DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

FOLIO OF THE
GILLETTE AREA, WYOMING
MAP I-848-C

ABOUT THE DIAGRAM

The diagram, called a fence diagram, shows the positions and thicknesses of coal beds in the Gillette area. It is based mainly on information from ten localities (A-J; see list near diagram), of which nine are wells and one is a mine, but also takes into account data obtained from many other wells. The top of each post is at the correct surface elevation, and the profiles forming the top lines of the diagram are a general representation of the land surface between points. The vertical distance between the surface profile and a given coal bed therefore measures the depth to that bed. The numbers along the sides of the outside posts indicate elevations above sea level.

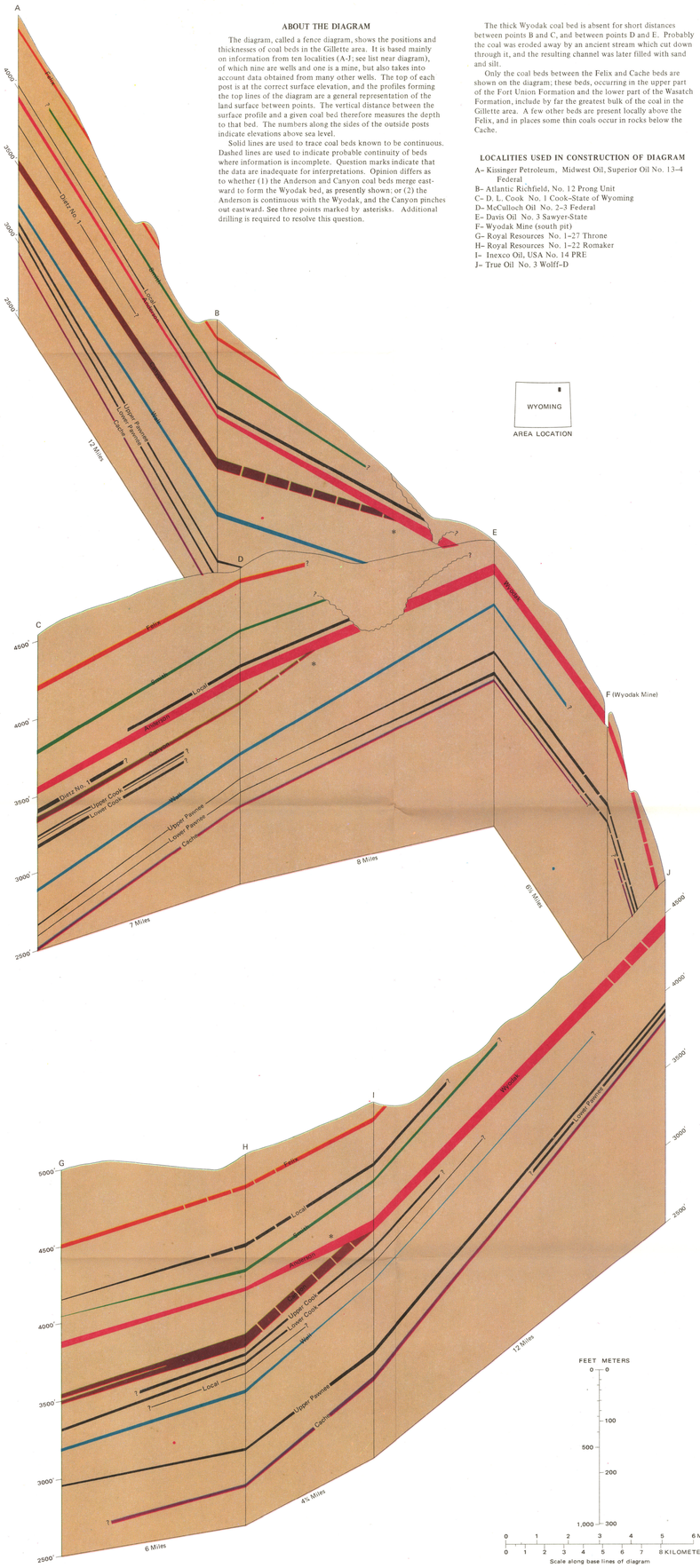
Solid lines are used to trace coal beds known to be continuous. Dashed lines are used to indicate probable continuity of beds where information is incomplete. Question marks indicate that the data are inadequate for interpretations. Opinion differs as to whether (1) the Anderson and Canyon coal beds merge eastward to form the Wyodak bed, as presently shown; or (2) the Anderson is continuous with the Wyodak, and the Canyon pinches out eastward. See three points marked by asterisks. Additional drilling is required to resolve this question.

The thick Wyodak coal bed is absent for short distances between points B and C, and between points D and E. Probably the coal was eroded away by an ancient stream which cut down through it, and the resulting channel was later filled with sand and silt.

Only the coal beds between the Felix and Cache beds are shown on the diagram; these beds, occurring in the upper part of the Fort Union Formation and the lower part of the Wasatch Formation, include by far the greatest bulk of the coal in the Gillette area. A few other beds are present locally above the Felix, and in places some thin coals occur in rocks below the Cache.

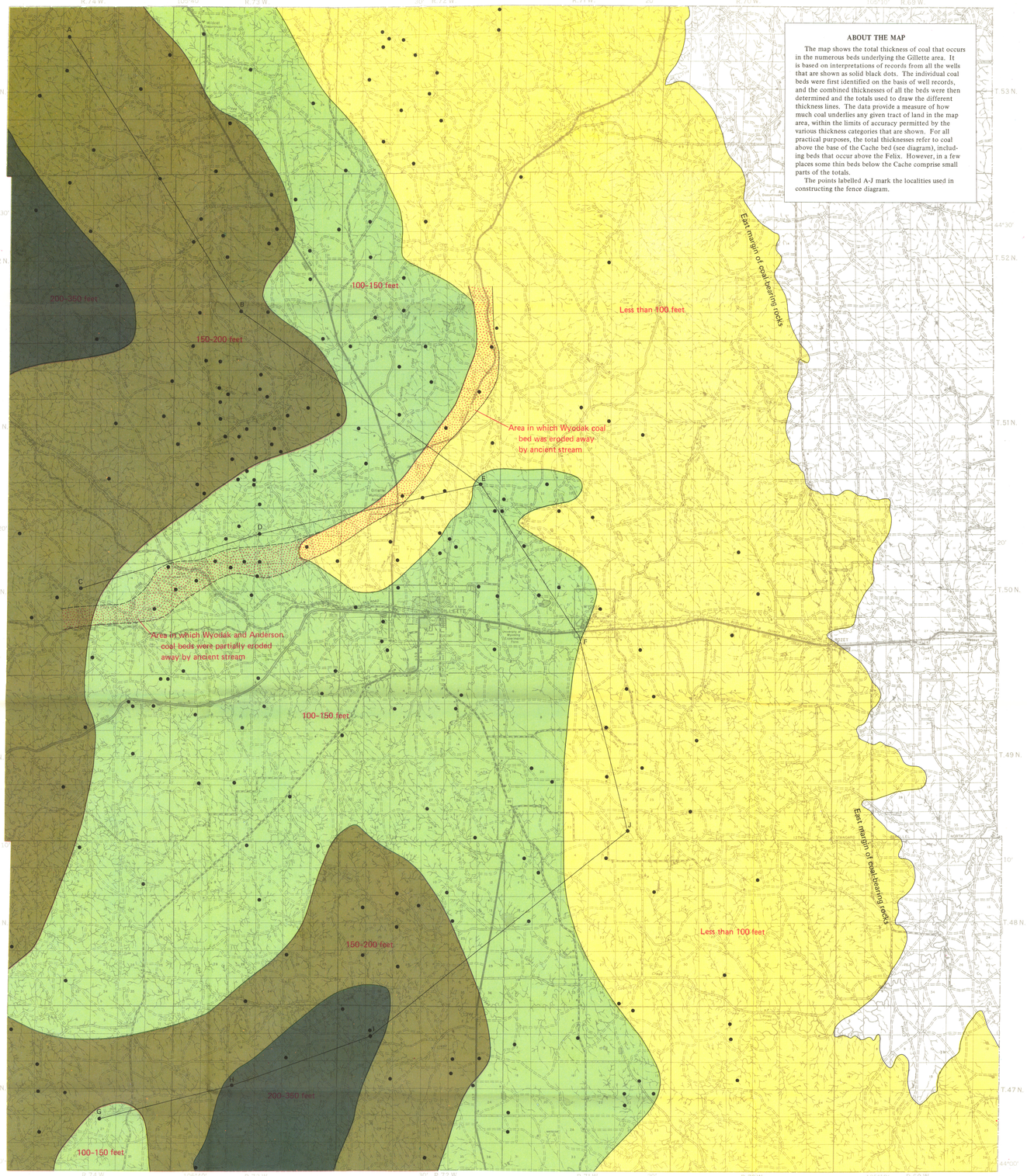
LOCALITIES USED IN CONSTRUCTION OF DIAGRAM

A– Kissinger Petroleum, Midwest Oil, Superior Oil No. 13–4 Federal
B– Atlantic Richfield, No. 12 Prong Unit
C– D. L. Cook No. 1 Cook-State of Wyoming
D– McCulloch Oil No. 2–3 Federal
E– Davis Oil No. 3 Sawyer-State
F– Wyodak Mine (south pit)
G– Royal Resources No. 1–27 Throne
H– Royal Resources No. 1–22 Romaker
I– Inexco Oil, USA No. 14 PRE
J– True Oil No. 3 Wolff-D



AREA LOCATION

DIAGRAM SHOWING DISTRIBUTION AND THICKNESS OF COAL BEDS IN GILLETTE AREA
(Locations of points A-J shown on map)



Base from Wyoming Highway Department, 1956, with main highway system updated to 1969

SCALE 1:125 000

2 0 2 4 6 8 10 MILES
2 0 2 4 6 8 10 KILOMETERS

MAP SHOWING TOTAL THICKNESS OF COAL IN THE GILLETTE AREA

ABOUT THE MAP

The map shows the total thickness of coal that occurs in the numerous beds underlying the Gillette area. It is based on interpretations of records from all the wells that are shown as solid black dots. The individual coal beds were first identified on the basis of well records, and the combined thicknesses of all the beds were then determined and the totals used to draw the different thickness lines. The data provide a measure of how much coal underlies any given tract of land in the map area, within the limits of accuracy permitted by the various thickness categories that are shown. For all practical purposes, the total thicknesses refer to coal above the base of the Cache bed (see diagram), including beds that occur above the Felix. However, in a few places some thin beds below the Cache comprise small parts of the totals.

The points labelled A-J mark the localities used in constructing the fence diagram.

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Compiled in part from unpublished data furnished by G. L. Galyardt, S. L. Grazes, P. T. Hayes, B. E. Law, W. J. Mapel, G. D. Mowatt, and E. M. Schell, U.S. Geological Survey

COAL RESOURCES OF THE GILLETTE AREA, WYOMING

Coal is one of the most vital commodities in a highly industrialized society. In addition to its importance as a major source of energy, it supplies basic raw materials for the manufacture of numerous and varied products – plastics, fertilizers, chemicals, medicines, cosmetics, and many more. Fortunately, coal is an abundant resource in many parts of the United States and the world.

Coal is composed of the hardened remains of trees and other plants that accumulated in swamps, marshes, and bogs, then became deeply buried by younger materials and were subjected to high pressure and temperature. The rank of the coal – whether lignite (lowest), sub-bituminous, bituminous, or anthracite (highest) – depends chiefly on how much of the original gases and liquids was squeezed out of the plant remains as they were being compressed, and on the amount of heating that was encountered during burial.

Conditions favoring the formation of coal existed many times during the last 100 million years or so in the region now occupied by the Powder River Basin. Especially important was that period of earth history extending from about 60 to 50 million years ago, when broad expanses of land in what is now northeastern Wyoming and southeastern Montana were relatively flat and covered by widespread swamps and extensive river flood plains that stood close to sea level (Brown, 1958, p. 111). The climate was probably warm temperate to temperate, and supported dense growths of vegetation – ferns, palms, magnolias, conifers, dogwoods, willows, and many others – over wide areas (Brown, 1962, p. 95–96). Today, following an eventful, 50-million year history of subsidence and deep burial, then uplift and subsequent removal of much overlying material by erosion, the one-time layers of matted plant debris form some of the world's thickest and most extensive coal beds. They are of sub-bituminous rank, and occur in the upper part of the Fort Union Formation and lower part of the Wasatch Formation (which represent the Paleocene and Eocene epochs, respectively, in terms of the geologic time scale) over much of the Powder River Basin. Most individual beds have been given formal names, as shown on the diagram. One especially significant property of the coals is their low sulfur content, which generally averages less than one percent (1%), and hence requires little processing to meet established environmental standards.

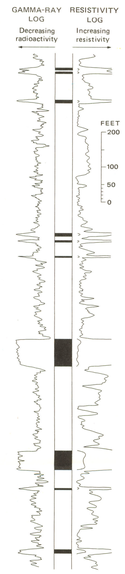
The area surrounding Gillette, Wyoming, is one of the most important coal-bearing areas in the Powder River Basin. The accompanying map and diagram show the combined thickness of all coal beds, and the distribution and depth of individual beds across this area. The interpretations are based on detailed geologic mapping of exposures of the coal-bearing rocks and on the study of records from many wells, most of which were drilled for oil and gas (see sample well log). Although individual coal beds vary from one place to another, owing chiefly to irregularities in the original pattern of deposition of the coal-forming materials, many of them are remarkably persistent over wide areas. In general, total coal thickness, number of beds, and depths to coal increase westward, reflecting the fact that the central part of the Powder River Basin, which lies west of Gillette, sank more than areas along the basin margins did during the period of coal formation.

From the standpoint of energy resources, primary interest in the Gillette area centers on the vast quantities of low-sulfur coal in beds that lie close enough to the ground surface to be strip-mined (for example, the Wyodak and Felix beds are less than 200 feet deep over large areas). Mining activity is increasing annually, bringing with it a host of complex problems.

REFERENCES CITED

Brown, R. W., 1958, Fort Union Formation in the Powder River Basin, Wyoming, *in* Wyoming Geol. Assoc. Guidebook 13th Ann. Field Conf., Powder River Basin, Wyoming, 1958: p. 111–113.

———, 1962, Paleocene flora of the Rocky Mountains and Great Plains: U.S. Geol. Survey Prof. Paper 375, 119 p.



SAMPLE WELL LOGS SHOWING INTERPRETATION OF COAL BED INTERVALS

IDENTIFICATION OF COAL BEDS IN WELLS

Because only a small percentage of the coal beds present in the Gillette area can be observed in surface exposures, much of the information concerning them must come from drill holes. Cores provide the best data on coals penetrated by wells; however, most of the wells in the area have been drilled chiefly for oil and gas and the coal-bearing rocks have not been cored extensively in many places. Where drill cores are absent, a variety of well logs are used to interpret the kinds of rocks encountered in wells. In the present study, the detection of coal beds beneath the ground surface is based primarily on examinations of gamma-ray and resistivity logs. Because the coals are virtually non-radioactive and are highly resistant to the passage of electrical currents, they show up conspicuously on these two types of logs, as shown above. Of the two, gamma-ray logs are generally considered to be the most reliable for identifying individual coal beds, but if both logs are available for a given well the degree of accuracy is substantially increased.

COAL RESOURCES OF THE GILLETTE AREA, WYOMING

By

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1973

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