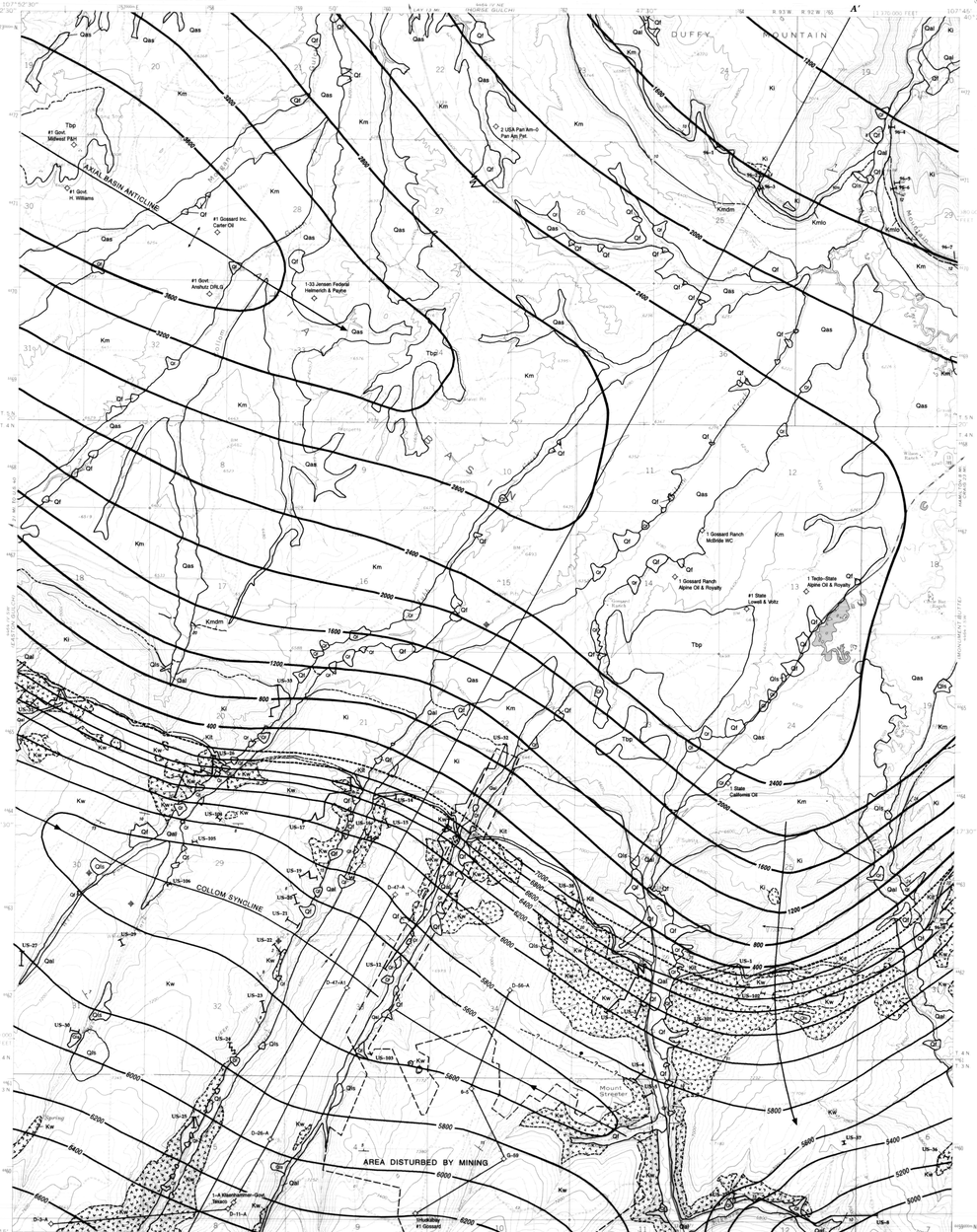
COLORADO GEOLOGICAL SURVEY
DIVISION OF MINERALS AND GEOLOGY
DEPARTMENT OF NATURAL RESOURCES

OPEN FILE MAP 97-5
PLATE 1



DESCRIPTION OF MAP UNITS

SURFICIAL DEPOSITS

Qal **Alluvium (Holocene)**—Clay, silt, sand, and some gravel along present stream channels. Thickness is variable

Qas **Alluvium and Sheetwash Alluvium (Holocene)**—Clay, silt, and sand along present stream channels and adjacent slopes. Deposited chiefly on the Mancos Shale (Km). Thickness is variable

Qf **Alluvial-Fan Deposits (Holocene and Pleistocene)**—Clay- to boulder-sized sediments constitute fan- shaped deposits where tributary drainages of steep gradient join lower gradient streams. Thickness is variable

Qls **Landslide Deposits (Holocene and Pleistocene)**—Heterogeneous mixtures of angular fragments, clay, silt, and sand. Most deposits occur as small slumps off valley walls in the Williams Fork Formation (Kw); a few are found in the Mancos, where exposed in the central part of the quadrangle

BEDROCK

Tpb **Browns Park Formation (Miocene)**—Crossbedded, light-gray to white, fine- to medium-grained, friable sandstone, poorly exposed. A thin basal conglomeratic sandstone contains multicolored rounded granular to cobbly gravel derived from igneous and metamorphic rocks, quartzite, and chert. Maximum thickness preserved in the quadrangle is estimated to be 15 ft

Kw **Williams Fork Formation (Upper Cretaceous)**—Interbedded tan to light-gray, fine-grained sandstone to shaly sandstone, gray mudstone, brown carbonaceous shale, and numerous lenticular coal beds as much as 18 ft thick. Large areas have been baked or fused by burning of underlying coal beds. Maximum thickness preserved in the quadrangle is about 1,275 ft

Iles Formation (Upper Cretaceous)

Kit **Trout Creek Sandstone Member**—Massive, crossbedded, tan, fine-grained sandstone capped with white sandstone (whitecap). Forms ledge at the top of the Iles Formation. Thickness about 120 ft

Ki **Main Body**—Interbedded tan to light-gray, fine-grained sandstone, gray mudstone, brown calcareous shale, and a few thin coal beds. A scattered number of small areas have been baked or fused by burning of underlying coal beds. Maximum thickness preserved in the quadrangle is about 1,200 ft

Km **Mancos Shale (Upper and Lower Cretaceous)**—Dark-gray marine shale; contains mappable sandstones in the upper half of the formation. About 1,900 ft of the Mancos above the Frontier Sandstone Member (Kmf) consists of light-gray calcareous shale and dark-gray shaly limestone. Total thickness of the Mancos is estimated at 5,100 ft

Kmlo **Loyd Sandstone Member**—Massive well- sorted, pale olive to yellowish-gray, very fine grained sandstone containing large fossiliferous concretions. Highly eroded throughout. Line represents top of the sandstone and is dashed where top is obscured. Thickness about 45 ft; top lies about 70 ft below the top of the Mancos Shale

Kmdm **Duffy Mountain Member**—Informal unit (Boyles and others, 1981) composed of fine- grained, moderately to well-sorted, yellowish-gray sandstone. Extensive crossbedding throughout and moderately bioturbated. Crops out primarily in northeastern part of the quadrangle along the base of Duffy Mountain for which it is named. Line represents the top of member; not mapped where obscured. Maximum thickness about 35 ft; top lies approximately 245 ft below the top of the Mancos Shale

Kmmo **Marapos Sandstone Member**—Shown on cross-section only. Thin-bedded, moderately sorted, light-gray and tan, fine- grained, slightly calcareous sandstone, shaly near base. Occurs only in drill holes as a sandy zone interbedded with gray shale. Thickness about 50 ft; top is approximately 750 ft below top of Mancos Shale

Kmme **Meeker Sandstone Member**—Shown on cross-section only. Thin-bedded, moderately sorted, pale- to medium-yellowish-brown, fine-grained, shaly, calcareous sandstone. Occurs only in drill holes as a sandy zone. Thickness in drill holes as much as 190 ft; top lies about 1,900 ft from the top of the Mancos Shale

Kmf **Frontier Sandstone Member**—Shown on cross section only. In the Elk Springs quadrangle, it has an upper unit of interbedded gray and tan sandstone and gray shale, and a lower unit of brownish-gray shale with thin bentonite beds. These are probably the equivalents of the Frontier Sandstone Member and the Benton Shale, respectively (Reheis, 1981). Thickness of the combined units in drill holes is 310 ft; top lies about 400 ft above the base of the Mancos Shale

Kmm **Mowry Member (Lower Cretaceous)**—Shown on cross section only. Medium dark gray weathering to silvery-gray shale; tends to split into very thin plates and contains abundant fish scales. Thickness about 80 ft in drill holes; forms the base of the Mancos Shale

Kd **Dakota Sandstone (Lower Cretaceous)**—Shown on cross section only. In the Elk Springs quadrangle it has upper and lower parts consisting of light- gray quartzitic sandstone with dark chert pebbles, separated by a middle part of dark- gray fissile shale. Thickness in drill holes averages 100 ft

MAP SYMBOLS

Contact—Dashed where inferred

Fault—Long-dashed where inferred. Bar and ball on down thrown side

Folds—Showing direction of plunge

Anticline

Syncline

Structure Contours

Top of Dakota Sandstone—North of Danforth Hills. Contour interval 400 ft

Top of Trout Creek Member of Iles Formation—To the south along Danforth Hills. Contour interval 200 ft. Dashed where contoured horizon projected above surface

Strike and Dip of Beds

Inclined

Horizontal

Baked and Fused Rock—Approximated areal extent in the Williams Fork and Iles Formation; results from the burning of underlying coal beds

Measured Section—Letters and numbers are keyed to coal sections

Oil and Gas or Coal Test Hole—Showing operator and well name

DISCUSSION

The Axial quadrangle was mapped in the summer of 1996 as part of the Colorado Geological Survey's mapping program to support economic geologic activities in Colorado. Funding for this project was derived from the Colorado severance tax fund. The Axial quadrangle was selected for this study because of coal mining interests and the absence of current geologic mapping at a 1:24,000 scale. Previous geologic mapping in the area includes a map by Nutt (1977) and an earlier map by Hancock (1925). The principal resource of economic interest in the quadrangle is coal, although some oil and gas and sand and gravel development is present.

The Axial quadrangle is bisected by the "Axial Basin Anticline", a broad, asymmetrical, southeast-trending, breached anticline that divides the quadrangle into three physiographic areas. Located in the northeast corner of the quadrangle is a subtle highland underlain by Upper Cretaceous age rocks of the lower Iles Formation. Coal seams are rare, and where found, are highly lenticular and rarely exceed one to two feet in thickness. The central part of the quadrangle, the core of the "Axial Basin Anticline", displays a rolling prairie-like character developed on the Upper Cretaceous Mancos Shale. The southern third of the quadrangle consists of a highly dissected, moderate highland known as the Danforth Hills, the focus of this study.

The southern part of the quadrangle is underlain by coal-bearing rocks of Upper Cretaceous age that include the Iles and Williams Fork Formations; the Trout Creek Sandstone Member is a non-coal bearing shoreface sequence assigned to the Iles Formation. Coal seams in the study area are not formally named. Coals assigned to the Iles Formation are lenticular and rarely exceed a few feet in thickness, although coal beds as much as 8 feet thick have been identified. Hancock and Eby (1930) designated two coal zones in the Iles Formation within the Meeker 15-minute quadrangle; the Black Diamond coal zone, just below the Trout Creek Sandstone Member, and the lower coal zone near the base of the Iles. Within the study area, coal beds corresponding to the Black Diamond coal zone appear to be poorly developed to absent, whereas those corresponding to the lower coal zone are as much as 8 feet thick. Coal beds in the overlying Williams Fork Formation are most abundant and of greatest thickness in the lower 850 feet, where beds are as much as 18 feet thick.

Coal production within the study area has been principally from the Red Wing Mine (formerly the Streeter Mine) and ColoWyo Mine that mined coal from the middle and upper part of the Williams Fork Formation. The Red Wing Mine, located along the west side of highway 13 in section 2, produced 20,741 tons of coal in it's last year of underground operation in 1974. The ColoWyo Mine, located immediately west and southwest of the Red Wing Mine, produced 4.335 million tons of coal from it's surface mine in 1995 making it the third largest producer of coal in Colorado. Multiple coal samples, analyzed by ColoWyo Coal Company in 1995 on an as received basis, were ranked as subbituminous B and yielded a heating value of 10,461 Btu/lb, a sulfur content of 0.38 percent, and an ash value of 5.76 percent.

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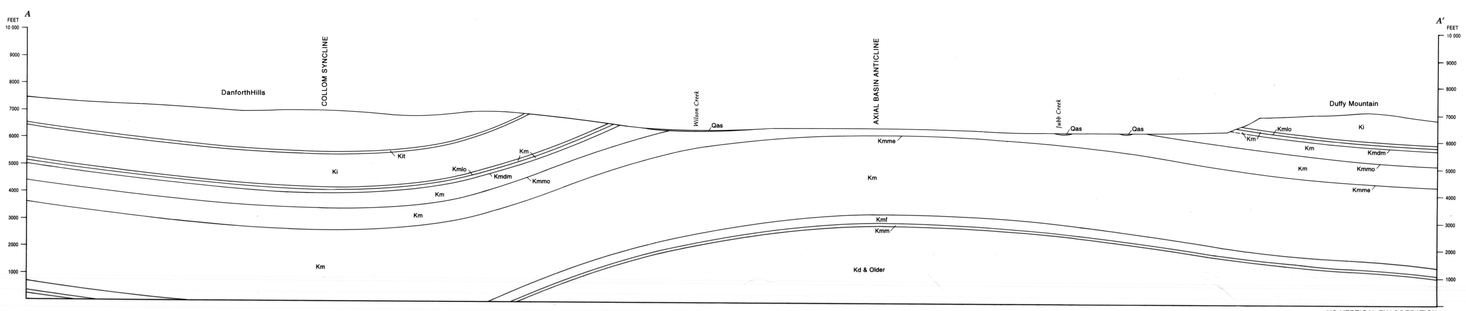
CORRELATION OF MAP UNITS

Qal, Qas, Qf	Qls	Holocene, Pleistocene	QUATERNARY	
UNCONFORMITY				
Tbp		Miocene	TERTIARY	
UNCONFORMITY				
Kw		Upper Cretaceous	CRETACEOUS	
Kit				
Ki				
Kmlo, Kmdm, Kmmo, Kmme		Upper and Lower Cretaceous		
Km				
Kmf		Lower Cretaceous		
Kmm				
Kd				



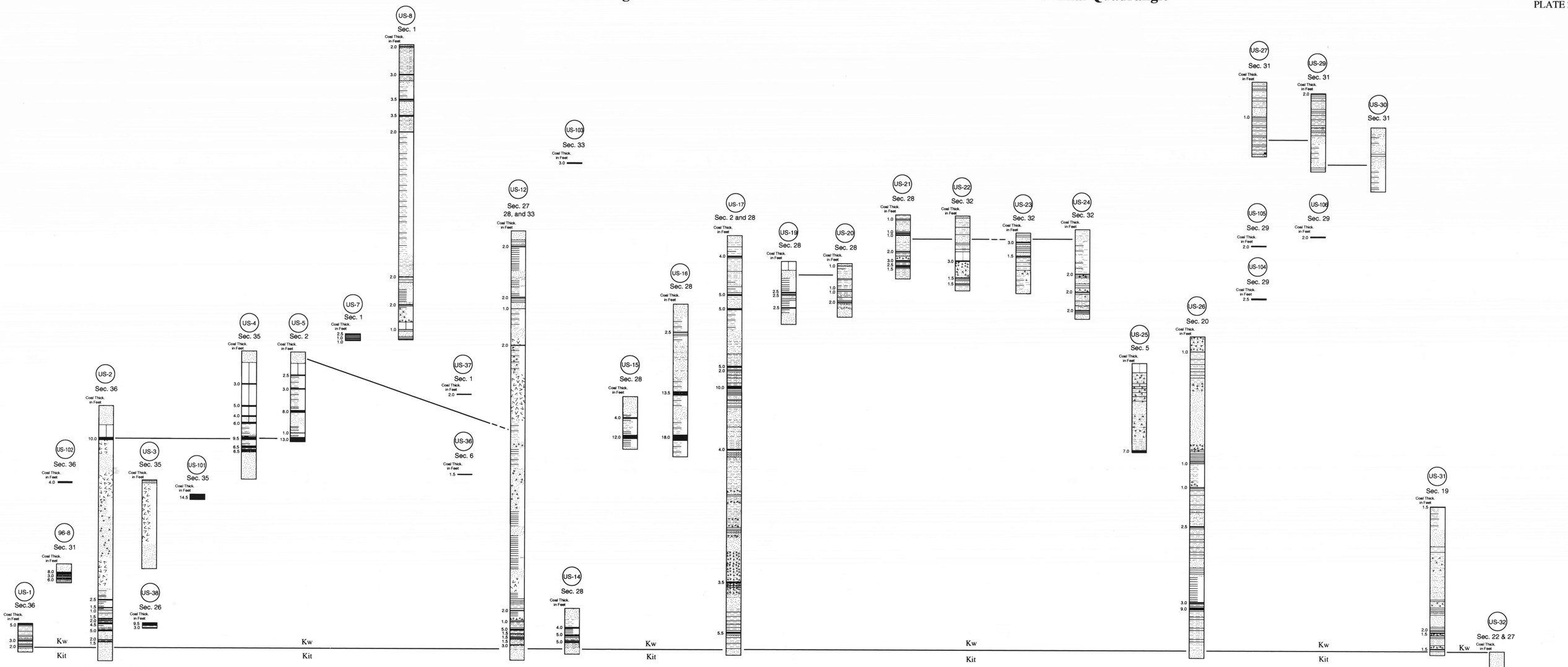
GEOLOGIC MAP AND COAL MEASURES OF THE AXIAL QUADRANGLE, MOFFAT AND RIO BLANCO COUNTIES, COLORADO

By
John K. Hardie and Jonathan M. Zook
1997

COLORADO GEOLOGICAL SURVEY
DEPARTMENT OF NATURAL RESOURCES
DENVER, COLORADO

OPEN FILE MAP 97-5
GEOLOGIC MAP AND COAL MEASURES OF THE AXIAL
QUADRANGLE, MOFFAT AND RIO BLANCO COUNTIES, COLORADO
PLATE 2

Measured Coal Sections along the Northern Part of Danforth Hills in the Southern Part of the Axial Quadrangle



EXPLANATION

Drill hole designations beginning with a "D" indicate a USGS coal test hole. Those beginning with a "G" indicate a coal test hole drilled in conjunction with mining activities. All other designations are for oil and gas well test holes and give the the operator and the well name. Drill logs are positioned vertically according to their elevation above sea level. The vertical position of measured sections is approximated from elevation and dip.

US-33 — "US" indicates that the measured section was derived from USGS Open-File report 81-12. Numbers less than 100 correspond directly to those presented in report 81-12.

Sec. 20 — Shows the section where the measured interval can be found on the geologic map.

VERTICAL SCALE

METERS	FEET
0	0
	250
100	
	500
200	
	750
300	1000

2.5 Coal (thickness in feet)

Impure coal

Baked or fused rock (clinker)

Subordinate amounts of baked of fused rock disseminated within a sandstone (or other type of lithology)

Shale

Poorly exposed shale (or other type of lithology)

Carbonaceous shale

Sandstone

Carbonaceous sandstone

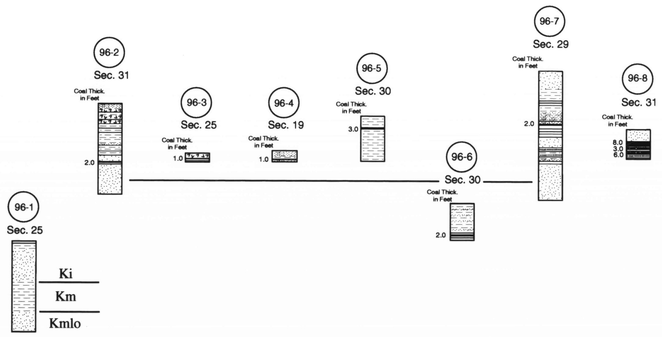
Sandy shale

Siltstone

Alluvium and colluvium

Concealed interval (measured sections)

Measured Coal Sections at and in the Vicinity of Duffy Mountain in the Northern Part of the Axial Quadrangle



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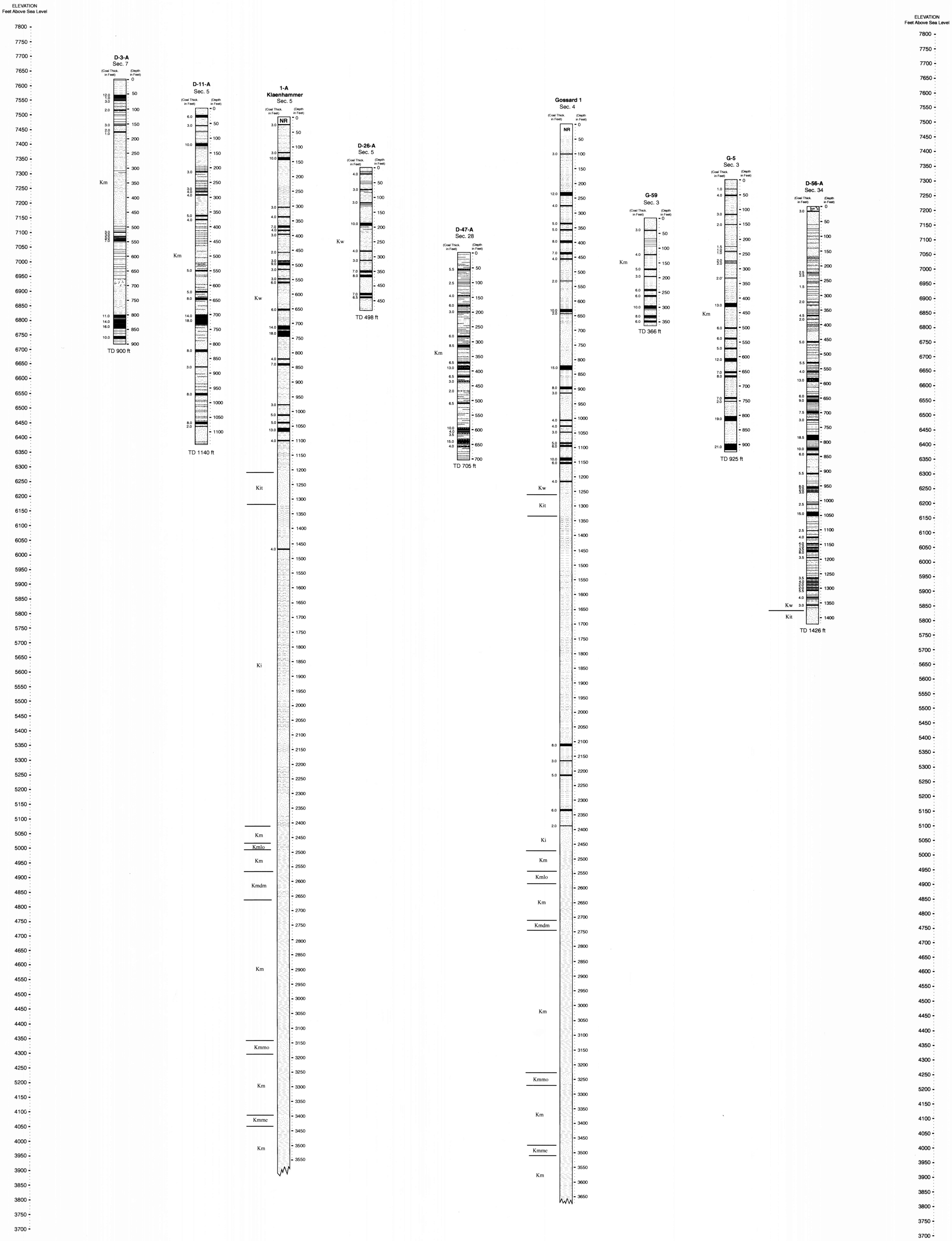
Oil and Gas Well and Coal Exploration Test Holes
Along the Northern Part of Danforth Hills in the Southern Part of the Axial Quadrangle



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