

LITHOLOGIC DESCRIPTION OF DRILL CORE FROM SINCLAIR OIL COMPANY
SKYLINE CORE HOLE 1, PICEANCE CREEK BASIN,
RIO BLANCO COUNTY, COLORADO

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Introduction

The Sinclair Oil and Gas Company Skyline core hole 1 penetrates a thick sequence of oil shale and associated nahcolite (NaHCO_3) and halite in the Eocene Parachute Creek Member of the Green River Formation in the northern part of the Piceance Creek Basin in northwestern Colorado. Several years ago drill core from this well was made available to the U.S. Geological Survey by Atlantic Richfield Company. A lithologic description of the drill core was prepared by the author in 1977. Because of the current interest in the commercial development of the Colorado oil-shale and nahcolite deposits, the lithologic log of this drill core is being open-filed.

Skyline core hole 1 is located on Federal lands in the NW 1/4 NE 1/4 sec. 26, T. 1 S., R. 98 W., Rio Blanco County, Colorado. The surveyed location within the section is 609.60 m from the east section line and 198.12 m from the north section line. Ground elevation of the well is 2,014 m. The location of the drill hole is shown on a geologic map of the Square S Ranch 7 1/2-minute topographic quadrangle (Duncan, 1976). Robb, Smith, and Trudell (1978) published the qualitative X-ray mineralogy and oil yields by Fischer assay on samples taken from this core hole between the depths of 396 m and 930 m.

One-fourth of a nearly 10-cm-diameter core in cardboard core boxes was available for study. Unfortunately, a large amount of core was misplaced in the core boxes when the core was compared with a set of photographs of the core provided by the company. Much of this core seems to be misplaced within a single core box (4.6 m of core per box), rather than mixed between boxes. An attempt was made to match where possible misplaced core with the core photos. Nevertheless, the value of the following lithologic description (table 1) is somewhat reduced due to overlooked misplaced core and to inaccuracies of depths recorded on the core boxes.

The total length of the core described is 688.8 m and extends from 240.5 m to 929.3 m below ground level. The top and base of the sequence of nahcolite and halite are 583.4 m and 896.8 m, respectively, below ground level. The depths and thicknesses of lean and rich oil-shale zones, as described by Dyni (1974), were determined from the lithology, mechanical logs, and other data and are tabulated below. The depths are those recorded on the core boxes. Compared with picks of beds on the sonic log for the drill hole, the core depths are consistently deeper by 1.2 to 2.7 m. Of 34 such picks scattered through the cored interval, the core depths average $1.8 \text{ m} + 0.72 \text{ m}$ (two standard deviations) deeper than corresponding picks on the sonic log.

Oil-shale zone		Depth in meters	
[Note: Odd-numbered zones and the Mahogany zone are units of relatively high-grade oil shale, whereas the even-numbered zones and A and B grooves are units of relatively low-grade oil shale.]			
		From	To
	Top of core	240.5	
A-groove		427.3	432.2
Mahogany		432.2	~486.2
B-groove		~486.2	~491.9
13		~491.9	552.0
12		552	605.5
11		605.5	722.1
10		722.1	~763.5
9		~763.5	~817.5
8		~817.5	824.5
7		824.5	873.6
6		873.6	882.1
5		882.1	912.3
4		912.3	921.1
3		921.1	959.8
	Base of core	929.3	
2		959.8	967.1
1		967.1	1005.8
<u>Total depth</u>		1031.71	

Acknowledgment

The author's sincere thanks are due Atlantic Richfield Company and Mr. Donald B. Tait, Exploration Advisor, Arco Coal Company, for providing the drill core for this study.

Table 1.--Lithologic description of core from Skyline core hole 1

Depth (meters)		Thickness	Lithology
From	To	(meters)	
240.49	241.40	0.91	Marly siltstone, mottled yellowish-brown and brown; laminated to micro-contorted bedding, calcitic, blocky, carbonaceous plant(?) fragments
241.40	278.89	37.49	No core
278.89	280.20	1.31	Marlstone, light-brownish-gray, evenly laminated, some wavy laminated, hard and blocky; 55 cm of well-laminated dark-brownish-black oil shale at 279.26 m
280.20	284.04	3.84	Marly siltstone, light-yellowish-brown; many carbonaceous plant fragments, massive to wavy laminated, much contorted bedding, hard and blocky, calcitic, locally sandy
284.04	284.71	0.67	Silty marlstone, grayish-brown and brownish-gray, laminated, hard and blocky; some carbonaceous plant fragments
284.71	297.09	12.37	Dominantly siltstone and marly siltstone with some marlstone, wavy laminated and massive; a few diagonal fractures, hard and blocky, black blobs (gilsonite?)--no recognizable plant fragments, locally sandy
297.09	303.61	6.52	Silty marlstone, light- to medium-yellowish-brown, laminated and wavy bedded; much micro-contorted bedding, hard and blocky; 14 cm massive siltstone at 303.15 m
303.61	303.89	0.27	Tuff, light-gray, very fine grained, structureless; a brown marlstone band about 2 cm thick near middle

Table 1.--Lithologic description of core from Skyline core hole 1--continued

Depth (meters)		Thickness	Lithology
From	To	(meters)	
303.89	306.90	3.02	Marlstone, light-yellowish-brown, evenly to wavy laminated; some blebby structure between 304.19 and 304.50 m; hard and blocky--some 2 to 4-cm-thick even layers between 304.19 and 305.14 m; locally contorted bedding between 305.56 and 305.71 m
306.90	308.76	1.86	Marly siltstone, light-brownish-gray, irregular streaky bedding, hard and blocky; numerous faint carbonaceous films
308.76	314.86	6.10	No core
314.86	319.43	4.57	Marlstone, medium- to dark-yellowish-brown, hard and blocky--a few 2- to 5-cm-thick layers in lower 0.3 m; evenly laminated with locally highly contorted bedding between 316.69 and 317.30 m and 317.60 and 317.97 m; 2-cm-thick brown marlstone breccia (soft and crumbly) at 319.25 m; 5-mm-thick tuff at 315.38 m; 20-mm-thick tuff at 316.26 m; 10 to 20-mm-thick contorted tuff (2 tuffs) at 316.93 m
319.43	323.27	3.84	Silty marlstone, yellowish-brown, hard and blocky, wavy laminated with locally highly micro-contorted bedding, permeable--soaks up water; more marlstone and less siltstone in upper 1 m; contorted blue tuff 5 mm thick at 320.01 m; lenticular 5-mm-thick tuff at 320.09 m
323.27	324.15	0.88	Marlstone, dark-yellowish-brown, laminated, hard and blocky; light-brown 2-cm-thick tuff at base
324.15	324.95	0.79	Marlstone, light- to medium-brown, laminated and some blebby structure, hard and blocky; silty in lower 0.15 m

Table 1.--Lithologic description of core from Skyline core hole 1--continued

Depth (meters)		Thickness	Lithology
From	To	(meters)	
324.95	~333.76	8.81	Mostly marly siltstone, light-yellowish-gray; some broken rock but largely blocky and hard; more marly between 329.79 and 331.62 m; locally contorted bedding and some marlstone fragments in siltstone
~333.76	346.25	12.50	No core
346.25	347.41	1.16	Silty marlstone, brownish-gray; some carbonaceous fragments, laminated and wavy bedding, streaky structure
347.41	353.72	6.31	Siltstone, light-brownish-gray, generally structureless; some marlstone layers and streaks; ribbed carbonaceous plant fragments; some pits containing pyrite in lower 10 cm; some broken fragments between 348.84 and 350.82 m, permeable--soaks up water; generally hard and blocky
353.72	354.12	0.40	Oil shale, dark-yellowish-brown; laminated with some blebby structure, hard and blocky
354.12	354.48	0.37	Siltstone, pale-yellowish gray, nearly structureless--with some bedding--dark streaks and a lenticular laminated marlstone layer 6 mm thick in upper part
354.48	359.05	4.57	Oil shale, dark-yellowish brown and brownish-black; some light-yellowish-brown oil shale, evenly laminated, in bedding--parallel layers and blocks commonly 3 to 15 cm thick, hard; 3-cm irregular vug filled with earthy material at 355.79 m; pitted creamy earthy-filled vug between 356.65 and 357.26 m; asphalt-coated bedding surface at 355.40 m

Table 1. Lithologic description of core from Skyline core hole 1--continued

Depth (meters)		Thickness	Lithology
From	To	(meters)	
359.05	360.61	1.55	Siltstone; some marly laminae, some diagonal fractures, hard and blocky, some brown hydrocarbon stains
360.61	361.68	1.07	Marlstone, medium-yellowish-brown; numerous brownish-stained siltstone or tuff layers
361.68	375.21	13.53	Siltstone, brownish-stained with hydrocarbons; numerous diagonal fractures coated with hydrocarbon, hydrocarbon odor on fresh fracture; generally structureless with some faint mottling; some hard and blocky dark-brown oil shale between 368.20 and 369.87 m, 370.03 and 370.18 m, 372.71 and 373.20 m--much of this may be out of place; 18-mm-thick light-brownish-stained tuff at 373.11 m
375.21	392.58	17.37	Oil shale, dark-yellowish-brown to blackish-brown, laminated; bluish blebs common; hard; diagonal fractures common; 5-mm-thick tuff at 378.13 m; lenticular ~10-mm-thick tuff at 378.90 m; 50-mm-thick mottled tuff at 379.48 m; 7-mm-thick lenticular tuff at 381.34 m; 65-mm-thick wavy-layered tuff at 381.46 m; contorted tuff 20 mm thick at 382.22 m; contorted tuff 20 mm thick at 384.54 m, 40-mm-thick tuff at 385.51 m. Oil-shale breccia with swelled blebs of oxidized pyrite between 386.43 and 386.61 m; diagonal fractures common; broken oil shale abundant between 386.18 and 391.97 m--about 2.1 m of core lost in this interval
392.58	395.14	2.56	Siltstone, pale-brown, hard and blocky; numerous small carbonaceous fragments; streaky in lower 11 cm; laminated marly layer 12 cm thick at 394.47 m

Table 1.--Lithologic description of core from Skyline core hole 1--continued

<u>Depth (meters)</u>		<u>Thickness (meters)</u>	<u>Lithology</u>
<u>From</u>	<u>To</u>		
395.14	397.67	2.53	Silty marlstone, laminated--some contorted bedding, hard and blocky; some diagonal fractures
397.67	400.26	2.59	Marlstone, mottled shades of brown, wavy laminated; numerous thin tuffs between 399.35 and 399.84 m, hard and blocky; some diagonal fractures
400.26	400.45	0.18	Tuff?, pale-brown; no bedding; some ≤ 2 -mm pits; some dark streaks; 10-mm-thick marlstone 35 mm below top
400.45	427.15	26.70	Oil shale, dark-yellowish-brown to dark-blackish-brown, laminated and banded, hard and generally blocky; many blue analcime? blebs in the upper 1.8 m; diagonal fractures are common; very prominently banded between ~423.1 and 424.1 m
427.15	430.93	3.78	Rubbly oil shale, in angular hard fragments commonly 2 to 5 cm across; some vuggy brecciated oil shale in the lower 0.6 m
430.93	434.64	3.72	Oil shale, medium-yellowish-brown; thin (2 cm) to blocky (35 cm) layers, hard, very evenly laminated
434.64	435.56	0.91	No core
435.56	438.58	3.02	Oil shale, brownish-black, prominently and evenly laminated and banded; oxidized sulfide zone between 436.78 and 437.02 m; ~7 thin tuffs between 436.17 and 436.29 m; lenticular 5-mm-thick tuff at 436.50 m; lenticular tuff ~10 mm thick at 436.75 m; 35-mm-thick tuff at 437.08; very rich grade oil shale between 437.72 and 438.33 m with irregular 22-mm-thick tuff 21 cm below top of unit; in blocky even layers 1 to 20 cm thick

Table 1.--Lithologic description of core from Skyline core hole 1--continued

Depth (meters)		Thickness	Lithology
From	To	(meters)	
438.58	443.91	5.33	Oil shale, yellowish-brown, evenly laminated and faintly banded, in even blocky layers 3 to 20 cm thick; yellowish-white tuff 135 mm thick at 442.26 m; 7-mm-thick tuff at 438.97 m; tuffaceous zone 20 mm thick at 443.79 m
443.91	449.46	5.55	Oil shale, dark-yellowish-brown and brownish-black, hard and smooth, blocky, evenly laminated; very prominently laminated and thin-banded between 447.14 and 448.36 m (includes Mahogany oil-shale bed); streaky structure between 446.84 and 447.14 m and 448.97 and 449.28 m; lenticular tuff lenticular tuff ~2 to 3 mm thick at 445.71 m
449.46	454.76	5.30	Oil shale, brownish-black and dark-yellowish-brown, much is fractured and broken, numerous irregular rough-surfaced fractures, no evidence of salines; 2.0 m of missing core; wavy laminated and some blebby structure
454.76	461.16	6.40	Oil shale, dark-blackish-brown and gray, mostly hard and blocky; porous brecciated zone between 457.69 and 457.90 m; carbonate-filled fractures are numerous between 457.90 and 458.54 m; broken fragments between 458.42 and 459.03 m; contorted 15-mm-thick brownish-stained tuff at 455.86 m
461.16	466.34	5.18	Oil shale; distinct streaky bedding; some smooth to irregular diagonal fractures, generally blocky

Table 1.--Lithologic description of core from Skyline core hole 1--continued

Depth (meters)		Thickness	Lithology
From	To	(meters)	
466.34	478.23	11.89	Oil shale, brownish-gray and dark-brownish-gray, evenly laminated; locally streaky bedding; very prominently banded between 595.88 and 596.49 m; some open nahcolite cavities; some broken rubbly oil shale and swelled and fractured pyritic oil shale; very rich oil shale 14 cm thick at 474.51 m
478.23	478.60	0.37	Tuffaceous oil shale, dark-yellowish-brown, prominently laminated and thin banded; about 12 lenticular bluish-gray tuffs 2 to 5 mm thick are scattered through unit
478.60	494.08	15.48	Mostly rubbly oil shale consisting of angular fragments and solution breccia (nahcolite cavity fillings?); 6.31 m of missing core
494.08	502.01	7.92	Oil shale, evenly to wavy laminated; locally streaky structure; some fractures; generally hard and blocky; some vertical fractures; 0.79 m of missing core; 20- to 35-mm-thick lenticular tuff at 496.40 m; 50- to 55-mm-thick lenticular tuff at 496.43 m
502.01	505.94	3.93	Tuffaceous siltstone, many dark streaks of brown marlstone parallel to subparallel bedding; hard and thick blocky, noncalcitic
505.94	512.67	6.74	Oil shale, dark-yellowish-brown, scattered nahcolite cavities to 6 cm across, wavy laminated and blebby structure; tuff 60 mm thick at 512.06 m; locally some broken irregular fragments; 3-4 lenticular tuffs 3 to 8 mm thick in 5-cm-thick zone at 512.52 m
512.67	514.50	1.83	Marlstone, yellowish-brown, evenly laminated, in smooth layers 5 to 13 cm thick; broken angular fragments between 513.59 and 514.50 m; lens of bluish-gray tuff 50 mm across at 514.32 m

Table 1.--Lithologic description of core from Skyline core hole 1--continued

Depth (meters)		Thickness	Lithology
From	To	(meters)	
514.50	515.02	0.52	Oil shale, dark-blackish-brown, wavy laminated; many white swelled blebs (sulfate resulting from oxidized pyrite); unit tends to split parallel to bedding along irregular surfaces; some diagonal fractures
515.02	~523.34	8.32	Oil shale, dark-yellowish-brown, streaked and evenly laminated-- locally highly contorted bedding between 519.68 and 520.90 m; swelled sulfide zone between 517.86 and 518.16 m; a few nahcolite cavities to 6 cm across; 15 cm of honeycomb crystal cavity zone between 519.44 and 519.59 m; some broken fragments of oil shale
~523.34	527.12	3.78	Interbedded marlstone and siltstone; siltstone has few to many marly streaks parallel to bedding; generally forms distinct beds 5 to 19 cm thick; comprises about 25 percent of the unit; marlstone is light-yellowish-brown, evenly to wavy laminated, hard, in thin platy layers 2 to 17 cm thick and also in angular fragments; no evidence of salines; 15-mm-thick tuff with vertical wavy fractures at 524.12 m
527.12	~531.27	4.15	Partly rubbly oil shale, laminated, dark-yellowish-brown, medium-smooth blocky; 0.49 m of unit in angular fragments commonly 2 to 8 cm across
~531.27	532.49	1.22	Honeycomb oil shale; abundant crystal cavities commonly \leq 1 mm across
532.49	551.98	19.51	Partly rubbly oil shale (similar to 527.12 and 531.27 m depth), very evenly to wavy laminated; distinct fine-streaky blebby structure in oil shale between 532.49 and 532.79 m; about 6.1 m of unit is in angular fragments 2 to 8 cm across; remainder is blocky with some irregular vertical fractures

Table 1.--Lithologic description of core from Skyline core hole 1--continued

<u>Depth (meters)</u>		<u>Thickness</u>	<u>Lithology</u>
<u>From</u>	<u>To</u>	<u>(meters)</u>	
551.98	554.77	2.77	Honeycomb oil shale, much finely pitted oil shale and bands of white (calcite after nahcolite?) crystals <1 mm across, some in dovetail twins; some oil shale free of crystal cavities; oil-shale breccia between 551.99 and 552.05 m
554.77	557.97	3.20	Oil shale, thin- to medium-blocky; few scattered crystals
557.97	561.69	3.72	Leached saliniferous oil shale, light-brown
561.69	563.27	1.58	Oil shale, dark-gray; many small oval powdery blebs parallel to bedding, some fractures
563.27	582.78	19.51	Leached saliniferous oil shale, brecciated in part; solution breccia between 575.77 and 576.68 m
582.78	583.39	0.61	Oil shale, brownish-black, very rich grade; some fractures
	583.29		Dissolution surface
583.39	586.13	2.74	Nahcolitic oil shale, large nahcolite aggregates to 25 cm; oil shale contains abundant northupite (bi-pyramidal crystals to 1 mm) and searlesite (thin rectangular platelets about 5 mm across)
586.13	590.09	3.96	Disseminated nahcolite and oil shale
590.09	594.36	4.27	White nahcolite; about 28 cm of marlstone partings; many pits 1-10 mm across
594.36	602.01	7.65	Halite and some nahcolite; halite is light-smoky-gray, coarse crystalline (up to 20 mm); some banded and irregular intergrowths of brown microcrystalline nahcolite; strong hydrogen sulfide odor on fresh fracture

Table 1.--Lithologic description of core from Skyline core hole 1--continued

<u>Depth (meters)</u>		<u>Thickness</u>	<u>Lithology</u>
<u>From</u>	<u>To</u>	<u>(meters)</u>	
602.01	603.32	1.31	Disseminated nahcolite and oil shale, brown; about 50 percent nahcolite in very fine to fine grained crystals and some coarse nahcolite crystals; some locally abundant nahcolite crystal aggregates about 5 mm across in upper 0.3 m
603.32	607.16	3.84	Halite, light-smoky-gray; very coarse crystals (up to ~15 mm across); some brown microcrystalline nahcolite and a few layers of marlstone as much as 2 cm thick; irregular interlocking mosaic of crystals; 30 cm of solid microcrystalline nahcolite at base
607.16	609.75	2.59	Nahcolite, halite, and oil shale; brownish-black; some blebs of light-smoky-gray coarse crystals of halite 2.5 to 10 cm across; nahcolite is in brown, fine-grained blebs (2x10 mm) and some irregular coarsely crystalline aggregates ≤2 to 3 cm across; dull-black solid hydrocarbon bleb (3x4 cm) at 608.38 m
609.75	611.98	2.23	Disseminated nahcolite and oil shale, dark-yellowish-brown; nahcolite in mostly fine grained to medium-grained disseminated crystals; estimated 30 percent nahcolite
611.98	612.16	0.18	Microcrystalline nahcolite, dense, hard, brown
612.16	615.09	2.93	Halite and some nahcolite; irregular mixture of coarse crystalline, clear to light-smoky-gray halite and dense microcrystalline brown nahcolite; halite crystals are ≤2x3 cm; a few scattered bands of marlstone 0.5 to 10 cm thick

Table 1.--Lithologic description of core from Skyline core hole 1--continued

Depth (meters)		Thickness	Lithology
From	To	(meters)	
615.09	620.88	5.79	Nahcolitic oil shale, brownish-black; blebby and streaky structure in upper 1.83 m, locally very evenly laminated and massive; pyrite-rimmed nahcolite aggregates ~3 to 7 cm across; some very fine grained disseminated nahcolite in several bands as much as 20 cm thick in lower 1.5 m
620.88	622.52	1.65	Halite and some microcrystalline nahcolite; halite is medium- to coarse-crystalline; nahcolite is in wavy but distinct laminae to thin layers about 1 to 30 mm thick; some marlstone bands as much as 6 cm thick
622.52	626.33	3.81	Nahcolitic oil shale, dark-yellowish-brown; distinctive blebby and streaky structure; fine-grained nahcolite blebs and dark-brown coarse nahcolite crystals and aggregates to ~7 cm across
626.33	627.98	1.65	Halite and nahcolite; intermixed coarse crystals of halite and light-brown patches of microcrystalline nahcolite; 20-cm-thick oil shale at 627.10 m
627.98	632.95	4.97	Nahcolitic oil shale, dark-brown; numerous bands of fine-grained to microcrystalline nahcolite commonly 1 to 3 cm thick; 22-cm-thick brown microcrystalline bed of nahcolite at 629.90 m; contorted tuff 5 mm thick at 662.39 m
632.95	635.26	2.32	Halite, tinged with wispy brown organic matter; some very large halite crystals ≥ 5 cm; a few marlstone bands to 18 cm thick; some thin laminae to thin layers of nahcolite as much as 5 mm thick

Table 1.--Lithologic description of core from Skyline core hole 1--continued

Depth (meters)		Thickness	Lithology
From	To	(meters)	
635.26	650.23	14.97	Nahcolitic oil shale, brown and grayish-brown; mostly streaky structure; nahcolite is moderately to locally very abundant in scattered fine-grained crystals, brown fine-grained blebs and pyrite-rimmed dark-brown coarse-crystalline aggregates 8 to 56 cm across; locally many "blisters" of oxidized pyrite; vertical halite-filled fracture between 649.83 and 650.14 m; generally hard and blocky but tends to split roughly along bedding due to oxidization of pyrite; 132-mm-thick tuff at 639.17 m
650.23	652.64	2.41	Halite and nahcolite; halite is in clean coarse-crystalline layers ≤25 cm thick; nahcolite is in brown microcrystalline, thin, slightly contorted to even laminae and thin layers as much as 5 cm thick; 12-cm-thick microcrystalline nahcolite layer at top
652.64	656.72	4.08	Nahcolitic oil shale, medium-blackish-brown; streaked structure; some contorted fine-grained beds of nahcolite commonly 1.5 to 6 cm thick and blue-tinged pyrite-rimmed nahcolite rosettes to 10 cm across
656.72	663.43	6.71	Nahcolitic oil shale, medium-yellowish-brown, faintly laminated to locally massive; scattered 1 to 2 mm nahcolite crystals; coarse-crystalline nahcolite rosettes 5 to 9 cm across and a few dense microcrystalline nahcolite layers 3 to 16 cm thick; scattered small swelled blebs of oxidized pyrite

Table 1.--Lithologic description of core from Skyline core hole 1--continued

Depth (meters)		Thickness	Lithology
From	To	(meters)	
663.43	665.17	1.74	Microcrystalline nahcolite and oil shale; about 20 dense, brown, fine-grained to microcrystalline layers of nahcolite about 0.5 to 30 cm thick (50 percent nahcolite) interbedded with evenly laminated oil shale; nahcolite beds contain irregularly curly patches of creamy microcrystalline quartz; some tiny blebs of pyrite scattered in nahcolite layers
665.17	669.10	3.93	Oil shale; sparse nahcolite in rosettes and fine- to medium-grained lenses 1 to 6 cm thick; brown and brownish-black, blebby and streaky structure; a few oxidized pyrite blebs; estimated 5 percent nahcolite; many of the blebs are sub(?)angular marlstone fragments which lie parallel to the bedding; 30-mm-thick tuff (with a marlstone lamina in middle) at 668.82 m
669.10	677.91	8.81	Nahcolitic oil shale, dark-blackish-brown; generally fine-streaky structure and some even laminae; scattered large (10-35 cm) pyrite-rimmed coarsely crystalline nahcolite aggregates; hard and blocky
677.91	679.70	1.80	Nahcolite, medium- to coarse-grained, estimated 80 percent; many thin irregular layers of marlstone
679.70	687.63	7.92	Disseminated nahcolite and oil shale, dark-brown, hard and blocky; mostly fine grained disseminated nahcolite in rich oil-shale matrix; some coarsely crystalline halite blebs between 685.50 and 685.59 m; solid dense bed of brown microcrystalline nahcolite between 683.97 and 684.28 m; some local bands of evenly laminated oil shale free of nahcolite; estimated 50-60 percent nahcolite

Table 1.--Lithologic description of core from Skyline core hole 1--continued

Depth (meters)		Thickness	Lithology
From	To	(meters)	
687.63	690.55	2.93	Halite and some interbedded nahcolite; halite is generally light-smoky-gray, very coarse to medium crystalline; nahcolite is in thin laminae and layers to 2 cm thick; some marlstone layers 2-26 cm thick
690.55	690.95	0.40	Disseminated nahcolite and oil shale; small amount of halite
690.95	694.30	3.35	Microcrystalline nahcolite, brown, contorted bedding; some halite; very highly contorted bedding and locally pitted in upper 0.9 m; disseminated nahcolite and nahcolite rosettes in oil shale in lower 1.2 m
694.30	695.04	0.73	Nahcolitic oil shale, wavy laminated to streaky; some fine- to medium-crystalline brown nahcolite lenses
695.04	695.95	0.91	Halite, nahcolite, and oil shale; halite and nahcolite are poorly banded to irregularly mixed; halite is light-smoky-gray, coarsely crystalline, nahcolite is brown microcrystalline; some interbedded streaky high-grade oil shale
695.95	696.56	0.61	Nahcolite and oil shale; nahcolite is in disseminated fine- to medium-grained crystals and small rosettes to 3 cm across; several 1 to 2-cm-thick bands of microcrystalline brown nahcolite in upper 10 cm containing small, vertical halite-filled fractures; estimated 70 percent nahcolite
696.56	699.09	2.53	Nahcolitic oil shale, brownish-black; laminated and streaky structure; some nahcolite rosettes to 6 cm across, 30-cm-thick band of disseminated nahcolite at 698.60 m

Table 1.--Lithologic description of core from Skyline core hole 1--continued

Depth (meters)		Thickness	Lithology
From	To	(meters)	
699.09	703.23	4.15	Halite and nahcolite; halite is light-smoky-brown, medium- to coarse-crystalline, in layers commonly 5 to 10 cm thick; nahcolite is mostly in microcrystalline, irregular brown patches mixed with halite; some layers of laminated marlstone 5 to 20 mm thick
703.23	707.75	4.51	Oil shale with nahcolite and halite; dark-brownish-black, irregular lenses of mixed halite and nahcolite 7 to 20 cm thick; nahcolite also in coalescent rosettes as much as 2 cm thick; zone of disseminated nahcolite between 705.92 and 706.83 m; vertical vein of halite at 707.14 m
707.75	716.43	8.69	Halite and nahcolite; halite is light-smoky-brown, fine- to coarse grained, in layers commonly 4 to 11 cm thick; nahcolite is light-brown, mostly microcrystalline; occurs in well-developed laminae alternating with halite; nahcolitic marlstone unit between 708.87 and 709.33 m; nahcolite becomes more abundant (~75 percent) below 714.45 m
716.43	720.09	3.60	Nahcolitic oil shale, grayish-brown; some fine-grained disseminated oxidized pyrite; irregular lenses (1-6 cm thick) of fine-grained brown nahcolite; 14-cm-thick layer of fine-grained nahcolite at 716.89 m
720.03	723.38	3.35	Disseminated nahcolite and oil shale; very fine grained disseminated nahcolite in many thin bands; some nahcolite crystals to 2 mm across
723.38	727.28	3.90	Nahcolitic oil shale, brownish-black, laminated, scattered dark-brown nahcolite aggregates 4 to 15 cm across

Table 1.--Lithologic description of core from Skyline core hole 1--continued

Depth (meters)		Thickness (meters)	Lithology
From	To		
727.28	727.47	0.18	Bedded nahcolite, brown, microcrystalline to fine-grained, laminated and banded; several laminae of microcrystalline quartz
727.47	732.04	4.57	Oil shale, dark-blackish-brown; a few small nahcolite aggregates 2 to 4 cm across; many blebs of swelled pyrite between top of unit and about 727.25 m; massive structure to 727.25 m, laminated below
732.04	737.98	5.94	Disseminated nahcolite and oil shale; scattered beds and bands (6-24 cm thick) of medium-grained nahcolite and disseminated nahcolite; core shows many fractures due to numerous swelled pyrite blebs
737.98	741.21	3.23	Nahcolitic oil shale; dark-brownish-black; scattered disseminated to coalescent clumps of coarse-grained brown nahcolite crystals and some small 2 to 3 cm nahcolite aggregates; light-brown, medium-grained lens or bed of nahcolite at 738.80 m; faintly laminated
741.21	743.96	2.74	Bedded nahcolite, brown, microcrystalline, banded; 55-cm-thick bed of nahcolite-rich oil shale at 742.55 m; some laminae and blebs of microcrystalline quartz; 16-cm-thick bed of nahcolitic oil shale at 741.73 m
743.96	746.97	3.02	Nahcolitic oil shale, dark-brown; many small, coarse crystalline clumps and rosettes of nahcolite as much as 5 cm across; a few medium-grained nahcolite lenses to 8 cm; many swelled pyrite blebs have caused core to fracture along irregular surfaces parallel to bedding
746.97	747.77	0.79	Nahcolitic oil shale; faint streaky structure, black; a few dark-brown coarse-grained nahcolite aggregates to 10 cm across

Table 1.--Lithologic description of core from Skyline core hole 1--continued

Depth (meters)		Thickness	Lithology
From	To	(meters)	
747.77	749.84	2.07	Disseminated nahcolite and oil shale; 8 to 14-cm-thick bands of very fine grained disseminated nahcolite; 18-cm-thick band of medium-grained disseminated nahcolite at 747.98 m with 15 cm of coalescent, 1- to 4-cm-diameter nahcolite aggregates below
749.84	750.72	0.88	Oil shale, medium-grayish-brown, very faintly streaked; a few irregular brown discontinuous microcrystalline lenses of nahcolite 1.5 to 8 cm thick
750.72	753.25	2.53	Bedded nahcolite, brown, microcrystalline; much contorted bedding; intermixed with 40-50 percent oil shale in irregular stringers and layers
753.25	757.79	4.54	Nahcolitic oil shale, brown; upper 1.2 m contains mostly disseminated medium-grained nahcolite crystals and a medium-grained nahcolite lens or bed 7 cm thick; remainder of unit contains coarse-grained brown nahcolite aggregates and a few rosettes 5 to 15 cm across
757.79	782.09	24.29	Nahcolitic oil shale, mottled-brown and grayish brown; mostly streaky structure with some rounded flat fragments of marlstone parallel to bedding; scattered dark-brown coarse-crystalline nahcolite aggregates 5 to 32 cm across; four thin lenses or beds of fine-grained brown nahcolite in upper 0.5 m; about 30 cm of similar nahcolite at 760.48 m; 28 cm of disseminated nahcolite at 763.83 m (depth may be in error due to mixed core); nahcolite aggregates have swelled rims of oxidized pyrite; also some swelled streaks and blebs of oxidized pyrite

Table 1.--Lithologic description of core from Skyline core hole 1--continued

Depth (meters)		Thickness	Lithology
From	To	(meters)	
782.09	787.09	5.0	Oil shale, dark-brown and black, laminated; several scattered white-coated nahcolite aggregates 6 to 14 cm across; 35-cm-thick bed of fine-grained nahcolite at 785.56 m
787.09	787.63	0.55	Disseminated nahcolite and oil shale, six discrete zones 4 to 7 cm thick of disseminated medium-grained nahcolite
787.63	794.31	6.68	Nahcolitic oil shale, blebby structure, dark-brownish-black; blebs are light-brown laminated and structureless fragments of marlstone; some bluish-white-coated nahcolite aggregates 7 to 12 cm across
794.31	797.36	3.05	Oil shale, brownish-black; streaky structure; one 7-cm nahcolite aggregate near base; possible oil-shale solution breccia (or fault gouge?) between 794.49 and 794.61 m
797.36	798.09	0.73	Bedded nahcolite, medium-grained; contorted bedding, some oil-shale stringers; some nahcolite aggregates near top
798.09	815.86	17.77	Nahcolitic oil shale, brownish-black; a few scattered white-coated pyrite-rimmed nahcolite aggregates 8 to 42 cm across; 19-cm-thick band of disseminated nahcolite at 799.19 m; 21-cm-thick bed of medium- to coarse-grained nahcolite at 800.80 m (these two beds may be out of place); faint streaky structure; light brown and prominently laminated between 804.06 and 804.31 m and 804.92 and 805.34 m; streaky structure with some blebby structure between 804.67 and 810.59 m

Table 1.--Lithologic description of core from Skyline core hole 1--continued

Depth (meters)		Thickness	Lithology
From	To	(meters)	
815.86	816.74	0.88	Oil shale, dark-grayish-brown with steel-gray cast on core surface; bands of massive oil shale alternate with bands of very evenly laminated oil shale; several vertical very irregular fractures filled with black material
816.74	816.99	0.24	No core
816.99	817.78	0.79	Oil shale ("Sixty" bed), high-grade, dark-yellowish-brown; distinctive blebby structure, creamy bedding-parallel blebs of dolomite(?) parallel to bedding (1-5 mm thick). This informal unit is the "Sixty" oil-shale bed of Dyni (1974, figs. 2 and 3)
817.78	817.87	0.09	No core
817.87	823.36	5.49	Oil shale, brownish-black with steel-gray cast on core surface, mostly evenly laminated; gray siltstone or tuff 13 cm thick at 820.77 m; three tuffs (6, 2, 1.5 mm thick) in zone 32 mm thick at 822.08 m; prominent vertical fractures between 819.91 and 821.04 m
823.36	823.48	0.12	Tuff(?), gray, very fine grained, structureless, one vertical fracture
823.48	824.85	1.37	Oil shale, dark-yellowish-brown, prominently evenly laminated and banded; some slump structure and looped bedding, some swelled pyrite blebs in lower 20 cm
824.85	828.72	3.87	Nahcolitic oil shale, yellowish-brown, very prominently laminated and banded; some scattered nahcolite rosettes and aggregates 3 to 16 cm across; a fine-grained nahcolite nodule 9 cm thick rimmed with swelled pyrite; some stringers and blebs of swelled pyrite

Table 1.--Lithologic description of core from Skyline core hole 1--continued

Depth (meters)		Thickness	Lithology
From	To	(meters)	
828.72	829.36	0.64	Bedded nahcolite and oil shale; nine thin beds (5-50 mm thick) of fine-grained nahcolite interbedded with evenly laminated oil shale
829.36	831.74	2.38	Nahcolitic oil shale; numerous scattered pods of medium-grained nahcolite and rosettes and aggregates of coarse-grained nahcolite 5 to 10 cm across in massive and faintly banded, yellowish-brown oil shale
831.74	832.62	0.88	Disseminated nahcolite and oil shale; numerous bands of very fine grained to medium-grained disseminated nahcolite in yellowish-brown oil shale (~50 percent nahcolite); a 9-cm-thick band of disseminated nahcolite 12 cm above base is distinctively laminated
832.62	841.61	8.99	Nahcolitic oil shale, mottled light- to medium-yellowish-brown; blebby structure; numerous creamy dolomite(?) blebs ≤12 mm but commonly 1 to 4 mm thick scattered throughout; minor massive and laminated yellowish-brown oil shale; some scattered fine-grained nodules of siliceous nahcolite 2 to 5 cm across; a few 6- to 30-cm dark-brown coarse crystalline rosettes of nahcolite and many scattered 1- to 3-mm nahcolite crystals; some swelled pyrite blebs
841.61	843.08	1.46	Disseminated nahcolite and oil shale; much fine- to medium-grained disseminated nahcolite and some small (1 cm) coarse-grained nahcolite aggregates in massive and locally laminated yellowish-brown oil shale; about 50 percent nahcolite

Table 1.--Lithologic description of core from Skyline core hole 1--continued

Depth (meters)		Thickness	Lithology
From	To	(meters)	
843.08	844.51	1.43	Nahcolitic oil shale, yellowish-brown; massive and some irregularly laminated structure; well-developed rosettes and some irregular aggregates of nahcolite commonly 3 to 8 cm across
844.51	851.55	7.04	Disseminated nahcolite and oil shale, dark-yellowish brown; mostly fine grained disseminated nahcolite in many laminated bands 5 to 45 cm thick; also scattered, small dark-brown, coarse-grained nahcolite aggregates 5 to 20 mm across; estimated 40 percent nahcolite
851.55	857.92	6.37	Nahcolitic oil shale, yellowish-brown, mostly massive but locally laminated; numerous 3 to 8-cm-thick dark-brown, coarse-grained nahcolite rosettes and aggregates, numerous swelled pyrite blebs; some white streaks of bladed carbonate crystals (nahcolite?) parallel to bedding
857.92	860.45	2.53	Disseminated nahcolite and oil shale, dark-brown; nahcolite is fine-grained; estimated 70 percent nahcolite
860.45	868.86	8.41	Nahcolitic oil shale, light-yellowish-brown and dark-yellowish-brown; massive in upper 2.74 m; faint streaky structure below; some nahcolite aggregates 5 to 11 cm across; distinct blebby structure between 866.85 and 867.52 m; nahcolite is sparse in lower 3.66 m
868.86	869.90	1.04	Disseminated nahcolite and oil shale, brown; nahcolite is mostly fine to medium grained; estimated 70-80 percent nahcolite
869.90	~873.86	3.96	Oil shale, brownish-black; faint streaky structure; hard, thick bedded

Table 1.--Lithologic description of core from Skyline core hole 1--continued

Depth (meters)		Thickness (meters)	Lithology
From	To		
~873.86	880.17	6.31	Oil shale, dark-blackish-brown, evenly laminated, silty; numerous healed, short vertical fractures; tends to split in smooth-surfaced layers
880.17	882.34	2.16	Disseminated nahcolite and oil shale, dark-brown; nahcolite is fine to medium grained and forms one thick band of dissminated crystals; estimated 80 percent nahcolite
882.34	900.41	18.07	Nahcolitic oil shale, light-yellowish-brown and brownish-black, massive, locally blebby; some steel-gray, very evenly laminated oil shale in lower part; some very large nahcolite rosettes commonly 20-35 cm across. Base of nahcolite facies at 896.84 m; some distinct, scattered star-shaped white twinned crystals ≤ 5 mm across between 896.87 and 898.25 m
900.41	903.79	3.38	Silty marlstone, dark-gray and dark-brownish-gray, very evenly laminated and banded; in smooth-surfaced, thin blocky layers 5 to 20 cm thick; numerous very sharp and even beds of very fine grained siltstone 1 to 20 cm thick scattered throughout most of the unit
903.79	908.21	4.42	Oil shale, dark-grayish-brown, blebby structure, hard and blocky
908.21	913.79	5.58	Oil shale; mixed, evenly laminated and thin blocky, steel-gray clayey oil shale and blocky yellowish-brown blebby oil shale; clayey oil shale contains some bright-yellow blebs and a plant(?) fragment; some algal mat(?) structure in lower 20 cm; base of unit is in very sharp contact with underlying clay-shale

Table 1.--Lithologic description of core from Skyline core hole 1--continued

Depth (meters)		Thickness	Lithology
From	To	(meters)	
913.79	929.34	15.54	Clayey oil shale and siltstone; dark-brown and blackish-brown clayey oil shale in thin layers 2 to 15 cm thick interbedded with some thin beds 3 to 18 cm thick of very fine grained steel-gray massive permeable siltstone having sharp contacts; oil shale is very evenly laminated. Some very fine grained disseminated pyrite--no evidence of oxidation and swelling. Some scattered 1- to 7-mm-thick fine-grained bluish-gray tuffs(?) between 919.55 and 920.80 m; 10-cm-thick prominently laminated unit (tuff?) at 918.70 m (may be good marker)

1,031.75 m (Total depth according to driller.)

Note: "Swelled" pyrite refers to pyrite and marcasite(?) that has oxidized on exposure to air in the core boxes to a puffy-black material that commonly fractures and splits adjacent oil shale.

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