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STATE OF ALASKA

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Report of Investigations 84-24

COAL GEOLOGY AND RESOURCES OF THE MATANUSKA VALLEY, ALASKA

By

R.D. Merritt and M.A. Relowich

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To convert feet to meters, multiply by 0.3048. To convert inches to centimeters, multiply by 2.54. To convert miles to kilometers, multiply by 1.61.

Coal-mine village at Chickaloon (ca. 1920) with filled coal cars of the Alaska Railroad in the foreground. The railroad was extended to Chickaloon in 1917: between 1913 and 1922 a total of 25,000 tons of coal was produced. Photograph courtesy Lulu Fairbanks Collection, University of Alaska (Fairbanks) Archives.

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By
R.D. Merritt[1] and M.A. Belowich[1]

MATANUSKA VALLEY COAT, OVERVIEW

The Matanuska coal field lies within the Matanuska River valley at the head of Cook Inlet between the Talkeetna and Chugach Mountain ranpes of south-central Alaska (fig. I, pl. 1). The coal field varies from 6 to 8 mi in width, is over 40 mi long, and has an area over 200 mi^2 (fig. 2). The valley generally trends N. 70" E. and lies from 25 to 60 mi northeast of tidewater. The lower Matanuska Valley (below Chickaloon) is about 100 mi north of Seward, whereas the Anthracite Ridge district in the upper Matanuske Valley (above Chickaloon) is nearly 200 mi from the coast at Seward. The Wishbone Hill district is located 40 mi northeast of Anchorage. The Matanuska coal field is accessible by rail from either Seward or Anchorage and is transected by the Glenn Highway.

The three major coal districts of the Matanuska Valley are Wishbone Hill, Chickaloon, and Anthracite Ridge. The Little Susitna district, although considered by some as within the lower Matanuska Valley, contains coals of the Kenai Group and hence is more akin to the Susitna lowland. Five significant coal fields (subfields) are distinguished in the Matanuska Valley: a) Eska-Moose, b) Young Creek, c) Castle Mountain, d) Chickaloon, and e) Anthracite Ridge (pl. 2). The Eska-Moose field stretches from Moose Creek eastward to the valley of Eska Creek and essentially encompasses the Wishbone Hill region. The Young Creek field is between the Eska-Moose and Chickaloon fields, and includes the coal deposits around Red Mountain. The deposits south of Castle Mountain and along the lower Kings River occupy the Castle Mountain field, whereas the deposits south of the Matanuska River in the vicinity of Coal Creek are included in the Chickaloon field. East of the Chickaloon field, there are no significant coal-bearing outcrops until the Anthracite Ridge field. Although the Chickaloon Formation covers large tracts from Moose Creek to Packsaddle Gulch, not all areas of coal-bearing rocks contain coal beds of workable character and thickness.

The coal-bearing sedimentary rocks of the Matanuska Valley are bounded on the north by the large-scale, high-angle Castle Mountain fault and on the south by the Chugach Mountains (fig. 2). This structural valley, 5 to 10 mi wide and about 50 mi long, occupies a trough named the Matanuska geosyncline by Payne (1955; fig. 3). The sedimentary rocks are generally strongly folded, with steep dips and complex structures present throughout much of the area. However, some tracts, particularly in the lower Matanuska Valley, show a uniform dip for considerable distances. Wishbone Hill is the dominant structural feature of lower Matanuska Valley and forms an open syncline that strikes S. 55" to 80" W. (fig. 4). Its axis plunges 10" to 25° to the southwest. Coal beds crop out around the margins of the syncline (canoe-shaped bowl), extend to considerable depths beneath Wishbone Hill, and occur within the Jonesville, Premier, Fska, and Burning Red coal series. In general, areas around Wishbone Hill and Castle Mountain are less structurally complex than those around Anthracite Ridge, where compression of the coal-bearing strata has been the greatest. There are abundant exposures of

[1]DGGS, Fairbanks, Alaska 99701.

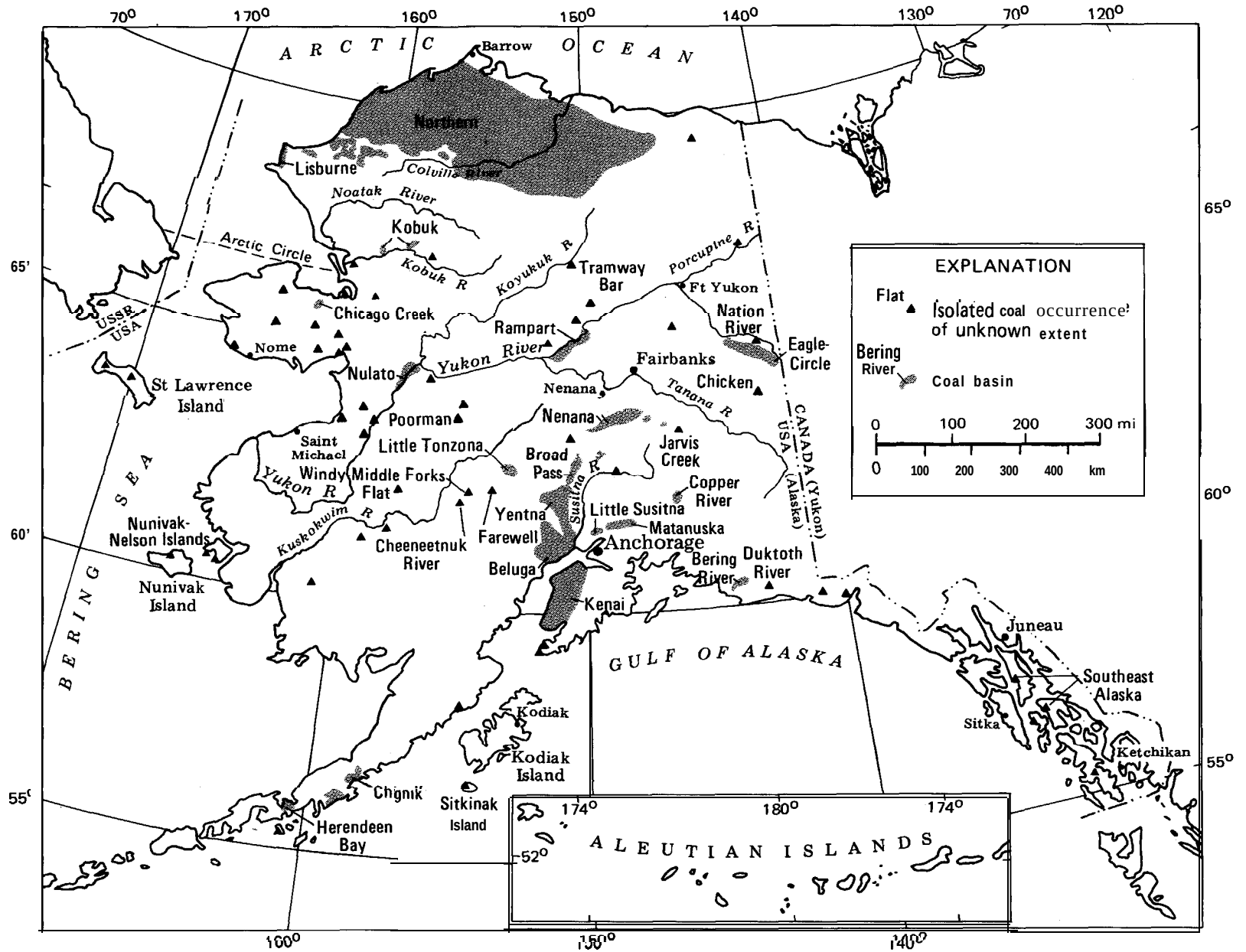
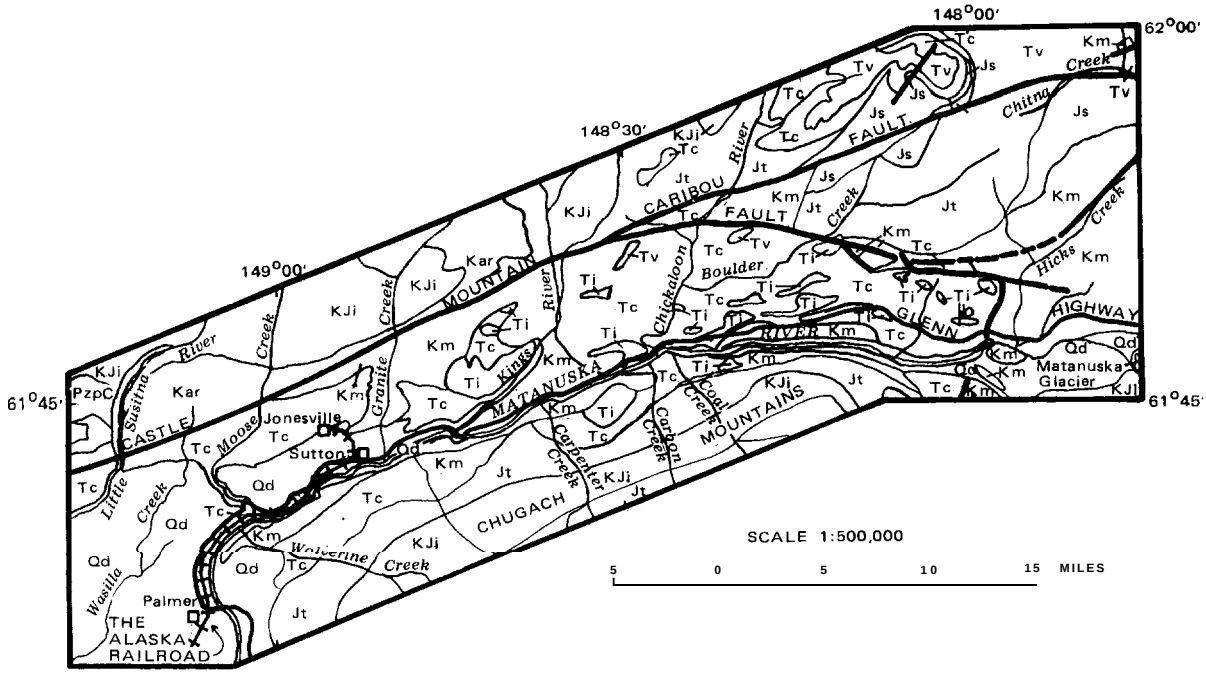


Figure 1. Alaska's coal basins, fields, and isolated occurrences.



CORRELATION OF MAP UNITS

Qd	Pleistocene and Recent	QUATERNARY
Tv	Oligocene	TERTIARY
Ti	Paleocene, Eocene, and Oligocene	
Tc		
Km	Lower and Upper(?) Cretaceous	CRETACEOUS
Kar		
KJi	Middle Jurassic to Early Cretaceous	JURASSIC
Js	Middle and Upper Jurassic	
Jt	Lower Jurassic	
PzpC		PRECAMBRIAN OR PALEOZOIC

DESCRIPTION OF MAP UNITS

Qd	Surficial deposits
Tv	Volcanic rocks -Mainly **basaltic lava flows**
Ti	**Hypabyssal** intrusive rocks
Tc	Continental **clastic** sedimentary rocks — **Includes Chickaloon,** Wishbone, and **Tsadaka** Formations
Km	Matanuska Formation — **Marine clastic sedimentary** rocks
Kar	**Arkose** Ridge Formation — **Nonmarine arkose,** conglomerate, and **siltstone**
KJi	**Plutonic** intrusive rocks — **Mainly quartz diorite and granodiorite**
Js	**Marine clastic sedimentary rocks — Consists of Tuxedni, Chinitna,** and **Naknek** Formations
Jt	Talkaetna Formation — **Dominantly** marine **intermediate volcanic** and **sedimentary rocks**
PzpC	Muscovite schist
	Contacts
	Faults — **Dashed where inferred. Only a few** of the largest are shown.

Figure 2. Generalized geologic map of the Matanuska Valley. Modified from Grantz, 1964.

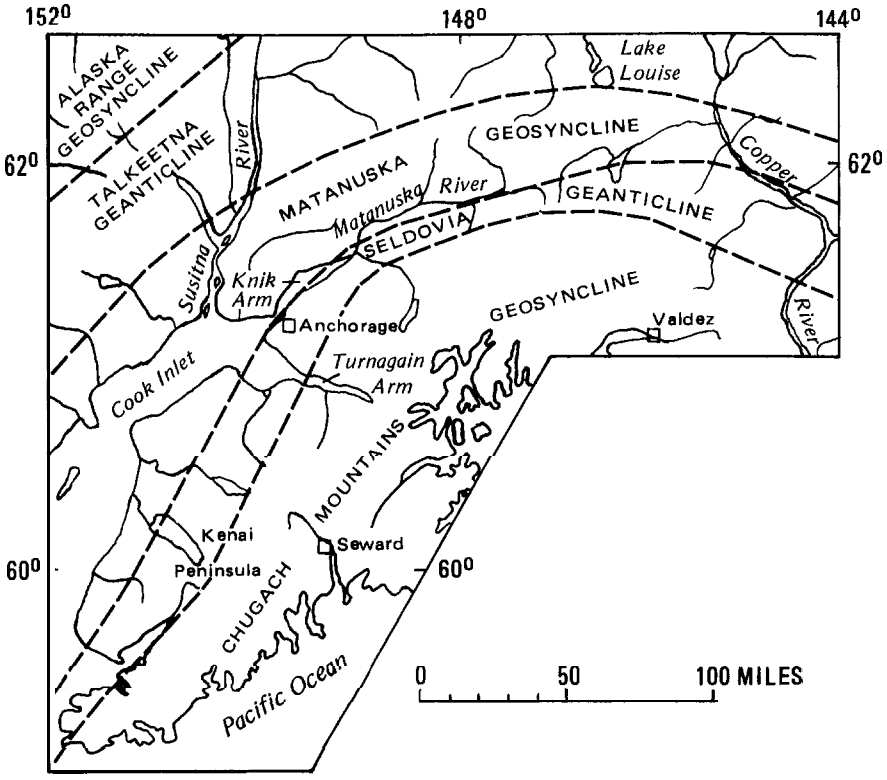
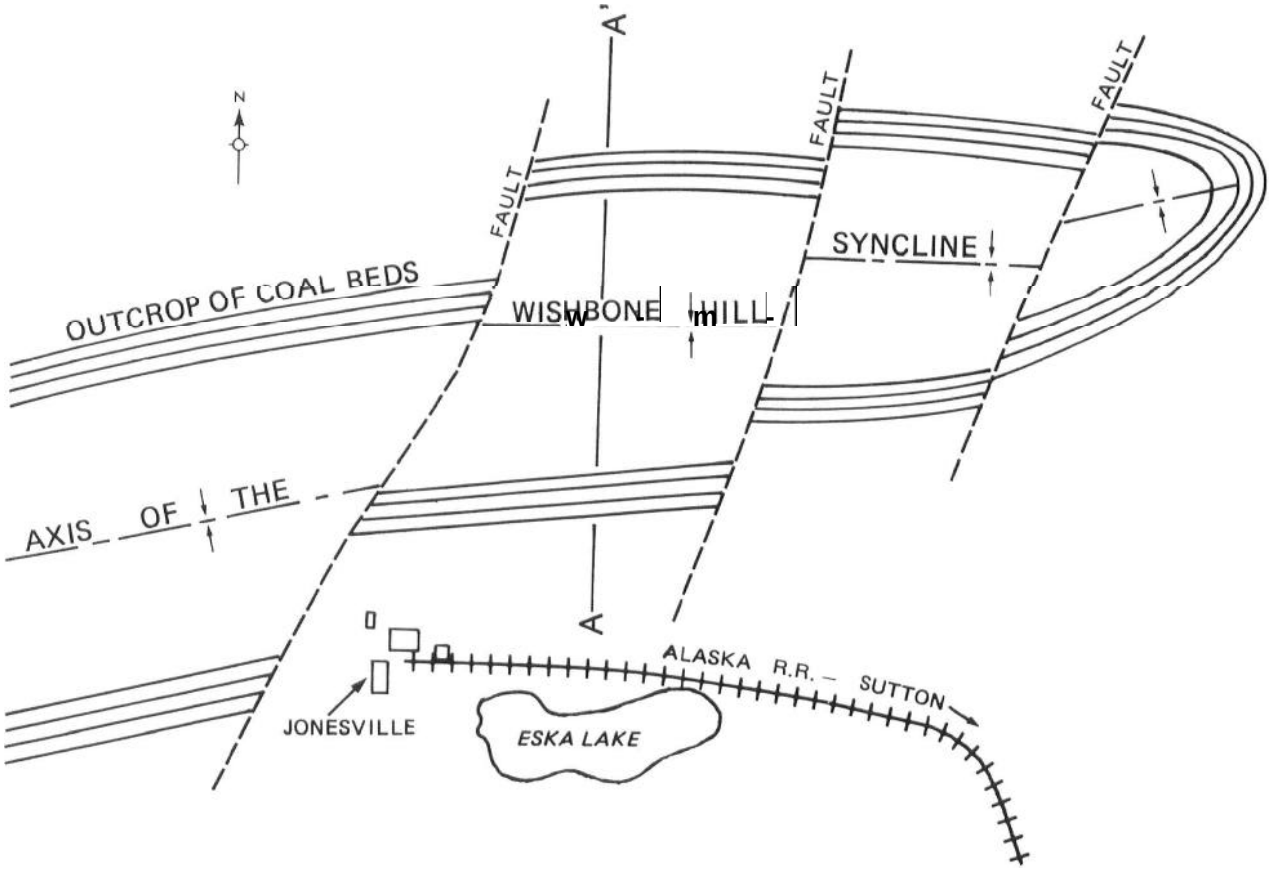


Figure 3. Major Mesozoic tectonic elements in the Matanuska Valley area, From Payne, 1955.

the Chickaloon Formation along the gulches that drain the south flank of Anthracite Ridge. In the upper Matanuska Valley, overturned folds are common, faults are numerous, and the beds are intruded by both large and small diabase sills and dikes.

The predominant Tertiary rock units of Matanuska Valley are the Chickaloon, Wishbone, and Tsadaka Formations, volcanic beds, and intrusive rocks. The Eska conglomerate, which forms the main mass of Wishbone Hill, is an informal unit that includes the Wishbone and Tsadaka Formations. Barnes end Papne (1956) divided the Eska conglomerate on the basis of compositional differences in the rock unit. The Tertiary correlation chart on plate 2 shows that the Chickaloon Formation is Paleocene to earliest Eocene in age, forms the base of the early Tertiary cycle, and is overlain unconformably by the Wishbone Formation. An angular unconformity separates the Chickaloon Formation from the underlying Cretaceous Matanuska Formation (table 1), which makes up over one-third of the bedrock outcrops of the Matanuska Valley (fig. 2; Grantz, 1964).

The Chickaloon Formation is at least 3,000 ft thick and contains up to 30 coal beds in the upper half of the unit (Conwell and others, 1982). Sections of the Chickaloon Formation at different localities are difficult to correlate because of the similarity of many beds, their lentjcularity, and numerous faults. Coal seams are interbedded with shales, sandstones, and



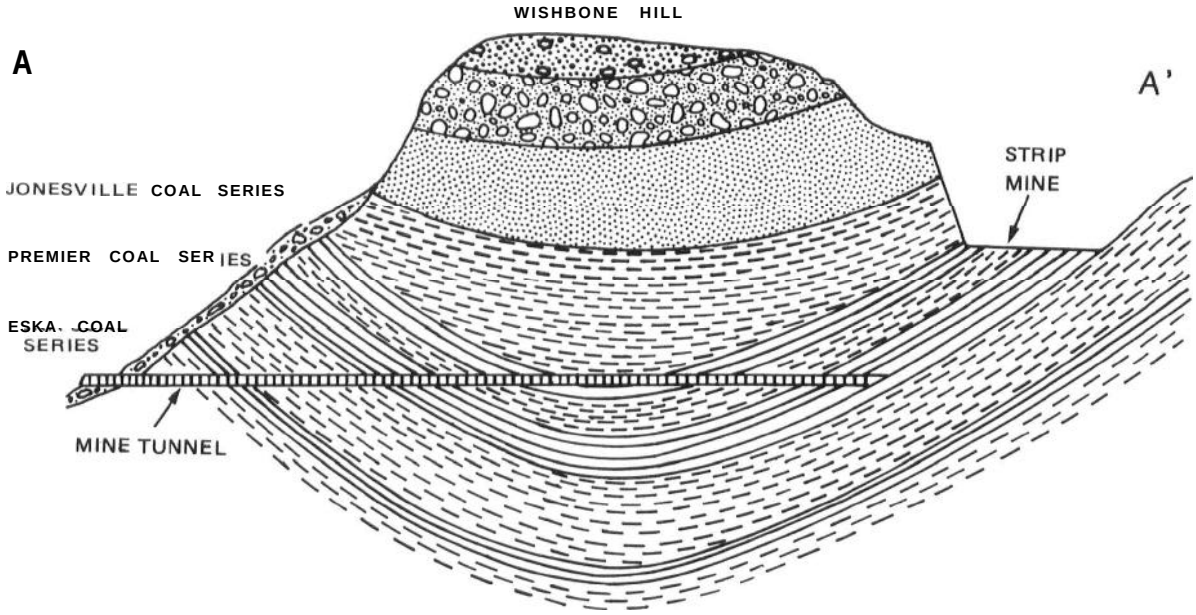


Figure 4. Plan view and schematic cross section of Wishbone Hill syncline. No scale implied. Modified from Patsch, 1981.

Table 1. Chief characteristics of Tertiary and Cretaceous sedimentary-rock Eormations of the Matanuska Valley. Compiled from Clardy, 1978.

Formation	Age	Thickness	Lithology	Stratigraphic relationship	Depositional environment
Tsadaka	Oligocene; time equivalent of lowest beds of Kenai Group	Over 150 m in Tsadaka Canyon	Crudely stratified, massive conglomerate; marginal conglomeratic facies of Kenai Group	Overlies Wishbone and Chickaloon Formations with a distinct angular unconformity in lower Matanuska Valley	Sheet-flood debris deposited on alluvial fan
Wishbone	Eocene	550-600 m	Well-ljthified conglomerates, sandstones, and siltstones	Overlies Chickaloon Formation unconformably in Matanuska Valley	Fluvial environment; alluvial fans and associated braided streams, perhaps meandering stream deposits in part.
Chickaloon	Paleocene	At least 1,500 m in Matanuska Valley	Well-indurated claystones, siltstones, sandstones, conglomerates, coal	Conformable with overlying Wishbone Formation south of Willow Creek in southwestern Talkeetna Mountains	Fluvial braided to meandering stream environment in lower part, and fluvial meandering to paludal environment in upper part
Arkose Ridge	Paleocene	Unknown	Coarse-prained elastics---arkosic conglomerates, minor shales	Nonconformably overlies plutonic rocks along south flank of Talkeetna Mountains and overlies Talkeetna Formation to northeast	Local source, fanglomerate deposit
Matanuska	Early to Late Cretaceous (Albian to Maestrichtian)	Over 1,200 m thick at type section in Matanuska Valley	Siltstones, sandstones, and cobble conglomerates	Underlies Tertiary rocks with local disconformity	Marine; sublittoral to outer bathyal or abyssal deposition by density currents or submarine slumps

thin conglomerate lenses. Sometimes alternating series of thin-bedded sandstone and shale occur. Concretions cemented by iron carbonate are common in the shales. Detailed geochemical and physical analyses of selected coal-overburden samples of the Chickaloon Formation are given in appendix A. Tn general, the samples show a very low content of pyritic sulfur and trace elements.

The coals of the Chickaloon Formation range in rank from subbituminous to anthracite. Generally, most coals of the lower Matanuska Valley are bituminous, whereas those of the upper Matanuska Vallev are semianthracite to anthracite. The coals of the Anthracite Ridge district have been upgraded in rank by contact metamorphism with igneous intrusives and by regional deformation. Wishbone Fill bituminous coals vary in heating content from 10,400 to 13,200 Btu, whereas some coals of the Chickaloon district, which is about 15 mi northeast of Eska, are of coking quality (pl. 2, table 2). Detailed proximate and ultimate coal analyses for Matanuska Valley samples are listed in appendix D.

Table 2. Representative analyses of Matanuska Valley coals on an as-received basis. Compiled from various sources.

Coal quality	Coal district		
	Wishbone Hill	Chickaloon	Anthracite Ridge
Moisture (x)	3-9	l-5	3-9
Volatile matter (%)	32-45	14-24	7-11
Fixed carbon (%)	38-51	60-72	65-81
Ash (%)	4-22	5-20	7-20
Sulfur (%)	0.2-1.0	0.4-0.7	0.2-0.7
Heating value, Btu	10,400-13,200	11,960-14,400	10,720-14,000
Rank[a]	hvBb	lvb	sa

[a]hvBb = high-volatile B hltuminous; lvb = low-volatile bituminous; and sa = semianthracite.

The Matanuska coal field has historically been one of the two major coal-producing fields of Alaska, the other being the Nenana. Coal mining was active in the Matanuska Valley from about 1915 to 1967 (fig. 5). Maximum underground productjon was in 1953, when over 285,000 short tons of coal were produced; surface-mining production peaked in 1962, when 340,000 short tons were produced. Almost all past coal mining was limited to the Wishbone Hill district of the lower Matanuska Valley, although minor amounts of coal were produced in the Chickaloon district. Conversion from coal to gas by the military bases near Anchorage in 1967 effectively closed the coal mines of the Matanuska Valley. Since then, the Premier Mine has produced but several thousand tons for local use; production dropped to less than 1,000 tons in 1983, and the mine did not operate in 1983. There are presently seven active state coal leases in the Matanuska coal field (pl. 2, appendix E), four of which are held by Hawlev Resource Properties, Inc. (Valley Coal Company!. A new coal-lease sale planned for December 1984 will be limited to tracts in

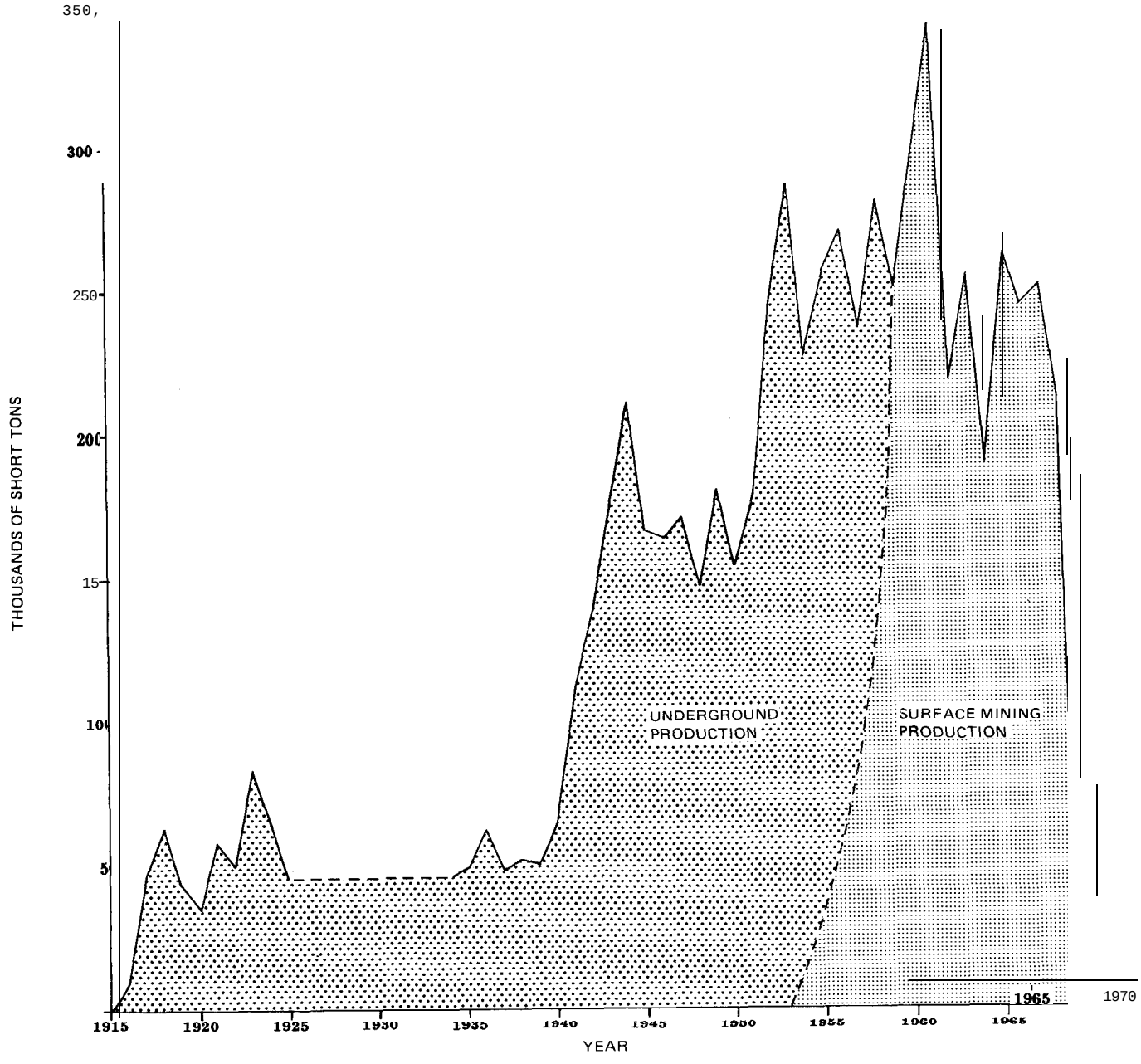


Figure 5. Coal production, Matanuska coal field, 1915-73.

the lower Matanuska Valley. Valley Coal Company and Rocky Fountain Energy completed a fairly extensive coal-exploration drilling program west and southwest of Wishbone Hill during the summer of 1983 that confirmed at least a 10-yr strippable reserve of bituminous coal; additional exploration drilling was completed by the companies in 1984. Beluga Coal Company (Placer Amex) recently performed a preliminary feasibility study to determine if the underground mine at Evan Jones could be reopened; underground mining there ceased in 1959.

The coal resources of the Matanuska Valley have been estimated by various authors (table 3). All estimates should be critically examined; the older estimates are inaccurate because of subsequent mining and the early poor definition of deposits. Further exploration programs are necessary to more accurately determine the true recoverable reserves of coal. Potentially minable coal resources have been recalculated for the five major subfields distinguished in this report (table 4, pl. 2). Estimates of the coal resources are given at three levels of assurance (high, moderate, and low) and are projected to a depth of 500 ft.

The future potential for coal development in the Matanuska Valley appears to he good, but large-scale operations (over 1 million short tons/yr as used here) are probably not practical. Coals are of high quality, and there are large relatively undisturbed minable blocks, Coal could be extracted by either surface or underground methods. Factors that may limit future coal production locally are: a) lenticularity (pinch and swell) of coal beds and their lack of continuity along strike; b) numerous faults, some of which have considerable displacement; c) dikes and sills that locally intrude the coal-hearing strata and cut it out or deteriorate coal quality; d) impurities (ash content) that will necessitate crushing and washing; e) steep angle of dip of certain beds; and f) gas pockets, which may be a problem in underground operations.

PLATE DESCRIPTIONS

Coal geology and structure map of the Matanuska Valley (pl. 1). The coal-bearing Tertiary units are stippled for emphasis. The geology is compiled at a scale of 1:100,000 from several sources that are indicated with an index and accompanying list of map references. Along with the major structural features of the region, the distribution and extent of the Chickaloon Formation are shown.

Geologic and coal-resource summary for the Matanuska coal field (pl. 2). Four categories of relative potential for coal development are shown: a) high potential, b) moderate potential, c) low to very low potential, and d) no potential (chiefly restricted to exposures of pre-Tertiary basement).

Five major coal subfields are defined: a) Eska-Moose field, b) Young Creek field, c) Castle Mountain field, d) Chickaloon field, and e) Anthracite Ridge field.

Table 3. Coal-resource estimates by various authors for areas of the Matanuska coal field (mst = million short tons, bst = billion short tons). Older estimates do not take into account subseauent mining and improved definition of deposits.

Area	Measured	Identified (indicated and inferred)	Hypothetical
Matanuska Valley			
1. McGee and Emmel, 1979	6.6 mst	112 mst	149 mst
2. McGee end O'Connor, 1975	- -	99 mst	248 mst
3. Barnes, 1967	- -	125 mst	274 mst
4. Sanders, 1982	- -	100 mst	500 mst
5. McFarland, 1978	30.0 mst	- -	- -
Matanuska province			
Renshaw, 1983	6.6 mst	96 mst	2.4 bst
Eastern Matanuska field			
Barnes and Ryers, 1945	- -	70 mst	- -
Western Matanuska field			
Payne and Hopkins, 1944	9.0 mst	- -	- -
Wishbone Hill district			
1. Barnes and Payne, 1956	- -	100 mst	- -
2. Patsch, 1981	- -	106 mst	- -
Northern limb, Wishbone Hill syncline			
1. Rao and Wolff, 1981	- -	100 mst	- -
2. Race, 1962	- -	185 mst	- -
3. McFarland, 1961.	10.0 mst (2.0 mst strippable)	- -	- -
Moose Creek district			
1. Apell, 1944	0.5 mst	2.8 mst	- -
2. U.S. Bureau of Mines, 1944	0.5 mst	3.2 mst	- -
Moose-Granite Creek field			
Griffith, 1905; 1906a,b	- -	18 mst	- -

Table 3. (con.)

Eska and Evan Jones			
Payne and Fopkins, 1944	5.9 mst (above 860 ft level)	- -	- -
Eska Creek			
1. Jolley and others, 1952	1.6 mst	3.5 mst	- -
2. Rao and Wolff, 1981	0.6 mst	- -	- -
3. Barnes, 1951	0.7 mst	- -	- -
4. Evans, 1925	- -	5 mst	25 mst
Evan Jones			
1. McFarland, 1961	- -	40 mst	- -
2. Rao and Wolff, 1981	- -	100 mst	- -
Coal Creek			
1. Evans, 1913	- -	6.4 mst	- -
2. Mining Congress Journal, 1922	- -	2 mst	- -
Chickaloon district			
1. Barnes, 1967	- -	- -	23 mst
2. Evans, 1925	- -	5 mst	20 mst
3. Mining Congress Journal, 1922	0.3 mst	- -	- -
Chickaloon-Rings River			
Evans, 1913	- -	- -	19.2 mst
Kings River-Chickaloon-Coal Creek			
Griffith, 1905; 1906a,b	- -	15 mst	62 mst
Chickaloon and Anthracite Ridge districts			
Barnes, 1967	- -	- -	25 mst
Anthracite Ridge			
Waring, 1936	- -	- -	0.75 mst

Table 4. Estimates of potentially minable coal resources of the Matanuska coal field (in millions of short tons to projected depth of 500 ft).

Field	High assurance	Moderate assurance	Low assurance
Eska-Moose	32.5	45	60
Young Creek	2.5	5	8
Castle Mountain	6.5	10	25
Chickaloon	20.5	30	40
Anthracite Ridge	4.5	10	20
Other (scattered)	14.5	20	30
Total	81	120	183

Coal-rank progression lines show a gradation from a subbituminous zone in the west to a semianthracite and anthracite zone In the east. The seven major state coal-lease areas on the map are described in appendix E. Some 121 drill-hole locations are cited and summarized in appendix F. Selected drill-hole logs are shown to 700 ft depth, and Eska area drill holes are located on an index map. DGGS coal-sample sites (1983 field season) can be keyed to the coal-locale descriptions in appendix B and the sampled outcrop sections in appendix C. Other information represented on plate 2 includes:

.An index map of Alaska showing the location of the Anchorage Quadrangle.

.An index map of the Anchorage Quadrangle showing the extent of the Matanuska coal field.

,A generalized geologic section of the Wishbone Hill district showing the different coal series.

.A surface and subsurface Tertiary stratigraphic correlation chart for the Matanuska Valley.

.A detailed inset map of Eska-Moose field showing the Wishbone Hill coal groups and the location of two geologic cross sections shown on plate 3.

.Location of coal sites and stratigraphic sections compiled by various authors,

.Location of Peterson Oil Chickaloon 1 test well,

.Alaska mine land inventory sites.

.Proposed region for 1984 coal lease-sale tract selections.

Generalized geologic cross sections of the Eska-Moose coal field. Matanuska Valley (pl. 3). The sections were constructed from representative drill-hole logs from the Wishbone Hill district, and are exaggerated from 3X to 4X. They generally show the lithologic nature and typical facies of the Chickaloon Formation and the depth and relative thickness of local overburden. Clastics are grouped into fine- and coarse-grained rocks. The Eska conglomerate is differentiated on section A-A'.

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Appendix A - Matanuska Valley coal-overburden characterization. Refer to plate 2 and appendixes B and C for sample locations.

Sample	$CaCO_3$ (%)	pH paste	EC (umho/cm)[a]	Na (meq/l)[b]	Ca (meq/l)[b]	Mg (meq/l)[b]	SAR[c]	K sat. paste (mg/l)	Sand (%)	Silt (%)	Clay (%)	Class	ESP[d]	Sat. (%)
CC3-1	0.4	8.04	480	0.67	0.81	4.17	0.43	6.5	70	12	18	SL	2.36	33
CC3-3	0.3	7.77	350	0.42	0.46	2.93	0.32	2.5	64	29	7	SL	2.94	27
CM1-1	0.5	6.10	170	0.99	0.52	0.12	1.75	3.0	73	13	14	SL	2.99	33
CM1-2	0.9	6.15	160	0.78	0.53	0.20	1.79	2.8	66	14	20	SCL/SL	2.20	28
CM1-3	0.6	6.06	130	0.45	0.51	0.26	0.73	6.3	70	12	18	SL	1.87	77
CM1-4	0.6	6.62	260	0.90	0.85	0.32	1.18	5.2	68	9	23	SCL	2.29	27
MM1-1	0.7	8.13	340	0.73	0.96	1.71	0.63	17.2	9	53	38	SiCL	3.27	51
MM1-2	0.6	8.02	410	0.60	1.16	2.46	0.45	16.1	24	31	45	C	7.74	46
MM1-3	0.3	7.61	590	0.51	2.32	3.61	0.30	11.0	76	10	14	SL	3.09	38
MM1-5	0.7	6.92	1200	0.56	9.85	6.97	0.19	15.3	56	20	24	SCL	2.87	39
MM1-7	0.3	7.86	390	0.52	1.45	2.27	0.38	10.7	45	30	25	L	3.64	33
MR2-1	<0.1	8.31	480	1.93	0.72	2.86	1.44	6.4	77	17	6	SL/LS	4.34	25
MR2-3	0.4	8.10	490	0.82	0.97	3.75	0.70	8.6	56	21	23	SCL	3.16	35
MR2-5	0.3	8.20	480	0.77	0.71	4.18	0.49	11.0	64	18	18	SL	2.92	33
MR2-6	0.5	7.42	240	0.64	0.68	0.92	0.72	5.1	41	27	32	CL	2.15	32
MR2-8	0.9	8.11	420	0.86	0.82	3.09	0.62	10.6	52	22	26	SCL	2.13	39
MR2-9	1.3	8.14	470	0.87	1.04	3.68	0.57	7.6	63	9	28	SCL	2.88	31
PC6-1	1.5	5.81	140	0.67	0.54	0.32	1.02	1.4	83	12	5	LS	1.02	56
PC6-3	0.5	5.12	160	0.77	0.41	0.27	1.32	2.5	66	14	20	SCL/SL	1.26	29
PC6-4	1.3	4.69	230	0.74	0.61	0.73	0.90	3.9	82	11	7	LS	0.96	37
PC6-6	0.4	5.20	140	0.39	0.42	0.45	0.59	2.9	85	9	6	LS	1.61	38
WH3-1	0.3	7.33	1900	17.42	0.43	0.18	31.54	7.0	68	11	21	SCL	51.60	48
WH3-3	1.4	9.03	2200	24.01	0.53	0.32	36.83	9.0	24	33	43	C	55.69	54
WH3-4	<0.1	8.11	1500	14.35	0.43	0.25	24.61	9.2	65	9	26	SCL	29.17	36
WH3-6	0.4	8.38	780	7.03	0.33	0.13	14.66	5.9	20	31	49	C	42.14	50
WH3-7	0.3	8.08	730	6.52	0.38	0.09	13.45	3.5	74	9	17	SL	52.18	34
WH3-9	0.5	8.66	1000	9.64	0.38	0.17	18.38	7.4	57	23	20	SCL/SL	45.13	20

[a] Micromhos per centimeter.
[b] Milliequivalents per liter.
[c] Sodium adsorption ratio.
[d] Exchangeable sodium percentage.

Sample no.	Tot-S (%)	Pyr-S (%)	SO4-S (%)	Org-S (%)	OM (%)	NO3-N (ppm)	PO4-P (ppm)	K (ppm)	B (ppm)	Cu (ppm)	Pb (ppm)	Mo (ppm)	Se (ppm)	ABP Tot-S	ABP Pyr-S
CC3-1	0.08	0.03	co.01	0.05	1.7	3.0	<1.0	133	3.8	0.40	0.14	<0.10	co.012	1.5	3.1
CC3-3	0.09	0.02	co.01	0.07	5.0	1.5	<1.0	95	3.3	1.12	0.24	<0.10	co.012	0.2	2.4
CM1-1	0.13	0.01	co.01	0.12	3.1	1.5	5.0	127	2.5	1.88	1.15	0.20	co.012	0.9	4.7
CM1-2	0.07	co.01	co.01	0.07	2.0	1.5	1.0	140	1.8	3.60	1.51	co.10	co.012	6.8	9.0
CM1-3	0.10	co.01	co.01	0.10	1.9	1.5	1.0	164	2.3	5.00	1.28	<0.10	co.012	2.9	6.0
CM1-4	0.04	co.01	co.01	0.04	1.3	1.5	<1.0	178	2.5	3.16	2.08	co.10	co.012	4.8	6.0
MM1-1	0.02	co.01	co.01	0.02	1.4	1.5	<1.0	170	4.3	2.52	0.66	<0.10	co.012	6.4	7.0
MM1-2	0.08	0.02	co.01	0.06	2.8	2.0	1.0	153	3.3	8.12	1.17	1.45	co.012	3.5	5.4
MM1-3	0.15	0.03	co.01	0.12	9.1	2.0	<1.0	93	4.3	5.00	0.23	0.12	co.012	-1.7	2.1
MM1-5	0.10	0.02	0.01	0.07	3.0	1.5	<1.0	78	3.3	3.28	0.50	<0.10	co.012	4.2	6.4
MM1-7	0.05	0.02	co.01	0.03	2.2	2.0	<1.0	91	5.0	1.76	0.52	<0.10	co.012	1.4	2.4
MR2-1	0.05	0.02	co.01	0.03	1.3	1.5	<1.0	99	1.8	1.40	0.50	<0.10	co.012	-1.6	-0.6
MR2-3	0.04	0.01	co.01	0.03	1.9	5.0	<1.0	112	2.0	0.68	0.68	<0.10	co.012	2.8	3.7
MR2-5	0.02	co.01	co.01	0.02	1.3	3.5	<1.0	143	2.0	0.64	0.72	<0.10	<0.012	2.4	3.0
MR2-6	co.01	<0.01	co.01	co.01	1.0	3.5	<1.0	86	1.8	17.32	7.04	0.15	<0.012	5.0	5.0
MR2-8	0.02	0.01	co.01	0.01	0.9	2.5	<1.0	132	1.5	0.64	0.46	<0.10	<0.012	8.4	8.7
MR2-9	0.02	0.03	co.01	co.01	1.6	3.5	<1.0	89	3.2	0.24	0.28	co.10	co.013	12.4	12.1
PC6-1	0.35	0.02	co.01	0.33	31.0	1.5	<1.0	39	3.2	1.24	1.35	<0.10	co.012	4.1	14.4
PC6-3	0.06	0.02	co.01	0.04	3.7	0.5	5.0	82	3.5	2.24	0.57	<0.10	co.012	3.1	4.4
PC6-4	0.19	0.02	co.01	0.17	32.0	0.5	<1.0	42	3.0	0.92	1.17	<0.10	co.012	7.1	12.4
PC6-6	0.17	0.02	co.01	0.15	7.7	2.0	10.4	79	5.3	1.28	0.28	<0.10	co.012	-1.3	3.4
WH3-1	0.38	0.02	0.01	0.35	6.2	2.5	<1.0	169	2.5	18.88	1.26	<0.10	co.012	-8.6	2.4
WH3-3	0.06	0.04	co.01	0.02	1.3	4.5	<1.0	184	2.8	2.88	1.15	<0.10	co.012	12.1	12.8
WH3-4	0.13	0.03	co.01	0.10	2.6	4.5	<1.0	171	3.8	2.00	0.68	0.11	co.012	-9.7	-0.9
WH3-6	0.04	co.01	co.01	0.04	1.2	2.0	<1.0	252	2.8	2.04	1.66	0.10	co.012	2.8	4.0
WH3-7	0.10	0.01	co.01	0.09	7.5	2.0	<1.0	158	3.5	2.44	1.54	0.22	co.012	-0.1	2.7
WH3-9	0.78	0.02	co.01	0.76	3.7	3.5	<1.0	209	3.3	4.52	1.51	<0.10	co.012	-19.4	4.4

Appendix B - Matanuska Valley coal locales (studied by Merritt and Belowich, 1983) with general description of coal outcrops shown on plate 2. Sample analyses are given in appendixes A and D.

Locale no.	Locale name	Locale code	Township	Range	sec.	Outcrop section thickness (ft)	Coal beds	Maximum coal-bed thickness	Dip	Samples		Comments
										Coal	Overburden	
1	Boulder Creek	BC1	20 N.	6 E.	16	Few hundred ft	Several	Thin (1.0-1.5 ft or less)	Moderate	2 (BC1-1, BC1-2)	--	Chickaloon Formation outcrop section on north side of lower Boulder Creek, east of Chickaloon River. Shaley coal beds with medium-gray claystones and siderite bands and nodules. Sandstone lenses near middle of section, increase toward base. Carbonaceous shale with ironstone nodules and platy, weathered thin coal lenses interlaminated. Rare replaced logs. Shrinkage cracks have resulted in prismatic fracturing in sandstones near midsection.
7	Billy Creek	BiC1	22 N.	9 E.	26	Less 100 ft exposed	None	--	25°	--	--	Sedimentary-rock (Chickaloon Formation?) exposure on lower Billy Creek, tributary to Caribou Creek in Talkeetna Mountains. Gray to brownish-gray silty claystones with calcite lenses and a few ironstone nodules. Claystones are slightly carbonaceous and fracture into small chips and prisms.
3	Billy Creek	BiC2	22 N.	9 E.	26	Few hundred ft	None	--	20°	--	--	Exposure of Cretaceous Matanuska Formation(?). Mainly bluish to purplish-gray silty claystones with abundant brachiopods and belemnites, calcite veins, and ironstone nodules.

Locale no.	Locale name	Locale code	Township	Range	sec.	Outcrop section thickness (ft)	Coal beds	Maximum coal-bed thickness	Dip	Samples: Coal	Samples: Overburden	comments
4	Coal Creek	cc1	19 N.	6 E.	5	275 ft	Six	5 ft	About 45"	6 (CC1-1, -2, -3, -4, -5, -6)	- -	Chickaloon Formation section on lower Coal Creek, south of Matanuska River and east of Kings Mountain. Common sequence of beds: intrusive sill, coke, coal, coke, intrusive sill. Prismatic fracturing locally evident in coke. Fissile shales. Siderite and ironstone bands and nodules.
5	Coal Creek	cc2	20 N.	6 E.	31	- -	- -	- -	- -	- -	- -	Site of old abandoned coal mine on lower Coal Creek (Hecky Mine). Tipple, adits, old buildings and structures, rail track, and other signs of former development present.
6	Coal Creek	cc3	20 N.	6 E.	31	About 75 ft	One	1.5 ft	30"	1 (CC3-2)	2 (CC3-1, -3)	Site on west side of Coal creek about 1,500 ft south of old abandoned mine. Coal-bearing exposures along top of ridge above Coal Creek. Chickaloon Formation strata with coaly shales and claystones and iron-cemented sandstone beds typically <1 ft; abundant siderite nodules and bands. Minor faults indicated by drag of beds. Material loose and broken up and very prone to slumps and slides. Plant fossils (leaf impressions) in both claystones and siltstones. Roof and floor materials sampled. Coked coal. seam and diabase 100 ft to northwest and 50 ft stratigraphically below site cc3.

Locale no.	Locale name	Locale code	Township	Range	Sec.	Outcrop section thickness (ft)	Coal beds	Maximum coal-bed thickness	Dip	Samples: Coal	Samples: Overburden	Comments
	Coal Creek	CC4	20 N.	6 E.	31	Less 100 ft	TWO	2.0 ft	65°	2 (CC4-1, -2)	- -	About 0.25 mi northwest of outcrop at CC3 and stratigraphically below that section. A 30-ft-thick, massive, hard and dense sandstone overlies 6 ft of carbonaceous, sandy, firm claystone and a 2-ft-thick coal bed. A second I-ft-thick coal bed sampled about 10 ft below upper seam. Iron-cemented sandstone nodules common. Dark-gray to black fissile, carbonaceous shales interbedded with claystones and sandstones. Plant impressions abundant. Local slumps and slides. Sites CC3 and CC4 may occur within synclinal structure that stretches from west side of Coal Creek to east side.
8	Carbon Creek	CbC1	19 N.	5 E.	1	Indeterminate	None	- -	Moderate to steep	- - - -		Section similar in appearance to section of Chickaloon Formation exposed at Boulder Creek, except no thin coal seams. More coarse-grained clastics than Chickaloon Formation outcrops elsewhere. Conglomerate beds ? to 6 ft thick abundant, hounded by carbonaceous silty claystones.
9	Carbon Creek	CbC2	19 N.	5 E.	1	Few hundred ft	None	- -	Moderate to steep	- - - -		Lower outcrop along Carbon Creek. Abundant dark-gray to black silty and sandy claystones but no coal seams. Diahase sills also present.

Locale no.	Locale name	Locale code	Township	Range	Sec.	Outcrop section thickness (ft)	Coal beds	Maximum coal-bed thickness	Dip	Samples: Coal	Samples: Overburden	Comments
10	Cascade Creek	CsCl	20 N.	8 E.	30	Hundreds of ft	None	- -	steep	--	--	Lower Cascade Creek. Chickaloon Formation strata with dark 'coallike' benches of hard, sandy, carbonaceous claystone but no coal seams. Coals appear to be present in outcrops north of highway hut absent from highway south to the Matanuska River.
11	Cascade Creek	csc2	20 N.	7 E.	25	Hundreds of ft	None	Thin (2 in.) lenses	Steep	- -	- -	Chickalcon Formation strata composed predominantly of dark claystones and shales (1-4 ft) interbedded with competent, hard and dense, medium-grained sandstones containing coaly inclusions and carbonized plant material. These sandstones stand cut dramatically in relief--they are differentially resistant to weathering. Park claystones and shales contain thin coal lenses and form benches that are conllike. More folded toward base. Siderite nodules and hands abundant in section.
12	Castle Mountain	CM1	20 N.	5 E.	15	About 160 ft exposed	One	1.? ft	60-65°	1 (CM1-5)	4 (CM1-1, -2, -3, -4)	Little Gravel Creek on south slope, midplateau of Castle Mountain. See appendix C.

Locale no.	Locale name	Locale code	Township	Range	Sec.	outcrop section thickness (ft)	Coal beds	Maximum coal-bed thickness	Dip	Samples: Coal	Samples: Overburden	Comments
13	Castle Mountain	CM2	20 N.	5 E.	21	Less 100 ft exposed	Two	2-3 ft of lower seam remaining; upper seam and top 4-6 ft; lower seam mined out	30-40°	3 (CM2-1, -2, -3)	- -	Old Castle Mountain mine. Coal-coke-intrusive relationships observable. Diagnostic prismatic fracturing in coke. Two pits at mine site; sampled coals from both upper (east) and lower (west) pits. Portions of seams mined out. Also sampled coal stockpile.
14	Chickaloon River	CR1	20 N.	6 E.	30	Indeterminate	Three exposed	16 ft	steep	3 (CR1-1, -2, -3)	- -	Site on south-facing slope on north side of Chickaloon River. At least one shaft was driven into face in 1920s. Talus slope covers about 50 ft vertically of lower part of outcrop; strata are exposed below rim of hillside for 30 ft. Carbonaceous claystones and fissile shales with thin lenses and pockets of coal on east side of outcrop. Diabase sill-coal-coke relationships observable at site. Local transformation from anthracite to "eta-anthracite to graphite.
15	Chickaloon River	CR2	20 N.	6 E.	19	About 200 ft with 50 ft interval concealed	At least six	2.5 ft	Moderate 28"	3 (CR2-1, -2, -3)	- -	Several relatively thin coal seams, shaly with claystone partings to a few inches thick. Carbonaceous claystones with plant fossil impressions and ironstone nodules. See appendix C.

Locale no.	Locale name	Locale code	Township	Range	Sec.	Outcrop section thickness (ft)	Coal beds	Maximum coal-bed thickness	Dip	Samples: Coal	Samples: overburden	Comments
16	Eska Creek	EC1	19 N.	3 E.	16	Less 200 ft exposed	Several	1.5 ft	30°	1 (EC1-1)	- -	Outcrop on Eska Creek with several relatively thin coal heds interbedded with black shale, bone, and claystone containing ironstone (siderite?) nodules. Local slump with 10 to 15 ft of displacement is present in middle of section.
17	Gravel Creek	GC1	20 N.	8 E.	24	150 ft exposed	None	Thin coal lenses to 2 in.	Moderate	- -	- -	Chickaloon Formation sediments, predominantly dark-gray to black graphitic and coaly claystones and black carbonaceous shales intercalated with thin coal lenses. Iron-cemented (sideritic?) sandstone nodules, lenses, and beds to 2 ft thick, very hard and dense.
19	Kings Mountain	KM1	19 N.	5 E.	15	Indeterminate	Few	2 ft	steep to near vertical	1 (KM1-1)	- -	Ravine exposure east of Carpenter Creek on northwest side of Kings Mountain near midelevation, west- to southwest-facing slope. Coal beds bony and shaly. Rhyolitic country rock.

Locale no.	Locale name	Locale code	Township	Range	Sec.	Outcrop section thickness (ft)	Coal beds	Maximum coal-bed thickness	Dip	Samples: Coal	Samples: Overburden	Comments
20	Kings Mountain	KM2	19 N.	5 E.	15	Indeterminate	Few	2 ft	Steep to overturned	1 (KM2-1)	- -	About 0.25 mi downslope to northwest from KM1. Minor coal beds of Chickaloon Formation generally occurring in lenses, pods, and pockets. Local graded bedding may indicate overturning of strata. Gray siderite or limestone beds in series of carbonaceous rocks. Abundant plant-leaf fossils in medium-grained, medium-gray, hard and dense sandstone.
21	King's River	KR1	20 N.	5 E.	20	Few hundred ft	Four	4 ft	70-25"	3 (KR1-1, -2, -3)	- -	Exposure of Chickaloon Formation on east bank (west-facing slope) of King's River near old King's River camp. Predominantly sandstone cliffs of Chickaloon Formation with intermittent 10-ft-thick sections of claystone, shale, and coal.
22	Muddy Creek	MC1	20 N.	8 E.	16	Indeterminate	Numer- "US	4 ft	Variable; generally steep to locally near vertical	6 (MC1-1, -7, -3, -4, -5, -6)	-	West fork of Muddy Creek. Contorted section of Chickaloon Formation in mountainside that overhangs basin. Coal beds that rim top of mountain and basin appear less deformed than those below 4,000 ft level. Coals bituminous. Carbonaceous plant fragments in sandstones and shales. Replaced trees, silicified wood, ironstone, and siderite bands, nodules, and concretions.

Locale no.	Locale name	Locale code	Township	Range	sec.	Outcrop section thickness (ft)	Coal beds	Maximum coal-bed thickness	Dip	Samples: Coal	Samples: Overburden	Comments
23	Muddy Creek	MC2	20 N.	8 E.	16	Indeterminate	Over 10	2 ft	Moderate to steep	2 (MC2-1, -2)	--	Mountain slope on west side of west branch of Muddy Creek about 1,000 ft south of MCI. Coal-bearing section and general lithologic features similar to MCl.
24	Middle Creek	MiCl	20 N.	17 F.	20	Less 300 ft	None	--	45"	--	--	Exposure of Chickaloon Formation(?) sediments on tributary east of Middle Creek that flows northward into East Fork. Section consists predominantly of bluish-gray shales, brownish claystones, and iron-cemented sandstones, all relatively thinbedded; rocks are overlain with angular unconformity by resistant pebble-cobble conglomerate.
25	Mrak Mine	MMl	19 N.	3 E.	10	Less 100 ft exposed	Two in local outcrop	6 ft	7-10"	2 (MM1-4, -6)	5 (MM1-1, -2, -3, -5, -7)	Site near old Mrak Vine, which operated in early 1960s. Chickaloon Formation strata very lenticular; coal beds and other rocks seem to have podlike or lensing character. Outcrop (partially mine cut) located along eastern nose of canoe-shaped, synclinal coal howl that underlies Wishbone Hill. Small-scale faults and slumps complicate stratigraphy and hinder understanding hed continuity and correlation to south. Ironstone nodules and hands end replaced trees with coaly rims occur randomly in sequence. See appendix C.

Locale no.	Locale name	Locale code	Township	Range	Sec.	Outcrop section thickness (ft)	Coal beds	Maximum coal-bed thickness	Dip	Samples		Comments
										Coal	Overburden	
26	Mrak Mine	MM2	19 N.	3 E.	10	Less 100 ft exposed	None	- -	Fairly gentle	- -	- -	Outcrop with regularly bedded Chickaloon Formation sediments (dark claystones, shales, and iron-cement& sandstones) cut by prominent sandstone channels and crossed by at least two near-vertical dikes.
27	Matanuska River	MR1	20 N.	6 E.	26	Several hundred ft	Numerous	Thin (less 1 ft)	Moderate to deformed	1 (MR1-1)	- -	Jumbled, highly folded and deformed Chickaloon Formation sedimentary and metasedimentary rocks on north side of Matanuska River. Lenticular beds of bituminous coal near midsection. Minor faults and shear planes. Intrusive sills near base. Dense, hard sandstone and conglomerate lenses cap sequence. Carbonaceous claystones and shales, locally graphitic and with slickensides. Siderite lenses and nodules and calcite veins. Stretched coaly stringers and thin lenses often form pods or fill pockets. Carbonaceous plant fragments in sandstones and one replaced log.

Locale no.	Locale name	Locale code	Township	Range	Sec.	Outcrop section thickness (ft)	Coal beds	Maximum coal-bed thickness	Dip	Samples: Coal	Samples: Overburden	Comments
28	Matanuska River	MR2	20N.	8 E.	27	About 315 ft outcrop section described	Seven	2.5 ft	20-30"	6 (MR2-2, -4, -7, -10, -11, -12, -13)	6 (MR2-1, -3, -5, -6, -8, -9)	East of Gravel Creek on south-facing north bank of Matanuska River southwest of Index Lake. Contact with Matanuska Formation occurs just east of site. Coal beds of Chickaloon Formation moderately folded to S-folds locally, especially near west end of outcrop. All seams are bituminous. Section includes ironstone nodules and bands and dense, hard sandstone ledges 2 to 6 ft thick. See appendix C.
29	Matanuska River	MR3	19 N.	5 E.	4	Several hundred ft	None	Thin coaly lenses to 2 in.	Moderate to steep	- -	- -	Site on Matanuska River north of Kings Mountain. Coaly shale and claystone strata of the Chickaloon Formation with thin intercalated coal lenses. These sediments are bounded by igneous rocks, mainly gabbro.
30	Purinton Creek	PC1	20 N.	7 E.	12	Indeterminate	Two(?)	8-10 ft	40-45°	3 (PC1-1, -2, -3)	- -	Chickaloon Formation strata with diabase dikes and sills, which have greatly altered the coal seams---poorer quality nearer the dikes. Leaders of dike appear to have been injected into fractures and cleats of the coal seams, and to have cooked away the volatiles and added ash. Section may be contained within local slump block. Structural complexity impedes determination of stratigraphic relationship of sampled beds.

Locale no.	Locale name	Locale code	Township	Range	Sec.	outcrop section thickness (ft)	Coal beds	Maximum coal-bed thickness	Dip	Samples: Coal	Samples: Overburden	Comments
31	Purinton Creek	PC2	20 N.	7 E.	12	Indeterminate	One	35-40 ft	Moderate	1 (PC2-1)	- -	Thick anthracite coal bed of Chickaloon Formation. Probably within local synclinal fold because dipping opposite to seams at PC1. Structurally appears to be local thickening. About 35 ft of coal in 40 ft of strata.
32	Purinton Creek	PC3	20 N.	7 E.	?	About 50 ft in local hank exposure	Three beds and minor lenses	6 ft	40"	3 (PC3-1, -2, -3)	- -	About 0.2 mi south along Purinton Creek drainage from PC?, several thin anthracite beds of the Chickaloon Formation crop out. See appendix C.
33	Purinton Creek	PC4	20 N.	7 E.	2	Indeterminate	Several	6 ft	56"	1 (PC4-1)	- -	Exposure on west side (east-facing slope') of draw to east of main gulch of Purinton Creek. Seams may correlate with those at PC3; several other thin (about I-ft-thick) seams are exposed below sampled (6-ft-thick) bed. Section overlain by diahase. Coal displays characteristic prismatic fracturing diagnostic of coked seam.

Locale no.	Locale name	Locale code	Township	Range	Sec.	Outcrop section thickness (ft)	Coal beds	Maximum coal-bed thickness	Dip	Samples - Coal	Samples - Overburden	Comments
34	Purinton Creek	PC5	20 N.	7 E.	12	Indeterminate	Several	5 ft	Variable generally moderate to steep	2 (PC5-1, -2)	- -	Exposure located in third gulch east of main branch of Purinton Creek. Chickaloon Formation beds within a rather tightly folded anticline best exposed on west-facing slope of gulch. Sampled two anthracite beds.
35	Purinton Creek	PC6	20 N.	7E.	23	Over 90 ft	At least four	3 ft	16"	2 (PC6-2, -5)	4 (PC6-1, -3, -4, -6)	Outcrop on Glenn Highway near Purinton Creek crossing point. Several relatively thin (1- to 3-ft-thick) bituminous coal beds. Sampled two coal beds and their roof and floor materials. See appendix C.
36	Packsaddle Gulch	PG1	20 N.	RF.	9	Indeterminate	Several	4 ft	Variable but generally moderate	3 (PG1-1, -2; -3)	- -	Relatively thick section of Chickaloon Formation exposed in east and west canyon walls of Packsaddle Gulch on south flank of Anthracite Ridge. May be near correlative of strata of Muddy Creek. Coals appear more flat-lying at higher altitudes. Stronger dips and more folded lower in section. Located at about 4,350-4,400 ft elevation. Alternating section of sandstones; silty, carbonaceous claystones; and black, fissile shales. Coal beds slightly folded and lenticular.

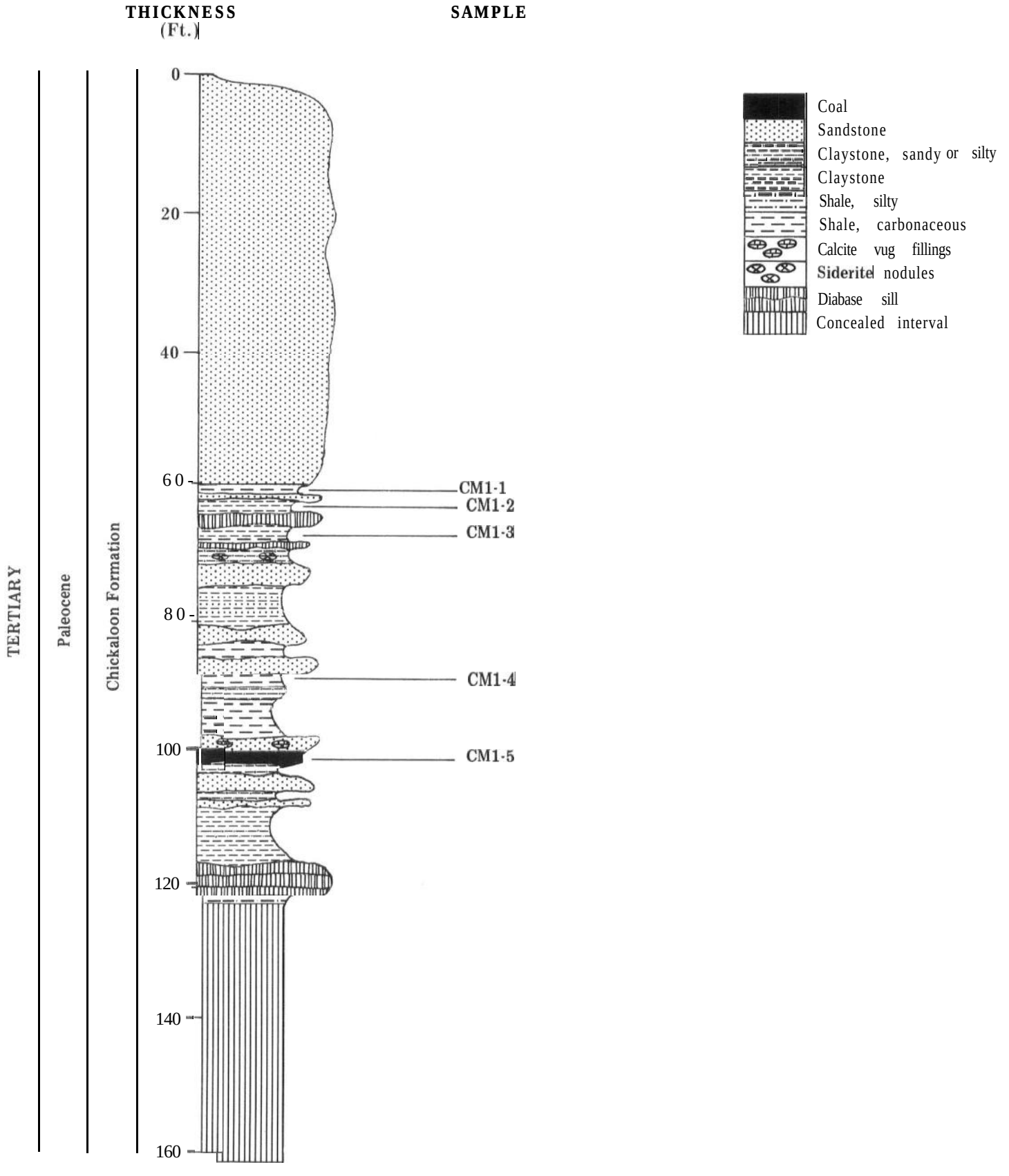
Locale no.	Locale name	Locale code	Township	Range	Sec.	Outcrop section thickness (ft)	Coal beds	Maximum coal-bed thickness	Dip	Samples: Coal	Samples: overburden	Comments
37	Packsaddle Gulch	PG2	20 N.	8 E.	9	Indeterminate	TWO observed locally	? ft	steep to overturned	2 (PG2-1, -2)	- -	Exposure on east-facing slope on west side of Packsaddle Gulch. Recumbent folded coal seams in core of small anticline. Probably stratigraphically lower than coal seams at PG1. Similar to larger fold structures on Muddy Creek; beds near equivalent within Tertiary section. Lower bed shows signs of shear. Carbonaceous claystone interburden to 3 ft thick but lenticular. Diabase dikes cut through Chickaloon Formation strata 200 ft south of site.
38	Packsaddle Gulch	PG3	20 N.	8 E.	16	Indeterminate	One	5 ft	steep to near vertical	1 (PG3-1)	- -	Chickaloon Formation coal seam sampled 10 ft from diabase dike. Coal predominantly bright and vitreous; seam has two thin partings of brown claystone (<0.5 ft).
39	Packsaddle Gulch	PG4	20 N.	8 E.	15	105 ft section described	Three	1.5 ft	Moderate	3 (PG4-1, -2, -3)	- -	Lenticular beds of Chickaloon Formation with diabase flows. Lowest coal bed brighter and of higher rank than two seams above. See appendix C.

Locale *@.	Locale name	Locale code	Township	Range	Sec.	Outcrop section thickness (ft)	Coal beds	Maximum coal-bed thickness	Dip	Samples: Coal	Samples: overburden	Comments
40	Red Mountain	RM1	20 N.	4 E.	22	Indeterminate	TWO	75 ft or more	50"	2 (RM1-1, -2)	- -	Site at about 3,850-ft elevation on north side of Red Mountain. Trenched coal seam much thicker than previously reported maximum 8-ft-thick bed. However, the coal seam could be within tight recumbent fold. Coaly shale and claystone partings within seam. A 7-ft-thick bed of similar strike and dip was sampled at about 3,775-ft elevation. Coaly shale and claystone lenses within seam. Relatively thick, medium-grained, whitish to tan, hard and dense sandstone below second seam. Sandstone seatrock typical of Chicksloon strata: locally weathered and friable.
41	Wishbone Hill	WH3	19 N.	3E.	17	About 300 ft	Several	2 ft	35"	3 (WH3-2, -5, -8)	6 (WH3-1, -?, -4, -6, -7, -9)	West of mine-cut trenches at WH1 and WH2 on the northeast side of Wishbone Hill. General lithologic characteristics of Chickaloon Formation sediments. Sampled three coal seams and their roof and floor materials. See appendix C.

Locale no.	Locale name	Locale code	Township	Range	Sec.	Outcrop section thickness (ft)	Coal beds	Maximum coal-bed thickness	Dip	Samples		Comments
										Coal.	overburden	
42	Young Creek	YC1	20 N.	4 E.	35	About 60 ft exposed	One	3 ft	5°	1 (YC1-1)	- -	Site southwest along Young Creek from Red Mountain. Coal seam bounded by thin (1-2 ft) sandy claystones and then by sandstone adjacent to these.
43	Young Creek	YC2	19 N.	4 E.	3	About 50 ft exposed	One	1 ft	5°	1 (YC2-1)	- -	Site about 0.5 mile southwest of YC1. Chickaloon Formation sequence interbedded with hard and dense, medium-grained sandstones (1-2 ft thick) and coaly claystones and shales, locally silty to sandy.
44	Young Creek	YC3	19 N.	4 E.	9	Less 50 ft exposed	One	1 ft	25°	1 (YC3-1)	- -	Chickaloon Formation exposure southwest of YC2 along Young Creek with black, carbonaceous, fissile shales; silty, carbonaceous, firm claystones; and thin coal lenses. Local siderite nodules.

Appendix C – Coal-bearing outcrop sections of the Chickaloon Formation, Matanuska Valley.

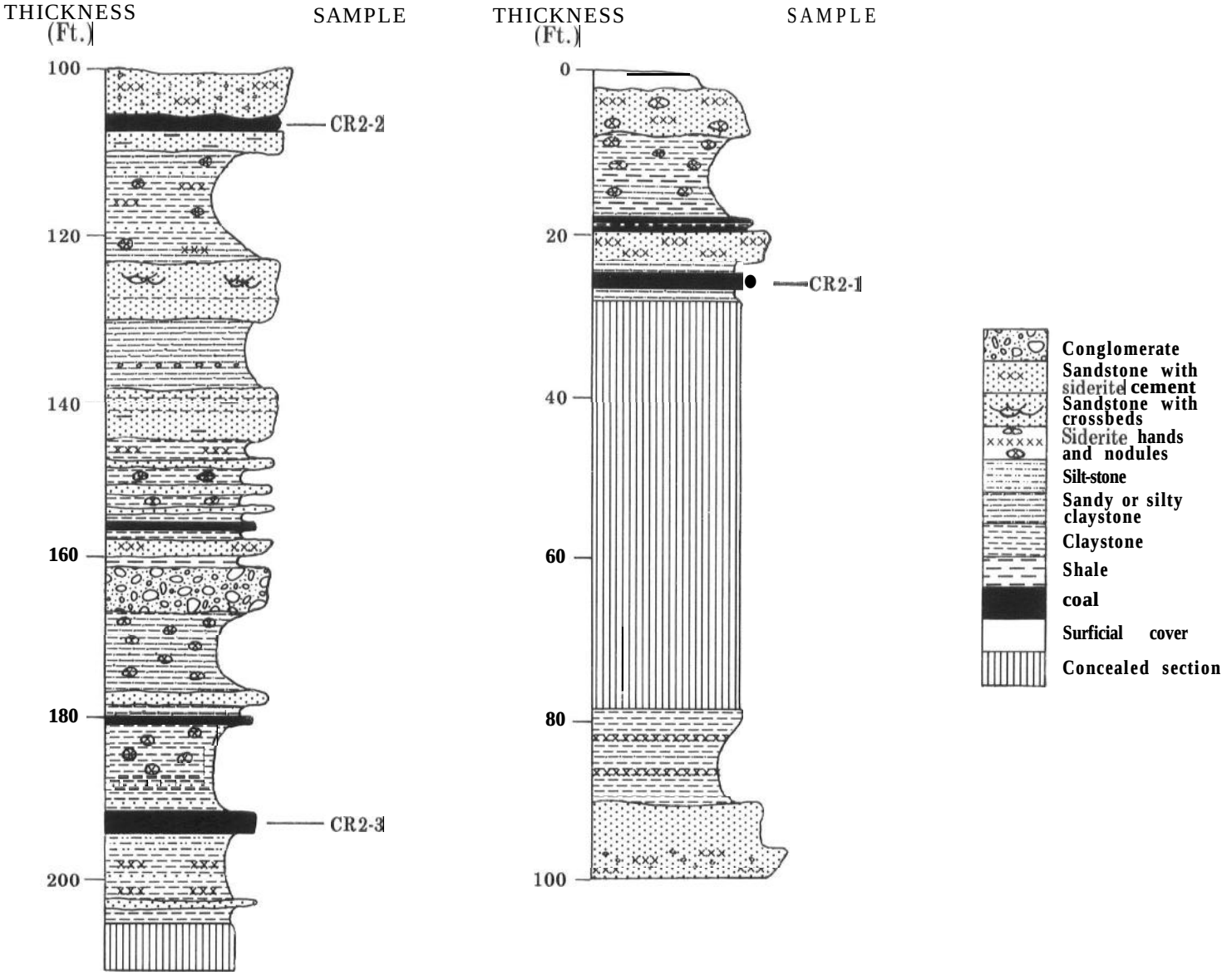
CASTLE MOUNTAIN SECTION
(LITTLE GRAVEL CREEK)
Site: CM1



CHICKALOON RIVER SECTION

Site:CR2

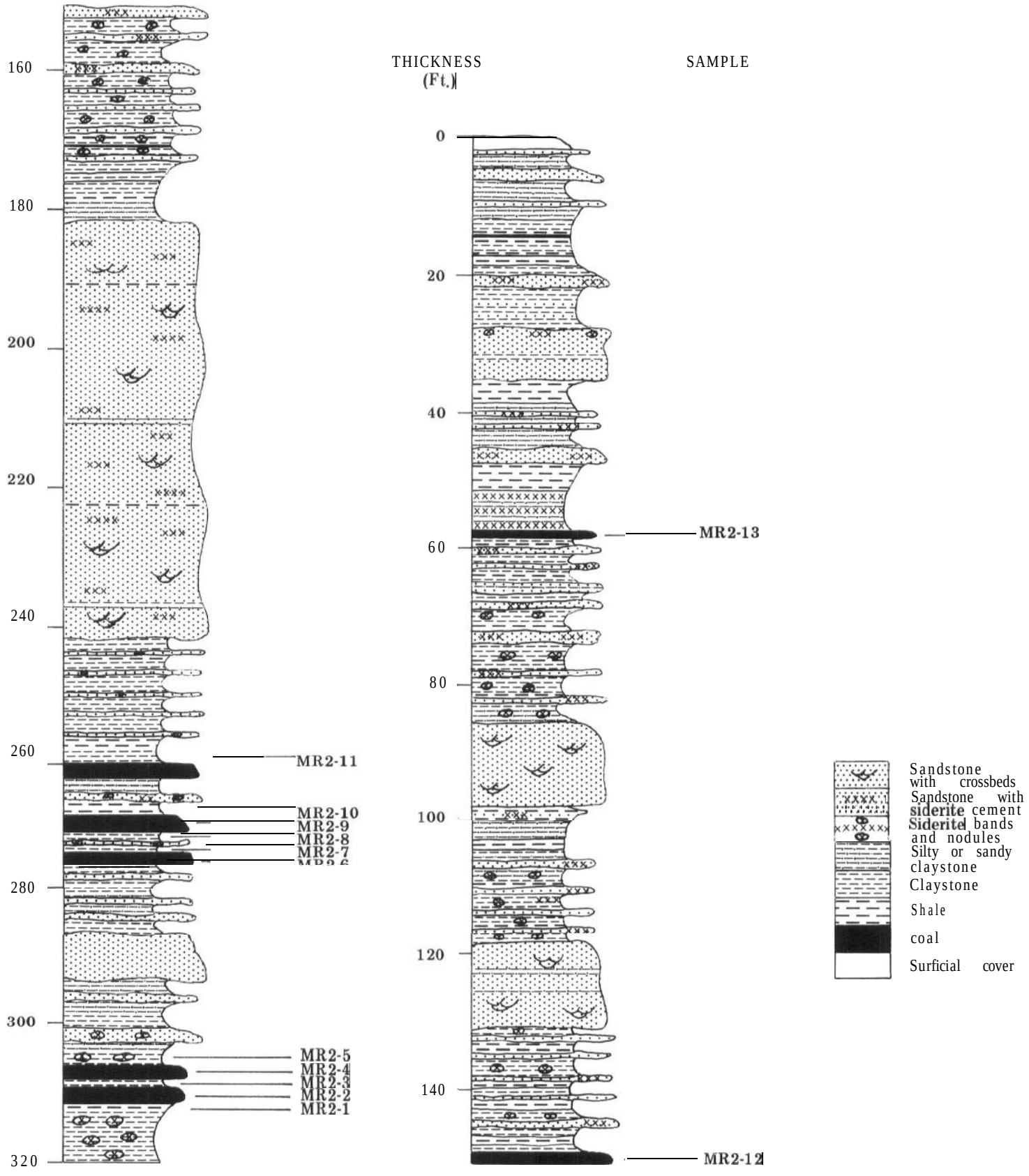
(Tertiary; Paleocene; Chickaloon Formation)



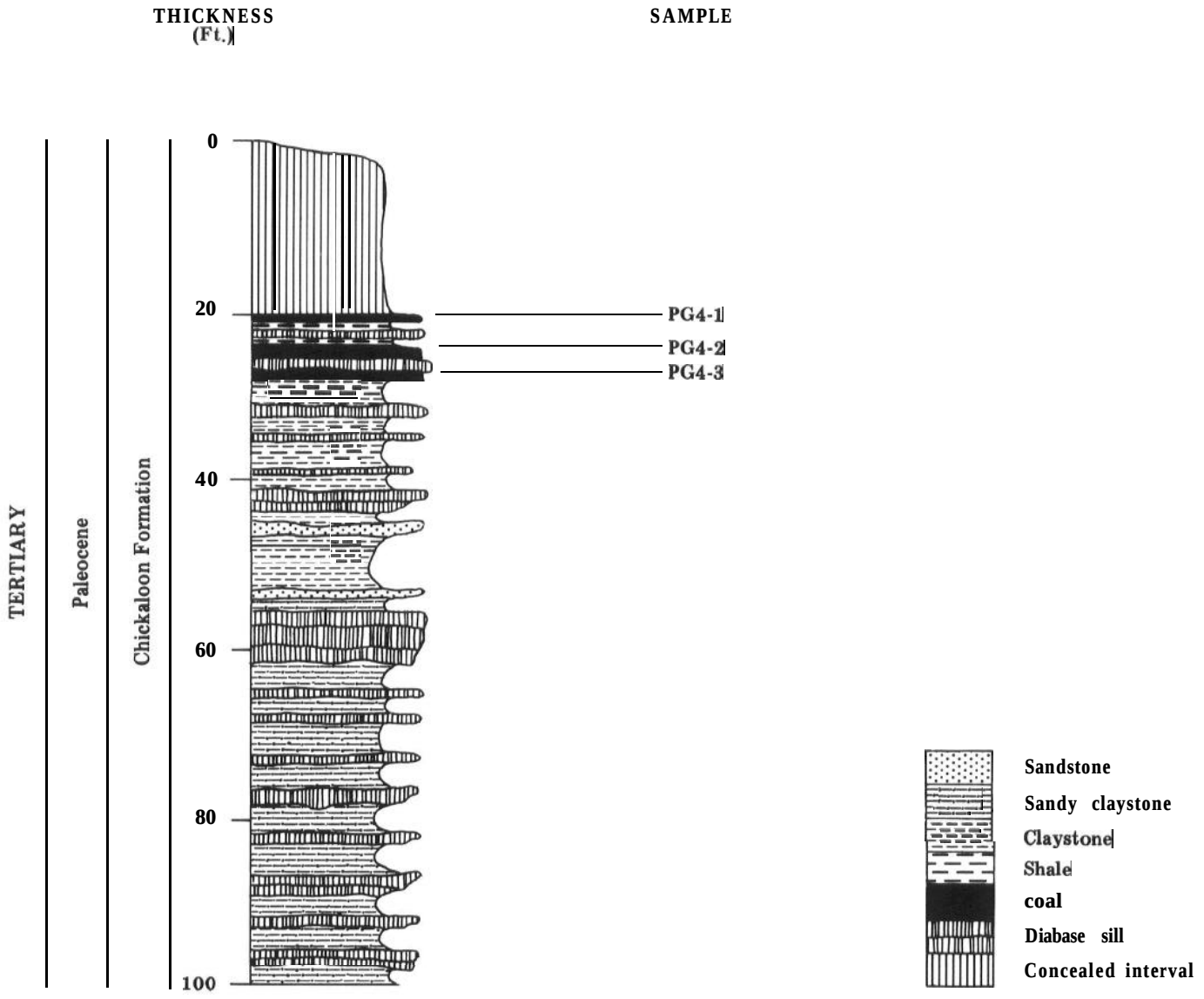
MATANUSKA RIVER SECTION

Site: MR2

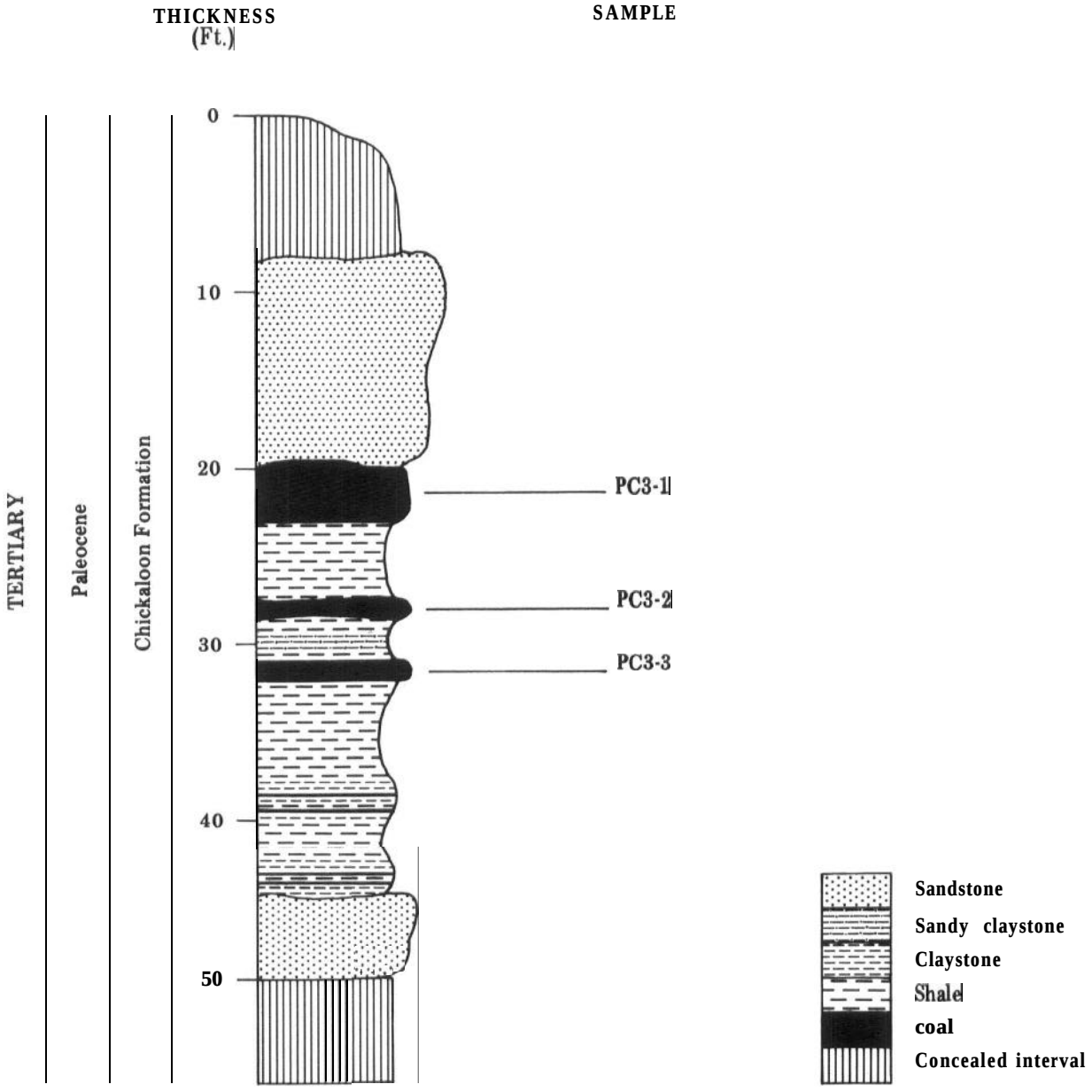
(Tertiary; Paleocene; Chickaloon Formation)



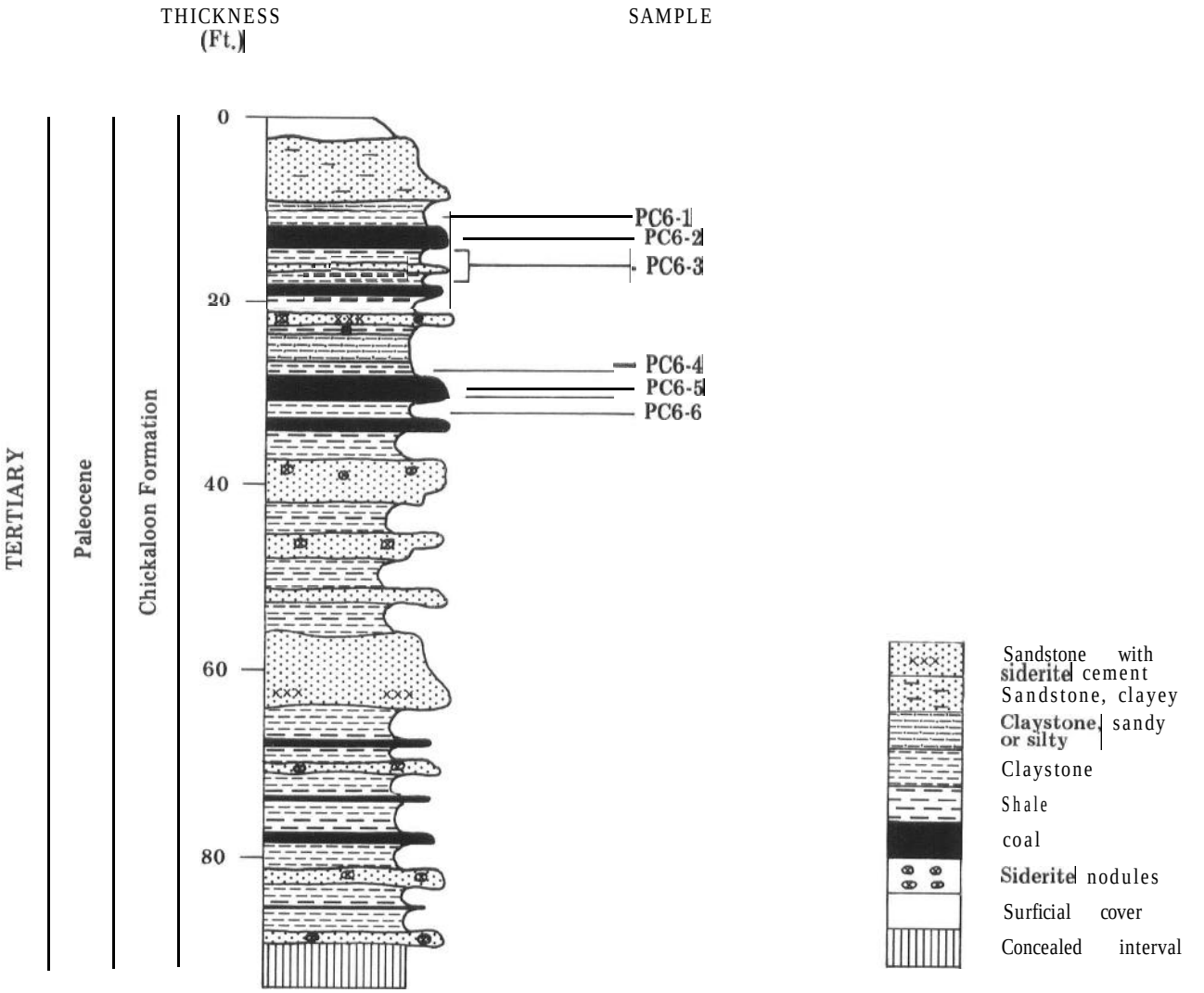
PACKSADDLE GULCH SECTION
Site:PG4



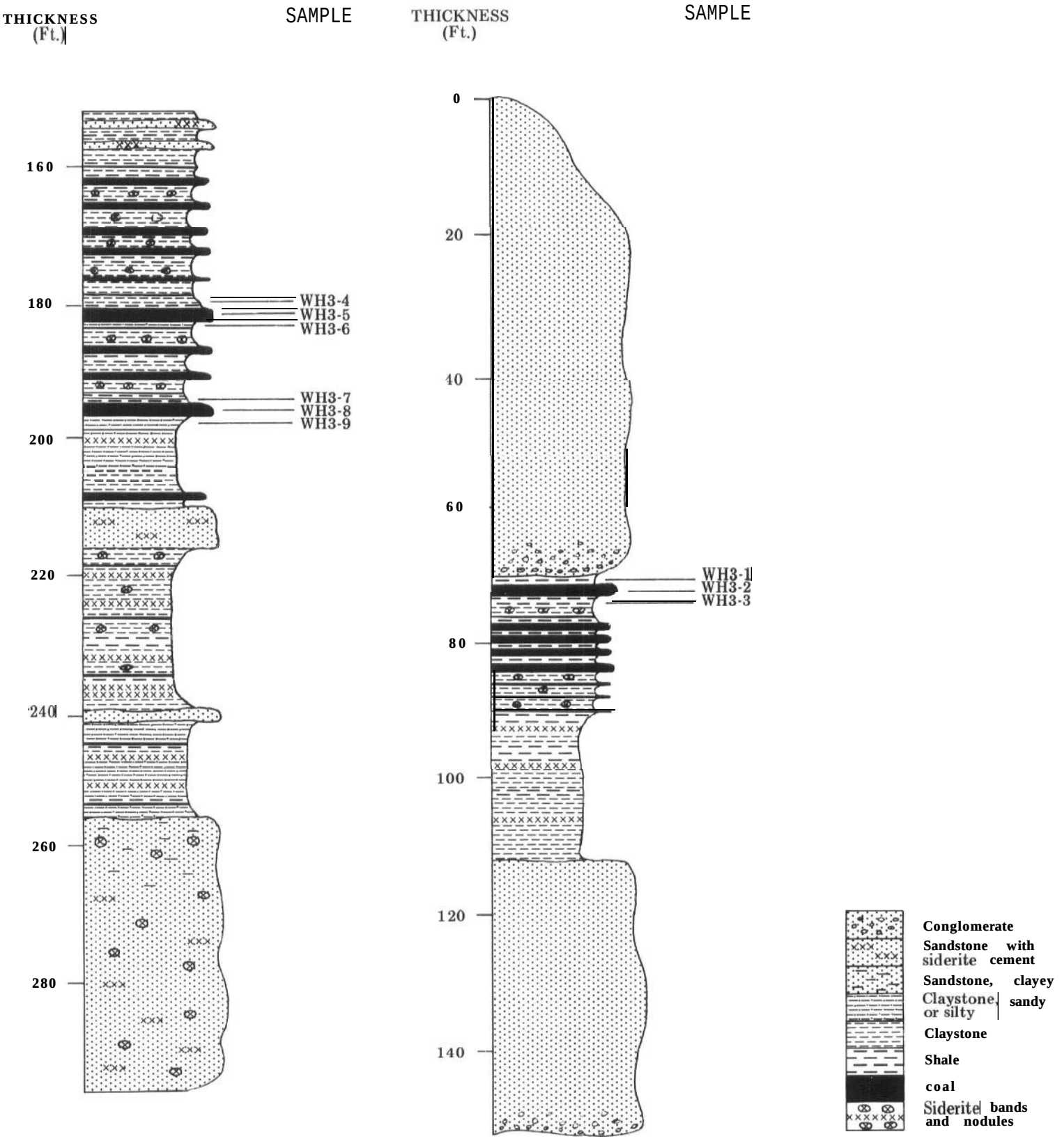
PURINTON CREEK SECTION
Site:PC3



PURINTON CREEK SECTION
Site:PC6



WISHBONE HILL SECTION
Site: WH3
(Tertiary; Paleocene; Chickaloon Formation)



(1) Kings River section
Site: KR1

Unit	Thickness (ft)	Sample
Top of section:		
Coal	2.0	KR1-3
Shale, coaly and claystone, carbonaceous	1.5	
Coal	1.0	
Shale, dark-gray to black, clayey, locally fissile	1.0	
Coal	4.0	KR1-2
Sandstone, hard and dense	40.0 (approx.)	
Coal	1.0	KR1-1

(2) Coal Creek section
Site: CC3

Unit	Thickness (ft)	Sample
Top of section:		
Claystone, brown, silty, carbonaceous, firm	1.0	
Claystone, dark-brownish-gray, silty, carbonaceous, firm	2.0	CC3-1
Sandstone, siderite-cemented, fine-grained, hard and dense, with leaf impressions	0.2	
Coal	1.5	CC3-2
Sandstone, siderite-cemented	0.3	
Shale, black, carbonaceous, fissile, firm; and clapstone, dark-gray to black, carbonaceous, firm	1.3	CC3-3
Shale, dark-gray, sandy, fissile, firm	(1.5	
Claystone, grayish-brown, sandy, firm with blocky fracture	4.0	

(3) Mrak Mine area section
Site: MM1

Unit	Thickness (ft)	Sample
Top of section:		
Claystone, light-gray, sandy, firm with siderite nodules and bands	1.3	MM1-1
Claystone, medium-grav, sandy, slightly carbonaceous, firm to hard, with ferruginous hands of soft claystone to 1 in. thick and coal pods and lenses to 3 in. thick.	1.4	MM1-2
Shale, black, carbonaceous, fissile; claystone, ferruginous, soft, coal y; coal lenses to 2 in.: and sandstone, sjderite-cemented, fine-grained, hard, and dense	1.0	MM1-3
Coal.	3.3	MM1-4
Claystone, dark-grayish-brown, sandy, firm to hard with coal lenses and pockets; siderite-cemented sandstone lenses to 3 in.	3.0	MM1-5
Coal	6.0	MM1-6
Clapstone, medium-grayish-brown, sandy, firm, blocky fracture, carbonaceous plant fossils	1.0	MM1-7

(4) Young Creek section
Site: YC3

Unit	Thickness (ft)	Sample
Top of section:		
Shale, black, carbonaceous, fissi3.e	1.0	
Claystone, silty, carbonaceous, fissile	0.6	
Shale, black, carbonaceous, fissile	0.3	
Coal	1.0	YC3-1
Shale, black, carbonaceous, fissile	0.5	
Shale, reddish-brown, sandy, ferruginous, firm	0.2	
Shale, black, carbonaceous, fissile	0.1	
Coal	0.4	
Shale, black, fissile, firm with l-in.-thick coal lense	0.5	
Claystone, medium-gray, silty, firm, blocky fracture with thin carbonaceous shale lenses to 2 in.	3.5	
Shale, black, carbonaceous, fissile	1.5	
Claystone, medium-gray, sandy, hard	0.5	
Claystone , medium-gray, sandy, with siderite nodules	4.0	

Appendix D - Proximate and ultimate analyses of Matanuska Valley coal samples. Note that the few samples with over 50-percent ash are carbonaceous shales. See plate-2 and appendixes B and C for sample locations.

Sample	Basis[a]	Moisture (%)	Volatile matter (%)	Fixed carbon (%)	Ash (%)	Heating value (Btu/lb)	C (%)	H (%)	N (%)	O (%)	Total sulfur (%)
BC1-1	1	4.80	7.66	11.19	76.35	- -			- -	- -	0.14
	2		8.05	11.75	80.20	- -			- -	- -	c.15
	3		40.65	59.35		- -	- -	- -	- -	- -	0.76
CC1-1	1	5.58	20.51	27.32	46.59	6253			- -	- -	0.57
	2		21.73	78.93	49.34	6623			- -	- -	C.61
	3		42.89	57.11		13074	- -	- -	- -	- -	1.20
CC1-2	1	5.56	24.91	37.61	31.92	8630			- -	- -	0.71
	2		26.38	39.83	33.80	9138			- -	- -	0.75
	3		39.84	60.16		13803	- -	- -	- -	- -	1.13
CC1-3	1	6.05	23.48	35.10	35.37	7764	- -	- -	- -	- -	0.77
	2		24.99	37.36	37.65	8264			- -	- -	0.82
	3		40.08	59.92		13254	- -	- -	- -	- -	1.32
CC1-4	1	4.40	23.91	29.37	42.32	7139	40.31	3.85	0.98	12.15	0.40
	2		25.02	30.72	44.26	7467	42.16	3.51	1.02	8.63	0.41
	3		44.88	55.12		13397	75.64	6.30	1.83	15.48	0.74
CC1-5	1	8.91	10.75	75.70	4.63	12704			- -	- -	0.36
	2		11.80	83.11	5.09	13947	- -	- -	- -	- -	0.40
	3		12.44	87.56		14694	- -	- -	- -	- -	0.42

[a] 1 - As received
2 - Moisture free
3 - Moisture and ash free
- - Not analyzed

Sample	Basis[a]	Moisture (%)	Volatile matter (%)	Fixed carbon (%)	Ash (%)	Heating value (Btu/lb)	C (%)	H (%)	N (%)	O (%)	Total sulfur (%)
Ccl-6	1	7.00	17.51	73.45	2.04	13273	--	--	--	--	0.43
	2		18.82	78.98	2.19	14772	--	--	--	--	0.47
	3		19.25	80.75		14592	--	--	--	--	0.48
CC3-2	1	4.66	11.37	23.02	60.96	--	--	--	--	--	0.32
	2		11.92	24.14	63.94	--	--	--	--	--	0.33
	3		33.06	66.94		--	--	--	--	--	0.93
CC4-1	1	4.54	18.29	60.41	16.76	11628	--	--	--	--	0.65
	2		19.16	63.28	17.56	17181	--	--	--	--	0.68
	3		23.74	76.76		14775	--	--	--	--	0.82
CC4-2	1	5.04	17.74	54.74	22.48	10597	--	--	--	--	0.58
	2		18.68	57.64	23.68	11159	--	--	--	--	0.61
	3		24.47	75.53		14621	--	--	--	--	0.79
CM1-5	1	4.82	7.18	28.89	59.11.	3935	29.95	2.16	1.02	7.58	0.18
	2		7.55	30.35	62.10	4135	31.46	1.70	1.07	3.47	0.19
	3		19.91	80.09		10909	83.02	4.49	2.83	9.16	0.51
CM2-1	1	8.03	7.76	76.04	8.11	12787	--	--	--	--	0.37
	2		8.44	82.73	8.83	13912	--	--	--	--	0.40
	3		9.26	90.74		15259	--	--	--	--	0.44
CM2-2	1	4.16	12.38	70.66	12.80	12541	--	--	--	--	0.52
	2		12.91	73.73	13.36	13085	--	--	--	--	0.54
	3		14.90	85.10		15102	--	--	--	--	0.63
CM2-3	1	3.02	28.09	60.61	8.28	13601	76.17	5.21	1.72	7.96	0.66
	2		28.97	62.50	8.53	14025	78.54	5.02	1.77	5.45	0.68
	3		31.67	68.33		15333	85.87	5.49	1.94	5.95	0.75

Sample	Basis[a]	Moisture (%)	Volatile matter (%)	Fixed carbon (%)	Ash (%)	Heating value (Btu/lb)	C (%)	H (%)	N (%)	O (%)	Total sulfur (%)
CR1-1	1	4.44	17.83	65.59	12.14	12482	--	--	--	--	0.81
	2		18.66	68.63	12.71	13067	--	--	--	--	0.85
	3		21.38	78.62		14963	--	--	--	--	0.97
CR1-2	1	4.02	17.58	61.16	17.74	11766	67.92	4.28	I.37	8.49	0.70
	2		18.32	63.72	17.96	12259	70.76	3.99	1.43	5.13	0.73
	3		22.33	77.67		14943	86.26	4.86	1.74	6.25	0.88
CR1-3	1	5.72	13.89	61.02	19.37	11122	--	--	--	--	0.51
	2		14.73	64.73	20.54	1.1797	--	--	--	--	0.54
	3		18.54	81.46		14847	--	--	--	--	0.69
CR2-1	1	4.86	12.42	97.16	55.56	5052	30.69	2.83	0.83	9.82	0.27
	2		13.06	28.54	58.40	5310	32.26	2.41	0.87	5.78	0.28
	3		31.35,	68.61		12765	77.55	5.79	2.09	13.89	Q.68
CR2-2	1	5.28	14.31	43.96	36.45	8403	--	--	--	--	0.34
	2		15.11	46.41	38.48	8871	--	--	--	--	0.36
	3		24.57	75.43		14421	--	--	--	--	0.59
CR2-3	1	4.54	12.74	27.84	55.38	--	--	--	--	--	0.26
	2		12.82	29.16	58.02	--	--	--	--	--	0.27
	3		30.54	69.46		--	--	--	--	--	0.65
EC1-1	1	10.86	30.27	40.66	18.21	9323	--	--	--	--	0.43
	2		33.96	45.61	20.43	10458	--	--	--	--	0.48
	3		42.68	57.32		13143	--	--	--	--	0.61
KM1-1	1	5.38	7.34	3.77	83.51						0.14
	2		7.75	3.99	88.26						0.15
	3		66.03	33.97							1.30

Sample	Basis[a]	Moisture (%)	Volatile matter (%)	Fixed carbon (%)	Ash (%)	Heating value (Btu/lb)	C (%)	H (%)	N (%)	O (%)	Total sulfur (%)
KM2-1	1	7.21	8.37	53.92	30.50	8436	--	--	--	--	0.55
	2		9.02	58.11	32.86	9092	--	--	--	--	0.59
	3		13.44	86.56		13543	--	--	--	--	0.88
KR1-1	1	3.53	17.62	46.71	32.14	9518	--	--	--	--	0.46
	2		18.26	48.42	33.32	9866	--	--	--	--	0.47
	3		27.39	72.61		14795	--	--	--	--	0.71
KR1-2	1	4.07	11.97	30.05	53.96	--	--	--	--	--	0.29
	2		12.47	31.13	56.22	--	--	--	--	--	0.30
	3		28.47	71.51		--	--	--	--	--	Ci.69
KR1-3	1	4.85	12.98	45.33	36.84	8483	--	--	--	--	0.41
	2		13.64	47.64	38.71	8916	--	--	--	--	0.43
	3		22.26	77.74		14548	--	--	--	--	0.71
MC1-1	1	3.18	16.07	13.30	67.46	--	--	--	--	--	0.25
	2		16.60	13.73	69.67	--	--	--	--	--	0.26
	3		54.72	45.28		--	--	--	--	--	0.86
MC1-2	1	4.19	20.73	24.99	50.09	--	--	--	--	--	0.44
	2		21.63	26.09	52.28	--	--	--	--	--	0.46
	3		45.34	54.66		--	--	--	--	--	0.97
MC1-3	1	4.58	31.64	53.26	10.52	12424	--	--	--	--	0.79
	2		33.16	55.81	11.03	13021	--	--	--	--	0.83
	3		37.27	62.73		14634	--	--	--	--	0.93
MC1-5	1	5.03	31.74	56.32	6.90	3102	73.37	5.60	1.44	12.10	0.58
	2		33.43	59.31	7.27	13796	77.26	5.30	1.51	8.04	0.62
	3		36.04	63.96		14877	83.32	5.72	1.63	8.67	0.66

Sample	Basis[a]	Moisture (%)	Volatile matter (%)	Fixed carbon (%)	Ash (%)	Heating value (Btu/lb)	C (%)	H (%)	N (%)	O (%)	Total sulfur (%)
MC1-6	1	4.75	**28.98**	47.73	18.54	11716	--	--	--	--	0.54
	2		30.42	50.11	19.47	11775	--	--	--	--	0.56
	3		37.78	62.22		14622	--	--	--	--	0.70
MC2-1	1	5.34	28.47	51.94	14.25	11758	66.26	5.00	1.54	12.37	0.57
	2		30.08	54.87	15.05	12421	70.00	4.65	1.63	8.06	0.61
	3		35.41	64.59		14622	82.W	5.48	1.91	9.49	0.71
MC2-2	1	4.48	28.39	51.21	15.93	11678	--	--	--	--	0.50
	2		29.72	53.61	16.68	12226	--	--	--	--	0.52
	3		35.66	64.34		14672	--	--	--	--	0.63
MM1-4	1	5.81	33.65	41.12	19.43	10708	59.46	5.09	1.49	13.97	0.57
	2		35.77	43.66	20.67	11368	63.12	4.71	1.58	9.35	0.61
	3		45.00	55.00		14322	79.53	5.94	1.99	11.78	0.76
MM1-6	1	6.53	34.33	44.94	14.20	11464	--	--	--	--	0.70
	2		36.73	48.08	15.19	12265	--	--	--	--	0.75
	3		43.30	56.70		14462	--	--	--	--	0.88
MR1-1	1	3.64	12.70	54.12	29.55	9981	--	--	--	--	0.49
	2		13.17	56.16	30.66	10358	--	--	--	--	0.51
	3		19.00	81.00		14939	--	--	--	--	0.74
MR2-2	1	3.38	9.04	40.75	46.82	6532	41.72	2.68	0.94	7.54	0.29
	2		9.36	42.18	48.46	6760	43.18	2.38	0.98	4.70	0.30
	3		18.16	81.84		13117	83.77	4.62	1.89	9.17	0.59
MR2-4	1	3.40	7.79	21.73	67.08	--	--	--	--	--	0.18
	2		8.06	22.44	69.45	--	--	--	--	--	0.18
	3		26.39	73.61		--	--	--	--	--	0.59

Sample	Basis[a]	Moisture (%)	Volatile matter (%)	Fixed carbon (%)	Ash (%)	Heating value (Btu/lb)	C (%)	H (%)	N (%)	O (%)	Total sulfur (%)
MR2-7	1	3.22	11.53	79.80	5.45	14027	--	--	--	--	0.49
	2		11.91	82.46	5.63	14494	--	--	--	--	0.50
	3		12.62	87.38		15359	--	--	--	--	0.53
MR2-10	1	4.27	9.47	35.17	51.10	--	--	--	--	--	0.23
	2		9.89	36.73	53.38	--	--	--	--	--	C.24
	3		21.21	78.79		--	--	--	--	--	0.52
MR2-11	1	3.39	9.60	48.11	38.90	8316	49.45	2.93	1.21	7.27	0.29
	2		9.94	49.80	40.26	8608	51.18	2.64	1.26	4.36	0.30
	3		16.64	83.36		14409	85.68	4.41	2.10	7.30	0.51
MR2-12	1	4.25	8.54	31.73	55.48	--	--	--	--	--	0.31
	2		8.91	33.14	57.95	--	--	--	--	--	0.32
	3		21.20	78.80		--	--	--	--	--	0.77
MR2-13	1	2.67	9.98	68.97	18.38	17049	--	--	--	--	0.51
	2		10.15	70.86	18.89	12379	--	--	--	--	0.53
	3		12.64	87.36		15261	--	--	--	--	0.65
PC1-1	1	8.64	9.78	73.74	7.84	12297	--	--	--	--	0.21
	2		10.71	80.71	8.58	13460	--	--	--	--	0.23
	3		11.71	88.29		14724	--	--	--	--	0.25
PC1-2	1	5.35	7.43	77.95	9.27	13386	--	--	--	--	0.30
	2		7.85	82.35	9.80	14143	--	--	--	--	0.31
	3		8.71	91.29		156'9	--	--	--	--	0.35
PC1-3	1	5.75	7.30	82.07	4.88	12863					0.35
	2		7.74	87.08	5.18	13647					0.37
	3		8.17	91.83		14392	--	--	--	--	0.39

Sample	Basis"	Moisture (%)	Volatile matter (%)	Fixed carbon (%)	Ash (%)	Heating value (Btu/lb)	C (%)	H (%)	N (%)	O (%)	Total sulfur (%)
PC2-1	1	4.26	6.89	80.45	8.39	11526	--	--	--	--	0.63
	2		7.20	84.03	8.77	12033	--	--	--	--	0.66
	3		7.89	92.11		13196	--	--	--	--	0.72
PC3-1	1	4.69	5.98	72.88	16.45	11922	71.95	2.87	1.22	6.81	0.69
	2		6.27	76.47	17.26	12509	75.50	2.46	1.28	2.77	0.73
	3		7.58	92.42		15119	91.24	2.97	1.55	3.35	0.88
PC3-2	1	5.07	6.67	74.69	13.57	12492	--	--	--	--	0.67
	2		7.03	78.68	14.30	13159	--	--	--	--	0.71
	3		8.20	91.80		15354	--	--	--	--	0.83
PC3-3	1	14.75	6.69	68.82	9.74	11015	--	--	--	--	0.72
	2		7.84	80.73	11.43	12920	--	--	--	--	0.85
	3		8.86	91.14		14588	--	--	--	--	0.95
PC4-1	1	7.76	10.55	66.07	15.62	JO788	--	--	--	--	0.66
	2		11.44	71.63	16.94	11696	--	--	--	--	0.71
	3		13.77	86.23		14081	--	--	--	--	0.86
PC5-1	1	5.34	8.01	70.53	16.12	11467	--	--	--	--	0.60
	2		8.46	74.51	17.03	12114	--	--	--	--	0.64
	3		10.20	89.80		14600	--	--	--	--	0.77
PC5-2	1	4.44	6.78	72.41	16.37	11704	--	--	--	--	0.67
	2		7.09	75.77	17.14	12748	--	--	--	--	0.70
	3		8.56	91.44		14780	--	--	--	--	0.84
PC6-2	1	11.26	14.89	61.35	1.2.49	10375	--	--	--	--	0.50
	2		16.78	69.14	14.08	11692	--	--	--	--	0.57
	3		19.53	80.47		13607	--	--	--	--	0.66

Sample	Basis[a]	Moisture (%)	Volatile matter (%)	Fixed carbon (%)	Ash (%)	Heating value (Btu/lb)	C (%)	H (%)	N (%)	O (%)	Total sulfur (%)
PC6-5	1	9.35	13.77	67.72	9.16	11626	70.39	4.18	1.72	14.15	0.39
	2		15.19	74.70	10.11	12825	77.65	3.46	1.90	6.45	0.43
	3		16.90	83.10		14267	86.38	3.85	2.11	7.18	0.48
PG1-1	1	11.41	26.95	44.70	16.94	9325	--	--	--	--	0.55
	2		30.42	50.46	19.12	10526	--	--	--	--	C.63
	3		37.61	62.39		13015	--	--	--	--	0.77
PG1-2	1	8.91	28.83	51.52	10.74	10946	--	--	--	--	0.71
	2		31.65	56.56	11.79	12017	--	--	--	--	0.78
	3		35.88	64.12		13623	--	--	--	--	0.88
PG1-3	1	5.97	29.94	45.35	18.74	10334	--	--	--	--	0.60
	2		31.84	48.23	19.93	10990	--	--	--	--	0.64
	3		39.76	60.24		13725	--	--	--	--	0.80
PG2-1	1	5.26	22.20	36.02	36.52	8132	--	--	--	--	0.56
	2		23.43	38.02	38.55	8583	--	--	--	--	0.59
	3		38.12	61.88		13967	--	--	--	--	0.95
PG2-2	1	5.14	19.47	28.87	h6.52	6631	--	--	--	--	0.35
	2		20.52	30.43	49.05	6990	--	--	--	--	0.37
	3		40.27	59.73		13718	--	--	--	--	0.73
PG3-1	1	8.12	23.95	44.46	23.47	9552	--	--	--	--	0.55
	2		26.07	48.39	25.54	10396	--	--	--	--	0.60
	3		35.01	64.99		13962	--	--	--	--	0.80
PG4-1	1	3.12	7.44	87.23	2.22	14292	--	--	--	--	0.57
	2		7.68	90.04	2.29	14752	--	--	--	--	0.59
	3		7.85	92.15		15097	--	--	--	--	0.60

Sample	Basis[a]	Moisture (%)	Volatile matter (%)	Fixed carbon (%)	Ash (%)	Heating value (Btu/lb)	C (%)	H (%)	N (%)	O (%)	Total sulfur (%)
PG4-2	1	2.84	7.59	81.86	7.71	13326	--	--	--	--	0.52
	2		7.81	84.25	7.94	13716	--	--	--	--	0.54
	3		p1.48	91.57.		14898	--	--	--	--	0.58
PG4-3	1	5.47	7.54	41.71	45.27	6425	42.77	2.43	1.15	8.08	0.30
	2		7.98	44.13	47.89	6796	45.24	1.93	1.22	3.41	0.31
	3		15.31	84.69		13043	86.82	3.69	2.33	6.55	0.60
RM1-1	1	10.64	25.64	49.69	14.02	9942	58.69	4.71	1.17	20.89	0.51
	2		28.70	55.61	15.69	11126	65.67	3.94	1.31	12.80	0.58
	3		34.04	65.96		13197	77.90	4.67	1.56	15.19	0.68
RM1-2	1	8.36	29.83	36.56	75.25	9031	--	--	--	--	0.29
	2		32.55	39.89	27.55	9855	--	--	--	--	0.32
	3		44.93	55.07		13604	--	--	--	--	0.44
WH3-2	1	8.08	30.37	38.27	23.27	9524	53.50	4.93	1.06	16.64	0.59
	2		33.04	41.64	25.32	10362	58.20	4.38	1.16	IO.30	0.64
	3		44.24	55.76		13875	77.93	5.87	1.55	13.79	0.86
WH3-5	1	6.73	33.72	37.90	21.65	10238	--	--	--	--	0.44
	2		36.15	40.64	23.21	10977	--	--	--	--	G.47
	3		47.08	52.92		14296	--	--	--	--	0.61
WH3-8	1	9.89	28.36	39.76	21.99	94.24	--	--	--	--	0.29
	2		31.47	44.13	24.40	10458	--	--	--	--	0.33
	3		41.63	58.37		13833	--	--	--	--	0.43
YCI-1	1	6.49	25.76	60.16	7.59	12509	--	--	--	--	0.51
	2		27.55	64.34	8.12	13277	--				0.55
	3		29.98	70.02		14558	--				0.59

Appendix E - State of Alaska coal leases, Matanuska Valley.

ıe	ADL	Description	Acres	Issued
Hawley Resource Properties, Inc.	32136	T. 19 N., R. 2 E., SM Sec. 13: NE¼ SW¼, NW¼ SE¼, SW¼ NE¼, N½ NW¼ SW¼, SE¼ NW¼ SW¼, S½ NW¼	230±	3/1/59
Hawley Resource Properties, Inc.	23803	T. 19 N., R. 2 E., SM Sec. 13: SW¼ SW¼, SW¼ NW¼ SW¼ 14: S½ NE¼ SE¼ SE¼ SE¼, S½ SW¼ SE¼ 23: N½ NE¼ NE¼	150±	7/8/64
Hawley Resource Properties, Inc.	32144	T. 19 N., R. 2 E., SM Sec. 22: S½ SW¼, W½ SE¼ 27: N½, N½ S½ 28: N½ SE¼, SE¼ NE¼, S½ SW¼ NE¼, NW¼ SW¼ NE¼	760±	2/1/66
R.W. Gore	33978	T. 20 N., R. 5 E., SM Sec. 21: N½ NE¼ 22: W½ NW¼ NW¼	100±	8/1/58
R.W. Gore	53509	T. 20 N., R. 5 E., SM Sec. 21: S½ NE¼	80±	3/25/68
American Exploration & Mining Co.	324600	T. 19 N., R. 3 E., SM Sec. 16: SW¼ NW¼, NE¼ SE¼ NW¼, W½ SE¼ NW¼, W½ NE¼ SW¼, NW¼ SW¼, S½ SW¼ 17: S½, S½ N½ 18: SE¼, E½ SW¼, SE¼ NE¼ 19: NE¼, E½ NW¼	1,210±	8/10/70
Hawley Resource Properties, Inc.	309947	T. 19 N., R. 2 E., SM Sec. 22: E½ SE¼ 23: NW¼, W½ NE¼, N½ SW¼	400±	11/15/66

Appendix F - Summary of drill-hcle data, Matanuska coal. field.

Map drill hole no. (pl. 2)	Reference driii hole	Reference report*	Total coal thickness (ft)	Elevation Top	Elevation Bottom	Total depth (ft)	Thickest bed (ft)	Total coal thickness in Beds >1 ft	Beds >2 ft	Beds >3 ft
1	DDH-6	1	**30**	**788**	-10	**798**	**3.0**	**25**	10	3
2	DDH-7	1	**4**	**825**	460	492[a]	2.0	**4**	4	0
3	DDH-8	1	**22**	**883**	**350**	731[a]	8.0	22	15	12
4	P-l	**6**	**81**	899	307	837[a]	8.0	**70**	61	**43**
5	MC17	**6**	0	892	801	91	0	0	0	0
6	MC15	**6**	**48**	849	-197	1046	20.1	50	**38**	**34**
7	MC14	**6**	**2**	**847**	199	**648**	**2.0**	1	0	0
8	**MC13**	6	0	**863**	**703**	**160**	0	0	0	0
9	MC12	**6**	0	**855**	**675**	180	0	0	0	0
10	MC16	**6**	**7**	794	195	599	**2.1**	6	4	0
11	MC11	**6**	0	**766**	532	**734**	0	0	0	0
12	MC10	**6**	**13**	**738**	**-64**	802	**1.7**	11	**5**	0
13	MC9	**6**	29	800	-111	911	**4.8**	**24**	19	**12**
14	**MC8**	**6**	**32**	**874**	-107	981	**5.3**	**27**	17	**8**

*l-Barnes and Payne, 1956.
2-Evan Jones Coal Company, 1949.
3-Hill, W.P.T., 1923; hole elevations taken from 1:63,360 topographic maps.
4-Jolley, T.R., and Toenges, A.L., 1952.
5-Tuck, Ralph, 1937; information taken from generalized graphical drill hole log reports.
6-Warfield, F.S., 1962.
7-Waring, G.A., 1936.

[a]Hole inclined at 45".
[b]Hole inclined at 60".
[c]Hole inclined at 56".
[d]Hole inclined at 42".
[e]Hole inclined at 17".
[f]Horizontally drilled.

Map drill hole no. (pl. 2)	Reference drill hole	Reference report*	Total coal thickness (ft)	Elevation Top	Elevation Bottom	Total depth (ft)	Thickest bed (ft)	Total coal thickness in Beds >1 ft	Beds >2 ft	Beds >3 ft
15	MC18	h	40	785	219	566	4.8	30	16	5
16	MC7	6	1	1150	-867	7017	0.3	0	0	0
17	MC6	6	0	1150	-52	1202	0	0	0	0
18	MC5	6	0	1107	185	922	0	0	0	0
19	MC4	6	17	1100	88	1012	5.9	16	15	13
20	MC3	6	19	1096	138	958	7.0	18	17	17
21	MC2	6	94	1084	-321	1405	9.8	88	71	54
22	MC1	6	84	1063	131	932[a]	7.1	78	63	44
23	DDH1	1	37	1003	552	612[a]	5.0	37	19	17
24	DDH2	1	35	1007	588	558[a]	6.3	34	22	16
25	DDH5	1	29	969	505	630[a]	5.0	29	25	12
26	DDH3		47	1021	610	553[a]	7.8	43	25	7
27	DDH?	1	88	1027	382	645[b]	14.0	88	84	75
28	DDH4	1	45	1099	728	408[b]	7.0	43	28	14
29	DDH10	1	77	1024	435	640[a]	11.0	77	77	69
30	DDH11	1	27	1014	660	490[a]	7.5	27	25	21
31	WH7	6	27	834	-129	963	2.7	21	7	0
32	WH8	6	20	833	-54	887	2.3	11	4	0
33	WH3	6	31	785	-573	1358	3.0	28	10	3
34	wH4	6	38	842	-156	998	4.8	34	21	9
35	WH1	6	38	835	-169	1004	4.2	29	19	11
36	wH5	h	25	871	135	736	4.6	19	15	8
37	WH6	6	16	857	446	411	3.1	11	7	3
38	wH2	6	11	74c	-17	757	2.5	9	9	5
39	EJ-1	2	8	812	631	181[f]	7.0	8	7	7
40	WH14	6	0	731	731	0[f]	0	0	0	0
41	WH11	6	41	1197	-903	2100	4.h	32	20	8
42	WH10	6	33	1032	-1068	2100	2.9	20	14	4
43	wH12	6	35	1171	-943	2114	4.4	26	11	8
44	WH9	6	35	1240	-864	2104	3.5	31	26	19
45	WH13	6	0	1646	-61	1707[b]	0	0	0	0
46	15-16	4	34	1220	523	805[b]	4.8	31	26	18
47	14-16	4	4	1230	803	493[b]	3.2	3	3	3

Map drill. hole no. (pl. 2)	Reference drill hole	Reference report*	Total coal thickness (ft)	Elevation		Total. depth (ft)	Thickest bed (ft)	Total coal thickness in		
				Top	Bottom			Beds >1 ft	Beds >2 ft	Beds >3 ft
48	13-16	4	63	1370	721	783[c]	3.8	57	28	14
49	F-1	5	22	1040	932	108	10.0	22	22	22
50	E-2	5	10	1045	978	67	5.0	10	10	10
51	E-3	5	11	1050	990	60	6.0	11	11	11
52	E-4	5	3	1062	996	66	3.0	3	3	3
53	F-5	5	13	1086	1024	62	10.0	13	13	10
54	E-6	5	13	1109	1005	104	9.0	13	13	13
55	E-7	5	9	1128	1083	45	9.0	9	9	9
56	E-8	5	5	1136	1042	94	5.0	5	5	5
57	E-9	5	8	1102	1069	33	8.0	8	8	8
58	E-10	5	7	1072	1028	44	5.0	7	7	5
59	E-11	5	10	1044	966	78	5.0	10	7	5
60	E-12	5	8	1035	980	55	8.0	8	8	8
61	E-13	5	12	1035	970	65	12.0	12	12	12
62	E-14	5	14	1035	938	97	9.0	14	9	9
63	E-15	5	10	1040	963	77	8.0	10	8	8
64	E-16	5	7	1042	937	105	2.0	7	2	0
65	E-17	5	7	1062	988	74	7.0	7	7	7
66	F-18	5	0	1086	1040	46	0	0	0	0
67	E-19	5	0	1123	1078	45	0	0	0	0
68	E-20	5	0	1120	1073	47	0	0	0	0
69	E-21	5	0	1083	1046	37	0	0	0	0
70	E-22	5	10	1054	993	61	10.0	10	10	10
71	E-23	5	10	1047	983	64	10.0	10	10	10
72	E-24	5	2	1042	975	67	1.5	2	0	0
73	E-25	5	6	1031	980	51	6.0	6	6	6
74	E-26	5	0	1020	970	50	0	0	0	0
75	E-27	5	0	1030	978	52	0	0	0	0
76	E-28	5	5	1036	917	119	1.0	5	0	0
77	E-29	5	1	1021	903	118	0.5	0	0	0
78	E-30	5	3	1030	893	137	2.0	3	2	0
79	E-31	5	11	973	888	85	11.0	11	11	11
80	E-32	5	0	972	917	60	0	0	0	0

Map hole no. (pl. 2)	Ref ereace drill hole	Reference report*	Total coal. thickness (ft)	Elevation Top	Elevation Bottom	Total. depth (ft)	Thickest bed (ft)	Total coal. thickness in Beds >1 ft	Beds >2 ft	Beds >3 ft
81	E-33	5	12	972	977	45	12.0	12	12	12
82	E-34	5	0	972	938	34	0	0	0	0
83	E-35	5	0	969	820	149	0	0	0	0
84	E-36	5	8	1055	904	151	1.0	8	0	0
85	E-37	5	5	1066	906	160	1.0	5	0	0
86	E-38	5	2	1047	897	155	1.0	2	0	0
87	E-39	5	7	1040	862	178	1.0	7	0	0
88	E-40	5	2	1033	853	180	1.0	1	0	0
89	E-41	5	3	1026	900	126	3.0	3	3	3
90	E-42	5	19	1017	911	106	12.0	19	15	15
91	E-43	5	5	1021	846	1.75	1.5	5	0	0
92	E-44	5	0	1011	935	76	0	0	0	0
93	E-45	5	0	1008	900	108	0	0	0	0
94	E-46	5	5	1012	833	179	5.0	5	5	5
95	E-47	5	9	1013	928	85	8.0	9	8	8
96	1-15	4	37	1031	438	593	3.5	28	14	4
97	2-15	4	18	1039	632	407	2.3	12	2	0
98	3-15	4	29	1075	471	604	2.4	24	12	0
99	4-15	4	25	1064	638	426	2.9	21	10	0
100	5-15	4	27	1068	412	656	2.9	19	7	0
101	6-10	4	24	1121	496	625	3.5	19	7	7
102	7-10	4	42	1223	561	662	3.0	38	21	9
103	8-10	4	28	1223	543	680	3.1	19	9	3
104	9-10	4	24	1263	758	505	2.5	18	9	0
105	cc-1	3	0	1375	541	1180[a]	0	0	0	0
106	cc-2.	3	16	1380	860	735[a]	8.1	15	13	11
107	cc-3	3	15	1385	918	660[a]	3.1	10	6	6
108	CC-6	3	0.6	1395	1112	400[a]	0.3	0	0	0
109	CC-5	3	22	1395	1104	435[d]	6.1	20	19	17
110	cc-4	3	41	1400	979	596[a]	6.3	39	29	25
111	CC-7	3	0.6	1415	920	700[a]	0.3	0	0	0
112	CC-8	3	35	1440	872	804[a]	7.0	33	26	21
113	c-9	3	12	1200	-145	1345	1.7	9	0	0

Map drill hole no. (pl. 2)	Reference drill hole	Reference report*	Total coal thickness (ft)	Elevation		Total depth (ft)	Thickest bed (ft)	Total coal thickness in		
				Top	Bottom			Beds >1 ft	Beds >2 ft	Beds >3 ft
114	SW A	7	0	2320	2030	994[e]	0	0	0	0
115	SW	7	0	2320	1451	869	0	0	0	0
116	SSW	7	0	2400	1422	978	0	0	0	0
117	S	7	0	2460	1350	1110	0	0	0	0
118	SE	7	0	2490	671	1819	0	0	0	0
119	C	7	0	2680	2004	676	0	0	0	0
120	NE	7	0	2950	2188	762	0	0	0	0
121	NW	7	0	2810	2017	793	0	0	0	0