Chapter 5

Fischer Assay Histograms of Oil Shale Drill Cores and Cuttings from the Uinta Basin, Utah and Colorado

Click here to return to
Volume Title Page

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

Chapter 5 of 7
Oil Shale Resources of the Uinta Basin, Utah and Colorado

By U.S. Geological Survey Oil Shale Assessment Team

U.S. Geological Survey Digital Data Series DDS–69–BB

U.S. Department of the Interior
U.S. Geological Survey

U.S. Department of the Interior
KEN SALAZAR, Secretary

U.S. Geological Survey
Marcia K. McNutt, Director

U.S. Geological Survey, Reston, Virginia: 2010

Suggested citation:
Self, J.G., Brownfield, M.E., Johnson, R.C., and Mercier, T.J., 2010, Fischer assay histograms of oil shale drill cores and cuttings from the Uinta basin, Utah and Colorado: U.S. Geological Survey Digital Data Series DDS–69–BB, chp. 5, 8 p.

Contents

Plate

Figures

Tables

Fischer Assay Histograms of Oil Shale Drill Cores and Cuttings from the Uinta Basin, Utah and Colorado

By Jesse G. Self, Michael E. Brownfield, Ronald C. Johnson, and Tracy J. Mercier

Introduction

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 Uinta Basin of northeastern Utah and northwestern Colorado. A database was compiled that includes 112,603 Fischer assays from 587 oil shale exploration holes. Most of the oil-yield data are from analyses performed by the former U.S. Bureau of Mines oil shale laboratory in Laramie, Wyo. with some analyses made by private laboratories. Location data for these 587 Utah oil shale drill holes are listed in a spreadsheet that is included in the CD–ROM.

These Utah 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 Utah, Colorado, and Wyoming held by the U.S. Geological Survey (USGS). Because of an increased interest in oil shale, this CD–ROM, which contains information on the Uinta Basin oil shale deposits in eastern Utah, is being released to the public. The Fischer assay data and oil-yield histograms from the Uinta Basin can be found in this chapter.

Microsoft Excel spreadsheets included with this chapter contain the Fischer assay data from the 587 holes, as well as data on the operator, drill-hole name, and well location. Histograms of the oil yields obtained from the Fischer assays are presented in Adobe PDF format. Fischer assay text-data files are also included in the CD–ROM.

For several decades, the USGS has collected core, cuttings, and other subsurface data from boreholes drilled to evaluate the oil shale deposits in the Eocene Green River Formation in the Uinta Basin of northeastern Utah and northwestern Colorado. In the Uinta Basin, the Green River Formation was deposited in Lake Uinta during early to middle Eocene time. Initially, Lake Uinta formed in an interior drainage basin that included both the present areas of the Uinta and Piceance Basins. Later, during the Long Point transgression, the lake expanded to cover both basins, but again became separate following the rise of the intervening Douglas Creek Arch (fig. 1; Johnson, 1985). The Long Point transgression marks the beginning of the deposition of the Garden Gulch, Parachute Creek, and Douglas Creek Members of the Green River Formation (fig. 2), with the richest oil shales deposited in the Garden Gulch and Parachute Creek Members. It was from this area rich in oil shale that 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.

The types of data collected include (1) thousands of Fischer (oil shale) assays (American Society for Testing and Materials, 1980) on cores and cuttings from rotary-drilled holes; (2) geophysical and lithologic logs of drill holes; (3) chemical, water-quality, and X-ray diffraction analyses; as well as (4) rock mechanics data. Fischer assay data and histograms for 587 drill holes, of which 365 were cored, are included in this chapter. Plate 1 shows the general locations of these drill holes in northeastern Utah and northwestern Colorado. Each drill hole was assigned a unique 4-digit number preceded by "U" for Utah (for example, U0001). The database created for this assessment contains 112,603 samples. 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 northeastern Utah and northwestern Colorado.

Most of the Fischer assays on oil shale samples were conducted by the former U.S. Bureau of Mines (USBM) laboratory in Laramie, Wyo. (Dyni and others, 2006; Vanden Berg and others, 2006), with some 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 Utah, Colorado, and Wyoming. 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 chapter in the CD–ROM reports data from three directories: Histograms, Spatial, and Spreadsheets. The Histogram directory contains oil-yield histograms, in scaled

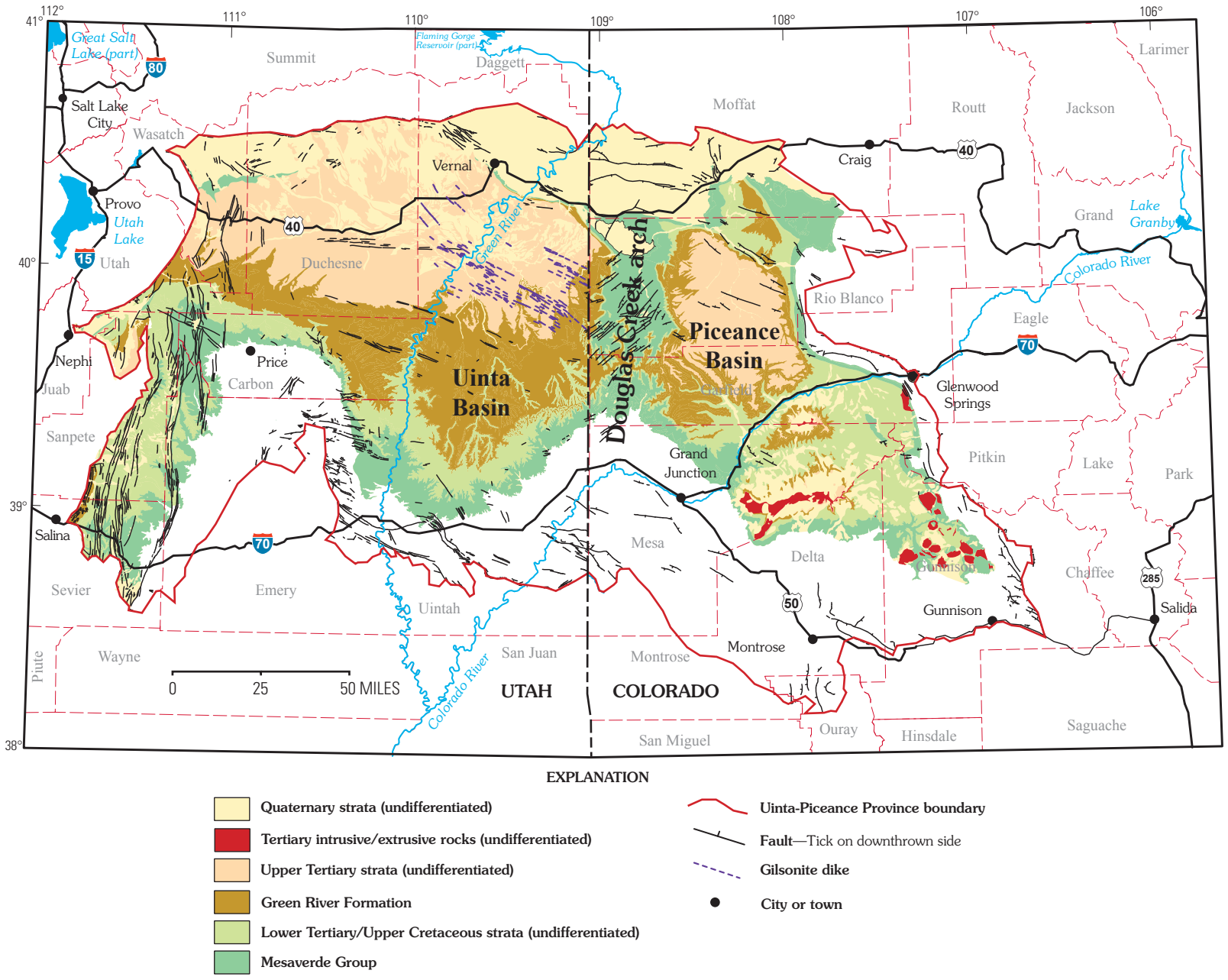

Figure 1. Geologic map of the Uinta and Piceance Basins, northeastern Utah and northwestern Colorado, showing Upper Cretaceous and Lower Tertiary units.

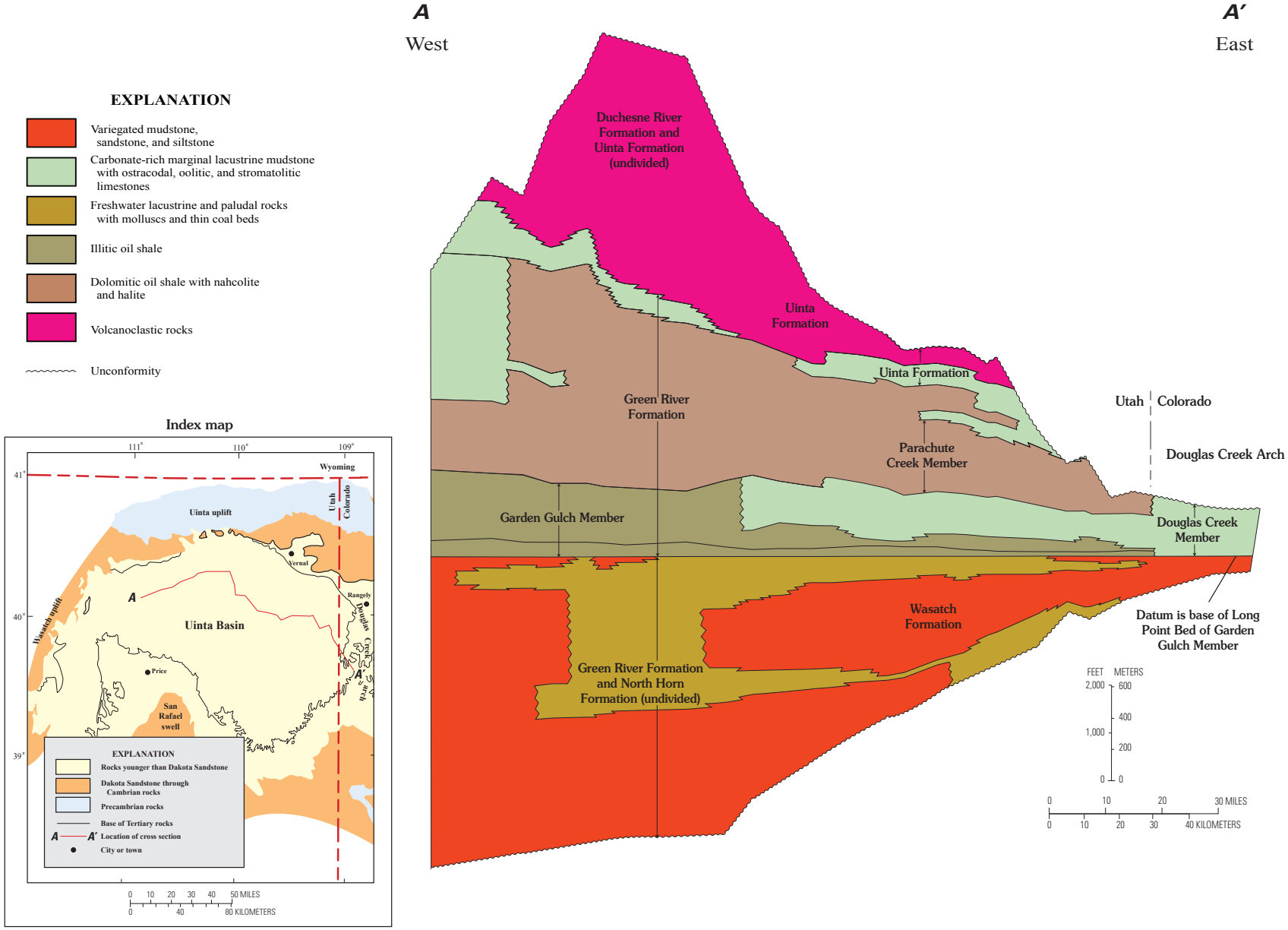

Figure 2. Tertiary stratigraphic column for the Uinta Basin, northeastern Utah and northwestern Colorado, showing the Wasatch, North Horn, Green River, Duchesne River, and Uinta Formations and associated members.

Adobe PDF format (Adobe Systems, Inc., 2007), for 587 drill holes with Fischer assay data. The Spatial directory contains data for these drill holes along with 109 additional wells that have no analyzed samples. These 109 drill holes are included on plate 1. The majority of the locations were digitized using ArcGIS ver. 9.1 (ESRI, 2005) based on footage measurements, east and west of Public Land Survey System (PLSS) section corners contained in the original database. Source PLSS files used for plotting locations were obtained from the U.S. Bureau of Land Management (BLM) in Utah 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, the 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 Utah Division of Oil, Gas, and Mining, and the State of Colorado Oil and Gas Conservation Commission's online databases. ASCII and Google Earth keyhole markup language (KML) file formats of the locations of the drill holes are also included in the Spatial folder.

The Spreadsheets folder includes Microsoft EXCEL (Microsoft Corp., 2006) spreadsheets (UT_Oil_Shale_Assays.xlsx; UT_Borehole.xlsx). The UT_Borehole.xlsx spreadsheet contains information on 587 core and rotary holes with Fischer assays, and the 109 holes without analyses. The drill holes are sorted by the USGS's unique 4-digit borehole number (U0001). 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. Table 1 defines the column headers in the Utah reference spreadsheet.

The Fischer assay data (Spreadsheet folder) included in this CD–ROM are presented in spreadsheet format (UT_Oil_Shale_Assays.xlsx). The UT_Oil_Shale_Assays.xlsx spreadsheet includes the 112,603 assays from the original laboratory Fischer assay reports. In a few cases, separate analyses were taken from the same drill hole and these sets of data are labeled with an "A" or "B" suffix following the drill-hole number. Rotary-drilled holes are identified by the suffix "R" following the USGS drill-hole number, whereas core holes have no "R" suffix after the drill-hole number. Table 2 defines the column headers in the Fischer assay data sets.

Where samples were not analyzed, the Fischer assay data fields are represented by "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 2) followed by "0" in all of the Fischer assay data fields.

Oil-Yield Histograms

Oil shale-yield histograms were created for the 587 holes with Fischer assay data in Grapher 7 (Golden Software, Inc., 2007) and saved in standard Grapher file format (u0001.grf). Due to restrictions on spreadsheet size in Grapher 7 the single EXCEL spreadsheet (UT_Oil_Shale_Assays.xlsx) had to be divided into three smaller EXCEL spreadsheets (U1–U250.xls, U251–U450.xls, and U451–U639.xls) which are also included in the Spreadsheet folder on this CD–ROM. The histograms were created using the "Step Plot" feature in Grapher 7 using data from one of the three newly created spreadsheets (for example U1–U250.xls). Once created, the histograms (or step plots) were then exported in PDF (U0001.pdf) format and opened in Adobe Illustrator CS3, where they were scaled vertically to 1 in. = 50 ft and exported again in PDF format (U0001.pdf, 69_BB_CH_5_SUP, Histogram folder). Figure 3 is an example of part of the oil-yield histogram plot for a borehole in the Histogram folder. As with the Fischer assay data, histograms of rotary-drilled holes are identified by the suffix "R," following the USGS drill-hole number and the core holes have no "R" suffix after the drill-hole number. Similarly, histograms of drill holes with two separate analyses are labeled with an "A" or "B" suffix. Due to document size restrictions within Adobe Illustrator CS3 (Adobe Systems, Inc., 2007), a few of the histograms created from the deeper wells had to be split into two parts and were labeled accordingly (for example U0316Rpart1.pdf and U0316Rpart2.pdf).

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

Table 1. Names and definitions from the column headers for the Utah oil shale borehole information spreadsheet (UT_Borehole.xlsx)

[USGS, U.S. Geological Survey; ID, identification; 3D, three dimension]

Column name	Column definition
USGSID	Unique ID assigned by staff geologist
OPERATOR	Name of the company or agency that drilled the borehole or project name
WELLNAME	Name of the borehole assigned by the company or agency that drilled it
API	American Petroleum Institute ID number
ALTAPI	Alternate American Petroleum Institute ID number
COUNTY	Name of county in Utah
TOWNSHIP	Township
RANGE	Range
SECTION	Section
QTRQTR	Quarter-quarter section
MERIDIAN	Principal meridian used: Salt Lake (SL) or Uinta (UN) meridian
UTME	Universal Transverse Mercator easting
UTMN	Universal Transverse Mercator northing
LATITUDE	Latitude, in decimal degrees, North American Datum 1927, software-calculated, original record
LONGITUDE	Longitude, in decimal degrees, North American Datum 1927, software-calculated, original record
EW	Distance, in feet, measured east or west from section line
NS	Distance, in feet, measured north or south from section line
YRDRILLED	Year that the borehole was drilled
TD	Total depth of the borehole, in feet
ELGRND	Elevation, in feet, of ground level at borehole
ELKELBUSH	Elevation, in feet, of Kelly bushing at borehole
ELDRLFRM	Elevation, in feet, of drill platform
CORETOP	Depths, in feet, of top of the interval that was cored in the borehole
COREBOT	Depths, in feet, of bottom of the interval that was cored in the borehole
CORELOC	Physical location of the core from core hole, for example, USGS Core Research Center
CUTTOP	Depths, in feet, of top of the interval that cuttings were collected from the borehole
CUTBOT	Depths, in feet, of bottom of the interval that cuttings were collected from the borehole
CUTLOC	Physical location of the cuttings from core hole, for example, USGS Core Research Center
FISCHTOP	Depths, in feet, of top of the sequence analyzed by Fischer assays
FISCHBOT	Depths, in feet, of bottom of the sequence analyzed by Fischer assays
TOTASSAYS	Number of Fischer assays that were made
NUMGT25	Number of Fischer assay samples with greater than 25 gallons per ton
ASSAYLAB	Name of laboratory where Fischer assays were performed
LITHLOGTOP	Depths, in feet, of top of the sequence of core or rotary cuttings for which a lithologic log was prepared
LITHLOGBOT	Depths, in feet, of bottom of the sequence of core or rotary cuttings for which a lithologic log was prepared
LOGLOC	Location of Geophysical logs
DENSTOP	Depths, in feet, of top of the density log of borehole
DENSBOT	Depths, in feet, of bottom of the density log of borehole
NEUTTOP	Depths, in feet, of top of the neutron log of borehole
NEUTBOT	Depths, in feet, of bottom of the neutron log of borehole
SONICTOP	Depths, in feet, of top of the sonic log of borehole
SONICBOT	Depths, in feet, of bottom of the sonic log of borehole

Table 1. Names and definitions from the column headers for the Utah oil shale borehole information spreadsheet (UT_Borehole.xlsx).—Continued

[USGS, U.S. Geological Survey; ID, identification; 3D, three dimension]

Column name	Column definition
ELECBOT	Depths, in feet, of bottom of the electric log of borehole
GAMMATOP	Depths, in feet, of top of the gamma ray log of borehole
GAMMABOT	Depths, in feet, of bottom of the gamma ray log of borehole
CALIPTOP	Depths, in feet, of top of the caliper log of borehole
CALIPBOT	Depths, in feet, of bottom of the caliper log of borehole
TEMPTOP	Depths, in feet, of top of the temperature log of borehole
TEMPBOT	Depths, in feet, of bottom of the temperature log of borehole
CEMENTTOP	Depths, in feet, of top of the cemented interval of borehole
CEMENTBOT	Depths, in feet, of bottom of the cemented interval of borehole
3DVELTOP	Depths, in feet, of top of the 3D velocity log of borehole
3DVELBOT	Depths, in feet, of bottom of the 3D velocity log of borehole
ELASTTOP	Depths, in feet, of top of the elastic properties log of borehole
ELASTBOT	Depths, in feet, of bottom of the elastic properties log of borehole
COMPROTOP	Depths, in feet, of top of the compensated density log of borehole
COMPROBOT	Depths, in feet, of bottom of the compensated density log of borehole
SPINTOP	Depths, in feet, of top of the spontaneous potential and conductivity log of borehole
SPINBOT	Depths, in feet, of bottom of the spontaneous potential and conductivity log of borehole
RADTRCTOP	Depths, in feet, of top of the radioactive tracer log of borehole
RADTRCBOT	Depths, in feet, of bottom of the radioactive tracer log of borehole
LOGLOC2	Location of geophysical logs

Table 2. Names and definitions for the column headers for the Fischer assay data spreadsheet (UT_Oil_Shale_Assays.xlsx).

[USGS, U.S. Geological Survey; Wyo.,Wyoming; ID, identification]

Column name	Column definition
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
SHLOILPCT	Amount of shale oil, in weight percent
WATERPCT	Amount of water, in weight percent
SHLRSDPCT	Amount of shale residue, in weight percent
GASPLSPCT	Amount of "gas plus loss," in weight percent
OILGPT	Oil yield, in U.S. gallons per short ton of rock
WTRGPT	Water, in U.S. gallons per short ton of rock
SPCFGRAV	Specific gravity of shale oil
COKETEND	Tendency for spent shale to coke
USGSID	Unique drill-hole number assigned by the USGS

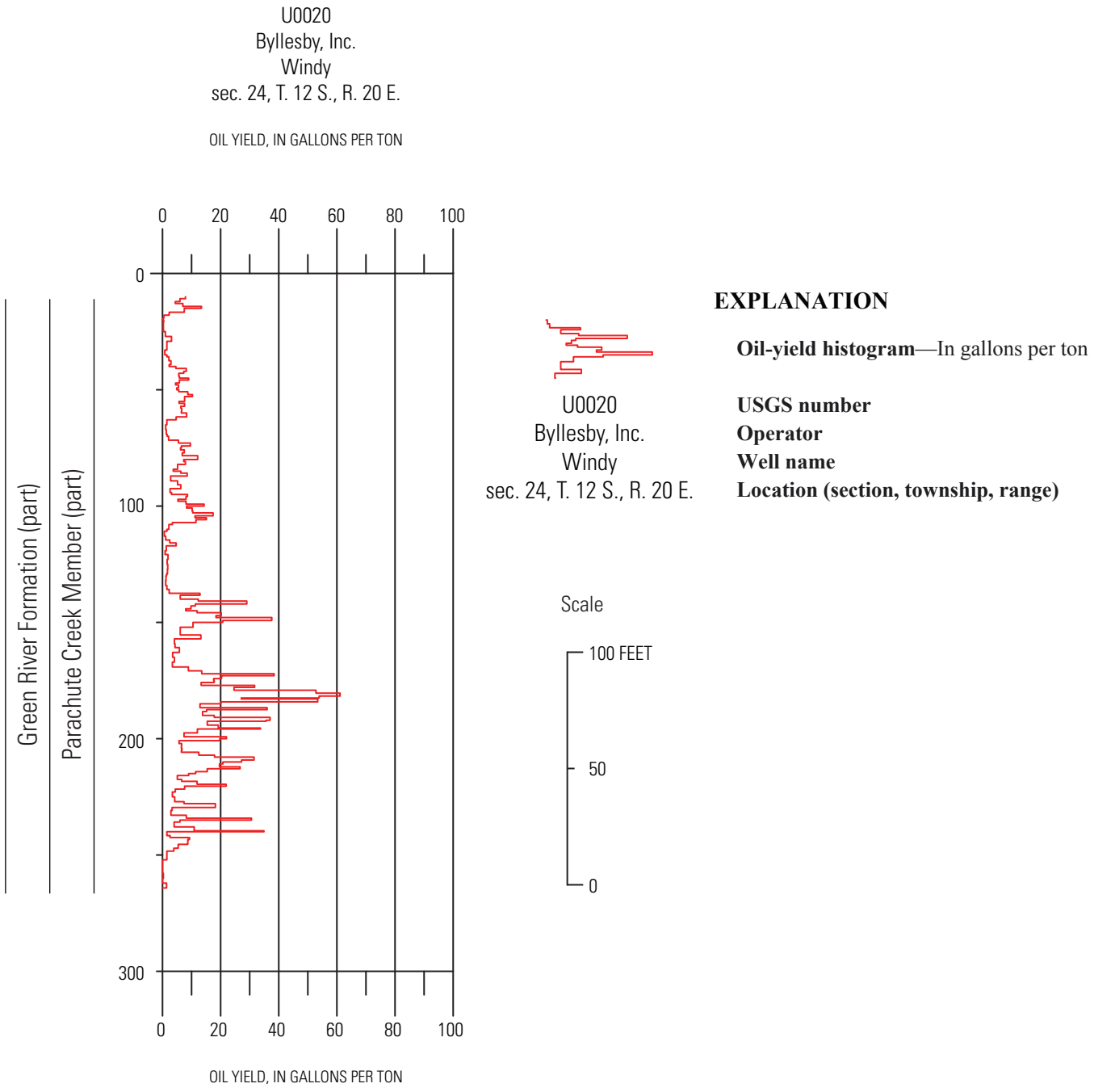

Figure 3. Part of the histogram plot showing Fischer assay oil-yield data, in gallons per ton, for borehole U0020; with sampling from the Parachute Creek Member of the Green River Formation in the Uinta Basin, northeastern Utah and northwestern Colorado.

References Cited

Adobe Systems, Inc., 2007, Adobe Design Premium CS3, San Jose, Calif.

American Society for Testing and Materials, 1980, Standard method of test for oil from oil shale: Annual Book of ASTM Standards, Part 25, Designation D 3904-80, p. 513–515.

Dyni, J.R., Donnell, J.R., Vanden Berg, M.D., and Tabet, D.E., 2006, Preliminary Utah oil shale database: U.S. Geological Survey Open-File Report OF-2006–1295, CD–ROM.

ESRI (Environmental Systems Research Institute), 2005, ArcGIS ver. 9.1, Redlands, Calif.

Golden Software, Incorporated, 2007, Grapher 7.

Johnson, R.C., 1985, Early Cenozoic history of the Uinta and Piceance Creek Basins, Utah and Colorado, *with special reference to* the development of Eocene Lake Uinta United States: Rocky Mountain Section, Society of Economic Paleontologists and Mineralogists: Denver, Colo., p. 247–276.

Microsoft Corporation, 2006, Microsoft Access and Excel (part of Microsoft Office 2007).

Vanden Berg, M.D., Dyni, J.R., and Tabet, D.E., 2006, Utah oil shale database: Utah Geological Survey Open-File Report 469, CD–ROM.

Click here to return to
Volume Title Page