

CORE LOG

U. S. GEOLOGICAL SURVEY **C179**

DRILL HOLE Shell Oil Co TR-1 23X-2 - Federal COLORADO Colorado PAGE 1 OF 63
 LOCATION NE 1/4 SW 1/4 sec. 2, T. 25 N., R. 98 W. ELEVATION 6532KB TOTAL DEPTH _____
 DATE BEGUN _____ DATE COMPLETED _____ DRILLER _____ LOGGED BY W. C. Culbertson
 CASING _____ REMARKS: _____

FROM	TO	THICK- NESS	LITHOLOGIC DESCRIPTION
780.0	785.8	5.8	Siltstone, tuffaceous, pale yellow brown to dk yellow brown, poorly bedded, with some contorted bedding, sparse carbonaceous fragments. Coarse grained analcite(?) from 781.3 to 781.9. Grades down to silty marlstone in lower 1.8'. Pyrite on fracture at 784.1
85.8	87.7	1.9	Oil shale, mod grade, dk yellow brown, alternate rich and lean layers
87.7	94.0	6.3	Siltstone, tuff, marly, pale yellow brown interbedded w/silty oil shale, low grade, dk yellow brown; poorly bedded to contorted bedding. Core in small fragments
94.0	98.0	4.0	Oil shale, mod grade, dk yellow brown, rich and lean laminae. 1/4" thick lenses of white mineral (analcite?) at 796.2
98.0	98.9	0.9	Siltstone, tuffaceous, carbonaceous, <u>pale</u> yellow brown, poorly bedded, broken core
98.9	801.0	2.1	Oil shale, lean, dark yellow brown, w/20% lenses of analcitic tuff. At 802.2 to 802.4 is coarse grained analcite
801.0	802.0	1.0	Missing

Drill hole

CORE LOG

U. S. GEOLOGICAL SURVEY

DRILL HOLE Shell Oil Co TR-1 23X-2

PAGE 3 OF

LOCATION _____ ELEVATION _____ TOTAL DEPTH _____

DATE BEGUN _____ DATE COMPLETED _____ DRILLER _____ LOGGED BY _____

CASING _____ REMARKS: _____

FROM	TO	THICK- NESS	LITHOLOGIC DESCRIPTION
838.6	842.7	4.1	Oil shale, mod to rich, indistinctly laminated, dk yellow brown to dusky brown lean in lower 0.7'
42.7	45.0	2.3	Oil shale, lean w/about 25% tuff (siltstone) in thin beds. Core in small pieces
45.0	53.2	8.2	Oil shale, mod to rich, dk yellow brown to brown-black, indistinctly laminated
53.2	71.1	17.9	Siltstone (tuff) pale yellow brown, poorly bedded, finely biotitic, sparsely carbonaceous. Contains lenses and layers of oil shale in upper 3.0 feet. From 867.0 to 867.9 is 90% oil shale, dk yellow brown, mod grade
71.1	922.0	50.9	Oil shale, dusky brown, dk yellow brown and brown-black, mod grade, possibly some rich, indistinctly laminated. Contains thin lenses (up to 1") and stringers of tuff as follows: 872.0-872.1; 877.1 to 877.3; 882.5 to 882.9; 883.9-884.1; 884.3 - 884.7; 889.2 to 889.3, 889.7 to 889.9; 890.6- 890.7; 895.5 to 895.7; 898.5 to 899.5; 901.7 to 901.8; 910.5 to 911.1; 916.5 to 917.2; 921.9 to 922.0. Lenses with tiny vugs at 873.5 to 873.9; 905.0 to 905.3 (analcite? feldspar?); 910.6. About every 2 to 4 feet is a fracture at about 60° to 70° from horizontal
922.0	926.0	4.0	(Core in tiny pieces). Oil shale, dk yellow brown to dusky yellow brown, laminated, breaks easily along laminae. Unusually brittle

Drill hole

CORE LOG

U. S. GEOLOGICAL SURVEY

DRILL HOLE Shell Oil Co TR-1 23X-2 LOCATION _____ ELEVATION _____ PAGE 4 OF _____
 DATE BEGUN _____ DATE COMPLETED _____ DRILLER _____ LOGGED BY _____ TOTAL DEPTH _____
 CASING _____ REMARKS: _____

FROM	TO	THICK- NESS	LITHOLOGIC DESCRIPTION	
926.0	935.0	9.0	Oil shale, mod grade, indistinct laminae, dk yellow brown to brown-black. Probably rich from 927.0 to 928.5, lenses and blebs of tuff (analcitic?)	
			928.5 to 928.55; 932.6 to 932.7; 934.6 to 934.65. Several fractures as above	
35.0	35.7	0.7	Siltstone (tuff), pale yellow brown, porous, carbonaceous	
			<i>very pale tuff?</i>	
35.7	40.3	4.6	Oil shale, mod grade, dk yellow brown to dusky yellow brown, laminated	
40.3	43.1	2.8	Oil shale, mod grade w/50% tuff (siltstone) in layers w/ abundant thin varvy laminae of oil shale <i>Varvy Bed</i>	
43.1	56.0	12.9	Oil shale, mod grade, indistinct laminae. Many blebs of tuff (siltstone) up to 0.02' thick, from 945.0 to 945.6 and from 950.2 to 952.1. A few high angle fractures with calcite film on surface	
56.0	57.1	1.1	Oil shale as above with several rosette-like solution cavities. Probably nahcolite	first nahcolite cavity
957.1	963.5	6.4	Oil shale, mod grade, dk yellow brown to dusky yellow brown, possibly lean, indistinct laminae. Several hairline layers and veins of calcite. Nahcolite(?) solution cavities at 962.0 to 962.2 and 963.3 to 963.5	

Drill hole

CORE LOG

U. S. GEOLOGICAL SURVEY

DRILL HOLE Shell Oil Co TR-1 23X-2

PAGE 5 OF

LOCATION _____ ELEVATION _____

DATE BEGUN _____ DATE COMPLETED _____ DRILLER _____ LOGGED BY _____ TOTAL DEPTH _____

CASING _____ REMARKS: _____

FROM	TO	THICK- NESS	LITHOLOGIC DESCRIPTION
963.5	990.0	26.5	Oil shale, mod grade, dk yellow brown to brown black, thin to thick laminae. Solution cavities at 967.2 and 977.9 to 978.1. A light gray tuff 0.1' thick at 966.6 with irregular contacts. Thin lenses of tuff (0.01 to 0.02') at 969.3, 970.5, 971.0 and 981.7. Films of calcite on fracture planes
90.0	94.7	4.7	Oil shale, rich?, brown black layered with dk yellow brown. Much loop or target bedding. Several high angle fractures
94.7	1009.1	14.4	Oil shale, mod grade, dusky yellow brown to grayish brown to dk yellow brown, upper 1.3' is almost massive, rest is thickly laminated. At 1006.0 are fragments of tuff (siltstone) dk yellow brown, on top of a leached(?) granular zone as much as 1" deep in marlstone. Tuff may be as much as 0.2' thick
1009.1	13.0	3.9	Tuff (siltstone) brown gray to lt brown gray, thick bedded. Contains layers of lean laminated oil shale as follows: 0.07' at 1009.7; 0.06' at 1011.0; 0.1' at 1011.3', 0.03' at 1011.45'; 0.4' at 1012.1'. At 1012.5' is 0.2' of intermixture of oil shale and tuff in lenses. At 1012.9 is 0.1' of tuff and oil shale with the tuff apparently injected
1013.0	1016.4	3.4	Oil shale, pale yellow brown to dusky yellow brown, lean to mod grade, possibly rich from 1015.6 to 1016.2, indistinctly laminated in part. Contorted bedding from thin tuff injections at 1015.9 to 1016.0 and 1016.2 to 1016.3. From 1014.5 to 1014.6 are tiny blebs of lt gray mineral, probably analcite

Drill hole

CORE LOG

U. S. GEOLOGICAL SURVEY

DRILL HOLE Shell Oil Co TR-1 23X-2

PAGE 8 OF

LOCATION _____ ELEVATION _____ TOTAL DEPTH _____

DATE BEGUN _____ DATE COMPLETED _____ DRILLER _____ LOGGED BY _____

CASING _____ REMARKS: _____

FROM	TO	THICK- NESS	LITHOLOGIC DESCRIPTION
1050.2	1052.6	2.4	Oil shale, rich, dusky yellow brown, laminated, much distortion and breaking of laminae at 1050.6 is 0.05' yellow gray tuff. Just below is a nearly black friable tuff(?) (siltstone) that probably was injected in a plastic state at high angle to the bedding. At 1051.0 is 0.02' It brown gray wavy tuff. A thin (0.01') layer of black tuff? at 1051.4
52.6	55.7	3.1	Oil shale, lean to moderate, pale yellow brown to brown gray, strongly laminated to varved. At 1052.6 is 0.07' vuggy tuff, irregular contacts, at 1054.4 is 0.04' ball of tuff. At 1055.4 is 0.07' brown gray tuff (siltstone) wavy contacts. At 1054.6 is 0.06' tuff, wavy contacts
55.7	57.8	2.1	Oil shale, rich at top to mod grade at base, brown black to dk yellow brown, predominantly thick lamination (0.02' to 0.05'). At 1057.2 is 0.05' tuff, brown gray; at 1057.7 is nahcolite solution cavity
57.8	61.2	3.3	Oil shale, rich ^{rich, grayish brown} to brown gray, indistinctly laminated to thick bedded. Breaks in high angle fracture. At 1060.7 is a nahcolite solution cavity(?)
1061.2	1076.2	15.0	Oil shale, mod grade, probably lean in lower 4 feet. Most is distinctly laminated to varved. At 1068.8 is 0.04' injected tuff. At 1070.7 is 0.07' yellow gray tuff bed. Blebs of analcite at 1074.9 and 1075.2

Drill hole

CORE LOG

U. S. GEOLOGICAL SURVEY

DRILL HOLE Shell Oil Co TR-1 23X-2 LOCATION _____ ELEVATION _____ PAGE 9 OF _____
 DATE BEGUN _____ DATE COMPLETED _____ DRILLER _____ LOGGED BY _____ TOTAL DEPTH _____
 CASING _____ REMARKS: _____

FROM	TO	THICK- NESS	LITHOLOGIC DESCRIPTION
1076.2	1077.8	1.6	Oil shale, rich, brown black, laminated. Bedding has high dip in lower 0.5'
			Mahogany bed(?)
77.8	81.7	3.9	Oil shale, mod grade, distinct even laminations. Contains thin lenses of tuff From 1081.0 to 1081.1
81.7	83.0	1.3	Oil shale, rich, indistinct laminations, discontinuous layers. Contains 0.05' lens of tuff at 1082.9 and a 0.03' layer of tuff at end of core next to missing section
83.0	84.0	1.0	Missing
84.0	97.5	13.5	Oil shale, rich, distinctly laminated. Marlstone from 1085.2 - 1085.7 (lean oil shale). Contains minute blebs of pale yellow brown marlstone(?) from 1085.6 to 1086.6. Contains distinct layers of pale yellow brown marlstone up to 0.03' thick from 1088.9 to 1090.8. Contains 0.02' layer of tuff at 1096.6, irr contacts
97.5	1101.1	3.6	Oil shale, mod grade, thick to thin laminations, many high angle fractures (80°)
1101.1	1103.8	2.7	Oil shale, rich, indistinct laminations, many thin lenses of marlstone(?)

Drill hole

CORE LOG

U. S. GEOLOGICAL SURVEY

DRILL HOLE Shell Oil Co TR-1 23X-2 LOCATION _____ ELEVATION _____ PAGE 10 OF _____
 DATE BEGUN _____ DATE COMPLETED _____ DRILLER _____ LOGGED BY _____ TOTAL DEPTH _____
 CASING _____ REMARKS: _____

FROM	TO	THICK- NESS	LITHOLOGIC DESCRIPTION
1103.8	1110.7	6.9	Oil shale, mod to lean grade, indistinct laminations to massive, dusky brown.
			Nahcolite solution cavity from 1106.6 to 1106.9
10.7	14.0	3.3	Oil shale, rich, except 1111.1 to 1111.5, poorly laminated in part. Oil shale contains minute lenses of pale yellow brown marlstone from 1111.9 to 1112.9
14.0	22.0	8.0	Oil shale, mod grade, except rich from 1118.7 to 1119.4, distinct even laminations, becoming slightly wavy and discontinuous in lower 1.5 feet. From 1117.8 to 1119.4 the core contains remnants of tuff that apparently filled a vertical fracture, and intrudes horizontally an inch or so into the oil shale. Irr lateral contact with oil shale
22.0	25.8	3.8	Oil shale, mod to lean grade, laminations, with minor wavy or discontinuous bedding. Lower 2 feet of core in small fragments, apparently contains some nahcolite solution cavities
25.8	30.0	4.2	Oil shale, rich, except mod grade from 1128.0 to 1128.8. Rich shale has abundant irr discontinuous black laminae, from 2 mm to 30 mm long. At 1129.3 is 0.02' lens of tuff. Mod shale has wavy and slightly contorted indistinct laminae
1130.0	1132.2	2.2	Oil shale, mod grade, indistinct laminae with little color contrast, some lenticular bedding

Drill hole

CORE LOG

U. S. GEOLOGICAL SURVEY

DRILL HOLE Shell Oil Co TR-1 23X-2

PAGE 11 OF

LOCATION _____ ELEVATION _____ TOTAL DEPTH _____

DATE BEGUN _____ DATE COMPLETED _____ DRILLER _____ LOGGED BY _____

CASING _____ REMARKS: _____

FROM	TO	THICK- NESS	LITHOLOGIC DESCRIPTION
			Note: In box 1140 to 1150, it is not clear which is top and bottom of core.
			No depths are marked in interior of box; depth marks on exterior are at same end as spacers--contrary to normal. Core described as if outside markings on wrong end of box
1132.2	1147.9	15.7	Oil shale, rich grade, except med grade from 1141 to 1143. Discontinuous black laminae in oil shale as follows: 1132.0 to 1135.0; 1135.7 to 1137.2; and 1143.0 to 1147.0. Rest is distinct even to some lenticular laminae with mod color contrast. Nahcolite(?) solution cavities from 1135.0 to at least 1135.5, and probably to 1138.0; also at 1146.4
47.9	56.6	8.7	Oil shale, mod grade, laminated with low color contrast, some lenticular bedding. From 1149.7' to 1154.0' core is in rubbly pieces--middle part is leached saline zone--mod yellow brown crumbly marlstone in bladed habit. An 0.07' lens of tuff in one fragment of oil shale at 1153.8, total thickness of tuff unknown. Nahcolite(?) cavities at 1148.5 and probably in sequences from 1153.0 to 1153.7, and 1155.0 to 1156.3
1156.6	1161.2	4.6	Oil shale, rich grade, distinctly laminated, minor loop bedding, becoming mod grade in lower part

Drill hole

CORE LOG

U. S. GEOLOGICAL SURVEY

DRILL HOLE Shell Oil Co TR-1 23X-2 LOCATION _____ ELEVATION _____ PAGE 12 OF _____
 DATE BEGUN _____ DATE COMPLETED _____ DRILLER _____ LOGGED BY _____ TOTAL DEPTH _____
 CASING _____ REMARKS: _____

FROM	TO	THICK- NESS	LITHOLOGIC DESCRIPTION
1161.2	1164.0	3.8	Oil shale, mod grade, laminated, low color contrast, except from 1162.6 to 1163.2 (core is rubbly so interval uncertain) is marlstone, yellow gray to pale yellow brown. Nacholite(?) solution cavity
64.0	66.0	2.0	Core in fragments, probably mostly mod grade oil shale, with some <i>nick</i> , probably with nahcolite solution cavity on high angle fracture at 1162.2
66.0	68.0	2.0	Oil shale, rich?, nonlaminated, earthy texture, probably partly leached
68.0	72.0	4.0	Core in fragments. Oil shale, mod grade, distinctly laminated, except almost massive from 1169.0 to 1170.0. Probably contains some nahcolite solution cavities
72.0	1173.9	1.9	Oil shale, rich, closely laminated, some loop bedding, splits readily along bedding plane
73.9	78.5	4.6	Oil shale, lean to med, thickly laminated, strong color contrast, some loop bedding
1178.5	1179.3	0.8	Oil shale, rich, indistinct lamination. Top 0.3' probably 60+ gallons per ton. Splits readily along bedding planes

Drill hole

CORE LOG

U. S. GEOLOGICAL SURVEY

PAGE 13 OF

DRILL HOLE Shell Oil Co TR-1 23X-2
 LOCATION _____ ELEVATION _____ LOGGED BY _____
 DATE BEGUN _____ DATE COMPLETED _____ DRILLER _____ TOTAL DEPTH _____
 CASING _____ REMARKS: _____

FROM	TO	THICK- NESS	LITHOLOGIC DESCRIPTION
1179.3	1187.8	8.5	Oil shale, mod grade, laminated, low contrast between laminations. From 1180.7 to base core becomes increasingly rubbly (small fragments). Apparently a zone leached of saline minerals
87.8	88.4	0.6	Oil shale, rich, distinctly laminated, unleached
88.4	90.8	2.4	Tuff, brown gray (siltstone), contains about 25% rich oil shale in lenses and stringers in tuff, oil shale more abundant near top <i>Curly bed</i>
90.8	1200.0	9.2	Oil shale, rich in top 2+ feet and from 1195.5 to 1196.3 grading down to mod grade, laminated, low color contrast. Core is in fragments pebble to fist size, but apparently is not leached. Contains several nahcolite(?) solution cavities from 1195.5 to 1197.0. At 1191.7 is 0.17' brown gray tuff with 0.02' rich oil shale in middle. A 0.01' calcite layer on bedding plane at 1198.5
1200.0	10.0	10.0	Core in small fragments, about 40% of which apparently are badly leached oil shale, rest is moderate grade oil shale, showing very little laminations
1210.0	1221.0	11.0	About 80% of core in small fragments. Oil shale, mod to rich, becoming leaner toward base, indistinctly laminated to massive, leached zones from 1213.3 to 1214.0; may be a few solution cavities in the rest. Oil shale from 1210.0 to 1217.0. Contains abundant small blebs (0.5 mm X 3 mm plus or minus) of opaque white crystalline carbonate mineral parallel to bedding. Possibly calcite, but shows some solution effects

Drill hole

Sec 2 TWP 02 S RANG 098 W
CORE LOG

20179

U. S. GEOLOGICAL SURVEY

PAGE 14 OF

DRILL HOLE Shell Oil Co TR-1 23X-2
 LOCATION _____ ELEVATION _____ TOTAL DEPTH _____
 DATE BEGUN _____ DATE COMPLETED _____ DRILLER _____ LOGGED BY _____
 CASING _____ REMARKS: _____

FROM	TO	THICK- NESS	LITHOLOGIC DESCRIPTION
1221.0	1231.0	10.0	Missing
31.0	31.5	0.5	Oil shale, wide banded to lenticular bedding--occurs only as fragments (possibly left in core hole from previous interval).
31.5	36.0	4.5	Marlstone, V lt gray, thinly laminated, occurs as broken fragments, pebble to fist sized, most splittling along bedding plane. Contains abundant pyrrhotite(?) a flaky black to irridescant mineral that is randomly oriented to bedding
1236.0	1236.09	0.9	Oil shale, lean, pale yellow brown to dk yellow brown, thinly laminated to wide banded, sparse pyrite. At 1236.6 is white opaque carbonate mineral in bird track pattern - calcite?
36.9	38.7	1.8	Leached zone. Solution breccia of lean to mod grade oil shale. Sparse V fine pyrite
38.7	47.3	8.6	Oil shale, rich from 1238.7 to 1239.7, 1242.0 to 1242.9, 1243.3 to 1244.7, mod grade in rest. Rich shale mostly discontinuous laminae, mod mostly well laminated. Small lenses (0.02' x 0.05') of white opaque carbonate mineral at 1246.1 and 1246.4. Mostly broken core
1247.3	1248.1	0.8	Oil shale, lean, broken, evenly laminated

Drill hole

CORE LOG

U. S. GEOLOGICAL SURVEY

DRILL HOLE Shell Oil Co TR-1 23X-2

PAGE 15 OF

LOCATION _____ ELEVATION _____

DATE BEGUN _____ DATE COMPLETED _____ DRILLER _____ LOGGED BY _____

CASING _____ REMARKS: _____

FROM	TO	THICK- NESS	LITHOLOGIC DESCRIPTION
1248.1	1255.0	6.9	Oil shale, mod and rich grade, distinct lamination, sharp color contrast. Brownish gray tufts as follows: 1250.0 to 1250.3 with *2 stringers of oil shale; 0.03' at 1250.9; 0.35' at 1251.1 containing stringers of oil shale in upper part. Lower 2 feet in small fragments, one fragment contains minute xtals of clear carbonate mineral. Evidence of several solution cavities in lower 2 ft
55.0	59.0	4.0	Missing
59.0	66.0	7.0	Oil shale, mod grade in top 0.6', lean oil shale to marlstone in rest, indistinct laminae, low color contrast, sparse loop bedding. Nahcolite(?) solution cavities from 1259.6 to 1260.2, and 1265.6 to 1266.0. Core broken from 1259-1260.0 and 1263.6 to 1266.0
66.0	68.7	2.7	Oil shale, rich, fine indistinct laminae
68.7	72.3	3.6	Oil shale, lean to mod grade, indistinct laminae to wide banded; except rich oil shale from 1271.6 to 1272.0
1272.3	1284.0	11.7	Oil shale, rich, except lean from 1276.5 to 1278.3. Indistinct laminae with many blebs of pale yellow brown dolomite. Many small solution cavities throughout. Contains thin (up to 0.03') lenses of brownish gray tuff from 1279.6 to 1280.0, and one ellipsoid of tuff at 1282.2

Drill hole

CORE LOG

U. S. GEOLOGICAL SURVEY

DRILL HOLE Shell Oil Co TR-1 23X-2

PAGE 16 OF

LOCATION _____ ELEVATION _____

DATE BEGUN _____ DATE COMPLETED _____ DRILLER _____ LOGGED BY _____ TOTAL DEPTH _____

CASING _____ REMARKS: _____

FROM	TO	THICK- NESS	LITHOLOGIC DESCRIPTION	
1284.0	1287.0	3.0	Broken core. Upper part contains a solution breccia, and fragments of rich oil shale, lower part is lean laminated oil shale	
87.0	90.0	3.0	Missing	
90.0	1307.8	17.8	Alternating beds of rich and mod grade oil shale. Rich oil shale has indistinct laminae, abundant discontinuous dark laminae, with sparse blebs of pale yellow brown dolomite. Rich oil shale from 1292.0-1293.9; 1298.0-1298.5, 1299.8-1303.4. Mod grade oil shale more distinctly laminated, low color contrast. Contains tuffs as follows: 0.02' lt brown gray at 1298.3; 0.05 lt brown gray at 1298.6; 0.06' lens of brown gray at 1303.9; 0.05' brown gray at 1304.9, 0.06' lens lt brown gray at 1307.3. Nacholite(?) solution cavities at 1290.7, 1292.2 to 1292.8 and 1300.0 to 1301.5. Core is a rubble from 1290.0-1291.0, 1292.5-1293.2, 1294.6 to 1295.1, 1299.0-1300.8 so contacts here are uncertain.	Msg 1296.0 to 1298.0
1307.8	09.9	2.1	Oil shale, lean, distinct laminations, some discontinuous dark laminae. Broken core	
09.9	11.0	1.1	Oil shale, dk yellow brown, structureless, many minute cavities, probably from solution of honeycomb nahcolite	
1311.0	1311.9	0.9	Oil shale, lean to mod grade, laminated, with low color contrast	

Drill hole

CORE LOG

U. S. GEOLOGICAL SURVEY

DRILL HOLE Shell 1 Oil Co TR-1 23X-2

PAGE 17 OF

LOCATION _____ ELEVATION _____ LOGGED BY _____ TOTAL DEPTH _____

DATE BEGUN _____ DATE COMPLETED _____ DRILLER _____

CASING _____ REMARKS: _____

FROM	TO	THICK- NESS	LITHOLOGIC DESCRIPTION
1311.9	1313.7	1.8	Oil shale, dk yellow brown, structureless, leached with several layers of lean dk yellow brown dense oil shale
13.7	18.4	4.7	Oil shale, lean, distinctly laminated, pale yellow brown to grayish brown, low color contrast, some loop bedding, several vertical fractures. Upper 0.4 is leached solution breccia
18.4	19.0	0.6	Oil shale, rich, grayish brown, closely laminated, splits along bedding plane into many biscuits
19.0	20.0	1.0	Solution breccia of oil shale. Broken core
20.0	26.6	6.6	Oil shale, rich in upper 2.2', mod grade in rest, varved to distinctly laminated. Lower 1 foot contains discontinuous dark laminae, sharp color contrast. At 1324.7 is 0.02' lens of tuff
26.6	28.4	1.8	Tuff (siltstone) lt brownish gray to white, contains abundant discontinuous black films (oil shale?) parallel to bedding. Core in small pieces, but pieces indicate no bedding
1328.4	1330.0	1.6	Oil shale, mod grade, distinctly laminated, some wavy and contorted bedding

CORE LOG

U. S. GEOLOGICAL SURVEY

DRILL HOLE Shell Oil Co TR-1 23X-2

LOCATION _____ ELEVATION _____

DATE BEGUN _____ DATE COMPLETED _____ DRILLER _____ LOGGED BY _____

CASING _____ REMARKS: _____

PAGE 18 OF _____

TOTAL DEPTH _____

FROM	TO	THICK- NESS	LITHOLOGIC DESCRIPTION
1330.0	1332.3	2.3	Tuff as 26.6-28.4, also broken
32.3	37.1	4.8	Oil shale, lean, to marlstone, yellow gray to dk yellow brown, distinct thick lamination, sharp color contrast. Broken core, splits along bedding plane
37.1	38.4	1.3	Rubbly pieces of mod grade oil shale, possibly broken as result of cavities
38.4	41.2	2.8	Oil shale, rich in top 1.6', mod grade in remainder. Upper 1.6' indistinct varving with lenticular dolomite?; remainder distinct laminations with sharp color contrast, some loop bedding
41.2	42.0	0.8	Oil shale, lean, indistinct bedding, dk yellow brown, several nahcolite(?) solution cavities
42.0	52.0	10.0	Broken rubbly core. Fragments are mainly rich oil shale in upper part and mod grade in lower part. One fragment at 1344.5 contains 0.06' lens of brown gray tuff. Upper part probably broken because of solution cavities; lower part probably from cavities of leaching of fine grained nahcolite
1352.0	1354.8	2.8	Oil shale, rich, brownish black, indistinct varving, discontinuous dk and lt laminations. Splits readily along bedding plane. Solution cavity at 52.1-52.3

Drill hole

Msg 1346.0 -

1348.0

CORE LOG

U. S. GEOLOGICAL SURVEY

DRILL HOLE Shell Oil Co TR-1 23X-2

PAGE 19 OF

LOCATION _____ ELEVATION _____ LOGGED BY _____ TOTAL DEPTH _____

DATE BEGUN _____ DATE COMPLETED _____ DRILLER _____

CASING _____ REMARKS: _____

FROM	TO	THICK- NESS	LITHOLOGIC DESCRIPTION
1354.8	1356.0	1.2	Oil shale, lean, faintly laminated. From 1355.0-1356.0 core consists mostly of subrounded pebbles of lean oil shale. Probably some solution cavities
56.0	64.0	8.0	Oil shale, mod grade, distinctly laminated, good color contrast. Leached crumbly oil shale from 1358.7 to 1359.0. From 1356.0 to 1357.1, oil shale contains minute blebs of white carbonate mineral, some showing solution effects, and sparse pyrrothite. From 1357.1 to 1358.0 is rubbly lean oil shale or marlstone with pyrrothite crystals. Core broken from 1362.0-1362.8
64.0	65.9	1.9	Marlstone, olive gray, grading up to dk yellow brown. Indistinct bedding. Sparse pyrite. Broken core. Possibly a few small solution cavities
65.9	67.9	2.0	Oil shale, rich, as 1352 to 1354.8. Contains minute (1 to 3mm) solution cavities on surface, pyrite xtals surrounding one cavity. Lower part contains larger solution cavity (up to 20 mm). Core is rubbly from 1366.3-1367.0
67.9	72.0	4.1	Oil shale, mod grade, distinctly laminated, good color contrast, splits readily parallel to bedding. Leached zone from 1367.9 to 1368.0 and at 1370.5. Broken core in lower 1 foot
1372.0	1380.0	8.0	Missing

Drill hole

CORE LOG

U. S. GEOLOGICAL SURVEY

DRILL HOLE Shell Oil Co 23X-2 Federal

PAGE 22 OF

LOCATION _____ ELEVATION _____

DATE BEGUN _____ DATE COMPLETED _____ DRILLER _____ LOGGED BY _____

CASING _____ REMARKS: _____

FROM	TO	THICK- NESS	LITHOLOGIC DESCRIPTION
1431.2	1438.1	6.9	Oil shale, lean, greenish gray to olive gray in top part, grading down to oil shale as 26.0 to 31.2; to yellow gray marlstone with pyrrhotite in lower 1 foot.
			Much disturbed and distorted bedding; healed breccia of oil shale fragments from 1435.2 to 1436.7. Blebs and xtals of pyrite. Solution cavities at 1431.9. Broken core from 31.2 to 32.0
38.1	44.4	6.3	Oil shale, lean, dk green gray to olive gray, indistinct thick laminae to massive, most with pale yellow brown blebs as 1425.0, some bands of pale yellow brown marlstone; minor healed breccia. Broken core from 39.0 to 40.7
44.4	48.2	4.2	Marlstone, pale yellow brown, indistinct banding, interbedded with 30% of dk green gray oil shale as above. Marlstone contains pyrrhotite and pyrite xtals. Healed breccia of lt and dk marlstone fragments. Broken core from 44.5 to 45.0
48.2	55.0	6.8	Oil shale, lean to mod grade, olive gray, indistinct laminations, with bands of pale yellow brown to dk yellow brown oil shale. Abundant white specks of white opaque mineral--not calcite. Healed breccia of oil shale at 54.4 to 54.6
1455.0	1460.4	5.4	Healed breccia of marlstone and oil shale fragments, mostly olive gray, greenish gray, and pale yellow brown. Broken core from 57.5 to 60.0
			healed breccia bed

Drill hole

CORE LOG

U. S. GEOLOGICAL SURVEY

DRILL HOLE Shell Oil Co 23X-2 Federal

PAGE 24 OF

LOCATION _____ ELEVATION _____

DATE BEGUN _____ DATE COMPLETED _____ DRILLER _____ LOGGED BY _____

CASING _____ REMARKS: _____

FROM	TO	THICK- NESS	LITHOLOGIC DESCRIPTION
1480.0	1482.5	2.5	Oil shale, olive gray, mod grade, indistinctly laminated, many lenticular brown black laminae, and lenses of pale yellow brown marlstone. May be one nahcolite solution cavity
82.5	90.0	7.5	Marlstone and oil shale. From 82.5 to 85.0, 85.8 to 87.1, and 88.9 to 90.0 is marlstone, med gray and pale yellow brown distinct even laminations, parts along bedding plane. Rest is lean oil shale, It olive gray to pale yellow brown, well laminated except 87.1 to 88.0, containing minor pyrrhotite and abundant tiny aggregates of a carbonate mineral, or numerous vugs where the mineral has been dissolved out. Nahcolite solution cavities from 85.0 to 88.0. Core is badly broken from 82.5 to 84.7
90.0	97.8	7.8	Core is rubbly in upper 3 feet, badly broken in rest. Mostly marlstone, med gray and pale yellow brown, well laminated, with olive gray, mod grade oil shale from 93.2 to 94.2. Numerous minute lenses of pyrite. Several nahcolite solution cavities
97.8	1500.0	2.2	Oil shale, olive gray, med grade, indistinct laminations, blebs of pale yellow brown marlstone. At 99.1 is a 0.03' thick lens of oil shale with perpendicular bedding. Probably a nahcolite solution cavity near base
1500.0	1502.0	2.0	Missing

Drill hole

CORE LOG

U. S. GEOLOGICAL SURVEY

DRILL HOLE Shell Oil Co 23X-2 Federal

PAGE 26 OF

LOCATION _____ ELEVATION _____

DATE BEGUN _____ DATE COMPLETED _____ DRILLER _____ LOGGED BY _____ TOTAL DEPTH _____

CASING _____ REMARKS: _____

FROM	TO	THICK- NESS	LITHOLOGIC DESCRIPTION
1530.0	1534.0	4.0	Oil shale, brown gray to gray brown, rich, indistinct lenticular laminations. From 1531.0- 1532.0 it contains lenticular vugs filled with crumbly grayish brown xtals of dolomite(?), probably the result of leaching of an organic nahcolite-dolomite mixture. Some solution cavities in lower 0.6'
34.0	38.7	4.7	Oil shale, mod rich(?) brownish gray(?) leached honeycomb nahcolitic oil shale. Base of leached saline zone
38.7	44.0	5.3	Oil shale, rich, grayish brown to brownish gray, indistinct lenticular laminations, with lenses of dark yellow brown oil shale up to 0.03' thick. Breaks on high angle fractures. Contains 6 rosettes of brownish gray nahcolite up to 0.2' diam. Bedding drapes around rosettes. Less than 5% nahcolite
44.0	46.0	2.0	Core badly broken, splits readily along bedding planes. Mostly oil shale lean to mod grade, distinctly laminated, dk yellow brown to pale yellow brown
1546.0	1553.0	7.0	Oil shale, rich, brownish gray, indistinct lamination in upper part to distinct low contrast laminations in lower part. Contains brownish nahcolite rosettes and xtal aggregates. At 46.5 and 47.0 rosettes are replaced by pyrite and at 46.5 rosette is 0.1' diam and only outer part is replaced. About 5% nahcolite

CORE LOG

U. S. GEOLOGICAL SURVEY

DRILL HOLE Shell Oil Co 23X-2 Federal

PAGE 28 OF

LOCATION _____ ELEVATION _____

DATE BEGUN _____ DATE COMPLETED _____ DRILLER _____ LOGGED BY _____ TOTAL DEPTH _____

CASING _____ REMARKS: _____

FROM	TO	THICK- NESS	LITHOLOGIC DESCRIPTION
1594.9	1597.0	2.1	Nahcolite, pale yellow brown, finely xtl'n, petroliferous, laminated in part, 95% nahcolite
97.0	98.7	1.7	Oil shale, brownish gray, indistinct to lenticular laminations, two large rosettes of brown gray nahcolite from 97.2 to 97.8. About 15% nahcolite. Pyrite in small lenses
98.7	1604.5	5.8	Oil shale, dk yellow brown, rich, poorly laminated. Contains honeycomb nahcolite from 98.7 to 1600.0 and 1600.6 to 1601.0. Contains rosettes of coarsely xtl'n brown nahcolite, and coarse disseminated xtals of nahcolite. About 30% nahcolite
04.5	08.5	4.0	Nahcolite as coarse xtals (pale yellow brown to brown gray) with oil shale matrix, and massive rich oil shale in layers up to 0.3' thick. About 80% nahcolite
08.5	12.7	4.2	Oil shale, dk yellow brown, mod grade, massive, with several rosettes of nahcolite. About 10% nahcolite
1612.7	1615.9	3.2	Nahcolite as coarse brown gray xtals in matrix of oil shale. About 80% nahcolite

Drill hole

CORE LOG

U. S. GEOLOGICAL SURVEY

DRILL HOLE Shell Oil Co 23X-2 Fed LOCATION _____ ELEVATION _____ PAGE 29 OF _____
 DATE BEGUN _____ DATE COMPLETED _____ DRILLER _____ LOGGED BY _____ TOTAL DEPTH _____
 CASING _____ REMARKS: _____

FROM	TO	THICK- NESS	LITHOLOGIC DESCRIPTION
1615.9	1623.0	7.1	Oil shale, mod to rich, lenticular dark laminae, lenses of pyrite up to 0.08' long and 0.01' thick. Honeycomb nahcolite as follows: 0.18' at 1616.2; 0.07 at 18.5; 0.05' at 18.8; 0.13 at 19.2, 0.5' at 1621.6, and 0.10' at 1622.4. Two lenses of coarse xtlm nahcolite. About 15% nahcolite
23.0	28.8	5.8	Oil shale, rich, brownish gray to brownish black, lenticular indistinct laminae, low color contrast. Contains nodules of coarsely xtlm brownish gray petroliferous nahcolite up to 0.6' thick. About 35% nahcolite
28.8	32.8	4.0	Oil shale, mod to rich, as above, except less than 1% nahcolite in single rosette at 32.4, which is partially replaced by pyrite
32.8	43.9	11.1	Oil shale and nahcolite. Oil shale as above, mod at top, rich in lower 4 feet. Nahcolite in coarsely xtlm petroliferous lenses. Nahcolite seems to have oil shale matrix. Major lenses as follows: 1.3' at 32.8, 0.8' at 35.7, 0.7' at 37.2, 0.5' at 38.3', 0.6' at 40.2 and 0.5' at 42.1. About 40% nahcolite
1643.9	1645.6	1.7	Core in small fragments, probably lean oil shale with some nahcolite

CORE LOG

U. S. GEOLOGICAL SURVEY

DRILL HOLE Shell Oil Co 23X-2 Fed

PAGE 31 OF

LOCATION _____ ELEVATION _____

DATE BEGUN _____ DATE COMPLETED _____ DRILLER _____ LOGGED BY _____ TOTAL DEPTH _____

CASING _____ REMARKS: _____

FROM	TO	THICK- NESS	LITHOLOGIC DESCRIPTION
1663.1	1664.0	0.9	Nahcolite, coarsely xtl ⁿ , petroliferous, oil shale matrix, irr contact, 95% Nahcolite
64.0	65.2	1.2	Oil shale, rich, brown gray to brownish black, indistinct lenticular laminae
65.2	74.0	8.8	Nahcolite and oil shale unit. Oil shale, mod rich, dk yellow brown; both distinct laminae, and massive. About 45% nahcolite, petroliferous, coarse grained as large rosettes or lenses, all has appearance of xtals growing in place
74.0	75.6	1.6	Oil shale, dk yellow brown, mod grade to rich--with 20% nahcolite as large xtals small rosettes, and as 0.2' maple sugar nahcolite at 74.0. Some pyrite in rosettes
75.6	76.4	0.8	Nahcolite, maple sugar, dense, irr contacts
76.4	83.9	7.5	Oil shale, rich, brownish gray, laminated, locally lenticular, locally contorted. Pyrite in small lenses in upper 2 feet, probably as replacement of nahcolite. About 10% nahcolite as irr masses and lenses, coarsely xtl ⁿ , petroliferous, brownish black
1683.9	1685.9	2.0	Oil shale and nahcolite. Oil shale, rich, laminated, brownish gray; 50% nahcolite as above (1680)

Drill hole

CORE LOG

U. S. GEOLOGICAL SURVEY

DRILL HOLE Shell Oil Co 23X-2 Fed

LOCATION _____ ELEVATION _____

DATE BEGUN _____ DATE COMPLETED _____ DRILLER _____ LOGGED BY _____

REMARKS: _____

PAGE 36 OF _____

TOTAL DEPTH _____

FROM	TO	THICK- NESS	LITHOLOGIC DESCRIPTION	
1790.4	1794.1	3.7	Oil shale, dk yellow brown, rich, indistinct laminae. Contains about 25% coarse grained nahcolite in rosettes and irr masses	
94.1	96.8	2.7	Oil shale and nahcolite. Oil shale, V rich, brown black, indistinct laminae, with 3 or 4 large masses of coarse grain brown black nahcolite at top and base. 40% nahcolite	
96.8	97.6	0.8	Oil shale, dk yellow brown, well laminated w/25% nahcolite as masses	
97.6	1806.6	9.0	Halite, clear to amber to smoky, coarsely xtlm, with V minor intermixture of nahcolite. From 1801.8 to 1802.7 is rich oil shale with lenses of brown black nahcolite. 5% nahcolite, 90% halite	msg 1799.0 to 1800.0
1806.6	20.0	13.4	Oil shale, nahcolite and halite unit. Oil shale, rich, brown black, except dk yellow brown in upper 1.3', indistinct laminae. From 6.6- 11.0 it contains about 35% coarsely xtlm halite and 5% nahcolite in irr masses. Remainder contains about 25% brown black, mostly coarsely xtlm nahcolite with 5% halite. Lower 0.3' is honeycomb nahcolite	
1820.0	1824.0	4.0	Oil shale, mod grade to rich, dk yellow brown to grayish brown, indistinctly laminated, except 22.1 to 22.5 which is jewelry grade oil shale, well laminated w/sharp color contrast. Unit contains about 40% nahcolite as the finely xtlm honeycomb type, with several irr masses at 21.3 to 22.0	

Drill hole

CORE LOG

U. S. GEOLOGICAL SURVEY

DRILL HOLE Shell Oil Co 23X-2 Fed LOCATION _____ ELEVATION _____ PAGE 38 OF _____
 DATE BEGUN _____ DATE COMPLETED _____ DRILLER _____ LOGGED BY _____ TOTAL DEPTH _____
 CASING _____ REMARKS: _____

FROM	TO	THICK- NESS	LITHOLOGIC DESCRIPTION
1865.3	1866.9	1.6	Oil shale, brownish gray to grayish brown, rich, well laminated, except massive from 66.5 to 66.9. No saline minerals
66.9	76.4	9.5	Oil shale, rich brownish gray, no laminations seen--massive. Contains increasing larger amounts downward of fine grained disseminated nahcolite(?) in layers; honeycomb nahcolite from 73.9 to 75.8. Appears to be grayish brown. About 30% nahcolite
76.4	84.3	7.9	Oil shale, rich, dusky brown, indistinct lenticular laminations. Contains several masses of coarsely xtl brown black nahcolite, layers of scattered xtals of nahcolite. Contains numerous small lenses of pyrite that have replaced nahcolite. About 10% nahcolite
84.3	90.3	6.0	Oil shale, mod grade, dk yellow brown, well laminated. Contains large masses of coarsely xtl brown black nahcolite, including rosettes with radiating xtals. Almost no disseminated xtals. At 85.9 is a lens of pyrite. About 20% nahcolite
1890.3	1892.1	1.8	Nahcolite and oil shale bed. Maple sugar nahcolite (pale yellow brown, dense, finely xtl) with layers of rich oil shale as follows: 0.15 at 90.5; 0.5' at 91.2. Oil shale contains disseminated saline minerals, probably Nahcolite. About 55% nahcolite

CORE LOG

U. S. GEOLOGICAL SURVEY

DRILL HOLE Shell Oil Co 23X-2 Fed LOCATION _____ ELEVATION _____ PAGE 41 OF _____
 DATE BEGUN _____ DATE COMPLETED _____ DRILLER _____ LOGGED BY _____ TOTAL DEPTH _____
 CASING _____ REMARKS: _____

FROM	TO	THICK- NESS	LITHOLOGIC DESCRIPTION	
1939.4	1954.4	16.5*	Oil shale with bedded nahcolite. Oil shale, rich, dusky brown indistinct lenticular laminations. Contains one bed of maple sugar nahcolite from 42.2 to 43.2. Contains other thin layers and lenses of massive nahcolite, and numerous xtal aggregates and rosettes of brown black coarsely xtl nahcolite. Minor pyrite associated with coarse grain nahcolite. About 20% nahcolite	
			*Note: Actual thickness of unit is 1.5' more than depth interval because on the core boxes the depth of 1946.5 was corrected back to 1945.0	
54.4	57.7	3.1	Nahcolite, coarsely xtl, brown black, as masses in rich oil shale. About 70% nahcolite	
57.7	62.9	5.2	Honeycomb nahcolite and oil shale. Oil shale, gray brown, mod to rich grade, few laminations to massive. Most oil shale contains such abundant fine grains of nahcolite in layers, that solution of nahcolite from outside surface of core leaves a honeycomb impression. From 62.0 to 62.9 nahcolite occurs as irr lenses of dense, dk yellow brown fine grained nahcolite. About 30% nahcolite	msg 1959.0 to 1960.0
1962.9	1968.0		Oil shale, gray brown, rich, indistinct lenticular laminae w/blebs of pale yellow brown oil shale. Core has speckled appearance from disseminated single grains of nahcolite, plus a few small xtal aggregates. Contains 2 layers, each 0.15' thick, of fine grained, pale yellow brown dense nahcolite from 66.6 to 67.5	

Drill hole

CORE LOG

U. S. GEOLOGICAL SURVEY

DRILL HOLE Shell Oil Co 23X-2 Fed

LOCATION _____ ELEVATION _____

DATE BEGUN _____ DATE COMPLETED _____ DRILLER _____ LOGGED BY _____

CASING _____ REMARKS: _____

PAGE 42 OF _____

TOTAL DEPTH _____

FROM	TO	THICK- NESS	LITHOLOGIC DESCRIPTION
1968.0	1969.1	1.1	Nahcolite, brownish gray, med xtl, with stringers of oil shale. This is probably a large lens or nodule. About 90% nahcolite
69.1	76.5	7.4	Oil shale, gray brown, rich, indistinct lenticular lamination. Core has speckled appearance from abundant disseminated xtals of nahcolite, and small xtal aggregate; several of which have been replaced by pyrite. About 5% nahcolite
76.5	78.1	1.6	Oil shale, dk yellow brown, mod rich, massive appearing; with 25% nahcolite in brown gray coarse xtal aggregates
78.1	82.2	4.1	Oil shale as 69.1 to 76.5 with disseminated nahcolite and pyrite, and with large masses of brown black coarsely xtl nahcolite. About 30% nahcolite
82.2	92.2	10.0	Oil shale, brown gray to gray brown, mod to rich; distinct, locally contorted laminae, except massive from 90.9 to 91.5. Contains about 45% nahcolite as feathery xtal aggregate, or large aggregate, all brown gray to brown black. From 82.9 to 84.3 is about 90% nahcolite. No disseminated xtals
1992.2	2006.3	14.1	Oil shale, rich, gray brown, indistinct lenticular laminae, with abundant disseminated fine xtals of nahcolite and with lenses of finely to med xtl brown gray nahcolite. A few small lenses of pyrite. About 25% nahcolite

Drill hole

CORE LOG

U. S. GEOLOGICAL SURVEY

DRILL HOLE Shell Oil Co 23X-2 Fed LOCATION _____ ELEVATION _____ PAGE 44 OF _____
 DATE BEGUN _____ DATE COMPLETED _____ DRILLER _____ LOGGED BY _____ TOTAL DEPTH _____
 CASING _____ REMARKS: _____

FROM	TO	THICK- NESS	LITHOLOGIC DESCRIPTION
2038.1	2040.9	2.7	Oil shale, V rich, brown black, well laminated, low color contrast, with minor loop and distorted bedding. Contains a 0.2 lens of brown black coarsely xtl n nahcolite. About 7% nahcolite
40.9	44.4	3.5	Oil shale, mod grade, dk yellow brown, almost no visible laminae. Contains 15% nahcolite as rosettes of radiating xtals. From 43.8 to 44.2, it contains disseminated xtals and tiny aggregates of nahcolite
44.4	55.5	11.1	Oil shale, rich, lenticular laminae, with fragments and lenses of lighter or darker colored oil shale. Sparse tiny lenses of opaque white carbonate mineral (0.1 mm x 2 mm). Contains 5% nahcolite in three masses of coarsely xtl n brown black nahcolite at 51.4 to 51.8 and 53.7 to 54.05, 54.9 to 55.1. Much contorted bedding adjacent to nahcolite. Lenses of pyrite, and pyrite replacement of rims of nahcolite masses
55.5	57.5	2.0	Oil shale, dk ^{brown} to dusky brown, mod grade, almost no visible laminae. Contains about 20% nahcolite in both brown gray xtl n masses, and honeycomb layers
2057.5	2060.4	2.9	Oil shale, brown gray to brown black, low contrast laminae, some loop and contorted bedding. From 57.5 to 58.8 it contains coarsely xtl n masses of brown gray nahcolite. About 20% nahcolite. Minor pyrite

Drill hole

CORE LOG

U. S. GEOLOGICAL SURVEY

DRILL HOLE Shell Oil Co 23X-2 Fed

PAGE 45 OF

LOCATION _____ ELEVATION _____ TOTAL DEPTH _____

DATE BEGUN _____ DATE COMPLETED _____ DRILLER _____ LOGGED BY _____

CASING _____ REMARKS: _____

FROM	TO	THICK- NESS	LITHOLOGIC DESCRIPTION	
2060.4	2061.6	1.2	Oil shale, brown gray, mod grade, massive, with minor lenticular laminae, 0% nahcolite	
61.6	68.4	6.8	Oil shale, rich, dusky brown to brown black, lenticular laminae with pale yellow brown blebs, grading down to well laminated. Contains 2 small masses of nahcolite almost completely replaced by pyrite. 0% nahcolite	msg 64.0 to 65.0
68.4	70.0	1.6	Oil shale, rich, dusky brown to brown black, well laminated, evenly laminated, with many laminae consisting of V fine grains of an opaque white carbonate mineral - calcite(?). No other salines. 0% nahcolite	
70.0	79.9	9.9	Oil shale, very rich, brown black, well laminated at top, to indistinctly laminated at base, low color contrast, minor loop bedding. A few thin masses of nahcolite(?), with some pyrite replacement. About 2% nahcolite	
79.9	86.9	7.0	Oil shale, mod grade and dk yellow brown, except rich, brown black from 80.7 to 82.4. Massive to faintly laminated. From 81.2 to 82.4 it contains honeycomb nahcolite, in rest it contains large aggregates of coarsely xtl brown black nahcolite. About 20% nahcolite	
2086.9	2088.1	1.2	Nahcolite lens--coarsely xtl brown gray nahcolite with irr contacts and a shale stringer. 90% nahcolite	

Drill hole

CORE LOG

U. S. GEOLOGICAL SURVEY

DRILL HOLE Shell Oil 23X-2 Fed LOCATION _____ ELEVATION _____ PAGE 46 OF _____
 DATE BEGUN _____ DATE COMPLETED _____ DRILLER _____ TOTAL DEPTH _____
 CASING _____ REMARKS: _____

FROM	TO	THICK- NESS	LITHOLOGIC DESCRIPTION
2088.1	2106.5	18.4	Oil shale, rich, indistinct laminae, abundant lenses and blebs of pale yellow brown marlstone and oil shale, up to 0.05' x 0.15'. Contains about 5% coarsely xtl'n brown black nahcolite in irr masses, which are partly or completely replaced by pyrite
2106.5	17.3	10.8	Oil shale, brown gray to dusky brown, mod grade at top to rich in lower half, from 6.5 to 10.0 well laminated, with much loop and contorted laminae; from 10.0 to 11.1 massive, from 11.1 to 17.3 is lenticular laminae with blebs of pale yellow brown oil shale. Contains about 2% nahcolite in several masses of coarsely xtl'n nahcolite. Minor pyrite replacement of nahcolite
17.3	18.8	1.5	Honeycomb nahcolite, brown gray with thin stringers of rich oil shale. About 85% nahcolite
18.8	25.0	6.2	Oil shale and nahcolite unit. Oil shale, dk yellow brown, mod grade, massive to faintly laminated; contains about 30% nahcolite in rosettes, coarse xtals and layers of medium xtals, all brown gray to brown black. Nahcolite deeply eroded for 0.5' above missing zone
2125.0	2138.0	19.2	Oil shale, rich, dusky brown, lenticular laminae, blebs of pale yellow brown oil shale. From 34.2 to 34.7 is coarsely xtl'n brown black nahcolite mass with rim of pyrite; at 37.5 is 0.5' lens of pyrite; at 25.8 is oil mass of nahcolite rimmed with pyrite. About 4% nahcolite

Drill hole

CORE LOG

U. S. GEOLOGICAL SURVEY

DRILL HOLE Shell Oil 23X-2 Fed

LOCATION _____ ELEVATION _____

DATE BEGUN _____ DATE COMPLETED _____ DRILLER _____ LOGGED BY _____

CASING _____ REMARKS: _____

PAGE 48 OF _____

TOTAL DEPTH _____

FROM	TO	THICK- NESS	LITHOLOGIC DESCRIPTION
2185.4	2187.3	1.9	Oil shale, rich, brown black, lenticular laminations and pale yellow brown blebs. It has so much minutely contacts and disturbed bedding that it resembles texture of marble. Contains a few minute xtals, and stringers of a white mineral that does not react with acid
87.3	90.5	2.2	Oil shale, olive gray, gray brown, and dk yellow brown, mod grade to rich, some even laminations, mostly lenticular laminae, locally with blebs of pale yellow brown oil shale
2190.5	2203.7	13.2	Oil shale, rich, dusky brown, even distinct laminations, low color contrast, minor loop bedding
2203.7	07.5	3.8	Oil shale, mod grade, brown gray to dk yellow brown, some bedding as above, Contains several thin stringers and lenses of pyrite that appear to be replacements of xtl'n nahcolite
2207.5	2210.1	2.6	Oil shale, mod grade, dk yellow brown to brown gray, indistinct laminae at top to distinct contorted laminae from 8.4 to base. Contains about 25% nahcolite as small lenses of brown gray coarsely xtl'n nahcolite, and as feathery aggregates of large xtals. Locally replaced by pyrite

CORE LOG

U. S. GEOLOGICAL SURVEY

DRILL HOLE Shell Oil 23X-2 Fed LOCATION _____ ELEVATION _____ PAGE 50 OF _____
 DATE BEGUN _____ DATE COMPLETED _____ DRILLER _____ LOGGED BY _____ TOTAL DEPTH _____
 CASING _____ REMARKS: _____

FROM	TO	THICK- NESS	LITHOLOGIC DESCRIPTION
2227.4	2232.3	4.9	Oil shale, dk yellow brown to gray brown, mod to rich, massive to faintly laminated. Contains about 20% nahcolite as brown black rosettes, small xtal aggregates, and two lenses of maple sugar nahcolite
32.3	36.5	4.2	Oil shale and nahcolite unit. Oil shale, mod grade, dk yellow brown to gray brown, faintly laminated to distinctly laminated. Contains 50% nahcolite as disseminated fine xtals, as "honeycomb" nahcolite, as layers of med xtals, and, from 35.5 to 36.5, as rosettes and aggregates of coarse brown gray xtals
36.5	63.3	26.8	Oil shale, mod to rich, dk yellow brown, lenticular laminae, abundant blebs of pale yellow brown oil shale. Core locally has speckled appearance from disseminated nahcolite xtals and small xtal aggregates. Contains large aggregates of coarsely xtl brown black nahcolite as follows: 47.6 to 48.7 is 90%; 49.3 to 49.6 is 70%; 56.5 to 58.8 is 75%; 59.8 to 60.4 is 70%; 61.2 to 61.6 is 70%, and 62.9 to 63.3 is 95%. Core broken in high angle fractures from 36.5 to 39.0. About 20% nahcolite
2263.3	2267.8	4.5	Oil shale, dk yellow brown to gray brown, rich, distinctly laminated in upper 0.8' to indistinct laminae in rest. Contains 10% nahcolite as layers and small feathery aggregates of coarse xtals from 65.6 to 67.8 - no disseminated saline minerals

Drill hole

CORE LOG

U. S. GEOLOGICAL SURVEY

DRILL HOLE Shell Oil 23X-2 Fed

PAGE 52 OF

LOCATION _____ ELEVATION _____ TOTAL DEPTH _____

DATE BEGUN _____ DATE COMPLETED _____ DRILLER _____ LOGGED BY _____

CASING _____ REMARKS: _____

FROM	TO	THICK- NESS	LITHOLOGIC DESCRIPTION
2304.1	2318.2	14.1	Oil shale, dusky brown, rich, indistinct laminae, blebs of pale yellow brown to dk yellow brown oil shale. Contains about 10% nahcolite in a few masses of brown black coarse xtals, as small angular aggregates and as scattered individual xtals. Minor pyrite replacing nahcolite
18.2	26.7	8.5	Honeycomb nahcolite, brown black. Densest from 18.6 to 24.5, alternating honeycomb nahcolite, and oil shale with xtals in remainder. About 85% nahcolite
26.7	34.3	7.6	Oil shale, dk yellow brown, mod grade, massive to faintly laminated. Contains about 15% nahcolite as brown black masses of radiating xtals
34.3	49.1	14.8	Oil shale, dusky brown, rich, lenticular laminae, many blebs of pale yellow brown oil shale, some wavy laminae. Contains about 10% nahcolite in 5 aggregates of brown black coarse xtals. At 46.5 is 0.06' irr layers of tuff(?) olive gray, siltsize
49.1	50.2	1.1	Nahcolite brown black, as lens(?) of coarse xtals
2350.2	2355.0	4.8	Oil shale, dusky brown, rich, indistinct laminae, a few pale yellow brown blebs. Contains about 30% nahcolite in layers or lenses of xtals, fairly coarse in upper part, decreasing to fine grained honeycomb nahcolite near base

CORE LOG

U. S. GEOLOGICAL SURVEY

DRILL HOLE Shell Oil 23X-2 Fed LOCATION _____ ELEVATION _____ PAGE 53 OF _____
 DATE BEGUN _____ DATE COMPLETED _____ DRILLER _____ LOGGED BY _____ TOTAL DEPTH _____
 CASING _____ REMARKS: _____

FROM	TO	THICK- NESS	LITHOLOGIC DESCRIPTION
2355.0	2357.4	2.4	Honeycomb nahcolite, brown black with stringers of oil shale. About 85% nahcolite
57.4	63.7	6.3	Oil shale, mod grade, dk yellow brown, massive to faintly laminated. Contains about 20% nahcolite as brown gray rosettes, and aggregates of coarse xtals. At 63.3 a feathery stringer is replaced by pyrite. Broken core from 60.0 to 61.0
63.7	73.6	9.9	Oil shale, rich, brown black to dusky brown, indistinct lenticular laminae, with a few blebs of pale yellow brown oil shale. At 71.2 are feathery stringers of pyrite. Small (0.05') aggregates of nahcolite at 68.9 0% nahcolite
73.6	81.7	8.1	Oil shale, olive gray, mod grade, mod well laminated, some wavy laminae. At 76.0 is lens of tuff(?), med gray, siltsize 0.03' by 0.07', probably analcitic. From 76.0 to base, oil shale contains laminae of silt or silty marlstone. From 81.0 to 81.5 a vertical fracture 0.02' wide is filled with a white xtl carbonat--calcite(?)
81.7	84.2	2.5	Oil shale, rich brown black to brown gray, well laminated, low color contrast. Appears silty from 82.0 to 82.6
2384.2	2392.5	8.3	Oil shale, mod grade, dusky yellow brown, except rich from 92.0 to 92.5, well laminated, mod color contrast; apparently a few silty laminae. From 91.5 to 92.3 it contains feathery stringers of pyrite

Drill hole

CORE LOG

U. S. GEOLOGICAL SURVEY

DRILL HOLE Shell Oil 23X-2 Fed

PAGE 54 OF

LOCATION _____ ELEVATION _____ LOGGED BY _____ TOTAL DEPTH _____

DATE BEGUN _____ DATE COMPLETED _____ DRILLER _____

CASING _____ REMARKS: _____

FROM	TO	THICK- NESS	LITHOLOGIC DESCRIPTION
2392.5	2399.4	6.9	Honeycomb nahcolite, brown black, interbedded with many thin layers of rich oil shale--oil shale layers more numerous from 92.5 to 94.5. About 60% nahcolite
99.4	2402.6	3.2	Oil shale, mod grade, pale yellow brown to mod yellow brown, well laminated, sharp color contrast. Contains about 30% nahcolite in rosettes and xtal aggregates (brown gray) and in one bed (2399.6 to 2400.2) of medium xtals (1 to 3 mm) of brown gray nahcolite. Pyrite from 2400.3 to 2401.0
2402.6	17.5	14.9	Oil shale, dusky yellow brown, mod to rich, indistinct lenticular laminae, numerous pale yellow brown blebs of marlstone; except mod grade with many wavy laminae from 16.4 to 17.5. Contains 2 or 3 small aggregates of xtl nahcolite rimmed with pyrite, and one 0.4' nodule of nahcolite at 11.4. Many small irr lenses or stringers of pyrite, probably complete replacement of nahcolite. About 4% nahcolite
17.5	22.5	5.0	Oil shale, grayish brown, rich, indistinct lenticular laminae w/pale yellow brown blebs. Contains about 50% nahcolite as large aggregates of coarsely xtl brown black nahcolite
2422.5	2429.6	7.1	Oil shale, mod grade, pale yellow brown to mod yellow brown, indistinct lenticular laminations, contains numerous lenses and blebs of marlstone from 26.0 to 29.6. Contains numerous lenses and blebs of marlstone from 26.0 to 29.6. Contains one 0.25' lens of coarsely xtl brown black nahcolite at 26.5, and a dendritic stringer of nahcolite at 29.0. About 3% nahcolite

Drill hole

CORE LOG

U. S. GEOLOGICAL SURVEY

DRILL HOLE Shell Oil 23X-2 Fed

PAGE 57 OF

LOCATION _____ ELEVATION _____

DATE BEGUN _____ DATE COMPLETED _____ DRILLER _____ LOGGED BY _____

CASING _____ REMARKS: _____

FROM	TO	THICK- NESS	LITHOLOGIC DESCRIPTION
2490.8	2502.4	11.6	Oil shale, rich, brown black, with some dk yellow brown layers, indistinct varving, some contorted bedding 90.8 to 92.0, and 94.1 to 94.4, and 2501.5 to 2501.7. At 92.9 and 93.9 are layers 0.01' thick of med gray translucent mineral, probably analcite
2502.4	09.3	6.9	Claystone, silty, med gray, nonbedded with minute brownish film up to 0.05' long parallel to bedding. Interbedded with 35% oil shale, rich, evenly varved, in beds up to 0.45' thick. Claystone appears bluish gray, but color chart shows medium gray
09.3	11.7	2.4	Oil shale, olive gray to lt olive gray, evenly varved, lean, splits readily along bedding plane, contains 25% silty claystone as above in thin beds from 10.3 to 11.7
11.7	13.0	1.3	Claystone, silty, med gray to olive gray, interbedded w/silty oil shale, lean, well laminated
13.0	15.0	2.0	Rubbly core--seems to be claystone, silty and nonsilty claystone, med gray to olive gray
2515.0	2527.5	12.5	Oil shale, rich to mod grade, brown black to olive gray to dk yellow brown, well laminated, splits readily into small pieces parallel to bedding plane. From 20.9 to 21.6 is claystone, silty, med gray

Drill hole

CORE LOG

U. S. GEOLOGICAL SURVEY

DRILL HOLE Shell 011 23X-2 Fed

PAGE 58 OF

LOCATION _____ ELEVATION _____ TOTAL DEPTH _____

DATE BEGUN _____ DATE COMPLETED _____ DRILLER _____ LOGGED BY _____

CASING _____ REMARKS: _____

FROM	TO	THICK- NESS	LITHOLOGIC DESCRIPTION
2527.5	2534.5	7.0	Oil shale and silty claystone. Claystone, silty, olive gray, nonbedded except abundant films of carbonaceous material parallel to bedding; interbedded w/30% oil shale, olive gray, to olive black evenly and closely laminated, mod to rich. Core badly broken from 29.5 - 30.4; 31.5 to 32.5, and 33.2 to 33.5
34.5	34.8	0.3	Tuff(?) light olive gray, siltsize, petroliferous, contains abundant films of carbonaceous material, even contacts
34.8	39.1	4.3	Oil shale, rich, brown black and dusky yellow brown, indistinct even varving, banded in layers up to 0.07' thick. Splits readily parallel to bedding
39.1	42.2	3.1	Oil shale, rich, dusky brown, massive to faintly laminated. From 41.2 to 42.2 contains layers of med gray silty claystone, core badly broken so total amount is unknown. At 39.7 is 0.02' thick lens of silty analcite(?)
42.2	50.6	8.4	Oil shale, rich to mod, olive gray to brown black to brown gray, closely varved, low color contrast. Contains a few small lenses of asphaltic(?) material. Contains lenses and layers, up to 0.02' thick of white mineral, probably acicular xtals, from 44.8 to 46.5--calcite(?). At 42.5 is 0.2' silty claystone as above
2550.6	2555.6	5.0	Oil shale, rich, brown black, varved indistinctly, with some light and dark lenses of oil shale in lower 3 feet

Drill hole

CORE LOG

U. S. GEOLOGICAL SURVEY

DRILL HOLE Shell Oil 23X-2 Fed

PAGE 59 OF

LOCATION _____ ELEVATION _____

DATE BEGUN _____ DATE COMPLETED _____ DRILLER _____ LOGGED BY _____ TOTAL DEPTH _____

CASING _____ REMARKS: _____

FROM	TO	THICK- NESS	LITHOLOGIC DESCRIPTION
2555.6	2556.0	0.4	Tuff? contorted, siltsize, petroliferous; outside surface of core is coated with about 0.02' layer of asphaltic material--probably has been bleeding oil. Upper 0.1' has lenses of siltstone with abundant golden flakes
56.0	63.5	7.5	Oil shale, rich to mod grade, indistinct close varving, splits into biscuits, parallel to bedding. Contains lenses of asphaltic(?) material
63.5	64.6	1.1	Claystone, silty, or siltstone clayey, med gray to olive gray, w/carbonaceous films of above
64.6	70.0	5.4	Oil shale, rich, brown black, varved, minor loop or contorted bedding. A lens of siltstone (0.07' thick) at 66.5
70.0	71.0	1.0	Msg
71.0	72.3	1.3	Oil shale, rich, dusky brown, distinct laminae, wavy and lenticular in part. Contains one lens 0.01' thick of pyrite
2572.3	2573.7	1.4	Oil shale, olive gray, silty(?), massive, several 1 mm or less stringers of oil shale

Drill hole

CORE LOG

U. S. GEOLOGICAL SURVEY

DRILL HOLE Shell Oil 23X-2 Fed LOCATION _____ ELEVATION _____ PAGE 60 OF _____
 DATE BEGUN _____ DATE COMPLETED _____ DRILLER _____ LOGGED BY _____ TOTAL DEPTH _____
 CASING _____ REMARKS: _____

FROM	TO	THICK- NESS	LITHOLOGIC DESCRIPTION
2573.7	2580.0	6.3	Oil shale, rich, brown black, close even varves, splits readily into biscuits parallel to bedding plane. From 77.2 to 78.1 contains about 60% med gray claystone in layers up to 0.3' thick. From 74.1 to 74.3 contains lenses up to 2 mm thick of white opaque carbonate mineral--calcite? From 76.8 to 77.0 and from 79.2 to 79.35 are layers of varved marlstone, dk yellow brown
80.0	82.0	2.0	Core is a rubble of small pieces. Seems to be mostly or all med gray to olive gray claystone. Breaks in mostly irr fractures
82.0	90.3	8.3	Oil shale and claystone unit. Oil shale, mod grade to rich, brown black evenly varved with abundant thin (1 mm or less) layers of asphalt(?) on bedding planes. Contains about 35% claystone, med gray to olive gray, nonsilty, except 83.9 to 84.4 which is silty; in beds and stringers up to 0.7' thick
90.3	94.0	3.7	Oil shale, rich, brown black, indistinct varving. Contains rounded lenses and stringers up to 0.04' thick of black asphaltic(?) material. At 91.7 is 0.12' of tuff(?) (siltstone) brown black, stained with dead oil
2594.0	2605.4	11.4	Oil shale, mod grade to rich, olive gray to brown black, indistinct laminae, locally closely varved. Contains two thin beds of olive gray claystone. At 98.6 contains stringers of calcite(?). From 2601.1 to 2603.0 contains large (up to 0.04' thick) lenses of asphaltic(?) material

Drill hole

CORE LOG

U. S. GEOLOGICAL SURVEY

DRILL HOLE Shell Oil 23X-2 Fed LOCATION _____ ELEVATION _____ PAGE 61 OF _____
 DATE BEGUN _____ DATE COMPLETED _____ DRILLER _____ LOGGED BY _____ TOTAL DEPTH _____
 CASING _____ REMARKS: _____

FROM	TO	THICK- NESS	LITHOLOGIC DESCRIPTION
2605.4	2609.0	3.6	Broken core. Mostly clay shale, med gray to olive gray, many pieces showing slickensides. Contains some clayey oil shale, olive black, laminated to wide banded. Contains one 0.02' layer of asphaltic material
			Note: Core depth corrected--apparently moving depth up 7 feet--three core boxes (183, 183A and 184) are labeled as follows: 2600 to 2610; 2606 to 2613 (duplicate core) 2610 to 2620. This core seems to be continuous core, and the the so called duplicate core is not a duplicate of any of the adjacent core
(box 183) (Box 183A) 09.0	11.1	7.1	Oil shale, mod grade to lean, brown black down to olive gray, distinctly laminated, splits readily along bedding plane, except 6.0 to 8.0 (Box 183A) is a mixture of dirt, small fragments of pale yellow brown marlstone, and some weathered oil shale. Does this belong here?
(box 183) (box 184) 11.1	12.6	5.5	Oil shale, rich, brown black, indistinct varving, abundant tiny blebs of dk yellow brown oil shale. At 11.9 (Box 184) is a 0.03' lens of siltstone, possibly a tuff
2612.6	2614.3	1.7	Oil shale(?), brown black, lean to mod grade, clayey?, breaks easily, indistinct laminae. Core badly broken, mostly parallel to bedding

Drill hole

