THE POTTER AND SPELLACY RESERVOIRS
MIDWAY-SUNSET FIELD
KERN COUNTY, CALIFORNIA

By

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The Potter and Spellacy Sands are collectively perhaps the two most important oil reservoirs in the Midway-Sunset Field. Conservatively, they have probably produced in excess of 50% of Midway's cumulative production. Both were first produced near the turn of the century and after a long period of primary recovery, both began thermally enhanced recovery in the 1960's. Today, cyclic steam, steamfloods and firefloods are all actively ongoing in these reservoirs often recovering up to 80% of the original oil in place.

The accompanying map (Figure 1) shows the locations of the detailed maps used in the March 11 & 12, 1994 core displays and in the papers on the Potter and Spellacy presented later in this volume. In addition, the accompanying stratigraphic column (Figure 2) details the various subunits of the Potter and Spellacy sands referred to in these papers.

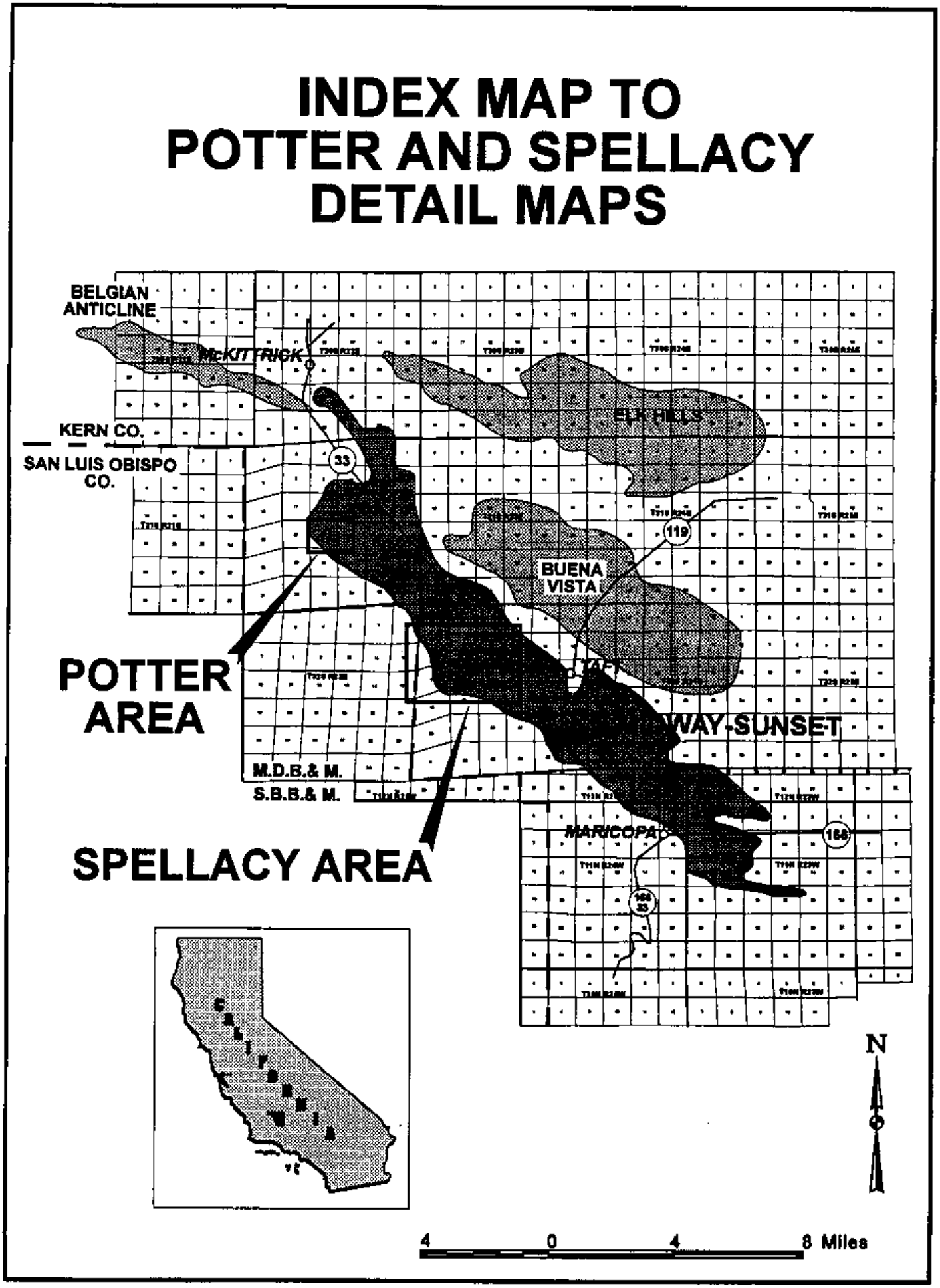

FIGURE 1 - Index Map to Potter & Spellacy Area

SYSTEM	SERIES	FORMATION		MEMBER	UNIT
QUATERNARY	PLEISTOCENE	TULARE			
TERTIARY	PLIOCENE	SAN JOAQUIN			
		ETCHEGOIN			
	MIOCENE	REEF RIDGE		**POTTER SANDS**	A, B, C, J, K, L, M, N, O SANDS
		SHALE		**SPELLACY SANDS**	SUBLAKEVIEW SAND MONARCH SAND REGENT SAND SOVERIGN SAND VICEROY SAND
		MONTEREY FORMATION	ANTELOPE SHALE	STEVENS SANDS	555 SAND MARVIC SAND 1-6 SANDS STEVENS SANDS CROCKER SANDS REPUBLIC SANDS WILLIAMS SANDS LEUHOLTZ SANDS METSON SAND
			MCDONALD SHALE		

Figure 2. Midway-Sunset Stratigraphic Column detailing the various units of the Potter and Spellacy Sands (from Santa Fe Energy Resources, March 1994).

THE POTTER SANDS
FROM SANTA FE ENERGY RESOURCES, INC.
WELL NO. 371, MIDWAY-SUNSET FIELD

By

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Location:

Well No. 371 is located in the southwest of the southeast of the northwest quarter of Section 21, T31S-R22E, Kern County, California (Figure 1). It is also on the northwestern edge of the Midway-Sunset Field about 35 miles west/southwest of Bakersfield.

Geology:

Oil production in this portion of the Midway-Sunset Field is from the Upper Miocene Potter sands. The Potter is a wedge of massive, moderately to poorly sorted, coarse grained sandstones, conglomerates with up to boulder size clasts, and diatomaceous siltstones. These interbedded sequences dip to the east/northeast at angles from 45 to 20 degrees, with the dip decreasing from west to east. The silt layers within the Potter, characterized by low resistivity, form vertical permeability barriers to short term oil migration. The most areally continuous of these barriers have been used to divide the Potter into the L, M, N, and O sand packages. These Potter sands are truncated by an unconformity that dips at a lower angle than the sands but in the same general direction (see Figure 1, Structure Map on the Top Potter Unconformity, and Figure 2, Cross Section D-D'). The sand that was cored at 717', in the No. 371, outcrops at the surface about 800' west of the well's surface location.

Whole Core:

Two cores were cut in the No. 371 on November 15, 1993. Core No. 1 from 717' to 734' cut 17' and recovered 11'. Core No. 2 from 734' to 761' cut 27' and recovered 17'. Due to the unconsolidated nature of the Potter, a PVC liner was incorporated in the core barrel to minimize disaggregation. Coring was done by Eastman/Christensen. The drilling fluid was gel-drispac, with a weight of 9.3 lb/gal and a water loss of 6.8. The rate of penetration was 20 ft/hr for Core No. 1 and 9.7 ft/hr for Core No. 2.

The core was analyzed by Goode Core Analysis Service. The core was slabbed longitudinally and photographed under white and ultraviolet (UV) light. One example showing the coarse cobbles occasionally found in the Potter is shown in Figure 3. Bedding dips of up to 45 degrees were observed throughout the core. Drilled plug samples were taken every foot and analyzed. A summary description of the core is: sand, brown to gray, very fine grained to cobbly, silty, oil stained, dull gold fluorescence, calcareous and well cemented in part. Permeabilities to air range from 0.1 to 5750.0 millidarcies (md). Porosities range from 2.8% to 31.8%. Oil saturations range from 22.0% to 69.0%. In addition to this analysis, selected samples were provided to Mineralogy Incorporated (Tulsa, OK) for thin section description and photomicrographs. The general description is: very coarse to coarse grained, very poorly sorted, dolomitic, feldspathic litharenitic sandstone with primarily intergranular porosity and detrital grains generally subangular to subrounded (see thin section photomicrographs in Figures 4 and 5).

The well was drilled to a total depth of 1309' and logged with Schlumberger's DIL-LDT/CNL-GR (triple-combo), contact temperature and 26 of 60 sidewall cores were shot in the same whole cored interval. A composite electric log of Well No. 371 showing the cored intervals may be found in the Appendix.

Typically, the sidewall core analysis showed less permeability (range: 81.0 to 1525.0 md), less porosity (range: 19.0% to 29.0%) and lower oil saturations (ranging from 7.0% to 41.0%) than the whole core analyses. Logged resistivities averaged 116 ohm/meters through the cored interval and the crossplot density/neutron porosity averaged 23.0%.

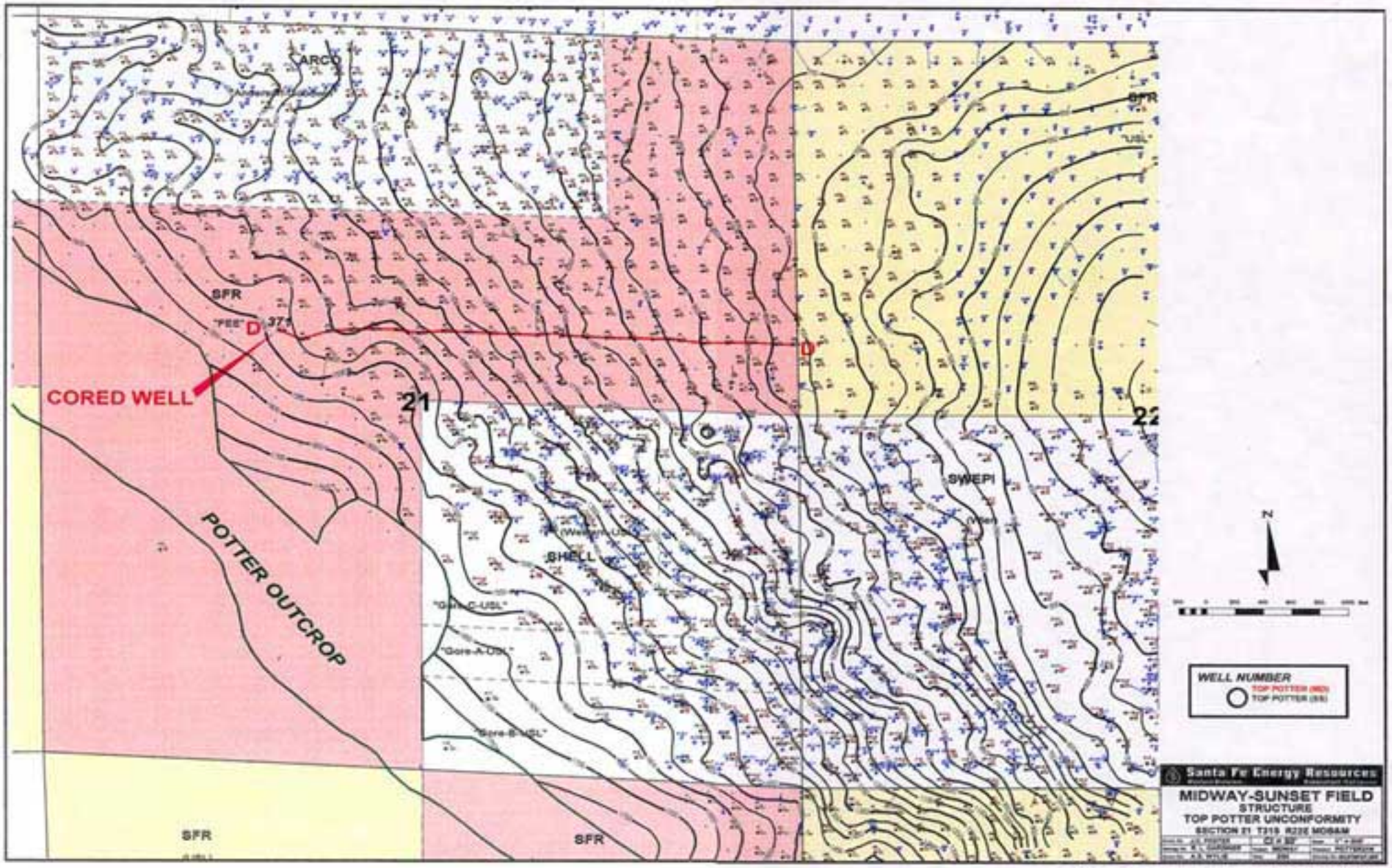


FIGURE 1 - Structure Map Top of Potter Unconformity
Showing Location of Cored Well Number 371-21

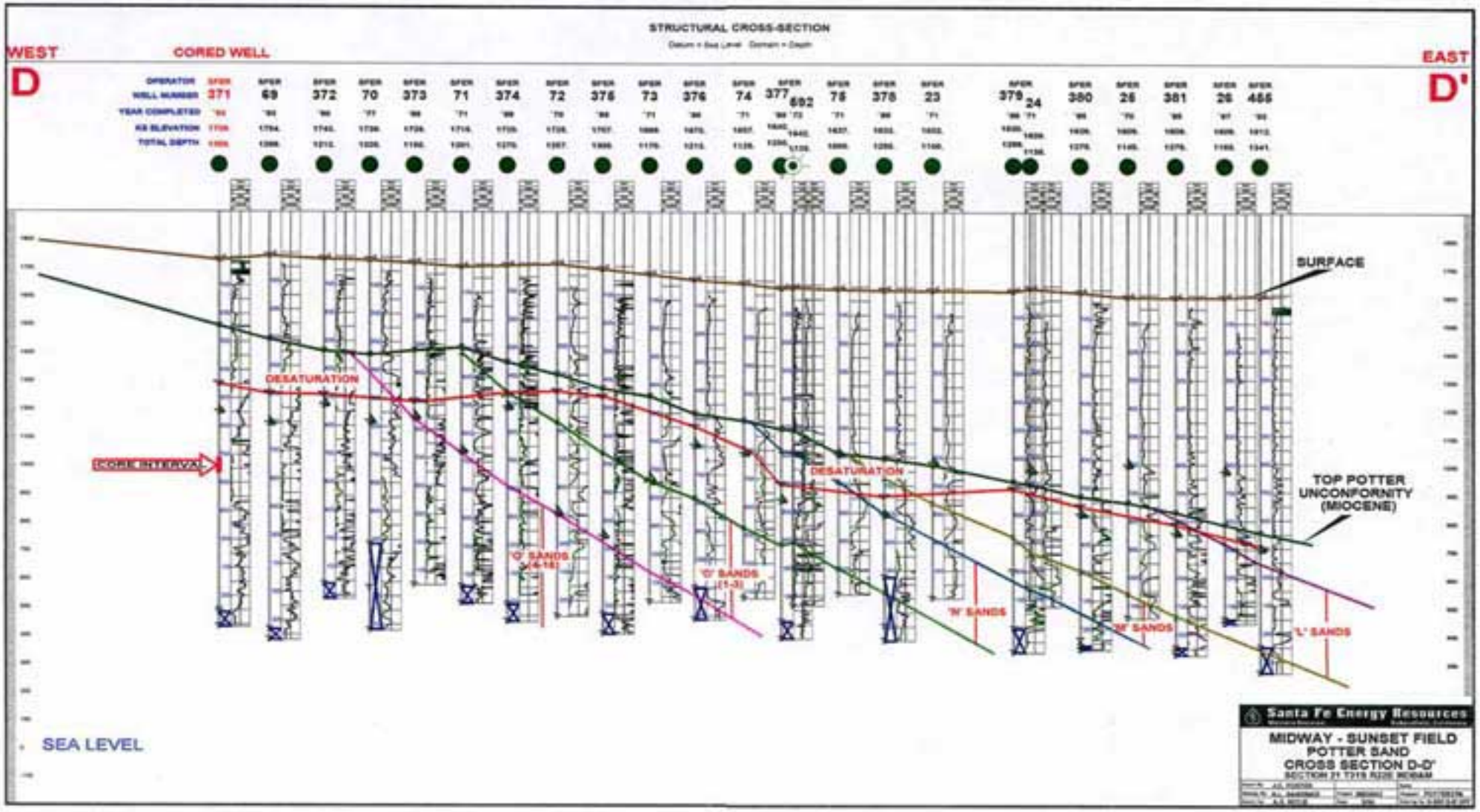


FIGURE 3 - West/East Dip Cross-Section
Showing Cored Interval in Well 371-G1

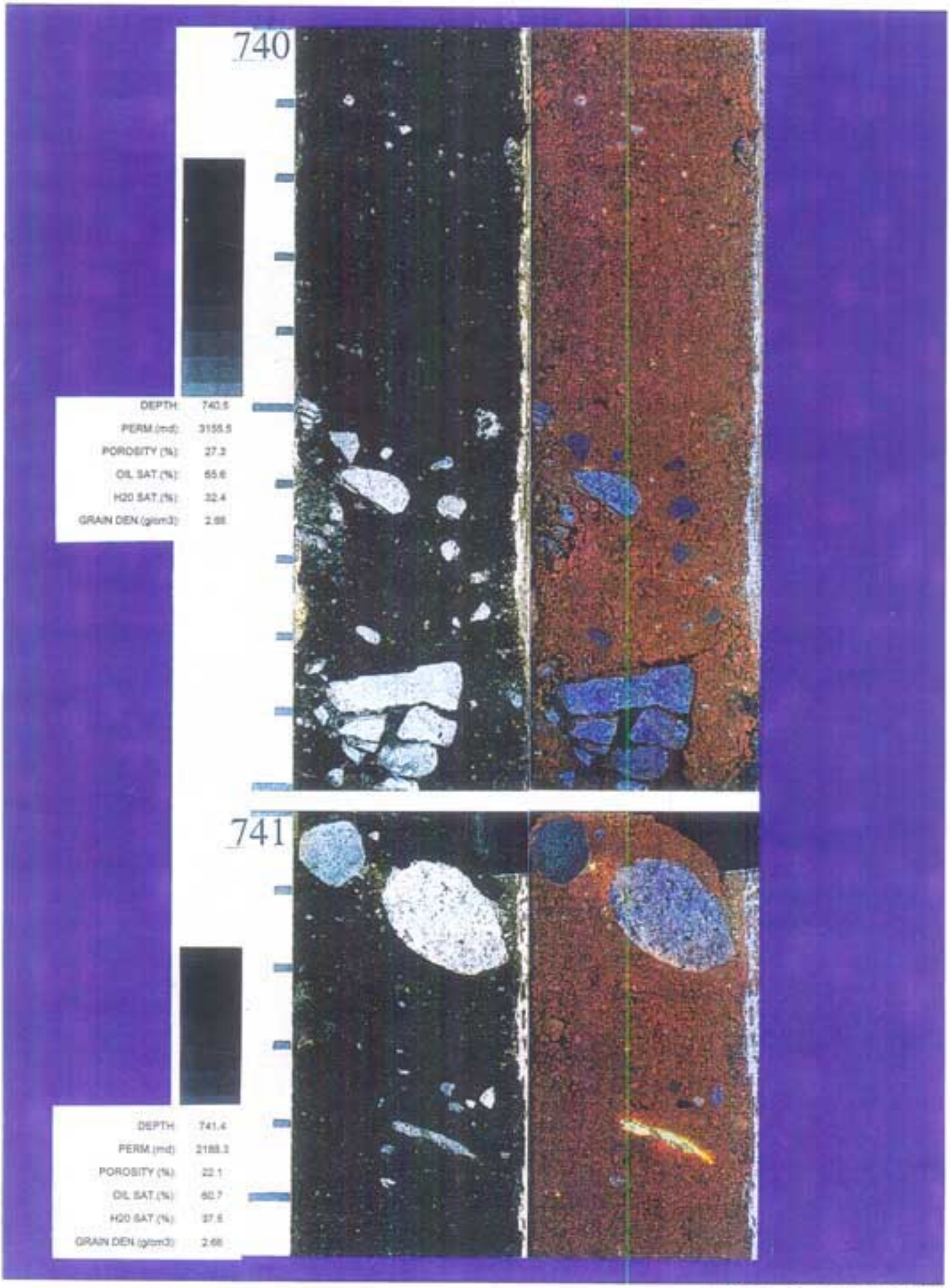


FIGURE 3 - Well 371-
Core Sample 740-7

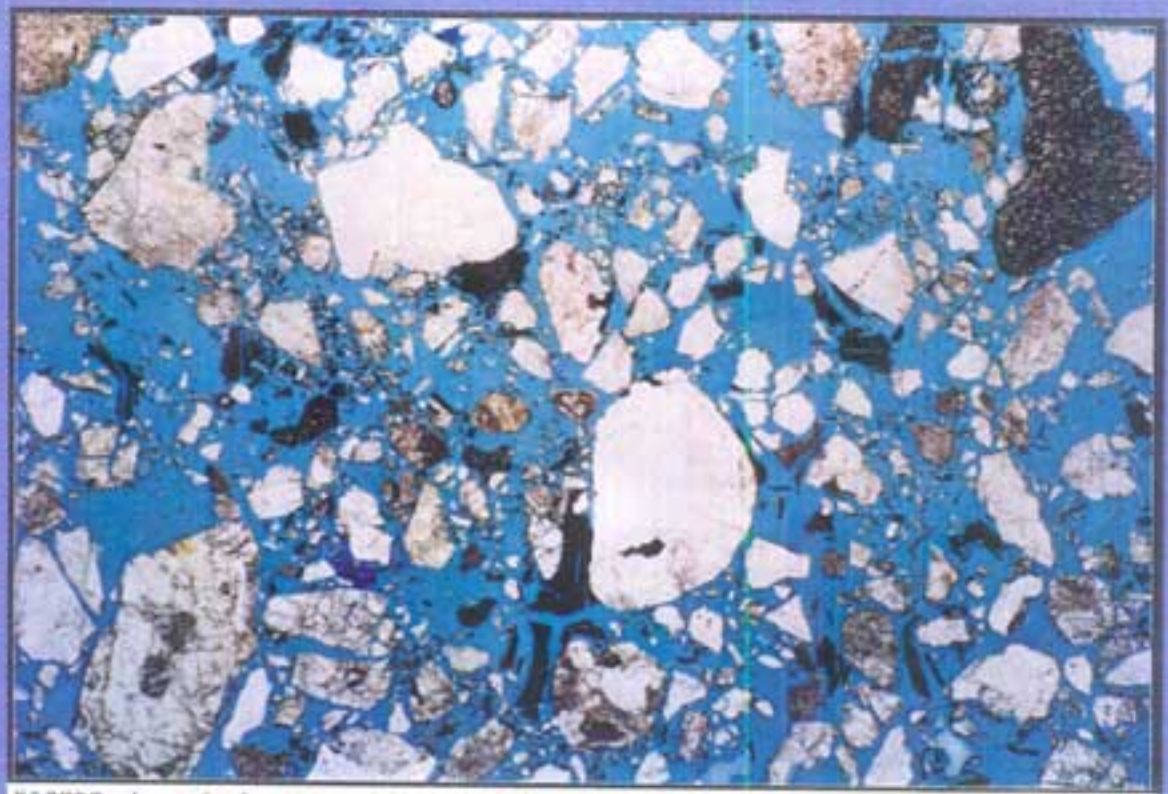
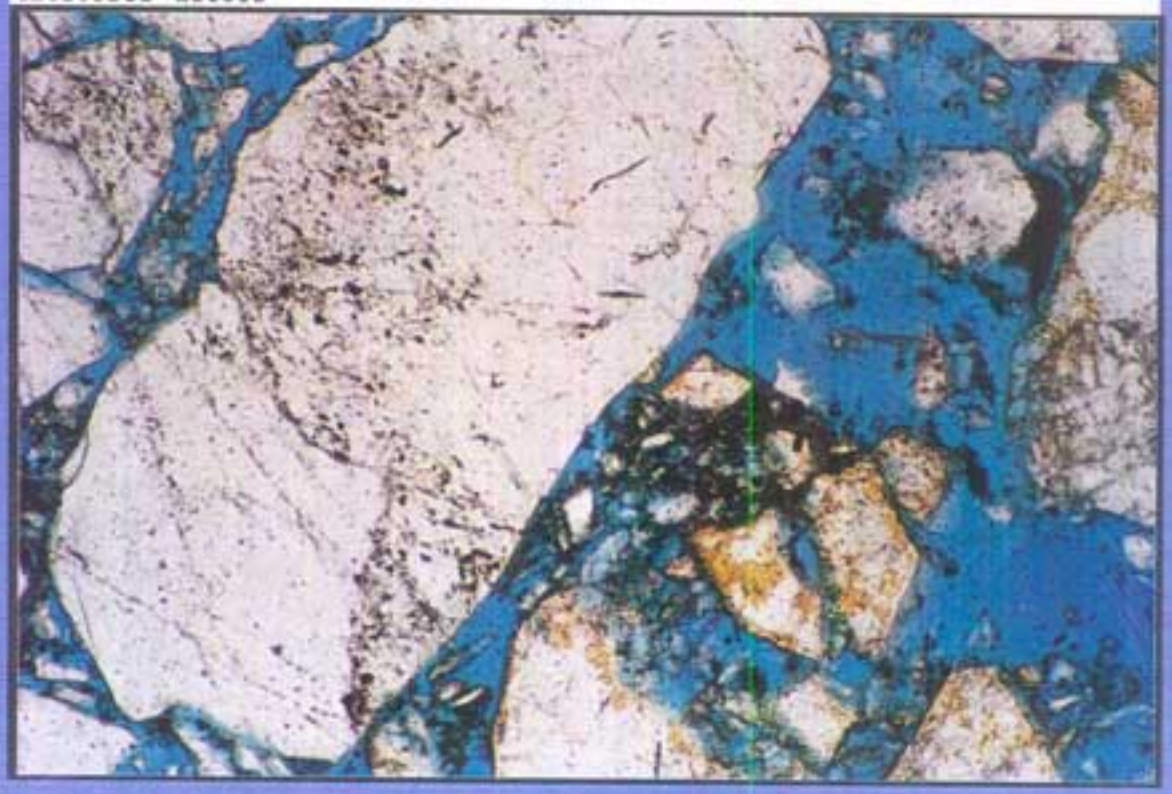


FIGURE 4 - A low magnification view of this coarse-grained, very poorly-sorted, unconsolidated and disaggregated, sublitharenitic sandstone. The framework of the sandstone disaggregated during the course of hydrocarbon extraction. 15X 1.2" = 2.0mm uncrossed nicols

FIGURE 5 - Santa Fe Energy Resources, Inc. : Well 371; 740.0 feet
A detailed view illustrating a cluster of authigenic clay matrix stained with hydrocarbons (center). 100X 1" = 0.25mm uncrossed nicols



THE SPELLACY SANDS
FROM SANTA FE ENERGY RESOURCES, INC.
WELL NO. 232-8, MIDWAY-SUNSET FIELD

By

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Santa Fe Energy Resources, Inc.

Location:

Well No. 232-8 is located 1105' southerly and 160' westerly from the center of Section 8, T32S-R23E, MDB&M, in the giant Midway-Sunset Field (Figure 1). Midway-Sunset is located along the western flank of the San Joaquin Valley, and except for a small portion in San Luis Obispo County, lies entirely in western Kern County, California.

Geology:

The Spellacy sands which produce at shallow depths (approximately 400' to 2100') in Sections 7, 8, and 17 crop out nearby in the southwestern portions of Sections 7 and 17 and in central Section 18 (Figure 1). From outcrop and close well control, it is concluded that these sands are typically channel-fill deposits, sourced from the west and southwest. The channels that carried the Spellacy sands cut into shaley to clean diatomites and diatomaceous shales (up to 500') during transport easterly and northeasterly. Spellacy reservoirs are typically composed of poorly sorted coarse conglomerates nearer the source, but are dominated by better sorted massive sands and pebble conglomerates distally. In the subsurface, the channel deposits are typically stacked with small offsets, producing lateral migration patterns upwards.

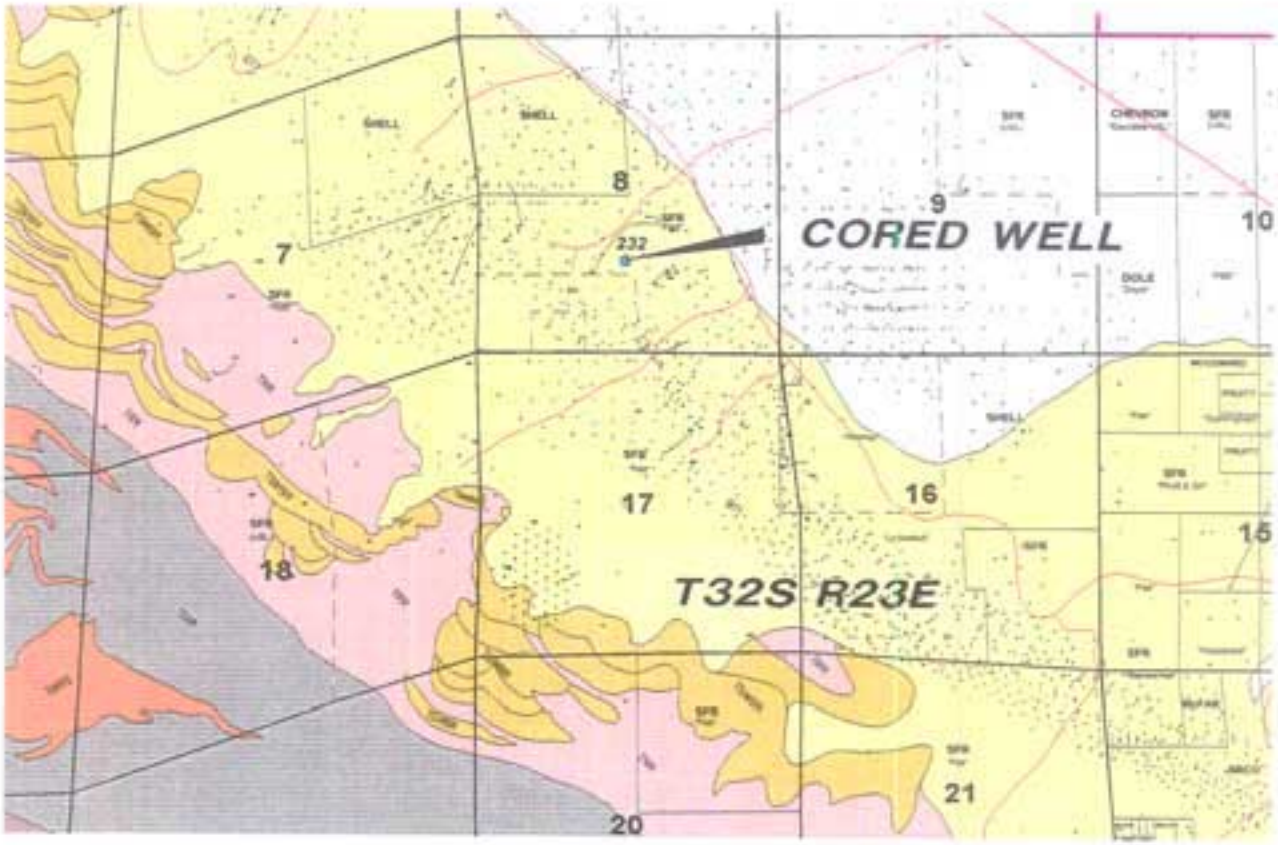
Whole Core:

During the drilling of Well No. 232-8 in December, 1989, two Spellacy sand intervals were cored in order to examine the physical properties of the reservoirs and of the fluids they contain; 221 feet of core were recovered of the 325 feet attempted. After drilling was completed, a variety of open hole logs were run, including resistivity, porosity, and dipmeter surveys. A composite electric log of Well No. 232-8 showing the cored intervals may be found in the Appendix.

Cores were recovered in plastic sleeves, chilled, and cut parallel to length into ⅓ and ⅔ pieces. The ⅓ pieces were photographed at half-scale in plain light and in ultraviolet light. Petroleum Testing Service, Inc. performed standard core analyses. Reservoir porosities range from 20.0% to 42.0% (average 33.0%); permeabilities range from approximately 300.0 millidarcies (md) to several darcies (average 1200.0 md).

The photos of the entire core recovery from Well No. 232-8 were displayed at the California Well Sample Repository beginning March 11, 1994, along side approximately 160 feet of representative ⅓ slabbed core. Figures 2 and 3 are color photocopies showing two typical features exhibited by the cores. Figure 2 shows a one-foot-thick bed of shaley diatomite (not oil-saturated) bounded by oil-bearing sands above and below (oil fluoresces yellow to orange under UV light). Figure 3 shows the basal contact of a pebbly conglomerate unit overlying nearly massive medium to coarse grained oil-bearing sandstones.

Note: In Figures 2 and 3, ϕ = Porosity, WC = Whole Core, So = % Oil Saturation, k = Permeability, Gr. Den. = Grain Density; Porosity and Oil Saturation are in decimal percent. The plain light photograph is on the left and the ultraviolet light photo is on the right. The numbers to the right are 10ths of feet divisions.



EXPLANATION

HOLOCENE	SURFICIAL SEDIMENTS	QAL	
PLIOCENE / PLEISTOCENE	TULARE FORMATION	QTT	
MIOCENE	REEF RIDGE SHALE / BELRIDGE DIATOMITE	TRR	SANTA MARGARITA SAND
			SANTA MARGARITA CONGLOMERATE
	UNCONFORMITY		
	ANTELOPE SHALE	TMA	STEVENS SANDS (UNDIFFERENTIATED) / CROCKER SANDS LOCALLY
			REPUBLIC SANDS
			STEVENS SANDS (UNDIFFERENTIATED)
			WILLIAMS SANDS
	McDONALD SHALE	TMD	
	GOULD SHALE	TMG	

POTTER SANDS

SPELLACY SANDS

N

Scale 1" = 3000'

REFERENCES

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- 1973 T.W. Dibble, Jr. - USGS Map 1957

Republic Sands Outcrop - 1980 Thesis
James Flanagan
University of Massachusetts

Williams Sands Outcrop - 1980 Thesis
John Gilbert, Jr.
University of Massachusetts

Spellacy Study - 1991 Tor Nilson
- 1994 Santa Fe Energy Resources, Inc.

Santa Fe Energy Resources

MIDWAY - SUNSET FIELD
SURFACE GEOLOGIC MAP
SPELLACY AREA
W/ WELL SPOTS
(Structural Data Not Posted)

Drawn by: J.C. Wallace		Scale: 1" = 3000'
Design by: G.J. Gregory	Project: MIDWAY	Program: GLOBAL
Issued for: A.S. Wylie	Date: 2/4/94	Drawing No: MIDYSA.DWF

FIGURE 1 - Spellacy Area Surface Geologic Map

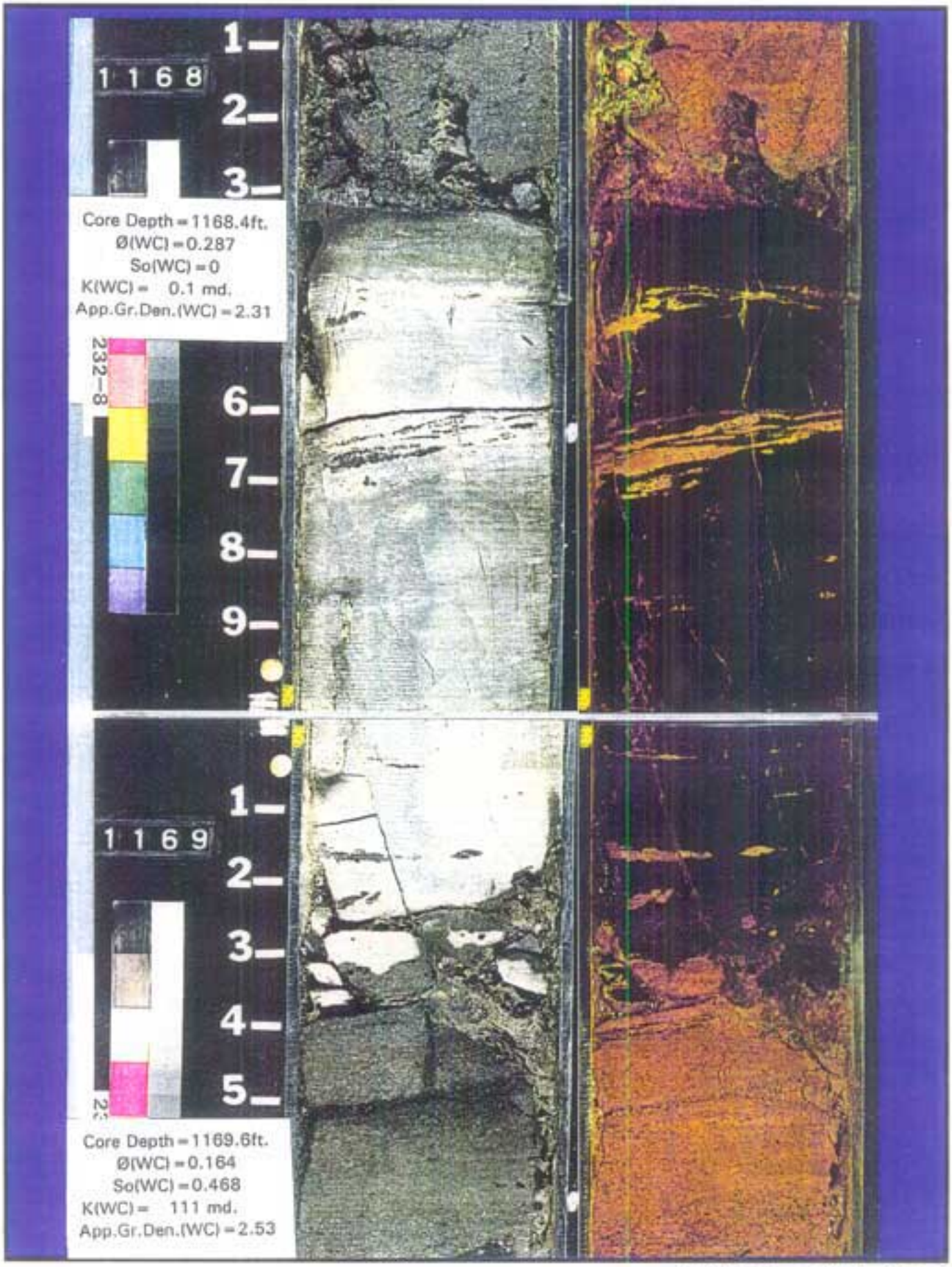

FIGURE 2 - Well 232-8
Core Sample 1168-1169

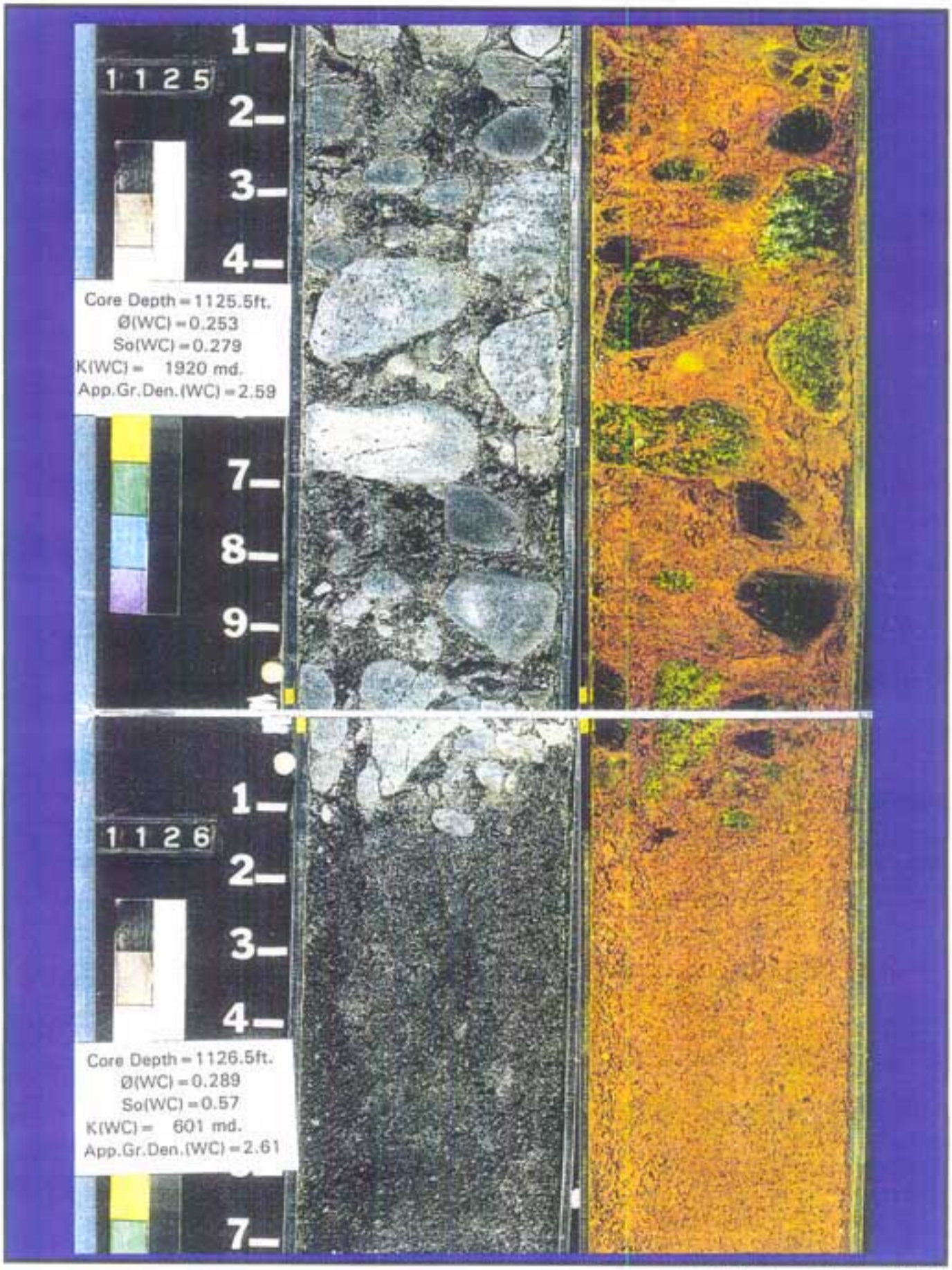

FIGURE 3 - Well 232-8
Core Sample 1125-1126