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By Michael E. Brownfield, Jesse G. Self, and Tracey J. Mercier

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Chapter 2–Fischer Assay Histograms of Oil-Shale Drill Cores and Cuttings from the Great Divide, Green River, and Washakie Basins, Southwestern Wyoming

By Michael E. Brownfield, Jesse G. Self, and Tracey J. Mercier[1]

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Abstract

This CD–ROM chapter presents oil-yield histograms of samples of cores and cuttings from exploration drill holes in the Eocene Green River Formation in the Great Divide, Green River, and Washakie Basins of southwestern Wyoming. A database was compiled that includes about 47,000 Fischer assays from 186 core holes and 240 rotary drill holes. Most of the oil yield data are from analyses performed by the former U.S. Bureau of Mines oil shale laboratory in Laramie, Wyoming, with some analyses made by private laboratories. Location data for 971 Wyoming oil-shale drill holes are listed in a spreadsheet that is included in the CD–ROM.

These Wyoming Fischer assays and histograms are part of a much larger collection of oil-shale information, including geophysical and lithologic logs, water data, chemical and X-ray diffraction analyses on the Green River oil-shale deposits in Colorado, Utah, and Wyoming held by the U.S. Geological Survey. Because of an increased interest in oil shale, this CD–ROM containing Fischer assay data and oil-yield histograms for the Green River oil-shale deposits in southwestern Wyoming is being released to the public.

Microsoft Excel spreadsheets included with this chapter contain the Fischer assay data from the 426 holes and data on the company name and drill-hole name, and location. Histograms of the oil yields obtained from the Fischer assays are presented in both Grapher and PDF format. Fischer assay text data files are also included in the CD–ROM.

Introduction

For several decades, the U.S. Geological Survey (USGS) has collected cores and cuttings and other subsurface data from boreholes drilled in the Eocene Green River Formation oil-shale deposits in the Great Divide, Green River, and Washakie Basins of southwestern and south-central Wyoming (fig. 1). These data were collected and preserved for use by researchers and industry in anticipation of the time when Green River oil-shale deposits would become an economically practical alternate source of fossil energy.

In Wyoming, the Green River Formation (fig. 2) was deposited in Lake Gosiute during the early to middle Eocene. The richest oil-shale deposits are in the Wilkins Peak, Tipton Shale, and Laney Members (Roehler, 1992); as many as 77 persistent beds of oil shale were identified in the Wilkins Peak Member by Roehler (1992).

The types of data collected include: (1) thousands of Fischer (shale-oil) assays (American Society for Testing and Materials, 1980) on cores and on cuttings from rotary-drilled holes; (2) geophysical and lithologic logs of drill holes; (3) chemical, water-quality, X-ray diffraction analyses; and (4) rock mechanics data. Fischer assay data and histograms for 426 drill holes, of which 186 were cored, are included in this report. Figure 3 shows the general locations of these drill holes and 480 other drill holes without analyzed samples. More than 47,000 samples were analyzed. Although this data set is far from complete, it most likely represents the largest single source of available subsurface information on the Green River Formation oil-shale deposits in southwestern Wyoming.

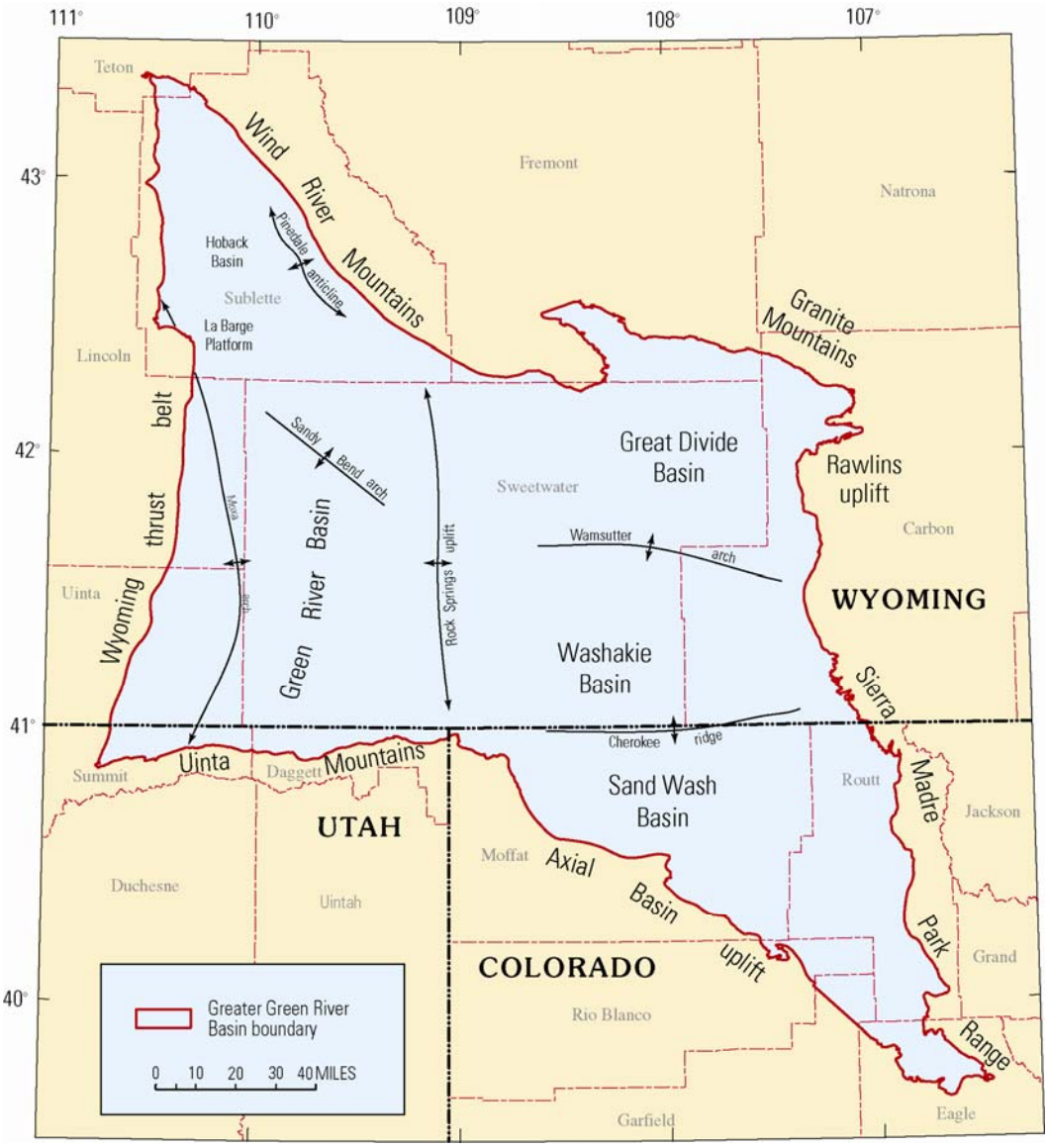

Figure 1. Map showing boundary of Greater Green River Basin and areas of Green River, Great Divide, Washakie, and Sand Wash Basins, county lines, and major geologic structures and uplifts in southwestern Wyoming, northwestern Colorado, and northeastern Utah. Modified from Finn and others (2005).

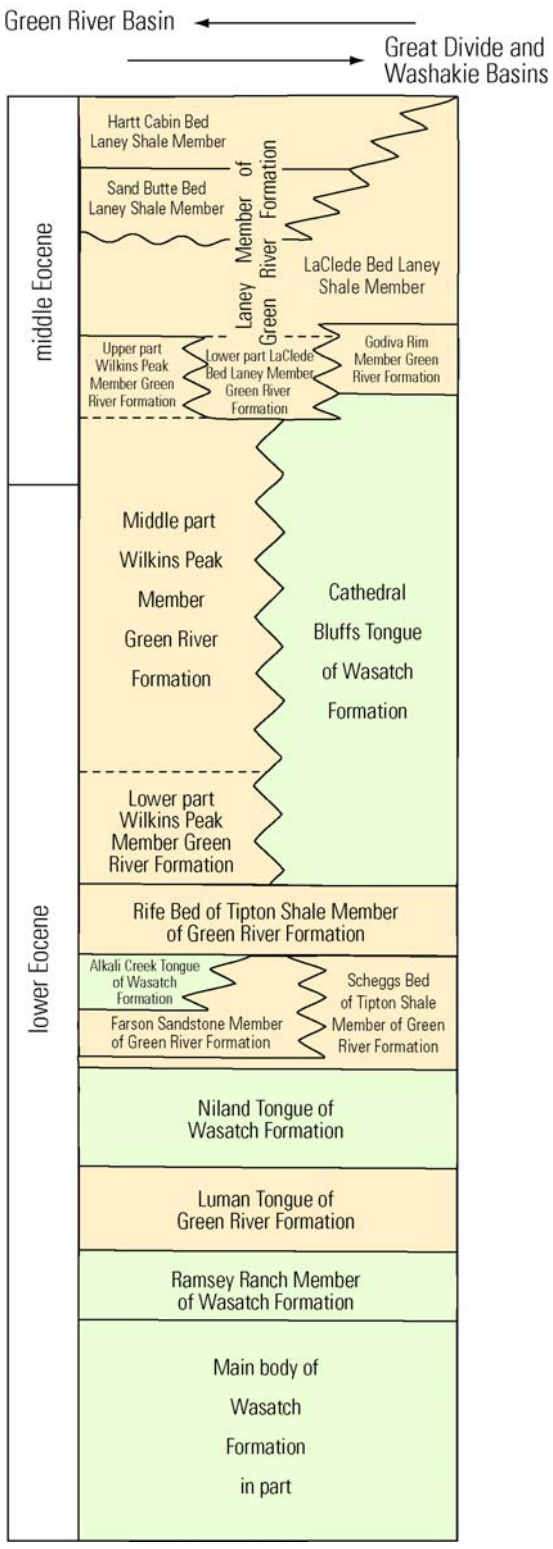

Figure 2. Lower and middle stratigraphic units in the Green River, Great Divide, and Washakie Basins, Wyoming, Colorado, and Utah. Eocene oil-shale-bearing Green River Formation shown in tan. Modified from Roehler (1992).

Most of the Fischer assays on oil-shale samples were conducted by the former U.S. Bureau of Mines (USBM) laboratory in Laramie, Wyoming (Dyni, 1998), with some also done by private laboratories. From the late 1940s to the early 1980s, the USBM analyzed core splits and drill cuttings from holes drilled by Federal agencies in the Green River Formation oil-shale deposits in Wyoming, Colorado, and Utah. A large amount of data was also obtained from energy companies that drilled exploratory holes on private or leased oil-shale lands in the region. Many of these companies generously donated analytical data as well as drill cores and cutting samples, which are being stored by the USGS.

CD–ROM

This CD–ROM chapter reports on data from three root directories: Assays, Spatial, and Spreadsheets. The Assays directory contains column-delimited and text files for 426 drill holes with Fischer assay data; the name, location, and operator data for each drill hole is in Record 1. Definitions for data fields included in these files are in Chapter 1 (Dyni and others, this CD–ROM). The Spatial directory contains spatial data for these drill holes and the 480 additional ones that have no analyzed samples. These drill holes are shown on figure 3. The majority of the locations were digitized using ArcGIS v. 9.1, based on footage measurements east and west of Public Land Survey System (PLSS) section corners contained in the original database. A custom tool described in Chapter 1 was used to measure and place points. Source PLSS files used for plotting locations were obtained from the Bureau of Land Management in Wyoming and projected to North American Datum 27 (NAD27). Where footage measurements were not available, locations were digitized as being in the center of the quarter-quarter section, quarter section, or the center of the section—that is, the best location data available in the original database were used. In a minimal number of cases where location data in the original database

were questionable, locations were verified using the State of Wyoming Oil and Gas Conservation Commission's online database. ASCII and Google Earth KML file formats of the locations of the drill holes are also included in the Spatial folder. The Spreadsheets

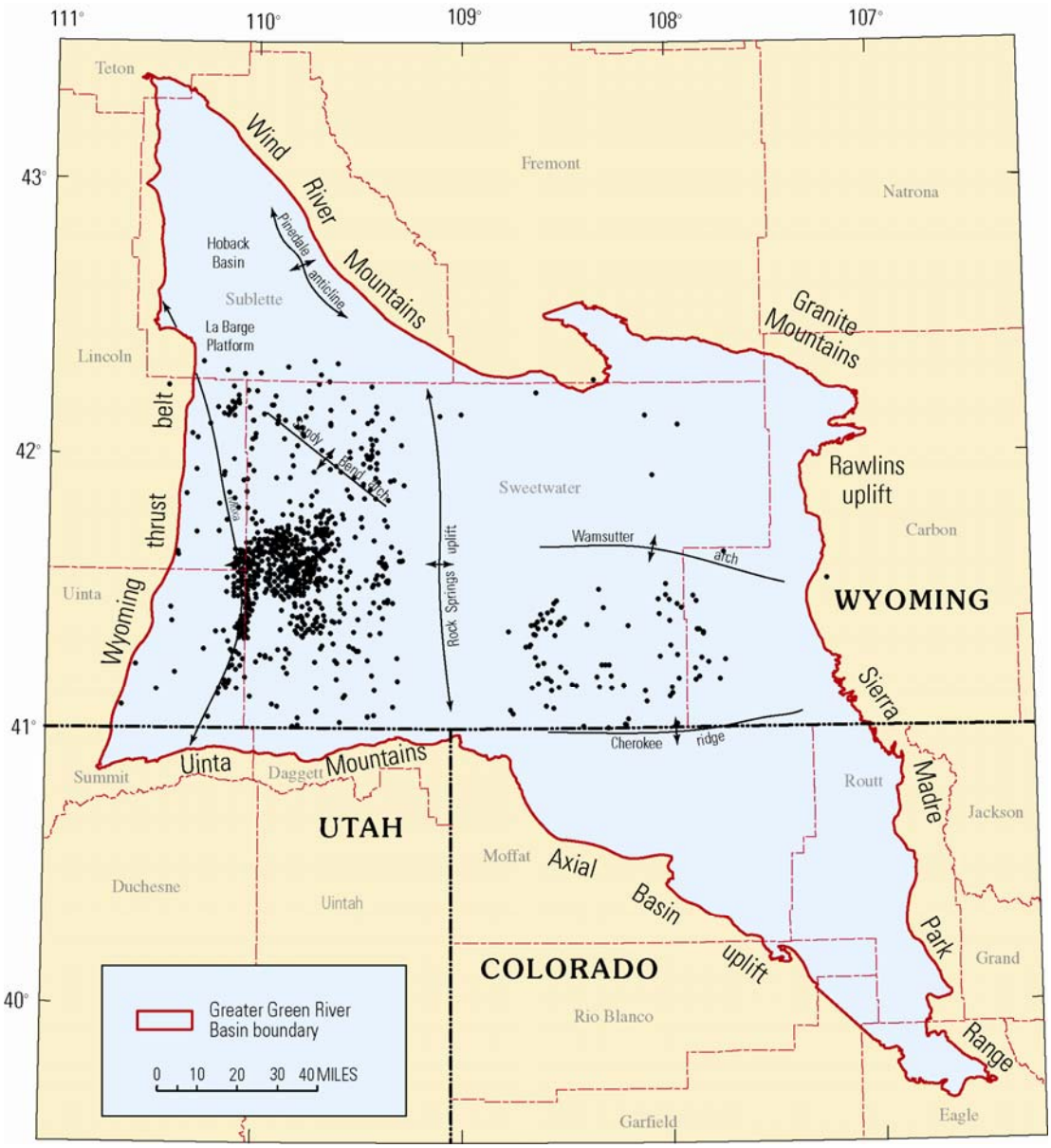

Figure 3. Map showing the approximate locations of 906 drill holes included in the Wyoming oil-shale assay database (WY_oil_Shale_Assays.xls), southwestern Wyoming. See figure 1 for locations of basins in the Greater Green River Basin.

folder includes two Microsoft EXCEL spreadsheets (WY_Borehole_Info.xls; WY_Oil_Shale_Assays.xls) and one Microsoft Access database (Wy_Oil_Shale_Assays.mdb). The Chapter 2 directory contains this document and two subdirectories: (1) the Grapher subdirectory, containing 427 Grapher 7 (Golden Software, Inc., Golden, Colorado) plot files for Fischer assay oil-yield data (two plots were created for one deep hole) in both Grapher and Adobe PDF format; and (2) the Histogram subdirectory containing the same files in scaled Adobe PDF format (Adobe Systems, Inc., San Jose, Calif.).

The WY_Oil_Shale_Assays.xls spreadsheet includes 47,003 assays from the original laboratory Fischer assay reports, such as those shown as images in the Images folder in the Chapter 1 folder (Dyni and others, this CD–ROM). The WY-Borehole_Info.xls spreadsheet contains information on 971 core and rotary holes and oil and gas tests, as well as a few surface sections of oil shale. The file includes well locations, operator and well name, surface elevation, core-hole location when known, depths of lithologic log units, geophysical logs that were run, and other data. The approximate locations of 906 drill holes included in the assay data file are shown in figure 3.

The Fischer assay data (Assay folder) included in this CD–ROM are presented in spreadsheet format (WY_Oil_Shale_Assays.xls). In a few cases, two data sets are listed for the same drill-hole number—rotary-drilled holes are identified by the suffix "R" following the USGS drill-hole number, whereas core holes have no suffix after the drill-hole number. Table 1 defines the column headers in the Fischer assay data spreadsheet.

Where samples were not analyzed, the Fischer assay data fields are represented by "0.0" to allow for a continuous histogram to be created. Missing sample intervals can be detected in the database by the lack of a USBM laboratory number (LABNO, table 1) followed by "0.0" in all of the Fischer assay data fields.

Column-delimited and text data files (Assays folder) included in this CD–ROM contain Fischer assay data and information on the drill hole including company name and drill-hole name and the drill-hole location. In the text data files, samples not analyzed are represented by "0.000B" in all of the Fischer assay data fields. Missing sample intervals can be located in text files by the lack of a USBM laboratory number followed by "0.0B" in all of the Fischer assay data fields.

Table 1. Names and definitions for the column headers for the Fischer assay data spreadsheet (WY_oil_Shale_Assays.xls). USGS, U.S. Geological Survey; Wyo., Wyoming.

Column name	Column definition
USGSID	Unique drill-hole number assigned by the USGS
LABNO	U.S. Bureau of Mines, Laramie, Wyo., laboratory number
TOPFT	Depth, in feet, measured from surface datum to top of sampled interval
BOTFT	Depth, in feet, measured from surface datum to base of sampled interval
SHLOILPT	Amount of shale oil in weight percent
WATERPT	Amount of water in weight percent
SHLRSDPT	Amount of shale residue in weight percent
GASPLSLSPT	Amount of "gas plus loss" in weight percent
OILGLTON	Shale oil in U.S. gallons per short ton of rock
WTRGLTON	Water in U.S. gallons per short ton of rock
SPCFGRAV	Specific gravity of shale oil
CIJETEBD	Tendency for spent shale to coke

Oil-Yield Histograms

Oil-shale-yield histograms were created for 426 holes in Grapher 7 (Golden Software, Inc., Golden, Colo.) and included in this CD–ROM as Grapher plot (W0001.grf) and PDF (W0001_grf.pdf) file formats. The histograms were created using the "Step Plot" feature in Grapher 7 and a renamed copy (WY_Assays.xls) of the assays database (WY_Oil_Shale_Assays.xls). This database is necessary to access the Grapher plot files with the Grapher 7 software (Golden Software, Inc., Golden, Colo.). The step plots (histograms) were then exported in PDF (W0001_grf.pdf) format (Grapher folder) and imported in Adobe

Illustrator where the histograms were scaled vertically to 1 inch = 50 feet and exported in PDF (w0001.pdf) format (Histogram folder). In one case, two histograms were created because the plots would not fit the maximum page size in Adobe Illustrator (W0341R_part1.pdf; W0342R_part2.pdf). As with the Fischer assay data, the rotary-drilled holes are identified by the suffix "R," following the USGS drill-hole number and the core holes have no suffix after the drill-hole number.

If errors or omissions of data are found in this disc, users are encouraged to contact Michael E. Brownfield at **mbrownfield@usgs.gov**, Ronald C. Johnson at **rcjohnson@usgs.gov**, or John Dyni at **jdyni@usgs.gov**.

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