

Open Copy

Open-file Report 77-271

Open-file Report 77-271

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SUBSURFACE GEOLOGY AND STRUCTURE IN THE VICINITY
OF THREE DRILL HOLES IN PICEANCE CREEK BASIN,
RIO BLANCO COUNTY, COLORADO

By

R. P. Snyder and S. S. Terry

1977

CONTENTS

	Page
ABSTRACT-----	1
INTRODUCTION-----	1
DRILL HOLE USBM-01-----	2
DRILL HOLE USBM-01A-----	7
DRILL HOLE USBM-02A-----	8
CORE RECOVERY, CONDITION, AND CORE INDEX-----	8
STRUCTURE-----	11
REFERENCES CITED-----	16
LITHOLOGIC DESCRIPTIONS OF CUTTINGS AND CORES FROM U.S. BUREAU OF MINES	
DRILL HOLES-----	17
<i>Cuttings from drill hole USBM-01</i> -----	18
<i>Core from drill hole USBM-01</i> -----	22
<i>Cuttings from drill hole USBM-01A</i> -----	37
<i>Core from drill hole USBM-01A</i> -----	40
<i>Core from drill hole USBM-02A</i> -----	54

ILLUSTRATIONS

	Page
Figure 1.--Location map of Piceance Creek Basin, Colorado-----	3
2.--Location map of sites for drill holes USBM-01, USBM-01A, and USBM-02A-----	4
3.--Graph showing lithology, structure, and core index of drill holes USBM-01, 01A, and 02A-----	[in pocket]
4.--Cross section from USBM-01 to USBM-02A-----	5
5.--Map showing structure contours drawn on base of Mahogany zone-----	12
6.--Isopach map of nahcolite deposits-----	14
7.--Structure contours drawn on base of the R-4 zone of the Parachute Creek Member of the Green River Formation-----	15

TABLES

Page

Table 1. Depths to selected marker beds in drill holes USBM-01, USBM-01A, and USBM-02A-----	6
2. Core data and core index for drill hole USBM-01-----[in pocket]	
3. Core data and core index for drill hole USBM-01A-----[in pocket]	
4. Core data and core index for drill hole USBM-02A-----[in pocket]	
5. Recovery, loss, and broken rock amounts, drill holes USBM-01, USBM-01A, and USBM-02A-----	9
6. CI numbers for selected zones in drill holes USBM-01, USBM-01A, and USBM-02A-----	10
7. Explanation of drill hole designations used on structure and isopach maps (figs. 5-7)-----	13

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SUBSURFACE GEOLOGY AND STRUCTURE IN THE VICINITY
OF THREE DRILL HOLES IN PICEANCE CREEK BASIN,
RIO BLANCO COUNTY, COLORADO

By

R. P. Snyder and S. S. Terry

ABSTRACT

The U.S. Geological Survey gave technical support to the U.S. Bureau of Mines during drilling of three holes in the Piceance Creek Basin area southwest of Meeker, Colo. The project as planned was to sample the Parachute Creek Member of the Green River Formation for oil-shale content as well as for nahcolite and dawsonite content.

The first hole penetrated the Uinta Formation and nearly all of the Parachute Creek Member. The second and third holes penetrated the Uinta Formation and were bottomed in the Garden Gulch Member of the Green River Formation below the Parachute Creek Member. Core samples were taken through most of the Parachute Creek Member.

Core index, a numerical representation of the engineering character of the rock, was calculated for each drill hole using the following formula:

$$CI \text{ (core index)} = \left[\frac{(\text{feet broken}) + (\text{feet core loss}) + (1/4 \text{ joints})}{\text{cored interval, in feet}} \right] \times 100$$

Core index numbers show that the rock best suited for mining extends downward from the top of the R-5 zone of Donnell and Blair to the base of the Parachute Creek Member of the Green River Formation.

An isopach map of nahcolite thickness and structure contour maps drawn on the bases of the Mahogany zone and the R-4 zone of Donnell and Blair show a northwest-southeast-trending depositional basin, which agrees with the regional maps of the area.

INTRODUCTION

The USGS (U.S. Geological Survey) gave the USBM (U.S. Bureau of Mines) technical support in the drilling (coring) of three holes in the Piceance Creek Basin area southwest of Meeker, Colo. The USBM was involved in exploratory work in the area to determine the feasibility of sinking a shaft, and to provide data for possible future mining, by various methods, of oil shale, nahcolite (NaHCO_3 , a sodium bicarbonate), and dawsonite ($\text{NaAl}(\text{OH})_2\text{CO}_3$, an aluminum-bearing mineral). The USGS furnished personnel to log core and cuttings obtained from this operation.

Figure 1 shows location of the Piceance Creek Basin, Colorado. Figure 2 shows location of sites for drill holes USBM-01, USBM-01A, and USBM-02A in relation to Piceance Creek, Ryan Gulch, and Fault and Horse Draws. Figure 3 (in pocket) shows lithology, structure, secondary features, and the CI (core index) log for these drill holes. Figure 4, a cross section, shows altitudes above sea level for various marker beds and oil-shale zones. Table 1 shows depths to these beds and zones in the drill holes, as determined from resistivity and density logs used in conjunction with the core.

The first core hole, USBM-01, was drilled in Fault Draw, a tributary of Ryan Gulch, 2,333 feet (711.1 m) west of the east line and 64 feet (19.5 m) north of the south line of sec. 31, T. 1 S., R. 97 W., at a surface elevation of 6,254 feet (1,906.2 m) (J. E. Hawkins, USBM, written commun., 1975). Indications of possible faults in the core and the highly fractured condition of much of it prompted a move to a second site about 8,000 feet (2,438 m) north-northeast of Fault Draw.

At the second site, Horse Draw, two holes were drilled. The first hole, USBM-01A, is located 2,124 feet (647.4 m) north of the south line and 549 feet (167.3 m) east of the west line of sec. 29, T. 1 S., R. 97 W., at a surface elevation of 6,236 feet (1,900.7 m) (J. E. Hawkins, USBM, written commun., 1975).

The second hole, USBM-02A, at the Horse Draw site is located at 2,393 feet (729.4 m) north of the south line and 1,088 feet (331.6 m) east of the west line of sec. 29, T. 1 S., R. 97 W., at an elevation of 6,224 feet (1,897.1 m) (J. E. Hawkins; USBM, written commun., 1975).

The two holes at the Horse Draw site are 610 feet (185.9 m) apart. The close spacing was necessary for hydrologic tests conducted by other USGS personnel. Hydrologic test results are not contained in this report.

DRILL HOLE USBM-01

Drill hole USBM-01 is located in Fault Draw, a tributary of Ryan Gulch near Piceance Creek, Rio Blanco County, Colo. Drilling began on October 5, 1975, and reached the total depth of 2,382.5 feet (726.2 m) on October 27, 1975.

The hole was drilled with a rock bit to a depth of 750 feet (228.6 m). Casing 10 3/4 inches (27.3 cm) in diameter was set to a depth of about 160 feet (48.8 m). A 9 5/8-inch (24.4-cm) hole was drilled from 160 to 750 feet (48.8 to 228.6 m). At 750 feet (228.6 m) continuous coring operations were begun using a 30-foot- (9.1-m-) long core barrel which cut a 4-inch- (10.2-cm-) diameter core. Continuous core was cut to the total depth of the hole.

Lithologic descriptions of rock from this hole are given in part A (cuttings) and part B (core) on pages 18 and 22. Figure 3 shows rock type (by symbol), structure, secondary features, and the CI log.

The top of the Parachute Creek Member of the Green River Formation is at a depth of about 700 feet (213.4 m), or 5,554 feet (1,692.9 m) above sea level (fig. 4). This contact was picked by matching density and resistivity logs of drill hole USBM-01 with logs of drill hole USBM-02A in which the contact was actually cored. Birdwell Division of Seismograph Service Corp. did the downhole logging.

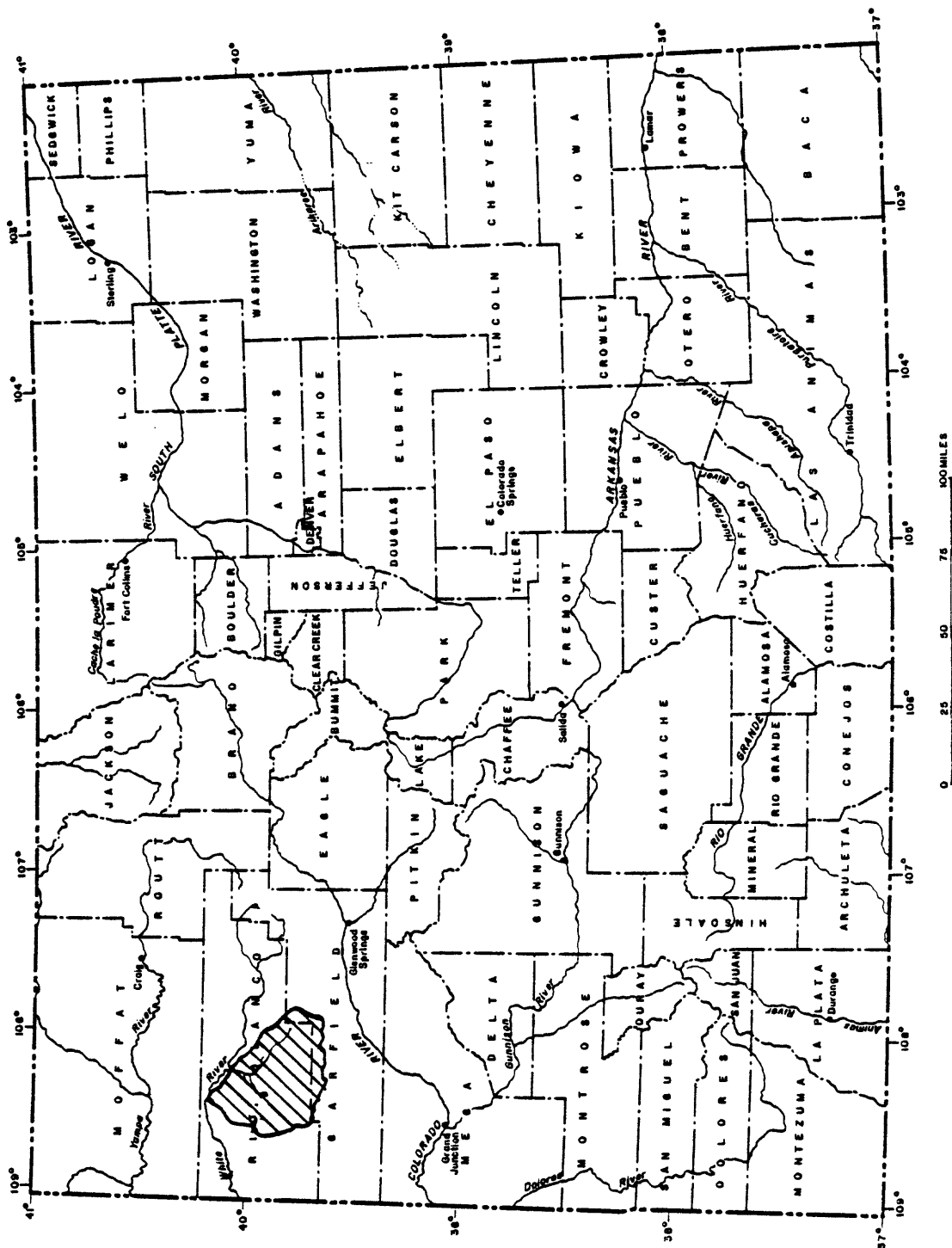


Figure 1.--Location map of Piceance Creek Basin (diagonal pattern), Colorado.

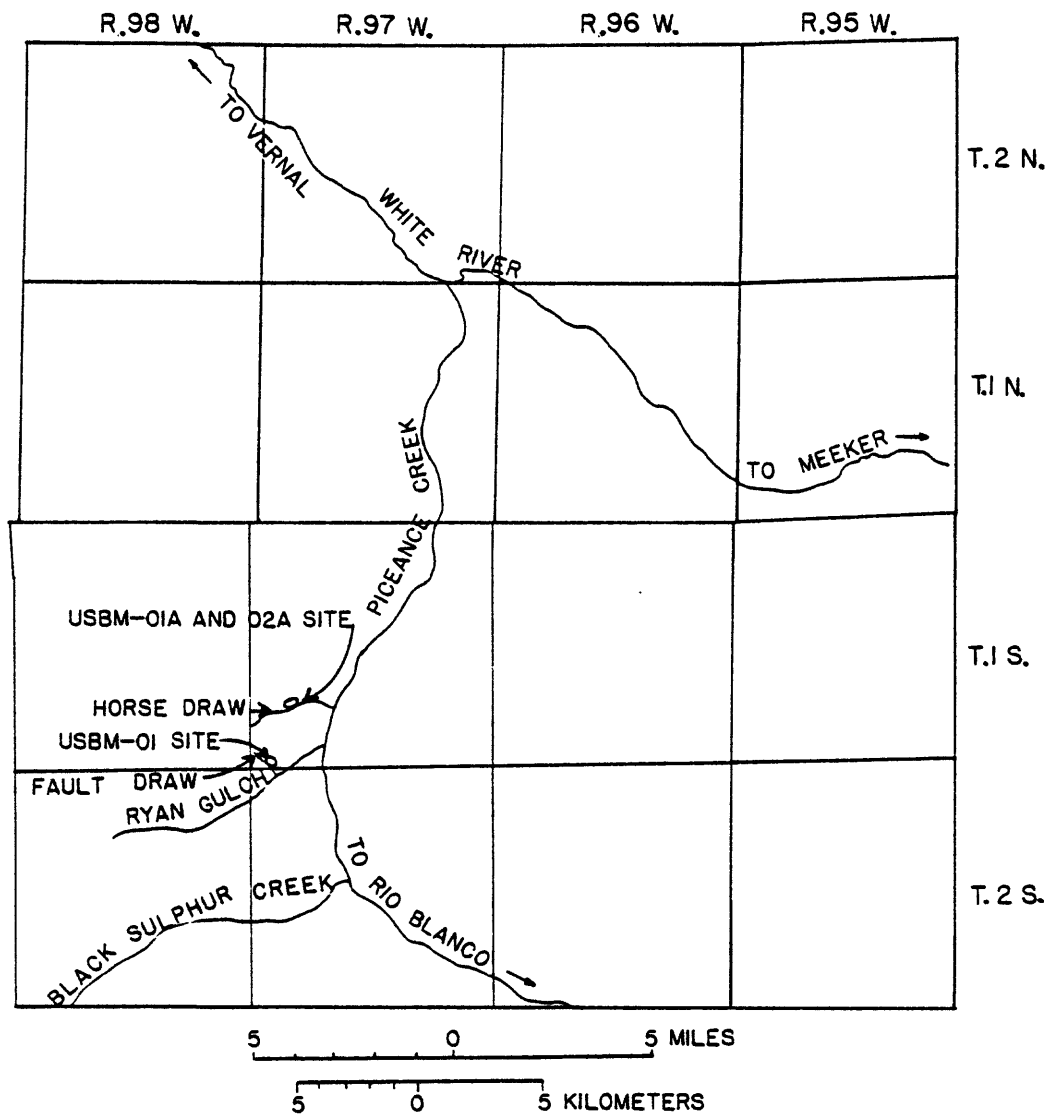


Figure 2.--Location map of sites for drill holes USBM-01, USBM-01A, and USBM-02A in Piceance Creek Basin.

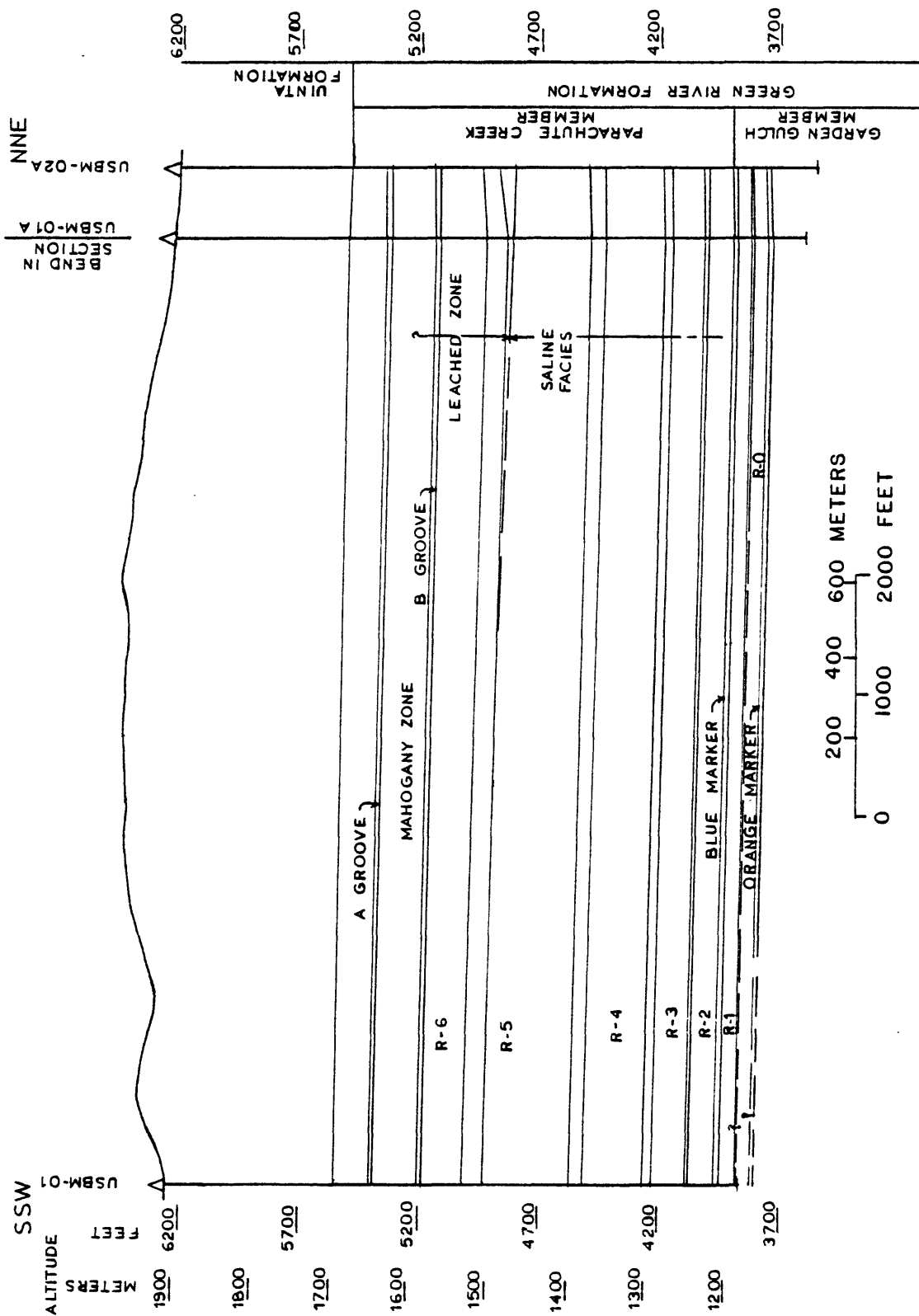


Figure 4.--Cross section from USBM-01 to USBM-02A. R-0 to R-6 are rich oil-shale zones of Donnell and Blair.

Table 1.--Depths to selected marker beds in drill holes USBM-01, USBM-01A, and USBM-02A
[Leaders (-----) not certain of depth]

	USBM-01		USBM-01A		USBM-02A	
	Elev. 6,254 feet (1,906.2 meters)		Elev. 6,236 feet (1,900.7 meters)		Elev. 6,224 feet (1,897.1 meters)	
	Depth to top feet (meters)	Depth to bottom feet (meters)	Depth to top ¹ feet (meters)	Depth to bottom feet (meters)	Depth to top feet (meters)	Depth to bottom feet (meters)
Uinta Formation	-----	700 (213.4)	-----	720 (219.5)	-----	720 (219.5)
A groove	850 (259.1)	870 (265.2)	880 (268.2)	900 (274.3)	865 (263.7)	885 (269.7)
Mahogany zone	870 (265.2)	1,050 (320.0)	900 (274.3)	1,080 (329.2)	885 (269.7)	1,060 (323.1)
Mahogany marker		900± (274.3±)		936 (285.3)		935 (285.0)
Mahogany bed		915 (278.9±)		950.5 (289.7)		950 (289.6)
B groove	1,050 (320.0)	1,070 (326.1)	1,080 (329.2)	1,100 (335.3)	1,060 (323.1)	1,080 (329.2)
Leached zone	-----	1,325 (403.9)	-----	1,400 (426.7)	-----	1,396 (425.5)
Blue marker		2,284 (696.2)		2,322 (707.7)		2,300 (701.0)
Orange marker		22,453 (747.7)		2,485 (757.4)		2,465 (751.3)
R-6	1,070 (326.1)	1,240 (378.0)	1,100 (335.3)	1,290 (393.2)	1,080 (329.2)	1,260 (384.0)
R-5	1,324 (403.6)	1,680 (512.1)	1,380 (420.6)	1,726 (526.1)	1,330 (405.4)	1,705 (519.7)
R-4	1,742 (531.0)	1,990 (606.6)	1,790 (545.6)	2,036 (620.6)	1,770 (539.5)	2,015 (614.2)
R-3	2,026 (617.5)	2,163 (659.3)	2,068 (630.3)	2,202 (671.2)	2,050 (624.8)	2,182 (665.1)
R-2	2,180 (664.5)	2,284 (696.2)	2,220 (676.7)	2,322 (707.7)	2,204 (671.8)	2,300 (701.0)
R-1	2,308 (703.5)	22,372 (723.0)	2,341 (713.5)	2,402 (732.1)	2,322 (707.7)	2,382 (726.0)
R-0	22,379 (725.1)	22,433 (741.6)	2,410 (734.6)	2,462 (750.4)	2,388 (727.9)	2,442 (744.3)

¹Depths from geophysical logs, L. G. Trudell, U.S. Energy Research and Development Administration, Laramie, Wyo.

²Depth estimates projected from USBM-01A.

The R- and L-zones are those of Donnell and Blair (1970). R-zones contain sections of rich oil shale and L-zones contain sections of lean oil shale. Depths of the zones were obtained for drill holes USBM-01 and USBM-01A from L. G. Trudell, ERDA (U.S. Energy Research and Development Administration), Laramie, Wyo., and density logs were matched between USBM-01A and USBM-02A to obtain depths in the latter hole. The Laramie ERDA office is currently analyzing the core for oil content by means of the modified Fischer assay method. Zone depths may be changed slightly when data from these analyses become available (L. G. Trudell, oral commun., 1976).

Surface pipe was set at a depth of 30 feet (9.1 m), and no cuttings were collected from the alluvium in this interval. Drill cuttings from 30 to 750 feet (9.1 to 228.6 m) were collected at 15-foot (4.6-m) intervals. Alluvium was drilled to a depth of about 60 feet (18.3 m). Between 60 and 540 feet (18.3 and 164.6 m) the drill encountered a thick sequence of interbedded siltstone, marlstone, and sandstone; and from 540 to 750 feet (164.6 to 228.6 m), a sequence of oil shale, marlstone, and minor siltstone.

The lithologic log and description, parts A and B (p. 18, 22) and figure 3 are self-explanatory and will not be discussed here. Clay(?) and brecciated rock were recovered in several cores, suggesting possible fault zones. These zones, however, may be collapse breccias, resulting from leaching of nahcolite vugs. Nevertheless, the drill site is close to a major fault and some of the brecciated zones may be related to faulting. No thickening or thinning of units is noticeable on the cross section (fig. 4) drawn between drill holes USBM-01 and USBM-01A.

DRILL HOLE USBM-01A

Drill hole USBM-01A is located in Horse Draw about 1 mile (1.6 km) west of the Piceance Creek road, and about 8,000 feet (2,438 m) north-northeast of drill hole USBM-01.

The hole was spudded on November 3, 1975. Casing was set at 184 feet (56.1 m), and the hole was deepened to 830 feet (253.0 m) using a rock bit. Continuous 4-inch- (10.2-cm-) diameter core was cut from 830 to 2,547.6 feet (253.0 to 776.5 m). The hole was deepened to 2,610 feet (795.5 m), again using a rock bit. Total depth was reached on November 23, 1975.

Lithologic descriptions of rock from this hole are given as part A (cuttings) and part B (core) on pages 37 and 40. Figure 3 shows rock type (by symbol), structure, secondary features, and the CI log.

The contact between the Uinta and Green River Formations is at an approximate depth of 720 feet (219.5 m). Table 1 lists depths to various additional marker units. These markers were picked using core descriptions as well as geophysical logs.

Drill cuttings from 210 to 725 feet (64.0 to 221.0 m) show a thick section of siltstone and minor sandstones, marlstones, and oil shales; from 725 to 830 feet (221.0 to 253.0 m) there is a sequence of oil shale and minor marlstone and siltstone. The base of the Parachute Creek Member is at 2,322 feet (707.7 m). The R-zones (Donnell and Blair, 1970) are shown on figure 4 and table 1.

The lithologic descriptions, part B, and figure 3 describe the continuous core in considerable detail and no further discussion will be given here.

DRILL HOLE USBM-02A

Drill hole USBM-02A was spudded December 8, 1975. A 36-inch (91.4-cm) corrugated metal pipe was set at 20 feet (6.1 m), and a 20-inch (50.8-cm) casing was set at 189.5 feet (57.8 m). Coring began at 197.5 feet (60.2 m) and continued to 980 feet (298.7 m). Water tests were run and the hole was reamed to a diameter of 17 1/2 inches (44.5 cm). A 13 3/8-inch (34.0-cm) casing was set to a depth of 844 feet (257.3 m) and coring began again, continuing to 1,451 feet (442.3 m). During the drilling out of the cement inside the casing, the bit drilled through the casing and actually cut a new hole along the outside of the casing. For this reason, when coring operations continued, the top of the cored interval was at 975 feet (297.2 m) instead of at the expected depth of 980 feet (298.7 m). Water tests were again run, the hole was reamed from 844 to 1,451 feet (257.3 to 442.3 m) to a diameter of 12 1/4 inches (31.1 cm), and a 9 5/8-inch (24.4-cm) liner was hung inside the existing 13 3/8-inch (34.0-cm) casing. The hole was deepened to 1,458 feet (444.4 m) with a rock bit, and was then cored to total depth of 2,660 feet (810.8 m). This depth was reached on January 24, 1976.

A lithologic description of the rock core is given on p. 54 and figure 3 shows rock type (by symbol), structure, secondary features, and the CI log. The base of the Uinta Formation is at a depth of 720 feet (219.5 m) and the base of the Parachute Creek Member is at 2,300 feet (701.0 m).

CORE RECOVERY, CONDITION, AND CORE INDEX

Core recovery and loss amounts are listed in tables 2, 3, and 4 for the three drill holes. Also listed are footages of fractured rock. Broken core (0.3 ft or smaller) footages are also listed, as is the number of open fractures per core run. The CI is a numerical representation of the engineering character of the core per drilled interval. The equation used to calculate the CI is:

$$CI = \left[\frac{(\text{feet broken}) + (\text{feet core loss}) + (1/4 \text{ joints})}{\text{cored interval, in feet}} \right] \times 100$$

An increase in the CI value is indicative of a corresponding increase in joint frequency, core loss, and amount of broken core, and therefore represents a decrease in the competency of the rock. The CI value of 50 has been designated as the general division between competent and incompetent rock (Terry and Cunningham, 1975). All three holes show a marked decrease of CI when the unleached zone is encountered.

Total lengths cored and lengths of core recovered, lost, and fractured are listed in table 5. Various zones, such as Uinta Formation, Mahogany zone (including A and B grooves), and the R-zones are listed with their CI numbers on table 6. When a core interval includes a zone boundary, the total core run that comes nearest to the contact is included. In all three holes, the lowest CI numbers are between the top of the R-5 zone and the base of the L-0 zone. This interval provides the best rock for mining.

Table 5.--Recovery, loss, and broken rock amounts, drill holes USBM-01, USBM-01A, and USBM-02A

	USBM-01		USBM-01A		USBM-02A	
	feet	(meters)	percent	feet	(meters)	percent
Total interval cored	1,636.3	(498.7)	100	1,716.6	(523.5)	100
Total interval recovered	1,539.4	(469.2)	94.1	1,572.7	(479.4)	91.6
Total interval lost	97.1	(29.6)	5.9	144.9	(44.2)	8.4
Total interval fractured	343.6	(104.7)	22.3	319.0	(97.2)	20.3
				2,438.3	(743.2)	100
				2,049.1	(624.6)	84.0
				389.2	(118.6)	16.0
				488.5	(148.9)	20.0

¹Discrepancies exist between actual cored footage and reported cored footages. These are caused by several resetttings of the depth counter on the drill rig and amounts to less than 5 feet for each of the three drill holes. This amount does not affect the percentage numbers in the table.

Table 6.--CI (core index) numbers for selected zones in drill holes USBM-01, USBM-01A, and USBM-02A
[Leaders (----) indicate data not available]

Stratigraphic units	USBM-01		USBM-01A		USBM-02A	
	foot	Cored interval (meters)	CI	foot	Cored interval (meters)	CI
Uinta Formation	----	----	----	----	197.5- 712.2	(60.2-217.1) 58
Top of Parachute Creek Member to base of B groove	2750	-1,052.6 (228.6-320.8)	61	830.0-1,082.7 (253.0-330.0)	712.2-1,076.4 (217.1-328.1)	62
1R-6+L-5	1,052.6-1,330.3	(320.8-405.5)	50	1,082.7-1,370.3 (330.0-417.7)	1,076.4-1,353.0 (328.1-412.4)	75
R-5+L-4	1,330.3-1,729.0	(405.5-527.0)	23	1,370.3-1,877.2 (417.7-572.2)	1,353.0-1,753.0 (412.4-534.3)	25
R-4+L-3	1,729.0-2,027.1	(527.0-617.9)	9	1,877.2-2,048.3 (572.2-624.3)	1,753.0-2,077.5 (534.3-633.2)	11
R-3+L-2	2,027.1-2,177.5	(617.9-663.7)	6	2,048.3-2,229.3 (624.3-679.5)	2,077.5-2,198.1 (633.2-670.0)	5
R-2+L-1	2,177.5-2,298.0	(663.7-700.4)	18	2,229.3-2,339.8 (679.5-713.2)	2,198.1-2,316.6 (670.0-706.1)	18
R-1+L-0				2,339.8-2,406.9 (713.2-733.6)	2,316.6-2,401.8 (706.1-732.1)	32
R-0 to Orange Marker	2,298.0-2,382.5	(700.4-726.2)	31	2,406.9-2,487.5 (733.6-758.2)	2,401.8-2,453.1 (732.1-747.7)	45
Orange Marker to Total Depth				2,487.5-2,547.6 (758.2-776.5)	2,453.1-2,660.0 (747.7-810.8)	55

¹R and L zones are those of Donnell and Blair (1970) and Cashion and Donnell (1972). R zones contain rich units of oil shale, L zones contain lean units.

²Cored interval figures are not exact for tops and bottoms of zones, because individual core runs bracket actual contacts and CI values are for whole core runs. The upper and lower figures for cored intervals are beginning and ending depths for core runs which most nearly match the unit depths.

STRUCTURE

The area of interest for further development by the USBM of experimental mining techniques for oil shale, nahcolite, and dawsonite covers parts of four townships. These four are: Ts. 1 and 2 S., Rs. 97 and 98 W. Structure contours in the area of interest, drawn on the base of the Mahogany zone (fig. 5 and table 7), show a north-northwest-plunging structural low. The configuration of this low is very similar to the configuration of a thick prism of nahcolite shown by isopachs (fig. 6 and table 7). An interrelationship must exist between the thickness of nahcolite and the structural low defined by contours on the base of the Mahogany zone. The low may be, in part, controlled by extensive leaching of nahcolite: where the nahcolite is thickest, the low is deepest and the greatest leaching has occurred. This hypothesis is supported by structure contours drawn on the base of the R-4 zone of the Parachute Creek Member (fig. 7 and table 7). This horizon lies within the zone of nahcolite deposits but below the thickest parts. The low is considerably less sharp at this horizon (compare figs. 5 and 7), but the structural gradient, nevertheless, is about the same at both horizons. The north-northwest dip and the orientation of the low are compatible with regional isopach maps that show an elongated basin trending northwest-southeast.

Geologic information acquired in the drilling and coring of USBM-01A and USBM-02A provides extremely useful data for drilling or mining a shaft in the immediate vicinity of these two holes.

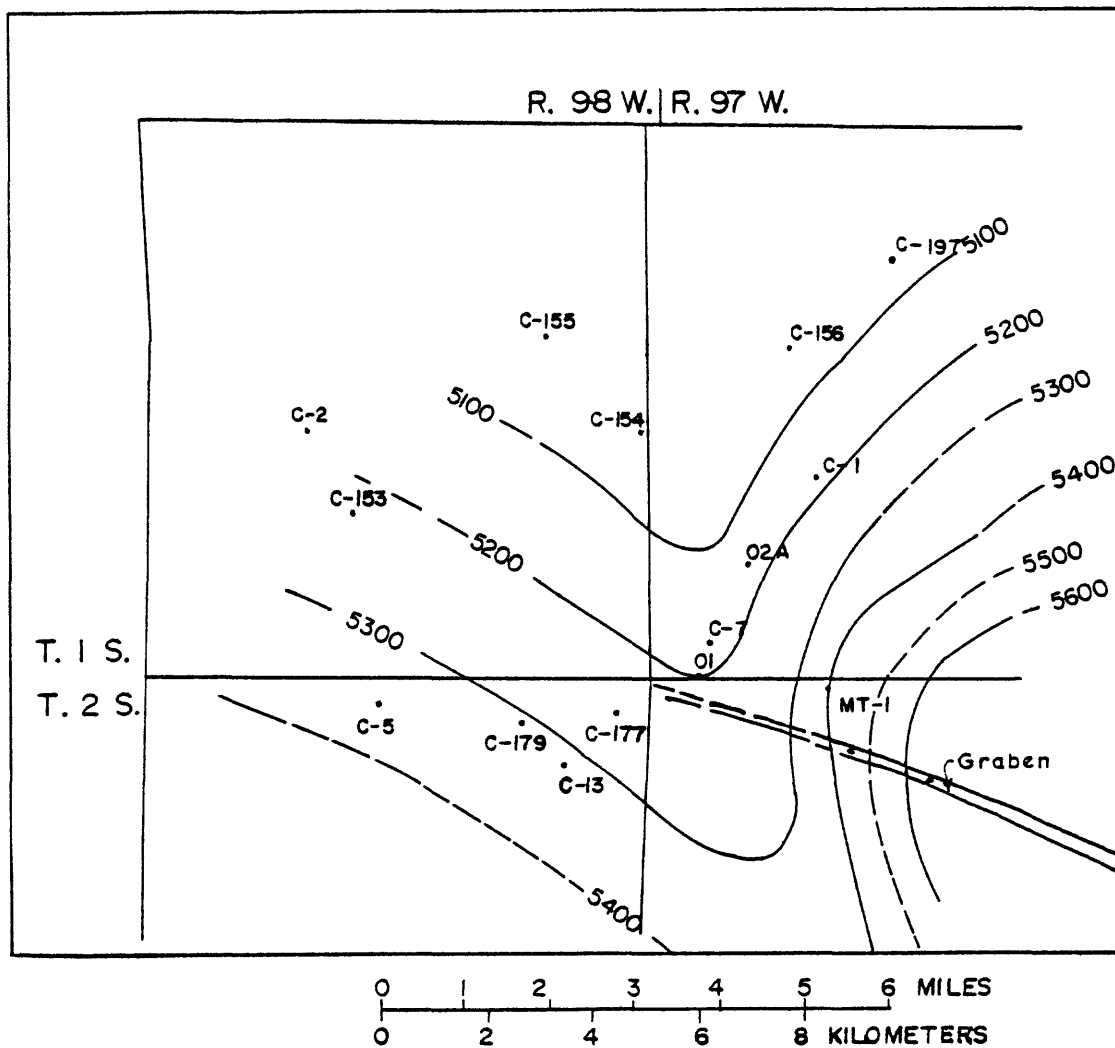


Figure 5.--Structure contours drawn on base of Mahogany zone. Contour interval 100 feet. Drill-hole designations explained in table 7.

Table 7.--Explanation of drill-hole designations used on structure and isopach maps (figs. 5-7)

No.	Designation
C-1	Irvin Nielson core hole 20-1, Wolf Ridge Minerals
C-2	John Dunn core hole 20-1, Wolf Ridge Minerals
C-5	Core hole 4-1, J. T. Juhan
C-7	Core hole Saterdal No. 1, Pan American Petroleum Corp.
C-13	Core hole Skyline No. 2, Sinclair Oil Corp.
C-153	Core hole Colorado Minerals 28-1, Wolf Ridge Minerals
C-154	Core hole Savage 24-1, Wolf Ridge Minerals
C-155	Core hole Colorado Minerals 14-1, Wolf Ridge Minerals
C-156	Core hole Nielson 17-1, Wolf Ridge Minerals
C-177	Core hole Shell and others, Tract 1, 22X-1, Shell Oil Co.
C-179	Core hole Shell-TOSCO, Tract 1, 23X-2, Shell Oil Co.
C-197	Core hole 41X-9, Shell Oil Co.
01	USBM core hole 01, Fault Draw
02A	USBM core hole 02A, Horse Draw
MT-1	Core hole Marathon Oil Co., Square S No. 1

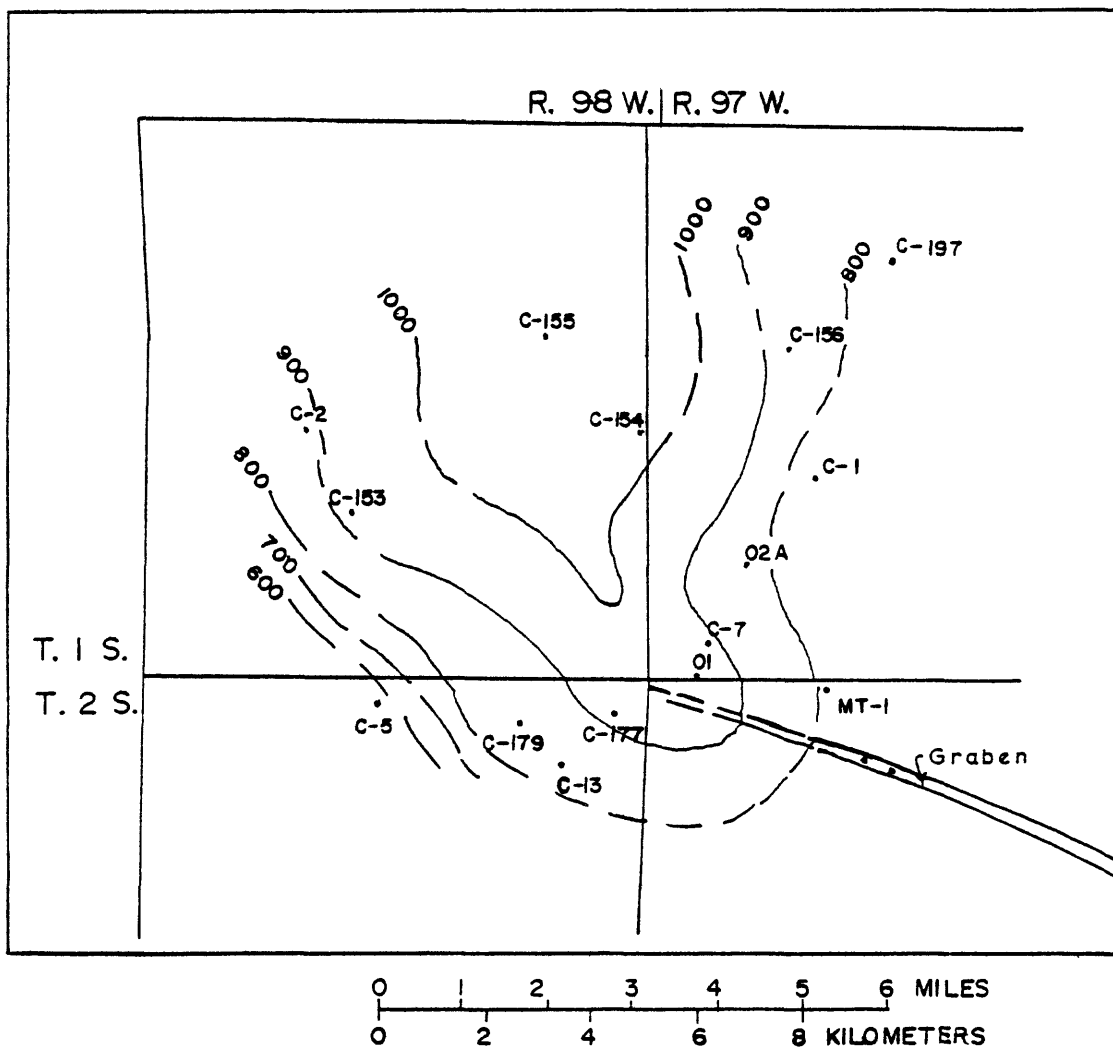


Figure 6.--Isopach map of nahcolite deposits. Contour interval 100 feet. Drill-hole designations explained in table 7.

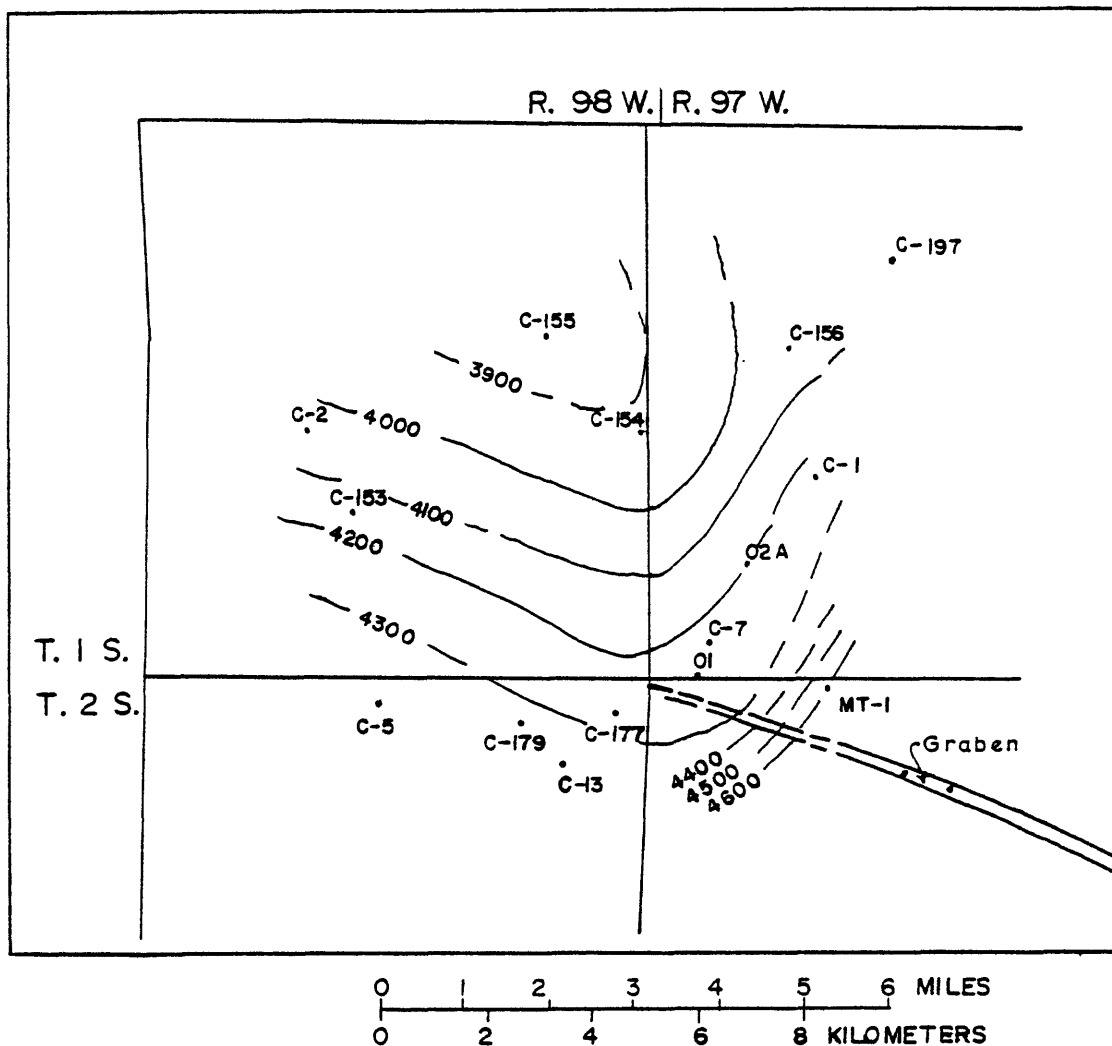


Figure 7.--Structure contours drawn on base of the R-4 zone of the Parachute Creek Member of the Green River Formation. Contour interval 100 feet. Drill-hole designations explained in table 7.

REFERENCES CITED

- Cashion, W. B., and Donnell, J. R., 1972, Chart showing correlation of selected key units in the organic-rich sequence of the Green River Formation, Piceance Creek Basin, Colorado, and Uinta Basin, Utah: U.S. Geol. Survey Oil and Gas Inv. Chart no. OC-65, 1 sheet.
- Donnell, J. R., and Blair, R. W., Jr., 1970, Resource appraisal of three rich oil-shale zones in the Green River Formation, Piceance Creek Basin, Colorado: Colorado School Mines Quart., v. 65, no. 4, p. 73-87.
- Terry, S. S., and Cunningham, M. J., 1975, Geology of the U12n.07 UG-3 drill hole, Area 12, Nevada Test Site: U.S. Geol. Survey Rept. USGS-474-207, 27 p.; available only from U.S. Dept. Commerce, Natl. Tech. Inf. Service, Springfield, Va. 22161.

LITHOLOGIC DESCRIPTIONS OF CUTTINGS AND CORES
FROM U.S. BUREAU OF MINES DRILL HOLES

*Lithologic description of cuttings (part A) from drill hole USBM-01,
Ryan Gulch*

Description	Depth interval feet (meters)
Quaternary	
Alluvium, not cemented, moderate-yellowish-brown, very fine grained (0.25 mm); grains mostly quartz; sparse biotite flakes-----	30-45 (9.1-13.7)
Alluvium, possible siltstone, moderate-yellowish-brown, very fine grained, same as above; contains 4 mm fragments of siltstone and sparse fragments of well-cemented sandstone (<2 mm) or quartzite(?)----	45-60 (13.7-18.3)
Tertiary	
Uinta Formation	
Siltstone, pale-yellowish-brown to dark-yellowish-brown, very fine grained, very thinly laminated, well cemented with silica-----	60-75 (18.3-22.9)
Siltstone, predominately dark-yellowish-brown, very fine grained, well-cemented; some laminae are grayish yellow; contains sparse very thinly laminated kerogenous marlstone-----	75-90 (22.9-27.4)
Siltstone, same as above, some dusky-yellowish-brown-----	90-105 (27.4-32.0)
Siltstone, predominately dusky-yellowish-brown, well-cemented (some silica and calcite); laminae are dark yellowish brown and grayish yellow; contains sparse laminae of kerogenous marlstone; breaks with concoidal fracture-----	105-120 (32.0-36.6)
Siltstone, pale-yellowish-brown, massive ~90 percent, and dusky- yellowish-gray kerogenous marlstone; calcite cement-----	120-135 (36.6-41.1)
Siltstone, same as above-----	135-150 (41.1-45.7)
Cement; interval at base of cemented casing-----	150-165 (45.7-50.3)
Siltstone, dark-yellowish-brown; laminated with dark-gray silt- stone; scattered (0.25 mm) flakes of biotite that equal 1 per- cent of rock; some parts have more dark-gray laminae; pyrite present in discrete large masses-----	165-180 (50.3-54.9)

*Lithologic description of cuttings (part A) from drill hole USBM-01,
Ryan Gulch--Continued*

Description	Depth interval feet (meters)
Tertiary--Continued	
Uinta Formation--Continued	
Sandstone, dark-gray, fine- to medium-grained, and minor amounts of light-brown, calcite-cemented siltstone; no calcite in sandstone; 70 percent of the sample is sandstone; dusky-yellowish-brown, fine- to medium-grained sandstone; contains tiny reddish-brown hematite, minor amounts of biotite, and scattered fine grains of rounded frosted quartz-----	180-195 (54.9-59.4)
No sample-----	195-290 (59.4-88.4)
Siltstone, dusky-yellowish-brown, laminated with kerogenous marlstone; contains minor amount of quartzitic sandstone and pyrite fragments-----	290-305 (88.4-93.0)
Sandstone, olive-gray to dusky-yellowish-brown, fine- to medium-grained; contains fragments of siltstone and subrounded quartz, minor biotite flakes, some kerogenous marlstone-----	305-330 (93.0-100.6)
Sandstone, same as above but with more angular quartz fragments-----	330-345 (100.6-105.2)
Sandstone and some siltstone, light-olive-gray; sandstone is fine grained with minor calcite cement and contains 85-90 percent quartz, <5 percent pyrite; both are cemented (silica cement and minor calcite); from cuttings, unit appears to be very thin interbedding of siltstone and sandstone-----	345-360 (105.2-109.7)
Siltstone, dusky-yellowish-brown, well-cemented; contains scattered subrounded quartz and minor (<5 percent) pyrite-----	360-375 (109.7-114.3)
Sandstone, dusky-yellowish-brown, fine- to medium-grained sub-angular quartz; contains pyrite; some siltstone appears to be poorly cemented-----	375-390 (114.3-118.9)
Siltstone, dark-yellowish-brown, very fine to fine-grained, well-cemented; contains minor sandstone (90 percent quartz); minor kerogenous marlstone stringers scattered throughout-----	390-405 (118.9-123.4)

*Lithologic description of cuttings (part A) from drill hole USBM-01,
Ryan Gulch--Continued*

Description	Depth interval feet (meters)
Tertiary--Continued	
Uinta Formation--Continued	
Siltstone, dark-yellowish-brown to dusky yellowish-brown, mostly quartz; contains minor sandstone (90 percent quartz), abundant pyrite, and minor kerogenous marlstone; all well cemented with silica and minor calcite-----	405-420 (123.4-128.0)
Siltstone and sandstone, pale-yellowish-brown to dusky-yellowish-brown, very fine to fine-grained, well-cemented; contains minor amounts of kerogenous marlstone; sandstone contains pyrite-----	420-435 (128.0-132.6)
Interbedded sandstone and siltstone, dark-yellowish-brown; 70 percent sandstone, 30 percent siltstone; contains minor amounts of kerogenous marlstone and minor pyrite; unconsolidated-----	435-450 (132.6-137.2)
Interbedded siltstone, marlstone, and sandstone, dark-yellowish-brown to dusky-yellowish-brown; 40 percent siltstone, 40 percent marlstone, 20 percent coarse-grained sandstone; some kerogenous stringers; unconsolidated-----	450-465 (137.2-141.7)
Interbedded marlstone and siltstone, dark-yellowish-brown; 50 percent marlstone, 50 percent unconsolidated siltstone-----	465-495 (141.7-150.9)
Same as above; possibly >60 percent marlstone-----	495-540 (150.9-164.6)
Laminated siltstone and kerogenous marlstone; siltstone (~50 percent of sample) is pale yellowish brown with minor amounts of dark-yellowish-brown calcareous cement; kerogenous marlstone (~50 percent of sample) is dusky yellowish brown; contains minor amounts of frosted quartz-----	540-555 (164.6-169.2)
Same as above, with siltstone increasing to ~90 percent-----	555-570 (169.2-173.7)
Same as above, with siltstone increasing to >95 percent-----	570-585 (173.7-178.3)
Laminated siltstone and kerogenous marlstone; siltstone (80 percent) is mostly pale yellowish brown, some dark yellowish brown, contains calcareous cement; marlstone (20 percent) is medium gray-----	585-600 (178.3-182.9)

*Lithologic description of cuttings (part A) from drill hole USBM-01,
Ryan Gulch--Continued*

Description	Depth interval feet (meters)
Tertiary--Continued	
Uinta Formation--Continued	
Laminated siltstone and kerogenous marlstone: siltstone (90 per- cent) is dark yellowish brown, contains calcareous cement; dusky-yellowish-brown marlstone-----	600-615 (182.9-187.5)
Laminated kerogenous marlstone and siltstone; marlstone (90 percent) is grayish black to olive black; siltstone (~10 per- cent) is pale yellowish brown and contains calcareous cement-----	615-630 (187.5-192.0)
Laminated kerogenous marlstone and fine-grained sandstone with kerogenous streaks; marlstone (95 percent) is grayish black to olive black; sandstone (5 percent) is yellowish gray-----	630-645 (192.0-196.6)
Laminated kerogenous marlstone and sandstone; marlstone, 90 percent; sandstone, 10 percent-----	645-660 (196.6-201.2)
Laminated kerogenous marlstone and sandstone; marlstone (90 Percent) is dusky yellowish brown and pale yellowish brown; sandstone (10 percent) is fine grained-----	660-675 (201.2-205.7)
Kerogenous marlstone, dusky-yellowish-brown-----	675-690 (205.7-210.3)
Kerogenous marlstone, dusky-yellowish-brown; calcite fills fractures; trace of pale-yellowish-brown, fine-grained sandstone-----	690-700 (210.3-213.4)
Green River Formation	
Marlstone, kerogenous, dusky-yellowish-brown; trace of pale- yellowish-brown, fine-grained sandstone with kerogenous streaks-----	700-720 (213.4-219.5)
Marlstone, kerogenous as above, with calcite coatings on fracture surfaces-----	720-735 (219.5-224.0)
Marlstone, kerogenous as above, 90 percent; 10 percent grayish- orange-pink, fine- to medium-grained sandstone with calcite cement; contains streaks of kerogen and sparse flakes of biotite-----	735-750 (224.0-228.6)
Bottom of rock-bit zone	

*Lithologic description of core (part B) from drill hole USBM-01,
Ryan Gulch*

Description	Depth interval feet (meters)
Tertiary	
Green River Formation	
Parachute Creek Member	
Oil shale, dusky-yellowish-brown, interlaminated, minor amounts of dark-gray and grayish-brown oil shale; calcite and nahcolite crystals on open fracture surfaces and in healed fractures; core ranges from competent to highly fractured-----	750-820.2 (228.6-250.0)
No sample-----	820.2-821.0 (250.0-250.2)
Oil shale, dusky-brown to dusky-yellowish-brown; calcite and nahcolite crystals on open and healed fracture surfaces; a breccia of clay and oil-shale fragments at 825.7-825.9 feet (251.7-251.7+ m)-----	821.0-830.0 (250.2-253.0)
Oil shale, grayish-black-----	830.0-831.0 (253.0-253.3)
Oil shale, like unit at 821.0-830.0 feet (250.2-253.0 m); below 838 feet (255.4 m) the laminae feather out across core; dusky yellowish brown is dominant color below 844 feet (257.3 m)-----	831.0-853.0 (253.3-260.0)
Marlstone, dusky-, dark-, and pale-yellowish-brown, very thinly laminated; calcite in open and healed fractures; pyrite crystals on fractures in lowest 1 foot (30 cm); occasional vugs, some contain nahcolite-----	853.0-860.0 (260.0-262.1)
Siltstone, interlaminated and bedded with marlstone. A Groove-----	860.0-868.0 (262.1-264.6)
Oil shale, pale-yellowish-brown and dark- and dusky-yellowish- brown, very thinly laminated; contains pyrite crystals throughout unit-----	868.0-869.0 (264.6-264.9)
No sample-----	869.0-870.0 (264.9-265.2)
Oil shale, like unit at 853.0-860.0 feet (260.0-262.1 m); brecciated layer of oil shale in a silty matrix, with pyrite crystals at 875.0-875.6 feet (266.7-266.9 m)-----	870.0-886.3 (265.2-270.1)

*Lithologic description of core (part B) from drill hole USBM-01,
Ryan Gulch--Continued*

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Parachute Creek Member--Continued	
Siltstone, dark-yellowish-brown; contains streaks of kerogen-----	886.3-886.5 (270.1-270.2)
Oil shale, like unit at 853.0-860.0 feet (260.0-262.1 m)-----	886.5-889.3 (270.2-271.1)
Oil shale, dusky-yellowish-brown, laminated-----	889.3-891.4 (271.1-271.7)
Oil shale, like unit at 853.0-860.0 feet (260.0-262.1 m); pyrite crystals in lower 1 foot (30 cm)-----	891.4-893.0 (271.7-272.2)
No sample-----	893.0-895.0 (272.2-272.8)
Oil shale, dusky-yellowish-brown, laminated with dark-yellowish- brown oil shale; pyrite and calcite crystals disseminated throughout core; some discing of core-----	895.0-904.0 (272.8-275.5)
Siltstone, dusky-yellowish-brown-----	904.0-904.6 (275.5-275.7)
Oil shale, like unit at 895.0-904.0 feet (272.8-275.5 m)-----	904.6-913.5 (275.7-278.4)
No sample-----	913.5-915.0 (278.4-278.9)
Oil shale, dusky-yellowish-brown, thinly laminated with pale- yellowish-brown oil shale; calcite on healed fractures-----	915.0-928.2 (278.9-282.9)
Siltstone, pale-yellowish-brown; contains thin wavy beds of kerogenous material-----	928.2-928.4 (282.9-283.0)
Oil shale, like unit at 915.0-928.2 feet (278.9-282.9 m); core shattered and disced; vuggy-----	928.4-929.0 (283.0-283.2)
Oil shale, dark-yellowish-brown, laminated with dusky-yellowish- brown oil shale; pale yellowish brown in lowest 1 foot (30 cm); some laminae are wavy, most are flat and horizontal; pyrite and calcite crystals on open and healed fractures; minor feathering of some laminae-----	929.0-949.0 (283.2-289.3)
Gilsonite(?), laminated with oil shale and a white micro- crystalline mineral (noncalcareous)-----	949.0-949.8 (289.3-289.5)

*Lithologic description of core (part B) from drill hole USBM-01,
Ryan Gulch--Continued*

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Parachute Creek Member--Continued	
Oil shale, like unit at 929.0-949.0 feet (283.2-289.3 m)-----	949.8-951.7 (289.5-290.1)
Brecciated zone; oil shale with silt- and sand-size matrix-----	951.7-951.9 (290.1-290.1+)
Oil shale, like unit at 929.0-949.0 feet (283.2-289.3 m)-----	951.9-980.0 (290.1+-298.7)
Oil shale, dark-yellowish-brown; laminated with dusky-yellowish- brown oil shale; brecciated zones at 982 and 986 feet (299.3 and 300.5 m) each 0.5 foot (15 cm) thick; open and partially open vugs first appear at 989.7 feet (301.7 m) with others at 994.0 and 996.0 feet (303.0 and 303.6 m); dusky-yellowish-brown color predominates at 987.0 feet (300.8 m); pyrite and calcite on fracture surfaces-----	980.0-997.0 (298.7-303.9)
Sandy-silty layer interbedded with thinly laminated oil shale-----	997.0-997.8 (303.9-304.1)
Oil shale, like unit at 980.0-997.0 feet (298.7-303.9 m); discing of core between 1,000.0 and 1,006.0 feet (204.8 and 306.6 m); brecciated zones at 1,001.0-1,001.3 feet (305.1-305.2 m) and 1,011.0-1,014.0 feet (308.2-309.1 m); dusky-yellowish-brown color predominates below 1,007.5 feet (307.1 m)-----	997.8-1,013.0 (304.1-308.8)
Sandstone, medium-grained-----	1,013.0-1,013.2± (308.8-308.8±)
Oil shale, like unit at 980.0-997.0 feet (298.7-303.9 m)-----	1,013.2±-1,015.0 (308.8±-309.4)
Oil shale, grayish-black to black-----	1,015.0-1,015.5 (309.4-309.5)
Oil shale, dark-yellowish-brown; interlaminated with dusky- yellowish-brown oil shale; lenses, pods, and thin beds of siltstone mainly between 1,016.0 and 1,019.1 feet (309.7- 310.6 m) and 1,022.0 and 1,023.0 feet (311.5-311.8 m); fairly competent core-----	1,015.5-1,023.0 (309.5-311.8)

*Lithologic description of core (part B) from drill hole USBM-01,
Ryan Gulch--Continued*

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Parachute Creek Member--Continued	
Oil shale, dark-yellowish-brown; interlaminated with minor amounts of very dusky red oil shale; contains several brecciated zones of oil-shale fragments in a sandy-silty matrix-----	1,023.0-1,039.0 (311.8-316.7)
No sample-----	1,039.0-1,039.2 (316.7-316.7+)
Oil shale and clay(?); upper 5 feet (1.5 m) is dark-yellowish-brown oil shale containing vugs partially filled with nahcolite; lowest 4 feet (1.2 m) is pale-yellowish-brown clay containing a few 2-inch (5-cm) fragments of oil shale-----	1,039.2-1,048.2 (316.7+-319.5)
No sample-----	1,048.2-1,052.6 (319.5-320.8)
Oil shale, light- to dusky-yellowish-brown; interlaminated with light-yellowish-brown siltstone-----	1,052.6-1,063.0 (320.8-324.0)
Oil shale, pale- to dusky-yellowish-brown, with minor beds of pale-yellowish-brown tuff(?); leaching evident at 1,072 and 1,083 feet (326.7 and 330.1 m); nahcolite in vugs at 1,083 feet (330.1 m); core discs easily-----	1,063.0-1,083.5 (324.0-330.3)
No sample-----	1,083.5-1,087.0 (330.3-331.3)
Like unit at 1,063.0-1,083.5 feet (324.0-330.3 m); tuff(?) layers occur between 1,088.6 and 1,089.6 feet (331.8 and 332.1 m)-----	1,087.0-1,093.0 (331.3-333.1)
Oil shale, pale- to dusky-yellowish-brown, thinly to very thinly laminated; calcite on fracture surfaces; sparse vugs as much as 2 inches (5 cm) in diameter contain minor amounts of nahcolite-----	1,093.0-1,109.0 (333.1-338.0)
Oil shale, as above, interbedded with pale- to moderate-yellowish-brown siltstone beds at 1,109-1,110, 1,112, 1,117, 1,120-1,121, and 1,125 feet (338.0-338.3, 338.9, 340.5, 341.4-341.7, and 342.9 m)-----	1,109.0-1,125.0 (338.0-342.9)

*Lithologic description of core (part B) from drill hole USBM-01,
Ryan Gulch--Continued*

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Parachute Creek Member--Continued	
Oil shale, like unit at 1,093.0-1,109.0 feet (333.1-338.0 m), with a very thin tuff(?) bed at 1,149 feet (350.2 m); collapse breccia zone at 1,142.0-1,142.6 feet (348.1-348.3 m) may match zone at 1,174-1,176.5 feet (357.8-358.6 m) in drill hole USBM-02A; core-loss interval below may match collapse breccia zone at 1,187 feet (361.8 m) in USBM-02A-----	1,125.0-1,152.2 (342.9-351.2)
No sample-----	1,152.2-1,155.2 (351.2-352.1)
Oil shale, pale-yellowish-brown, interlaminated with minor very thin laminae of dark- and dusky-yellowish-brown to olive-black oil shale; contains a few scattered vugs as wide as 0.75 inch (2 cm), some containing minor amounts of nahcolite-----	1,155.2-1,167.0 (352.1-355.7)
Oil shale, as above, interlaminated with thin-bedded, moderate-yellowish-brown siltstone; possible thin tuff bed at 1,167 feet (355.7 m)-----	1,167.0-1,172.5 (355.7-357.4)
Oil shale, like unit at 1,155.2-1,167.0 feet (352.1-355.7 m); collapse breccias at 1,172.5-1,174.5 feet (355.7-358.0 m) and 1,175.4-1,178.0 feet (358.3-359.1 m); a thin, medium- light-gray pyritiferous siltstone at 1,174.5 feet (358.0 m); zone at 1,172.5-1,174.5 feet (357.4-358.0 m) contains a layer of white crystalline mineral; unit may correspond to core-loss interval at 1,201.8-1,209.5 feet (366.3-368.7 m) in drill hole USBM-02A-----	1,172.5-1,178.0 (357.4-359.1)
Oil shale, dark-yellowish-brown, very thinly laminated; thin, moderate-yellowish-brown siltstone layer at 1,181 feet (360.0 m), moderately well cemented; dusky-yellowish-brown to dusky-brown oil shale at 1,185-1,189 feet (361.2-362.4 m); open vugs, as much as 2 inches (5 cm) contain minor amounts of nahcolite; evidence of leaching at 1,197.4-1,198.0 feet (365.0-365.2 m); minor amounts of calcite and pyrite on fracture surfaces; unit is brittle and incompetent-----	1,178.0-1,203.9 (359.1-366.9)

*Lithologic description of core (part B) from drill hole USBM-01,
Ryan Gulch--Continued*

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Parachute Creek Member--Continued	
No sample-----	1,203.9-1,207.2 (366.9-368.0)
Siltstone, pale-yellowish-brown and yellowish-gray, very thinly laminated; some is thin bedded; contains minor amounts of dark- to dusky-yellowish-brown, very finely laminated oil shale and marlstone(?); faults at 1,218 and 1,230 feet (371.2 and 374.9 m)--the lower one has abundant calcite dispersed throughout zone-----	1,207.2-1,230.0 (368.0-374.9)
Marlstone, pale-yellowish-brown, yellowish-gray, and dark-yellowish-brown, very thinly laminated to thin-bedded; contains minor amounts of dusky-yellowish-brown oil-shale laminae and thin siltstone stringers; vugs, 1/4 inch (1 cm) in diameter, filled with calcite and minor amounts of nahcolite; calcite and pyrite on fracture surfaces; base of R-6 zone at 1,240 feet (378.0 m)-----	1,230.0-1,287.7 (374.9-392.5)
No sample-----	1,287.7-1,292.7 (392.5-394.0)
Siltstone, pale-yellowish-brown, yellowish-gray, and medium-gray, thinly bedded; contains minor amounts of marlstone and oil shale; vugs (as wide as 3 in.) contain calcite and nahcolite; pyrite and calcite on fracture surfaces; collapse breccia or fault zone at 1,318-1,320.8 feet (401.7-402.6 m)-----	1,292.7-1,320.8 (394.0-402.6)
No sample; base of L-5 zone at 1,327 feet (403.6 m)-----	1,320.8-1,330.3 (402.6-405.5)
Oil shale, dusky-yellowish-brown and dusky-brown, very thinly laminated; contains minor amounts of siltstone and marlstone; evidence of leaching at 1,330.3-1,331.3 feet (405.5-405.8 m); small blebs of nahcolite at 1,330.3-1,332.7 feet (405.5-406.2 m)-----	1,330.3-1,335.1 (405.5-406.9)
No sample-----	1,335.1-1,335.9 (406.9-407.2)

*Lithologic description of core (part B) from drill hole USBM-01,
Ryan Gulch--Continued*

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Parachute Creek Member--Continued	
Oil shale, pale-yellowish-brown and yellowish-gray, very thinly laminated, platy; interlaminated with nahcolite and halite-----	1,335.9-1,353.4 (407.2-412.5)
No sample-----	1,353.4-1,363.8 (412.5-415.7)
Oil shale, nahcolite, and halite, like unit at 1,335.9- 1,353.4 feet (407.2-412.5 m)-----	1,363.8-1,370.5 (415.7-417.7)
Oil shale, brownish-black and dusky-yellowish-brown, very thinly laminated; contains rosettes of nahcolite-----	1,370.5-1,371.4 (417.7-418.0)
Oil shale, pale-yellowish-brown and yellowish-gray, very thinly laminated; interlaminated with pale-brown nahcolite and minor amounts of halite; crystalline zone at 1,373.1- 1,379.1 feet (418.5-420.3 m); pitting along laminae in this crystalline zone; calcite on some fracture surfaces-----	1,371.4-1,385.5 (418.0-422.3)
Oil shale, dusky-yellow-brown and brownish-black, very thinly laminated; light-brown transparent nahcolite rosettes scattered throughout rock-----	1,385.5-1,393.8 (422.3-424.8)
Oil shale, moderate-brown, dark-yellowish-brown, and dusky- brown, very thinly laminated; minor laminae of marlstone; contains light-brown nahcolite rosettes as much as 6 inches (15.2 cm) in diameter and minor halite beds-----	1,393.8-1,421.2 (424.8-433.2)
Oil shale, moderate-brown, moderate-yellowish-brown and dark- yellowish-brown, very thinly laminated; intervals between 1,430.0-1,448.0, 1,451.0-1,477.0, 1,484.0-1,486.0, and 1,487.5-1,489.0 feet (435.9-441.4, 442.3-450.2, 452.8- 452.9, and 453.3-453.8 m) contain nahcolite rosettes as much as 6 inches (15.2 cm) in diameter-----	1,421.2-1,489.0 (433.2-453.8)
Halite, white, translucent-----	1,489.0-1,492.0 (453.8-454.8)

*Lithologic description of core (part B) from drill hole USBM-01,
Ryan Gulch--Continued*

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Parachute Creek Member--Continued	
Oil shale, dark- and dusky-yellowish-brown, very thinly laminated; with minor amounts of yellowish-gray and dusky-brown oil shale; moderate-brown translucent crystalline nahcolite in beds, rosettes, and pods scattered through unit-----	1,492.0-1,510.8 (454.8-460.5)
Nahcolite, moderate-brown, translucent, and pale-yellowish-brown, opaque-----	1,510.8-1,515.0 (460.5-461.8)
Oil shale, like unit at 1,492.0-1,510.8 feet (454.8-460.5 m); contains small amounts of olive-black oil shale-----	1,515.0-1,524.0 (461.8-464.5)
Nahcolite, like unit at 1,510.8-1,515.0 feet (460.5-461.8 m)-----	1,524.0-1,534.0 (464.5-467.6)
Oil shale, dusky- to dark-yellowish-brown, very thinly laminated; contains pods and irregular lenses of moderate-brown, translucent, crystalline nahcolite-----	1,534.0-1,549.0 (467.6-472.1)
Nahcolite, pale-yellowish-brown, opaque, crystalline-----	1,549.0-1,554.0 (472.1-473.7)
Oil shale, dusky-yellowish-brown, dusky-brown, brownish-black, and minor dark-yellowish-brown, very thinly laminated; contains a 0.8-foot-thick (24-cm) nahcolite bed at 1,575.0 feet (480.1 m)-----	1,554.0-1,587.0 (473.7-483.7)
Nahcolite, white to pale-yellowish-brown, bedded, opaque, crystalline; interbedded with laminae of oil shale-----	1,587.0-1,598.3 (483.7-487.2)
Oil shale, like unit at 1,554-1,587 feet (473.7-483.7 m)-----	1,598.3-1,599.3 (487.2-487.5)
No sample-----	1,599.3-1,600.8 (487.5-487.9)
Oil shale, like unit at 1,554-1,587 feet (473.7-483.7 m)-----	1,600.8-1,603.8 (487.9-488.8)

*Lithologic description of core (part B) from drill hole USBM-01,
Ryan Gulch--Continued*

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Parachute Creek Member--Continued	
Halite, bedded-----	1,603.8-1,604.3 (488.8-489.0)
Nahcolite and oil shale, interbedded-----	1,604.3-1,610.0 (489.0-490.1)
Oil shale, like unit at 1,554-1,587 feet (473.7-483.7 m)-----	1,610.0-1,616.0 (490.1-492.6)
Nahcolite and oil shale, interbedded-----	1,616.0-1,620.5 (492.6-493.9)
Oil shale, like unit at 1,554-1,587 feet (473.7-483.7 m)-----	1,620.5-1,622.6 (493.9-494.6)
Nahcolite and oil shale, interbedded-----	1,622.6-1,629.0 (494.6-496.5)
Halite, bedded-----	1,629.0-1,629.5 (496.5-496.7)
Nahcolite and oil shale, interbedded-----	1,629.5-1,632.0 (496.7-497.4)
No sample (loss due to solubility of salts)-----	1,632.0-1,639.0 (497.4-499.6)
Oil shale, dusky-yellowish-brown, dark-yellowish-brown and minor light-brown, very thinly laminated; interbedded with halite zones, as much as 0.5 foot (15 cm) thick, and moderate-brown, crystalline, translucent nahcolite beds and rosettes; some nahcolite is pale yellowish brown-----	1,639.0-1,660.0 (499.6-506.0)
Oil shale, as above-----	1,660.0-1,667.7 (506.0-508.3)
No sample-----	1,667.7-1,669.0 (508.3-508.7)
Oil shale, like unit at 1,639.0-1,660.0 feet (499.6-506.0 m); contains scattered nahcolite rosettes; base of R-5 zone at 1,680.9 feet (512.3 m)-----	1,669.0-1,680.9 (508.7-512.3)
Nahcolite, dusky- to dark-yellowish-brown; contains a halite stringer at 1,682 feet (512.7 m)-----	1,680.9-1,686.9 (512.3-514.2)
No sample-----	1,686.9-1,699.0 (514.2-517.9)
Nahcolite, like unit at 1,680.9-1,686.9 feet (512.3-514.2 m)-----	1,699.0-1,702.5 (517.9-518.9)

*Lithologic description of core (part B) from drill hole USBM-01,
Ryan Gulch--Continued*

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Parachute Creek Member--Continued	
Oil shale, dusky-yellowish-brown, with minor amounts of pale-yellowish-brown, very thinly laminated oil shale; moderate-brown, translucent crystalline nahcolite rosettes as much as 3 inches (8 cm) in diameter scattered throughout core-----	1,702.5-1,715.0 (518.9-522.7)
Nahcolite, pale-yellowish-brown, opaque, crystalline, thin-bedded-----	1,715.0-1,717.0 (522.7-523.3)
Oil shale, like unit at 1,702.5-1,715.0 feet (518.9-522.7 m); contains some brownish-black oil shale-----	1,717.0-1,727.9 (523.3-526.7)
No sample-----	1,727.9-1,729.0 (526.7-527.0)
Oil shale, like unit at 1,717.0-1,727.9 feet (523.3-526.7)-----	1,729.0-1,734.5 (527.0-528.7)
Nahcolite, moderate-brown, translucent, crystalline, thin-bedded; with minor amounts of oil shale-----	1,734.5-1,737.0 (528.7-529.4)
Oil shale, like unit at 1,717.0-1,727.9 feet (523.3-526.7 m)-----	1,737.0-1,739.0 (529.4-530.0)
Nahcolite, like unit at 1,734.5-1,737.0 feet (528.7-529.4 m); base of L-4 zone at 1,742 feet (531.0 m)-----	1,739.0-1,742.0 (530.0-531.0)
Oil shale, like unit at 1,717.0-1,727.9 feet (523.3-526.7 m); contains a 4-inch-thick (10-cm) bed of nahcolite and halite at 1,750.9 feet (533.7 m)-----	1,742.0-1,759.0 (531.0-536.1)
Nahcolite, pale-yellowish-brown and moderate-brown, opaque to translucent, thin-bedded; with minor oil shale-----	1,759.0-1,768.5 (536.1-539.0)
Oil shale, dark-yellowish-brown and dusky-yellowish-brown, very thinly laminated-----	1,768.5-1,777.5 (539.0-541.8)
Nahcolite, like unit at 1,759.0-1,768.5 feet (536.1-539.0 m)-----	1,777.5-1,779.5 (541.8-542.4)
Oil shale, like unit at 1,768.5-1,777.5 feet (539.0-541.8 m)-----	1,779.5-1,783.0 (542.4-543.5)

*Lithologic description of core (part B) from drill hole USBM-01,
Ryan Gulch--Continued*

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Parachute Creek Member--Continued	
Nahcolite, like unit at 1,759.0-1,768.5 feet (536.1-539.0 m)-----	1,783.0-1,788.2 (543.5-545.0)
No sample-----	1,788.2-1,789.0 (545.0-545.3)
Oil shale, like unit at 1,768.5-1,777.5 feet (539.0-541.8 m); nahcolite rosettes, as wide as 4 inches (10 cm), and nahco- lite beds scattered throughout interval-----	1,789.0-1,818.9 (545.3-554.4)
No sample-----	1,818.9-1,819.4 (554.4-554.6)
Oil shale, dusky-yellowish-brown, contains rosettes of nahco- lite as much as 9 inches (23 cm) in diameter-----	1,819.4-1,828.4 (554.6-557.3)
Nahcolite, bedded and rosettes-----	1,828.4-1,830.0 (557.3-557.8)
Oil shale, nahcolite, and minor marlstone, interbedded and laminated, pale-yellowish-brown to dusky-yellowish-brown; rosettes as much as 10 inches (25 cm) in diameter; halite fills vertical fractures at 1,834 and 1,846 feet (559.0 and 562.7 m)-----	1,830.0-1,850.0 (557.8-563.9)
Oil shale, dusky-yellowish-brown, laminated with dusky- to dark- yellowish-brown marlstone; nahcolite rosettes as much as 6 inches (15 cm) in diameter every foot or two; fine- to medium-grained nahcolite bed at 1,873-1,873.5 feet (570.9- 571.0 m), and a 0.1-foot-thick (3-cm) bed at 1,853.8 feet (565.0 m)-----	1,850.0-1,874.0 (563.9-571.2)
No sample-----	1,874.0-1,879.0 (571.2-572.7)
Nahcolite, interbedded with dark-yellowish-brown and minor dusky-yellowish-brown marlstone(?); nahcolite beds range from 0.3 to 1.0 foot (8 to 30 cm) thick; dark-gray silt- stone layer at 1,887.5-1,887.7 feet (575.3-575.4 m); nah- colite rosettes scattered throughout lower half of unit (1,893-1,907.4 feet (577.0-581.4 m))-----	1,879.0-1,907.4 (572.7-581.4)

*Lithologic description of core (part B) from drill hole USBM-01,
Ryan Gulch--Continued*

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Parachute Creek Member--Continued	
Oil shale, dark-yellowish-brown, thinly laminated; minor laminae are dusky yellowish brown; bedded opaque nahcolite at 1,908.2-1,908.4 and 1,921.3-1,921.5 feet (581.6-581.7 and 585.6-585.7 m); nahcolite rosettes as much as 7 inches (18 cm) in diameter, most are 3-5 inches (8-15 cm); eroded rosettes cause core to break in 0.5-to 2-foot (15- to 60-cm) lengths-----	1,907.4-1,937.2 (581.4-590.5)
No sample-----	1,937.2-1,937.4 (590.5-590.5+)
Oil shale, dark- to dusky-yellowish-brown, thinly laminated; thin interbeds of nahcolite at 1,943, 1,960, 1,961.5, 1,969.8-1,970.2, and 1,972.3-1,972.9 feet (592.2, 597.4, 597.8, 600.4-600.5, and 601.2-601.3 m); nahcolite rosettes between 1,946 and 1,967 feet (593.1 and 599.5 m) and scattered between 1,968 and 1,997 feet (599.8 and 608.7 m); abundant dolomite lenses as long as 1 inch (3 cm) and as high as 1/8 inch (0.3 cm) throughout oil shale; "60 bed" at 1,988-1,992 feet (605.9-607.2 m); base of R-4 zone at 1,997 feet (608.7 m)-----	1,937.4-1,997.0 (590.5+-608.7)
Marlstone(?), dark-yellowish-brown, laminated with minor amounts of dusky-yellowish-brown oil shale; unit contains thin-bedded nahcolite at 2,002.0, 2,004.6, 2,017.6, and 2,020.6 feet (610.2, 611.0, 615.0, and 615.9 m); nahcolite rosettes 1-3 inches (3-8 cm) in diameter below 2,015 feet (614.2 m); bottom of L-3 zone at 2,026 feet (617.5 m)-----	1,997.0-2,025.9 (608.7-617.5)
No sample-----	2,025.9-2,027.1 (617.5-617.9)
Oil shale, dark-yellowish-brown, interlaminated and interbedded with bedded nahcolite, ranging from laminae to 3 inches (8 cm) thick; unit contains pale-yellowish-brown lenses of dolomite as much as 2 inches (5 cm) long (most are 1/4-1 in. (1-3 cm)); rock is 50 percent or more nahcolite; rosettes of nahcolite as much as 1.5 feet (45 cm) in diameter-----	2,027.1-2,085.7 (617.9-635.7)

Lithologic description of core (part B) from drill hole USBM-01,
Ryan Gulch--Continued

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Parachute Creek Member--Continued	
No sample-----	2,085.7-2,087.0 (635.7-636.1)
Oil shale, like unit at 2,027.1-2,085.7 feet (617.9-635.7 m), with nahcolite beds as much as 6 inches (15 cm) thick-----	2,087.0-2,094.0 (636.1-638.3)
Oil shale, dark- to dusky-yellowish-brown, containing nahcolite rosettes-----	2,094.0-2,116.3 (638.3-645.0)
No sample-----	2,116.3-2,117.0 (645.3-647.1)
Nahcolite, dark-yellowish-brown, bedded-----	2,117.0-2,123.0 (645.3-647.1)
Oil shale, dusky- to dark-yellowish-brown; unit contains opaque and translucent brown nahcolite rosettes as much as 1 foot (30 cm) in diameter (most are 3-5 in. (8-15 cm)); pale- yellow-brown lenses of dolomite below 2,137 feet (651.4 m)-----	2,123.0-2,146.5 (647.1-654.3)
No sample-----	2,146.5-2,147.5 (654.3-654.6)
Oil shale, dusky-yellowish-brown, interlaminated with minor dark-yellowish-brown marlstone; upper 3 feet (90 cm) is interbedded marlstone, nahcolite, and nahcolite rosettes; base of R-3 zone-----	2,147.5-2,163.0 (654.6-659.3)
Marlstone(?) dark-yellowish-brown, thinly laminated-----	2,163.0-2,175.5 (659.3-663.1)
No sample-----	2,175.5-2,177.5 (663.1-663.7)
Marlstone(?), like unit at 2,163-2,175.5 feet (659.3- 663.1 m)-----	2,177.5-2,180.5 (663.7-664.6)
Oil shale, dusky- and dark-yellowish-brown, thinly laminated-----	2,180.5-2,189.0 (664.6-667.2)
Nahcolite, bedded-----	2,189.0-2,195.0 (667.2-669.0)

*Lithologic description of core (part B) from drill hole USBM-01,
Ryan Gulch--Continued*

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Parachute Creek Member--Continued	
Oil shale, dark- to dusky-yellowish-brown, laminated; contains minor amounts of marlstone(?) and bedded nahcolite; nahcolite rosettes as large as 8 inches (20 cm) (most are 2-4 in. (5-8 cm) scattered throughout core; dolomite lenses in upper 32 feet (9.8 cm)-----	2,195.0-2,245.0 (669.0-684.3)
Marlstone(?), dark-yellowish-brown, laminated; contains minor amounts of nahcolite-----	2,245.0-2,254.3 (684.3-687.1)
No sample-----	2,254.3-2,258.0 (687.1-688.2)
Oil shale, dusky- to dark-yellowish-brown, laminated-----	2,258.0-2,268.0 (688.2-691.3)
Oil shale(?), dark-yellowish-brown, laminated; contains dolomite lenses 1/8-1/2 inch (0.3-1 cm) long-----	2,268.0-2,281.0 (691.3-695.2)
Garden Gulch Member	
No sample. Blue marker at 2,284 feet (696.2 m); base of R-2 zone-----	2,281.0-2,286.0 (695.2-696.8)
Oil shale, dusky- to dark-yellowish-brown, laminated; dolomite lenses-----	2,286.9-2,290.5 (696.8-698.1)
Oil shale, dusky-yellow-brown, laminated; unit has what appear to be slickensides on horizontal fracture surfaces-----	2,290.5-2,299.0 (698.1-700.7)
Interbedded shale, marlstone, and a white bedded material; shale is bluish gray from 2,305 to 2,310 feet (702.6-704.1 m); marlstone is dusky yellowish brown, laminated to thin bedded; white material between 2,299 and 2,305 feet (700.7 and 702.6 m) is in layers less than 0.1 foot (3 cm) thick; core discs easily; base of L-1 zone-----	2,299.0-2,310.0 (700.7-704.1)

*Lithologic description of core (part B) from drill hole USBM-01,
Ryan Gulch--Continued*

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Garden Gulch Member--Continued	
Marlstone, oil shale, and shale, interlaminated and inter-bedded, dark- to dusky-yellowish-brown; whitish-gray, very thin beds between 2,344.5-2,346.0 feet (714.6-715.1 m); fossils in 2,326-2,327-foot (709.0-709.3-m) interval may be fish vertebrae; core discs easily, shattered in many places-----	2,310.0-2,382.0 (704.1-726.0)
No sample, drilled with rock bit-----	2,382.0-2,382.5 (726.0-726.2)
Total depth-----	2,382.5 (726.2)

*Lithologic description of cuttings (part A) from drill hole USBM-01A
Horse Draw*

Description	Depth interval feet (meters)
Tertiary	
 Uinta Formation	
Siltstone, dusky-yellowish-brown (wet); grains mostly smoky quartz; trace of clear quartz and tiny pyrite fragments; no calcareous cement-----	210-225 (64.0-68.6)
Siltstone, as above, with trace of magnetite-----	225-240 (68.6-73.2)
Siltstone, as above, with more magnetite and pyrite; pyrite occurs in clumps of tiny crystals; trace of laminated siltstone and oil shale; very thin laminae-----	240-255 (73.2-77.7)
Same as above; no laminated material-----	255-270 (77.7-82.3)
Siltstone, as above; trace of very fine grained quartzitic sandstone; contains smoky quartz grains; no laminated material-----	270-295 (82.3-89.9)
Same as above; contains trace of oil shale as <1 mm fragments; trace of siltstone with calcite cement, subangular smoky quartz, and trace of clear quartz grains-----	295-310 (89.9-94.5)
Siltstone and very fine grained quartzitic sandstone; siltstone as above; traces of pyrite and magnetite; very thin laminae or lenses of yellowish-brown to dusky-yellowish-brown shale-----	310-365 (94.5-111.3)
Marlstone and siltstone; marlstone is very thinly laminated, pale yellowish brown and dark yellowish brown; siltstone is light gray to pale yellowish brown; minor amount of very fine grained sandstone of quartz grains, no calcareous cement; cuttings very fine-----	365-380 (111.3-115.8)
Marlstone, as above; trace of siltstone, no sandstone-----	380-425 (115.8-129.5)
No sample-----	425-440 (129.5-134.1)
Marlstone, as above, 95 percent of samples; dusk-yellowish-brown oil shale, 5 percent; trace pyrite-----	440-470 (134.1-143.3)

*Lithologic description of cuttings (part A) from drill hole USBM-01A,
Horse Draw--Continued*

Description	Depth interval feet (meters)
Tertiary--Continued	
Uinta Formation--Continued	
Same as above, with ~2 percent oil shale-----	470-500 (143.3-152.4)
Siltstone, sandstone, marlstone, and oil shale; siltstone (~50 percent) is pale to dark yellowish brown, very thinly laminated; sandstone (~25 percent) has very fine grains of smoky and clear quartz; marlstone (~25 percent) is pale to dark yellowish brown, very thinly laminated; oil shale (~3-5 percent) is dusky yellowish brown-----	500-515 (152.4-157.0)
Marlstone, sandstone, and oil shale as above; probably no siltstone-----	515-545 (157.0-166.1)
Marlstone, pale- to dark-yellowish-brown; ~1 percent dusky- yellowish-brown oil shale-----	545-575 (166.1-175.3)
Marlstone and oil shale; ~80 percent pale- to dark-yellowish- brown, thinly laminated, marlstone; ~20 percent dusky- yellowish-brown oil shale-----	575-590 (175.3-179.8)
Marlstone, dark-yellowish-brown, and dusky-yellowish-brown oil shale; equal parts-----	590-620 (179.8-189.0)
Similar to above; trace of light-gray to white, very fine grained sandstone-----	620-650 (189.0-198.1)
Marlstone (95 percent), pale- to dark-yellowish-brown, thinly laminated with dusky-yellowish-brown oil shale (5 percent); trace of light-gray to white, very fine grained sandstone-----	650-665 (198.1-202.7)
Marlstone and oil shale, as above; trace of pyrite and rusted fragments (iron mineral, magnetic; may be drill steel)-----	665-680 (202.7-207.3)
Marlstone (75 percent) and oil shale (25 percent); trace of pyrite-----	680-695 (207.3-211.8)
Oil shale (60+ percent), marlstone (35 percent), and siltstone (5 percent); pale-yellowish-brown to light-gray-----	695-710 (211.8-216.4)

*Lithologic description of cuttings (part A) from drill hole USBM-01A,
Horse Draw--Continued*

Description	Depth interval feet (meters)
Tertiary--Continued	
Uinta Formation--Continued	
Siltstone, pale-yellowish-brown, with tiny streaks of marlstone and oil shale (75 percent); dusky-yellowish-brown oil shale (20 per- cent); pale- to dark-yellowish-brown marlstone (5 percent); thinly laminated units-----	710-720 (216.4-219.5)
Oil shale, dusky-yellowish-brown to black, 95 percent; marlstone and siltstone total 5 percent-----	720-815 (219.5-248.4)
Oil shale, 50 percent; marlstone and siltstone total 50 percent; calcareous-----	815-830 (248.4-253.0)
Bottom of rock-bit zone	

*Lithologic description of core (part B) from drill hole USBM-01A,
Horse Draw*

Description	Depth interval feet (meters)
Tertiary	
Green River Formation	
Parachute Creek Member	
Oil shale, dusky-yellowish-brown, with minor amounts of dark-yellowish-brown oil shale, very thinly laminated; laminations horizontal to as much as 10° at 853-foot (260.0-m) depth; minor thin laminae of marlstone; calcite on open fractures; leached zone at 844 feet (257.3 m), and leached and collapse breccia zone at 855.5 feet (260.8 m)-----	830.0-855.5 (253.0-260.8)
No sample-----	855.5-857.0 (260.8-261.2)
Marlstone, interlaminated with minor siltstone, both pale to dark yellowish brown, very thinly laminated; minor dusky-yellowish-brown fissile oil shale; leaching at 874-876 feet (266.4-267.0 m) and 884-885 feet (269.4-269.7 m); calcite and pyrite on open fractures; laminae horizontal-----	857.0-885.5 (261.2-269.9)
No sample-----	885.5-887.0 (269.9-270.4)
Siltstone, pale-brown and pale-yellowish-brown, predominantly thinly laminated with some thin-bedded intervals-----	887.0-909.0 (270.4-277.1)
Oil shale, dusky-yellowish-brown, fissile; minor amounts of light-gray to pale-brown oil shale; unit contains very thin layers of wavy ash(?) beds; calcite and pyrite on open fractures; unit very brittle, disced, and fractured-----	909.0-912.8 (277.1-278.2)
No sample-----	912.8-915.0 (278.2-278.9)
Oil shale, like unit at 909.0-912.8 feet (277.1-278.2 m)-----	915.0-921.0 (278.9-280.7)
Marlstone, pale- and dark-yellowish-brown; very thinly laminated with minor siltstone and mudstone; calcite on open fractures; collapse breccia at 924 feet (281.6 m)-----	921.0-933.4 (280.7-284.5)
No sample-----	933.4-934.0 (284.5-284.7)

*Lithologic description of core (part B) from drill hole USBM-01A,
Horse Draw--Continued*

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Parachute Creek Member--Continued	
Oil shale, dusky-yellowish-brown and moderate-brown; thinly laminated with minor dark-yellowish-brown marlstone and siltstone; light-gray ash beds between 935 and 935.5 feet (285.0 and 285.1 m); pyrite in ash beds-----	934.0-946.6 (284.7-288.5)
No sample-----	946.6-948.6 (288.5-289.1)
Oil shale, dusky-yellowish-brown, fissile; some very thin beds of moderate-brown siltstone (ash?) throughout interval; collapse breccia at 956.4-957.4 feet (291.5-291.8 m)-----	948.6-963.8 (289.1-293.8)
No sample-----	963.8-966.0 (293.8-294.4)
Oil shale, dusky- and dark-yellowish-brown, fissile; laminae are horizontal; minor amounts of interlaminated marlstone; thin bed of moderate-yellowish-brown siltstone at 983.5 feet (299.8 m); minor amounts of calcite on fracture surfaces-----	966.0-992.8 (294.4-302.6)
No sample-----	992.8-996.0 (302.6-303.6)
Oil shale, like unit at 966.0-992.8 feet (294.4-302.6 m); collapse breccia at 1,004-1,005 feet (306-306.3 m) and 1,006-1,007 feet (306.6-306.9 m); some vugs in core-----	996.0-1,009.5 (303.6-307.7)
No sample-----	1,009.5-1,012.4 (307.7-308.6)
Oil shale, dusky- to dark-yellowish-brown and brownish-black, like unit at 966.0-992.8 feet (294.4-302.6 m); collapse breccia at 1,012.4-1,020.4 feet (308.6-311.0 m), 1,023-1,026 feet (311.8-312.7 m), and 1,028 feet (313.3 m); minor amounts of pyrite on fractures-----	1,012.4-1,029.3 (308.6-313.7)

*Lithologic description of core (part B) from drill hole USBM-01A,
Horse Draw--Continued*

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Parachute Creek Member--Continued	
Oil shale and minor mudstone, dusky-yellowish-brown and brownish-black with minor amounts of pale-yellowish-brown fissile oil shale in richer parts; horizontal laminae; minor amounts of calcite on fractures; vuggy and minor collapse breccia at 1,033-1,034.5 feet (314.9-315.3 m) and 1,040-1,041 feet (317.0-317.3 m)-----	1,029.3-1,047.2 (313.7-319.2)
Oil shale interlaminated with siltstone, dusky- and dark-yellowish-brown; fissile oil shale in richer parts; few rounded vugs probably contained nahcolite; collapse breccia (fault zone?) at 1,056-1,060 feet (321.9-323.1 m) contains clay- to cobble sized fragments-----	1,047.2-1,068.8 (319.2-325.8)
No sample-----	1,068.8-1,074.3 (325.8-327.4)
Oil shale, dark-yellowish-brown, very thinly laminated-----	1,074.3-1,078.0 (327.4-328.6)
Siltstone and interlaminated marlstone, pale- to dark-yellowish-brown and moderate-brown; leaching of nahcolite at 1,078-1,080 feet (328.6-329.2 m) and 1,081-1,082 feet (329.5-329.8 m); totally unconsolidated between 1,084.7 and 1,090 feet (330.6 and 332.2 m); B-groove zone-----	1,078.0-1,090.0 (328.6-332.2)
No sample, B-groove zone(?)-----	1,090.0-1,101.5 (332.2-335.7)
Marlstone, dusky- and pale-yellowish-brown, very thinly laminated; calcite on open fractures; small vugs-----	1,101.5-1,104.0 (332.2-336.5)
Siltstone, pale-yellowish-brown, thin-bedded-----	1,104.0-1,106.0 (336.5-337.1)
Oil shale, dusky-yellowish-brown, very thinly laminated; horizontal laminae-----	1,106.0-1,116.5 (337.1-340.3)
Siltstone, like unit at 1,104.0-1,106.0 feet (336.5-337.1 m)-----	1,116.5-1,117.0 (340.3-340.5)

*Lithologic description of core (part B) from drill hole USBM-01A,
Horse Draw--Continued*

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Parachute Creek Member--Continued	
Oil shale, like unit at 1,106.0-1,116.5 feet (337.1-340.3 m)-----	1,117.0-1,120.7 (340.5-341.6)
Siltstone, like unit at 1,104.0-1,106.0 feet (336.5-337.1 m)-----	1,120.7-1,121.1 (341.6-341.7)
Oil shale, like unit at 1,106.0-1,116.5 feet (337.1-340.3 m)-----	1,121.1-1,122.0 (341.7-342.0)
Marlstone, like unit at 1,101.5-1,104.0 feet (335.8-336.5 m)-----	1,122.0-1,125.9 (342.0-343.2)
No sample-----	1,125.9-1,129.5 (343.2-344.3)
Oil shale, olive-black and dusky-yellowish-brown, with minor yellowish-gray marlstone and siltstone; very thin horizontal laminae; minor scattered vugs as much as 2 inches (5 cm) in diameter which previously contained nahcolite; gilsonite at 1,133 feet (345.3 m) and stringers of oil at 1,136 feet (346.3 m)-----	1,129.5-1,152.5 (344.3-351.3)
No sample-----	1,152.5-1,153.5 (351.3-351.6)
Oil shale, olive-black and dusky-yellowish-brown, with minor amounts of pale-yellowish-brown fissile oil shale-----	1,153.5-1,166.0 (351.6-355.4)
Siltstone, moderate-yellowish-brown-----	1,166.0-1,167.0 (355.4-355.7)
Oil shale, same as unit at 1,153.5-1,166.0 feet (351.6-355.4 m)-----	1,167.0-1,181.5 (355.7-360.1)
Oil shale, olive-black and dusky-yellowish-brown, fissile; minor moderate-yellowish-brown siltstone; collapse breccia at 1,194-1,195 feet (363.9-364.2 m); calcite on open fractures-----	1,181.5-1,194.0 (360.1-363.9)
Marlstone, pale- to dark-yellowish-brown, very thinly laminated-----	1,194.0-1,204.0 (363.9-367.0)
Oil shale, dusky-yellowish-brown, very thinly laminated; thin bed of moderate-yellowish-brown siltstone at 1,217.5 feet (371.1 m); small vugs at 1,218 feet (371.2 m); thin-bedded siltstone at 1,220.0 feet (371.9 m); collapse breccia at 1,220-1,222 feet (371.9-372.5 m)-----	1,222.0-1,233.5 (372.5-376.0)

*Lithologic description of core (part B) from drill hole USBM-01A,
Horse Draw--Continued*

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Parachute Creek Member--Continued	
Marlstone, pale-yellowish-brown; very thinly laminated with dark- to dusky-yellowish-brown oil shale-----	1,222.0-1,233.5 (372.5-376.0)
No sample-----	1,233.5-1,240.7 (376.0-378.2)
Oil shale, dusky-yellowish-brown and olive-black; very thinly laminated with minor marlstone; vugs and open joints at 1,248 feet (380.4 m)-----	1,240.7-1,255.0 (378.2-382.5)
No sample-----	1,255.0-1,261.1 (382.5-384.4)
Oil shale, pale- to moderate-yellowish-brown; very thinly laminated to thin bedded with some dusky-yellowish-brown oil shale; evidence of leaching, minor calcite on fracture surfaces-----	1,261.1-1,287.1 (384.4-392.3)
Siltstone, yellowish-gray with minor dusky-yellow, very thinly laminated; laminae generally horizontal; inter- laminated with dusky-yellowish-brown oil shale which becomes more prominent in lower 4 feet (1.2 m)-----	1,287.1-1,300.0 (392.3-396.2)
Siltstone, pale-yellowish-brown, thinly laminated; laminae are horizontal; leached zones from 1,300.3 to 1,303.3 (396.3 to 397.2 m); vugs as much as 1/4 inch in diameter at 1,312 feet (399.9 m)-----	1,300.0-1,315.0 (396.2-400.8)
Siltstone, light-olive-gray and olive-black, very finely laminated; laminae are horizontal; leached zone from 1,317.5 to 1,317.7 feet (401.6 to 401.7 m)-----	1,315.0-1,318.7 (400.8-401.9)
Siltstone, yellowish-gray and medium-gray, thinly laminated to thin-bedded; horizontal laminae and beds; leached zone from 1,318.7 to 1,327.9 feet (401.9 to 404.7 m); pinhead- sized vugs contain traces of calcite-----	1,318.7-1,331.7 (401.9-405.9)
Oil shale, dusky-yellow; thinly laminated with minor amounts of silty inclusions-----	1,331.7-1,332.4 (405.9-406.1)

*Lithologic description of core (part B) from drill hole USBM-01A,
Horse Draw--Continued*

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Parachute Creek Member--Continued	
No sample-----	1,332.4-1,335.2 (406.1-407.0)
Marlstone, olive-gray, thinly laminated, horizontal laminations-----	1,335.2-1,337.4 (407.0-407.6)
Siltstone, pale- and dark-yellowish-brown; horizontal to subhorizontal bedding; minor amounts of laminated oil shale; calcite on fracture surfaces-----	1,337.4-1,341.2 (407.6-408.8)
Siltstone, dark-yellowish-brown, calcitic, leached; hori- zontal bedding-----	1,341.2-1,347.4 (408.8-410.7)
Siltstone, pale-yellowish-brown, with minor amounts of light-olive-gray and dusky-yellowish-brown laminated oil shale; bedding horizontal to subhorizontal-----	1,347.4-1,352.2 (410.7-412.2)
Clay, dark-yellowish-brown-----	1,352.2-1,353.2 (412.2-412.5)
Siltstone, shattered-----	1,353.2-1,353.6 (412.5-412.7)
No sample-----	1,353.6-1,354.6 (412.7-412.9)
Oil shale, dusky-yellowish-brown, very thinly laminated with minor amounts of dark-yellowish-brown oil shale; siltstone layer at 1,359 feet (414.2 m); collapse breccia between 1,354.6 and 1,359.5 feet (412.9 and 414.4 m); leached at 1,361.3-1,361.6 feet (414.9- 415.0 m); vugs as much as 3 inches (7.6 cm) wide throughout core-----	1,354.6-1,361.6 (412.9-415.0)
No sample-----	1,361.6-1,370.3 (415.0-417.7)
Oil shale, pale-yellowish-brown, yellowish-gray, and light- olive-gray, thinly laminated to thin-bedded; pods contain- ing clay and calcite with minor amounts of pyrite at 1,400- 1,420 feet (426.7-432.8 m); unit contains thin to thick beds of pale-yellowish-brown translucent nahcolite, disseminated nahcolite, and scattered rosettes of nahcolite as much as 4 inches (10.2 cm) in diameter-----	1,370.3-1,420.0 (417.7-432.8)

*Lithologic description of core (part B) from drill hole USBM-01A,
Horse Draw--Continued*

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Parachute Creek Member--Continued	
Nahcolite, very light gray to pale-yellowish-brown, translucent, thin-bedded-----	1,420.0-1,422.0 (432.8-433.4)
Oil shale, pale-yellowish-brown, dusky-yellowish-brown, and dusky-brown, thinly laminated; rosettes of nahcolite as much as 4 inches (10.2 cm) in diameter throughout interval; unit is grayish black between 1,429.4 and 1,436.2 feet (435.7-437.8 m)-----	1,422.0-1,437.3 (433.4-438.1)
Nahcolite, moderate-yellowish-brown, coarsely crystalline, bedded; contains rosettes at 1,438.8-1,439.2 feet (438.5-438.7 m)-----	1,437.3-1,440.2 (438.1-439.0)
Halite, white to dusky-yellowish-brown, coarsely crystalline; minor thin beds of moderate-yellowish-brown oil shale-----	1,440.2-1,443.4 (439.0-439.9)
Oil shale, dark-yellowish-brown and dusky-yellow, thinly laminated; most laminae horizontal; thin nahcolite beds and rosettes scattered throughout unit-----	1,443.4-1,473.2 (439.4-449.0)
Halite, moderate-brown to dusky-brown, transparent to translucent, coarsely crystalline; minor amounts of nahcolite-----	1,473.2-1,477.5 (449.0-450.3)
Oil shale, dusky-yellow, very thinly laminated, interlayered with nahcolite rosettes-----	1,477.5-1,487.9 (450.3-453.5)
No sample-----	1,487.9-1,488.9 (453.5-453.8)
Oil shale, olive-gray and dusky-yellowish-brown, fissile in part; laminae are horizontal; interlaminated and bedded with moderate-brown, transparent crystalline nahcolite-----	1,488.9-1,504.0 (453.8-458.4)
Oil shale, as above; nahcolite rosettes scattered throughout unit-----	1,504.0-1,522.0 (458.4-463.9)

*Lithologic description of core (part B) from drill hole USBM-01A,
Horse Draw--Continued*

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Parachute Creek Member--Continued	
Nahcolite, dark-yellowish-brown, translucent to transparent, crystalline; interlaminated with oil shale-----	1,522.0-1,531.0 (463.9-466.6)
Nahcolite, moderate-brown; crystalline rosettes as much as 5 inches (12.4 cm) in diameter interlayered with olive- black and dusky-yellowish-brown oil shale-----	1,531.0-1,577.4 (466.6-480.8)
No sample-----	1,577.4-1,578.4 (480.8-481.1)
Oil shale, dusky-yellowish-brown and olive-black; contains scattered rosettes and thin beds of nahcolite-----	1,578.4-1,589.6 (481.1-484.5)
Oil shale, as above; contains thin beds of crystalline nahcolite as much as 2.4 feet (0.7 m) thick-----	1,589.6-1,633.0 (484.5-497.7)
Halite, olive-black, coarsely crystalline; interbedded with oil shale-----	1,633.0-1,635.3 (497.7-498.4)
Oil shale, dusky-yellowish-brown and grayish-brown, fissile and thinly laminated; white to dark-yellowish-brown crys- talline nahcolite in beds and rosettes scattered through- out unit; minor amounts of white to medium-light-gray crystalline halite-----	1,635.3-1,682.8 (498.4-512.9)
No sample-----	1,682.8-1,698.6 (512.9-517.7)
Nahcolite, moderate-brown, finely crystalline, thin-bedded-----	1,698.6-1,704.0 (517.7-519.4)
Halite, white to dark-gray, fine to coarsely crystalline; interbedded and laminated with dusky-yellow, finely crystalline nahcolite-----	1,704.0-1,719.0 (519.4-524.0)
Nahcolite, like unit at 1,698.6-1,704.0 feet (517.7-519.4 m)-----	1,719.0-1,722.0 (524.0-524.9)
Halite and nahcolite, like unit at 1,704.0-1,719.0 feet (519.4-524.0 m)-----	1,722.0-1,729.0 (524.9-527.0)

*Lithologic description of core (part B) from drill hole USBM-01A,
Horse Draw--Continued*

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Parachute Creek Member--Continued	
Oil shale, black and dark-yellowish-brown to 1,732.0 feet (527.9 m), and dark- to dusky-yellowish-brown oil shale below 1,732.0 feet (527.9 m); minor amounts of dark-yellow- ish-brown, bedded, crystalline nahcolite and nahcolite rosettes as much as 2 inches (5 cm) in diameter; trace of pyrite-----	1,729.0-1,757.8 (527.0-535.8)
No sample-----	1,757.8-1,758.0 (535.8-535.8+)
Nahcolite, pale-brown, laminated to thin-bedded, opaque to translucent, crystalline-----	1,758.0-1,760.0 (535.8+-536.4)
Oil shale, dusky-yellowish-brown and pale-brown, fissile; contains nahcolite rosettes as much as 5 inches (12.7 cm) in diameter-----	1,760.0-1,786.0 (536.4-544.4)
Nahcolite, like unit at 1,758.0-1,760.0 feet (535.8-536.4 m)-----	1,768.0-1,790.0 (544.4-545.6)
Oil shale, like unit at 1,760.0-1,786.0 feet (536.4-544.4 m)-----	1,790.0-1,791.0 (545.6-545.9)
Nahcolite, like unit at 1,758.0-1,760.0 feet (535.8+-536.4 m)-----	1,791.0-1,795.0 (545.9-547.1)
Oil shale, like unit at 1,760.0-1,786.0 feet (536.4-544.4 m)-----	1,795.0-1,804.0 (547.1-549.9)
Nahcolite, Like unit at 1,758.0-1,760.0 feet (535.8+-536.4 m)-----	1,804.0-1,814.0 (549.9-552.9)
Oil shale, like unit at 1,760.0-1,786.0 feet (536.4-544.4 m)-----	1,814.0-1,816.5 (552.9-553.7)
No sample-----	1,816.5-1,818.3 (553.7-554.2)
Nahcolite, pale-brown to pale-yellowish-brown, laminated to thin-bedded, opaque to transparent, crystalline-----	1,818.3-1,832.0 (554.2-558.4)
Oil shale, olive-gray and dusky-yellowish-brown, fissile; minor amounts of grayish-olive oil shale; abundant moderate-brown nahcolite rosettes as wide as 6 inches (15.2 cm)-----	1,832.0-1,839.0 (558.4-560.5)

*Lithologic description of core (part B) from drill hole USBM-01A,
Horse Draw--Continued*

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Parachute Creek Member--Continued	
Nahcolite, like unit at 1,818.3-1,832.0 feet (554.2-558.4 m)-----	1,839.0-1,848.0 (560.5-563.3)
Oil shale, like unit at 1,832.0-1,839.0 feet (558.4-560.5 m)-----	1,848.0-1,852.0 (563.3-564.5)
Nahcolite, like unit at 1,818.3-1,832.0 feet (554.2-558.4 m)-----	1,852.0-1,857.0 (564.5-566.0)
Oil shale, like unit at 1,832.0-1,839.0 feet (558.4-560.5 m)-----	1,857.0-1,860.0 (566.0-566.9)
Nahcolite, like unit at 1,818.3-1,832.0 feet (554.2-558.4 m)-----	1,860.0-1,861.0 (566.9-567.2)
Oil shale, like unit at 1,832.0-1,839.0 feet (558.4-560.5 m)-----	1,861.0-1,866.0 (567.2-568.8)
Nahcolite, like unit at 1,818.3-1,832.0 feet (554.2-558.4)-----	1,866.0-1,867.0 (568.8-569.1)
Oil shale, like unit at 1,832.0-1,839.0 feet (558.4-560.5 m)-----	1,867.0-1,877.2 (569.1-572.2)
Nahcolite, pale-yellowish-brown, opaque, crystalline-----	1,877.2-1,879.0 (572.2-572.7)
Oil shale, dark-yellowish-brown, fissile; minor amounts of dusky-yellowish-brown and pale-yellowish-brown oil shale below 1,907.8 feet (581.5 m); some stringers of dusky- brown oil shale above 1,907.8 feet (581.5 m); interval contains moderate-brown nahcolite rosettes as large as 18 inches (46 cm) in diameter-----	1,879.0-1,914.7 (572.7-583.6)
Nahcolite, like unit at 1,877.2-1,879.0 feet (572.2-572.7 m)-----	1,914.7-1,915.7 (583.6-583.9)
Oil shale, like unit at 1,879.0-1,914.7 feet (572.7-583.6 m); rosettes as much as 12 inches (31 cm) in diameter-----	1,915.7-1,930.4 (583.9-588.4)
No sample-----	1,930.4-1,934.5 (588.4-589.6)
Oil shale, olive-gray and dark-yellowish-brown, thinly laminated to thinly bedded; laminae and beds horizontal; occasional blebby and streaked structure; scattered rosettes of moderate-brown to grayish-black nahcolite as much as 5 inches (12.7 cm) in diameter-----	1,934.5-1,939.6 (589.6-591.2)

*Lithologic description of core (part B) from drill hole USBM-01A,
Horse Draw--Continued*

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Parachute Creek Member--Continued	
Nahcolite, moderate-brown to grayish-black, bedded, fine to medium crystalline-----	1,939.6-1,941.7 (591.2-591.8)
Oil shale, like unit at 1,934.5-1,939.6 feet (589.6-591.2 m)-----	1,941.7-1,947.0 (591.8-593.4)
Nahcolite, like unit at 1,939.6-1,941.7 feet (591.2-591.8 m)-----	1,947.0-1,947.7 (593.4-593.7)
Oil shale, like unit at 1,934.5-1,939.6 feet (589.6-591.2 m)-----	1,947.7-1,988.0 (593.7-605.9)
Nahcolite, dark-yellowish-brown, bedded and rosette, coarsely crystalline-----	1,988.0-2,023.0 (605.9-616.6)
Oil shale, olive-gray to dusky-yellow and grayish-black, thinly laminated; streaked and blebby structure at 2,002, 2,007, and 2,036 feet (610.2, 611.7, and 620.6 m); clay zone (fault) at 2,048.3 feet (624.3 m)-----	2,023.0-2,048.3 (616.6-624.3)
Oil shale, pale-yellowish-brown, with thin beds of dusky-yellowish-brown and olive-black oil shale, thinly laminated; horizontal laminae; scattered transparent moderate-brown rosettes of nahcolite as much as 6 inches (15 cm) in diameter-----	2,048.3-2,067.0 (624.3-630.0)
Oil shale, as above; unit contains beds of pale-yellowish-brown opaque crystalline nahcolite-----	2,067.0-2,086.0 (630.0-635.8)
Oil shale, olive-gray to dark-yellowish-brown, fissile; numerous beds of finely crystalline, and rosettes of coarsely crystalline, grayish-brown to moderate-yellowish-brown nahcolite; beds range to as much as 1 foot (30 cm) thick, and rosettes to 6 inches (15 cm); pyrite throughout unit-----	2,086.0-2,156.0 (635.8-657.1)
Nahcolite, grayish-brown to moderate-yellowish-brown, bedded; stringers of oil shale-----	2,156.0-2,163.5 (657.1-659.4)

*Lithologic description of core (part B) from drill hole USBM-01A,
Horse Draw--Continued*

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Parachute Creek Member--Continued	
Oil shale and nahcolite, like unit at 2,086.0-2,156.0 feet (635.8-657.1 m)-----	2,163.5-2,167.9 (659.4-660.8)
No sample-----	2,167.9-2,168.8 (660.8-661.1)
Oil shale, olive-gray to grayish-brown, fissile to thinly laminated; grades downward into olive-black oil shale; streaked and blebby structure from 2,178.0 to 2,187.0 feet (663.9-666.6 m); unit contains scattered beds and rosettes of nahcolite and a 0.1-foot- (3-cm-) thick bed of halite at 2,185.0 feet (666.0 m)-----	2,168.8-2,224.0 (661.1-677.9)
Nahcolite, moderate-brown, platy; transparent crystals, beds and rosettes-----	2,224.0-2,239.0 (677.9-682.4)
Oil shale, dusky-yellow-brown and olive-black, alternating with laminae of moderate- and pale-yellowish-brown oil shale, fissile, thin-bedded; laminae generally horizontal-- those at 2,255 feet (687.3 m) dip as much as 10°; unit contains blebs and stringers of pale-yellowish-brown oil shale; scattered rosettes of nahcolite 6-7 inches (15-18 cm) in diameter-----	2,239.0-2,260.0 (682.4-688.8)
Oil shale, dusky-yellowish-brown, with stringers and blebs of pale-yellowish-brown oil shale; unit contains minor amounts of disseminated nahcolite-----	2,260.0-2,289.0 (688.8-697.7)
Oil shale, olive-gray, alternating with grayish-brown and dusky-brown oil shale; a few black laminae of oil shale; blebs of thinly laminated dusky-yellow oil shale between 2,316 and 2,318 feet (705.9 and 706.5 m); irregular clast- like structures of dusky-yellowish-brown oil shale cut across and slightly disrupt laminations; blue marker at 2,322 feet (707.7 m)-----	2,289.0-2,322.0 (697.7-707.7)

*Lithologic description of core (part B) from drill hole USBM-01A,
Horse Draw--Continued*

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Garden Gulch Member	
Oil shale, olive-gray, grayish-brown, and dusky-brown, inter- laminated with medium-dark-gray to dark-gray shale; shale is brittle and massive; stringers of sandy limestone at 2,333.1 feet (711.1 m), and limestone at 2,332.6 feet (711.0 m) and 2,334.2 feet (711.5 m)-----	2,322.0-2,334.2 (707.7-711.5)
Oil shale, olive-gray, grayish-brown, and dusky-brown, thinly laminated-----	2,334.2-2,335.8 (711.5-712.0)
No sample-----	2,335.8-2,339.8 (712.0-713.2)
Oil shale, dark- and dusky-yellowish-brown, in thin to thick laminations; below 2,347 feet (715.4 m) rock is light yellowish brown; siltstone laminae at 2,345.2 feet (714.8 m) and 2,346.7 feet (715.3 m); thinly laminated blebs of dusky-yellowish-brown oil shale between 2,339.8 and 2,345 feet (713.2 and 714.8 m)-----	2,339.8-2,354.3 (713.2-717.6)
No sample-----	2,354.3-2,386.7 (717.6-727.5)
Oil shale, light-olive-gray and grayish-black, fissile to thin- bedded, brittle, in alternating thin laminae with minor amounts of olive-black oil shale-----	2,386.7-2,405.7 (727.5-733.3)
No sample-----	2,405.7-2,406.9 (733.3-733.6)
Shale, grayish-black, interlaminated with dusky-yellowish- brown oil shale; blebs of rich oil shale at 2,413.0-2,413.4 feet (735.5-735.6 m); thin silty layers at 2,415.5 and 2,423.6 feet (736.2 and 738.7 m); rock shatters and discs easily; waxy surfaces on disc faces-----	2,406.9-2,426.5 (733.6-739.6)
No sample-----	2,426.5-2,436.2 (739.6-742.6)
Shale, olive-black, interlaminated with light-olive-brown oil shale; horizontal laminations; core discs and shatters easily; waxy surfaces on disc faces-----	2,436.2-2,444.0 (742.6-744.9)

*Lithologic description of core (part B) from drill hole USBM-01A,
Horse Draw--Continued*

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Garden Gulch Member--Continued	
Oil shale, dusky-yellowish-brown, with slightly darker stringers-----	2,444.0-2,460.0 (744.9-749.8)
Shale, olive-black, olive-gray, and dusky-yellowish-brown; dusky-gray laminated shale at 2,468-2,482 feet (752.2- 756.5 m)-----	2,460.0-2,484.5 (749.8-757.3)
No sample-----	2,484.5-2,487.5 (757.3-758.2)
Shale, light-olive-gray, laminated with dark-gray to olive-gray shale; horizontal laminations; some laminae of dusky-yellow oil shale; core discs along waxy-coated laminae; calcareous to slightly calcareous from 2,491.0 to 2,502.0 feet (759.3 to 762.6 m)-----	2,487.5-2,539.6 (758.2-774.1)
No sample-----	2,539.6-2,547.6 (774.1-776.5)
Total depth of core-----	2,547.6 (776.5)
Total depth for hole-----	2,610.0 (795.5)

*Lithologic description of core from drill hole USBM-02A,
Horse Draw*

Description	Depth interval feet (meters)
Tertiary	
Uinta Formation	
Mudstone, dark-gray; no calcite cement-----	197.5-198.0 (60.2-60.4)
Shale, dark- and dusky-yellowish-brown, laminated; laminae are horizontal except between 192.5 and 192.9 feet (58.7 and 58.8 m) where laminae are in swirls-----	198.0-201.4 (60.4-61.4)
Siltstone, medium-light-gray; salt-and-pepper appearance-----	201.4-202.1 (61.4-61.6)
Siltstone and interlaminated shale; siltstone is medium light gray; olive-gray and minor amounts of brownish-gray shale-----	202.1-204.0 (61.6-62.2)
Siltstone, like unit at 201.4-202.1 feet (61.4-61.6 m)-----	204.0-204.4 (62.2-62.3)
No sample-----	204.4-204.5 (62.3-62.3+)
Shale, dusky- to dark-yellowish-brown, thinly laminated; horizontal to swirly laminae; minor amounts of pale-yellowish-brown siltstone-----	204.5-211.3 (62.3+-64.4)
No sample-----	211.4-212.5 (64.4-64.8)
Drilled with rock bit-----	212.5-217.5 (64.8-66.3)
Shale, medium-gray to yellowish-gray; very thin to thin bedding, generally horizontal, with some swirly patterns; some black carbonaceous streaks parallel to bedding; a few thin beds of light-gray to medium-light-gray siltstone-----	217.5-240.3 (66.3-73.2)
Siltstone, light-gray; horizontally laminated with dark-yellowish-brown and dusky-brown shale; laminae in swirls between 245.5 and 248.0 feet (74.8 and 75.6 m)-----	240.3-251.3 (73.2-76.6)
No sample-----	251.3-262.6 (76.6-80.0)
Sandstone, pale-brown and grayish-brown, fine-grained, laminated; scattered carbonaceous stringers; rounded quartz grains <1 mm; no calcite cement-----	262.6-270.6 (80.0-82.5)
No sample-----	270.6-272.7 (82.5-83.1)
Cement, from higher up in core hole-----	272.7-273.0 (83.1-83.2)

Lithologic description of core from drill hole USBM-02A, Horse Draw--Continued

Description	Depth interval feet (meters)
Tertiary--Continued	
Uinta Formation--Continued	
Sandstone, brownish-gray and light-gray, fine-grained; beds range from 2 to 6 inches (5 to 15 cm) thick; wavy bedding dips as much as 40°; thin stringers of carbonaceous material-----	273.0-281.0 (83.2-85.6)
Claystone, dark-brown-----	281.0-282.2 (85.6-86.0)
Sandstone, light-gray and brownish-gray, friable-----	282.2-283.0 (86.0-86.3)
No sample-----	283.0-288.0 (86.3-87.8)
Sandstone, like unit at 282.2-283.0 feet (86.0-86.3 m)-----	288.0-291.0 (87.8-88.7)
Siltstone and marlstone, laminated; siltstone is grayish brown; shale is pale brown with dusky-yellow-brown streaks; nearly horizontal laminae; calcite cement-----	291.0-303.0 (88.7-92.4)
Marlstone, dusky- and dark-yellowish-brown, laminated; discs easily-----	303.0-304.3 (92.4-92.8)
No sample-----	304.3-307.0 (92.8-93.6)
Marlstone, pale-brown, grayish-orange-pink, and grayish-brown; wavy laminae dip about 20°; pyrite and calcite on fracture surface at 309 feet (94.2 m); medium-gray sandstone in lower 6 inches (15 cm); core shattered and pyritiferous in lower 2 feet (60 cm)-----	307.0-316.5 (93.6-96.5)
No sample-----	316.5-320.7 (96.5-97.7)
Sandstone, brownish-gray, fine-grained; mostly rounded quartz grains-----	320.7-325.0 (97.7-99.1)
Marlstone, dark- and pale-yellowish-brown, laminated with minor amounts of light-grayish-brown siltstone; laminae horizontal to 10°; pyrite on fractured surfaces; a 0.1-inch- (0.3-cm-) thick clay zone at about 328.5 feet (100.1 m)-----	325.0-329.8 (99.1-100.5)
Shale, light-olive-gray to olive-gray, very thinly laminated; laminae horizontal and intermittently indistinct; minor thin laminae of yellowish-gray and dark-yellowish-gray marlstone; light- to medium- light-gray, fine-grained, thin-bedded sandstone zones occur at 331 feet and 340 feet (100.9 m and 103.6 m). Pyrite disseminated in marlstone-----	329.8-347.9 (100.5-106.0)

Lithologic description of core from drill hole USBM-02A, Horse Draw--Continued

Description	Depth interval feet (meters)
Tertiary--Continued	
Uinta Formation--Continued	
No sample-----	347.9-350.9 (106.0-107.0)
Marlstone, olive-gray, finely interlaminated with yellowish-gray marlstone; laminae are horizontal except for locally deformed laminae at 353 and 358 feet (107.6 and 109.1 m); pyrite on fracture surfaces---	350.9-363.0 (107.0-110.6)
No sample-----	363.0-364.3 (110.6-111.0)
Marlstone, dusky-brown, olive-gray, and light-olive-gray, thinly laminated; laminae are horizontal except for distorted interval at 364.3-365.0 feet (111.0-111.3 m); thin, medium-light-gray, fine- grained sandstone beds at 369 and 370 feet (112.5 and 112.8 m); pyrite disseminated in marlstone-----	364.3-370.3 (111.0-112.9)
No sample-----	370.3-377.2 (112.9-115.0)
Marlstone, dark- and dusky-yellowish-brown, laminated; laminae dips range from 5° to 45°; pale-yellowish-brown zone between 373.6 and 374.5 feet (113.9 and 114.1 m); pyrite disseminated throughout unit in 3-6 mm pods and streaks along laminae-----	377.2-383.2 (115.0-116.8)
No sample-----	383.2-386.2 (116.8-117.7)
Marlstone, dark-yellowish-brown, laminated with minor amounts of dusky- and pale-yellowish-brown marlstone; core fractured by 45°; fractures every 3-8 inches (8-20 cm); pyrite on fracture surfaces-----	386.2-413.6 (117.7-126.1)
Marlstone, olive-gray and light-olive-gray, laminated; generally horizontal laminae, a few local deformations; pyrite on fracture surfaces; discs easily; some pods and thin beds of medium-light- gray, fine-grained, noncalcareous sandstone-----	413.6-440.9 (126.1-134.4)
No sample-----	440.9-444.5 (134.4-135.5)
Marlstone, like unit at 413.6-440.9 feet (126.1-134.4 m); no sandstone---	444.5-451.0 (135.5-137.5)
No sample-----	451.0-451.8 (137.5-137.7)
Marlstone, light-olive-gray, like unit at 444.5-451.0 feet (135.5- 137.5 m)-----	451.8-463.0 (137.7-141.1)

Lithologic description of core from drill hole USBM-02A, Horse Draw--Continued

Description	Depth interval feet (meters)
Tertiary--Continued	
Uinta Formation--Continued	
No sample-----	463.0-469.5 (141.1-143.1)
Marlstone, dusky-yellow and light-olive-gray, very finely laminated; laminae horizontal, a few local distortions; abundant pyrite on fracture surfaces-----	469.5-478.4 (143.1-145.8)
No sample-----	478.4-481.2 (145.8-146.7)
Marlstone, like unit at 469.5-478.4 feet (143.1-145.8 m), with some thin beds of medium-light-gray, fine-grained sandstone-----	481.2-487.2 (146.7-148.5)
No sample-----	487.2-493.7 (148.5-150.5)
Marlstone, dark-yellowish-brown, laminated with dusky-and pale-yellowish- brown marlstone; laminae are wavy and contorted; very thinly laminated 0.04-foot (1-cm) bed of carbonaceous material at 495.3 feet (151.0 m); pyrite on fracture surfaces; tiny flakes and stringers of carbonaceous material from 494.6 to 499.0 feet (150.8 to 152.1 m)-----	493.7-503.4 (150.5-153.4)
No sample-----	503.4-505.5 (153.4-154.1)
Marlstone, like unit at 493.7-503.4 feet (150.5-153.4 m)-----	505.5-512.2 (154.1-156.1)
No sample-----	512.2-515.8 (156.1-157.2)
Marlstone, pale-yellowish-brown, interlaminated with dark-yellowish- brown marlstone; two thin laminae of oil shale-----	515.8-517.0 (157.2-157.6)
Sandstone, dark-yellowish-brown, very fine grained, well-sorted, calcareous cement; contains pods of light-gray, fine-grained sandstone with calcareous stringers-----	517.0-518.5 (157.6-158.0)
Marlstone, dark-yellowish-brown, laminated with minor amounts of dusky- yellowish-brown marlstone and fine-grained sandstone; grades downward to mostly sandstone starting at 521 feet (158.8 m); wavy and contorted laminae in 518.5 to 521-foot (158.0 to 158.8-m) interval-----	518.5-523.0 (158.0-159.4)
No sample-----	523.0-528.2 (159.4-161.0)

Lithologic description of core from drill hole USBM-02A, Horse Draw--Continued

Description	Depth interval feet (meters)
Tertiary--Continued	
Uinta Formation--Continued	
Sandstone, interlaminated with pale- to grayish-brown marlstone and minor dusky-yellowish-brown oil shale; laminae dip from 20° to horizontal; pale-yellowish-brown tuffaceous layer 0.05 foot (2 cm) thick at 528.6 feet (161.1 m)-----	528.2-530.8 (161.0-161.8)
No sample-----	530.8-534.0 (161.8-162.8)
Oil shale, olive-gray and light-olive-gray interlaminated; laminae horizontal; light-gray to medium-light-gray, fine-grained sandstone layer 0.1 foot thick at 535.0 feet (163.1 m)-----	534.0-535.0 (162.8-163.1)
Marlstone, dark- to dusky-yellowish-brown, very thin horizontal laminae; brittle rock; sandstone layer like above at 535.6 feet (163.3 m)-----	535.0-537.3 (163.1-163.8)
Oil shale, like unit at 534.0-535.0 feet (162.8-163.1 m)-----	537.3-538.0 (163.8-164.0)
Marlstone, like unit at 535.0-537.3 feet (163.1-163.8 m); sandstone layers at 538.1 and 541.0 feet (164.0 and 164.9 m)-----	538.0-545.2 (164.0-166.2)
No sample-----	545.2-553.6 (166.2-168.7)
Oil shale, dusky-yellowish-brown and moderate-olive-brown, thinly laminated with minor amounts of light-olive-gray and dark-yellowish marlstone to 560 feet (170.7 m); below 560 feet (170.7 m) marlstone is predominant over oil shale-----	553.6-563.3 (168.7-171.7)
No sample-----	563.3-568.5 (171.7-173.3)
Marlstone, light-olive-gray, olive-gray, and pale-yellowish-brown, thinly laminated; discs easily; dark-yellowish-brown, thinly laminated oil shale 0.2 foot (6 cm) thick at 573.5 feet (174.8 m)-----	568.5-574.5 (173.3-175.1)
No sample-----	574.5-578.2 (175.1-176.2)
Marlstone, light-olive-gray and olive-gray, thinly laminated; horizontal laminae; incompetent rock-----	578.2-584.0 (176.2-178.0)
No sample-----	584.0-588.6 (178.0-179.4)

Lithologic description of core from drill hole USBM-02A, Horse Draw--Continued

Description	Depth interval feet (meters)
Tertiary--Continued	
Uinta Formation--Continued	
Marlstone and oil shale, interlaminated; color ranges from pale yellowish brown to dusky yellowish brown, marlstone is lighter shades; core broken and disced, footages are approximate; laminae range from paper thin to 1 inch (3 cm); tuff(?) layers <0.5 inch (1 cm) thick at 592, 594, and 595 feet (180.4, 181.1, and 181.4 m)-----	588.6-598.7 (179.4-182.5)
Sandstone and interlaminated marlstone; sandstone is pale yellowish brown, fine grained, noncalcareous; marlstone is like unit above-----	598.7-600.7 (182.5-183.1)
No sample-----	600.7-612.8 (183.1-186.8)
Marlstone, dark-yellowish-brown, laminated-----	612.8-613.0 (186.8-186.8+)
Sandstone, pale-yellowish-brown, fine-grained; calcareous cement; minor laminae of dusky- and dark-yellowish-brown marlstone and oil shale; pyrite on fracture surfaces-----	613.0-615.8 (186.8+-187.7)
Sandstone, like unit above-----	615.8-619.5 (187.7-188.8)
Sandstone and marlstone, like unit at 613.0-615.8 feet (186.8+-187.7 m)--	619.5-622.9 (188.8-189.9)
Siltstone, pale-yellowish-brown; calcite cement-----	622.9-626.0 (189.9-190.8)
No sample-----	626.0-639.8 (190.8-195.0)
Marlstone, dark-yellowish-brown, interlaminated and bedded with pale-yellowish-brown marlstone and pale-brown to pale-yellowish-brown, fine-grained sandstone; laminae from paper thin to 1 inch (3 cm); beds as much as 5 inches (13 cm) thick-----	639.8-647.2 (195.0-197.3)
Oil shale, dusky-yellowish-brown, laminated-----	647.2-647.9 (197.3-197.5)
Laminated marlstone and sandstone, like unit at 639.8-647.2 feet (195.0-197.3 m); stringers of oil shale-----	647.9-655.8 (197.5-199.9)
Oil shale, like unit at 647.2-647.9 feet (197.3-197.5 m)-----	655.8-657.3 (199.9-200.3)

Lithologic description of core from drill hole USBM-02A, Horse Draw--Continued

Description	Depth interval feet (meters)
Tertiary--Continued	
Uinta Formation--Continued	
Marlstone, dark-yellowish-brown, laminated with pale-yellowish-brown marlstone; minor oil shale laminae between 657.3 and 658.0 feet (200.3 and 200.6 m) and between 665.0 and 665.2 feet (202.7 and 202.8 m); pale-yellowish-brown sandstone from 668.1 to 669.2 feet (203.6-204.0 m); pyrite on fracture surfaces-----	657.3-676.7 (200.3-206.3)
No sample-----	676.7-682.2 (206.3-207.9)
Marlstone, like unit at 657.3-676.7 feet (200.3-206.3 m); pale-yellowish-brown, fine-grained sandstone at 682.5-683.0, 684.9-685.6, and 698.8-700.0 feet (208.0-208.2, 208.8-209.0, and 213.0-213.4 m); minor laminated shale in sandstone portion; pyrite on fracture surfaces-----	682.2-707.5 (207.9-215.6)
No sample-----	707.5-712.2 (215.6-217.1)
Marlstone, dark-yellowish-brown, laminated with minor dusky-yellowish-brown oil shale in upper half; lower half is oil shale with minor marlstone-----	712.2-720.2 (217.1-219.5)

Lithologic description of core from drill hole USBM-02A, Horse Draw--Continued

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation	
Parachute Creek Member	
Siltstone, grayish-red; no calcite cement; thin laminae of marlstone at 720.6 feet (219.6 m)-----	720.2-720.9 (219.5-219.7)
Oil shale, dusky-yellowish-brown, laminated; tuff(?) beds at 729.9 and 730.2 feet (222.5 and 222.6 m)-----	720.9-733.1 (219.7-223.4)
Oil shale, dusky- and dark-yellowish-brown; laminae are horizontal-----	733.1-739.0 (223.4-225.2)
Sandstone, reddish-brown, fine-grained; calcite cement-----	739.0-740.3 (225.2-225.6)
Oil shale, like unit at 733.1-739.0 feet (223.4-225.2 m)-----	740.3-743.7 (225.6-226.7)
No sample-----	743.7-750.7 (226.7-228.8)
Oil shale, dusky-yellowish-brown, interlaminated with minor amounts of dark-yellowish-brown oil shale; laminae are horizontal-----	750.7-759.0 (228.8-231.3)
No sample-----	759.0-772.1 (231.3-235.3)
Oil shale, like unit at 750.7-759.0 feet (228.8-231.3 m); minor laminae of yellowish-gray marlstone; very fine grained, pale-yellowish-brown sandstone at 772.3-773.0 feet (235.4-235.6 m); vugs in middle portion of unit; minor amount of pyrite on fracture surfaces-----	772.1-781.0 (235.3-238.0)
No sample-----	781.0-786.0 (238.0-239.6)
Oil shale, dusky-yellowish-brown; thinly laminated with dark-yellowish-brown marlstone; laminae horizontal; small amount of calcite on fracture surfaces-----	786.0-792.7 (239.6-241.6)
No sample-----	792.7-796.0 (241.6-242.6)
Oil shale and marlstone, like unit at 786.0-792.7 feet (239.6-241.6 m)-----	796.0-803.0 (242.6-244.8)

Lithologic description of core from drill hole USBM-02A, Horse Draw--Continued

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Parachute Creek Member--Continued	
No sample-----	803.0-809.0 (244.8-246.6)
Oil shale and marlstone, like unit at 786.0-792.7 feet (239.6-241.6 m); laminae are paper thin in oil shale; shattered zones scattered throughout unit; conglomerate contains shale fragments and rounded quartz grains at 814.7-815.0 feet (248.3-248.4 m); sandy conglomerate contains white mineral fragments at 822.3-822.4 feet (250.6-250.7 m)-----	809.0-830.4 (246.6-253.1)
No sample-----	830.4-831.8 (253.1-253.5)
Oil shale, dusky-yellowish-brown, laminated and inter- bedded with dark-yellowish-brown siltstone; calcite cement in siltstone on fracture surfaces in oil shale; laminae and beds range from 0.03 to 0.3 foot (0.9 to 9 cm)-----	831.8-849.7 (253.5-259.0)
No sample-----	849.7-852.8 (259.0-259.9)
Oil shale, dusky-yellowish-brown, laminated-----	852.8-853.8 (259.9-260.2)
Marlstone, dark-yellowish-brown, laminated with pale-brown marlstone-----	853.8-854.4 (206.2-260.4)
Siltstone, grayish-brown-----	854.4-854.5 (260.4-260.5)
Marlstone, dark- to pale-yellowish-brown, laminated-----	854.5-855.5 (260.5-260.8)
Siltstone, like unit at 854.4-854.5 feet (260.4-260.5 m)-----	855.5-855.7 (260.8-260.8+)
Oil shale, dusky- to pale-yellowish-brown, laminated; laminae range from paper thin to 1 inch (3 cm); laminae dip 10°; discing of thinner laminae; calcite-healed fractures, minor amount of pyrite on open fractures-----	855.7-866.2 (260.8+-264.0)
No sample-----	866.2-870.6 (264.0-265.4)

Lithologic description of core from drill hole USBM-02A, Horse Draw--Continued

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Parachute Creek Member--Continued	
Oil shale, dusky-yellowish-brown, interlaminated and interbedded with siltstone and minor amounts of light-brown marlstone; minor amount of calcite on fracture surfaces; core shattered-----	870.6-878.5 (265.4-267.8)
No sample-----	878.5-882.8 (267.8-269.1)
Oil shale, dusky-yellowish-brown, laminated-----	882.8-883.8 (269.1-269.4)
Siltstone, pale-yellowish-brown; calcite cement-----	883.8-885.7 (269.4-270.0)
Oil shale and siltstone, like above two units; minor amounts of pyrite and calcite on fracture surfaces-----	885.7-887.6 (270.0-270.5)
No sample-----	887.6-892.1 (270.5-271.9)
Oil shale, dusky-yellowish-brown, interlaminated with grayish-orange siltstone; calcite cement in siltstone-----	892.1-898.2 (271.9-273.8)
Oil shale, pale- and dark-yellowish-brown; very thin beds of siltstone at 914.8, 915.0, and 915.6 feet (278.8, 278.9, and 279.1 m); thin unit of oil shale near middle of unit discs easily-----	898.2-917.0 (273.8-279.5)
No sample-----	917.0-921.3 (279.5-280.8)
Oil shale, dusky- to dark-yellowish-brown; laminae dip 0°-10°; a few laminae of dark- to pale-yellowish-brown marlstone in upper 3 feet (0.9 m) and at 931.4 feet (283.9 m); tuff(?) layer 0.04 foot (1.2 cm) thick at 934.7 feet (284.9 m)-----	921.3-948.2 (280.8-289.0)
No sample-----	948.2-951.3 (289.0-290.0)
Oil shale, dusky-yellowish-brown, with minor laminae of dark-yellowish-brown; minor discing, shattered core, and collapse breccia-----	951.3-971.2 (290.0-296.0)

Lithologic description of core from drill hole USBM-02A, Horse Draw--Continued

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Parachute Creek Member--Continued	
No sample-----	971.2-975.5 (296.0-297.3)
Drilled with rock bit, no core-----	975.5-983.0 (297.3-299.6)
Oil shale, dusky-yellowish-gray and olive-black, very thinly laminated; unit contains minor amounts of dark-yellowish-brown laminae, stringers, and blebs of oil shale; evidence of leaching at 984 and 991.2 feet (299.9 and 302.1 m); minor amount of 1-cm-diameter vugs throughout unit; some oil shale is platy and flaky; calcite in joints at 983 and 992.5 feet (299.6 and 302.5 m); pyrite in joint at 989.0 feet (301.4 m)-----	983.0-993.3 (299.6-302.8)
No sample-----	993.3-997.3 (302.8-304.0)
Oil shale, dark- to dusky-yellowish-brown, with olive-black oil shale in upper 18 feet (5.5 m); thin to very thin wavy laminae; collapse breccia at 998.6-998.8, 1,002.5-1,002.6, 1,003.6-1,003.9, 1,012.3-1,013.0, 1,014.7-1,015.0, 1,018.6-1,018.9, 1,019.4-1,019.9, 1,022.4-1,022.6, 1,024.6-1,025.8, 1,031.0-1,033.0, and 1,055.6-1,056.5 feet (304.4-304.4+, 305.6-305.6+, 305.9-308.5, 308.5-308.8, 309.3-309.4, 310.5-310.6, 310.7-310.9, 311.6-311.7, 312.3-312.7, 314.2-314.9, and 321.7-322.0 m); several calcite-healed fractures; vugs range in width from pinhead to 2 inches (5 cm); pyrite throughout unit; some discing and shattering of rock-----	997.3-1,065.0 (304.0-324.6)
No sample-----	1,065.0-1,076.4 (324.6-328.1)
Siltstone, oil shale, and minor marlstone, interlaminated, pale- to dusky-yellowish-brown; collapse breccia at 1,077.1-1,078.8 and 1,090.2-1,092.5 feet (328.3-328.8 and 332.3-333.0 m); vugs as wide as 1 cm and pyrite throughout unit; top of the R-6 zone is at 1,080 feet (329.2 m)-----	1,076.4-1,092.5 (328.1-333.0)

Lithologic description of core from drill hole USBM-02A, Horse Draw--Continued

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Parachute Creek Member--Continued	
Oil shale, dusky-brown to dark-yellowish-brown, very thinly laminated; collapse breccia at 1,090.0-1,095.5 feet (333.8-333.9 m); vugs as large as 2 inches (5 cm); brittle core near bottom of unit-----	1,092.5-1,097.6 (333.0-334.5)
No sample-----	1,097.6-1,100.0 (334.5-335.3)
Oil shale, dusky-brown to light-olive-gray, very thinly laminated; thin beds of very pale orange tuff(?) throughout unit; collapse breccia at 1,115.0-1,116.0 feet (339.9-340.2 m); minor small vugs; calcite on some fracture surfaces-----	1,100.0-1,116.0 (335.3-340.2)
No sample-----	1,116.0-1,127.6 (340.2-343.7)
Oil shale, olive-black, very thinly laminated with minor grayish-olive oil shale; collapse breccia at 1,133.0-1,134.0 and 1,136.0-1,137.0 feet (345.3-345.6 and 346.3-346.6 m)-----	1,127.6-1,137.5 (343.7-346.7)
No sample-----	1,137.5-1,142.8 (346.7-348.3)
Oil shale, olive-black, thinly laminated with dark-yellowish-brown oil shale; dark-yellowish-brown ash bed at 1,143.3-1,143.4 feet (348.4+-348.5 m); vugs in lower half of unit; laminae dip 5°-----	1,142.8-1,149.7 (348.3-350.4)
Oil shale, dark- to dusky-yellowish-brown, thinly laminated; a 1/4-inch (0.6-cm) thick, medium-bluish-gray shale(?) at 1,151.6 feet (351.0 m); vugs throughout unit-----	1,149.7-1,156.0 (350.4-352.3)
Oil shale, like unit at 1,142.8-1,149.7 feet (348.3-350.4 m)-----	1,156.0-1,162.2 (352.3-354.2)
No sample-----	1,162.2-1,167.1 (354.2-355.7)
Oil shale, olive-black, brownish-black, and dark-yellowish-brown, very thinly laminated; horizontal laminae; dark-yellowish-brown, fine- to medium-grained ash beds at 1,173.5-1,174.0 and 1,182.2-1,182.4 feet (357.7-357.8 and 360.0-360.1 m); collapse breccias throughout unit; unit contains pods and lenses of pyrite-----	1,167.1-1,187.3 (355.7-361.9)

Lithologic description of core from drill hole USBM-02A, Horse Draw--Continued

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Parachute Creek Member--Continued	
No sample-----	1,187.3-1,194.5 (361.9-364.1)
Oil shale, dusky-yellowish-brown and dusky-brown, very thinly laminated with minor dark-yellowish-brown oil shale; laminae horizontal; rock mostly shattered-----	1,194.5-1,201.8 (364.1-366.3)
No sample-----	1,201.8-1,209.5 (366.3-368.7)
Oil shale, grayish-brown, thinly laminated with dusky-yellowish-brown oil shale-----	1,209.5-1,211.0 (368.7-369.1)
Marlstone, dark-yellowish-brown, calcareous-----	1,211.0-1,211.2 (369.1-369.2)
Oil shale, grayish-brown, thinly laminated with moderate-brown oil shale; evidence of leaching-----	1,211.2-1,213.2 (369.2-369.8)
Oil shale, dark-yellowish-brown and dusky-yellowish-brown; minor evidence of leaching-----	1,213.2-1,220.0 (369.8-371.9)
No sample-----	1,220.0-1,230.6 (371.9-375.1)
Oil shale, olive-black and light-olive-gray; very thin horizontal laminae; thin bed of grayish-orange fine-grained tuff(?) at 1,250.0 feet (381.0 m); several leached zones less than 1 foot (30 cm) thick throughout unit; minor amount of pyrite on fracture surfaces-----	1,230.6-1,252.3 (375.1-381.7)
No sample-----	1,252.3-1,259.0 (381.7-383.7)
Oil shale, olive-black and brownish-black, with minor pale-yellowish-brown oil shale; very thin horizontal laminae; leached zone from 1,267.9 to 1,271.0 feet (386.5 to 387.4 m) contains pods of calcite and pyrite as large as 5 mm-----	1,259.0-1,271.0 (383.7-387.4)
No sample. Bottom of R-6 zone at 1,275 feet (388.6 m)-----	1,271.0-1,281.3 (387.4-390.5)

Lithologic description of core from drill hole USBM-02A, Horse Draw--Continued

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Parachute Creek Member--Continued	
Oil shale, pale-yellowish-brown, thinly laminated with dark-yellowish-brown oil shale; medium-gray tuff bed 0.1 inch (0.3 cm) thick at 1,282.6 feet (390.9 m); vugs as large as 1 inch (2.5 cm) in diameter, some filled with medium-gray material-----	1,281.3-1,283.9 (390.5-391.3)
Oil shale, olive-black, thinly laminated-----	1,283.9-1,285.6 (391.3-391.9)
Oil shale, dark- to dusky-yellowish-brown, thinly laminated with minor amount of pale-yellowish-brown oil shale-----	1,285.6-1,287.0 (391.9-392.3)
Oil shale, dark-yellowish-brown, thinly laminated; hackly fracture-----	1,287.0-1,287.4 (392.3-392.4)
Oil shale, olive-black, thinly laminated; discing; no leaching----	1,287.4-1,289.6 (392.4-393.1)
Oil shale, pale- to dark-yellowish-brown; broken and ground-up rock-----	1,289.6-1,290.1 (393.1-393.2)
No sample-----	1,290.1-1,293.4 (393.2-394.2)
Oil shale, dusky-yellowish-brown, bedded and laminated with pale-yellowish-brown oil shale; moderate-yellowish-brown tuff(?) bed at top of core run; laminae offset 1/4 inch (0.6 cm) by reverse faulting-----	1,293.4-1,296.2 (394.2-395.1)
Oil shale, pale-yellowish-brown, laminated and bedded with grayish-orange oil shale; grades downward to medium-gray and light-olive-gray oil shale; unit crumbly-----	1,296.2-1,301.2 (395.1-396.6)
Oil shale, olive-black; bedded, pale-yellowish-brown oil shale near top of unit; vugs <0.1 inch (0.3 cm) in diameter-----	1,301.2-1,306.2 (396.6-398.1)
No sample-----	1,306.2-1,307.8 (398.1-398.6)
Oil shale, dusky-yellowish-brown, laminated with light-brown oil shale-----	1,307.8-1,308.8 (398.6-398.9)

Lithologic description of core from drill hole USBM-02A, Horse Draw--Continued

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Parachute Creek Member--Continued	
Oil shale, pale- to dusky-yellowish-brown; contorted and faulted laminae and bedding-----	1,308.8-1,311.9 (398.9-399.9)
Oil shale, olive-black, thinly laminated-----	1,311.9-1,314.8 (399.9-400.8)
Oil shale, dusky-yellowish-brown and olive-black; laminated with light-brown siltstone containing calcite cement; unit crumbly and broken; no exact depths for rock types-----	1,314.8-1,319.0 (400.8-402.0)
No sample-----	1,319.0-1,325.1 (402.0-403.9)
Oil shale, brownish-black to light-olive-gray, and leached zones of moderate-brown oil shale; very thinly laminated to bedded; calcite pods 3 mm wide from 1,329.0 to 1,330.0 feet (405.1 to 405.4 m); most of unit is leached to platy soillike shale; friable-----	1,325.1-1,337.0 (403.9-407.5)
No sample-----	1,337.0-1,338.1 (407.5-407.9)
Oil shale, like unit at 1,325.1-1,337.0 feet (403.9-407.5 m); siltstone layer at 1,338.6-1,339.1 feet (408.0-408.2 m); pyrite on laminae planes-----	1,338.1-1,342.6 (407.9-409.2)
No sample-----	1,342.6-1,353.0 (409.2-412.4)
Oil shale, dusky- and pale-yellowish-brown, very thinly laminated; entire unit is collapse breccia and platy, leached oil shale; light-gray clay and fragments of oil shale; friable-----	1,353.0-1,358.7 (412.4-414.1)
No sample-----	1,358.7-1,376.4 (414.1-419.5)
Oil shale, olive-gray, laminated-----	1,376.4-1,376.5 (419.5-419.6)
Oil shale, dark-yellowish-brown, interlaminated with minor pale-yellowish-brown oil shale-----	1,376.5-1,381.5 (419.6-421.1)
Oil shale, olive-gray, interlaminated with minor light-brown and pale-yellowish-brown oil shale-----	1,381.5-1,386.1 (421.1-422.5)

Lithologic description of core from drill hole USBM-02A, Horse Draw--Continued

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Parachute Creek Member--Continued	
Siltstone, pale-brown; poorly cemented with calcite-----	1,386.1-1,386.8 (422.5-422.7)
No sample-----	1,386.8-1,391.0 (422.7-424.0)
Oil shale, olive-black, laminated; grades downward to dark-yellowish-brown oil shale; vugs in upper part; nahcolite-filled vugs in lower part at 1,391.0-1,395.7 feet (424.0-425.4 m)-----	1,391.0-1,395.7 (424.0-425.4)
Nahcolite, moderate-brown, interbedded with minor dark-yellowish-brown oil shale-----	1,395.7-1,402.5 (425.4-427.5)
Halite, interbedded with nahcolite-----	1,402.5-1,403.5 (427.5-427.8)
Oil shale, pale-brown, with oblong vugs filled with nahcolite----	1,403.5-1,404.1 (427.8-428.0)
Halite, interbedded with nahcolite-----	1,404.1-1,407.4 (428.0-429.0)
Oil shale, brownish-black, grading downward to grayish-brown oil shale; thin 0.1- to 0.2-foot (3- to 6-cm) layers of nahcolite at 1,407.5, 1,408.8, 1,409.4, 1,410.1, 1,410.6, 1,414.6, 1,416.4, and 1,418.0 feet (429.0, 429.4, 429.6, 429.8, 430.0, 431.2, 431.7, and 432.2 m); nahcolite rosettes at 1,417.4-1,417.8 and 1,418.5-1,419.0 feet (432.0-432.1 and 432.4-432.5 m)-----	1,407.4-1,421.5 (429.0-433.3)
Oil shale, dusky-yellowish-brown and moderate-brown, with minor, very thin laminae of pale-yellowish-brown oil shale-----	1,421.5-1,423.5 (433.3-433.9)
Nahcolite, pale-yellowish-brown, opaque; crystalline beds with halite at 1,431 feet (436.2 m) and 1,427.7-1,428.8 feet (435.2-435.5 m); nahcolite rosettes as much as 5 inches (13 cm) in diameter scattered throughout unit-----	1,423.5-1,432.0 (433.9-436.5)
Oil shale, like unit at 1,421.5-1,423.5 feet (433.3-433.9 m)-----	1,432.0-1,451.0 (436.5-442.3)
Drilled with rock bit, no core-----	1,451.0-1,458.0 (442.3-444.4)

Lithologic description of core from drill hole USBM-02A, Horse Draw--Continued

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Parachute Creek Member--Continued	
Oil shale, dark- and dusky-yellowish-brown, very thinly laminated; nahcolite rosettes-----	1,458.0-1,459.0 (444.4-444.7)
Nahcolite, pale-yellowish-brown; bedded with moderate-brown nahcolite rosettes-----	1,459.0-1,463.0 (444.7-445.9)
Oil shale and nahcolite rosettes, like unit at 1,458.0-1,459.0 feet (444.4-444.7 m)-----	1,463.0-1,470.6 (445.9-448.2)
Nahcolite, like unit at 1,459.0-1,463.0 feet (444.7-445.9 m)-----	1,470.6-1,472.6 (448.2-448.8)
Oil shale-----	1,472.6-1,473.0 (448.8-449.0)
Nahcolite rosettes-----	1,473.0-1,477.0 (449.0-450.2)
Oil shale, like unit at 1,458.0-1,459.0 feet (444.4-444.7 m); nahcolite layers at 1,478.5 and 1,479.4 feet (450.6 and 450.9 m)-----	1,477.0-1,481.0 (450.2-451.4)
Nahcolite rosettes-----	1,481.0-1,482.0 (451.4-451.7)
Oil shale-----	1,482.0-1,484.0 (451.7-452.3)
Nahcolite rosettes-----	1,484.0-1,486.0 (452.3-452.9)
Oil shale-----	1,486.0-1,488.0 (452.9-453.5)
Nahcolite, bedded-----	1,488.0-1,492.0 (453.5-454.8)
Oil shale-----	1,492.0-1,504.0 (454.8-458.4)
Nahcolite, bedded-----	1,504.0-1,507.0 (458.4-459.3)
Halite-----	1,507.0-1,507.5 (459.3-459.5)
Oil shale-----	1,507.5-1,508.8 (459.5-459.9)
Nahcolite, bedded-----	1,508.8-1,511.0 (459.9-460.6)
Oil shale, with numerous vugs as large as 0.7 foot (21 cm) filled with nahcolite-----	1,511.0-1,532.0 (460.6-467.0)

Lithologic description of core from drill hole USBM-02A, Horse Draw--Continued

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Parachute Creek Member--Continued	
Nahcolite, moderate-yellowish-brown, bedded, opaque, finely crystalline-----	1,532.0-1,536.0 (467.0-468.2)
Oil shale, dark- and dusky-yellowish-brown; very thin horizontal laminae; numerous vugs as large as 0.7 feet (21 cm) filled with opaque to translucent, platy, crystalline, moderate-yellowish-brown nahcolite-----	1,536.0-1,545.0 (468.2-470.9)
Nahcolite, like unit at 1,532.0-1,536.0 feet (467.0-468.2 m)-----	1,545.0-1,547.0 (470.9-471.5)
Oil shale, like unit at 1,536.0-1,545.0 feet (468.2-470.9 m)-----	1,547.0-1,561.0 (471.5-475.8)
Nahcolite, like unit at 1,532.0-1,536.0 feet (467.0-468.2 m)-----	1,561.0-1,562.0 (475.8-476.1)
Oil shale, like unit at 1,536.0-1,545.0 feet (468.2-470.9 m)-----	1,562.0-1,566.0 (476.1-477.3)
Nahcolite, like unit at 1,532.0-1,536.0 feet (467.0-468.2 m)-----	1,566.0-1,568.0 (477.3-477.9)
Oil shale, like unit at 1,536.0-1,545.0 feet (468.2-470.9 m)-----	1,568.0-1,572.0 (477.9-479.1)
Oil shale, like unit at 1,536.0-1,545.0 feet (468.2-470.9 m); no vugs or nahcolite-----	1,572.0-1,576.9 (479.1-480.6)
No sample-----	1,576.9-1,577.0 (480.6-480.7)
Oil shale, dusky-yellowish-brown and olive-black; very thin horizontal laminae-----	1,577.0-1,602.0 (480.7-488.3)
Nahcolite, dark-yellowish-brown, opaque, finely crystalline; disseminated with oil shale in upper part, grading to bedded in lower part-----	1,602.0-1,605.6 (488.3-489.4)
Nahcolite, dark-yellowish-brown, bedded, crystalline, opaque; halite layer at 1,612.5 feet (491.5 m)-----	1,605.6-1,614.5 (489.4-492.1)
Halite, white, bedded, coarsely crystalline, opaque to translucent-----	1,614.5-1,620.0 (492.1-493.8)
Nahcolite, like unit at 1,605.6-1,614.5 feet (489.4-492.1 m)-----	1,620.0-1,622.0 (493.8-494.4)

Lithologic description of core from drill hole USBM-02A, Horse Draw--Continued

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Parachute Creek Member--Continued	
Halite, like unit at 1,614.5-1,620.0 feet (492.1-493.8 m)-----	1,622.0-1,626.0 (494.4-495.6)
Oil shale, dusky-yellowish-brown and moderate-brown, very thinly laminated-----	1,626.0-1,632.0 (495.6-497.4)
Halite, like unit at 1,614.5-1,620.0 feet (492.1-493.8 m)-----	1,632.0-1,636.0 (497.4-498.7)
Oil shale, moderate-brown and dusky-yellowish-brown, very thinly laminated; halite and nahcolite in very thin beds throughout unit-----	1,636.0-1,645.0 (498.7-501.4)
Halite, white to brownish-gray, bedded, coarsely crystalline, transparent to opaque-----	1,645.0-1,649.4 (501.4-502.7)
Oil shale, like unit at 1,636.0-1,645.0 feet (498.7-501.4 m)-----	1,649.4-1,651.0 (502.7-503.2)
Nahcolite, dark-yellowish-brown, bedded, finely crystalline, opaque-----	1,651.0-1,655.5 (503.2-504.6)
Halite, like unit at 1,645.0-1,649.4 feet (501.4-502.7 m)-----	1,655.5-1,660.5 (504.6-506.1)
Oil shale, like unit at 1,636.0-1,645.0 feet (498.7-501.4 m)-----	1,660.5-1,666.2 (506.1-507.9)
Nahcolite, pale-yellowish-brown, bedded, opaque-----	1,666.2-1,668.0 (507.9-508.4)
Halite, white to dark-yellowish-brown, bedded, coarsely crystalline, opaque, with minor laminae of dusky- and dark- yellowish-brown oil shale-----	1,668.0-1,683.5 (508.4-513.1)
Nahcolite, like unit at 1,666.2-1,668.0 feet (407.9-508.4 m)-----	1,683.5-1,686.5 (513.1-514.0)
Halite, like unit at 1,668.0-1,683.5 feet (508.4-513.1 m)-----	1,686.5-1,688.1 (514.0-514.5)
No sample-----	1,688.1-1,694.0 (514.5-516.3)
Halite, white, coarsely crystalline-----	1,694.0-1,695.0 (516.3-516.6)

Lithologic description of core from drill hole USBM-02A, Horse Draw--Continued

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Parachute Creek Member--Continued	
Oil shale, olive-gray, light-olive-brown, and dusky-yellowish-brown; thin horizontal laminae; unit contains scattered nahcolite rosettes between 1,695 and 1,700 feet (516.6-518.2 m), and below 1,716 feet (523.0 m); bedded, white to dark-yellowish-brown crystalline nahcolite with oil shale between 1,702 and 1,711 feet (518.8 and 521.5 m); calcitic concretions as large as 1 inch (2.6 cm) throughout unit-----	1,695.0-1,732.0 (516.6-527.9)
Oil shale-----	1,732.0-1,738.0 (527.9-529.7)
Oil shale, olive-black and dusky-yellowish-brown, very thinly laminated; scattered minor nahcolite beds and rosettes-----	1,738.0-1,762.5 (529.7-537.2)
Nahcolite, pale- and dark-yellowish-brown, thin-bedded, finely crystalline, opaque-----	1,762.5-1,768.0 (537.2-538.9)
Oil shale, like unit at 1,738.0-1,762.5 feet (529.7-537.2 m)-----	1,768.0-1,782.0 (538.9-543.2)
Oil shale, with abundant moderate-brown transparent to translucent nahcolite rosettes as large as 1.5 feet (46 cm) in diameter-----	1,782.0-1,788.0 (543.2-545.0)
Nahcolite, bedded, with abundant rosettes-----	1,788.0-1,792.0 (545.0-546.2)
Oil shale and nahcolite rosettes, like unit at 1,782.0-1,788.0 feet (543.2-545.0 m)-----	1,792.0-1,801.0 (546.2-548.9)
Nahcolite, bedded, with abundant rosettes-----	1,801.0-1,802.5 (548.9-549.4)
Oil shale, olive-gray, dusky-brown, and dusky-yellowish-brown, with numerous dusky-yellowish-brown, opaque, crystalline nahcolite rosettes; nahcolite content decreases below 1,842.0 feet (561.4 m)-----	1,802.5-1,870.5 (549.4-570.1)
No sample-----	1,870.5-1,871.0 (570.1-570.3)

Lithologic description of core from drill hole USBM-02A, Horse Draw--Continued

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Parachute Creek Member--Continued	
Oil shale, grayish-brown and dusky-brown, with some dusky-yellowish-brown laminae; thinly laminated, horizontal laminae, some minor distortions around nahcolite rosettes; rosettes are moderate brown and brownish black and are scattered throughout unit; fossiliferous zone from 1,888.0 to 1,890.0 feet (575.5-576.1 m)-----	1,871.0-1,899.9 (570.3-579.1)
Oil shale, grayish-brown and dusky-brown, thin, laminated; blebby structure between 1,911.0 and 1,920.0 feet (582.7 and 585.2 m); interbedded dusky-brown and moderate-brown, platy, crystalline nahcolite; beds range up to 1.8 feet (55 cm) thick--	1,899.9-1,928.9 (579.1-587.9)
Oil shale, olive-black and grayish-black, very thinly laminated; horizontal laminae; scattered moderate-brown nahcolite rosettes as large as 6 inches (15 cm) in diameter-----	1,928.9-1,938.0 (587.9-590.7)
Nahcolite, moderate-brown, thin- to thick-bedded-----	1,938.0-1,941.0 (590.7-591.6)
Oil shale, like unit at 1,928.9-1,938.0 feet (587.9-590.7 m)-----	1,941.0-1,947.0 (591.6-593.4)
Oil shale, no nahcolite-----	1,947.0-1,954.0 (593.4-595.6)
Oil shale, like unit at 1,928.9-1,938.0 feet (587.9-590.7 m); nahcolite content decreases downward-----	1,954.0-1,988.8 (595.6-606.2)
Oil shale, olive-gray, olive-black, and brownish-black, very thinly laminated; horizontal laminae; unit contains some blebs and pods of yellowish-gray dolomite(?) at 2,000.0-2,004.0 feet (609.6-610.8 m)-----	1,988.8-2,009.6 (606.2-612.5)
No sample-----	2,009.6-2,018.2 (612.5-615.1)
Oil shale, light-olive-gray and pale- to dark-yellowish-brown; very thin to thin laminations, generally horizontal, local distortion around nahcolite rosettes; scattered rosettes, as large as 0.3 foot (9 cm) in diameter, of dark- and dusky-yellowish-brown nahcolite; numerous thin beds of nahcolite between 2,047.0 and 2,050.0 feet (623.9-624.8 m); brecciated zone at 2,058.7-2,059.5 feet (627.5-627.7 m); trace of pyrite in unit-----	2,018.2-2,077.5 (615.1-633.2)

Lithologic description of core from drill hole USBM-02A, Horse Draw--Continued

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Parachute Creek Member--Continued	
Oil shale, dusky-yellowish-brown; very thin laminae generally horizontal; unit contains numerous rosettes of moderate-brown, platy, coarsely crystalline nahcolite as much as 4 inches (10 cm) in diameter-----	2,077.5-2,084.0 (633.2-635.2)
Nahcolite, moderate-brown to dusky-yellowish-brown, finely crystalline, opaque, thin- to thick-bedded-----	2,084.0-2,103.0 (635.2-641.0)
Oil shale, like unit at 2,077.5-2,084.0 feet (633.2-635.2 m); abundant nahcolite rosettes as large as 3 inches (8 cm)-- smaller ones contain pyrite-----	2,103.0-2,121.0 (641.0-646.5)
Oil shale, dusky-yellowish-brown, very thinly laminated-----	2,121.0-2,125.0 (646.5-647.7)
Nahcolite, like unit at 2,084.0-2,103.0 feet (635.2-641.0 m); minor amount of pyrite-----	2,125.0-2,132.0 (647.7-649.8)
Oil shale, like unit at 2,121.0-2,125.0 feet (646.5-647.7 m)-----	2,132.0-2,136.9 (649.8-651.3)
No sample-----	2,136.9-2,137.1 (651.3-651.4)
Oil shale, dusky- and dark-yellowish-brown, laminated; most laminae are horizontal--those at 2,149.0-2,150.0 feet (655.0-655.3 m) dip 10°; rosettes of dusky-yellowish-brown, coarsely crystalline, platy, translucent nahcolite as large as 6 inches (15 cm) scattered throughout unit; open joints at 2,152.0-2,153.0 feet (655.9-656.2 m)-----	2,137.1-2,166.0 (651.4-660.4)
Oil shale, dusky-yellowish-brown, dusky-brown, and light-olive-gray, thinly laminated; laminae are horizontal; no nahcolite; calcite-filled joints at 2,188.0 feet (666.9 m)-----	2,166.0-2,189.0 (660.4-667.2)
Nahcolite, olive-black and grayish-brown, fine crystalline; numerous thin beds and some light-olive-gray and dusky-brown oil shale laminae-----	2,189.0-2,195.7 (667.2-669.2)
Oil shale, dusky- to dark-yellowish-brown, thin; laminated; scattered brownish-black and dusky-brown, coarsely crystalline nahcolite rosettes-----	2,195.7-2,197.1 (669.2-669.7)

Lithologic description of core from drill hole USBM-02A, Horse Draw--Continued

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Parachute Creek Member--Continued	
No sample-----	2,197.1-2,198.1 (669.7-670.0)
Oil shale, like unit at 2,195.7-2,197.1 feet (669.2-669.7 m)-----	2,198.1-2,211.6 (670.0-674.1)
Nahcolite, brownish-black and dusky-brown, interbedded with minor oil shale-----	2,211.6-2,214.6 (674.1-675.0)
Oil shale, like unit at 2,195.7-2,197.1 feet (669.2-669.7 m)-----	2,214.6-2,223.6 (675.0-677.8)
Nahcolite, like unit at 2,211.6-2,214.6 feet (674.1-675.0 m)-----	2,223.6-2,224.6 (677.8-678.1)
Oil shale, like unit at 2,195.7-2,197.1 feet (669.2-669.7 m); stringers and blebs of calcite at 2,235.6-2,237.6 feet (681.4-682.0 m)-----	2,224.6-2,253.6 (678.1-686.9)
Shale, medium-bluish-gray, laminated-----	2,253.6-2,256.6 (686.9-687.8)
Oil shale, dark- and dusky-yellowish-brown, very thinly laminated; laminae horizontal-----	2,256.6-2,267.0 (687.8-691.0)
Oil shale (like above) with scattered nahcolite-----	2,267.0-2,291.0 (691.0-698.3)
Shale, medium-bluish-gray and dark-greenish-gray, interbedded and laminated with minor dusky-yellowish-brown oil shale; thin stringers of calcite at 2,296.8-2,297.2 feet (700.1-700.2 m); core discs easily-----	2,291.0-2,300.0 (698.3-701.0)
Garden Gulch Member	
Oil shale, like unit at 2,267.0-2,291.0 feet (691.0-698.3 m)-----	2,300.0-2,312.4 (701.0-704.8)
No sample-----	2,312.4-2,316.6 (704.8-706.1)
Oil shale, dusky- to dark-yellowish-brown, olive-gray, and moderate-olive-brown, thinly laminated; scattered 0.1-foot- (3-cm) thick beds of olive-gray, soft siltstone; thicker beds of siltstone at 2,358.0-2,358.7 and 2,365.6-2,366.3 feet (718.7-718.9 and 721.0-721.2 m); scattered stringers of soft, white crystalline calcite and some pyrite; thin bed of black, soft shale covered with a film of yellow oil at 2,333.5 feet (711.3 m); rock discs easily, brittle-----	2,316.6-2,369.5 (706.1-722.2)

Lithologic description of core from drill hole USBM-02A, Horse Draw--Continued

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Garden Gulch Member--Continued	
Oil shale, olive-black and olive-gray, very thinly laminated; horizontal laminae; some thin beds of medium-bluish-gray shale scattered throughout unit; minor thin beds of light-olive-gray siltstone at 2,374.0, 2,376.0, and 2,378.0 feet (723.6, 724.2, and 724.8 m); rock is shattered from 2,396.4 to 2,400.3 feet (730.4 to 731.6 m); rock discs readily-----	2,369.5-2,400.3 (722.2-731.6)
No sample-----	2,400.3-2,401.8 (731.6-732.1)
Oil shale, dark- to dusky-yellowish-brown and dusky-brown, thinly laminated; laminae horizontal; blebs of pale- to dark-yellowish-brown oil shale and dolomite(?); rock discs easily-----	2,401.8-2,447.1 (732.1-745.9)
No sample-----	2,447.1-2,453.1 (745.9-747.7)
Oil shale and shale, dusky-brown and dusky-yellowish-brown, thinly laminated; laminae horizontal; silica crystals coat fracture surfaces at 2,467.1 feet (752.0 m); below 2,460 feet (749.8 m) rock is mostly shale; rock discs easily-----	2,453.1-2,499.3 (747.7-761.8)
No sample-----	2,499.3-2,503.4 (761.8-763.0)
Oil shale and shale, olive-gray and dusky-yellowish-brown, thinly laminated; laminae are horizontal, some are indistinct; pyrite disseminated throughout shales; very thin layers of fine-grained, well-cemented, light-colored sandstone at 2,525.0, 2,528.2, 2,531.7-2,533.0, and 2,541.8 feet (769.6, 770.6, 771.7-772.1, and 774.7 m); core is fractured and discs easily-----	2,503.4-2,555.4 (763.0-778.9)
No sample-----	2,555.4-2,561.1 (778.9-780.6)
Shale, olive-gray, light-olive-gray, and some olive-black, thinly laminated; laminae horizontal; fresh surfaces have waxy appearance; brecciated zone at 2,602.0-2,602.2 feet (793.1-793.2 m); rock is brittle and discs easily-----	2,561.1-2,606.4 (780.6-794.4)
No sample-----	2,606.4-2,619.9 (794.4-798.5)

Lithologic description of core from drill hole USBM-02A, Horse Draw--Continued

Description	Depth interval feet (meters)
Tertiary--Continued	
Green River Formation--Continued	
Garden Gulch Member--Continued	
Shale, black; conchoidal fractures; grades downward to medium-dark-gray, silty shale at about 2,622.5 feet (799.3 m), and to medium-dark-gray siltstone at about 2,624.0-2,652.0 feet (799.8-808.3 m); no calcareous cement in siltstone; at 2,652.0 feet (808.3 m) unit grades back to silty shale-----	2,619.9-2,656.5 (798.5-809.7)
Sandstone, medium-gray; salt-and-pepper texture, not very porous-----	2,656.5-2,659.6 (809.7-810.6)
Shale, dark-gray-----	2,659.6-2,660.0 (810.6-810.8)
Total depth-----	2,660.0 (810.8)