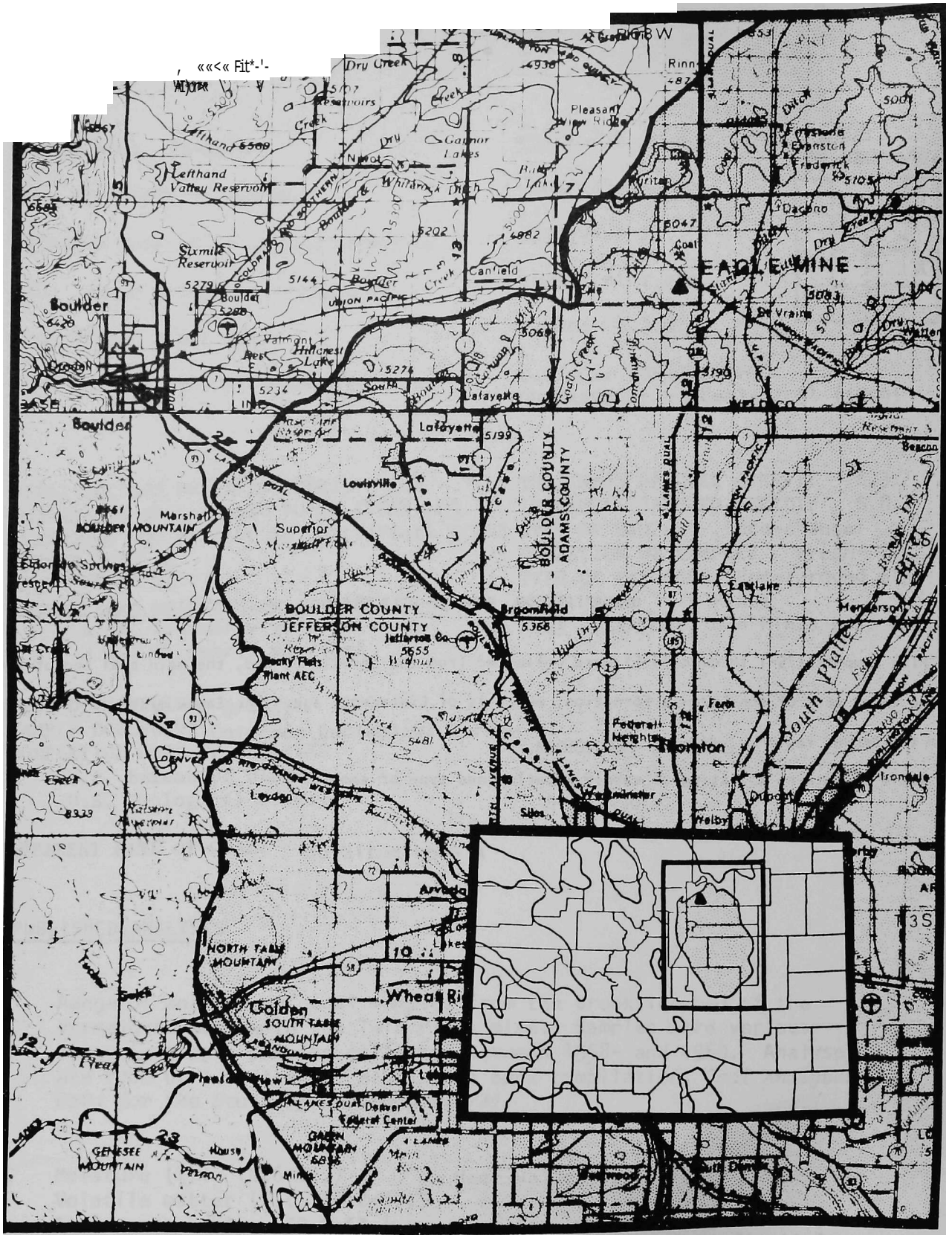


Figure 8.-Index map of the Denver region, Boulder-Weld field showing the mine location. The coal-bearing region is shaded Base map ™d,f,ed from Army Map Service Denver 1°x 2°quadrangle(1953;rev,sed by U.S.G.S. 1963)

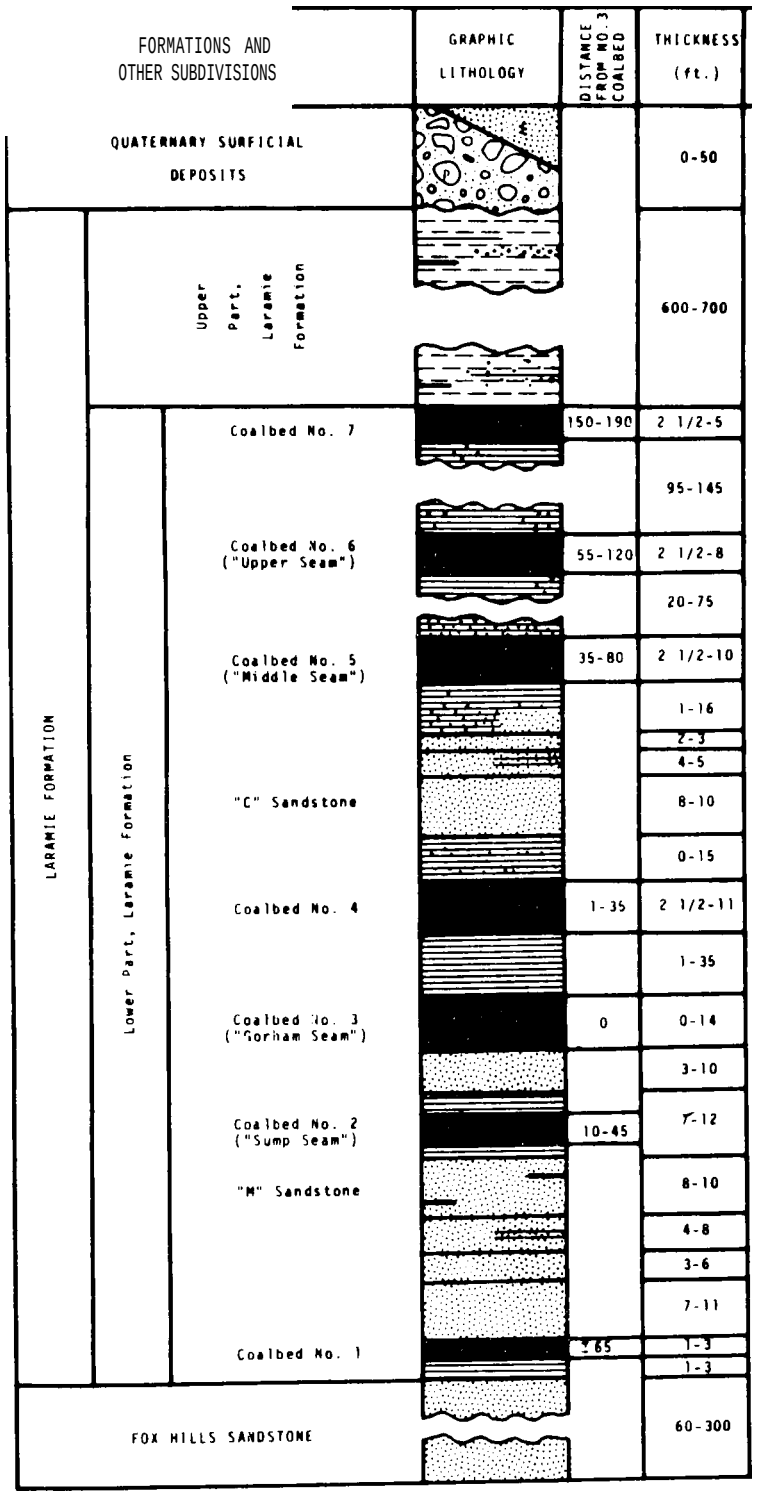


Figure 9--Generalized columnar section of coal-bearing rocks of the Boulder-Weld field, Weld County,Colorado(from Amuedo and lvey,1975J

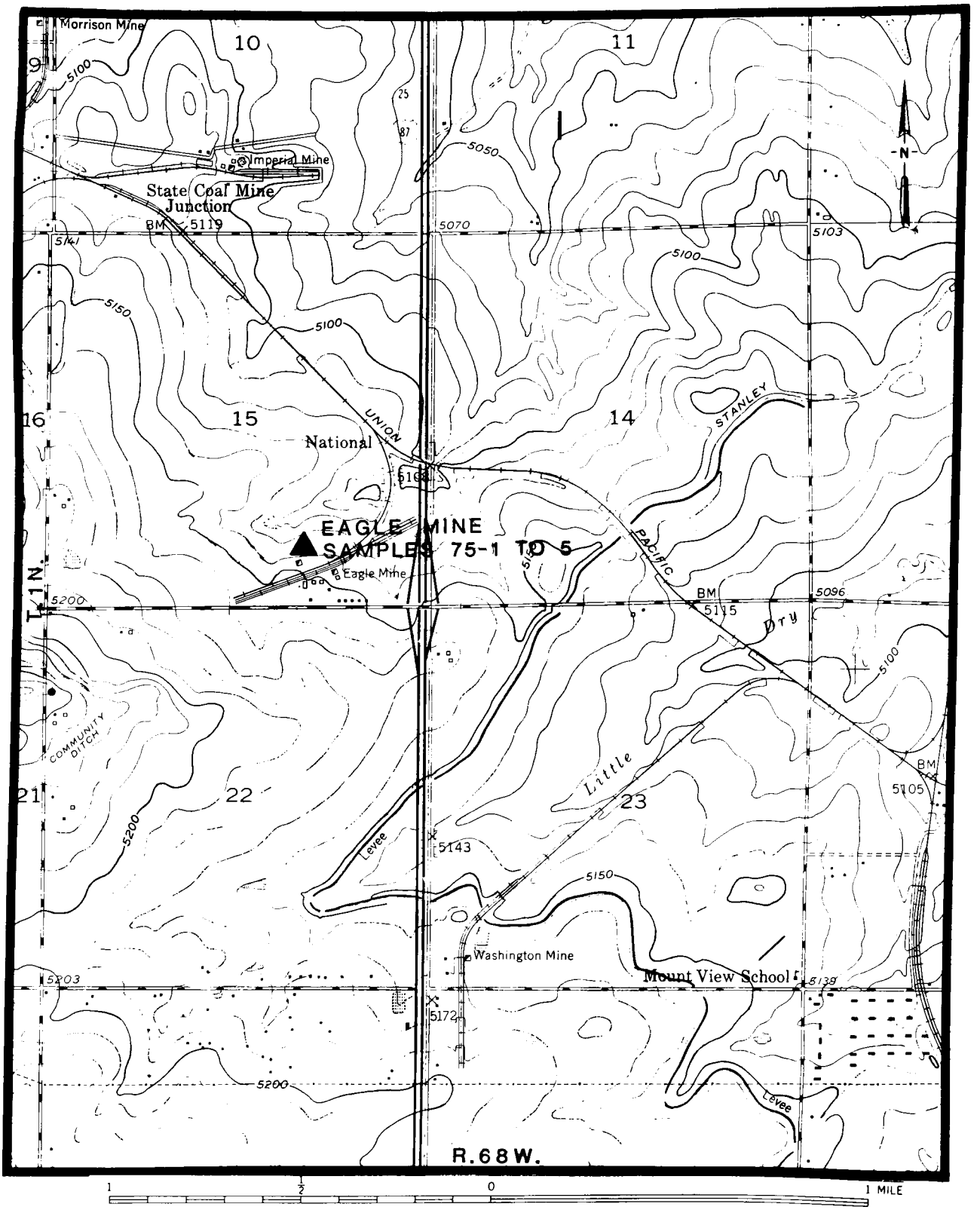


Figure 10.-Detailed location map of coal samples 75~l,2,and 5,floor rock sample 75-3 and roof rock sample 75-/* from Eagle Mine, Weld County.Colorado Base map modified from U.S. Geological Survey's Frederick 7 1/2 ' quadrangle (1950, revised I969)

SAMPLE NO.: 75-1, Channel No. 1 1

STATE: Colorado

LOCATION IN SECTION

COAL BED NAME: Laramie No. 3

COUNTY: Weld

GEOLOGIC ROCK UNIT: Laramie Formation

SECTION: 15

AGE: Upper Cretaceous

TOWNSHIP: T.IN.

COAL FIELD: Boulder-Weld

RANGE: R.68W.

COAL-BEARING REGION: Denver

U.S.G.S. TOPOGRAPHIC QUADRANGLE: Frederick 7i' (1969)

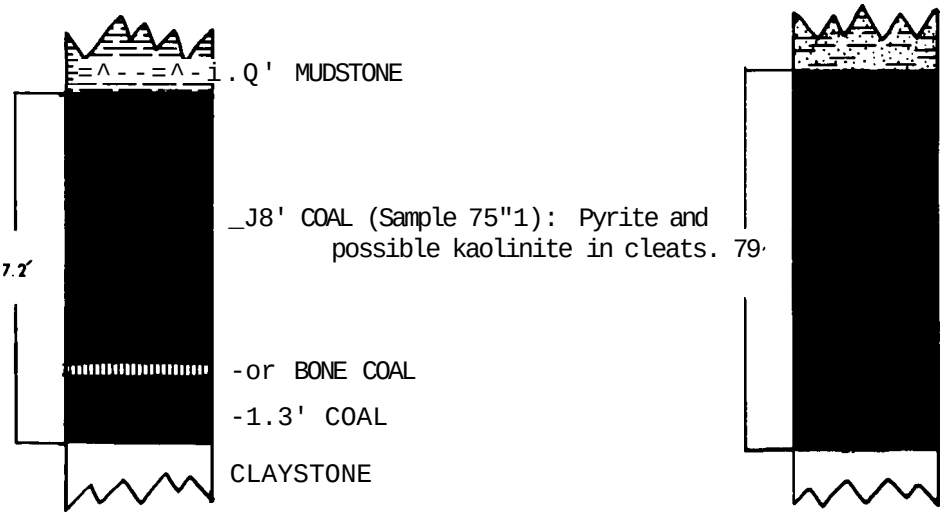
TOTAL SECTION MEASURED (FEET): 9.17
OVERBURDEN AT SAMPLING POINT (FEET): 370
ELEVATION TOP OF SAMPLED COAL:(Feet)4,785
STRIKE: Est. N 10°E
DIP: 1° SE
MAJOR CLEAT ORIENTATION IN COAL:

THICKNESS OF COAL (FEET): 7.17
THICKNESS SAMPLED (FEET): 7.17
TYPE OF SAMPLE:Face"channel
CONDITION OF SAMPLE: Fresh
TYPE OF EXPOSURE: Underground mine
MINE NAME: Eagle
MINE OPERATOR: Imperial Coal Co.

DATE OF SAMPLING: A/3/75
SAMPLE COLLECTOR: Colorado Geological Survey
COMPLETION DATE OF ANALYSES
U.S. Bureau of Mines; 7/3/75
U.S. Geological Survey:8/27/75

LABORATORY NUMBERS
K-53910
D-173^88

APPARENT RANK OF COAL: Subbituminous B



Two channel cuts were sampled at different faces in the mine

SAMPLE NO.: 75"2, Channel No. 2 1

STATE: Colorado

LOCATION IN SECTION

COAL BED NAME: Laramie No. 3

COUNTY: Weld

GEOLOGIC ROCK UNIT: Laramie Formation

SECTION: 15

——,——1——1—

AGE: Upper Cretaceous

TOWNSHIP: T.1N.

i i i

- r r x V

COAL FIELD: Boulder-Weld

RANGE: R.68W.

COAL-BEARING REGION: Denver

U.S.G.S. TOPOGRAPHIC QUADRANGLE: Frederick 7-5' (1969)

TOTAL SECTION MEASURED (FEET): 8.25
OVERBURDEN AT SAMPLING POINT (FEET): 370
ELEVATION TOP OF SAMPLED COAL: (Feet) h,785 '
STRIKE: Est N 10° E
DIP:]° SE
MAJOR CLEAT ORIENTATION IN COAL:

THICKNESS OF COAL (FEET): 7.75
THICKNESS SAMPLED (FEET): 5.75
TYPE OF SAMPLE: Face-channel
CONDITION OF SAMPLE: Fresh
TYPE OF EXPOSURE: Underground mine
MINE NAME: Eagle
MINE OPERATOR: Imperial Coal Co.

DATE OF SAMPLING: V3/75
SAMPLE COLLECTOR: Colorado Geological Survey

COMPLETION DATE OF ANALYSES	LABORATORY NUMBERS
U.S. Bureau of Mines; 7/3/75	K-539H
U.S. Geological Survey: 8/27/75	0-173489

APPARENT RANK OF COAL: Subbituminous B

Two channel cuts were sampled at different faces in the mine.

SAMPLE NO.: 75-3, channel No. 2 1

STATE: Colorado

LOCATION IN SECTION
1 1
1 1
1 -f\S-\--
1 1

COAL BED NAME: Laramie No. 3

COUNTY: Weld

GEOLOGIC ROCK UNIT: Laramie Formation

SECTION: 15

AGE: Upper Cretaceous

TOWNSHIP: T. IN.

COAL FIELD: Boulder-Weld

RANGE: R.68W.

COAL-BEARING REGION: Denver

U.S.G.S. TOPOGRAPHIC QUADRANGLE: Frederick 7-5' (1969)

TOTAL SECTION MEASURED (FEET): 8.25
OVERBURDEN AT SAMPLING POINT (FEET):370
ELEVATION TOP OF SAMPLED COAL: (Feet) 4,785 '
STRIKE: Est. N 10°E
DIP: 1° SE
MAJOR CLEAT ORIENTATION IN COAL:

THICKNESS OF COAL (FEET): 7.75
THICKNESS SAMPLED (FEET):0.5(below coa 1)
TYpE OF SAMPLE: Floor rock -grab
CONDITION OF SAMPLE: Fresh
TYPE OF EXPOSURE: Underground mine
MINE NAME: Eagle
MINE OPERATOR: Imperial Coal Co.

DATE OF SAMPLING: 4/3/75
SAMPLE COLLECTOR: Colorado Geological Survey
COMPLETION DATE OF ANALYSES
U.S. Bureau of Mines;
U.S. Geological Survey: 8/20/75

LABORATORY NUMBERS
D-173491

APPARENT RANK OF COAL:

Two channel cuts were sampled at different faces in the mine

SAMPLE NO.: 75-4, Channel No. 2 1

COAL BED NAME: Laramie No. 3

GEOLOGIC ROCK UNIT: Laramie Formation

AGE: Upper Cretaceous

COAL FIELD: Boulder-Weld

COAL-BEARING REGION: Denver

STATE: Colorado

COUNTY: Weld

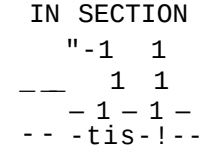
SECTION: 15

TOWNSHIP: T.1N.

RANGE: R. 68W.

U.S.G.S. TOPOGRAPHIC
QUADRANGLE: Frederick 7.5' (1969)

LOCATION IN SECTION



TOTAL SECTION MEASURED (FEET): 8.25
OVERBURDEN AT SAMPLING POINT (FEET): 370
ELEVATION TOP OF SAMPLED COAL: (Feet) 4,785 '
STRIKE: Est. N 10° E
DIP: 1° SE
MAJOR CLEAT ORIENTATION IN COAL:

THICKNESS OF COAL (FEET): 7.75
THICKNESS SAMPLED (FEET):
TYPE OF SAMPLE: Roof rock- grab
CONDITION OF SAMPLE: Fresh
TYPE OF EXPOSURE: Underground mine
MINE NAME: Eagle
MINE OPERATOR: Imperial Coal Co.

DATE OF SAMPLING: 4/3/75
SAMPLE COLLECTOR: Colorado Geological Survey
COMPLETION DATE OF ANALYSES
U.S. Bureau of Mines;
U.S. Geological Survey: 8/20/75

LABORATORY NUMBERS
D-l73492

APPARENT RANK OF COAL:

Two channel cuts were sampled at different faces in the mine.

SAMPLE NO.: 75-5

COAL BED NAME: Laramie No. 3

GEOLOGIC ROCK UNIT: Laramie Formation

AGE: Upper Cretaceous

COAL FIELD: Boulder-Weld

COAL-BEARING REGION: Denver

STATE: Colorado

COUNTY: Weld

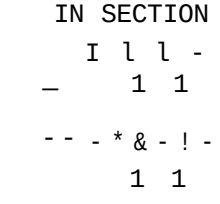
SECTION: 15

TOWNSHIP: T.IN.

RANGE: R.68W.

U.S.G.S. TOPOGRAPHIC
QUADRANGLE: Frederick 7-5' (1969)

LOCATION IN SECTION



TOTAL SECTION MEASURED (FEET):
OVERBURDEN AT SAMPLING POINT (FEET): 370
ELEVATION TOP OF SAMPLED COAL:(Feet) 4,785
STRIKE: Est. N 10" E
DIP: 1 SE
MAJOR CLEAT ORIENTATION IN COAL:

THICKNESS OF COAL (FEET):
THICKNESS SAMPLED (FEET):
TYPE OF SAMPLE: Tipple
CONDITION OF SAMPLE: Fresh
TYPE OF EXPOSURE: Underground mine
MINE NAME: Eagle
MINE OPERATOR: Imperial Coal Company

DATE OF SAMPLING: 4/3/75
SAMPLE COLLECTOR: Colorado Geological Survey

COMPLETION DATE OF ANALYSES
U.S. Bureau of Mines; 7/3/75
U.S. Geological Survey: 8/27/75

LABORATORY NUMBERS
K-53912
D-l73490

APPARENT RANK OF COAL: Subbituminous B

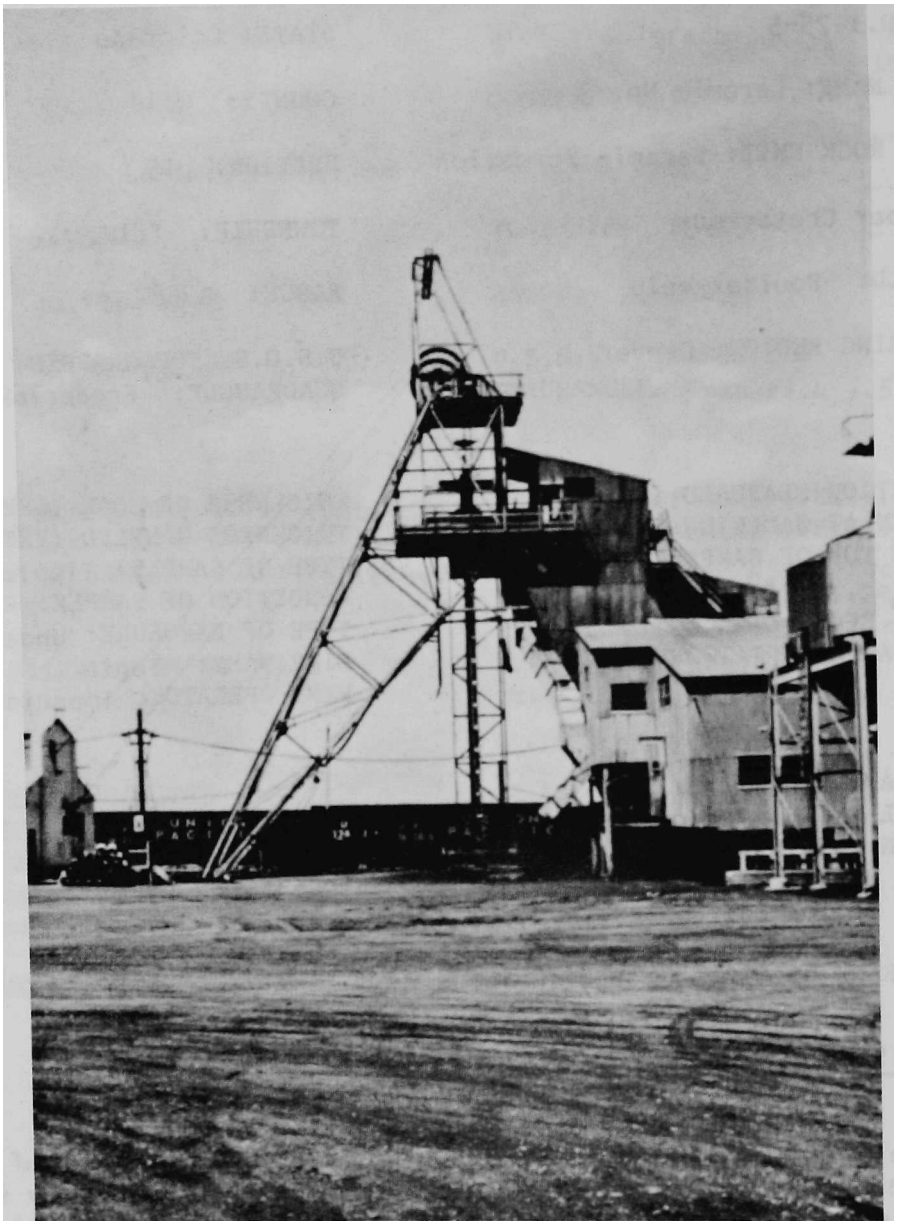
PUBLISHED ANALYSES:

Range of analyses of coal samples from an uncorrelated bed of the Laramie Formation in the Eagle mine. Samples were variously sized tipple samples collected between 1942 and 1970. Analyses are from U. S. Bureau of Mines data bank compilation, Coal Analyses for the State of Colorado (1973).

Moisture (%): 22.1-23.5
Volatile matter {%): 37.2-40.
Fixed carbon {%): 53.4-57-4
Ash (*): 4.6-7.7
Sulfur (%): 0.2-0.4

Heat value (Btu/lb):

As-received: 9,560-9,880
Moisture-free: 12,300-12,700
Moisture- and-ash-free: 13,250-13,430



Tipple, underground mine, Boulder-Weld coal field, Weld County, Colorado

GREEN RIVER REGION, YAMPA FIELD

Twenty-nine samples were taken from the Yampa coa, field, in the Green River region. Most of the samples were collected from the Wadge coal bed in the Williams Fork Formation (upper part of the Mesaverde Group), which is of Late Cretaceous age. Five samples were taken from the Pinnacle coal bed in the „es Formation, iower Mesaverde Group. Twenty-one samples were collected from the Wadge coa, bed, in the middle coa, group; and three samples were taken from the Fish Creek coal bed, in the upper coal group (of Bass, i»5J i <nf Race lqqq') in the Williams Fork Formation. Samples 75-W-10 and 75"A-2 through 7 5 " ^ were taken from the Pinnacle coal bed at the Apex No. 2 underground mine. Samples 75-vM through 75-W-9 were taken from the Wadge bed at the Edna Strip mine^ T h e ^ following were taken from surface workings of Energy Fuels Corporation's strip mines: 75-W-U through 75-W . .. i -ic u n rhrouah 75-W-13 from the Fish Creek and 75-W-18 through 75-W-20 from the Wadge bed, Energy Strip No. ,; 75-w bed, Energy Strip No. 2; and 75-W-2, through 75-W-23 from the Wadge bed, Energy Strip No. 3- Five samP,es, 75-W-24 through 75-W-28, were taken from the Wadge bed in the Seneca No. 2 Strip mine.

Tab,e ,. Lists the locations and descriptions of the samples co„ected from this region.

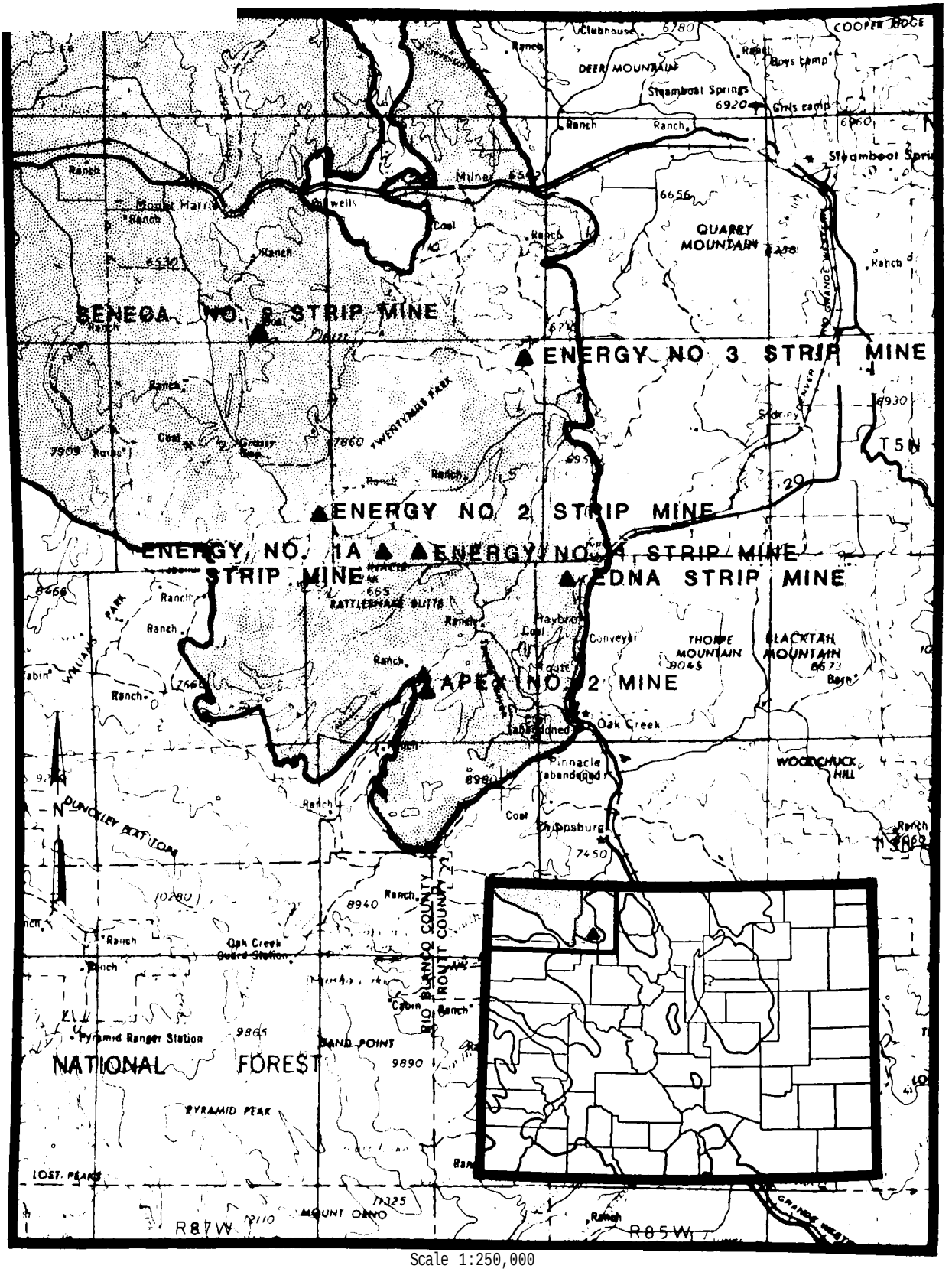
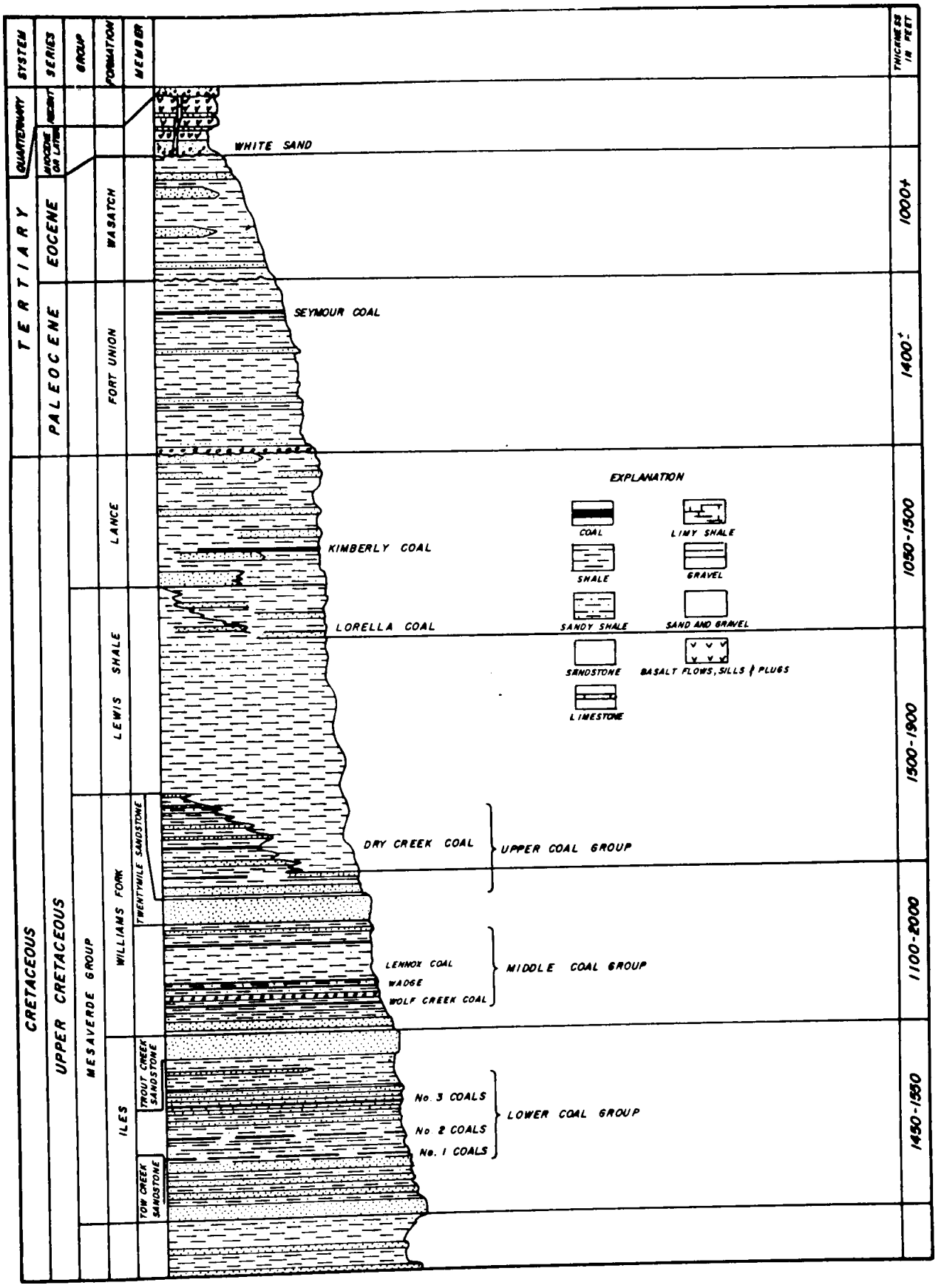


Figure 11.-Index map of the Green River region, Yampa field showing mine locations . The coal-bearing region is shaded. Base map- modified from Army Map Service Craig 1° x 2° quadrangle(1954)



,'.'''-t-:rMi nf pxDosed coal-bearing rocks in

'•'•>-' "-Sr^ir'SfSl - 3 ' ^S^lSTcor-. (fro. ,«. «. par others, 1955)

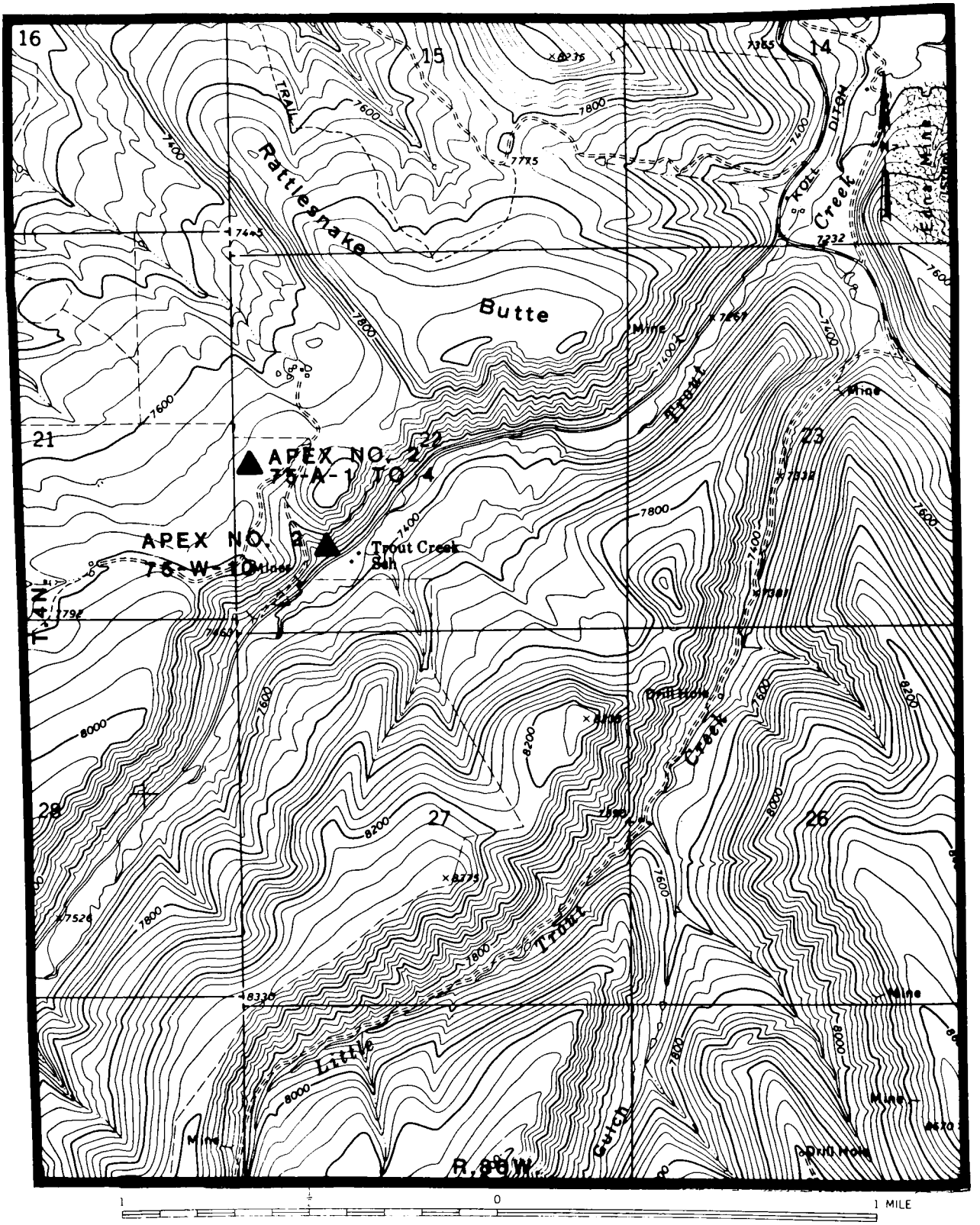


Figure 13.-Detailed location map of coal samples 75-A-l,2 and 10, floor-rock sample 74-A-3, and roof-rock sample 74-A-4 from the Apex No.2 Mine, Green River region-Yampa field, Routt County, Colorado. Base map modified from U.S.Geological Survey Rattlesnake Butte 7 1/21 quadrangle (1971)

SAMPLE NO.: 75~A-1 , Cnannel No. ^

STATE: Colorado

LOCATION IN SECTION

COAL BED NAME: Pinnacle

COUNTY: Routt

GEOLOGIC ROCK UNIT: lies Formation
lower Mesaverde Group

SECTION: 22

AtJis: Upper Cretaceous

TOWNSHIP: T.4N.

COAL FIELD: Yampa

RANGE: R. 86W.

COAL-BEARING REGION: Green River

U.S.G.S. TOPOGRAPHIC
QUADRANGLE: Rattlesnake Butte 7-51 (1971)

TOTAL SECTION MEASURED (FEET): 4.6-4-.8
OVERBURDEN AT SAMPLING POINT (FEET); 300
ELEVATION TOP OF SAMPLED COAL: (peet) ±7^00
STRIKE: Est. N 55° e
DIP: 3° NW
MAJOR CLEAT ORIENTATION IN COAL:
N 3° E; 60° NW

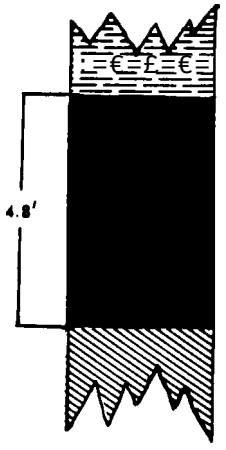
THICKNESS OF COAL (FEET): 4.6-4.8
THICKNESS SAMPLED (FEET): 4.6
TYPE 0F SAMPLE: Face-channel
CONDITION OF SAMPLE: Fresh
TYPE OF EXPOSURE: Underground mine
MINE NAME: Apex No. 2
MINE OPERATOR: Sun land Mining Corp.

DATE OF SAMPLING: 7/2/75
SAMPLE COLLECTOR: Colorado Geological Survey
COMPLETION DATE OF ANALYSES
U.S. Bureau of Mines;
U.S. Geological Survey: 1/7/76

LABORATORY NUMBERS

D-176381

APPARENT RANK OF COAL:



SHALE (Sample 75-A-A) : Grey, carbonaceous.

COAL (Sample 75-A-l) Bright,attrital with thin, sparse to abundant, stringers of vitrain.

COAL (Sample 75-A-2): Same as above.

FLOOR - NO DESCRIPTION (Sample 75-A-3)

(Sample 75'W-IO)

Two channels; channel No, 2 was cut 10 feet laterally from channel No. 1

SAMPLE NO.: 75-A-2 , Channel No. 2

COAL BED NAME: Pinnacle

GEOLOGIC ROCK UNIT: lies Formation, lower Mesaverde Group
AGE: Upper Cretaceous

COAL FIELD: Yampa

COAL-BEARING REGION: Green River

STATE: Colorado

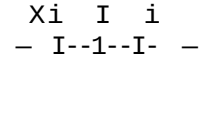
COUNTY: Routt

SECTION: 22

TOWNSHIP: T.4N.

RANGE: R.86W.

LOCATION IN SECTION



U.S.G.S. TOPOGRAPHIC QUADRANGLE: Rattlesnake Butte 7.5' (1971)

TOTAL SECTION MEASURED (FEET): 4.6-4.8
OVERBURDEN AT SAMPLING POINT (FEET): 300
ELEVATION TOP OF SAMPLED COAL: (Feet) ±7400
STRIKE: Est. N 55° E
DIP: 3° NW
MAJOR CLEAT ORIENTATION IN COAL: N 3° E, 60° NW

THICKNESS OF COAL (FEET): 4.6-4.8
THICKNESS SAMPLED (FEET): 4.6
TYPE 0F SAMPLE: Face-channel
CONDITION OF SAMPLE: Fresh
TYPE OF EXPOSURE: Underground mine
MINE NAME: Apex No. 2
MINE OPERATOR: Sun land Mining Corp.

DATE OF SAMPLING: 7/2/75
SAMPLE COLLECTOR: Colorado Geological Survey
COMPLETION DATE OF ANALYSES
U.S. Bureau of Mines;
U.S. Geological Survey: I/7/76

LABORATORY NUMBERS
D-176382

APPARENT RANK OF COAL:

Two channels; channel No. 2 was cut 10 feet lateral k, f laterally from Channel No. 1

SAMPLE NO.: 75-A-3, Channel No. 21

STATE: Colorado

LOCATION IN SECTION

COAL BED NAME: Pinnacle

COUNTY: Routt

GEOLOGIC ROCK UNIT: lies Formation, lower Mesaverde Group

SECTION: 22

AGE: Upper Cretaceous

TOWNSHIP: T.4N.

COAL FIELD: Yampa

RANGE: R.86W.

COAL-BEARING REGION: Green River

U.S.G.S. TOPOGRAPHIC QUADRANGLE: Rattlesnake Butte 7-51 (1971)

TOTAL SECTION MEASURED (FEET): 4.6-4.8
OVERBURDEN AT SAMPLING POINT (FEET): 300
ELEVATION TOP OF SAMPLED COAL: (Feet) ±7400
STRIKE: Est. N 55° E
DIP: 3° NW
MAJOR CLEAT ORIENTATION IN COAL:

THICKNESS OF COAL (FEET): 4.6-4.8,
&ICKNESS SAMPLED (FEET):
TYPE OF SAMPLE: Floor rock- grab
CONDITION OF SAMPLE: Fresh
TYPE OF EXPOSURE: Underground mine
MINE NAME: Apex No. 2
MINE OPERATOR: Sun land Mining Corp.

DATE OF SAMPLING: 7/2/75
SAMPLE COLLECTOR: Colorado Geological Survey

COMPLETION DATE OF ANALYSES	LABORATORY NUMBERS
U.S. Bureau of Mines;	
U.S. Geological Survey: 1/21/76	D-l76367

APPARENT RANK OF COAL:

Two channels; channel No. 2 was cut 10 feet laterally from channel No. 1

SAMPLE NO.: 75-A-4 , Channel No. 1^

STATE: Colorado

LOCATION IN SECTION

COAL BED NAME: Pinnacle

COUNTY: Routt

GEOLOGIC ROCK UNIT: lies Formation, lower Mesaverde Group

SECTION: 22

AGE: upper Cretaceous

TOWNSHIP: T.4N.

COAL FIELD: Yampa

RANGE: R.86W.

COAL-BEARING REGION: Green River

U.S.G.S. TOPOGRAPHIC QUADRANGLE: Rattlesnake Butte 7-5' (1971)

TOTAL SECTION MEASURED (FEET): 4.6-4.8

THICKNESS OF COAL (FEET): 4.6-4.8

OVERBURDEN AT SAMPLING POINT (FEET): .300

THICKNESS SAMPLED (FEET):

ELEVATION TOr OF SAMPLED COAL: (Feet) -7400

TYPE OF SAMPLE: Roof rock- grab

STRIKE: Est.N 55° E

CONDITION OF SAMPLE: Fresh

DIP: 3° NW

TYPE OF EXPOSURE: Underground mine

MAJOR CLEAT ORIENTATION IN COAL:

MINE NAME: Apex No. 2

MINE OPERATOR: Sun land Mining Corp.

DATE OF SAMPLING: 7/2/76

SAMPLE COLLECTOR: Colorado Geological Survey

COMPLETION DATE OF ANALYSES

U.S. Bureau of Mines;

U.S. Geological Survey: 1/21/76

LABORATORY NUMBERS

D-l76368

APPARENT RANK OF COAL:

Two channels: channel No. 2 was cut 10 feet laterally from channel No. 1

SAMPLE NO.: 75-W-10

STATE: Colorado

LOCATION IN SECTION

COAL BED NAME: Pinnacle

COUNTY: Routt

GEOLOGIC ROCK UNIT: lies Formation, lower Mesaverde Group

SECTION: 22

AGE: Upper Cretaceous

TOWNSHIP: T.4N.

COAL FIELD: Yampa

RANGE: R.86W.

COAL-BEARING REGION: Green River

U.S.G.S. TOPOGRAPHIC QUADRANGLE: Rattlesnake Butte 7.5' (1971)

TOTAL SECTION MEASURED (FEET):

OVERBURDEN AT SAMPLING POINT (FEET):

ELEVATION TOP OF SAMPLED COAL: (Feet) ±7400

STRIKE; Est, N 55°E

DIP: 3° NW

MAJOR CLEAT ORIENTATION IN COAL: N 3° E; 60° NW

THICKNESS OF COAL (FEET): 4.6-4.8

THICKNESS SAMPLED (FEET):

TYPE 0F SAMPLE: Tipple

CONDITION OF SAMPLE: Fresh

TYPE OF EXPOSURE: Underground mine

MINE NAME: Apex No. 2

MINE OPERATOR: Sunland Mining Corp.

DATE OF SAMPLING: 6/28/75

SAMPLE COLLECTOR: Colorado Geological Survey

COMPLETION DATE OF ANALYSES

U.S. Bureau of Mines; 2/26/76

U.S. Geological Survey: 1/21/76

LABORATORY NUMBERS

K-59615

D-176366

APPARENT RANK OF COAL: High-volatile C bituminous

PUBLISHED ANALYSES:

Range of analyses of coal samples from the Pinnacle bed of the Mesaverde Group in the Apex No. 2 mine. Samples were variously sized tipple samples collected in 1967. Analyses are from U. S. Bureau of Mines data bank compilation, Coal Analyses Data for the State of Colorado. (1973).

Moisture {%): 9.0-9.6
Volatile matter {%): 40.5-41.6
Fixed carbon {%): 52.5-53.9
Ash (%): 4.4-7.0
Sulfur {%): 0.5-0.6

Heat value (Btu/lb):

As-received: 11,730-12,180
Moisture-free: 12,980-13,390
Moisture- and ash-free: 13,960-14,020

Proximate and Elemental Analyses of Run-of-Mine Samples from the Apex No. 2 mine.

Analyses by:		Hazen Research, Inc.	Commercial Testing and Engineering Co.
Moisture (%)	1	6.70	6.66
	2		
Volatile Matter (%)	1	34.92	37.14
	2	37.43	39-79
Fixed Carbon (%)	1	54.39	51.93
	2	58.29	55-63
Ash (%)	1	3-99	4.27
	2	4.28	4.58
Sulfur (%)	1	0.54	0.59
	2	0.58	0.63
Heat Value (Btu/lb)	1	12419	12434
	2	13311	13321

Elemental Analysis of Ash

Si02	44.13	47.78
A12°3	29.05	26.84
Ti02	0.86	0.56
Fe203	6.26	6.69
CaO	6.85	6.88
MgO	0.82	1.04
Na20	2.03	2.06
K20	0.66	1.48
P2°5	4.87	3.02
SO,	1.52	3.28

Copies of test results were submitted by the Sunland Mining Corp., owners of the Apex No. 2 mine. Two laboratories, Hazen Research, Inc., Golden, Colorado and Commercial Testing and Engineering Co., Denver} Colorado ran Proximate and Elemental analyses on the samples. 1 denotes samples analyzed "As Received," and 2 denotes samples analyzed on a "Dry Basis."

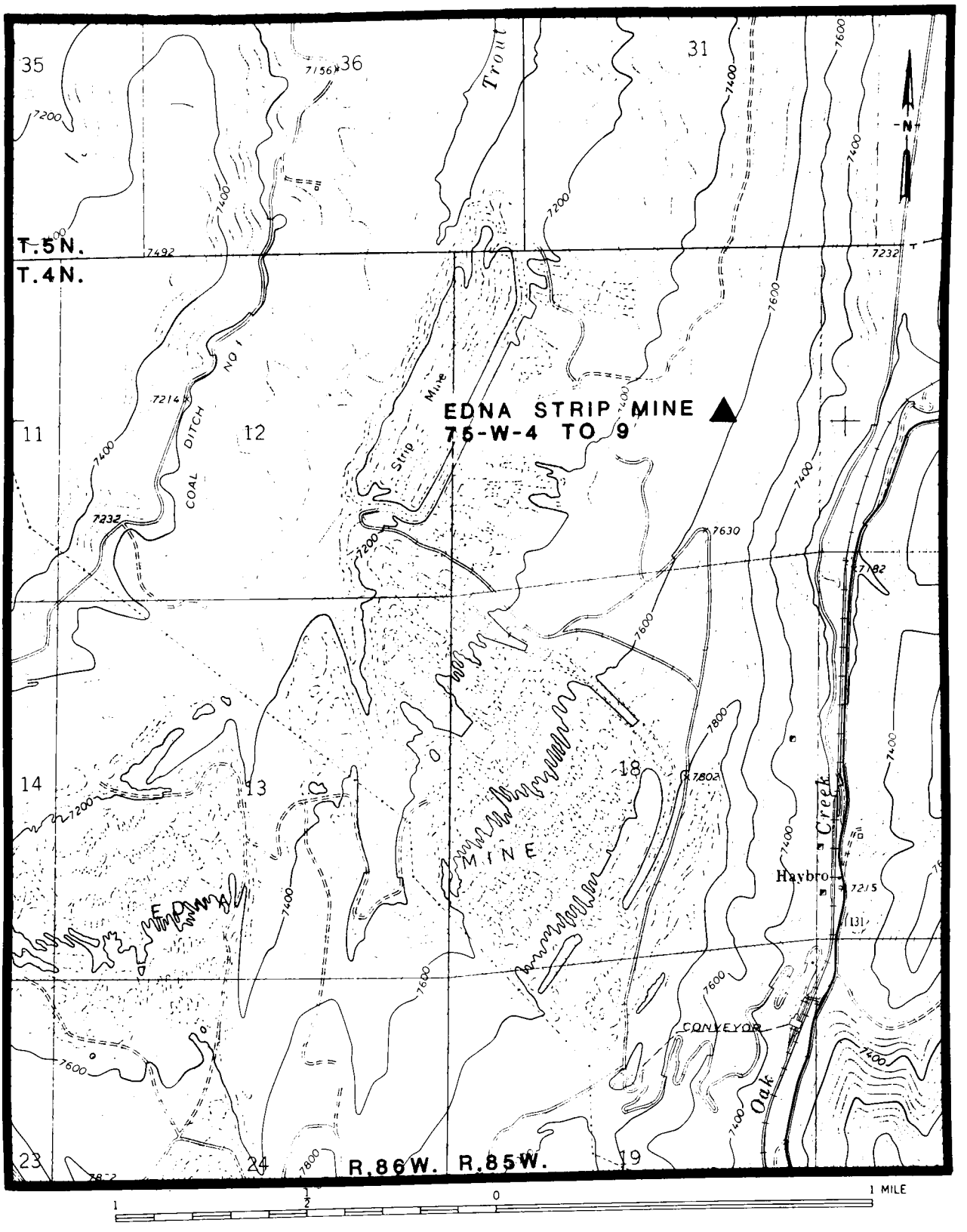


Figure ,4.-Detailed location map of coal samples 7 5-W-4.5.and ^ ° f rock sample 75-W-6, and floor rock sample 75^-7 from Edna Strip Mine, Routt County, Colorado. Base map mod, f^d from U.S. Geological Survey Oak Creek 7 1/* quadrangle(l969).

SAMPLE NO.: 75-W-4 , Channel No. 11

COAL BED NAME: Wadge

GEOLOGIC ROCK UNIT: William* Fork Format" tion, upper Mesaverde Group
AGEtjpper Cretaceous

COAL FIELD: Yampa

COAL-BEARING REGION: Green River

STATE: Colorado

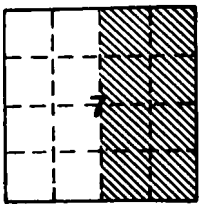
COUNTY: Routt

SECTION: 7

TOWNSHIP: T.4N.

RANGE: R.85W.

LOCATION IN SECTION



U.S.G.S. TOPOGRAPHIC QUADRANGLE: Oak Creek 7.5' (1969)

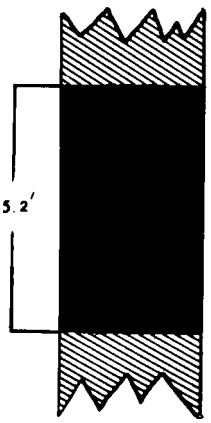
TOTAL SECTION MEASURED (FEET): 5 7
OVERBURDEN AT SAMPLING POINT (FEET):40~50
ELEVATION TOP OF SAMPLED COAL: (Feet) 7,521
STRIKE: Est. N 12° W
DIP: 10° NE
MAJOR CLEAT ORIENTATION IN COAL:
S 7° E; 74° w (spacing 0.5'-2' poor)

THICKNESS OF COAL (FEET): 5.2
THICKNESS SAMPLED (FEET): Upper 2.5
TYPE OF SAMPLE: Face-channel
CONDITION OF SAMPLE: Fresh
TYPE OF EXPOSURE: Strip mine
MINE NAME: Edna Strip
MINE OPERATOR: Pittsburg 6 Midway Coal Mining Co.

DATE OF SAMPLING:6/28/75
SAMPLE COLLECTOR: Colorado Geological Survey

COMPLETION DATE OF ANALYSES	LABORATORY NUMBERS
U.S. Bureau of Mines; 2/26/76	K-59616
U.S. Geological Survey:1/21/76	D-l76362

APPARENT RANK OF COAL: High-volatile C bituminous



-*' ROOF - NO DESCRIPTION (Sample 75-W-6)

-2.5' COAL (Sample 75-W-4 75-W-8): Briqhtjattrital with sparse, lenticular vitrain; conchoidal fracture common in the attrital.

-»•»' COAL (Sample 75-W-5.75-W-9): Same as above.

•3' FLOOR - NO DESCRIPTION (Sample 75-W-7)

Two parallel channels; channel No. 2 was cut 35 feet from Channel No. 1

SAMPLE NO.: 75-W-5, channel No. 11

COAL BED NAME: Wadge

GEOLOGIC ROCK UNIT: Williams Fork Formation, upper Mesaverde Group

AGE: Upper Cretaceous

COAL FIELD: Yampa

COAL-BEARING REGION: Green River

STATE: Colorado

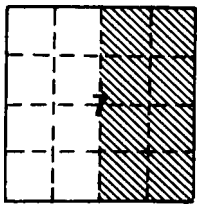
COUNTY: Routt

SECTION: 7

TOWNSHIP: T.4N.

RANGE: R.85W.

LOCATION IN SECTION



U.S.G.S. TOPOGRAPHIC QUADRANGLE: Oak Creek 7-5' (1969)

TOTAL SECTION MEASURED (FEET): 5.7
OVERBURDEN AT SAMPLING POINT (Fe'eT): 40-50
ELEVATION TOP OF SAMPLED COAL: (Feet) 7,521
STRIKE: Est N 12° w
DIP: i0o NE
MAJOR CLEAT ORIENTATION IN COAL:

S 7° E, 74° w (Spacing 0.5'-2' poor)

THICKNESS OF COAL (FEET): 5.2
THICKNESS SAMPLED (FEET): Lower 2.75
TYPE OF SAMPLE: Face-channel
CONDITION OF SAMPLE: Fresh
TYPE OF EXPOSURE: Strip mine
MINE NAME: Edna Strip
MINE OPERATOR: Pittsburg & Midway Coal Mining Co.

DATE OF SAMPLING: 6/28/75
SAMPLE COLLECTOR: Colorado Geological Survey

COMPLETION DATE OF ANALYSES	LABORATORY NUMBERS
U.S. Bureau of Mines; 2/26/76	K-59616
U.S. Geological Survey: 1/21/76	D-l76363

APPARENT RANK OF COAL: High-volatile A bituminous

1 Two parallel channels; channel No. 2 was cut 35 feet from channel Na>. 1

SAMPLE NO.: 75"W-6 , Channel No. 1

COAL BED NAME: Wadge

GEOLOGIC ROCK UNIT: Williams Fork Formation, upper Mesaverde Group
AGE: Upper Cretaceous

COAL FIELD: Yampa

COAL-BEARING REGION: Green River

STATE: Colorado

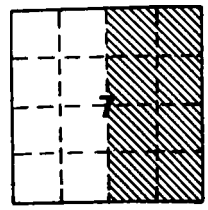
COUNTY: Routt

SECTION: 7

TOWNSHIP: T.4N.

RANGE: R.85W.

LOCATION IN SECTION



U.S.G.S. TOPOGRAPHIC QUADRANGLE: Oak Creek 7.5' (1969)

TOTAL SECTION MEASURED (FEET): 5.7
OVERBURDEN AT SAMPLING POINT (FEET):40-50
ELEVATION TOP OF SAMPLED COAL: (Feet) 7,521
STRIKE- Est N 12° W
DIP: 10° NE*
MAJOR CLEAT ORIENTATION IN COAL:

THICKNESS OF COAL (FEET): 5.2,
THICKNESS SAMPLED (FEET): 0.2
TYPE OF SAMPLE: Roof rock- grab
CONDITION OF SAMPLE: Fresh
TYPE 0F exp0SURE: Strip mine
MINE NAME: Ecjna Strip
MINE OPERATOR: pittsbury & Midway Coal Mining Co.

DATE OF SAMPLING: 6/28/75
SAMPLE COLLECTOR:Colorado Geological Survey
COMPLETION DATE OF ANALYSES
U.S. Bureau of Mines;
U.S. Geological Survey: 1/7/76

LABORATORY NUMBERS
D-176379

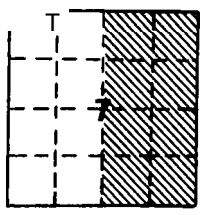
APPARENT RANK OF COAL:

Two parallel channels; channel No. 2 was cut 35 feet form channel No. 1

SAMPLE NO.: 75-W-7 , Channel No. 11

STATE: Colorado

LOCATION IN SECTION



COAL BED NAME: Wadge

COUNTY: Routt

GEOLOGIC ROCK UNIT- Williams Fork Formation, upper Mesaverde Group

SECTION: 7

AGE: Upper Cretaceous

TOWNSHIP: j.4N.

COAL FIELD: Yampa

RANGE: R.85W.

COAL-BEARING REGION: Green River

U.S.G.S. TOPOGRAPHIC QUADRANGLE: 0ak Creek 7.5' (1969)

TOTAL SECTION MEASURED (FEET): 5.7

THICKNESS OF COAL (FEET): 5.2

OVERBURDEN AT SAMPLING POINT (FEET):40-50

THICKNESS SAMPLED (FEET):0.3

ELEVATION TOP OF SAMPLED COAL: (Feet) 7,521

TYPE OF SAMPLE: Floor rock- grab

STRIKE: Est. N 12° w '

CONDITION OF SAMPLE:Fresh

DIP: io° NE

TYPE 0F EXPOSURE: Strip mine

MAJOR CLEAT ORIENTATION IN COAL:

MINE NAME: Edna Strip

MINE OPERATOR:Pittsburg £ Midway Coal Mining Company

DATE OF SAMPLING: 6/28/75

SAMPLE COLLECTOR: Colorado Geological Survey

COMPLETION DATE OF ANALYSES

U.S. Bureau of Mines;
U.S. Geological Survey: 1/7/76

LABORATORY NUMBERS

D-I7638O

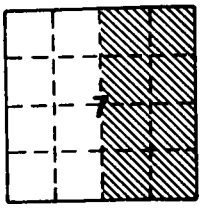
APPARENT RANK OF COAL:

1 Two parallel channels; channel No. 2 was cut 35 feet from channel No. 1

SAMPLE NO.: 75-W-8, Channel No. 21

STATE: Colorado

LOCATION IN SECTION



COAL BED NAME: Wadge

COUNTY: Routt

GFOLOGIC ROCK UNIT:Wi11iams Fork Formation
upper Mesaverde Group

SECTION: 7

AGE: Upper Cretaceous

TOWNSHIP: T.4N.

COAL FIELD: Yampa

RANGE: R.85W.

COAL-BEARING REGION: Green River

U.S.G.S. TOPOGRAPHIC QUADRANGLE: Oak Creek 7.5' (1969)

TOTAL SECTION MEASURED (FEET): 5.5

THICKNESS OF COAL (FEET): 5.5

OVERBURDEN AT SAMPLING POINT (FM): 40-50

THICKNESS SAMPLED (FEET): Upper 2.5

ELEVATION TOP OF SAMPLED COAL:(Feet) 7,521

TYPE OF SAMPLE: Face-channel

STRIKE- Est N 12° W

CONDITION OF SAMPLE: Fresh

DIP: 10° NE

TYPE 0F EXP0SURE: Strip mine

MAJOR CLEAT ORIENTATION IN COAL:
S 7° E; 74° W (spacing 0.5'-2' P°°r)

MINE NAME: Edna Strip

MINE OPERATOR:Pittsburg S Midway Coal Mining Company

DATE OF SAMPLING: 6/28/75

SAMPLE COLLECTOR: Colorado Geological Survey

COMPLETION DATE OF ANALYSES	LABORATORY NUMBERS
U.S. Bureau of Mines; 2/26/76	K-59614
U.S. Geological Survey:1/21/76	D-176364

APPARENT RANK OF COAL: Subbituminous A

Two parallel channels; Channel No. 2 was cut 35 feet from Channel No. 1

SAMPLE NO.: 75-W-9, Channel No. 2

COAL BED NAME: Wadge

GEOLOGIC ROCK UNIT: Williams Fork Formation, upper Mesaverde Group

AGE: Upper Cretaceous

COAL FIELD: Yampa

COAL-BEARING REGION: Green River

STATE: Colorado

COUNTY: Routt

SECTION: 7

TOWNSHIP:T.4N.

RANGE: R.85W.

U.S.G.S. TOPOGRAPHIC QUADRANGLE: Oak Creek 7-5' (1969)

LOCATION IN SECTION

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~ T J | |

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! m i

TOTAL SECTION MEASURED (FEET): 5.5

OVERBURDEN AT SAMPLING POINT (FEfiT): 40-50

ELEVATION TOP OF SAMPLED COAL: (Feet) 7 521

STRIKE: Est. N 12° W '

DIP: 10° NE

MAJOR CLEAT ORIENTATION IN COAL:

S 7 E; 74° n (spacing 0.5'-2' poor)

THICKNESS OF COAL (FEET): 5.5,

THICKNESS SAMPLED (FEET): Lower 3-0

TYPE 0F SAMPLE: Face-channel

CONDITION OF SAMPLE: Fresh

TYPE 0F EXPOSURE:Strip mine

MINE NAME: Edna Strip

MINE OPERATOR:Pittsburg & Midway Coal Mining Company

DATE OF SAMPLING: 6/28/75

SAMPLE COLLECTOR: Colorado Geological Survey

COMPLETION DATE OF ANALYSES

U.S. Bureau of Mines; 2/26/76

U.S. Geological Survey: 1/21/76

LABORATORY NUMBERS

K-59614

D-176365

APPARENT RANK OF COAL: High-volatile B bituminous

PUBLISHED ANALYSES:

Range of analyses of coal samples from the Wadge bed of the Mesaverde Group in the Edna strip mine. Samples were variously sized tipple samples collected between 1948 and 1966- Analyses are from U. S. Bureau of Mines data bank compilation, Coal Analyses Data for the State of Colorado (1973).

Moisture {%)'. 8.9-12.5

Volatile matter {%): 37.2-42.6

Fixed carbon (*): 48.7~52.5

Ash (%): 7.1-13.2

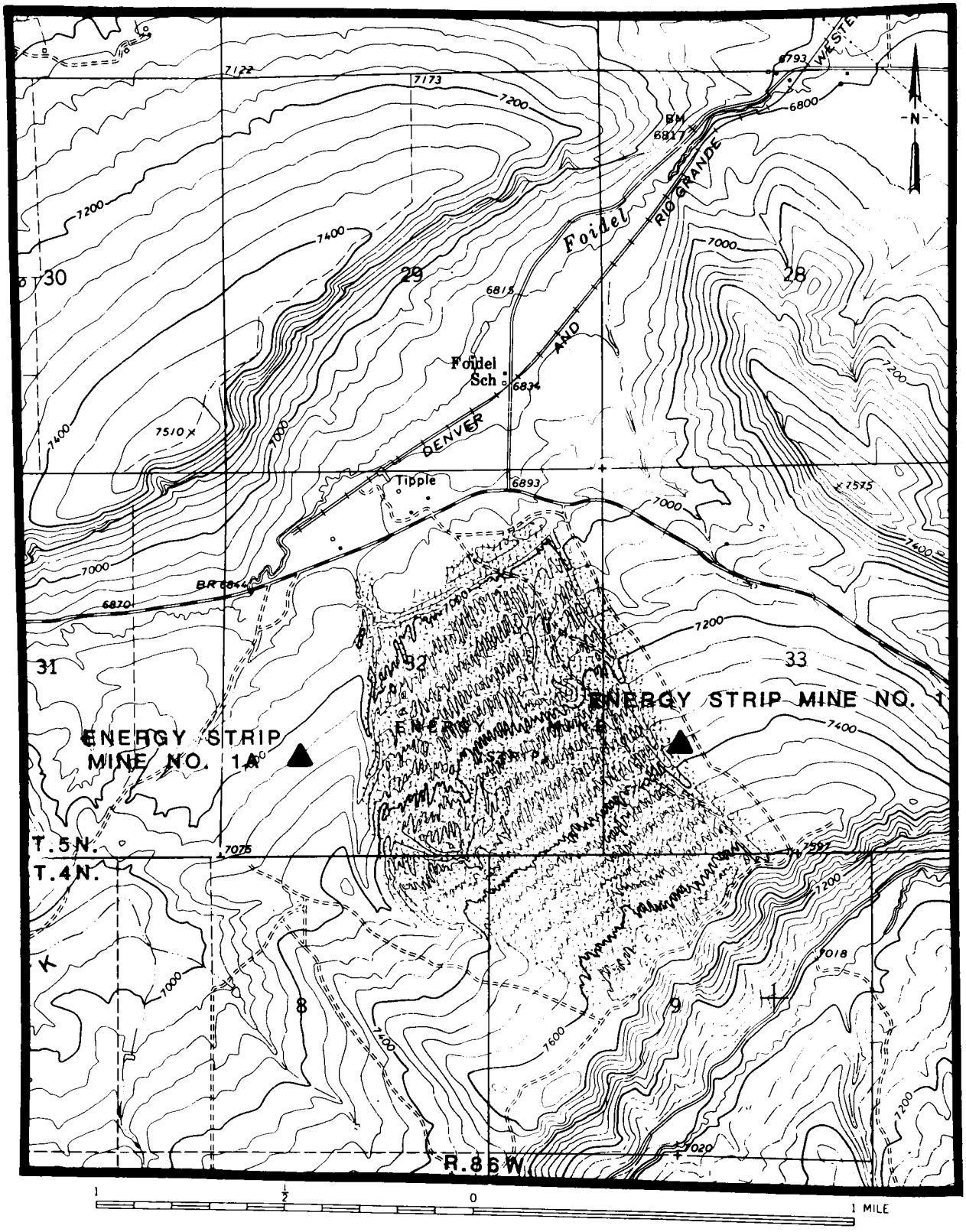
Sulfur {%): 0.6-0.9

Heat value (Btu/lb):

As-received: 10,400-11,390

Moisture-free: 11,890-12,670

Moisture- and ash-free: 13,640-13,760



Ftoure 15.-D.t,M.d loc-t.cn Mp of coa, samples 75^-, 5. , 6 ,, B, and ,9, roof rock sample 75-W- 1 4 ,' f loor roc Im e 7 5 ^ ^ H 9> sample 75-W-20 from Energy No. 1 and No 1A S rin M ' ?* Part'ng -Yampa field, Routt County, C^rado iL "' T" RiVer region Geological Survey Rattlesnake. Butte 7 Base Map modified from U.S. / Ml quadrangle(!97D

SAMPLE NO. : 75-^-]/,

COAL BED NAME: Wadge

GEOLOGIC ROCK UNIT: Williams Fork Formation^ upper Mesaverde Group
AGE: Upper Cretaceous

COAL FIELD: Yampa

COAL-BEARING REGION: Green River

STATE: Colorado

COUNTY: Routt

SECTION: 33

TOWNSHIP: T.5N.

RANGE: R.86W.

LOCATION IN SECTION

—I—I--I—
l 1 l

U.S.G.S. TOPOGRAPHIC QUADRANGLE: Rattlesnake Butte 7.5 (1971)

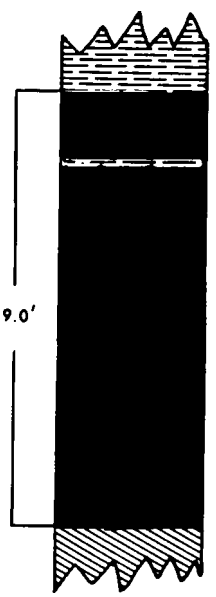
TOTAL SECTION MEASURED (FEET): 8.2
OVERBURDEN AT SAMPLING POINT (FEET): 50
ELEVATION TOP OF SAMPLED COAL: (Feet) 7,325
STRIKE:No10° E
DIP: 20 NW
MAJOR CLEAT ORIENTATION IN COAL:

THICKNESS OF COAL (FEET): 8.2
THICKNESS SAMPLED (FEET):
TYPE OF SAMPLE: Roof rock- grab
CONDITION OF SAMPLE: Fresh
TYPE OF EXPOSURE: Strip mine
MINE NAME: Energy Strip Mo. 1
MtHE OPERATOR: Energy Fuels Corp.

DATE OF SAMPLING: 6/28/75
SAMPLE COLLECTOR: Colorado Geological Survey
COMPLETION DATE OF ANALYSES
U.S. Bureau of Mines;
U.S. Geological Survey: 1/7/76

LABORATORY NUMBERS
D-176384

APPARENT RANK OF COAL:



SHALE: Dark grey.

rLi'SHALE (Sample 75-W-20): Black, hard,with light grey shale lenses 0.21 thick in the center of the parting.

•* °' COAL (Sample 75-W-19)

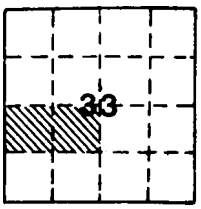
5 °' COAL (Sample 75-W-18)

FLOOR - NO DESCRIPTION

SAMPLE NO. : y5_w_15

STATE: Colorado

LOCATION IN SECTION



COAL BED NAME: Wadge

COUNTY: Routt

GEOLOGIC ROCK UNIT: Wi 1 1 iams Fork Format ion; up per Mesaverde Group

SECTION: 33

AGE: Upper Cretaceous

TOWNSHIP: T.5N.

COAL FIELD: Yampa

RANGE: R.86W.

COAL-BEARING REGION: Green River

U.S.G.S. TOPOGRAPHIC QUADRANGLE: Rattlesnake Butte 7.5' (1971)

TOTAL SECTION MEASURED (FEET): 8.2

OVERBURDEN AT SAMPLING POINT (FEET): 50

ELEVATION TOP OF SAMPLED COAL: (Feet) 7,325

STRIKE N 10° E

DIP 20° NW

MAJOR CLEAT ORIENTATION IN COAL

S 50° E; 85° NE (spacing 0.2'-0.5', fair)

S 25° E; 70 SW (±20°) (spacing poor)

THICKNESS OF COAL (FEET): 8.2 , Lower 4.0

THICKNESS SAMPLED (FEET):

TYPE 0F SAMPLE: Face-channel

CONDITION OF SAMPLE: Fresh

TYPE OF EXPOSURE: Strip mine

MINE NAME: Energy Strip No. 1

MINE OPERATOR: Energy Fuels Corp.

DATE OF SAMPLING: 6/28/76

SAMPLE COLLECTOR: Colorado Geological Survey

COMPLETION DATE OF ANALYSES

U.S. Bureau of Mines; 2/26/76

U.S. Geological Survey: 1/21/76

LABORATORY NUMBERS

K-59618

D-176371

APPARENT RANK OF COAL: High-volatile C bituminous

SAMPLE NO. : 75_v/-16

STATE:Colorado

COAL BED NAME: Wadge

COUNTY: Routt

GEOLOGIC ROCK UNIT: Williams Fork Formation,upper Mesaverde Group

'SECTION: 33

AGE: Upper Cretaceous

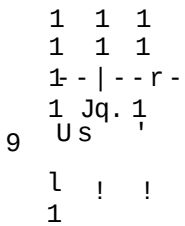
TOWNSHIP: T.5N.

COAL FIELD: Yampa

RANGE: R.86W.

COAL-BEARING REGION: Green River

LOCATION IN SECTION



U.S.G.S. TOPOGRAPHIC QUADRANGLE: Rattlesnake Butte 7-5' (1971)

TOTAL SECTION MEASURED (FEET): 8.2
OVERBURDEN AT SAMPLING POINT (FEET): 50
ELEVATION TOP OF SAMPLED COAL: (Feet) 7,325
STRIKEN 10° E
DIP: 20° NW
MAJOR CLEAT ORIENTATION IN COAL:
S 50° E; 85° NE (spacing 0.2-0.5', fair)
S 25° E; 70° W (+20°) (spacing, poor)

THICKNESS OF COAL (FEET): 8.2
THICKNESS SAMPLED (FEET): upper 4.2
TYPE OF SAMPLE: Face "channel
CONDITION OF SAMPLE: Fresh
TYPE OF EXPOSURE: strip mine
MINE NAME: Energy Strip No. 1
MINE OPERATOR: Energy Fuels Corp.

DATE OF SAMPLING: 6/28/75
SAMPLE COLLECTOR: Colorado Geological Survey

COMPLETION DATE OF ANALYSES
U.S. Bureau of Mines; 2/26/76
U.S. Geological Survey)/2I/76

LABORATORY NUMBERS
K-59618
D-l76372

APPARENT RANK OF COAL: High-volatile B bituminous

SAMPLE NO.: 75-W-17

COAL BED NAME: Wadge

GEOLOGIC ROCK UNIT: Williams Fork Forma
tion, upper Mesaverde Group
AGE: Upper Cretaceous

COAL FIELD: Yampa

COAL-BEARING REGION: Green River

STATE: Colorado

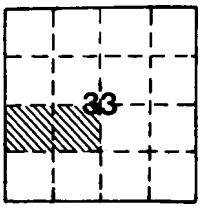
COUNTY: Routt

SECTION: 33

TOWNSHIP: T.5N.

RANGE: R.86W.

LOCATION IN SECTION



U.S.G.S. TOPOGRAPHIC QUADRANGLE: Rattlesnake Butte 7.5 (1971)

TOTAL SECTION MEASURED (FEET):
OVERBURDEN AT SAMPLING POINT (FEET): 50
ELEVATION TOP OF SAMPLED COAL:(Feet) 7,325
STRIKE: N 10° E '
DIP: 20° NW
MAJOR CLEAT ORIENTATION IN COAL:

THICKNESS OF COAL (FEET): 8 2
THICKNESS SAMPLED (FEET):
TYPE 0F SAMPLE:Floor rock- grab
CONDITION OF SAMPLE: Fresh
TYPE OF EXPOSURE: Strip mine
MINE NAME:Energy Strip No. 1
MINE OPERATOR: Energy Fue'ls Corp.

DATE OF SAMPLING: 6/28/75
SAMPLE COLLECTOR: Colorado Geological Survey
COMPLETION DATE OF ANALYSES
U.S. Bureau of Mines;
U.S. Geological Survey: 1/7/76

LABORATORY NUMBERS
D-l76385

APPARENT RANK OF COAL:

SAMPLE NO.: 75-W-I8

STATE: Colorado

LOCATION IN SECTION

COAL BED NAME: Wadge

COUNTY: Routt

GEOLOGIC ROCK UNIT: Williams Fork Formation, upper Mesaverde Group

SECTION: 32

AQE:Upper Cretaceous

TOWNSHIP: T.5N.

COAL FIELD: Yampa

RANGE: R.86W.

COAL-BEARING REGION: Green River

U.S.G.S. TOPOGRAPHIC QUADRANGLE: Rattlesnake Butte 7-5' (1971)

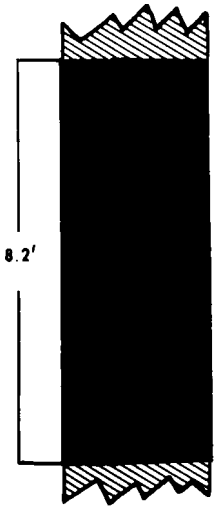
TOTAL SECTION MEASURED (FEET): 9.0
OVERBURDEN AT SAMPLING POINT (FEET): 40
ELEVATION TOP OF SAMPLED COAL: (Feet) 7,035
STRIKE: N 10° E
DIP: 20° NW
MAJOR CLEAT ORIENTATION IN COAL:
S 60° E- 90°
N 20° E'; 80° (±20°)

THICKNESS OF COAL (FEET): 9-0
THICKNESS SAMPLED (FEET): Lower 5.0
TYPE OF SAMPLE: Face-channel
CONDITION OF SAMPLE: Fresh
TYPE OF EXPOSURE: Strip mine
MINE NAME: Energy Strip No. 1A
MINE OPERATOR: Energy Fuels Corp.

DATE OF SAMPLING: 6/28/75
SAMPLE COLLECTOR:Colorado Geological Survey

COMPLETION DATE OF ANALYSES	LABORATORY NUMBERS
U.S. Bureau of Mines; 2/26/76	K-59619
U.S. Geological Survey: 1/21/76	D-176373

APPARENT RANK OF COAL: High-volatile C bituminous



ROOF - NO DESCRIPTION (Sample 75~W-14)

*2' COAL (Sample 75-W-16): Bright,attrital with abundant,thin stringers of vitrain; possible kaolinite in cleats and lenses, 0.5" - 1.0" long; minor amounts of pyrite.

-4.0' COAL (Sample 75"W-15): Same as above.

FLOOR - NO DESCRIPTION (Sample 75-W-17)

SAMPLE NO.: 75~W-19

STATE: Colorado

LOCATION IN SECTION

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COAL BED NAME: Wadge

COUNTY: Routt

GEOLOGIC ROCK UNTT: Williams Fork Forma tion, upper Mesaverde Group

SECTION: 32

AGE: Upper Cretaceous

TOWNSHIP: T.5N.

COAL FIELD: Yampa

RANGE: R.86W.

COAL-BEARING REGION: Green River

U.S.G.S. TOPOGRAPHIC QUADRANGLE: Rattlesnake Butte 7-5' (1971)

TOTAL SECTION MEASURED (FEET): 9.0
OVERBURDEN AT SAMPLING POINT (FEET) :i,0
ELEVATION TOP OF SAMPLED COAL:(Feet) 7,035 '
STRIKE: N 10° E
DIP: 20° NW
MAJOR CLEAT ORIENTATION IN COAL:
S 60" E; 90
N 20° E; 0° (±20°)

THICKNESS OF COAL (FEET): 9.0
THICKNESS SAMPLED (FEET): Upper 4.0
TYPE 0F SAMPLE: Face-channel
CONDITION OF SAMPLE: Fresh
TYPE OF EXPOSURE: Strip mine
MINE NAME: Energy Strip No. 1A
MINE OPERATOR: Energy Fuels Corp.

DATE OF SAMPLING: 6/28/75
SAMPLE COLLECTOR: Colorado Geological Survey

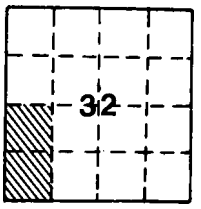
COMPLETION DATE OF ANALYSES	LABORATORY NUMBERS
U.S. Bureau of Mines; 2/26/76	K-596I9
U.S. Geological Survey: 1/21/76	D-176374

APPARENT RANK OF COAL: High-volatile C bituminous

SAMPLE NO.: 75-W-20

STATE: Colorado

LOCATION IN SECTION



COAL BED NAME: Wadge

COUNTY: Routt

GEOLOGIC ROCK UNIT:Wi11iams Fork Formation^SECTION: 32
upper Mesaverde Group

AGE: Upper Cretaceous

TOWNSHIP: T.5N.

COAL FIELD: Yampa

RANGE: R.86W.

COAL-BEARING REGION: Green River

U.S.G.S. TOPOGRAPHIC
QUADRANGLE: Rattlesnake Butte 7.5' (1971)

TOTAL SECTION MEASURED (FEET): 9.0
OVERBURDEN AT SAMPLING POINT (FEET): 40
ELEVATION TOP OF SAMPLED COAL: (Feet) 7,035
STRIKE: N 10° E
DIP: 20° NW
MAJOR CLEAT ORIENTATION IN COAL:

THICKNESS OF COAL (FEET): 9.0
THICKNESS SAMPLED (FEET):
TYPE OF SAMPLE: Parting- grab
CONDITION OF SAMPLE: Fresh
TYPE OF EXPOSURE: Strip mine
MINE NAME: Energy Strip No. 1A
MINE OPERATOR: Energy Fuels Corporation

DATE OF SAMPLING: 6/28/75
SAMPLE COLLECTOR: Colorado Geological Survey
COMPLETION DATE OF ANALYSES
U.S. Bureau of Mines;
U.S. Geological Survey: 1/7/76

LABORATORY NUMBERS
D-176386

APPARENT RANK OF COAL:

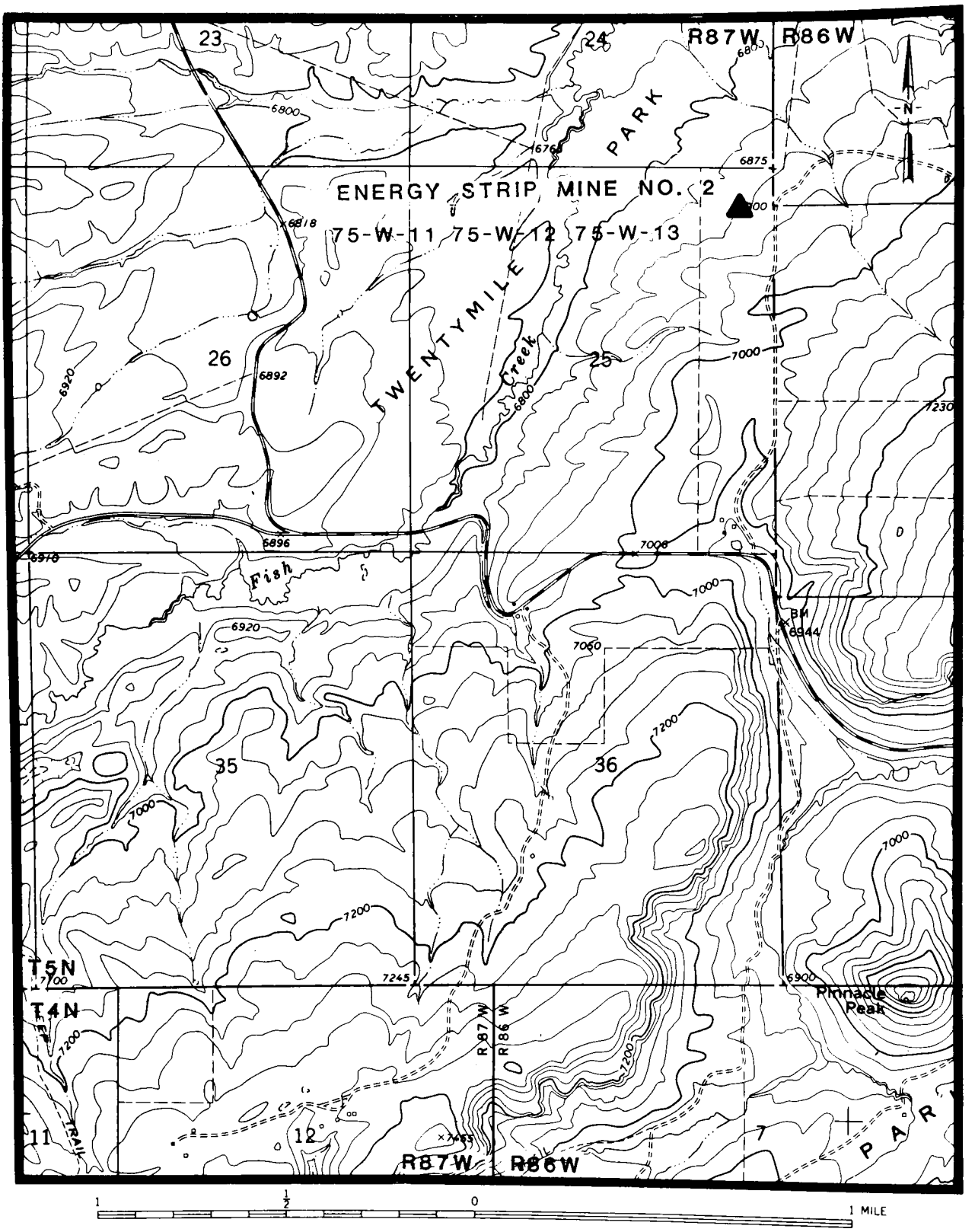
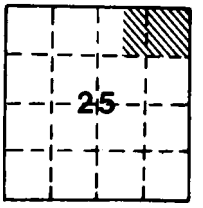


Figure 16;-Detailed location map of coal samples 75-W-ll and 12 and floor rock sample 7S-W-13 from Energy Strip Mine No.2, Green River region-Yampa field , Routt County, Colorado. Base map from U S Geological Survey Rattlesnake Butte 1 \/T quadrangle(1971)

SAMPLE NO.: 75-W-ll

STATE: Colorado

LOCATION IN SECTION



COAL BED NAME: Fish Creek

COUNTY: Routt

GEOLOGIC ROCK UNIT: Williams Fork Formation, upper Mesaverde Group

SECTION: 25

AGE: Upper Cretaceous

TOWNSHIP: T.5N.

COAL FIELD: Yampa

RANGE: R.87W.

COAL-BEARING REGION: Green River

U.S.G.S. TOPOGRAPHIC QUADRANGLE: Dunckley 7-51 (197D

TOTAL SECTION MEASURED (FEET): 5.2
OVERBURDEN AT SAMPLING POINT (FEET): ±50
ELEVATION TOP OF SAMPLED COAL: (Feet) 6,775
STRIKE: Est. N 32° W
DIP: 4 ° NE
MAJOR CLEAT ORIENTATION IN COAL:
S 45° E; 80° SW
S 40° W; 60° NW

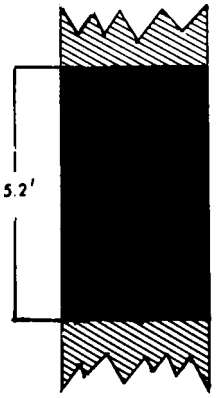
THICKNESS OF COAL (FEET): 5.2
THICKNESS SAMPLED (FEET): upper 2.5
TYPE OF SAMPLE: Face~channel
CONDITION OF SAMPLE: Fresh
TYPE OF EXPOSURE: Strip mine
MINE NAME: Energy Strip No. 2
MINE OPERATOR: Energy Fuels Corp.

DATE OF SAMPLING: 6/28/75
SAMPLE COLLECTOR: Colorado Geological Survey

COMPLETION DATE OF ANALYSES
U.S. Bureau of Mines; 2/26/76
U.S. Geological Survey: 1/21/76

LABORATORY NUMBERS
K-59617
D-176369

APPARENT RANK OF COAL: Subbituminous A



ROOF - NO DESCRIPTION

COAL (Sample 75-W-ll): Bright,attrital with thin.abundant lenses of vitrain; primary and secondary pyrite.

COAL (Sample 75-W-12): Same as above.

FLOOR - NO DESCRIPTION (Sample 75-W-13)

SAMPLE NO.: 75_w_12

STATE: Colorado

LOCATION IN SECTION

COAL BED NAME: Fish Creek

COUNTY: Routt

GEOLOGIC ROCK UNIT: Wi 1 1 iams Fork Formation
upper Mesaverde Group

SECTION: 25

AGE: Upper Cretaceous

TOWNSHIP: T.5N.

COAL FIELD: Yampa

RANGE: R.87W.

COAL-BEARING REGION: Green River

U.S.G.S. TOPOGRAPHIC QUADRANGLE: Dunckley 7.5' (1971)

TOTAL SECTION MEASURED (FEET): 5.2
OVERBURDEN AT SAMPLING POINT (FEET):±50
ELEVATION TOP OF SAMPLED COAL:(Feet) 6,775
STRIKE:Est. N 32u W
DIP: 4° NE
MAJOR CLEAT ORIENTATION IN COAL:
S 45° E, 80° S
S 40° W, 60° W

THICKNESS OF COAL (FEET): 5.2
THICKNESS SAMPLED (FEET): Lower 2.7
TYPE 0F SAMPLE: Face-channel
CONDITION OF SAMPLE:Fresh
TYPE OF EXPOSURE: Strip mine
MINE NAME: Energy Strip No. 2
MINE OPERATOR: Energy Fuels Corp.

DATE OF SAMPLING: 6/28/75
SAMPLE COLLECTOR:Colorado Geological Survey

COMPLETION DATE OF ANALYSES
U.S. Bureau of Mines; 2/26/76
U.S. Geological Survey:1/21/76

LABORATORY NUMBERS
K-59617
D-l76370

APPARENT RANK OF COAL: Subbiturninous A

SAMPLE NO.: 75-W-13

COAL BED NAME: Fish Creek

GEOLOGIC ROCK UNIT: Williams Fork Formation, upper Mesaverde group
AGE: Upper Cretaceous

COAL FIELD: Yampa

COAL-BEARING REGION: Green River

STATE: Colorado

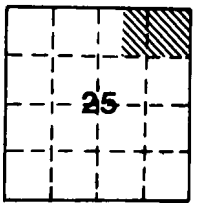
COUNTY: Routt

SECTION: 25

TOWNSHIP: T.5N.

RANGE: R.87W.

LOCATION IN SECTION



U.S.G.S. TOPOGRAPHIC QUADRANGLE: Dunckley 7.5' (1971)

TOTAL SECTION MEASURED (FEET):
OVERBURDEN AT SAMPLING POINT (FEET):+rQ
ELEVATION TOP OF SAMPLED COAL:(Feet) 6,775
STRIKER Est. N 42° W
DIP: 4 NE
MAJOR CLEAT ORIENTATION IN COAL:

THICKNESS OF COAL (FEET): 5.2
THICKNESS SAMPLED (FEET):
TYPE OF SAMPLE:Floor roclk- grab
CONDITION OF SAMPLE:Fresh
TYPE OF EXPOSURE: Strip mine
MINE NAME: Energy Strip No. 2
MINE OPERATOR: Energy Fuels Corp.

DATE OF SAMPLING: 6/28/75
SAMPLE COLLECTOR:Colorado Geological Survey
COMPLETION DATE OF ANALYSES
U.S. Bureau of Mines;
U.S. Geological Survey: 1/7/76

LABORATORY NUMBERS
D-l76383

APPARENT RANK OF COAL:

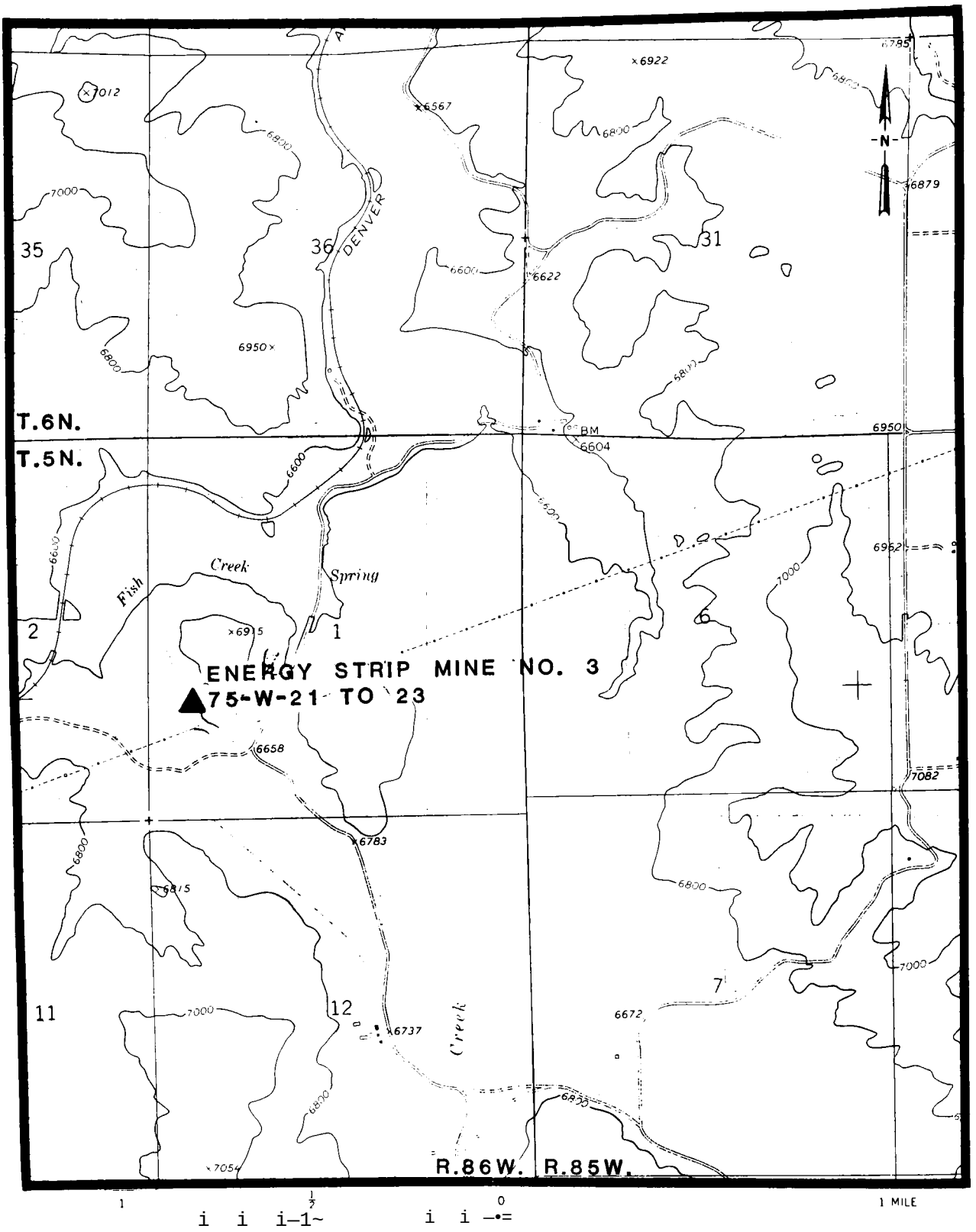


Figure 17.-Detailed location map of coal samples 75-W-21 through 75-W-23 from Energy No.3 Strip Mine, Green River region-Yampa field, Routt County, Colorado. Base map modified from U.S.Geological Survey Cow Creek 7 1/2' quadrangle(l970)

SAMPLE NO.: 75-W-21

STATE: Colorado

COAL BED NAME: Wadge

COUNTY: Routt

GEOLOGIC ROCK UNIT: Williams Fork Formation, upper Mesaverde Group

SECTION: l

AGE: Upper Cretaceous

TOWNSHIP: T.5N.

COAL FIELD: Yampa

RANGE: R.86W.

COAL-BEARING REGION: Green River

U.S.G.S. TOPOGRAPHIC QUADRANGLE: Cow Creek 7.5' (1969)

LOCATION IN SECTION

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TOTAL SECTION MEASURED (FEET): 8.5
OVERBURDEN AT SAMPLING POINT (FEET): 0-100
ELEVATION TOP OF SAMPLED COAL:(Feet) 6,775
STRIKE: N 40° w '
DIP:250 sw
MAJOR CLEAT ORIENTATION IN COAL:

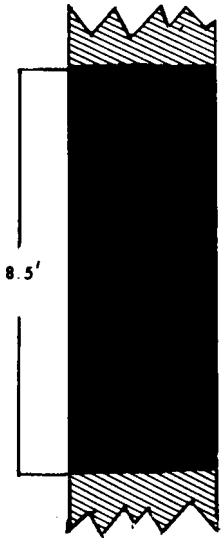
THICKNESS OF COAL (FEET): 8.5
THICKNESS SAMPLED (FEET):
TYPE 0F SAMPLE: Floor rock" grab
CONDITION OF SAMPLE: Fresh
TYPE 0F EXPOSURE: Strip mine
MINE NAME: Energy Strip No. 3
MINE OPERATOR: Energy Fuels Corp.

DATE OF SAMPLING: 7/2/75
SAMPLE COLLECTOR: Colorado Geological Survey
COMPLETION DATE OF ANALYSES
U.S. Bureau of Mines;
U.S. Geological Survey: 1/7/76

LABORATORY NUMBERS

D-176387

APPARENT RANK OF COAL:



-4.0' COAL (Sample 75-W-23): Moderately bright.attrital with sparse thin lenses of vitrain; secondary pyrite.

COAL (Sample 75"W-22): Same as above

-4.5'

FLOOR - NO DESCRIPTION (Sample 75-W-21)

SAMPLE NO.: 75-W-22

STATE: Colorado

COAL BED NAME: Wadge

COUNTY: Routt

GEOLOGIC ROCK UNIT: Williams Fork Formation, upper Mesaverde Group

SECTION: 1

AGE: Upper Cretaceous

TOWNSHIP T.5N.

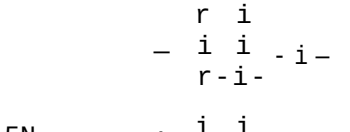
COAL FIELD: Yampa

RANGE: R.86W.

COAL-BEARING REGION: Green River

U.S.G.S. TOPOGRAPHIC QUADRANGLE: Cow Creek 7.5' (1969)

LOCATION IN SECTION



TOTAL SECTION MEASURED (FEET): 8.5

OVERBURDEN AT SAMPLING POINT (FEET): q- 100

ELEVATION TOP OF SAMPLED COAL:(Feet) 6,775

STRIKE: n40° W '

DIP: 250 SW

MAJOR CLEAT ORIENTATION IN COAL:

S 45° E; 90 (spacing .2'-.5', fair)

N 55 E; 90 (spacing 61, poor)

THICKNESS OF COAL (FEET): 8.5

THICKNESS SAMPLED (FEET): Lower 4.5

TYPE 0F SAMPLE: Face-channel

CONDITION OF SAMPLE: Fresh

TYPE OF EXPOSURE: Strip mine

MINE NAME: Energy Strip No. 3

MINE OPERATOR: Energy Fuels Corp.

DATE OF SAMPLING: 7~2~75

SAMPLE COLLECTOR:Colorado Geological Survey

COMPLETION DATE OF ANALYSES

U.S. Bureau of Mines; 2/26/76

U.S. Geological Survey:l/21/76

LABORATORY NUMBERS

K-59620

D-l 76375

APPARENT RANK OF COAL: Subbituminous A

SAMPLE NO. : 75-W-23

STATE: Colorado

COAL BED NAME: Wadge

COUNTY: Routt

GEOLOGIC ROCK UNIT: Wi 11iams Fork Formation
upper Mesaverde Group

SECTION: 1

AGE: Upper Cretaceous

TOWNSHIP: T.5N.

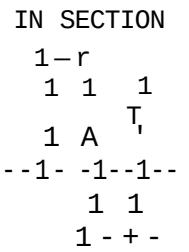
COAL FIELD: Yampa

RANGE: R.86W.

COAL-BEARING REGION: Green River

U.S.G.S. TOPOGRAPHIC
QUADRANGLE: Cow Creek 7.5' (1969)

LOCATION IN SECTION



TOTAL SECTION MEASURED (FEET): 8.5
OVERBURDEN AT SAMPLING POINT (FEET): 0-100
ELEVATION TOP OF SAMPLED COAL: (Feet) 6,775
STRIKE: N40° W
DIP: 25° SW
MAJOR CLEAT ORIENTATION IN COAL:
S 45° E; 90° (spacing .2 -.5', fair)
N 55° E; 90° (spacing 6', poor)

THICKNESS OF COAL (FEET): 8.5
THICKNESS SAMPLED (FEET): Upper 4.0
TYPE 0F SAMPLE: Face "channel
CONDITION OF SAMPLE: Fresh
TYPE OF EXPOSURE: Strip mine
MINE NAME: EnergyStrip No. 3
MINE OPERATOR: Energy Fuels Corp.

DATE OF SAMPLING: 7/2/75
SAMPLE COLLECTOR: Colorado Geological Survey

COMPLETION DATE OF ANALYSES
U.S. Bureau of Mines; 2/26/76
U.S. Geological Survey: 1/21/76

LABORATORY NUMBERS
K-59620
D-176376

APPARENT RANK OF COAL: Subbiturninous A

PUBLISHED ANALYSES:

Range of analyses of coal samples from the Wadge bed of the Mesa-verde Group in the Energy mine. Samples were variously sized tipple samples collected in 1963 and 1968. Analyses are from U. S, Bureau of Mines data bank compilation, Coal Analyses Data for the State of Colorado (1973).

Moisture (%): 10.1-10.4
Volatile matter (%): 39.1-M.3
Fixed carbon {%): 50.7-51.8
Ash (*): 8.0-9.1
Sulfur (%): 0.5

Heat value (Btu/lb):

As-received: 11,240-11,380
Moisture-free: 12,5^0-12,660
Moisture- and ash-free: 13,760-13,800

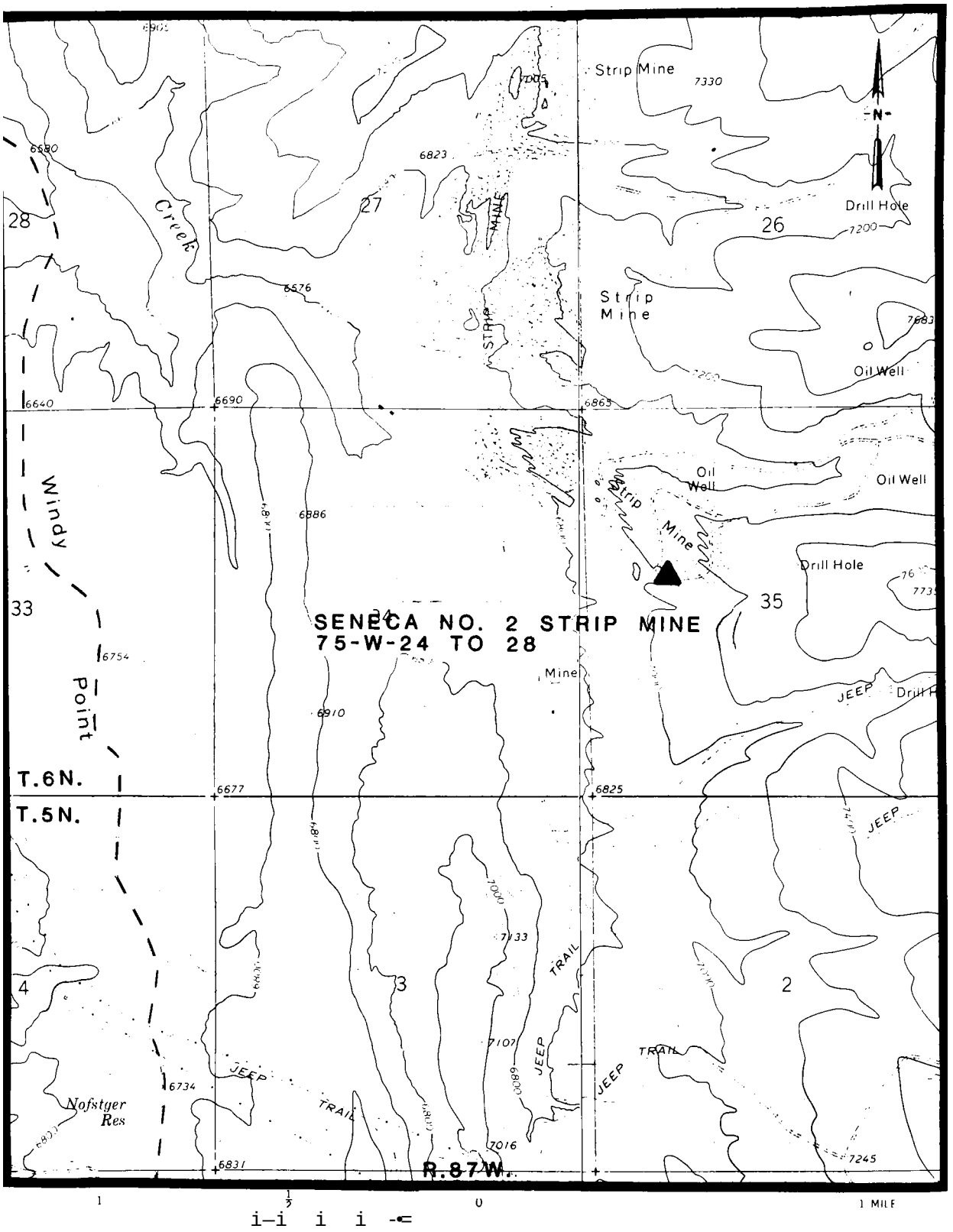


Figure 18.-Deta.i led location map of coal samples 75-W-25 and 26, roof rock sample 75-W-24, floor rock sample 75-W-27, and parting sample 75-W-28 from the Seneca No.2 Strip Mine, Green River region-Yampa field, Routt County, Colorado. Base map modified from U.S. Geological Survey Milner 7 1/2' (1871) and Mt. Harris 7 1/2' (1971) quadrangles.

SAMPLE NO.: 75-W-24

STATE: Colorado

LOCATION IN SECTION

COAL BED NAME: Wadge

COUNTY: Routt

GEOLOGIC ROCK UNIT: Williams Fork Formation upper Mesaverde Group

SECTION: 35

AGE: Upper Cretaceous

TOWNSHIP: T.6N.

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COAL FIELD: Yampa

RANGE: R.87W.

COAL-BEARING REGION: Green River

U.S.G.S. TOPOGRAPHIC QUADRANGLE: Milner 7-5' (1971) and Mount Harris 7-5 (1971)

TOXAL SECTION MEASURED (FEET): g>2

THICKNESS OF COAL (FEET): 9.0

OVERBURDEN AT SAMPLING POINT (FEET): 45

THICKNESS SAMPLED (FEET): 0.2

ELEVATION TOP OF SAMPLED COAL: (Feet) 7,023

TYPE OF SAMPLE: Roof rock-grab

STRIKE:Est. N 10° W

CONDITION OF SAMPLE: Fresh

DIP: 20° SW

TYPE OF EXPOSURE: Strip mine

MAJOR CLEAT ORIENTATION IN COAL:

MINE NAME: Seneca Strip No. 2

MINE OPERATOR: Seneca Coals, Ltd.

DATE OF SAMPLING: 6/28/75

SAMPLE COLLECTOR: Colorado Geological Survey

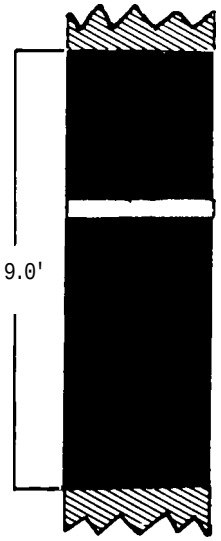
COMPLETION DATE OF ANALYSES

U.S. Bureau of Mines;
U.S. Geological Survey: 1/7/76

LABORATORY NUMBERS

D-I76388

APPARENT RANK OF COAL:



2'' ROOF - NO DESCRIPTION (Sample 75"W-2't)

COAL (Sample 75-W-25): Attrital, moderately bright with thin
*' vitrain stringers; thin partings in upper bed; minor pyrite and possible kaolinite in cleats.

.3" CLAY (Sample 75-W-28): Tan.

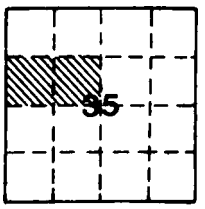
COAL (Sample 75"W-26): Same as upper.coal section.

FLOOR - NO DESCRIPTION (Sample 75-W-27)

SAMPLE NO.: 75-W-25

STATE: Colorado

LOCATION IN SECTION



COAL BED NAME: Wadge

COUNTY: Routt

GEOLOGIC ROCK UNIT:Wi11iams Fork Formation
upper Mesaverde Group

SECTION: 35

AGE: Upper Cretaceous

TOWNSHIP: T.6N.

COAL FIELD: Yampa

RANGE: R.87W.

COAL-BEARING REGION: Green River

U.S.G.S. TOPOGRAPHIC QUADRANGLE: Milner 7-5' 097D and Mount Harris 7-5' (1971)

TOTAL SECTION MEASURED (FEET): 9.2

OVERBURDEN AT SAMPLING POINT (FEET): 45

ELEVATION TOP OF SAMPLED COAL:(Feet) 7,023

STRIKE: Est. N 10°W '

DIP: 20° SW

MAJOR CLEAT ORIENTATION IN COAL:

THICKNESS OF COAL (FEET): 9.0

THICKNESS SAMPLED (FEET): Upper 4.0

TYPE OF SAMPLE: Face-channel

CONDITION OF SAMPLE: Fresh

TYPE OF EXPOSURE: Strip mine

MINE NAME: Seneca Strip No. 2

MINE OPERATOR: Seneca Coals Ltd.

DATE OF SAMPLING: 6/28/75

SAMPLE COLLECTOR: Colorado Geological Survey

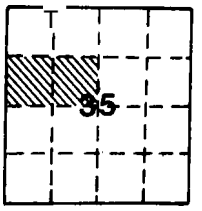
COMPLETION DATE OF ANALYSES		LABORATORY NUMBERS
U.S. Bureau of Mines;	2/26/76	K-59621
U.S. Geological Survey:	1/21/76	D-176377

APPARENT RANK OF COAL: High-volatile C bituminous

SAMPLE NO.: 75-W-26

STATE: Colorado

LOCATION IN SECTION



COAL BED NAME: Wadge

COUNTY: Routt

GEOLOGIC ROCK UNIT: Williams Fork Formation, upper Mesaverde Group

SECTION: 35

AGE: Upper Cretaceous

TOWNSHIP: T.6N.

COAL FIELD: Yampa

RANGE: R.87W.

COAL-BEARING REGION: Green River

U.S.G.S. TOPOGRAPHIC QUADRANGLE: Milner 7-51 (1971) and Mt. Harris 7-5' (1971)

TOTAL SECTION MEASURED (FEET): 9.2

THICKNESS OF COAL (FEET): 9.0

OVERBURDEN AT SAMPLING POINT (FEET): 45

THICKNESS SAMPLED (FEET): Lower 5.0

ELEVATION TOP OF SAMPLED COAL: (Feet) 7.023

TYPE OF SAMPLE: Face-channel

STRIKE'. Est. N 10°W

CONDITION OF SAMPLE: Fresh

DIP: 20° SW

TYPE OF EXPOSURE: Strip mine

MAJOR CLEAT ORIENTATION IN COAL:

N 45°W, 80°NE (spacing 2"-3", fair)
S 60°W, 80°NW (spacing l"-3 'Poor'

MINE NAME: Seneca Strip No. 2

MINE OPERATOR: Seneca Coals, Ltd.

DATE OF SAMPLING: 6-28-76

SAMPLE COLLECTOR: Colorado Geological Survey

COMPLETION DATE OF ANALYSES

U.S. Bureau of Mines; 2-26-76
U.S. Geological Survey:1-21-76

LABORATORY NUMBERS

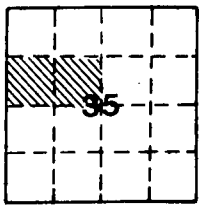
K-59621
D-176378

APPARENT RANK OF COAL: High-volatile C bituminous

SAMPLE NO.: 75-W-27

STATE: Colorado

LOCATION IN SECTION



COAL BED NAME: Wadge

COUNTY: Routt

GEOLOGIC ROCK UNIT:Wi11iams Fork Formation, ipper Mesaverde Group

SECTION: 35

AGE: Upper Cretaceous

TOWNSHIP: T.6N.

COAL FIELD: Yampa

RANGE: R.87W.

COAL-BEARING REGION: Green River

U.S.G.S. TOPOGRAPHIC QUADRANGLE: Milner 7.51 (1970 and Mount Harris 7-5' (1971)

TOTAL SECTION MEASURED (FEET): 9.2

THICKNESS OF COAL (FEET): 9.0

OVERBURDEN AT SAMPLING POINT (FEET): 45

THICKNESS SAMPLED (FEET):

ELEVATION TOP OF SAMPLED COAL:(Feet) 7,023

TYPE OF SAMPLE: Floor rock- grab

STRIKE! Est. N 10°W

CONDITION OF SAMPLE: Fresh

DIP: 20° SW

TYPE 0F SXPOSURE: Strip minp

MAJOR CLEAT ORIENTATION IN COAL:

MINE NAME: Seneca Strip No. 2

MINE OPERATOR: Seneca Coals, Ltd.

DATE OF SAMPLING: 6/28/75

SAMPLE COLLECTOR: Colorado Geological Survey

COMPLETION DATE OF ANALYSES

LABORATORY NUMBERS

U.S. Bureau of Mines;

U.S. Geological Survey: 1/7/76

D-I76389

APPARENT RANK OF COAL:

SAMPLE NO.: 75-W-28

STATE: Colorado

LOCATION IN SECTION

1 1 1
1 '__•_.
SPls-j..-
1 1 1
--l--t--t—
I ! I

COAL BED NAME .-Wadge

COUNTY: Routt

GEOLOGIC ROCK UNIT: Williams Fork Formation, upper Mesaverde Group

SECTION: 35

AGE: Upper Cretaceous

TOWNSHIP: T.6N.

COAL FIELD:Yampa

RANGE: R.87W.

COAL-BEARING REGION: Green River

U.S.G.S. TOPOGRAPHIC QUADRANGLE: Milner 7.5' (1971) and Mount Harris 7.5' (1971)

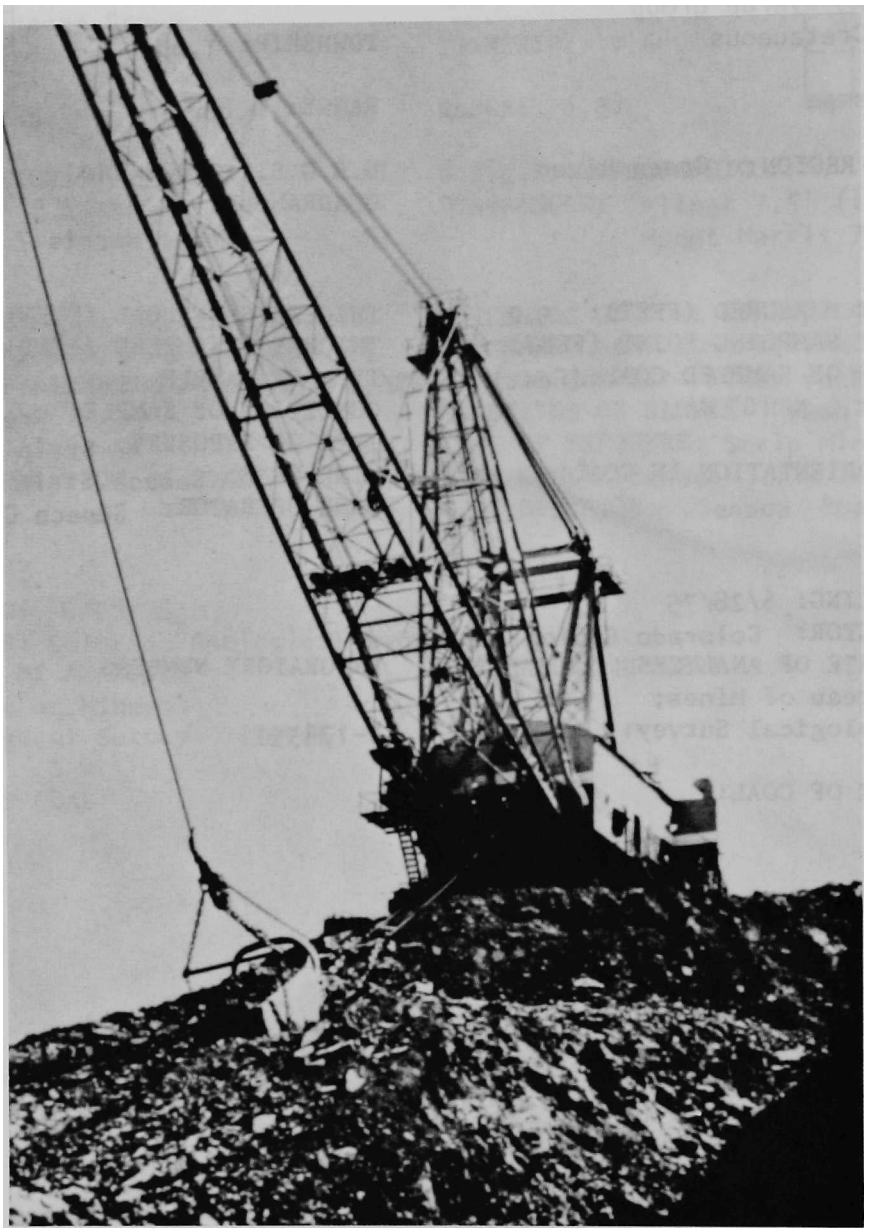
TOTAL SECTION MEASURED (FEET): 9.2
THICKNESS OF COAL (FEET): 9.0
OVERBURDEN AT SAMPLING POINT (FEET):45
THICKNESS SAMPLED (FEET):
ELEVATION TOP OF SAMPLED COAL:(Feet) 7,023
TYPE OF SAMPLE: Parting- grab
STRIKE! Est. N 10°W
CONDITION OF SAMPLE: Fresh
DIP: 20° SW
TYPE OF EXPOSURE: strip mine
MAJOR CLEAT ORIENTATION IN COAL:
MINE NAME: Seneca Strip No. 2
MINE OPERATOR: Seneca Coals, Ltd.

DATE OF SAMPLING: 6/28/75
SAMPLE COLLECTOR: Colorado Geological Survey

COMPLETION DATE OF ANALYSES
U.S. Bureau of Mines;
U.S. Geological Survey: 1/7/76

LABORATORY NUMBERS
D-l76390

APPARENT RANK OF COAL:



Dragline stripping overburden on surface coal mine. Routt County, Colorado

NORTH PARK REGION, NORTH PARK FIELD

Twenty-four samples were collected in the North Park field. All of the samples were taken from the Coalmont Formation, which is of Paleocene age. Six samples, 75-H-l through 75-H-6, were taken from the Sudduth coal bed in Kerr Coal Company's Marr No. 1 Strip mine. Samples 7*»-H-27 through 7/t-H-31 were taken from an inactive strip mine located one-half mile from the Marr No. 1 Strip mine. Sample 75-H-10 was taken from an uncorrected bed approximately 30 ft below the Sudduth bed at an outcrop in the Canadian Strip mine. Samples 75-H-l through 75-H-l5 and 75-W-l through 75-W-5 were obtained from the Riach coal bed in the inactive Grizzly Creek Strip mine.

Table 1 gives the location, number, and sample description of samples taken in North Park field.

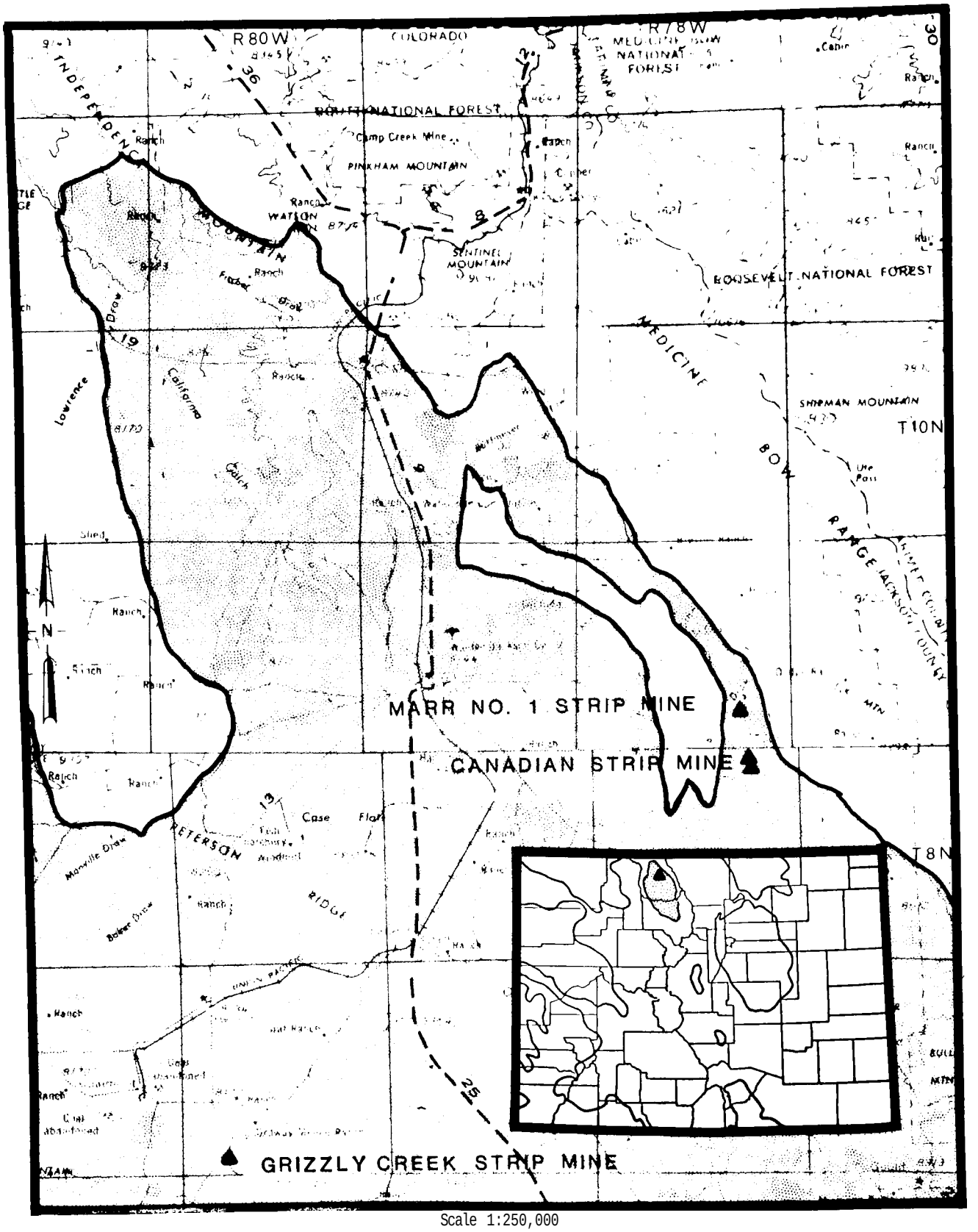


Figure 19--lndex map of the North Park field showing mine locations. Coal-bearing region is shaded. Base map modified from Army Map Service Craig 1° x 2° quadrangle(1954).

NORTH PARK COALMONT DISTRICT

Rock Units	Lithology	Thickness (ft.)	Description
RIACH	 -360	22-77'	Brown to grey arkosic sandstone; grey, green, and brown carbonaceous shale.
SEAM 4			Coal
	-1000'		
SEAM 3		I2'	Coal
	-I250'		Arkosic sandstone, conglomerate, and shale; coal in lower part.
SEAM 2		18'	Coal
SEAM 1		8.5'	Coal
PIERRE SHALE			

Figure 20.-Generalized columnar section of coal-bearing rocks of the Coalmont District, North Park field(after Hail, 1968; Hornbaker and others, 1976).

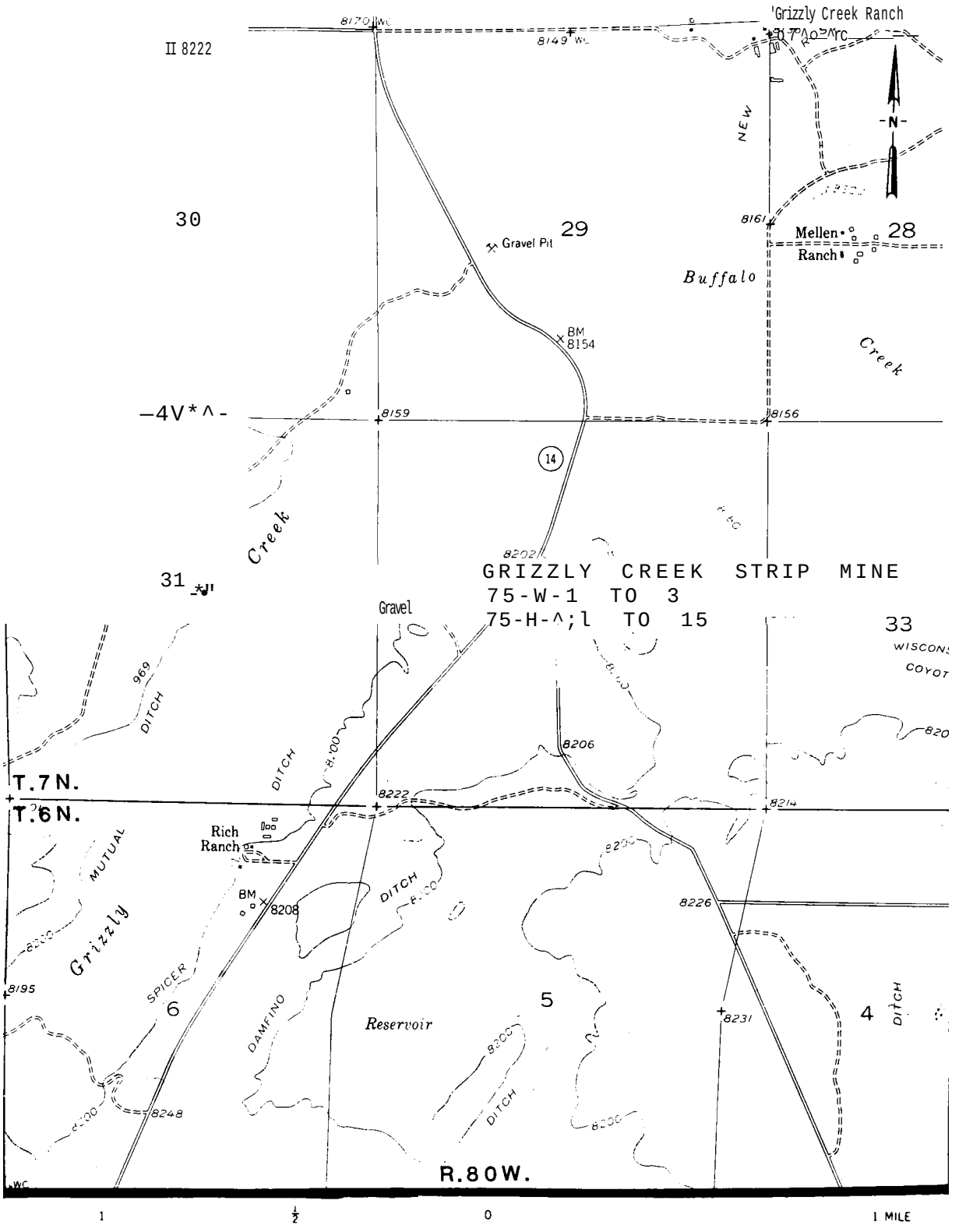


Figure 21.-Detailed location map of wall rock samples 75-W-2 and 3, coal samples 75-W-l, 75-H-l1, 11A, 12, 12A, 13, \h, and 15, and parting samples 75-H-11B from Grizzly Creek Strip Mine, North Park field, Jackson County, Colorado. Base map modified from U.S.Geological Survey Coalmont 7 1/2' quadrangle (1955).

SAMPLE NO.: 75-H-l1, Channel No. 1

COAL BED NAME: Riach

GEOLOGIC ROCK UNIT: Coalmont Formation

AGE: Pal eocene-Eocene

COAL FIELD: North Park

COAL-BEARING REGION: North Park

STATE: Colorado

COUNTY: Jackson

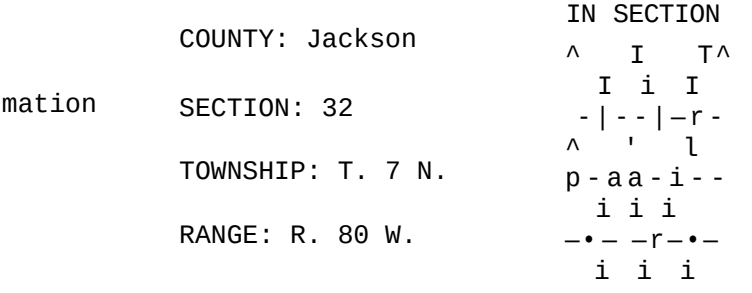
SECTION: 32

TOWNSHIP: T. 7 N.

RANGE: R. 80 W.

U.S.G.S. TOPOGRAPHIC
QUADRANGLE: Coalmont 7-5' (1955)

LOCATION IN SECTION



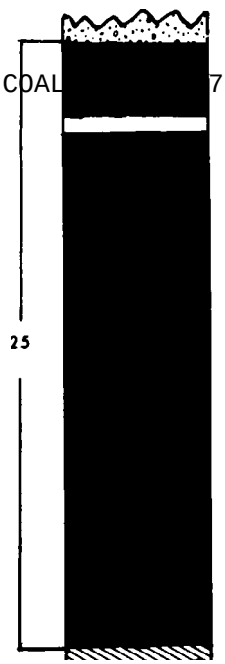
TOTAL SECTION MEASURED (FEET): 23.0
OVERBURDEN AT SAMPLING POINT (FEET): 4-25
ELEVATION TOP OF SAMPLED COAL: (Feet)8,190
STRIKE: S 30°E
DIP: 20°NE
MAJOR CLEAT ORIENTATION IN COAL:
N 55°W; 90°(face cleat)
N 5°E; 80° (butt cleat)

THICKNESS OF COAL (FEET): 25-0
THICKNESS SAMPLED (FEET): 2.0-7-0 from top
TYPE OF SAMPLE: Face-channel
CONDITION OF SAMPLE: Fresh
TYPE OF EXPOSURE: Strip mine
MINE NAME: Grizzly Creek Strip
MINE OPERATOR: Sunflower Energy Corp.

DATE OF SAMPLING: 5/28/75
SAMPLE COLLECTOR: Colorado Geological Survey
COMPLETION DATE OF ANALYSES
U.S. Bureau of Mines; 12/8/75
U.S. Geological Survey: 8/28/75

LABORATORY NUMBERS
K-56764
D-17^81

APPARENT RANK OF COAL: Subbiturninous B



UNC0NSILI DATED SAND AND GRAVEL

COAL (Sample 75-H-l1, 75-H-lIA)

CLAY (Sample 75-H-15, 75-H-lIB): Grey, soft.

COAL (Sample 75-H-12, 75-H-12A): Attrital bright with vitrain in abundant thin bands; primary and secondary pyrite, clay and 1imonite in cleats.

25

75-W-2

COAL (Sample 75-H-13): Same as above.

COAL (Sample 75-H-l'i): Same as above.

75-W-l

75-W-3

FLOOR - NO DESCRIPTION

'Tw/pTrTneT channels: Channel No. 2 was cut 150 feet from Channel No. 1

SAMPLE NO.: 75-H-l1A, Channel No. 21

STATE: Colorado

COAL BED NAME: Riach

COUNTY: Jackson

GEOLOGIC ROCK UNIT: Coalmont Formation

SECTION: 32

AGE: Paleocene-Eocene

TOWNSHIP: T.7N.

COAL FIELD: North Park

RANGE: R.80W.

COAL-BEARING REGION: North Park

U.S.G.S. TOPOGRAPHIC QUADRANGLE: Coalmont 7-5' (1955)

LOCATION IN SECTION

TOTAL SECTION MEASURED (FEET): 23-0

OVERBURDEN AT SAMPLING POINT (FEET): k-25

ELEVATION TOg OF SAMPLED COAL: (Feet) 8,175

STRIKE: S 30 E

DIP: 20° NE

MAJOR CLEAT ORIENTATION IN COAL:
N 55° W; 90° (face cleat)
N 5° E;'80° (butt cleat)

THICKNESS OF COAL (FEET): 25.0

THICKNESS SAMPLED (FEET):0-5-0 from top

TYPE OF SAMPLE: Face-channel

CONDITION OF SAMPLE: Fresh

TYPE OF EXPOSURE: Strip mine

MINE NAME: Grizzly Creek Strip

MINE OPERATOR: Sunflower Energy Corp.

DATE OF SAMPLING: 5/28/75

SAMPLE COLLECTOR: Colorado Geological Survey

COMPLETION DATE OF ANALYSES

U.S. Bureau of Mines;
U.S. Geological Survey: 8/28/75

LABORATORY NUMBERS

D-l 7^87

APPARENT RANK OF COAL: Subbituminous B

Two parallel channels: Channel No. 2 was cut 150 feet from Channel No. 1

SAMPLE NO.: 75-H-lIB

STATE: Colorado

COAL BED NAME: Riach

COUNTY: Jackson

GEOLOGIC ROCK UNIT: Coalmont Formation

SECTION: 32

AGE: Pal eocene-Eocene

TOWNSHIP: T. 7 N.

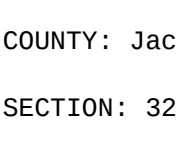
COAL FIELD: North Park

RANGE: R. 80 W.

COAL-BEARING REGION: North Park

U.S.G.S. TOPOGRAPHIC
QUADRANGLE: Coalmont 7-5'(1955)

LOCATION IN SECTION



TOTAL SECTION MEASURED (FEET): 23.0
OVERBURDEN AT SAMPLING POINT (FEET): k-25
ELEVATION TOP OF SAMPLED COAL:(Feet)8,190
STRIKE: S 30°E
DIP: 20°NE
MAJOR CLEAT ORIENTATION IN COAL:

THICKNESS OF COAL (FEET): 25-0
THICKNESS SAMPLED (FEET):
TYPE OF SAMPLE:Parting-grab
CONDITION OF SAMPLE: Fresh
TYPE OF EXPOSURE:Strip Mine
MINE NAME: Grizzly Creek Strip
MINE OPERATOR: Sunflower Energy Corp.

DATE OF SAMPLING: 5/28/75
SAMPLE COLLECTOR: Colorado Geological Survey
COMPLETION DATE OF ANALYSES
U.S. Bureau of Mines;
U.S. Geological Survey: 8/28/75

LABORATORY NUMBERS

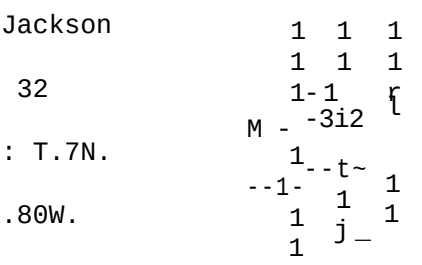
D-17^82

APPARENT RANK OF COAL: Subbituminous B

SAMPLE NO.: 75-H-12, Channel No. 11

STATE: Colorado

LOCATION IN SECTION



COAL BED NAME: Rjacn

COUNTY: Jackson

GEOLOGIC ROCK UNIT: Coalmont Formation

SECTION: 32

AGE: Pal eocene-Eocene

TOWNSHIP: T.7N.

COAL FIELD: North Park

RANGE: R.80W.

COAL-BEARING REGION: North Park

U.S.G.S. TOPOGRAPHIC QUADRANGLE: Coalmont 7.5' (1955)

TOTAL SECTION MEASURED (FEET): 23.0

THICKNESS OF COAL (FEET): 25.0

OVERBURDEN AT SAMPLING POINT (FEET): k-2$

THICKNESS SAMPLED (FEET) : -j%0-1 2.0 from top

ELEVATION TOP OF SAMPLED COAL:(Feet) 8,190

TYPE OF SAMPLE: Face-channel

STRIKE: S 30° e

CONDITION OF SAMPLE: Fresh

DIP: 20° NE

TYPE OF EXPOSURE: StrFp m m e

MAJOR CLEAT ORIENTATION IN COAL:
N 55° W; 90° (face cleat)
N 5° E; 80° (butt cleat)

MINE NAME: Grizzly Creek Strip

MINE OPERATOR: Sunflower Energy Corp.

DATE OF SAMPLING:5/28/75

SAMPLE COLLECTOR: Colorado Geological Survey

COMPLETION DATE OF ANALYSES
U.S. Bureau of Mines; 12/8/75
U.S. Geological Survey: 8/28/75

LABORATORY NUMBERS
K-56765
D-17^83

APPARENT RANK OF COAL: Subbiturninous B

Two parallel channels: Channel No. 2 was cut 150 feet from Channel No. 1

SAMPLE NO.: 75-H-12A, Channel No. 2

STATE: Colorado

COAL BED NAME: Riach

COUNTY: Jackson

GEOLOGIC ROCK UNIT: Coalmont Formation

SECTION: 32

AGE: Pal eocene-Eocene

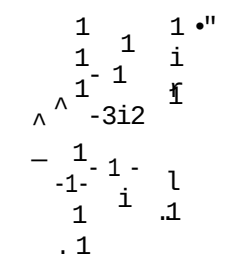
TOWNSHIP: T. 7 N.

COAL FIELD: North Park

RANGE: R. 80 W.

COAL-BEARING REGION: North Park

U.S.G.S. TOPOGRAPHIC QUADRANGLE: Coalmont 7-5' (1955)



TOTAL SECTION MEASURED (FEET): 23.0
OVERBURDEN AT SAMPLING POINT (FEET): *»-25
ELEVATION TOP OF SAMPLED COAL: (Feet)8,175
STRIKE: S 30°E
DIP: 20°NE
MAJOR CLEAT ORIENTATION IN COAL:
N 55°W; 90° (face cleat)
N 5° E; 80° (butt cleat)

THICKNESS OF COAL (FEET): 25.0
THICKNESS SAMPLED (FEET): Lower 5-0
TYPE OF SAMPLE: Face-channel
CONDITION OF SAMPLE: Fresh
TYPE OF EXPOSURE: Strip mine
MINE NAME: Grizzly Creek Strip
MINE OPERATOR: Sunflower Energy Corp.

DATE OF SAMPLING: 5/28/75 ?
SAMPLE COLLECTOR: Colorado Geological Survey
COMPLETION DATE OF ANALYSES
U.S. Bureau of Mines;
U.S. Geological Survey: 8/28/75

LABORATORY NUMBERS

D-l 7^88

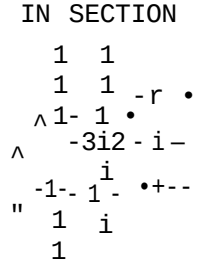
APPARENT RANK OF COAL: Subbituminous B

'Two parallel channels: Channel No. 2 was cut 150 feet from Channel No. 1

SAMPLE NO.: 7q-H-n ru, ^ » ,1
1j n I.}, Channel No. 1

STATE: Colorado

LOCATION IN SECTION



COAL BED NAME: Riach

COUNTY: Jackson

GEOLOGIC ROCK UNIT: Coalmont Formation

SECTION: 32

AGE: Pal eocene-Eocene

TOWNSHIP: T.7N.

COAL FIELD: North Park

RANGE: R.80W.

COAL-BEARING REGION: North Park

U.S.G.S. TOPOGRAPHIC QUADRANGLE: Coalmont 7-5' (1955)

TOTAL SECTION MEASURED (FEET): 23.0

THICKNESS OF COAL (FEET): 25.0

OVERBURDEN AT SAMPLING POINT (FEET): Z, -25

THICKNESS SAMPLED (FEET) : 12.0-17.0 from top

ELEVATION TOP OF SAMPLED COAL:(Feet) 8,190

TYPE OF SAMPLE: Face-channel

STRIKE:S 30° E

CONDITION OF SAMPLE: Fresh

DIP: 20° NE

TYPE OF EXPOSURE:Strip mine

MAJOR CLEAT ORIENTATION IN COAL

N 55° W; -90° (spacing l"-5", good)

N 5° E; t8oo (spacjng 1„_]l> poor)

MINE NAME: Grizzly Creek Strip

MINE 0PERAT0R: Sunflower Energy Corp.

DATE OF SAMPLING: 5/28/75

SAMPLE COLLECTOR: Colorado Geological Survey

COMPLETION DATE OF ANALYSES

U.S. Bureau of Mines; 12/8/75

U.S. Geological Survey: 8/28/75

LABORATORY NUMBERS

K-56766

D-l 7^8**

APPARENT RANK OF COAL: Subbiturninous B

Two parallel channels: Channel No. 2 was cut 150 feet from Channel No. 1

SAMPLE NO.: 75-H-li», Channel No. I1

COAL BED NAME: Riach

GEOLOGIC ROCK UNIT: Coalmont Formation

AGE: Pal eocene-Eocene

COAL FIELD: North Park

COAL-BEARING REGION: North Park

STATE: Colorado

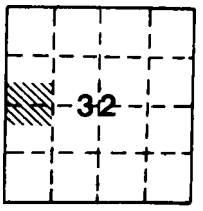
COUNTY: Jackson

SECTION: 32

TOWNSHIP: T.7N.

RANGE: R.80W.

LOCATION IN SECTION



U.S.G.S. TOPOGRAPHIC QUADRANGLE: Coalmont 7.5' (1955)

TOTAL SECTION MEASURED (FEET): 23.0
OVERBURDEN AT SAMPLING POINT (FEET): 4-25
ELEVATION TOP OF SAMPLED COAL:(Feet) 8,190
STRIKE:S 30 E
DIP: 20° NE
MAJOR CLEAT ORIENTATION IN COAL:
N 55° W; t o,o(sPacing 1M"5"; good)
N 5° E; + 8o(sPaclng T'"1'; Poor)

THICKNESS OF COAL (FEET): 25-0
THICKNESS SAMPLED (FEET): Lower 3.0
TYPE OF SAMPLE: Face-channel
CONDITION OF SAMPLE: Fresh
TYPE OF EXPOSURE:Strip mine
MINE NAME: Grizzly Creek Strip
MINE OPERATOR: Sunflower Energy Corp.

DATE OF SAMPLING: 5/28/75
SAMPLE COLLECTOR: Colorado Geological Survey
COMPLETION DATE OF ANALYSES
U.S. Bureau of Mines; 12/8/75
U.S. Geological Survey: 8/28/75

LABORATORY NUMBERS
K-56767
D-l 7^85

APPARENT RANK OF COAL: Subbituminous B

1 Two parallel channels: Channel No. 2 was cut 150 feet from Channel No. 1

SAMPLE NO.: 75-H-l5, Channel No. 11

COAL BED NAME: Riach

GEOLOGIC ROCK UNIT: Coalmont Formation

AGE: Pal eocene-Eocene

COAL FIELD: North Park

COAL-BEARING REGION: North Park

STATE: Colorado

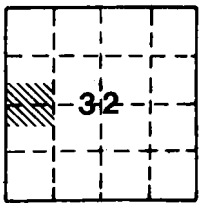
COUNTY: Jackson

SECTION: 32

TOWNSHIP: T.7N.

RANGE: R.80W.

LOCATION IN SECTION



U.S.G.S. TOPOGRAPHIC QUADRANGLE: Coalmont 7.5' (1955)

TOTAL SECTION MEASURED (FEET): 23 0
OVERBURDEN AT SAMPLING POINT (FEET)': /4_25
ELEVATION TOP OF SAMPLED COAL:(Feet) 8,190
STRIKE: S 30° E
DIP: 20° NE
MAJOR CLEAT ORIENTATION IN COAL:

THICKNESS OF COAL (FEET): 25.0
THICKNESS SAMPLED (FEET): 18-18.7 from top
TYPE OF SAMPLE: Parting
CONDITION OF SAMPLE: Fresh
TYPE OF EXPOSURE: Strip mine
MINE NAME: Grizzly Creek Strip
MINE OPERATOR: Sunflower Energy Corp.

DATE OF SAMPLING: 5/28/75
SAMPLE COLLECTOR: Colorado Geological Survey

COMPLETION DATE OF ANALYSES	LABORATORY NUMBERS
U.S. Bureau of Mines; 12/8/75	K-56768
U.S. Geological Survey:8/28/75	D-l7*^86

APPARENT RANK OF COAL: Subbituminous B

Two parallel channels: Channel No. 2 was cut 150 feet from Channel No. 1

SAMPLE NO.:75-W-l

STATE: Colorado

LOCATION IN SECTION

COAL BED NAME: Riach

COUNTY: Jackson

GEOLOGIC ROCK UNIT: Coalmont Formation

SECTION: 32

AGE: Pal eocene-Eocene

TOWNSHIP: T.7N.

COAL FIELD: North Park

RANGE: R.80W.

COAL-BEARING REGION: North Park

U.S.G.S. TOPOGRAPHIC QUADRANGLE: Coalmont 7-5' (1955)

TOTAL SECTION MEASURED (FEET): 25.0
OVERBURDEN AT SAMPLING POINT (FEET): 4-25
ELEVATION TOP OF SAMPLED COAL:(Feet) 8,190
STRIKE: S 30° E«
DIP: 20° N. E.
MAJOR CLEAT ORIENTATION IN COAL:
N 55° W;90° (face cleat)
N 50 E;80 (butt cleat)

THICKNESS OF COAL (FEET): 25.0
THICKNESS SAMPLED (FEET): Lower 10.0
TYPE OF SAMPLE: Face-grab
CONDITION OF SAMPLE: Fresh
TYPE OF EXPOSURE: Strip mine
MINE NAME: Grizzly Creek Strip
MINE OPERATOR: Sunflower Energy Corp.

DATE OF SAMPLING: 6/27/75
SAMPLE COLLECTOR:Colorado Geological Survey

COMPLETION DATE OF ANALYSES	LABORATORY NUMBERS
U.S. Bureau of Mines; 2/26/76	K-59613
U.S. Geological Survey:1/21/76	D-176359

APPARENT RANK OF COAL:

SAMPLE NO.: 75-W-2

STATE: Colorado

COAL BED NAME: Riach

COUNTY: Jackson

GEOLOGIC ROCK UNIT: Coalmont Formation

SECTION: 32

AGE: Pal eocene-Eocene

TOWNSHIP: T.7N.

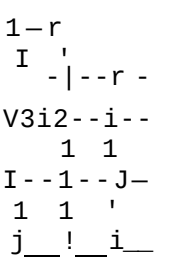
COAL FIELD: North Park

RANGE: R.80W.

COAL-BEARING REGION: North Park

U.S.G.S. TOPOGRAPHIC QUADRANGLE: Colamont 7-5' (1955)

LOCATION IN SECTION



TOTAL SECTION MEASURED (FEET): 25.0
OVERBURDEN AT SAMPLING POINT (FEET):4-25
ELEVATION TOP OF SAMPLED COAL:(Feet) 8,190
STRIKE'. S 30 E.
DIP: 20°NE
MAJOR CLEAT ORIENTATION IN COAL:

THICKNESS OF COAL (FEET): 25.0
THICKNESS SAMPLED (FEET):
TYPE OF SAMPLE: Face-grab
CONDITION OF SAMPLE: Fresh
TYPE OF EXPOSURE: Strip mine
MINE NAME: Grizzly Creek Strip
MINE OPERATOR: Sunflower Energy Corp.

DATE OF SAMPLING: 6/27/76
SAMPLE COLLECTOR: Colorado Geological Survey

COMPLETION DATE OF ANALYSES
U.S. Bureau of Mines;
U.S. Geological Survey:1/21/76

LABORATORY NUMBERS
D-I7636O

APPARENT RANK OF COAL: Subbituminous B

SAMPLE NO.: 75"W~3

COAL BED NAME: Riach

GEOLOGIC ROCK UNIT: Coalmont Formation

AGE: Pal eocene-Eocene

COAL FIELD: North Park

COAL-BEARING REGION: North Park

STATE: Colorado

COUNTY: Jackson

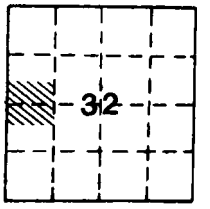
SECTION: 32

TOWNSHIP: T.7N.

RANGE: R.80W.

U.S.G.S. TOPOGRAPHIC
QUADRANGLE: Coalmont 7-5'(1955)

LOCATION IN SECTION



TOTAL SECTION MEASURED (FEET): 25.0
OVERBURDEN AT SAMPLING POINT (FEET): 4-25
ELEVATION TOg OF SAMPLED COAL: (Feet) 8,190
STRIKE: S 30 F-
DIP: 20 NE'
MAJOR CLEAT ORIENTATION IN COAL:

THICKNESS OF COAL (FEET): 25.0
THICKNESS SAMPLED (FEET): Lower 5.0
TYPE OF SAMPLE: Face-grab
CONDITION OF SAMPLE: Fresh
TYPE OF EXPOSURE: Strip mine
MINE NAME:Grizzly Creek Strip
MINE OPERATOR: Sunflower Energy Corp.

DATE OF SAMPLING: 6/27/75
SAMPLE COLLECTOR: Colorado Geological Survey
COMPLETION DATE OF ANALYSES
U.S. Bureau of Mines;
U.S. Geological Survey: 1/21/76

LABORATORY NUMBERS
D-176361

APPARENT RANK OF COAL: Subbituminous B

NORTH PARK-MCCALLUM ANTICLINE DISTRICT

Rock Units	Lithology	Thickness (ft.)	Descriptions
UPPER WINSCOM (UPPER VICAPRO U)	200 - 300'	12	Coal
LOWER WINSCOM / LOWER VICAPRON/		8-12	Coal
			Arkosic sandstone, conglomerate, and shale; coal in lower part.
SUDDUTH		50 - 60	Coal, at or near base of Coalmont Fm.
PIERRE SHALE			

Figure 22.-Generalized columnar section of coal-bearing rocks of the North Park field McCallum Anticline District(from Hornbaker and others, 1976).

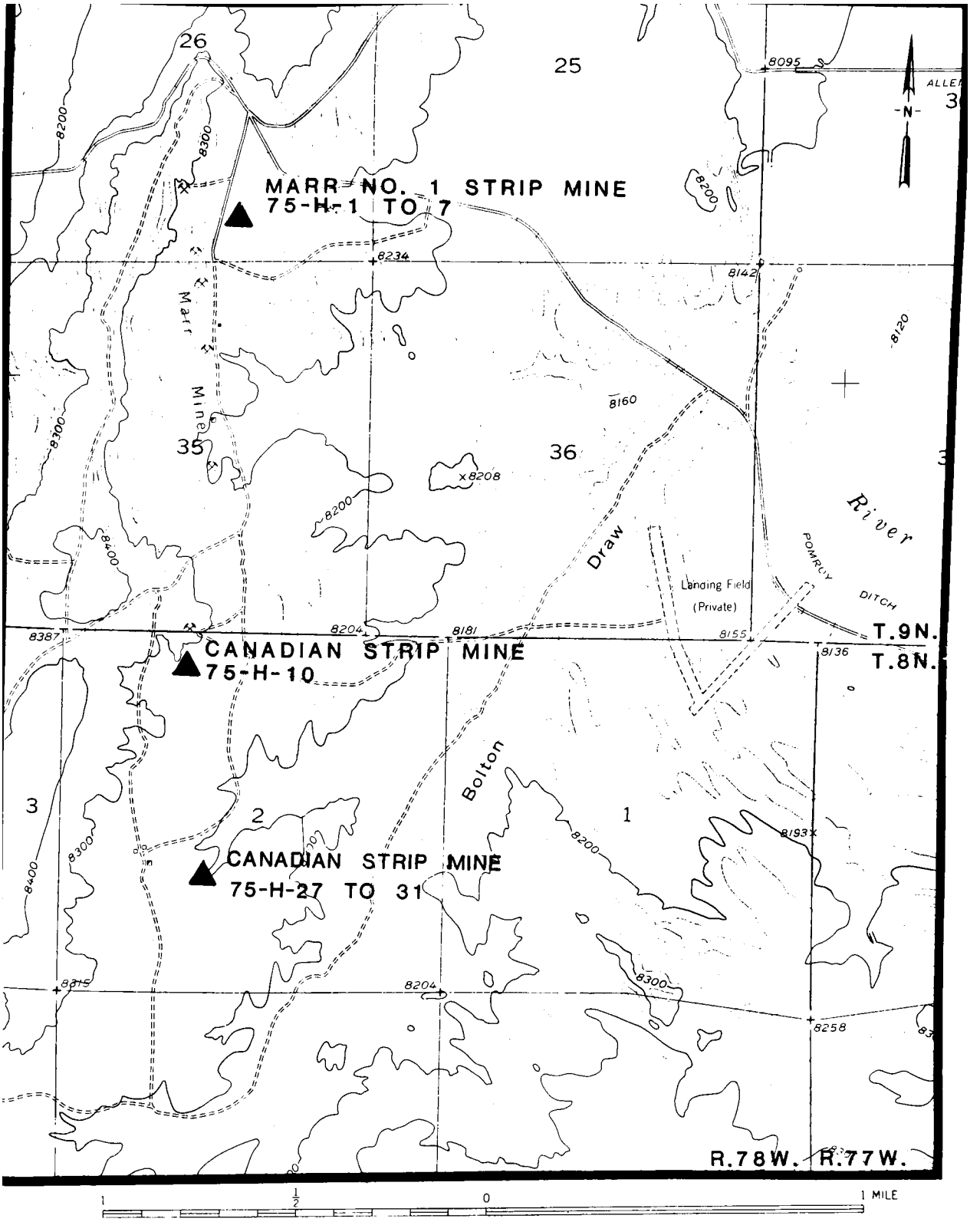


Figure 23.-Detailed location map of coal samples 75~H-l to 75-H-7 from the Marr No. I Strip Mine, 75-H-lO from uncorrelated bed approximately 30 feet above the Sudduth on the Canadian Strip Mine, and Jk-\\-2J to 74-H-31 from the Canadian Strip Mine, North Park field, Jackson County, Colorado. Base map modified from U.S.Geological Survey Johnny Moore Mountain 7 1/2' (1956), and Gould NW 7 1/2' (1955) quadrangles.

SAMPLE NO.: 75-H-10

COAL BED NAME: Uncorrelated, appox 30 ft. above the Sudduth

GEOLOGIC ROCK UNIT: Coalmont Formation

AGE: Pal eocene-Eocene

COAL FIELD: North Park

COAL-BEARING REGION: North Park

STATE: Colorado

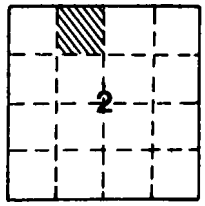
COUNTY: Jackson

SECTION: 2

TOWNSHIP: T.8N.

RANGE: R.78W.

LOCATION IN SECTION



U.S.G.S. TOPOGRAPHIC QUADRANGLE: Johnny Moore Mountain 7.5' (1956)

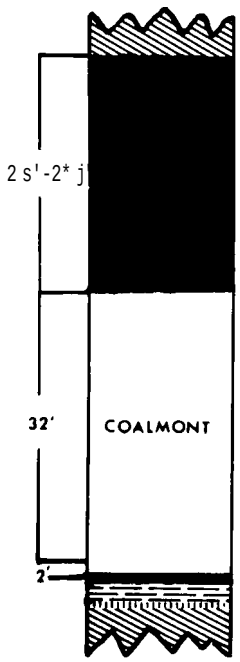
TOTAL SECTION MEASURED (FEET): 2.0
OVERBURDEN AT SAMPLING POINT (FEET):-50
ELEVATION TOP OF SAMPLED COAL: (Feet) 8,270
STRIKE:
DIP:
MAJOR CLEAT ORIENTATION IN COAL:

THICKNESS OF COAL (FEET): 2.0
THICKNESS SAMPLED (FEET): 2.0
TYPE OF SAMPLE:Face -grab
CONDITION OF SAMPLE: Fresh
TYPE OF EXPOSURE: Strip mine
MINE NAME: Canadian Strip
MINE OPERATOR:(Ralph Flesch S Sons, Inc., Owner)

DATE OF SAMPLING: 3/12/75
SAMPLE COLLECTOR:Colorado Geological Survey
COMPLETION DATE OF ANALYSES
U.S. Bureau of Mines; 5/20/75
U.S. Geological Survey:5/27/75

LABORATORY NUMBERS
K-52669
D-172059

APPARENT RANK OF COAL: Subbiturninous A



ROOF - NO DESCRIPTION

COAL - SUDDUTH

COAL- SUDDUTH

UNDIFFERENTIATED - COALMONT

COAL - UNNAMED BED (Sample 75-H-IO)
SHAL2: Carbonaceous, 3-8' thick.
BONE COAL: 0.5'thick.

74-H-27
74-H-28
7A-H-29
74-H-30
74-H-31

SAMPLE NO.: 74-H-27

COAL BED NAME: Sudduth

GEOLOGIC ROCK UNIT: Coalmont

AGE: Pal eocene-Eocene

COAL FIELD: North Park

COAL-BEARING REGION: North Park

STATE: Colorado

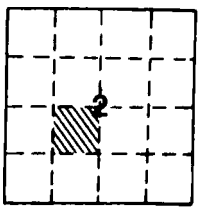
COUNTY: Jackson

SECTION: 2

TOWNSHIP: T.8N.

RANGE: R.78W.

LOCATION IN SECTION



U.S.G.S. TOPOGRAPHIC QUADRANGLE: Johnny Moore Mountain 7.5' (1956)

TOTAL SECTION MEASURED (FEET): 29.5
OVERBURDEN AT SAMPLING POINT (FEET):±50
ELEVATION TOP OF SAMPLED COAL: (Feet) 8,200
STRIKE: N. 20° E '
DIP: 48° S.E.
MAJOR CLEAT ORIENTATION IN COAL:

THICKNESS OF COAL (FEET): 29.5
THICKNESS SAMPLED (FEET): 29.5
TYPE OF SAMPLE: Face -channel
CONDITION OF SAMPLE: Fresh
TYPE OF EXPOSURE: Strip mine
MINE NAME:Canadian Strip
MINE OPERATOR: Sigma Mining Co.
(Ralph Flesch S Sons, Owner)

DATE OF SAMPLING: 12/11/74
SAMPLE COLLECTOR: U. S. Geological Survey
COMPLETION DATE OF ANALYSES
U.S. Bureau of Mines; 2/10/75
U.S. Geological Survey:2/24/75

LABORATORY NUMBERS
K-50383
D-170627

APPARENT RANK OF COAL: Subbiturninous A

SAMPLE NO.: 74-H-28

COAL BED NAME: Sudduth

GEOLOGIC ROCK UNIT: Coalmont Formation

AGE: Pal eocene Eocene

COAL FIELD: North Park

COAL-BEARING REGION: North Park

STATE: Colorado

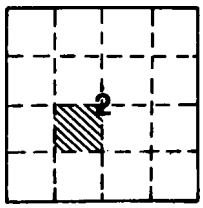
COUNTY: Jackson

SECTION: 2

TOWNSHIP: T.8N.

RANGE: R.78W.

LOCATION IN SECTION



U.S.G.S. TOPOGRAPHIC QUADRANGLE: Johnny Moore Mountain 7-5' (1956)

TOTAL SECTION MEASURED (FEET): 29.5
OVERBURDEN AT SAMPLING POINT (FEET):+50
ELEVATION TOP OF SAMPLED COAL: (peet) 8,200
STRIKE: n. 20° E. '
DIP: 48°*S. E. "
MAJOR CLEAT ORIENTATION IN COAL:

THICKNESS OF COAL (FEET): 29.5
THICKNESS SAMPLED (FEET): 29*5
TYPE 0F SAMPLE: Face-channel*
CONDITION OF SAMPLE: Fresh
TYPE OF EXPOSURE: Strip mine
MINE NAME: Canadian Strip
MINE OPERATOR: Sigma Mining Co.
(Ralph Flesch & Sons, Inc., Owner)

DATE OF SAMPLING: 12/11/74
SAMPLE.COLLECTOR: U. S. Geologoical Survey
COMPLETION DATE OF ANALYSES
U.S. Bureau of Mines; 2/10/75
U.S. Geological Survey: 2/24/75

LABORATORY NUMBERS
K-50384
D-l70628

APPARENT RANK OF COAL: Subbiturninous A

SAMPLE NO.: 74-H-29

STATE: Colorado

LOCATION IN SECTION

COAL BED NAME: Sudduth

COUNTY: Jackson

GEOLOGIC ROCK UNIT: Coalmont Formation

SECTION: 2

AGE: Pal eocene-Eocene

TOWNSHIP: T.8N.

COAL FIELD: North Park

RANGE: R. 78w#

COAL-BEARING REGION: North Park

U.S.G.S. TOPOGRAPHIC QUADRANGLE: Johnny Moore Mountains 7.5' (1956)

TOTAL SECTION MEASURED (FEET): oq c

OVERBURDEN AT SAMPLING POINT (FEET): ±S0

ELEVATION TOP OF SAMPLED COAL: g 200

STRIKE: N.20° E.

DIP: 48 S.E.

MAJOR CLEAT ORIENTATION IN COAL:

THICKNESS OF COAL (FEET): 29,5

THICKNESS SAMPLED (FEET): 29.5

TYPE OF SAMPLE: Face_channel

CONDITION OF SAMPLE: Fresh

TYPE OF EXPOSURE: Strip mine

MINE NAME: Canadian Strip

MINE OPERATOR: Sigma Mining Co.
(Ralph Flesch 6 Sons, Inc., Owner)

DATE OF SAMPLING: 12/11/74

SAMPLE COLLECTOR: U. S, Geological Survey

COMPLETION DATE OF ANALYSES
U.S. Bureau of Mines; 2/10/75
U.S. Geological Survey: 2/24/75

LABORATORY NUMBERS
K-50385
D-170629

APPARENT RANK OF COAL: Subbituminous A

SAMPLE NO.: 74-H-30

COAL BED NAME: Sudduth

GEOLOGIC ROCK UNIT: Coalmont Formation

AGE: Pal eocene-Eocene

COAL FIELD: North Park

COAL-BEARING REGION: North Park

STATE: Colorado

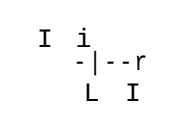
COUNTY: Jackson

SECTION: 2

TOWNSHIP: T.8N.

RANGE: R.78N.

LOCATION IN SECTION



U.S.G.S. TOPOGRAPHIC QUADRANGLE: Johnny Moore Mountain 7.5' (1956)

TOTAL SECTION MEASURED (FEET): 29.51
OVERBURDEN AT SAMPLING POINT (FEET): ±50
ELEVATION TOP OF SAMPLED COAL:(peet) 8 200
STRIKE: N. 20° E. '
DIP: ^° S.E.
MAJOR CLEAT ORIENTATION IN COAL:

THICKNESS OF COAL (FEET): 29-5
THICKNESS SAMPLED (FEET): 29.5
TYPE 0F SAMPLE: Face-channel
CONDITION OF SAMPLE: Fresh
TYPE OF EXPOSURE: Strip mine
MINE NAME: Canadian Strip
MINE OPERATOR: Sigma Mining Co.
(Ralph Flesch S Sons, Inc., Owner)

DATE OF SAMPLING: 12/11/74
SAMPLE COLLECTOR: u. S. Geological Survey
COMPLETION DATE OF ANALYSES
U.S. Bureau of Mines; 2/10/75
U.S. Geological Survey: 2/24/75

LABORATORY NUMBERS
K-50386
D-170630

APPARENT RANK OF COAL: Subbituminous A

SAMPLE NO.: 74-H-31

COAL BED NAME: Sudduth

GEOLOGIC ROCK UNIT: Coalmont Formation

AGE: Pal eocene-Eocene

COAL FIELD: North Park

COAL-BEARING REGION: North Park

STATE: Colorado

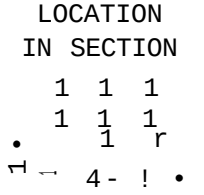
COUNTY: Jackson

SECTION: 2

TOWNSHIP: T.8N.

RANGE: R.78W.

LOCATION IN SECTION



U.S.G.S. TOPOGRAPHIC QUADRANGLE: Johnny Moore Mountain 7.5' (1956)

TOTAL SECTION MEASURED (FEET): 29.5
OVERBURDEN AT SAMPLING POINT (FEET):±50
ELEVATION TOP OF SAMPLED COAL:(Feet) 8,200
STRIKE:N 20° E.
DIP: 48° S.E.
MAJOR CLEAT ORIENTATION IN COAL:

THICKNESS OF COAL (FEET): 29.5
THICKNESS SAMPLED (FEET): 29.5
TYPE OF SAMPLE: Face-channel
CONDITION OF SAMPLE: Fresh
TYPE OF EXPOSURE: Strip mine
MINE NAME: Canadian Strip
MINE OPERATOR: Sigma Mining Co.
(Ralph Flesch & Sons, Inc., Owner)

DATE OF SAMPLING: 12/11/74
SAMPLE COLLECTOR: U. S. Geological Survey
COMPLETION DATE OF ANALYSES
U.S. Bureau of Mines; 2/10/75
U.S. Geological Survey: 2/24/75

LABORATORY NUMBERS
K-50387
D-170631

APPARENT RANK OF COAL: Subbituminous B

SAMPLE NO.: 75-H-l

COAL BED NAME: Sudduth

GEOLOGIC ROCK UNIT: Coalmont Formation

AGE: Pal eocene-Eocene

COAL FIELD: North Park

COAL-BEARING REGION: North Park

STATE: Colorado

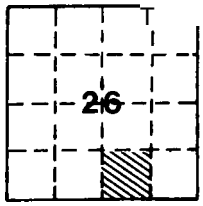
COUNTY: Jackson

SECTION: 26

TOWNSHIP: T.9N.

RANGE: R.78W.

LOCATION IN SECTION



U.S.G.S. TOPOGRAPHIC QUADRANGLE:Johnny Moore Mountain 7.5' (1956)

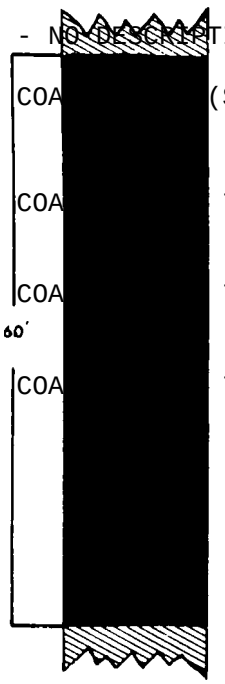
TOTAL SECTION MEASURED (FEET): 70.0 +
OVERBURDEN AT SAMPLING POINT (FEET):~50
ELEVATION TOP OF SAMPLED COAL:(Feet) 8,250
STRIKE: N. to N. 5°W
DIP: 53-58° E
MAJOR CLEAT ORIENTATION IN COAL:

THICKNESS OF COAL (FEET): 70.0 (apparent)
THICKNESS SAMPLED (FEET): Top 10.0
TYPE OF SAMPLE: Face-channel
CONDITION OF SAMPLE: Fresh
TYPE OF EXPOSURE: Strip mine
MINE NAME: Marr Strip No, 1
MINE OPERATOR: Kerr Uoal Co.

DATE OF SAMPLING: 3/12/75
SAMPLE COLLECTOR: Colorado Geological Survey

COMPLETION DATE OF ANALYSES	LABORATORY NUMBERS
U.S. Bureau of Mines; 5/19/75	K-52662
U.S. Geological Survey: 5/27/75	D-l72052

APPARENT RANK OF COAL: Subbiturninous A



ROOF - NO DESCRIPTION

-10' COA (Sample 75-H-l): Bright, b'locky, attri tal with thin vitrain bands; very little visible pyrite.

-,0' COA 75-H-2): Same as above.

-'0' COA 75-H-3): Same as above.

-io' COA 75-H-A): Same as above.

>°' COAL (Sample 75-H-5): Same as above.

,0' COAL (Sample 75-H-6): Same as above.
COAL (Sample 75-H-7): Same as above.

FLOOR - NO DESCRIPTION

d?p^S*r6orftaPhiC thiGkneSS f°r samP1es 75-H-1 through 75-H-7 (corrected for

SAMPLE NO.: 75-H-2

COAL BED NAME: Sudduth

GEOLOGIC ROCK UNIT: Coalmont

AGE: Pal eocene-Eocene

COAL FIELD: North Park

COAL-BEARING REGION: North Park

STATE: Colorado

COUNTY: Jackson

SECTION: 26

TOWNSHIP: T.9N.

RANGE: R.78W.

LOCATION IN SECTION

1 1 1
1 1 1
1 1 r •

1 1 1

! T H

U.S.G.S. TOPOGRAPHIC QUADRANGLE: Johnny Moore Mountain 7-5' (1956)

TOTAL SECTION MEASURED (FEET): 70.O
OVERBURDEN AT SAMPLING POINT (FEET):^50
ELEVATION TOP OF SAMPLED COAL: (Feet) 8,250
STRIKE: N. to N. 5° W
DIP: 53-58 E
MAJOR CLEAT ORIENTATION IN COAL:

THICKNESS OF COAL (FEET): 70.0 (apparent)
THICKNESS SAMPLED (FEET): 10.0-20.0 from top
TYPE OF SAMPLE: Face-channel'
CONDITION OF SAMPLE: Fresh
TYPE OF EXPOSURE: Strip mine
MINE NAME: Marr Strip No. 1
MINE OPERATOR: Kerr Coal Co.

DATE OF SAMPLING: 3/12/75
SAMPLE COLLECTOR: Colorado Geological Survey

COMPLETION DATE OF ANALYSES
U.S. Bureau of Mines; 5/19/75
U.S. Geological Survey:5/27/75

LABORATORY NUMBERS
K-52663
D-l72053

APPARENT RANK OF COAL: Subbiturninous A

1 True stratigraphic thickness for samples 75-H-l through 75"H~7 (corrected for dip) = t 60 feet.

SAMPLE NO.: 75-H-3

STATE: Colorado

LOCATION IN SECTION

1 1 1

I I r- '

—!—2f6-—i—

i i i

" j ' M "

COAL BED NAME: Sudduth

COUNTY:Jackson

GEOLOGIC ROCK UNIT: Coalmont Formation

SECTION: 26

AGE: Paleocene-Eocene

TOWNSHIP: J.9N.

COAL FIELD: North Park

RANGE:R.78W.

COAL-BEARING REGION: North Park

U.S.G.S. TOPOGRAPHIC QUADRANGLE: Johnny Moore Mountain 7.51 (1956)

TOTAL SECTION MEASURED (FEET): 70.0

THICKNESS OF COAL (FEET): 70.0 (apparent)

OVERBURDEN AT SAMPLING POINT (FEET): ^50

THICKNESS SAMPLED (FEET): 20.0-30.0 from top

ELEVATION TOP OF SAMPLED COAL: (Feet) 8,l40

TYPE OF SAMPLE: Face-channel

STRIKEN, to N. 5° W

CONDITION OF SAMPLE: Fresh

DIP: 53 to 58° E

TYPE OF EXPOSURE: Strip mine

MAJOR CLEAT ORIENTATION IN COAL:

MINE NAME: Marr Strip No. 1

MINE OPERATOR: Kerr Coal Co.

DATE OF SAMPLING: 3/12/75

SAMPLE COLLECTOR: Colorado Geological Survey

COMPLETION DATE OF ANALYSES	LABORATORY NUMBERS
U.S. Bureau of Mines; 5/19/76	K-52664
U.S. Geological Survey: 5/27/76	D-172054

APPARENT RANK OF COAL: Subbiturninous A

True stratigraphic thickness for samples 75-H-l through 75-H-7 (corrected for dip) = 60 feet.

SAMPLE NO.: 75-H-4

COAL BED NAME: Sudduth

GEOLOGIC ROCK UNIT: Coalmont Formation

AGE: Paleocene-Eocene

COAL FIELD: North Park

COAL-BEARING REGION: North Park

STATE: Colorado

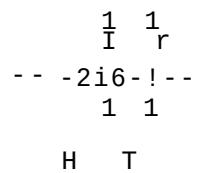
COUNTY: Jackson

SECTION: 26

TOWNSHIP: T. 9N.

RANGE: R.78W.

LOCATION IN SECTION



U.S.G.S. TOPOGRAPHIC QUADRANGLE:Johnny Moore Mountain 7-5' (1956)

TOTAL SECTION MEASURED (FEET): 70.0
OVERBURDEN AT SAMPLING POINT (FEET): ±$q
ELEVATION TOP OF SAMPLED COAL:(Feet) 8,140
STRIKEn# to N. 5° W '
DIP: 53-58° E
MAJOR CLEAT ORIENTATION IN COAL:

THICKNESS OF COAL (FEET): 70.0 (apparent)
THICKNESS SAMPLED (FEET) : 30.0-40.0 from top
TYPE OF SAMPLE: Face-channel
CONDITION OF SAMPLE: Fresh
TYPE OF EXPOSURE: Strip mine
MINE NAME: Marr Strip No. 1
MINE OPERATOR: Kerr Coal Co.

DATE OF SAMPLING: 3/12/75
SAMPLE COLLECTOR: Colorado Geological Survey

COMPLETION DATE OF ANALYSES	LABORATORY NUMBERS
U.S. Bureau of Mines; 5/19/75	K-52665
U.S. Geological Survey: 5/27/75	D-172055

APPARENT RANK OF COAL: Subbituminous A

1 True stratigraphic thickness for samples 75-H-l through 75"H~7 (corrected for dip) = t 60 feet.

SAMPLE NO.: 75"H~5

COAL BED NAME: Sudduth

GEOLOGIC ROCK UNIT: Coalmont Formation

AGE: Pal eocene-Eocene

COAL FIELD: North Park

COAL-BEARING REGION: North Park

STATE: Colorado

COUNTY: Jackson

SECTION: 26

TOWNSHIP: T>qN.

RANGE: R.78W.

LOCATION IN SECTION

1 1 •
1 1
"1
1 1
'--

U.S.G.S. TOPOGRAPHIC QUADRANGLE: Johnny Moore Mountain 7.51 (1956

TOTAL SECTION MEASURED (FEET): 70.0
OVERBURDEN AT SAMPLING POINT (FEET):±50
ELEVATION TOP OF SAMPLED COAL:(Feet) 8,140
STRIKE:N. to N. 5 W
DIP: 53-58° E
MAJOR CLEAT ORIENTATION IN COAL:

THICKNESS OF COAL (FEET): 70.0 (apparent)
THICKNESS SAMPLED (FEET): 40.0-50.0 from top:
TYPE OF SAMPLE: Face-channel
CONDITION OF SAMPLE: Fresh
TYPE OF EXPOSURE: Strip mine
MINE NAME: Marr Strip No. 1
MINE OPERATOR: Kerr Coal Co.

DATE OF SAMPLING: 3/12/75
SAMPLE COLLECTOR: Colorado Geological Survey

COMPLETION DATE OF ANALYSES
U.S. Bureau of Mines; 5/19/75
U.S. Geological Survey:5/27/75

LABORATORY NUMBERS
K-52666
D-172056

APPARENT RANK OF COAL: Subbituminous A

Two stratigraphic thickness for samples 75-H-l thnough 75-H-7 (corrected for dip) = - 60 feet

SAMPLE NO.: 75-H-6

COAL BED NAME: Sudduth

GEOLOGIC ROCK UNIT: Coalmont

AGE: Pal eocene-Eocene

COAL FIELD: North Park

COAL-BEARING REGION: North Park

STATE: Colorado

COUNTY: Jackson

SECTION: 26

TOWNSHIP: T.9N.

RANGE: R.78W.

LOCATION IN SECTION

1 1 1
1 1 1
1 I r •
--l-a'e-i1--
1 1 1

U.S.G.S. TOPOGRAPHIC QUADRANGLE: Johnny Moore Mountain 7.5' (1956)

TOTAL SECTION MEASURED (FEET): 70.0
OVERBURDEN AT SAMPLING POINT (FEET):±cQ
ELEVATION TOP OF SAMPLED COAL:(Feet) 8,140
STRIKE: N. to N. 5 W
DIP: 53 to 58 E
MAJOR CLEAT ORIENTATION IN COAL:

THICKNESS OF COAL (FEET):70.0 (apparent)
THICKNESS SAMPLED (FEET):50.0-60.0 from top
TYPE OF SAMPLE: Face-channel
CONDITION OF SAMPLE: Fresh
TYPE OF EXPOSURE: Strip mine
MINE NAME: Marr Strip No. 1
MINE OPERATOR: Kerr Coal Company

DATE OF SAMPLING: 3/12/75
SAMPLE COLLECTOR: Colorado Gological Survey
COMPLETION DATE OF ANALYSES
U.S. Bureau of Mines; 5/19/75
U.S. Geological Survey: 5/27/75

LABORATORY NUMBERS
K-52667
D-l72057

APPARENT RANK OF COAL: Subbiturninous A

Two stratigraphic thickness for samples 75-H-1 through 75-H-7 (corrected for dip) = t 60 feet.

SAMPLE NO.: 75"H"7

COAL BED NAME: Sudduth

GEOLOGIC ROCK UNIT: Coalmont Formation

AGE: Pal eocene-Eocene

COAL FIELD: North Park

COAL-BEARING REGION: North Park

STATE: Colorado

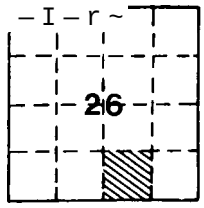
COUNTY: Jackson

SECTION: 26

TOWNSHIP: T.9N.

RANGE: R.78W.

LOCATION IN SECTION



U.S.G.S. TOPOGRAPHIC QUADRANGLE: Johnn/ Moore Mountain 7-5' (1956)

TOTAL SECTION MEASURED (FEET): 70.O

OVERBURDEN AT SAMPLING POINT (FEET):±50

ELEVATION TOP OF SAMPLED COAL: (Feet) 8,l40

STRIKE: N. to N. ^ßO W

DIP: 53 to 58° E.

MAJOR CLEAT ORIENTATION IN COAL:

THICKNESS OF COAL (FEET): 70.0 (apparent)

THICKNESS SAMPLED (FEET): Bottom 10.0 of " section

TYPE OF SAMPLE:Face-channel

CONDITION OF SAMPLE: Fresh

TYPE OF EXPOSURE: Strip mine

MINE NAME: Marr Strip No. 1

MINE OPERATOR: Kerr Coal Company

DATE OF SAMPLING: 3/12/75

SAMPLE COLLECTOR: Colorado Geological Survey

COMPLETION DATE OF ANALYSES

U.S. Bureau of Mines; 5/20/75

U.S. Geological Survey: 5/27/75

LABORATORY NUMBERS

K-52668

D-172058

APPARENT RANK OF COAL: Subbituminous A

PUBLISHED ANALYSES:

Range of analyses of coal samples from an uncorrelated bed in the Coalmont Formation in the Marr strip mine. Samples were variously sized tipple samples collected in 1947. Analyses are from U. S. Bureau of Mines data bank compilation, Coal Analyses Data for the State of Colorado (1973).

Moisture {%): 11.9-14.3

Volatile matter (%): 39-7-42.9

Fixed carbon {%): 54.0-56.4

Ash (%): 3.1-3.9

Sulfur (%): 0.2-0.3

Heat value (Btu/lb):

As-received: 11,000-11,460

Moisture-free: 12,840-13,070

Moisture- and ash-free: 13.360-13,490

SELECTED PUBLICATIONS OF THE COLORADO GEOLOGICAL SURVEY

BULLETINS

34-A--8IBLI0GRAPHY, COAL RESOURCES IN COLORADO, R.D. Holt, 1972, 32 p., $1.00.

41—BIBLIOGRAPHY AND INDEX OF PUBLICATIONS RELATED TO COAL IN COLORADO: 1972-77, H.B. Fender, D.C. Jones, and D.K. Murray, 1978, 54 p., $2.00.

INFORMATION SERIES

7—COLORADO COAL ANALYSES 1975. (ANALYSES OF 64 SAMPLES COLLECTED IN 1975), D.L. Boreck, D.C. Jones, D.K. Murray, J.E. Schultz, and D.C. Suek, 1977, 112 p., $4.00.

MAP SERIES

15--MAP OF LICENSED COAL MINES IN COLORADO (as of Jan. 1, 1980). (in preparation).

RESOURCE SERIES

1--GE0L0GY OF ROCKY MOUNTAIN COAL--A SYMPOSIUM, 1976, D.K. Murray, ed., 1977, 175 p., $4.00.

4—PROCEEDINGS OF THE SECOND SYMPOSIUM ON THE GEOLOGY OF ROCKY MOUNTAIN COAL - 1977, H.E. Hodgson, ed., 1978, 219 p., $5.00.

5--C0AL RESOURCES OF THE DENVER AND CHEYENNE BASINS, COLORADO, R.M.' Kirkham and L.R. Ladwig, 1979, 70 p., $7.00.

7—EVALUATION OF COKING COALS IN COLORADO, S.M. Goolsby, N.S. Reade, and D.K. Murray, 1979, 72 p., $6.00.

10—PROCEEDINGS OF THE FOURTH SYMPOSIUM ON THE GEOLOGY OF ROCKY MOUNTAIN COAL, 1980, L.M. Carter, ed., 1980, .$5.00.

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78-8--L0CATI0N MAP OF DRILL HOLES USED FOR COAL EVALUATION IN THE DENVER AND CHEYENNE BASINS, COLORADO, R.M. Kirkham, 1978, $3.00.

78-9--C0AL MINES AND COAL ANALYSES OF THE DENVER AND CHEYENNE BASINS, COLORADO, R.M. Kirkham, 1978, $5.00.

79-1--C0L0RAD0 COAL RESERVE DEPLETION DATA AND COAL MINE SUMMARIES, D.L. Boreck and D.K, Murray, 1979, 65 p., $4.00.

80-1—GEOPHYSICAL AND LITHOLOGICAL LOGS FROM THE 1979 COAL DRILLING AND CORING PROGRAM, DENVER EAST QUADRANGLE, COLORADO, K.E. Brand, $3.50.

80-5—CONSERVATION OF METHANE FROM MINA6LE COAL BEDS,. COLORADO, D.L. Boreck, and Mark Strever, (in preparati on)1.

80-9—GEOPHYSICAL AND LITHOLOGICAL LOGS FROM THE 1980 COAL DRILLING AND CORING PROGRAM, DENVER EAST 1/2° x 1° QUADRANGLE, K.E. Brand, and Caine, J.M., 1980, $2.50.

MISCELLANEOUS

BULLETIN 37--BIBLI0GRAPHY AND INDEX OF COLORADO GEOLOGY, 1875 TO 1975, American Geological Institute, 1976, 488 p., Softbound 7.50; Hardbound 10.00 . ,.

ENERGY RESOURCES MAP OF COLORADO--USGS and CGS, 1977, (scale 1:500,000). (USGS Misc. Geol. Inv. Map 1-1039). $2.00

GEOLOGIC MAP OF C0L0RAD0--USGS, Ogden Tweto, 1979, (scale 1:500,000). Over-the-counter or mailed folded, $4.00; Mailed rolled, $4.50.

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