

The Lower Abo Horizontal Oil Play of Southeast New Mexico*

Ted Gawloski¹

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Abstract

The Lower Abo Horizontal Oil Play (LAHOP) began in February, 2007 when the Reindeer “21” Fed. #1 was kicked off and drilled a 3412’ lateral to target the Lower Abo carbonate reservoirs. After a relatively small frac by today’s standards, the well came in for 174 BOPD and 182 MCFGPD and continues to produce a steady 35 BOPD & 150 MCFGPD. The LAHOP now extends across 3 southeast New Mexico counties in a trend roughly 15 miles wide by 60 miles long. At present, the play has approximately 140 completed horizontal wells and several hundred potential locations yet to be drilled. Geologically, the LAHOP is located along the Northern Shelf of the Delaware Basin where Lower Abo sediments were deposited within shallow shelf, intertidal, lagoonal and sabkha environments. The porosity is mostly secondary, the result of dissolution of dolomite rhombs (intercrystalline to vuggy porosity), skeletal fragments (moldic porosity) and cement (interparticle and intercrystalline porosity). The best production is primarily from the secondary dolomite lenses which have much better porosity and permeability. New horizontal drilling, properly steered through the pay section, connects these scattered and discontinuous porosity zones creating a much greater and more effective drainage area. Production numbers for some of the horizontal wells are as much as 10 to 15 times that of the average vertical Lower Abo completion. Several of the new horizontal wells have practical initial rates over 1000 BOEPD and have produced as much as 345 MBOE in just 2 years. The play is slowly expanding from the more established Crow Flats-High Lonesome area in Eddy County to the Caprock area of southern Chaves County east and northeastward into central Lea County.

THE LOWER ABO HORIZONTAL OIL PLAY OF SOUTHEAST NEW MEXICO (10 TIMES THE FUN)

TED GAWLOSKI
SENIOR STAFF GEOLOGIST
APACHE CORPORATION

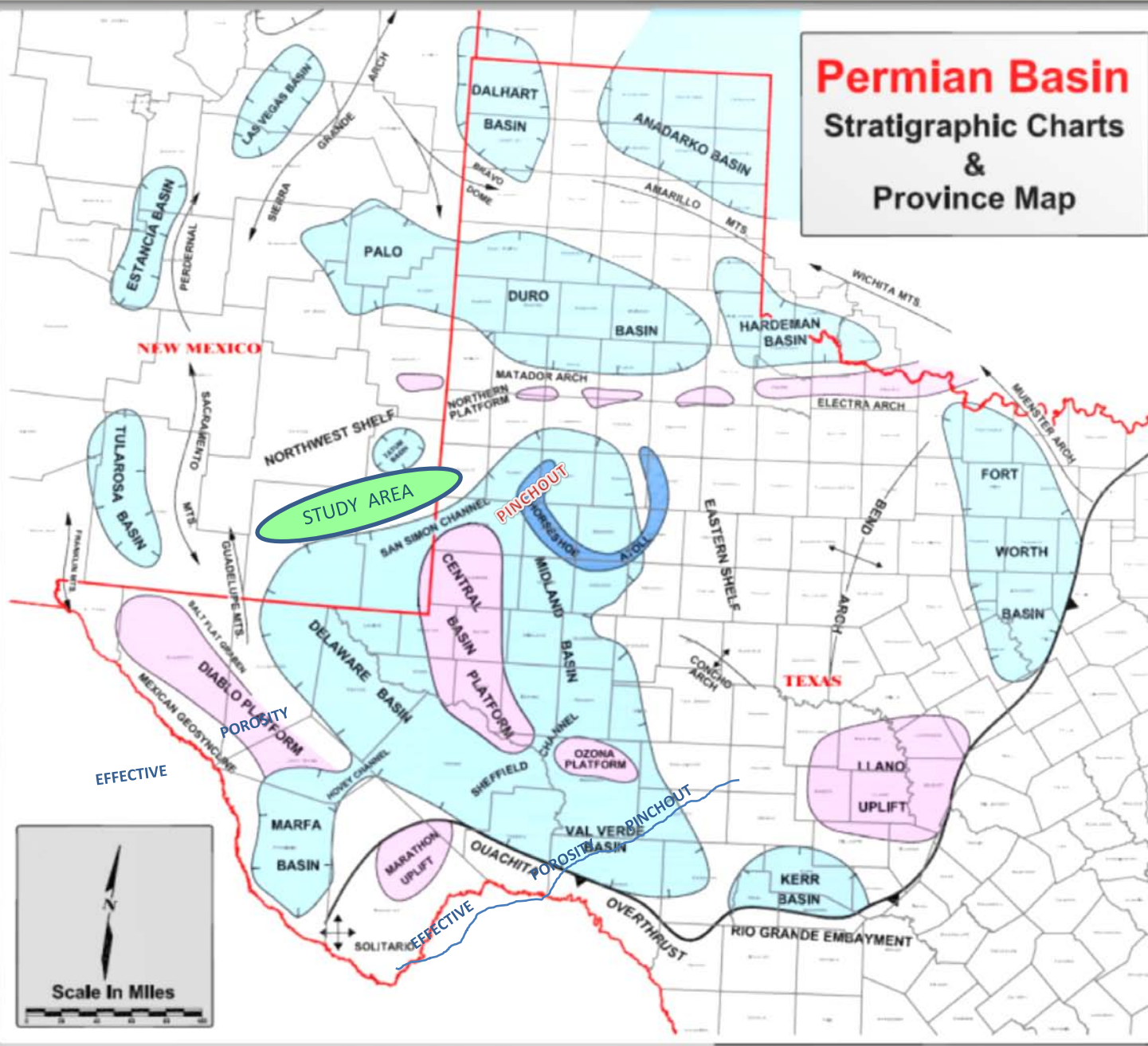


A LOOK FROM PAVO MESA AT LOWER ABO DRILLING ACTIVITY IN THE CROW FLATS AREA OF EDDY COUNTY, NEW MEXICO

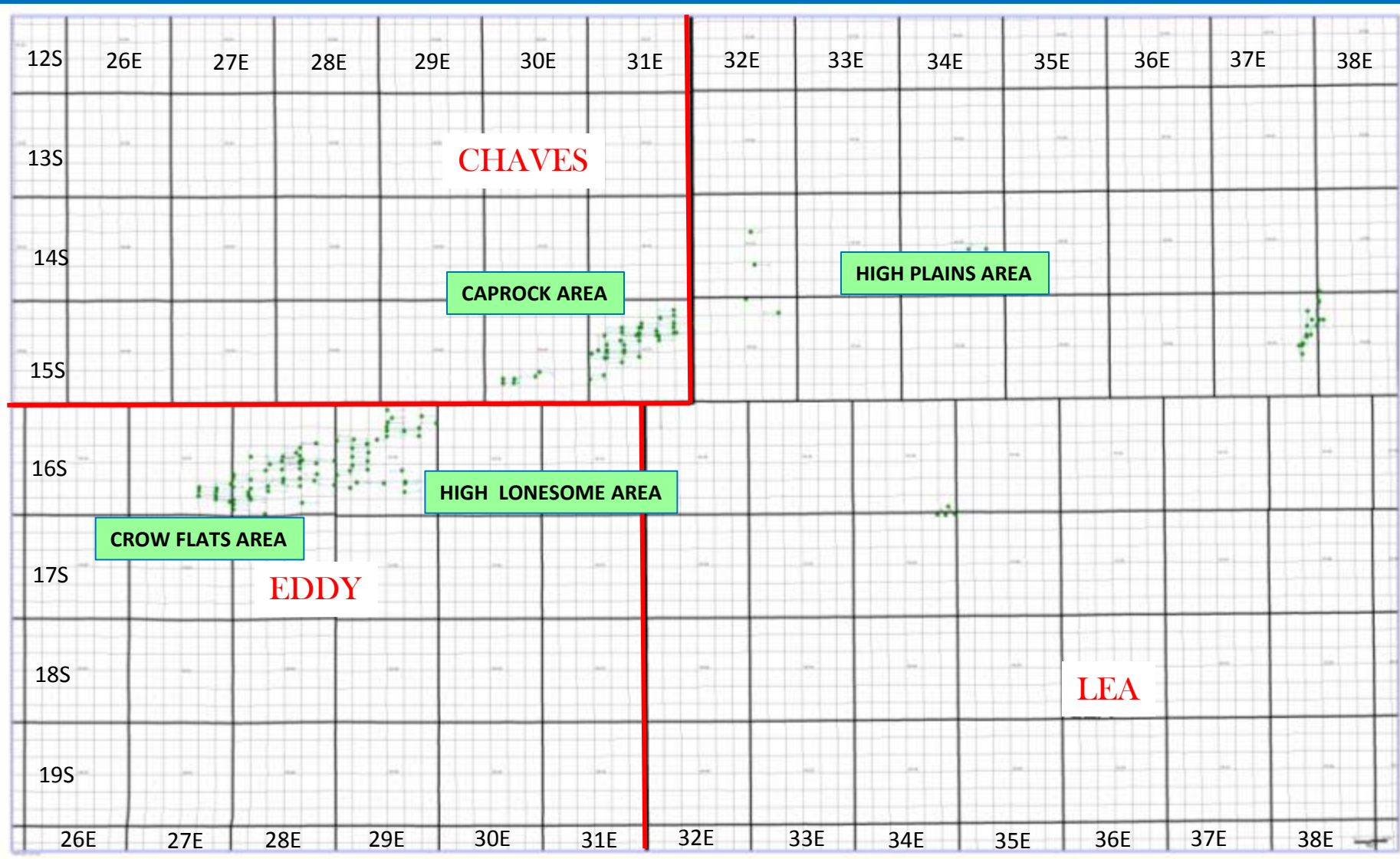
TALK OUTLINE

- INTRODUCTION
- AREA SETTING
- STRATIGRAPHY AND ZONE DEFINITION
- FACTS & FIGURES
- LITHOLOGY, LITHOFACIES & DEPOSITIONAL ENVIRONMENTS
- PETROGRAPHY
- THE LOWER ABO RESERVOIR
- TRAP TYPES
- DIAGENESIS – THE GOOD, THE BAD AND THE UGLY
- EXPLORING FOR THE LOWER ABO – SIMPLE WORKS BEST
- SUMMATION AND CONCLUSIONS

Permian Basin Stratigraphic Charts & Province Map



11 LOWER ABO HORIZONTAL OIL PLAY INDEX MAP



STRATIGRAPHIC COLUMN SOUTHEAST NEW MEXICO

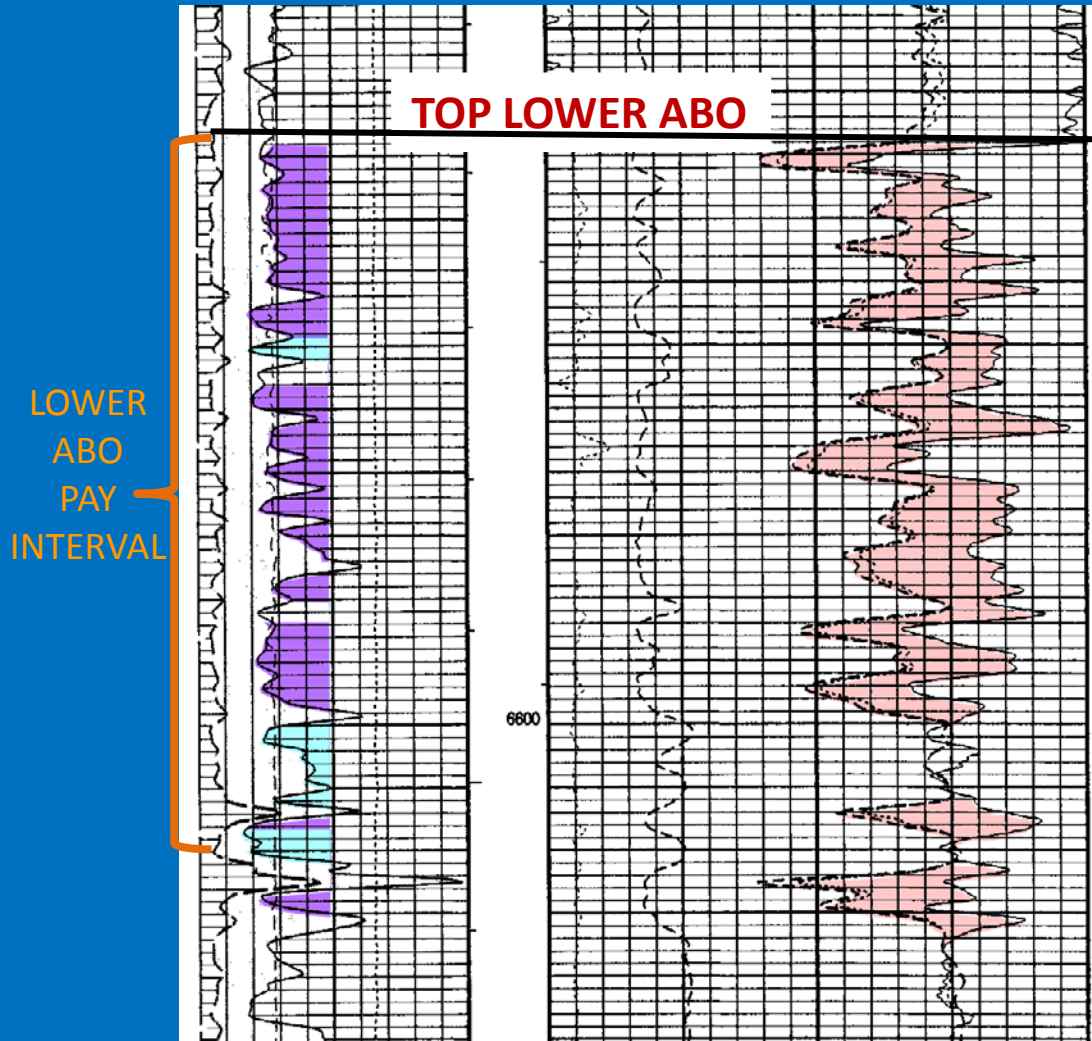
Age		Strata		Oil Plays		
Triassic		Chinle				
		Santa Rosa				
		Dewey Lake				
		Rustler				
		Salado				
Permian	Ochoan	Artesia Group		Artesia Platform Sandstone		
		Tansill				
		Yates				
		Seven Rivers				
		Queen				
	Guadalupian	Grayburg		Upper San Andres and Grayburg Platform - Artesia Vacuum Trend		
		San Andres		Upper San Andres and Grayburg Platform - Central Basin Platform Trend		
		Glorieta		Leonardian Restricted Platform Carbonate		
		Yeso	Paddock			
			Blinebry			
	Tubb					
	Drinkard					
	Leonardian	Abo		Abo Platform Carbonate		
		Hueco ("Wolfcamp")		Wolfcamp Platform Carbonate		
	Pennsylvanian	Virgilian	Bough		Northwest Shelf Upper Pennsylvanian Carbonate	
Cisco						
Missourian		Canyon		Northwest Shelf Strawn Patch Reef		
Des Moinesian		Strawn				
Atokan		Atoka				
Morrowan		Morrow				

STRATIGRAPHIC COLUMN SOUTHEAST NEW MEXICO

System	Epoch/ Series/ Stage	Time (m.y.)	Delaware Basin		NW Shelf New Mexico	
PERMIAN	Ochoan	251	Dewey Lake		Dewey Lake	
			Rustler		Rustler	
			Salado		Salado	
			Castile		Castile	
	Guadalupian		Delaware Mountain Group	Bell Canyon	Artesia Gp.	Tansill
						Yates
				Cherry Canyon		Seven Rivers
						Queen
				Grayburg		
				Upper San Andres		
			Brushy Canyon			
	Leonardian		Cutoff		Lower San Andres	
			Bone Spring	1st carbonate	Glorieta	
				1st sand	Paddock	Yeso
				2nd carbonate		
				2nd sand	Blinebry	
				3rd carbonate	Tubb	
				3rd sand	Drinkard	
			Lower carbonate	Abo		
	Wolfcampian		Wolfcamp		Wolfcamp	



FOR THE PURPOSE OF THIS TALK THE TOP OF THE LOWER ABO WILL BE AT THE BASE OF THE REGIONAL ANHYDRITE. THE LOWER ABO RESERVOIR WILL BE CONSIDERED THE TOP 100-125 FEET OF SECTION IMMEDIATELY BELOW THE ANHYDRITE SECTION.



**BASE OF ANHYDRITE =
TOP OF LOWER ABO**

COG OPERATING
COMET "22" FED. #4
COMP. 11-2008
(LOWER ABO) HORIZONTAL
F 1539 BOPD & 1616 MCFGPD
1808 BOEPD
CUM. 127MBO & 491 MMCFG
(210 MBOE)
LT (5-2011) P 11 BOPD & 239 MCFPD

FACTS & FIGURES

THE LOWER ABO HORIZONTAL OIL PLAY BEGAN IN FEB.2007 WITH THE DRILLING OF A 3412' LATERAL HOLE IN THE REINDEER FED."21" #1 IN THE CROW FLATS AREA IN EDDY CO. NEW MEXICO.

THE PLAY NOW STRETCHES ACROSS THREE SOUTHEAST NEW MEXICO COUNTIES IN A SE-NW TREND ROUGHLY 60 MILES LONG BY 15 MILES WIDE.

UPDIP WIDESPREAD ANHYDRITE DEPOSITS PROVIDE A REGIONAL SEAL AND TRAP

VERTICAL COMPLETIONS WERE MOSTLY UNSUCCESSFUL BECAUSE THE RESERVOIR IS DISCONTINUOUS HORIZONTALLY AND VERTICALLY LIMITED. PROPERLY STEERED HORIZONTAL DRILLING CONNECTS THESE DISCONTINUOUS POROSITY LENSES.

THRU MAY 2011 THE PLAY HAS PRODUCED 8.4 MMBOE WITH THE LAST MONTH'S PRODUCTION AT 402 MBOE. MANY WELLS HAVE IP'S OVER 1000 BOEPD AND EUR'S RANGE UP TO 1.2 MMBOE/WELL.

HIGH BTU ASSOCIATED GAS (>1500 BTU) GETS PREMIUM PRICE (4-2011) \$10.50/MCF

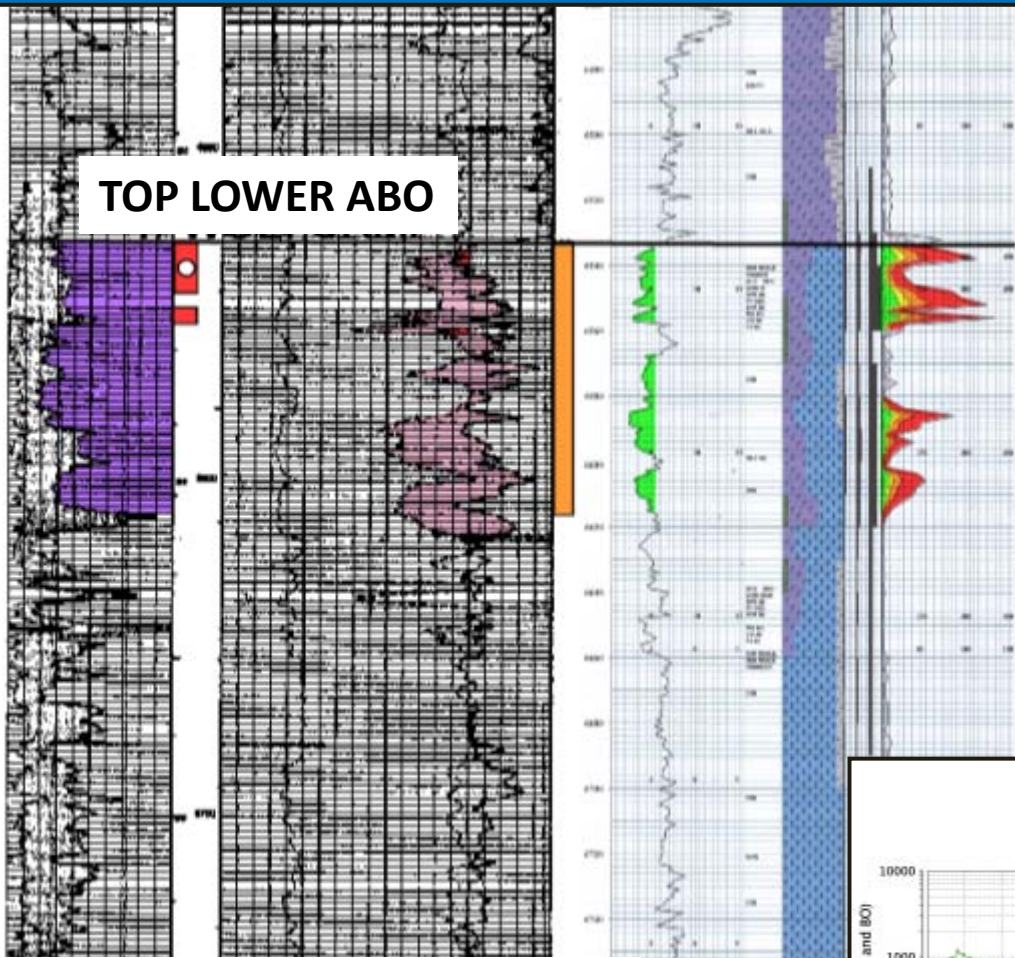
FACTS & FIGURES CONTINUED...

PRODUCTION IS USUALLY LOCATED WITHIN POROUS AND PERMEABLE DOLOMITE LENSES FOUND SCATTERED THRU THE FIRST 125 ' OF LOWER ABO ROCKS.

THE AVERAGE LATERAL IS SLIGHTLY UNDER 5000' AND ARE USUALLY FRAC'D IN STAGES (UP TO 12) USING 800,000 – 1,500,000 # OF PROPPANT.

STEERING OF THE LATERAL HOLE AND KEEPING WITHIN THE PAY ZONES (GOOD MUDLOG SHOWS) IS VERY IMPORTANT AND USUALLY LEADS TO BETTER PRODUCTIVITY.

TOP LOWER ABO



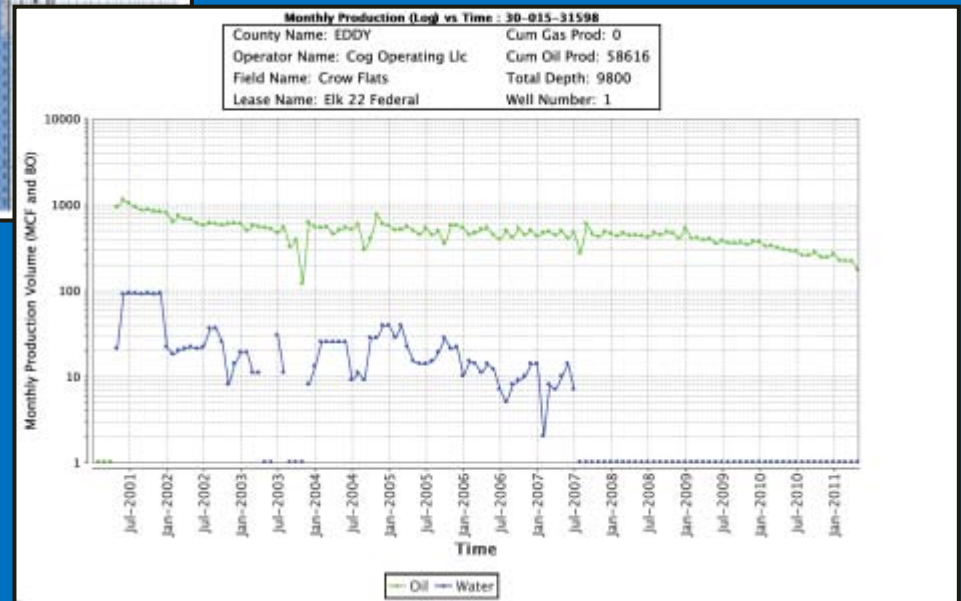
**COMP
5-01**

**IP (ABO) 6528-6626',
P 47 BOPD + 60 MCFD + 225 BWPD**

**PERF 6528-6543', 6548-6553', 6567-6568',
6581-6595', 6602-6615', 6624-6626',
ACIDIZED W/ 2000 GALS. 15%, RE-ACIDIZE
W/ 32,000 GALS. 20%, FRAC W 54,000 GALS. 40# GEL**

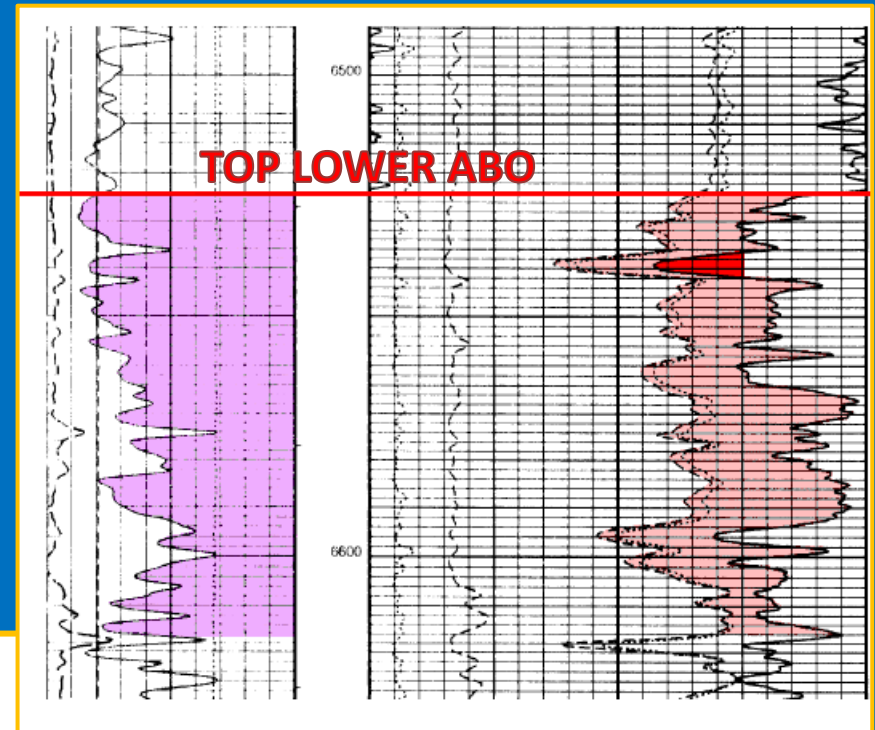
**MACK ENERGY
ELK 22 FED. COM. #1
SEC.22-16S-28E
660' FNL & 660' FWL
VERTICAL COMPLETION
CUM. 58 MBO, LT 6 BOPD
EUR = 105 MBO &
GAS NOT REPORTED**

THIS IS THE BEST LOWER ABO VERTICAL COMPLETION



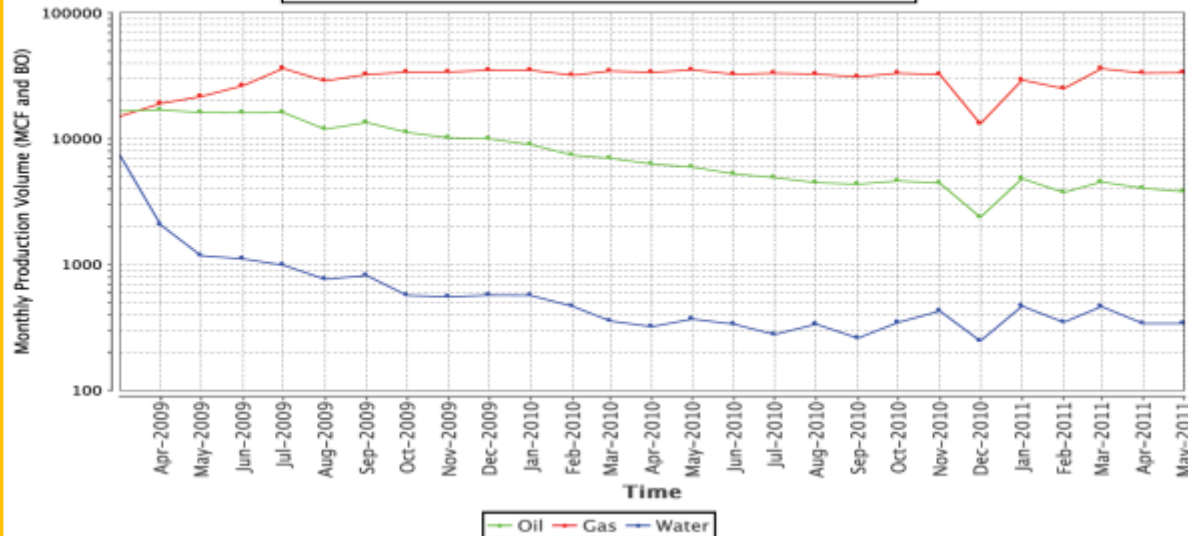
**COG OPERATING
REINDEER "21" FEDERAL # 3
SECTION 21-T16S – R28E
HORIZONTAL L. ABO OIL PRODUCER
CUM. 226 MBO & 821 MMCFG. (363 MBOE)
LT 5-2011, P127 BOPD & 1120 MCFGPD.**

**EUR = 391 MBO & 4.4 BCFG OR
1125 MBOE**



Monthly Production (Log) vs Time : 30-015-36538

County Name: EDDY	Cum Gas Prod: 820582
Operator Name: Cog Operating Llc	Cum Oil Prod: 226284
Field Name: Wc	Total Depth: 10600
Lease Name: Reindeer 21 Federal	Well Number: 3



**HOW ABOUT AN EUR
GREATER THAN 10X
THAT OF A NEARBY
VERTICAL COMPLETION**

VERTICAL VS HORIZONTAL COMPLETIONS

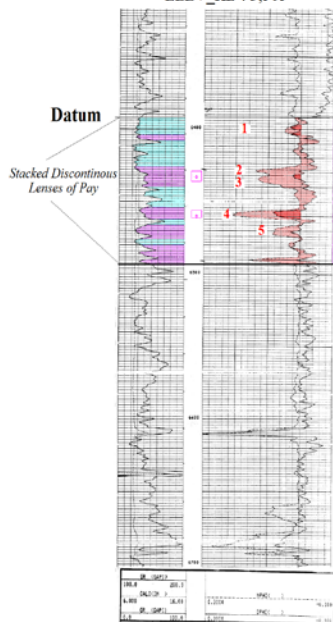
D

D'

THREE SPAN OIL & GAS INC CROW FLATS FED COM #1

30015233860000

T16S R28E S30
ELEV_KB : 3,565



Comp : 9/1980
Comp (Lo. Abo) 10/1990

Lower Abo Cum : 52,545 BO + 0.086 BCF
Curr : 3 BOPD + 5 MCFD

IP (Lower Abo) 6,429-6,472'
F 20 MCFD + 38 BOPD
thru 48/64" CHK, FTP 10#

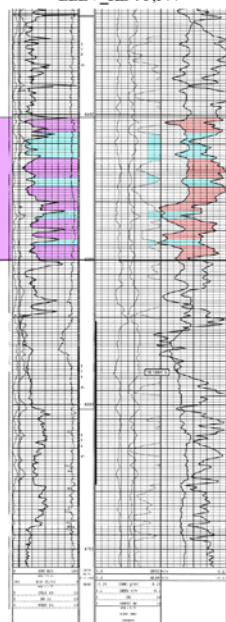
Perf 6,428'-6,436', 6,456'-6,461', Acidized W/
2000 Gals. 15% HCL

* 21 years of production
67 MBOE

COG OPERATING LLC DONNER 30 FED COM #3

30015358070000

T16S R28E S30
ELEV_KB : 3,577



Comp : 2/2009

Lower Abo Cum : 115,553 BO + 0.34 BCF +
17,605 BW
Curr : 52 BOPD + 380 MCFD + 6 BWPD

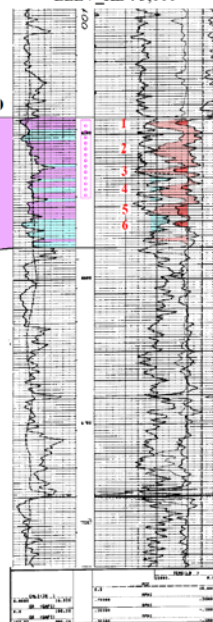
IP (Lower Abo) 6,753' - 8,874'
P 539 BOPD + 792 MCFD

* 27 months of production
172 MBOE

RSC RESOURCES LIMITED CROW FLATS FED COM #1

30015248760000

T16S R28E S30
ELEV_KB : 3,600



Comp : 8/1992

Lower Abo Cum : 48,988 BO + 0.07 BCF +
157 BW
Curr : 28 MCFD + 13 BOPD
IP (Lower Abo) 6,490' - 6,544'
P 68 BOPD + 73 MCFD

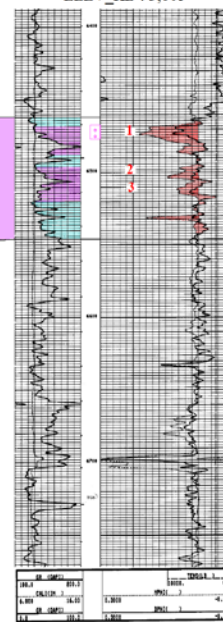
Perf 6,490' - 6,544', Acidized W/ 4000 Gals. 20% NEFE

* 19 years of production
61 MBOE

EAGLE OIL & GAS COMPANY CROW FLATS 'A' FED #1

30015235350000

T16S R28E S19
ELEV_KB : 3,605



Comp : 5/1981

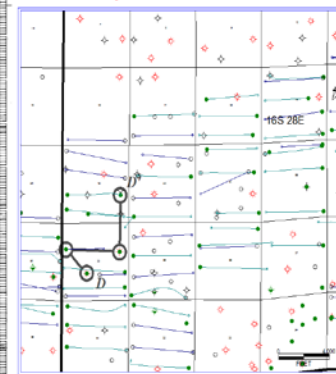
Lower Abo Cum : 20,933 BO + 0.002 BCF + 259 BW
P&A'd 4/1991 Ina 1/1991

IP (Lower Abo) 6,467' - 6,477', Acidized W/ 5000 Gals.
P 19 BOPD + 29 MCFD + 3 BWPD

Perf 6,467' - 6,477', Acidized W/5000 Gals.
Perf 6,650' - 6,652' SQZ'D W/ 180 SXs
CISP @ 6,325' W/ 35' CMT

* 10 years of production
21 MBOE

Eddy Co., New Mexico



Apache

Dog Canyon Area

LOWER ABO STRATIGRAPHIC

CROSS SECTION D-D'

Eddy Co., New Mexico

Horizontal Scale = 354.9

Vertical Scale = 40.0

Vertical Exaggeration = 8.9x

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LOWER ABO LITHOFACIES AND DEPOSITIONAL ENVIRONMENTS

FACIES 1 – SKELETAL MUDSTONE TO WACKESTONE (SHALLOW SHELF)

FACIES 2 - SKELETAL AND PELOIDAL PACKSTONE TO GRAINSTONE (CARBONATE BANK OR SHOAL)

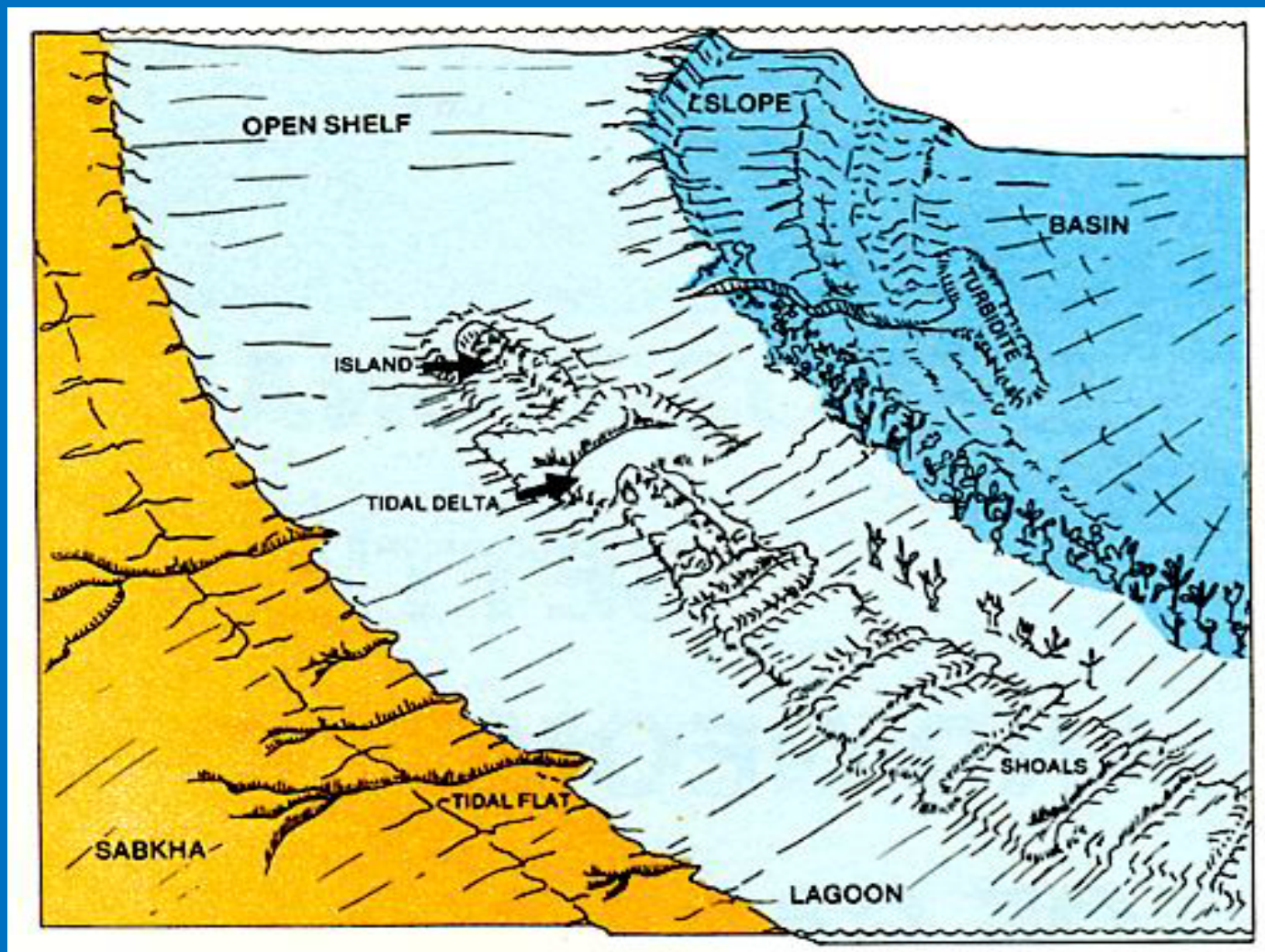
FACIES 3 - SKELETAL AND BURROWED DOLOMITIC PACKSTONE (RESTRICTED SHELF)

FACIES 4 - FINE CRYSTALLINE DOLOMITE WITH SCATTERED GRAIN DISSOLUTION, SOME DOLOMITE INFILLING AND PORE OCCLUDING ANHYDRITE (RESTRICTED SHELF OR LAGOON)

FACIES 5 - FINE – V/ FINE CRYSTALLINE DOLOMITE (SEMI-RESTRICTED SHELF)

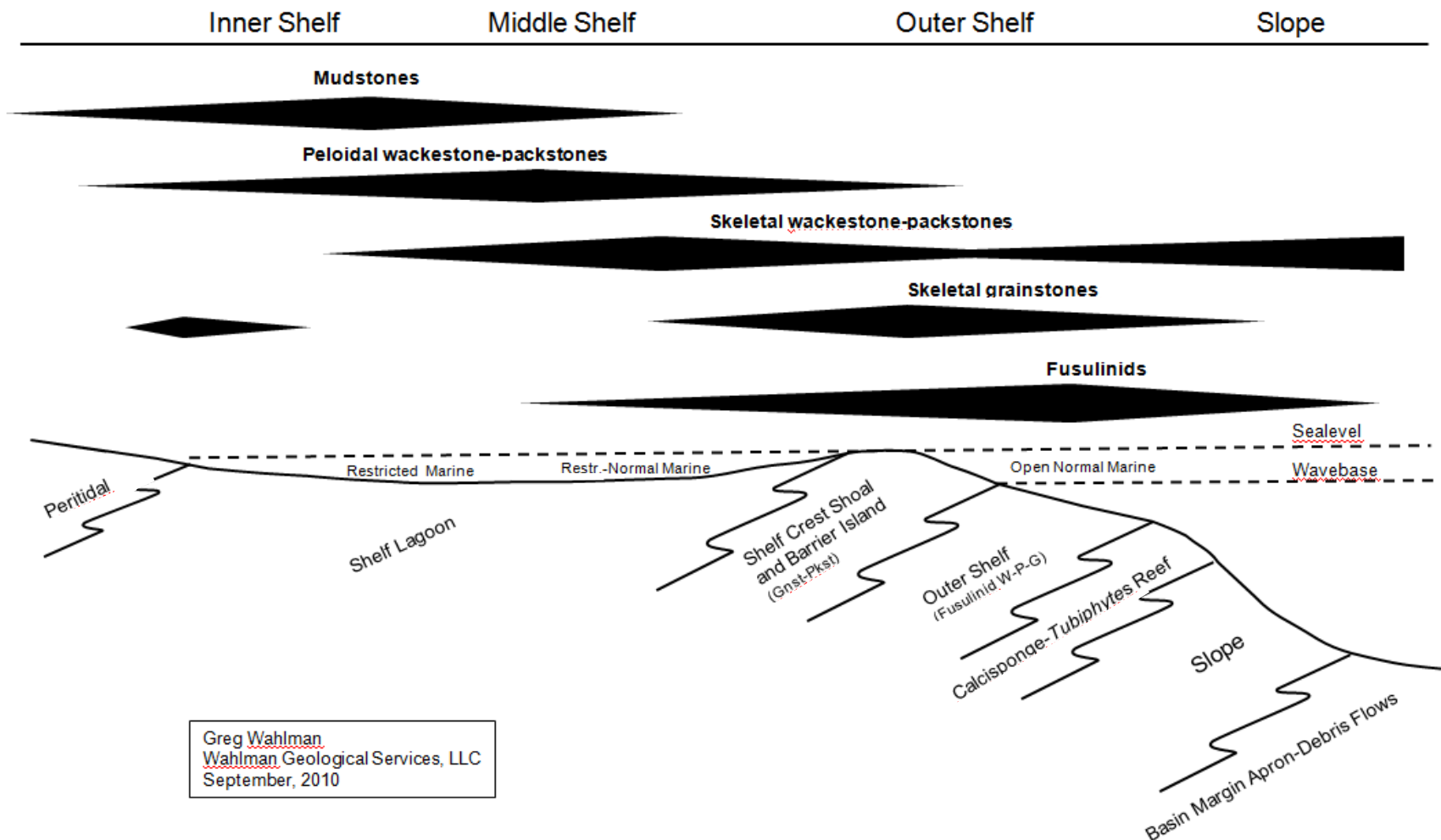
FACIES 6 - FINE - V /FINE CRYSTALLINE CHERTY PELLOIDAL/BIOCLASTIC DOLOPACKSTONE (RESTRICTED – SEMI RESTRICTED SHELF)

FACIES 7 - ANHYDRITE/ANHYDRITIC DOLOMITE (SABKHA)

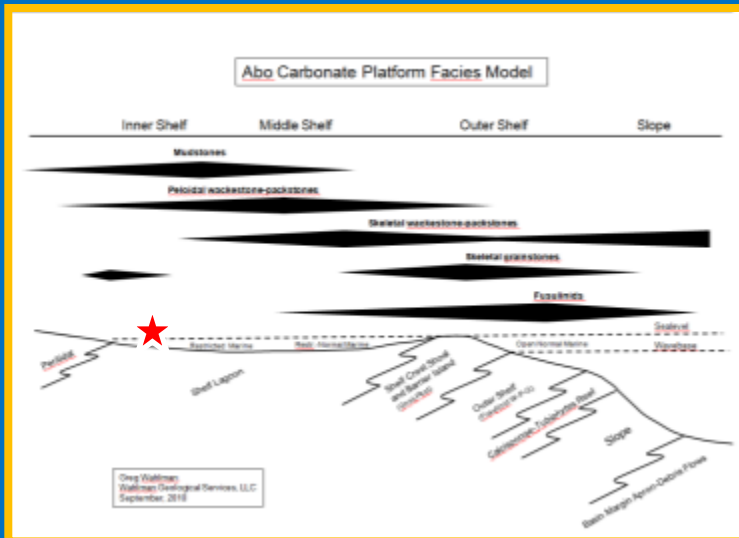


THE DIVERSE LITHOFACIES REPRESENTED SUGGEST DEPOSITION WITHIN SHALLOW SUBTIDAL CARBONATE PLATFORM ENVIRONMENTS SUBJECTED TO EPISODIC PERIODS OF RESTRICTION AND DEVELOPMENT OF EVAPORITIC CONDITIONS .

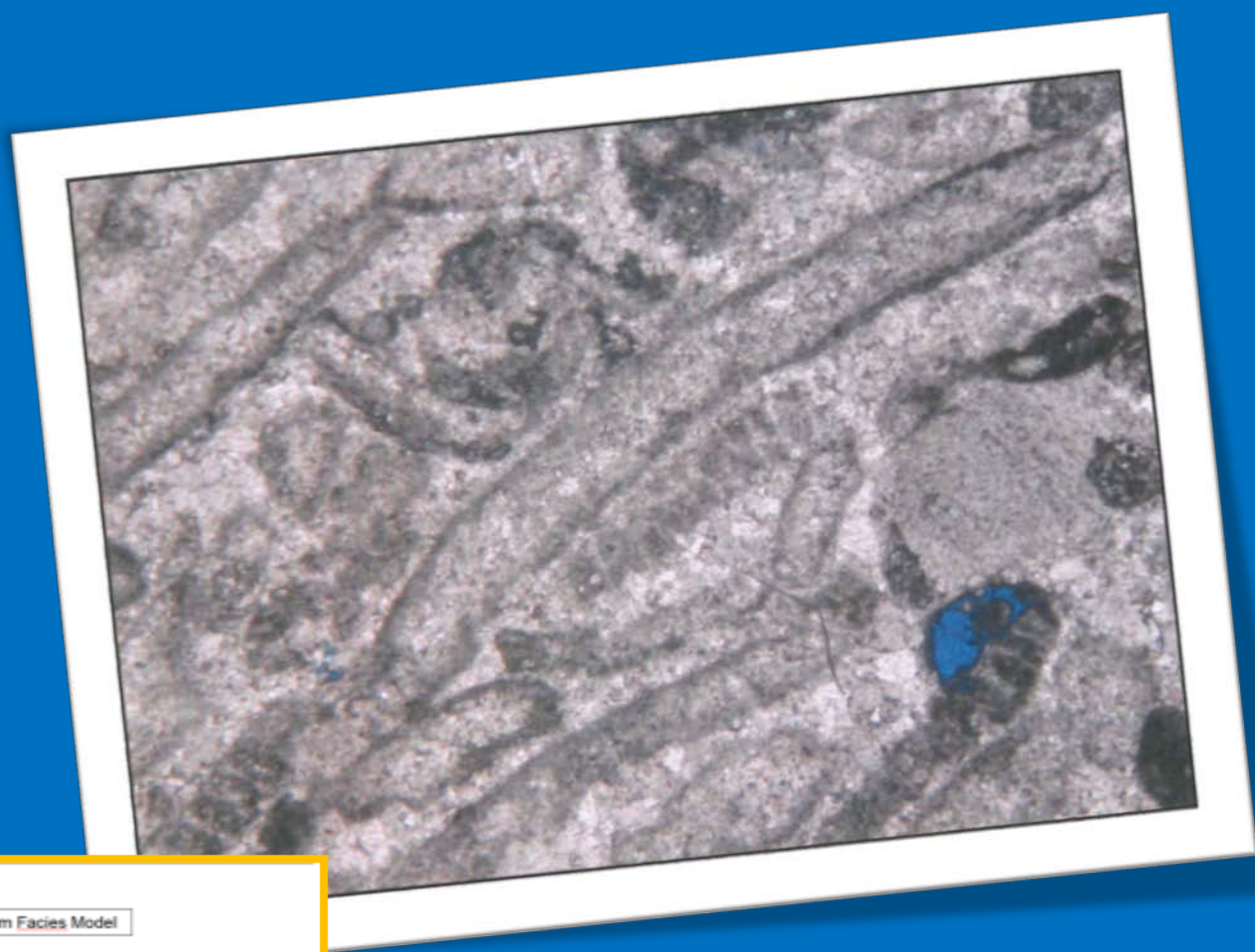
LOWER ABO CARBONATE PLATFORM FACIES MODEL



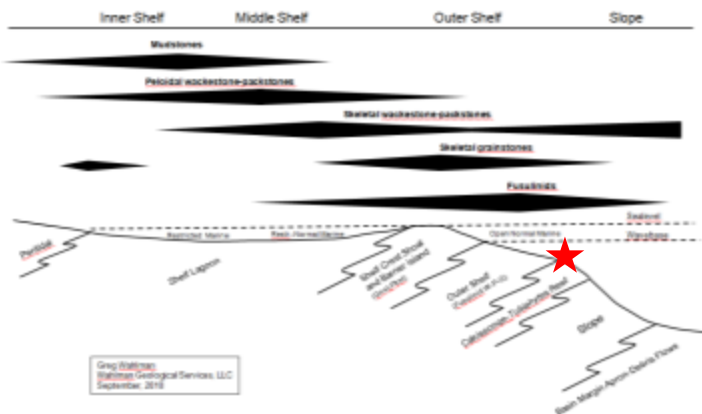
SKELETAL MUDSTONE - WACKESTONE



FACIES 2



Abo Carbonate Platform Facies Model

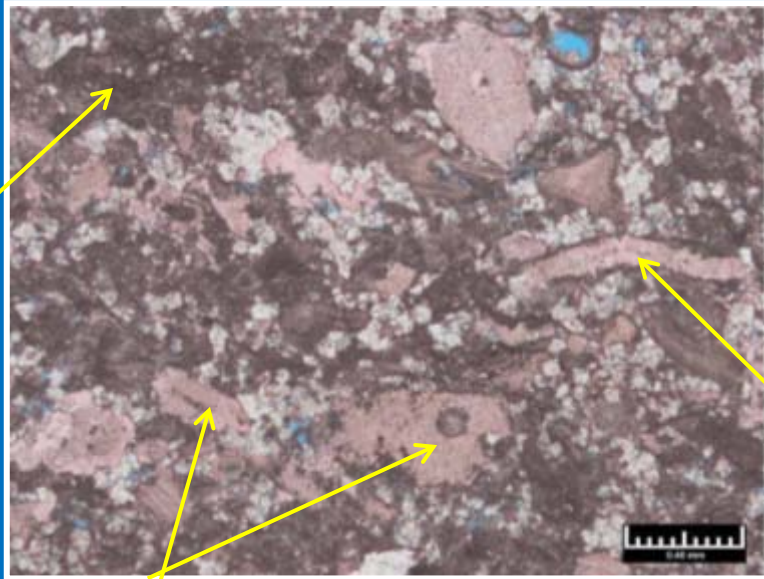


**PHYLLOID ALGAL FRAGMENTS
WHICH THRIVED IN SHALLOW
WATER BANKS AND SHOALS**

FACIES 2

SLIGHTLY DOLOMITIC SKELETAL & PELOIDIAL LIME PACKSTONE

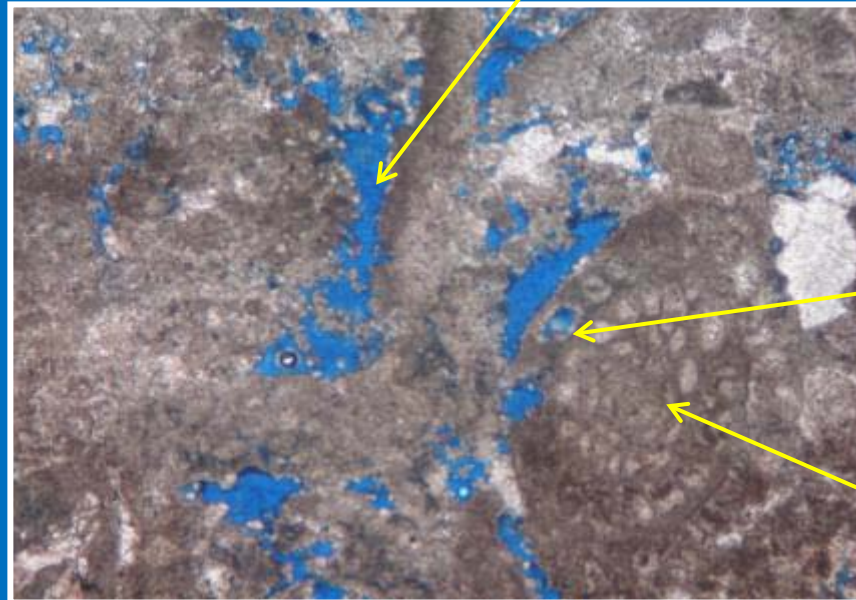
PELOIDS



MOLLUSK
FRAGMENTS

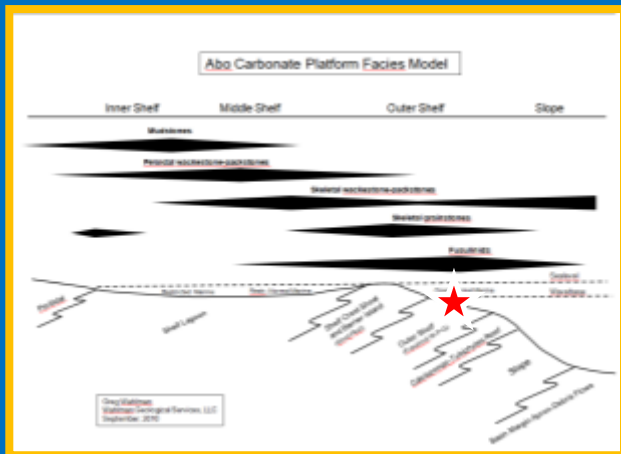
ECHINODERM
FRAGMENTS

INTERPARTICLE
POROSITY



INTRAPARTICLE
POROSITY

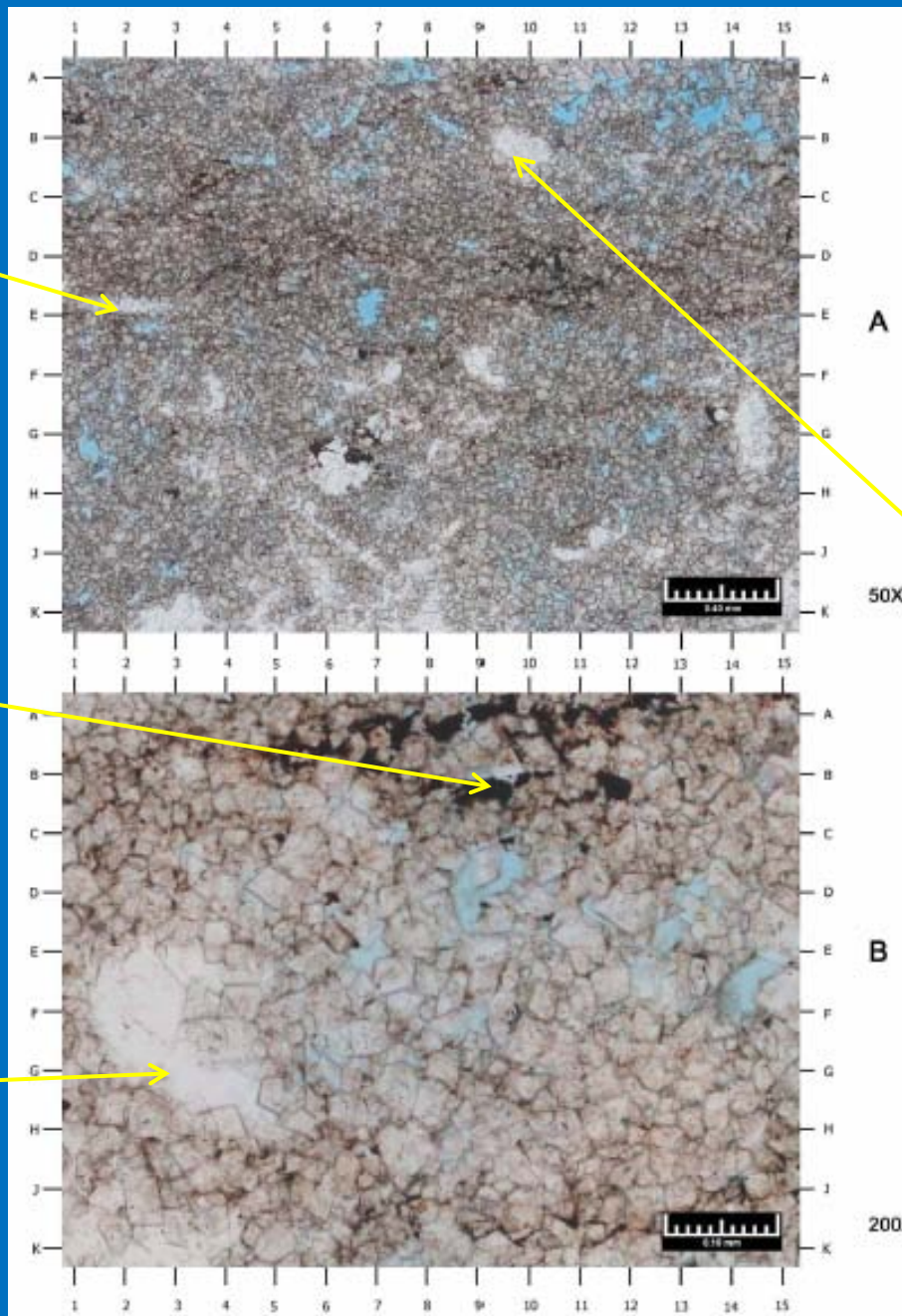
FUSULINID



BURROW

BITUMEN

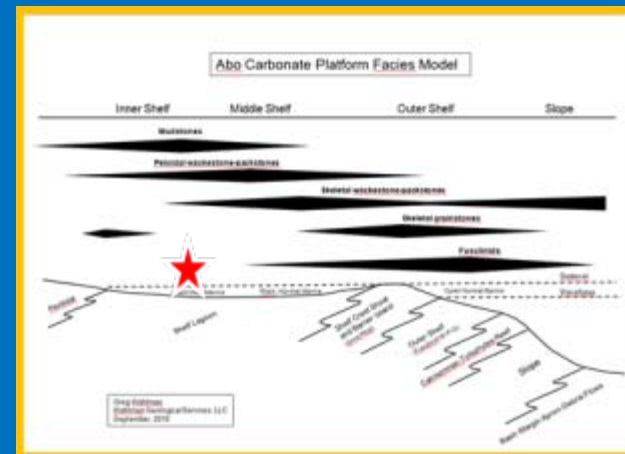
ANHYDRITE
FILLED
MOLD



FACIES 3

**ANHYDRITIC, PELOIDAL,
SKELETAL
DOLOWACKESTONE**

ANHYDRITE
FILLED
MOLDS

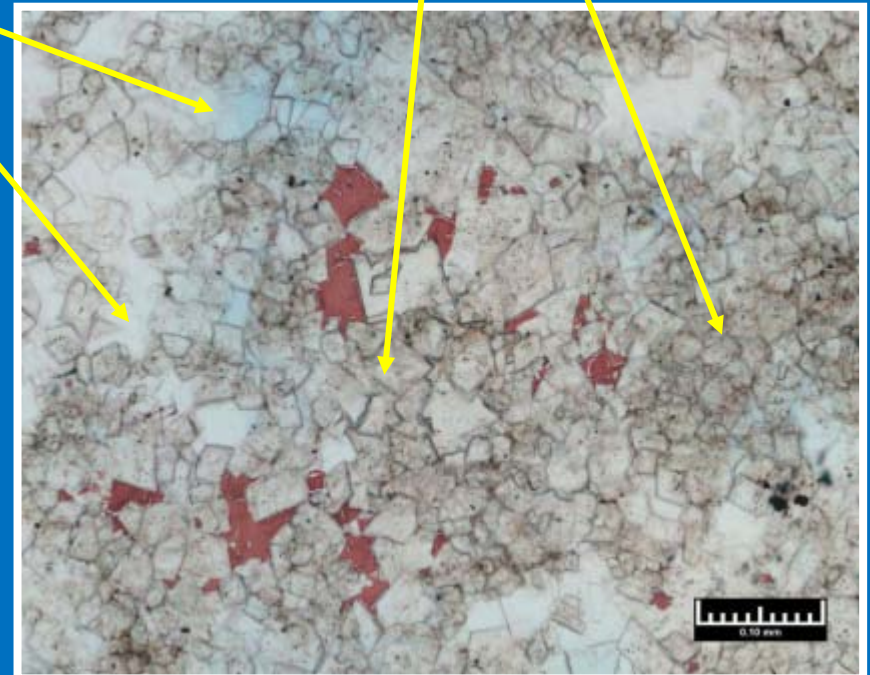
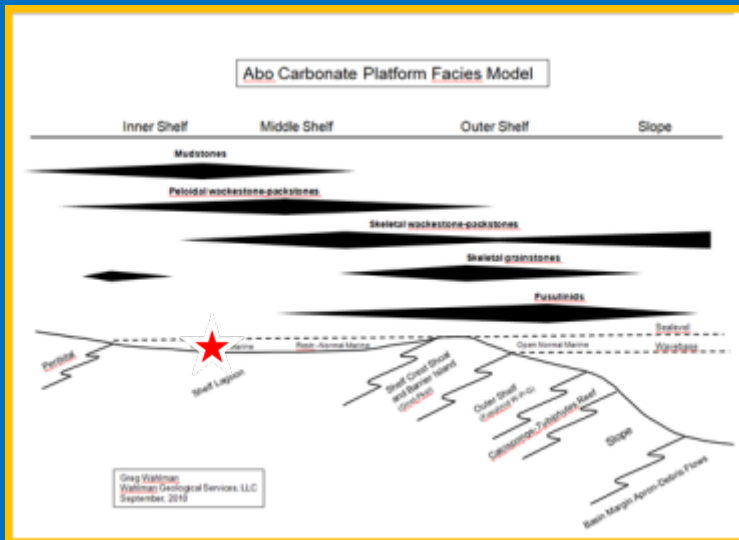


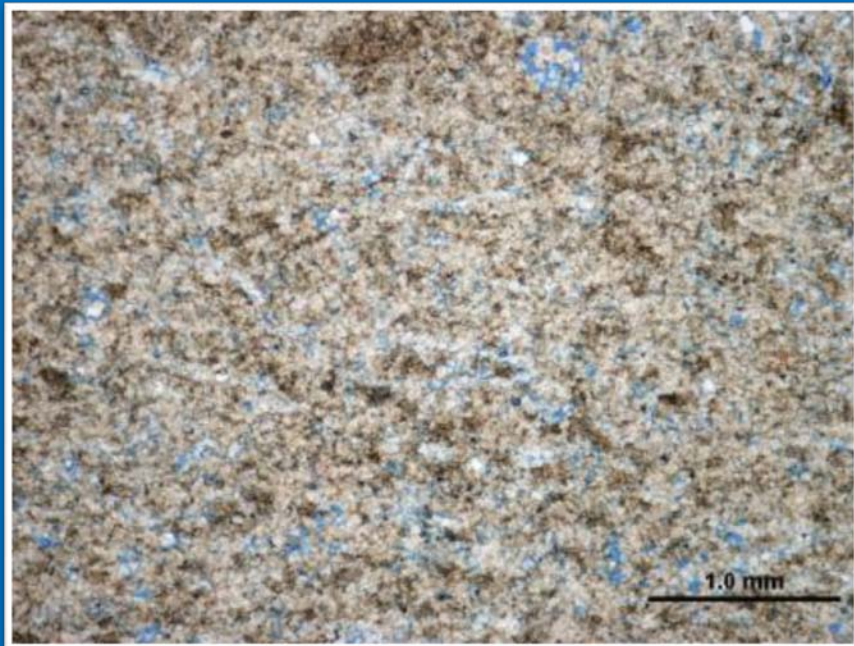
FACIES 4

FINE CRYSTALLINE DOLOMITE SHOWING GRAIN DISSOLUTION WITH SOME DOLOMITE INFILLING AND PORE OCCLUDING ANHYDRITE

PORE-FILLING ANHYDRITE
CEMENT

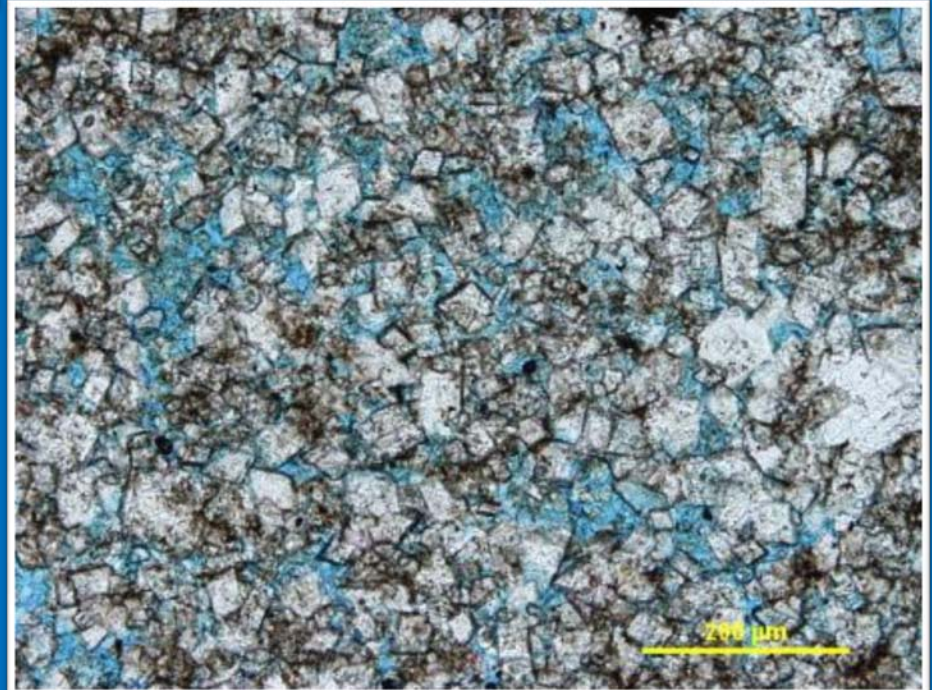
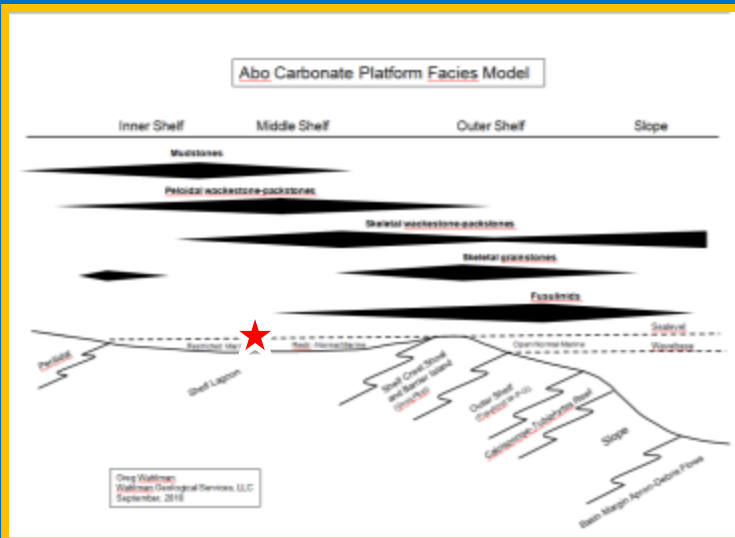
PORE FILLING
DOLOMITE CEMENT





FACIES 5

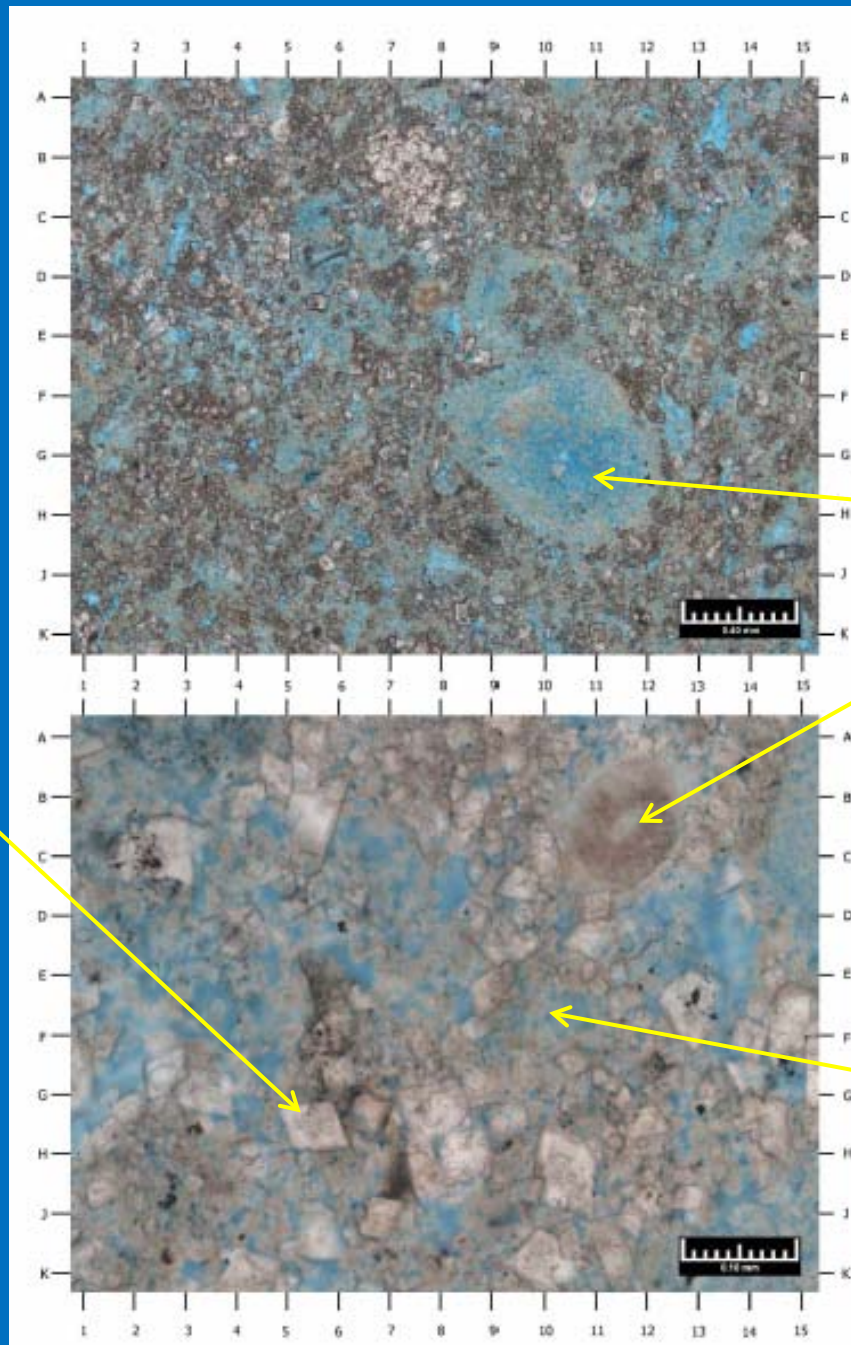
**V/FINE - FINE CRYSTALLINE DOLOMITE
WITH GOOD INTERCRYSTALLINE
POROSITY**



FACIES 6

**FINELY CRYSTALLINE, CHERTY,
PELOIDAL, SKELETAL
DOLOPACKSTONE
WITH CHERT AND DOLOMITE
REPLACED
SKELETAL FRAGMENTS**

DOLOMITE
RHOMB



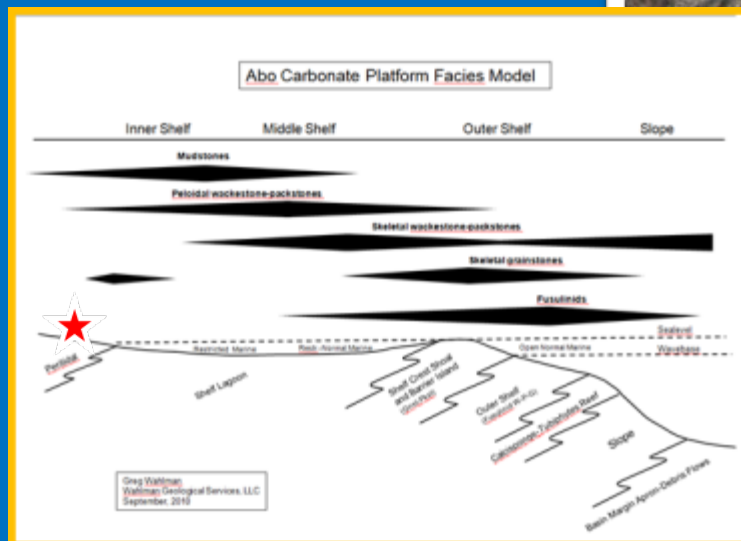
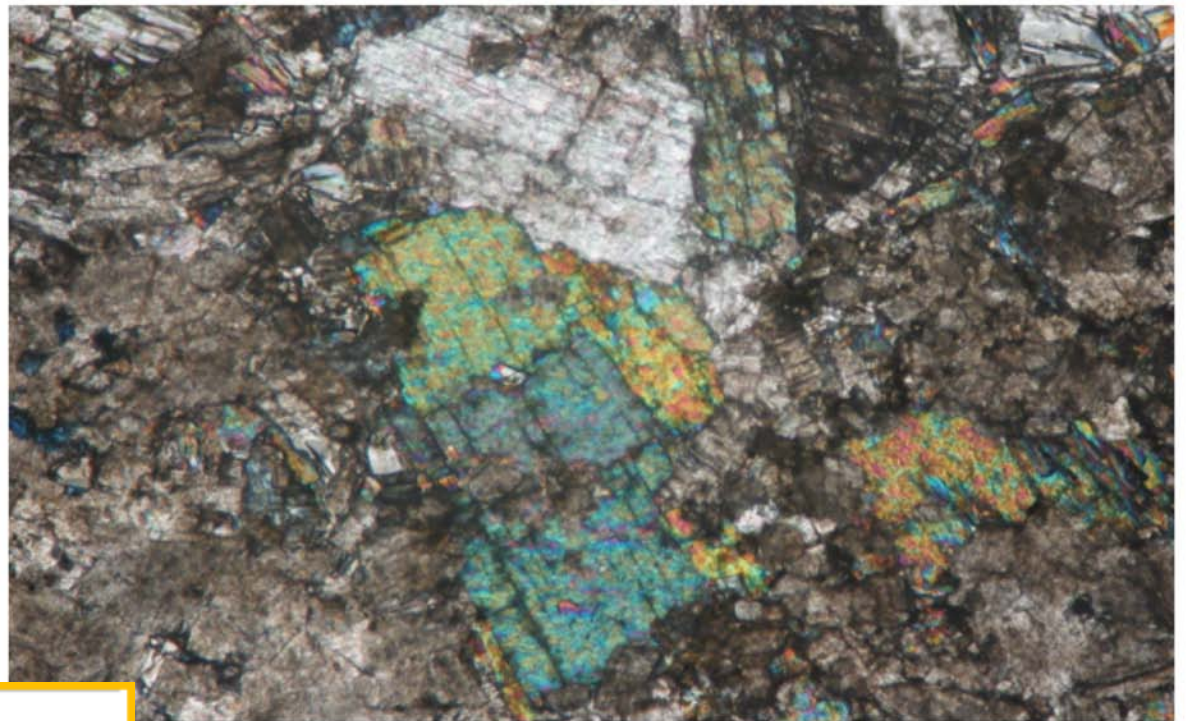
DISSOLVED
ECHINODERM
FRAGMENT

ECHINODERM
FRAGMENT

CHERT

FACIES 7

VERY SLIGHTLY
DOLOMITIC/
ANHYDRITE



THE LOWER ABO RESERVOIR

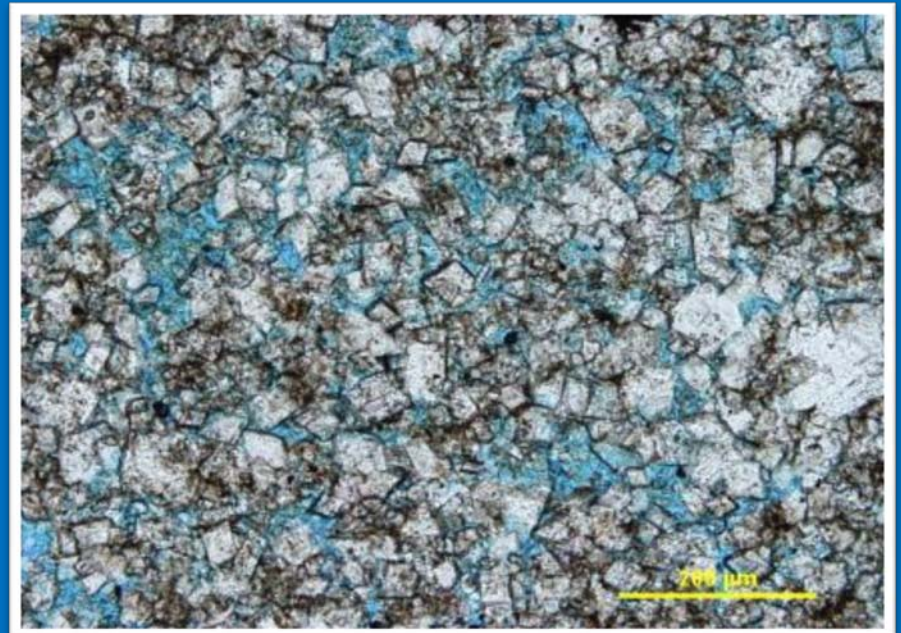
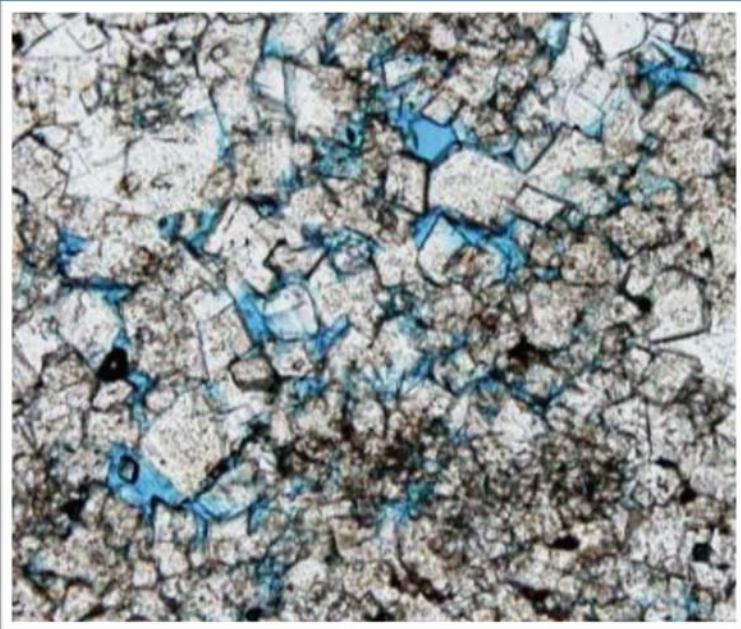
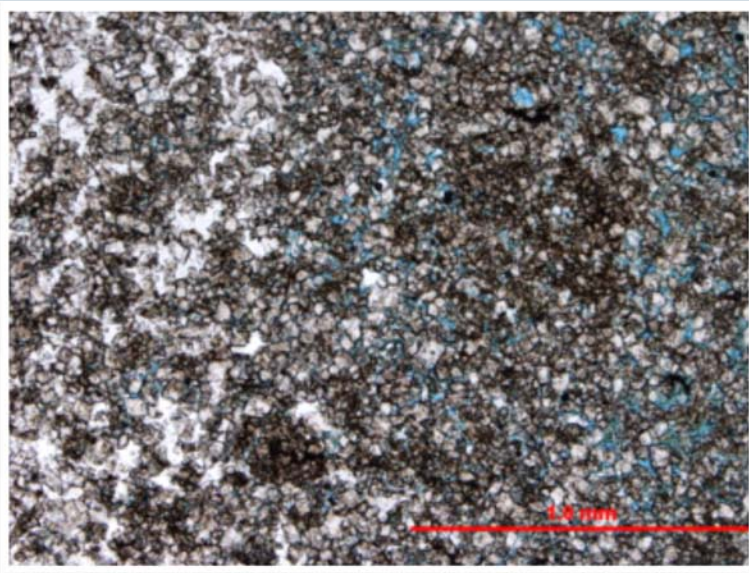
THE RESERVOIR ROCKS OF THE LOWER ABO ARE COMPOSED ALMOST EXCLUSIVELY OF DOLOMITE WHERE THE BEST POROSITY AND PERMEABILITY ARE FOUND.

MOST CORE ANALYSIS OF THE LIMESTONE LITHOLOGIES INDICATE THAT THESE UNITS, ALTHOUGH ON OCCASION MAY HAVE FAIR – GOOD POROSITY, USUALLY HAVE POOR – V/POOR PERMEABILITY. PRESENTLY ,THERE ARE ONLY 2 KNOWN LOWER ABO HORIZONTAL WELLS WHICH PRODUCE FROM OF A LIMESTONE RESERVOIR.

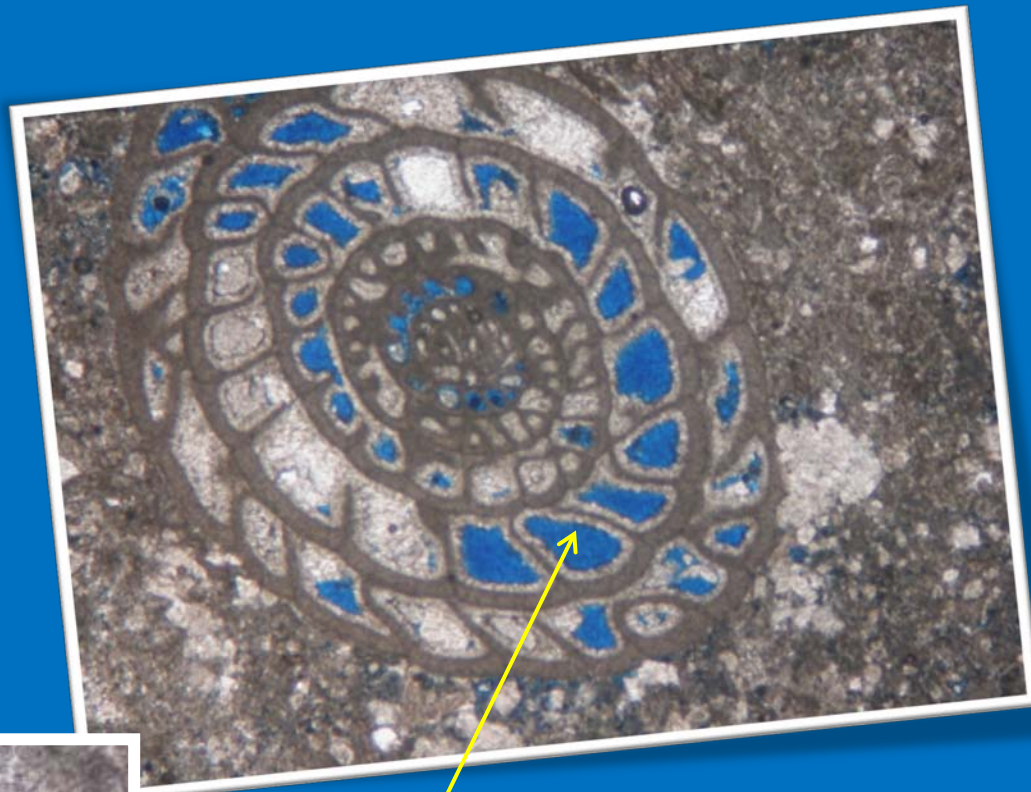
THE PRIMARY PORE TYPES FOUND IN THE LOWER ABO ARE: INTERCRYSTALLINE, MOLDIC, INTRAPARTICLE, INTERPARTICLE AND SOME SMALL VUGS.

THE BEST RESERVOIRS ARE FOUND IN FACIES 5 & 6 WHERE THE LOWER ABO HAS BEEN COMPLETELY DOLOMITIZED AND HAS GOOD INTERCRYSTALLINE POROSITY.

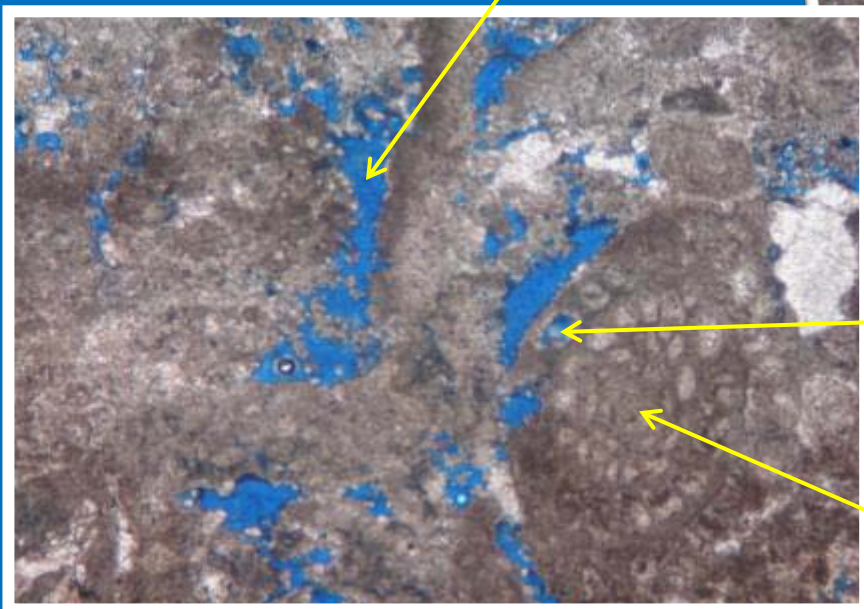
**INTERCRYSTALLINE
POROSITY
DEVELOPED IN THE LOWER
ABO DOLOMITE**



INTRAPARTICLE & INTERPARTICLE POROSITY DEVELOPED IN THE LOWER ABO



INTERPARTICLE
POROSITY



INTRAPARTICLE
POROSITY

FUSULINID

TRAP TYPES

LOWER ABO TRAPS ARE PRINCIPALLY STRATIGRAPHIC IN NATURE
CONSISTING OF:

PINCHOUTS OF INDIVIDUAL LENSES OF POROSITY &
PERMEABILITY.

PINCHOUT OF THE ENTIRE LOWER ABO PAY SECTION INTO
THE REGIONAL ANHYDRITE.

“ATTIC” POROSITY DEVELOPED AT THE UNCONFORMITY ON THE
TOP OF THE LOWER ABO.

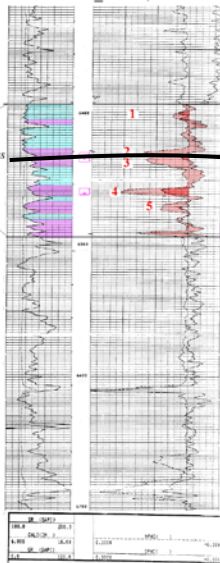
POROSITY PINCHOUT OF INDIVIDUAL PAY LENSES

D

D'

THREE SPAN OIL & GAS INC
CROW FLATS FED COM #1
30015233860000

T16S R28E S30
ELEV_KB : 3,565



Comp : 9/1980
Comp (Lo. Abo) 10/1990

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Curr : 3 BOPD + 5 MCFD

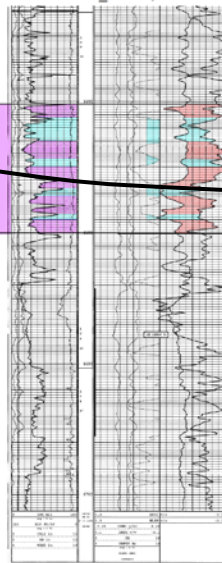
IP (Lower Abo) 6,429'-6,472'
F 20 MCFD + 38 BOPD
thru 48/64" CHK, FTP 10#

Perf 6,428'-6,436', 6,456'-6,461', Acidized W/
2000 Gals. 15% HCl.

* 21 years of production
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COG OPERATING LLC
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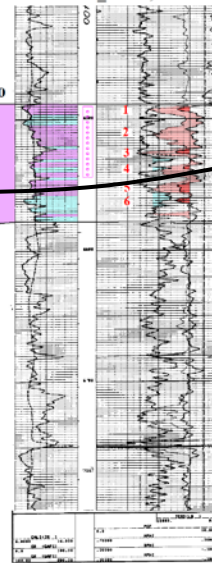
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157 BW

Curr : 28 MCFD + 13 BOPD

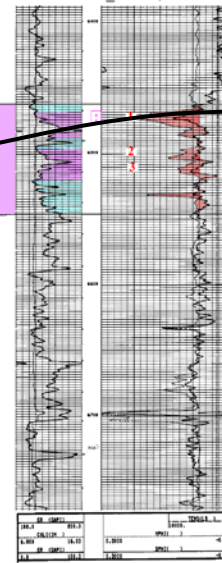
IP (Lower Abo) 6,490' - 6,544'
P 68 BOPD + 73 MCFD

Perf 6,490' - 6,544', Acidized W/ 4000 Gals. 20% NEFE

* 19 years of production
61 MBOE

EAGLE OIL & GAS COMPANY
CROW FLATS 'A' FED #1
30015235350000

T16S R28E S19
ELEV_KB : 3,605



Comp : 5/1981

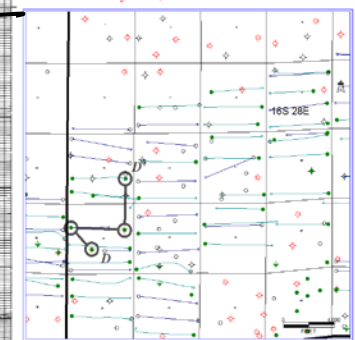
Lower Abo Cum : 20,933 BO + 0.002 BCF + 259 BW
P&A'd 4/1991 Ina 1/1991

IP (Lower Abo) 6,467' - 6,477', Acidized W/ 5000 Gals.
P 19 BOPD + 29 MCFD + 3 BWPD

Perf 6,467' - 6,477', Acidized W/5000 Gals.
Perf 6,650' - 6,652' SQZ'D W/ 180 SXs
CISP @ 6,325' W/ 35' CMT

* 10 years of production
21 MBOE

Eddy Co., New Mexico



Apache

Dog Canyon Area

LOWER ABO STRATIGRAPHIC

CROSS SECTION D-D'

Eddy Co., New Mexico

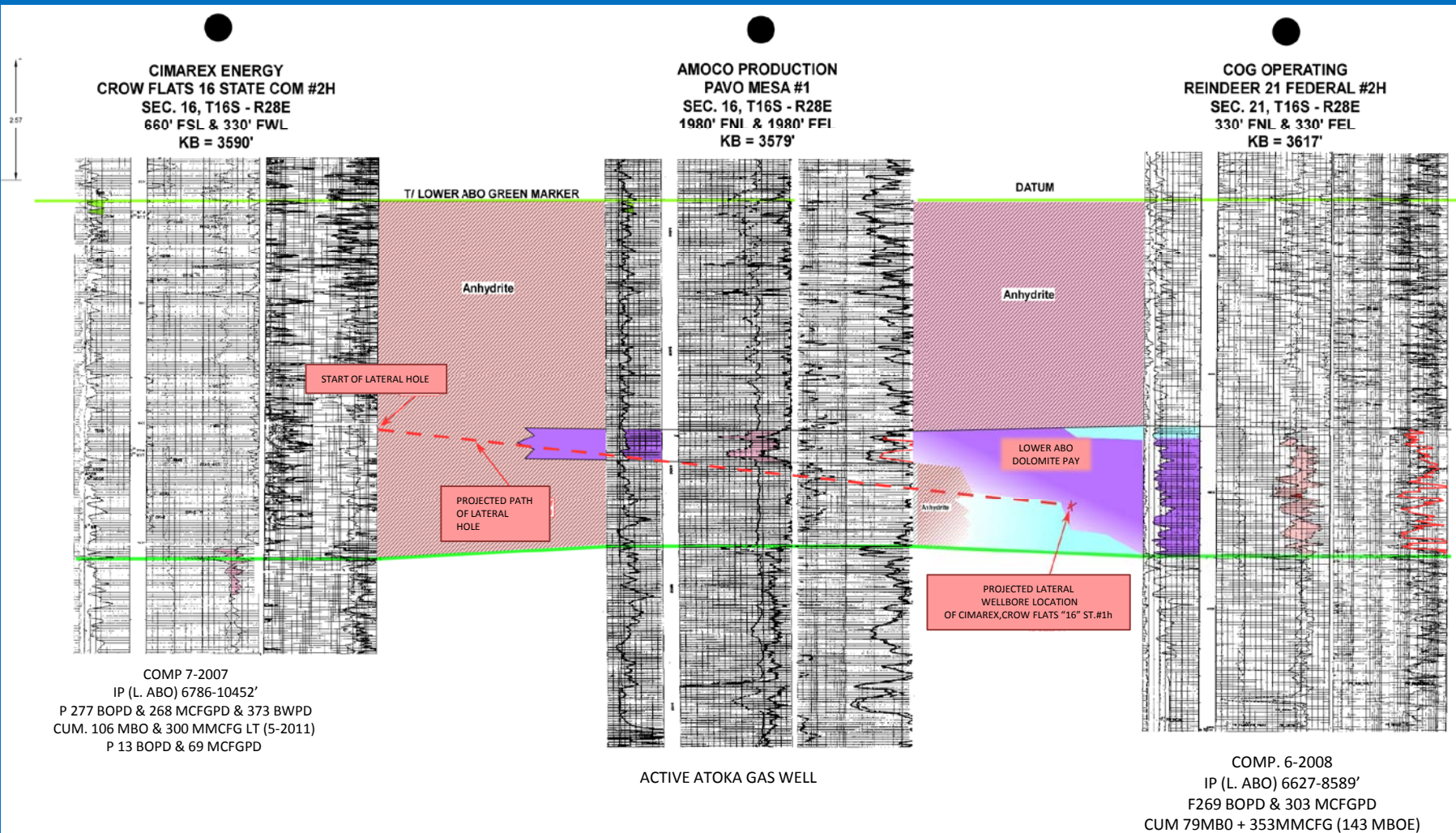
Horizontal Scale = 354.9

Vertical Scale = 40.0

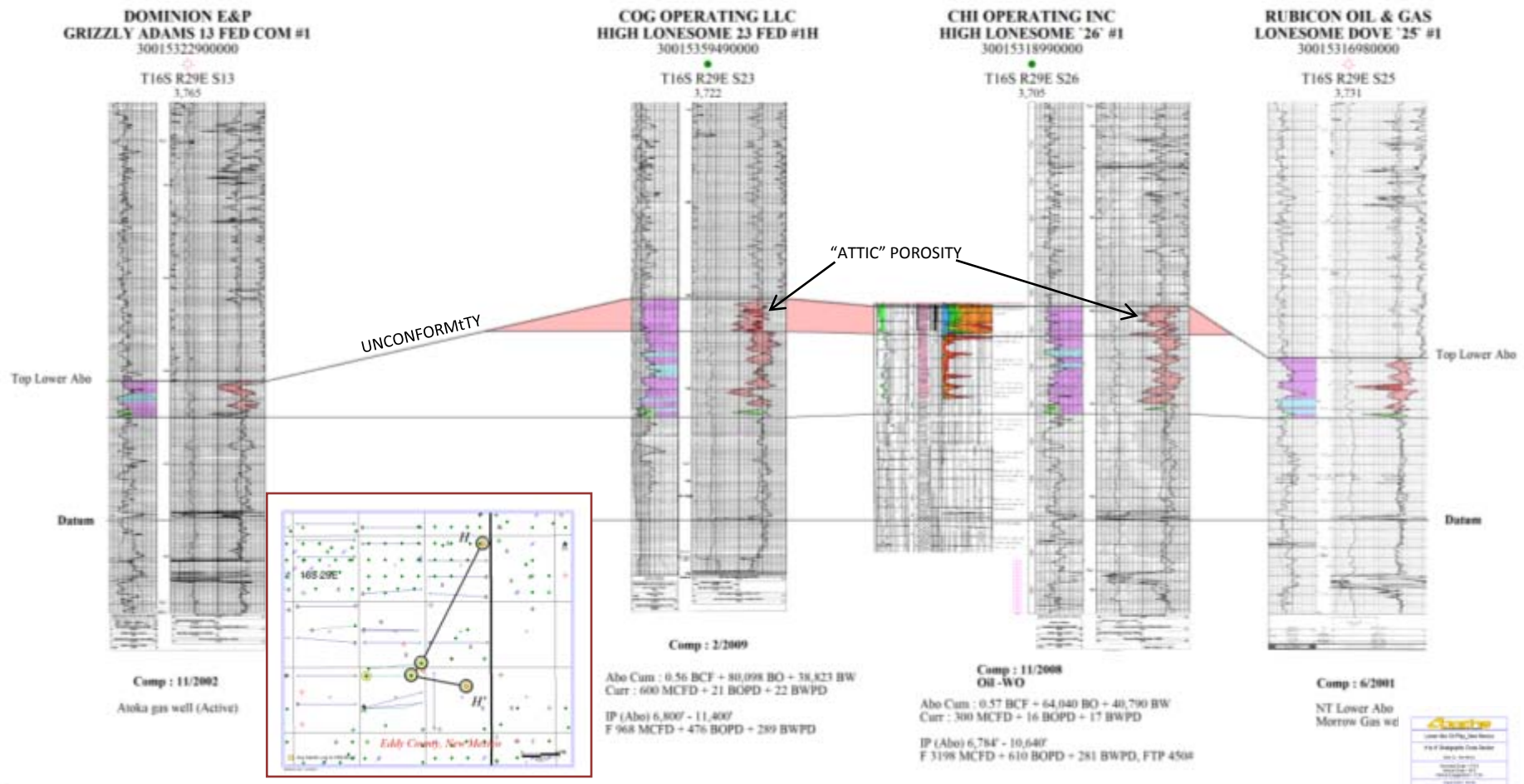
Vertical Exaggeration = 8.9x

August 22, 2011 8:56 AM

POROSITY PINCHOUT INTO MASSIVE ANHYDRITE



POROSITY PINCHOUT INTO UNCONFORMITY AT TOP OF LOWER ABO



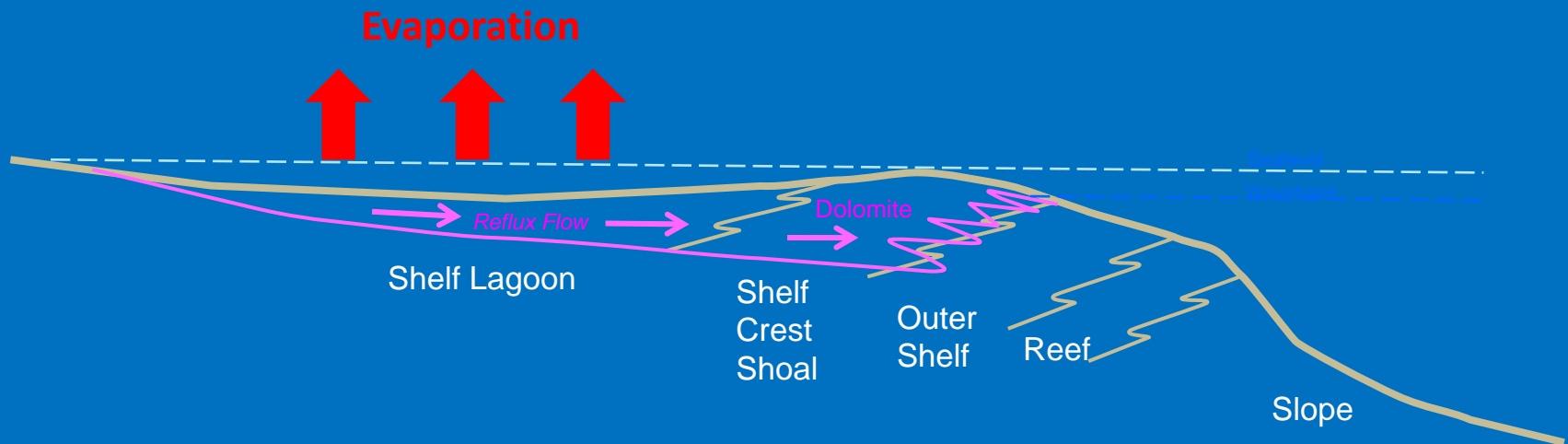
THE DIAGENETIC FOOTPRINT

THE LOWER ABO HAS UNDERGONE MANY PHASES OF DIAGENESIS;
SOME FOR THE BETTER AND SOME NOT. EITHER WAY IT HAS CREATED A
COMPLEX, MIXED-BAG OF LITHOLOGIES AND DISCONTINUOUS LENSES OF PAY

DIAGENETIC SEQUENCE OF EVENTS

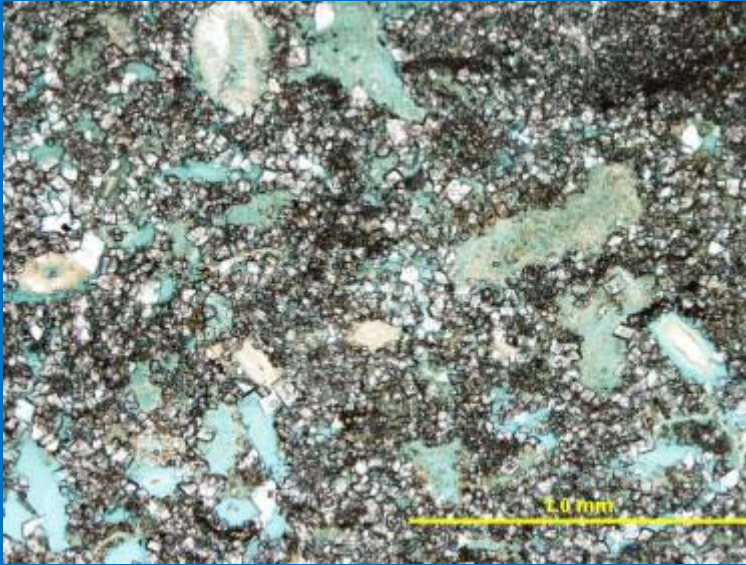
- DEPOSITION OF LOWER ABO SEDIMENTS
- EARLY COMPACTION
- EARLY DOLOMITIZATION
- DISSOLUTION OF SKELETAL FRAGMENTS
- PRECIPITATION OF CALCITE, ANHYDRITE AND SILICA (CHERT) CEMENTS
- SECONDARY DOLOMITE RECRYSTALLIZATION
- OIL MIGRATION

LOWER ABO FACIES AND REFLUX DOLOMITIZATION



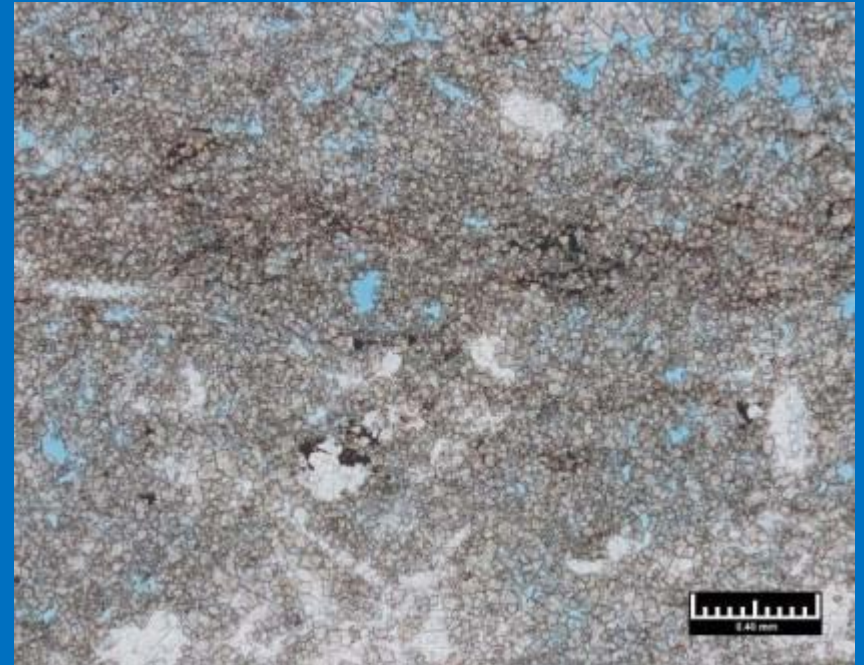
IN THE ARID-TROPICAL PALEOCLIMATE OF ABO TIME, PROTECTED SHELF LAGOON SEAWATERS EVAPORATED, AND THE RESULTANT HEAVY HYPERSALINE MG-SATURATED BRINES SANK INTO THE SEDIMENTS AND FLOWED DOWNSLOPE DOLOMITIZING THE PLATFORM LIMESTONES UNTIL THE MG WAS DEPLETED. IN THE LOWER ABO POROSITY UNIT, THE DOLOMITIZING FLUIDS APPARENTLY BECAME MOSTLY DEPLETED IN THE CRESTAL SHELF MARGIN SHOAL.

THE GOOD

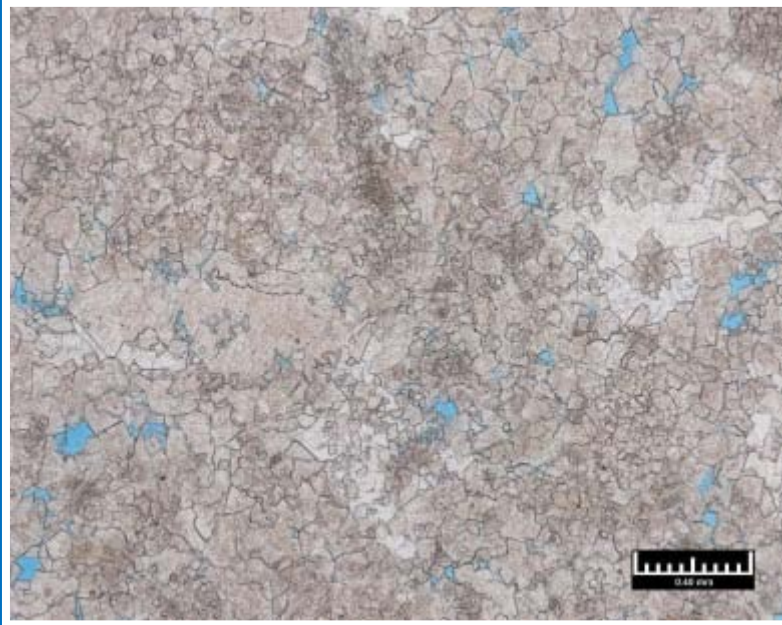


DOLOPACKSTONE WITH GOOD INTERCRYSTALLINE, MOLDIC AND INTERPARTICLE POROSITY

FINE V/FINE CRYSTALLINE DOLOMITE WITH GOOD MOLDIC AND INTRAPARTICLE POROSITY AND FAIR INTERCRYSTALLINE POROSITY. SOME OF THE SKELETAL MOLDS ARE FILLED WITH ANHYDRITE CEMENT

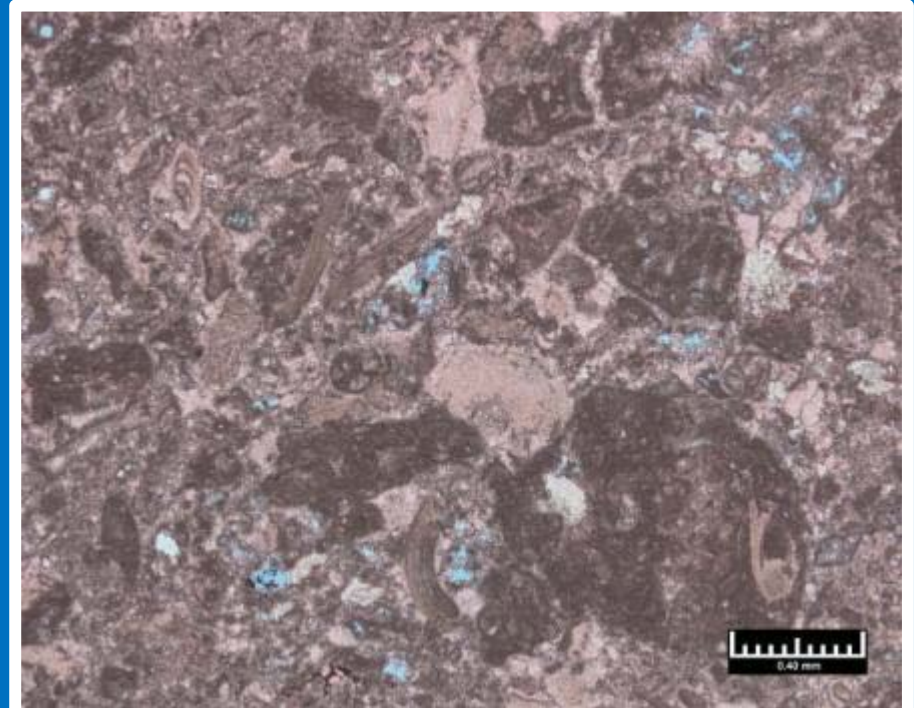


THE BAD

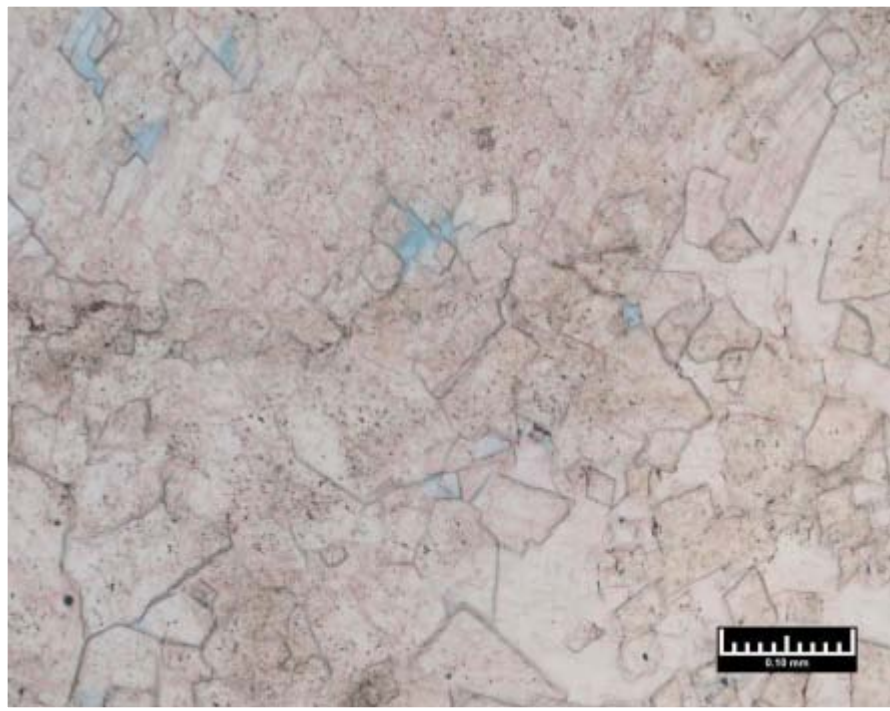


EXTENSIVE CEMENTATION
BY ANHYDRITE AND SECONDARY
DOLOMITE WITH SOME PRESERVED
MOLDIC AND INTRAPARTICLE POROSITY

DOLOMITIC SKELETAL LIME PACKSTONE
WITH ABUNDANT PORE FILLING CALCITE,
DOLOMITE AND ANHYDRITE

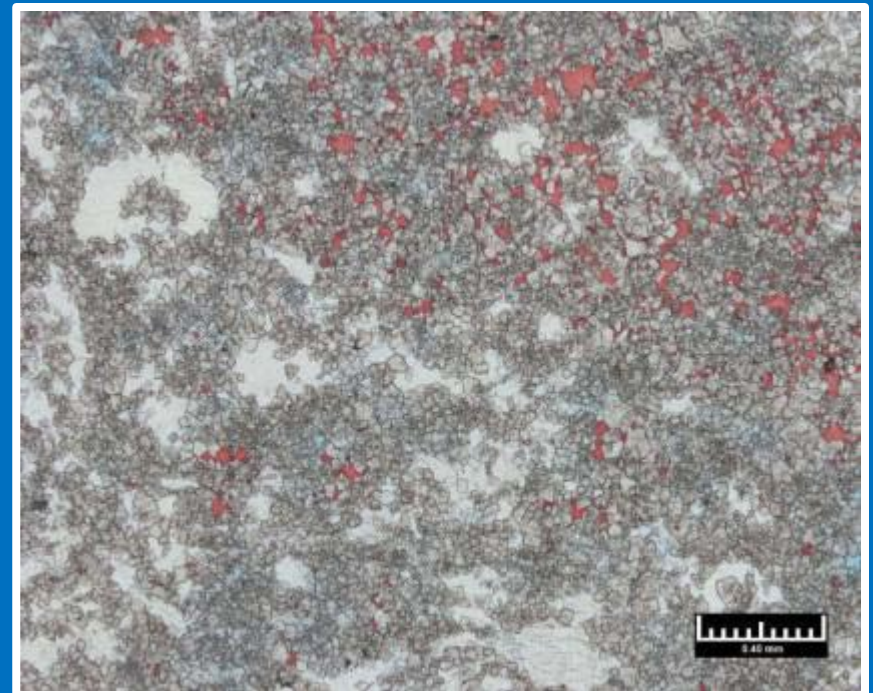


THE UGLY



ALMOST COMPLETE CEMENTATION
BY ANHYDRITE AND SECONDARY
DOLOMITE

ABUNDANT PORE-FILLING CALCITE (RED)
AND ANHYDRITE CEMENT



EXPLORING FOR THE LOWER ABO

IDENTIFY THE PAY INTERVAL AND LATERAL EXTENT OF THE PLAY.

DETERMINE PAY PARAMETERS (LITHOLOGY, POROSITY & PERMEABILITY)

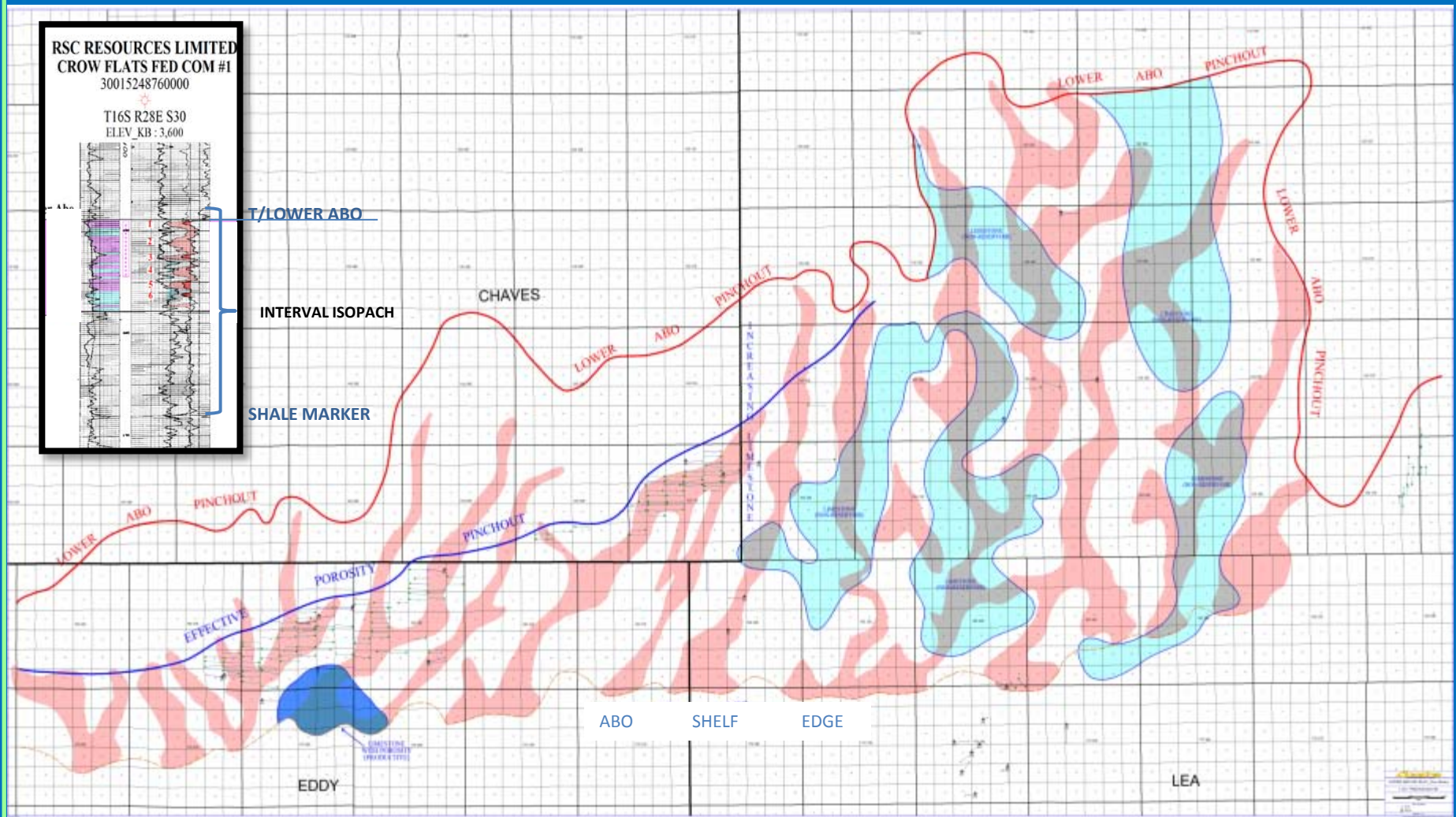
CONSTRUCT A REGIONAL GRID OF CROSS SECTIONS. STRATIGRAPHIC SECTIONS WORK BEST. HANG SECTIONS ON THE REGIONAL SHALE MARKER BELOW THE PAY INTERVAL. LOOK FOR POTENTIAL TRENDS & ANOMALIES.

LOOK FOR OLD VERTICAL WELLS WITH MUDLOG SHOWS AND DST'S WITHIN THE LOWER ABO PAY. DST RECOVERIES ARE USUALLY VERY LOW CONSISTING OF O&GCM. THE FACT THEY RAN A DST IS ENCOURAGING AND A DIRECT INDICATOR OF A HYDROCARBON MUDLOG SHOW.

BUILD A INTERVAL ISOPACH MAP OVER THE ENTIRE PLAY AREA AND ADD A LITHOLOGY OVERLAY. TARGET AREAS IN ISOPACH THICKS THAT LIE WITHIN YOUR DOLOMITE LITHOLOGY OUTLINE.

INCORPORATE AVAILABLE 3-D SEISMIC. MODEL THE RESERVOIR, CONSTRUCT A STRUCTURE & PERTINENT STRATIGRAPHIC ATTRIBUTE MAPS. ALSO USE TO HELP IN STEERING THE LATERAL HOLE.

SIMPLE WORKS BEST- THE INTERVAL ISOPACH AND FACIES MAP



INTERVAL ISOPACH THICKS (POTENTIAL PAY)

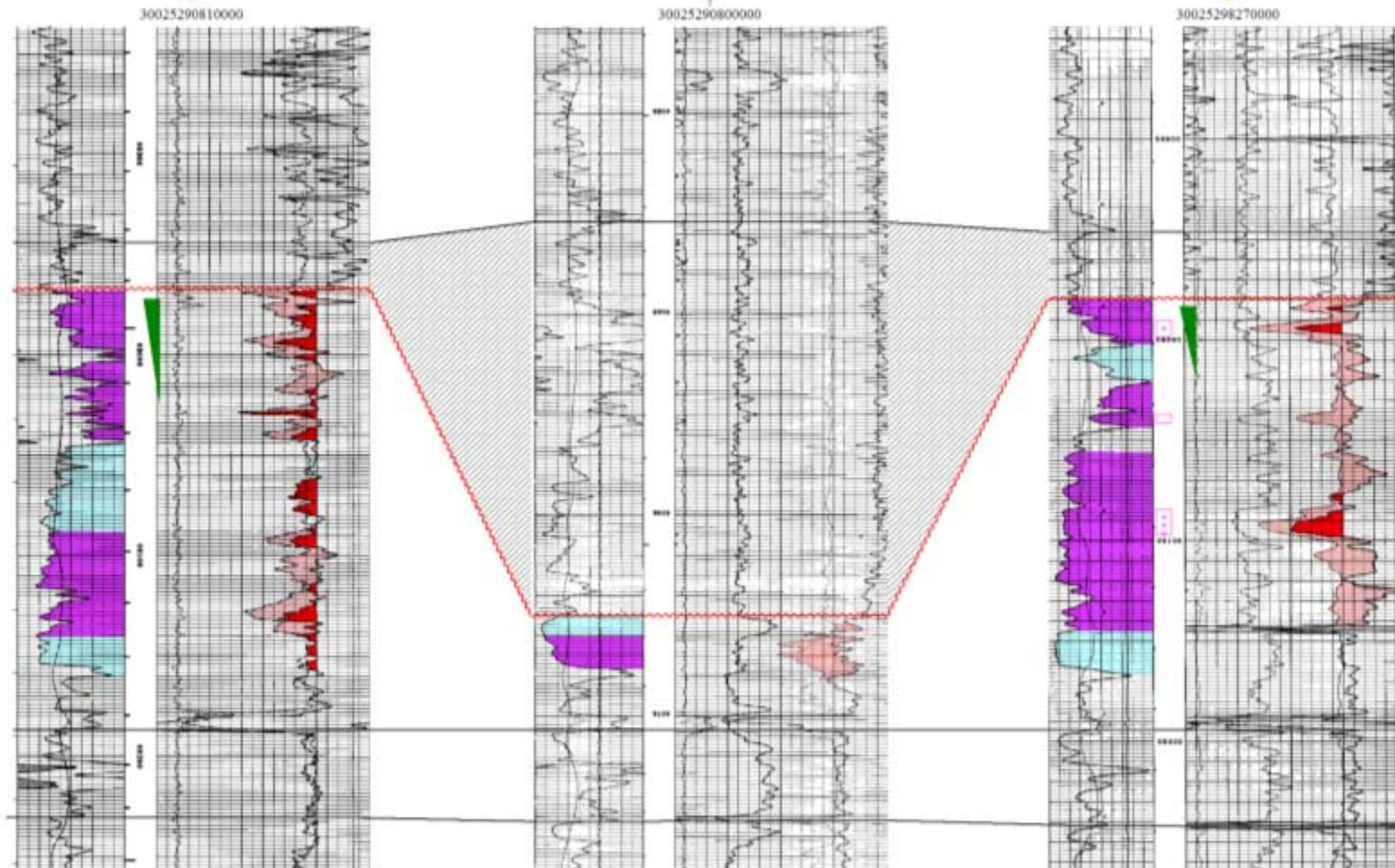


LOWER ABO LIMESTONE FACIES (NOT PRODUCTIVE)

YATES PETROLEUM CORP
 PYRO 'ABK' STATE #1
 T13S R33E S33
 660 FNL 1980 FEL

EXXON CORPORATION
 NEW MEXICO 'EN' STATE #1
 T13S R33E S21
 1980 FSL 660 FEL

YATES PETROLEUM CORP
 MESA 'AAF' STATE #1
 T13S R33E S28
 990 FSL 990 FWL



Comp : 5/85

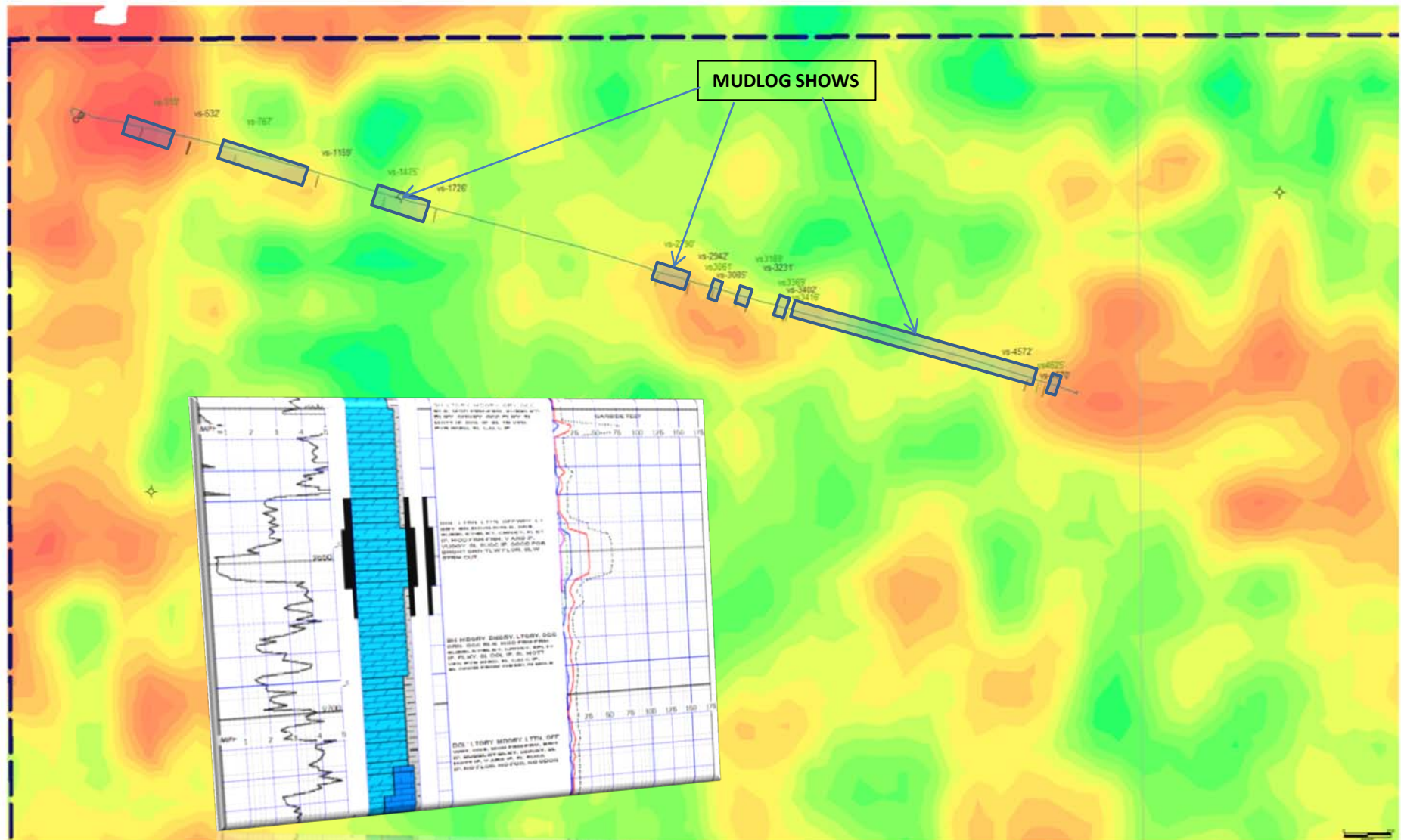
DST (L/Abo) 8972-9024
 Rec 300' DF
 ISIP 3328#
 FSIP 3148#
 INA 11/94

**Comp : 12/85 P&A
 NT L/Abo**

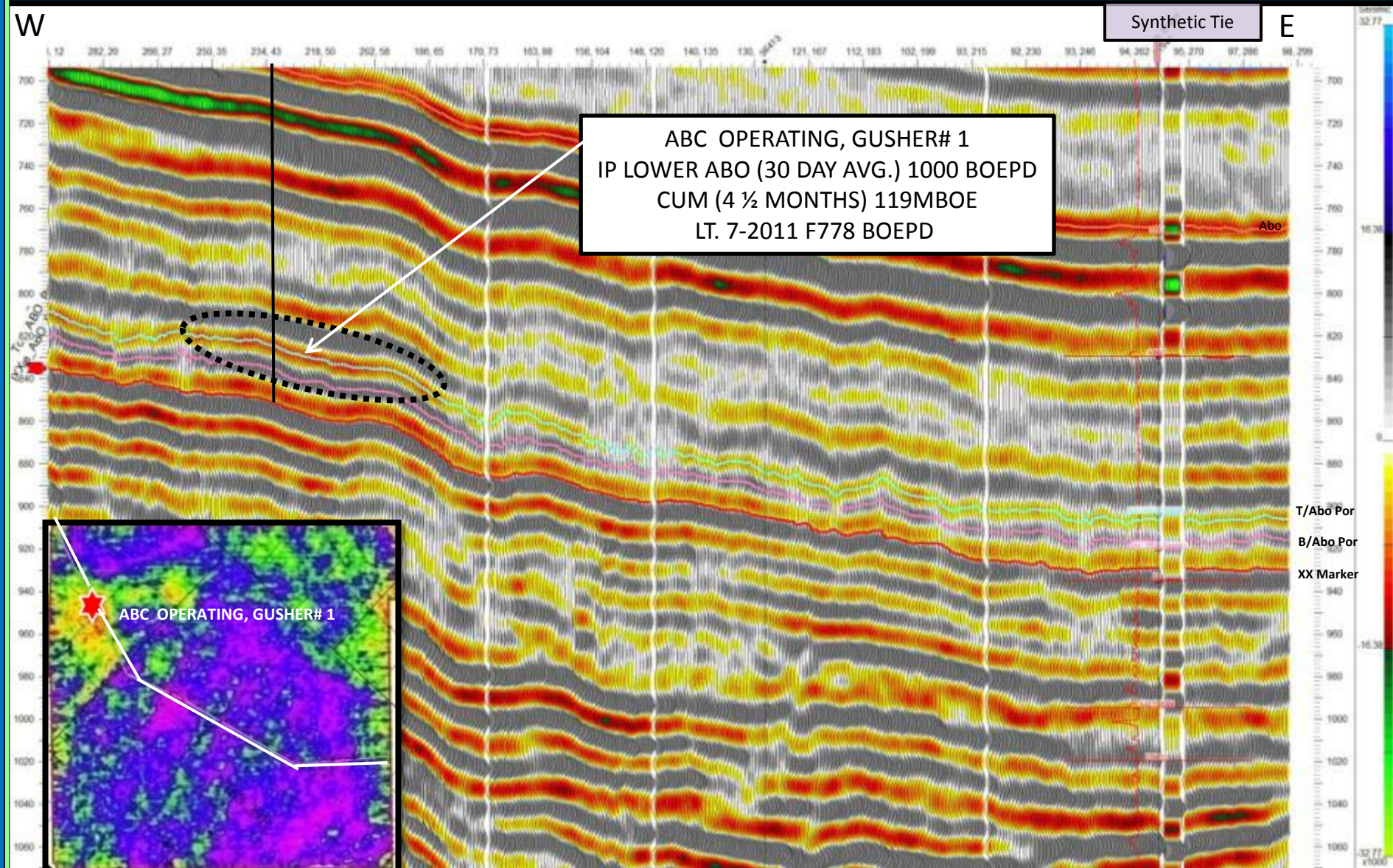
OWWO 3/06

IP (L/Abo) 8,990' - 9,097'
 P 89 BOPD + 96 BFPD, FTP 150#
 PERF 8,990'-8,998', 9,307'-9,041', 9,084-9,097',
 ACIDIZED W/7500 GALS. 15% HCL
 Cum (L/Abo)
 8 MBO + 15 MMCFG
 March 2011 OWWO comingled L/Abo perf's
 with Lower Wolfcamp & Penn perf's

AMPLITUDE VS MUDLOG SHOWS



3D: ARB LINE SHOWING AMPLITUDE RESPONSE IN THE LOWER ABO



CONCLUSION & OBSERVATIONS

IT TOOK A LOT OF
HARD WORK &
EFFORT TO
CONVINCE
MANAGEMENT TO
TAKE A
CHANCE ON THE
LOWER ABO PLAY.
IT WAS OUT OF THE
NORM TO DRILL
HORIZONTAL
WELLS IN A TIGHT
PLATFORM
CARBONATE AND
MAKE THEM WORK

SO, THE NEXT TIME
YOU'RE OUT THERE
HUNTING FOR THE NEXT
SHALE RESOURCE PLAY
DON'T FORGET TO LOOK A
LITTLE
CLOSER AT YOUR SECTION,
THERE MIGHT JUST BE
ANOTHER LOWER ABO
TYPE PLAY TO BE FOUND.

SPECIAL THANKS TO :

RUBY STRAHAN, JOHN POLASEK & KEITH McKAMEY, APACHE CORP.
RALPH WORTHINGTON & LEE CATALINO, CIMAREX & GREG WAHLMAN

