C446

GEOLOGIC AND ROCK STRUCTURE LOG

COMPANY: Union Oil Company of California
CORE HOLE: OM-4A-80
LOCATION: Approx. 3690' FNL and 840' FEL
Sec. 31, T5S, R95W
Approx. N641,822' and E1,269,899' by
Colorado State Coordinate System

CORE SIZE: 2.4" (NC)
ELEVATION: 8045'
DESCRIBED BY: Nieuwenhuis
DATE DESCRIBED: July 13-17, 1980

MARKER BED:	DEPTH	ELEVATION
Top "A" Groove	872'	7173'
Base "A" Groove	884'	7161'
Mahogany Marker	907'	7138'
Top 60' Mine Zone	911'	7134'
Top "B" Groove	1003'	7042'
Base "B" Groove	Did not penetrate	

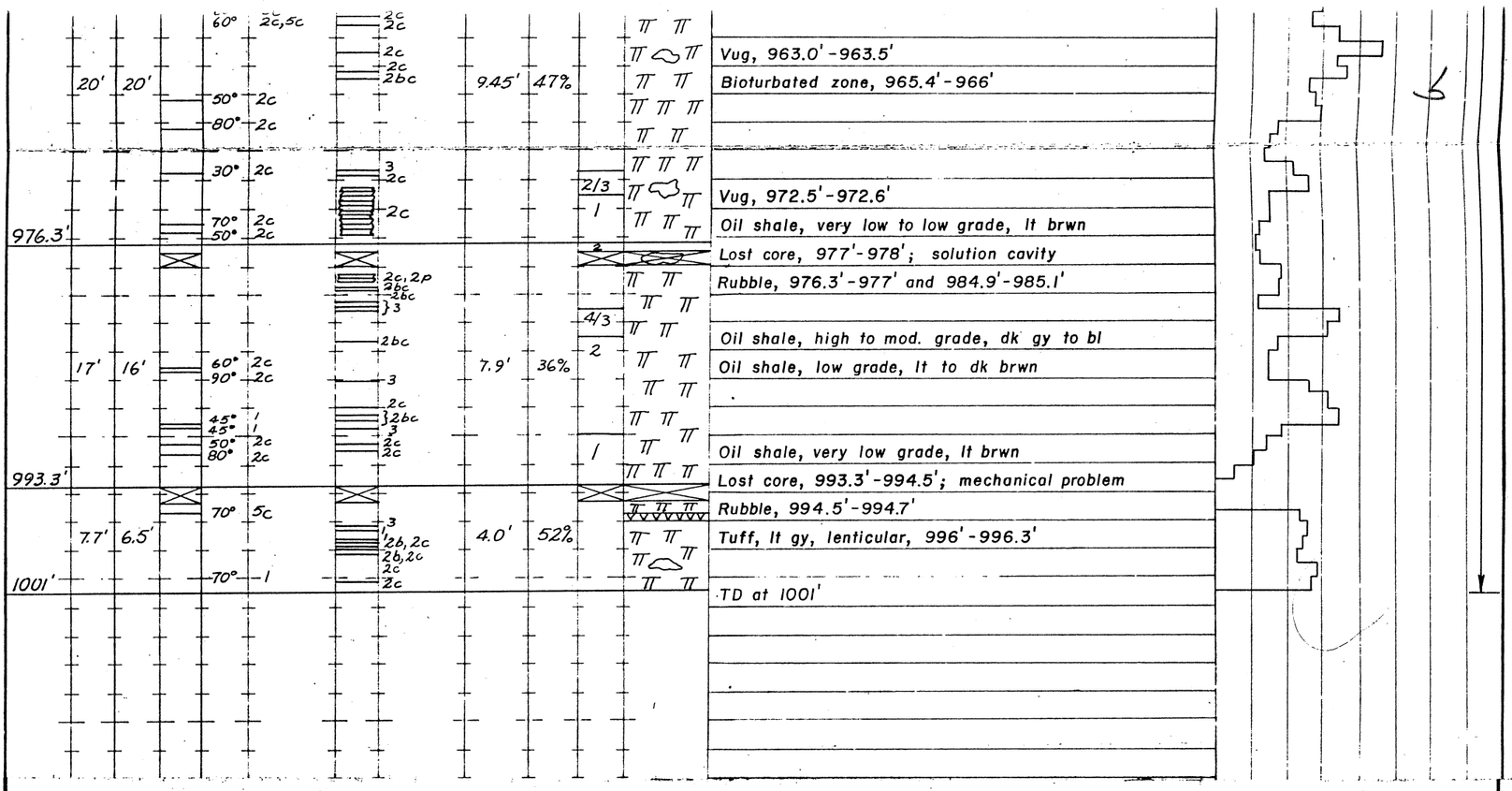
Note: The measurements above reflect a two-foot correction; driller's depths were two feet shallow.

Depth	Core: Footage	Core: Recovery	Joints and Fractures: Location	Joints and Fractures: Dip	Joints and Fractures: Nature	Partings: Location	Partings: Nature	RQD: Sum of Piece Lengths > 0.35'	RQD: RQD Percentage	Oil Shale Grade	Lithology	Description and Remarks
870'												
						3				2		TOP "A" GROOVE at approx. 870'
						3						Lost core, 872.2'-872.8'; solution cavity; rubble, 872.8'-874.5'
	12.5'	10.9'				2c		3.15'	26%			Oil shale, very low to low grade, lt gy to dk gy-brwn
				60°	2c	2c				1		
				90°	2c							Lost core, 878'-879'; rubble, 879.2'-879.6'
882.5'				90°	1					2		Oil shale, low to mod. grade, gy to bl, tuffaceous
										3		BASE "A" GROOVE at approx. 882'
						3				2		
						2c						
						2c						
	14'	13.7'				2c		12.05	86%	3		"False" Marker tuff at 889.8'-890.2'
										1		Oil shale, very low grade, dk gy to bl
						3				4		Clay seam at 894.0', interbedded with high grade oil shale
										3		Oil shale, mod. grade, dk gy
896.2'										1		
						2b				2		Oil shale, very low grade, lt gy to tan
						3						Oil shale, low to mod. grade, lt gy to bl, to 920.5'
						3						
						3						
						2b						
						3						
	20'	19.5'				2b,2c		16.8'	80%			MAHOGANY MARKER, 904.65'-905.0'
						3						
												"Roof" Tuff at 909.2'
						2b				3		
						2b				2		Vugs with bitumen infilling at 908.9' and 910.1'
916.2'												Lost core; ground up in core shoe
										3		
						3				4		Oil shale, mod. to high grade, dk gy to bl, pinch and
										3/4		swell laminations with minor bedding offsets 921.3'-921.7'
				50°	2c							
	19.7'	19.7'						18.45'	92%			
										2		Oil shale, low grade, lt gy to dk gy
										3		Oil shale, mod. grade, dk gy to bl, with soft sediment
										1		deformation features 931.6'-931.9'
935.8'										2/3		Oil shale, very low to high grade, lt gy, tan, bl
										3/4		
										0		
										3		Marlstone, barren, lt gy
				30°	2bc	2c				2		Oil shale, low to mod. grade, lt gy to bl
				80°	1	2b,2c						
	20'	19.9'						16.75'	84%	3		
										1		Oil shale, very low grade, lt gy
						2c						Oil shale, low to mod. grade, gy to bl, to 971.5'
						3 2bc				3		
										2		
						2P						
						2c						
955.7'												Rubble, 955.8'-956.2'; vuggy
				30°	2c					3		
				60°	2c					2		
				60°	5c							
				70°	2c							
				30°	2c,5c	2c						
				60°	5c	2c						
				60°	2c,5c	2c						
						2c						Vug, 963.0'-963.5'
						2c						
	20'	20'				2bc		9.45'	47%			Bioturbated zone, 965.4'-966'
				50°	2c							
				80°	2c							
				30°	2c	3						
						2c				2/3		Vug, 972.5'-972.6'
						2c				1		
				70°	2c							Oil shale, very low to low grade, lt brwn
976.3'				50°	2c							

Assay — Gallons Per Ton (0, 20, 40, 60, 80)

U. Oil Sim. Fisch.

C.S.M. Modified Fischer



KEY TO GEOLOGIC AND ROCK STRUCTURE LOG

ROCK TYPES

- SANDSTONE
- SILTSTONE
- CLAY
- MARLSTONE OR OIL SHALE, LIMY
- MARLSTONE OR OIL SHALE, DOLOMITIC
- LIMESTONE
- DOLOMITE
- TUFF
- BRECCIA

ACCESSORIES

- ARGILLACEOUS
- SILTY
- CALCAREOUS
- DOLOMITIC
- SANDY
- TUFFACEOUS
- NODULE, DOLOMITIC
- CHERT NODULE
- P M — PYRITE OR MARCASITE
- b — SOLID BITUMEN
- CARBONACEOUS DEBRIS
- F — FOSSILS
- CONTORTED BEDDING
- NO CORE RECOVERY
- SOLUTION CAVITIES OR VUGS
- NO CORE RECOVERY DUE TO SOLUTION CAVITY
- L — LIMONITE STAIN

JOINT AND FRACTURE NATURE

1.....SURFACES SHOW NO MINERALIZATION OR SLICKENSIDES
2.....SURFACES SHOW MINERALIZATION
- 2c.....CALCITE MINERALIZATION
- 2p.....PYRITE MINERALIZATION
- 2bc.....BICARBONATE MINERALIZATION
- 2b.....SOLID BITUMEN

3.....SURFACES SHOW SLICKENSIDES
4.....BEDDING SHOWS OFFSET
5.....SEALED JOINT OR FRACTURE
- 5c.....SEALED WITH CALCITE
- 5p.....SEALED WITH PYRITE
- 5bc.....SEALED WITH BICARBONATE
- 5b.....SEALED WITH BITUMEN

6.....BREAK APPEARS TO BE MECHANICALLY INDUCED

PARTING NATURE

1.....SURFACES SHOW CHANGE IN LITHOLOGY
2.....SURFACES SHOW MINERALIZATION
- 2c.....CALCITE MINERALIZATION
- 2p.....PYRITE MINERALIZATION
- 2bc.....BICARBONATE MINERALIZATION
- 2b.....SOLID BITUMEN

3.....SURFACES SHOW GRINDING IN CORE BARREL
4.....BREAK APPEARS TO BE MECHANICALLY INDUCED
5.....SURFACES SHOW SLICKENSIDES
6.....SEALED PARTING PLANES
- 6c.....SEALED WITH CALCITE
- 6p.....SEALED WITH PYRITE
- 6bc.....SEALED WITH BICARBONATE
- 6b.....SEALED WITH BITUMEN

OIL SHALE GRADE

1.....VERY LOW
2.....LOW
3.....MEDIUM
4.....HIGH

ROCK QUALITY DESIGNATION (RQD)

SUM OF PIECE LENGTHS 0.35' (4") OR LONGER DIVIDED BY RUN LENGTH