Weatherford LABORATORIES

Geochemical Services Group
143 Vision Park Blvd. Shenandoah, Texas 77384
Telephone: 281-681-2200 **Fax:** 281-681-0326

Client:
Attn: PK
Well Name: P. Smith No. 1

Vitrinite Reflectance Report

Weatherford Project: HH-47676

Introduction:

Two polished whole rock cuttings samples (6680-6690 and 6930-6940') are analyzed for vitrinite reflectance thermal maturity (%Ro), a very basic estimate of relative abundances of visual kerogen types and other kerogen characteristics. Maturity data indicate that these samples are in the early 'Dry gas window' zone (Table 1). Amorphous kerogen dominates over terrestrial kerogen in these samples.

Discussion:

The 2 Ro values are 1.41% and 1.48% respectively. Vitrinite is sparse in these samples and the desired 40 vitrinite particle readings per sample are not obtained in either sample. The upper sample has only 6 vitrinite reflectance readings and is therefore considered to be poor quality data. The deeper sample has 13 readings. Vitrinite reflectance data quality is considered to be fairly good overall.

Minor solid bitumen particles are noted in these samples. Their presence is a clue that liquid hydrocarbon generation has likely occurred in the past

Framboidal pyrite is common in both samples (Table 3). This may be indicative of marine influence. The sulfate reducing bacterial activity on organic matter in marine deposits reportedly can result in this type of pyrite. It is normally most common in hydrogen rich (reducing) marine source rocks. Pyritized hollow spines noted in the deeper sample may be from marine fossils.

Vitrinite and TAI values are generally divided into the following categories of thermal maturity:

Immature:	0.02% to 0.60%	TAI up to 2+ (2.3)
Oil window maturity:	0.60% to 1.10%	TAI 2+(2.3) up to 3+(3.3)
Condensate and /or wet-gas window:	1.10% to 1.40%	TAI 3+ (3.3)
Dry gas window:	1.40% to 3.0 or 4.0%	TAI 4-(3.7) and higher

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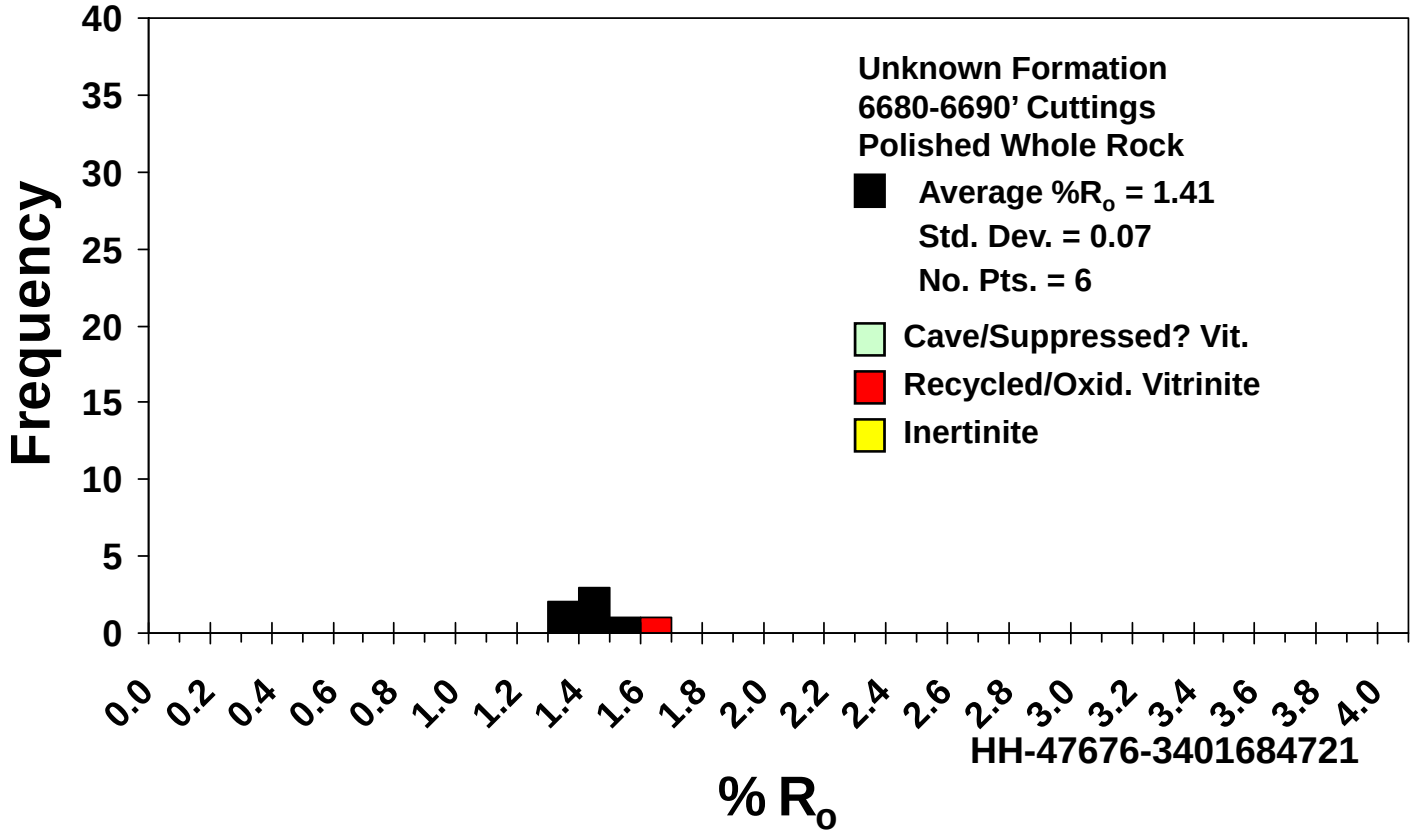

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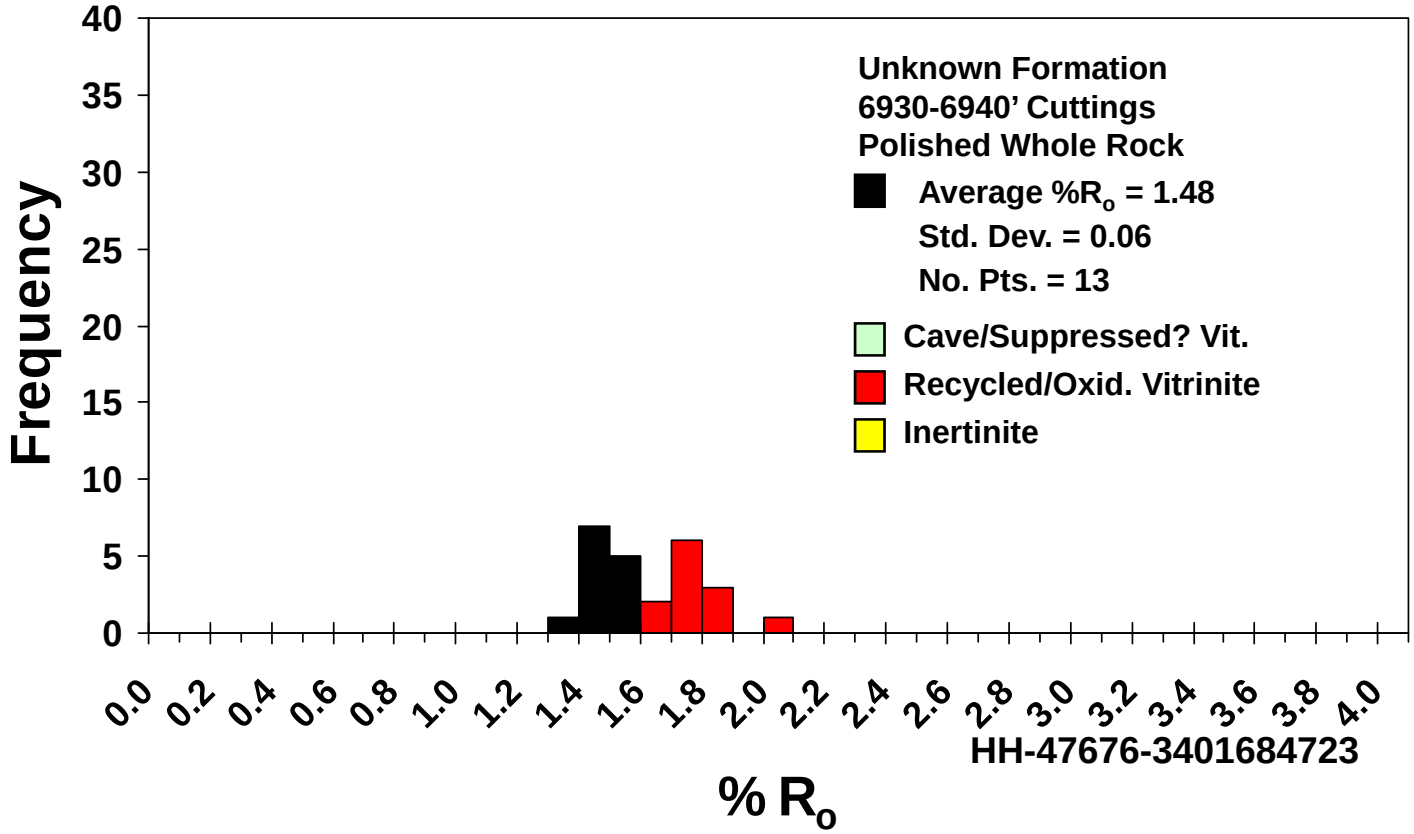

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Table 1
Dispersed Organic Matter Thermal Alteration, Kerogen Type and Total Compositional Analysis

									% Source Material							Preservation				Recovery			% Kerogen Comp.							Vitrinite				
WFT ID	Well Name	Client ID	Depth 1	Depth 2	Depth Units	Type	Color	TAI	Amorphous Debris	Finely Dissem. OM	Herb. Plant Debris (Vit.)	Woody Plant Debris	Coaly Fragments	Algal Debris	Palynomorphs	Good	Fair	Poor	Very poor	Good	Very Poor	Barren	Indigenous Vitrinite	Caved Vitrinite	Recycled/Oxidized Vitrinite	Inertinite	Solid Bitumen	Drilling Additive/Contamination	Amorphous Kerogen	# of Readings	Total Sample Ro (%)	# of Indigeonus Readings	Indigenous Ro (%)	*Comments*
3401684721	P. Smith No.1	1	6680	6690	ft	Cutting			99		1					X							1		tr	tr	tr		99	7	1.45	6	1.41	sparse organics
3401684723	P. Smith No.1	2	6930	6940	ft	Cutting			98		2					X							1		1	tr	2		96	25	1.63	13	1.48	pyritized hollow spines

tr = trace

TAI Scale: 1=Unaltered
1+ or 1.5
2=Slight alteration
2+ or 2.5
3=Moderate alteration
3+ or 3.5
4=Strong alteration
4+ or 4.5
5=Severe alteration

Color Abbreviations:

GLY	Green-Light Yellow	B	Brown
Y	Yellow	DBDG	Dark Brown-Dark Gray
YO	Yellow-Orange	DGBL	Dark Gray-Black
OB	Orange-Brown	BLK	Black
LB	Light Brown		

Table 3. Pyrite types and abundance in kerogen

1 = very rare
2 = rare
3 = common
4 = abundant
5 = very abundant

WFT ID	Well Name	Client ID	Depth 1	Depth 2	Depth Units	Type	Pyrite types		
							Finely Disseminated	Euhedral	Framboidal
3401684721	P. Smith No.1	1	6680	6690	ft	Cutting	3	4	3
3401684723	P. Smith No.1	2	6930	6940	ft	Cutting	3	4	3

Table 4. Individual Reflectance Readings

Sample ID	3401684721		3401684723	
Client ID	P. Smith No.1		P. Smith No.1	
Well Name	P. Smith No.1		P. Smith No.1	
Top Depth	6680		6930	
	All Data	Indigenous Data	All Data	Indigenous Data
	1.31	1.31	1.39	1.39
	1.36	1.36	1.41	1.41
	1.4	1.4	1.41	1.41
	1.41	1.41	1.44	1.44
	1.43	1.43	1.45	1.45
	1.52	1.52	1.48	1.48
	1.69		1.49	1.49
			1.49	1.49
			1.52	1.52
			1.54	1.54
			1.55	1.55
			1.56	1.56
			1.57	1.57
			1.66	
			1.67	
			1.71	
			1.74	
			1.75	
			1.77	
			1.77	
			1.79	
			1.8	
			1.87	
			1.89	
			2	
Average $\%R_o$	1.45	1.41	1.63	1.48
Standard Dev.		0.07		0.06
# of Points	7	6	25	13

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TOTAL ORGANIC CARBON, PROGRAMMED PYROLYSIS DATA

Well Name : P. SMITH NO.1	Operator :	State :	Weatherford Labs Project
	API # :	County :	HH-47676 / HH-47676

Client ID	Depth (ft)			Formation	Sample Type	Sample Prep	*	TOC	SRA			Tmax (°C)	Calc % Ro	Meas. % Ro	HI	OI	S2/S3	S1/TOC *100	PI	Notes		Lab ID
	Top	Bottom	Median						S1	S2	S3									Checks	Pyrogram	
1	6680	6690	6685		Cutting	NOPR		0.33	0.10	0.34	0.07	463	1.174	1.41	103	21	5	30	0.23	SRA TOC	hts2p:lts2sh	3401684721
2	6930	6940	6935		Cutting	NOPR		1.67	0.57	1.75	0.21	468	1.264	1.48	105	13	8	34	0.25	SRA TOC	h:lts2sh	3401684723

Notes:

"-1" – not measured or invalid value for T_{max}
TOC - Total Organic Carbon, wt. %
S1 - volatile hydrocarbon (HC) content, mg HC/ g rock
S2 - remaining HC generative potential, mg HC/ g rock
S3 - carbon dioxide content, mg CO_2 / g rock

* - comments regarding contamination
** - low S2, Tmax is unreliable
Meas. %Ro - measured vitrinite reflectance
HI - Hydrogen index = S2 x 100 / TOC, mg HC/ g TOC
OI - Oxygen Index = S3 x 100 / TOC, mg CO_2/ g TOC
PI - Production Index = S1 / (S1+S2)

Pyrogram:
f - flat S2 peak
n - normal
ltS2sh - low temperature S2 shoulder
ltS2p - low temperature S2 peak
htS2p - high temperature S2 peak

SRA - Programmed pyrolysis on SRA instrument
RE - Programmed pyrolysis on Rock-Eval instrument
EXT - Extracted Rock
NOPR - Normal Preparation

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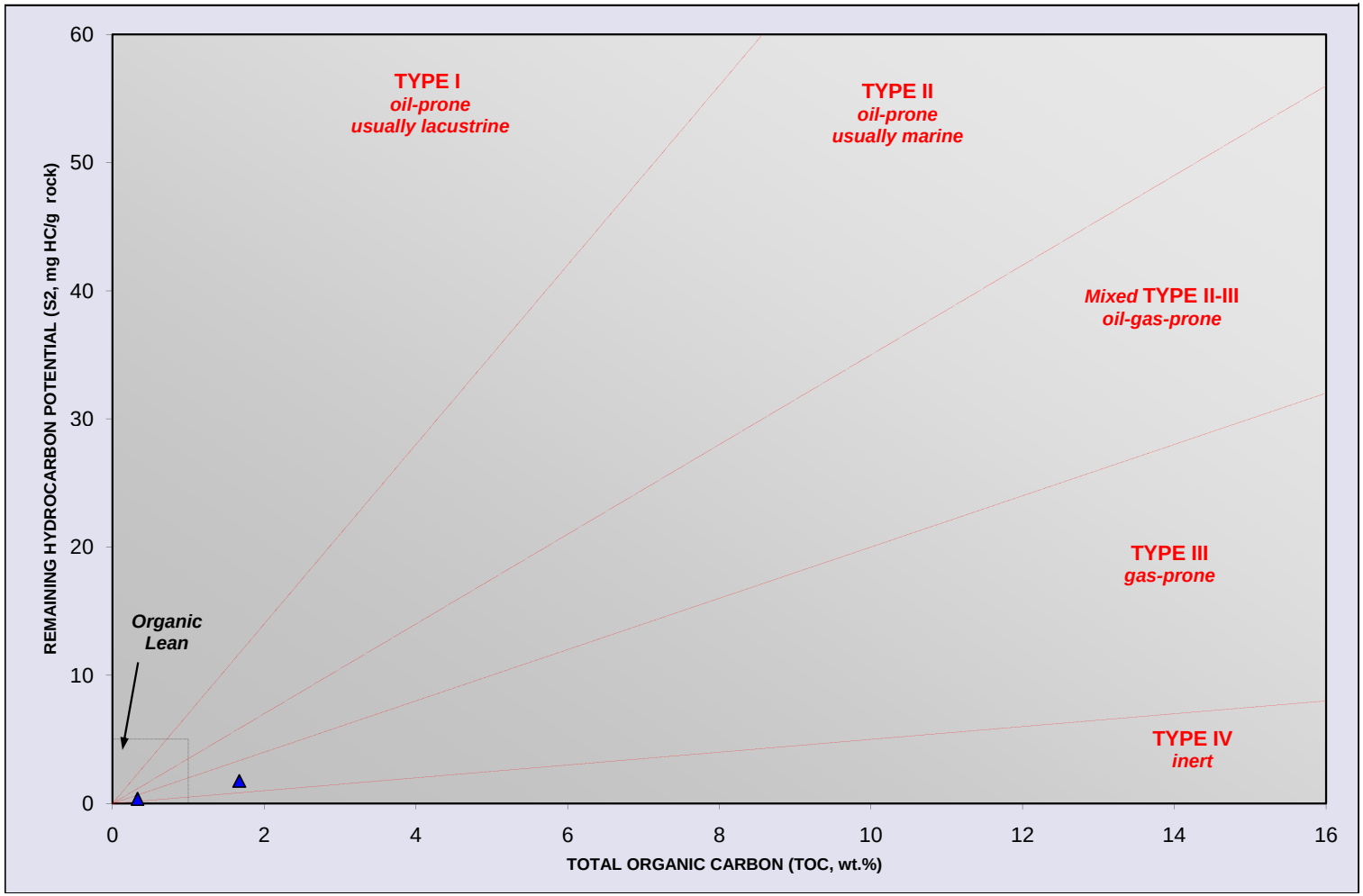
KEROGEN QUALITY PLOT - P. SMITH NO.1

Company: **Project #: HH-47676 / HH-47676**



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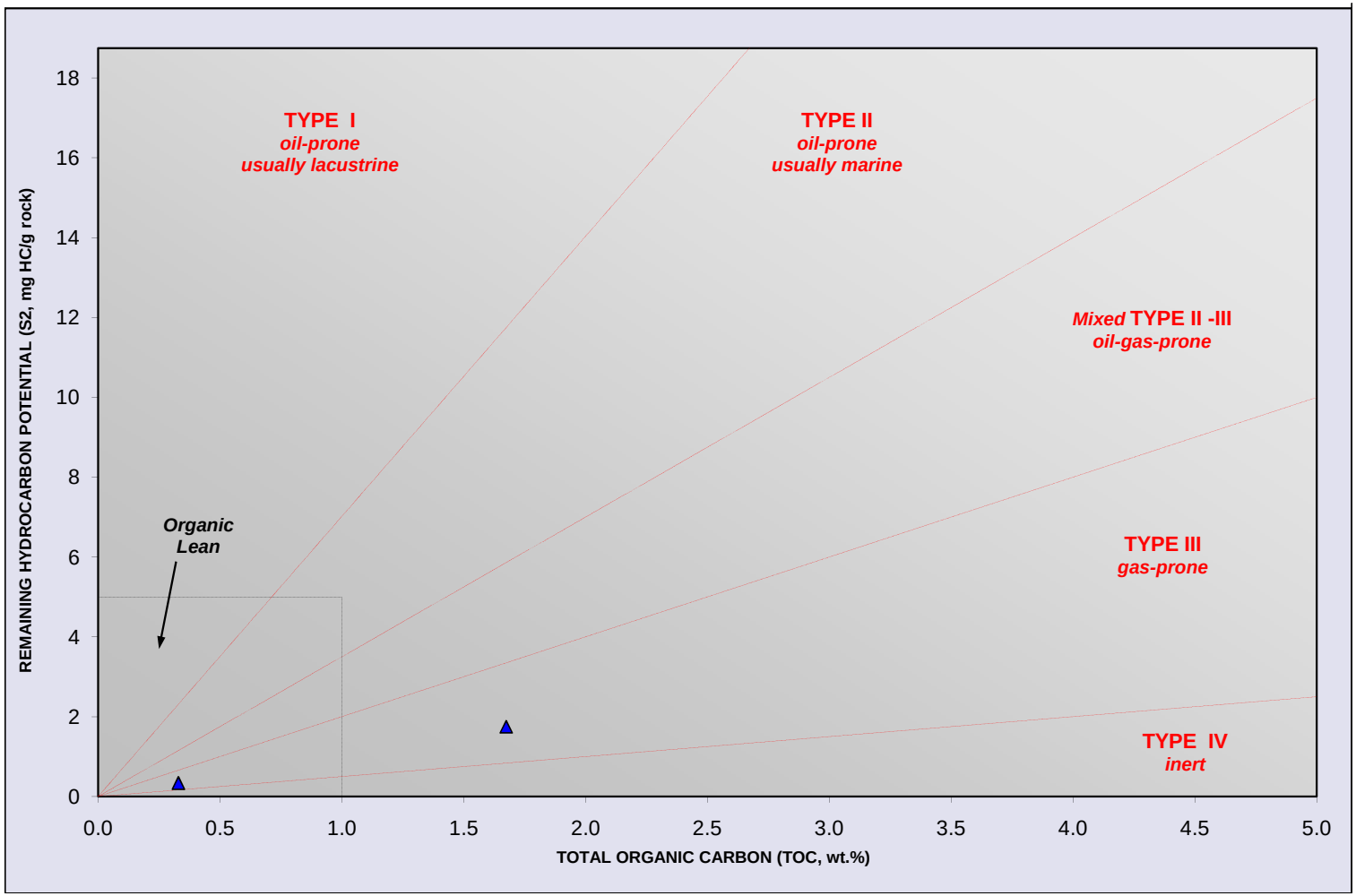

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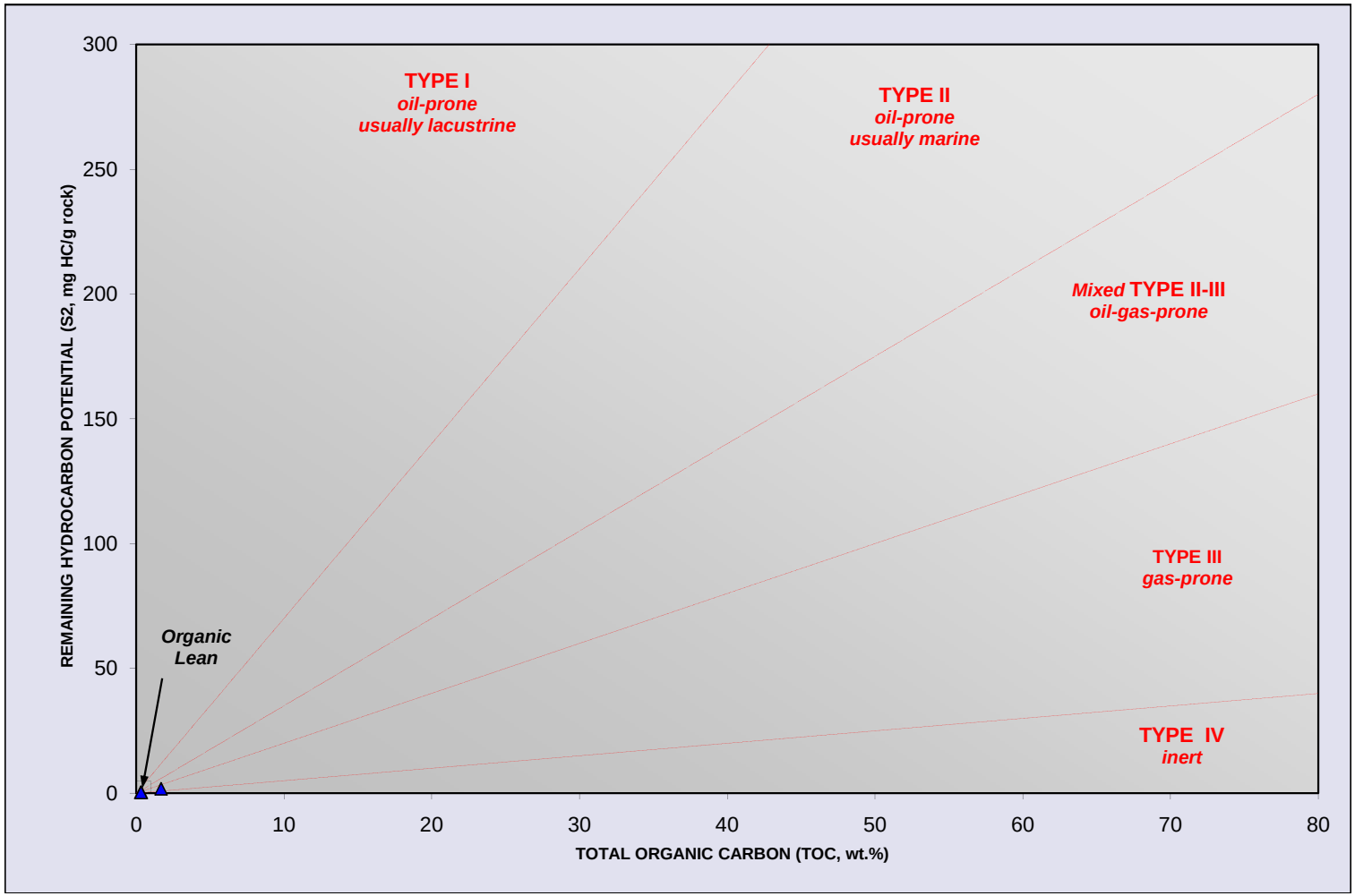

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KEROGEN TYPE - P. SMITH NO.1

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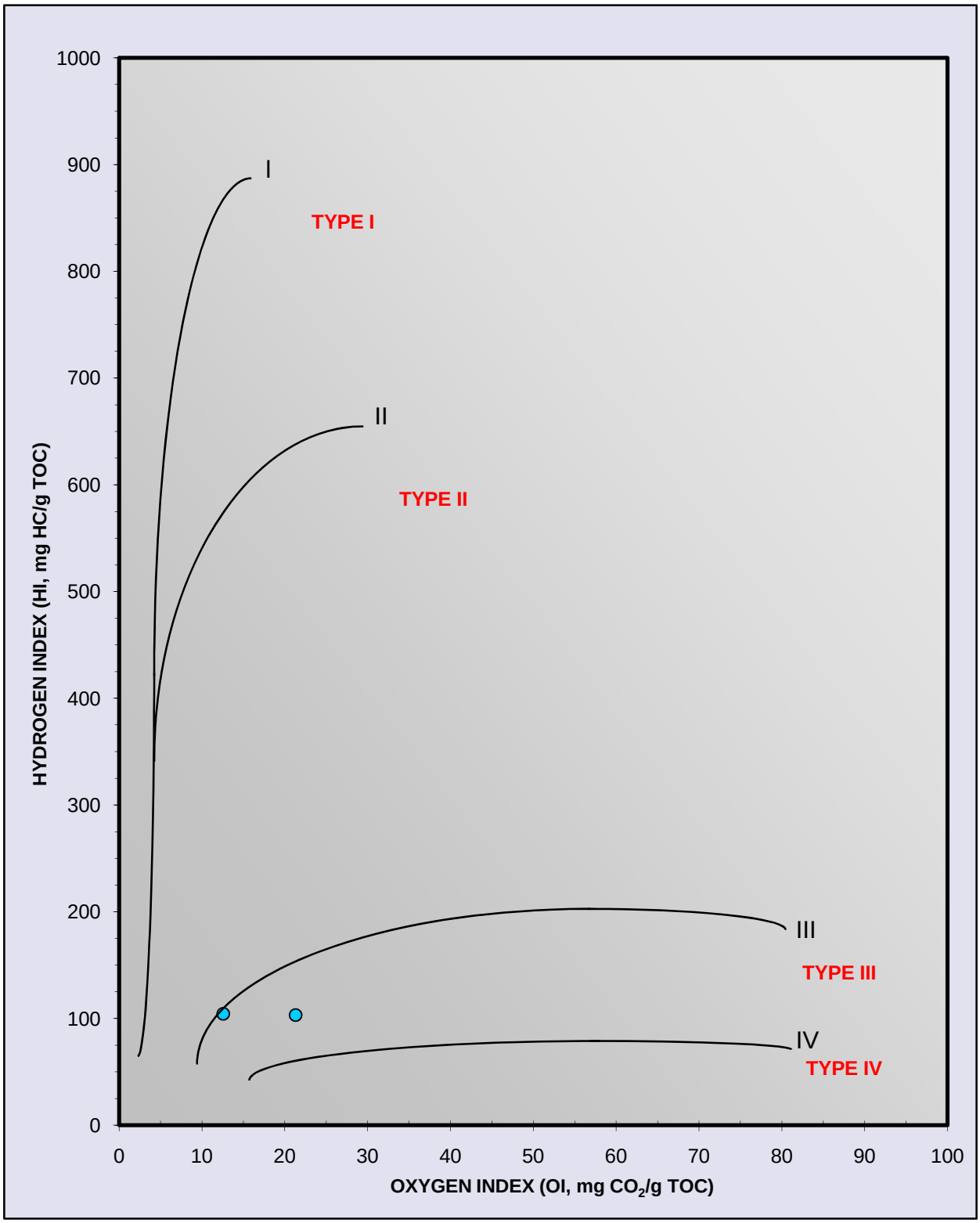

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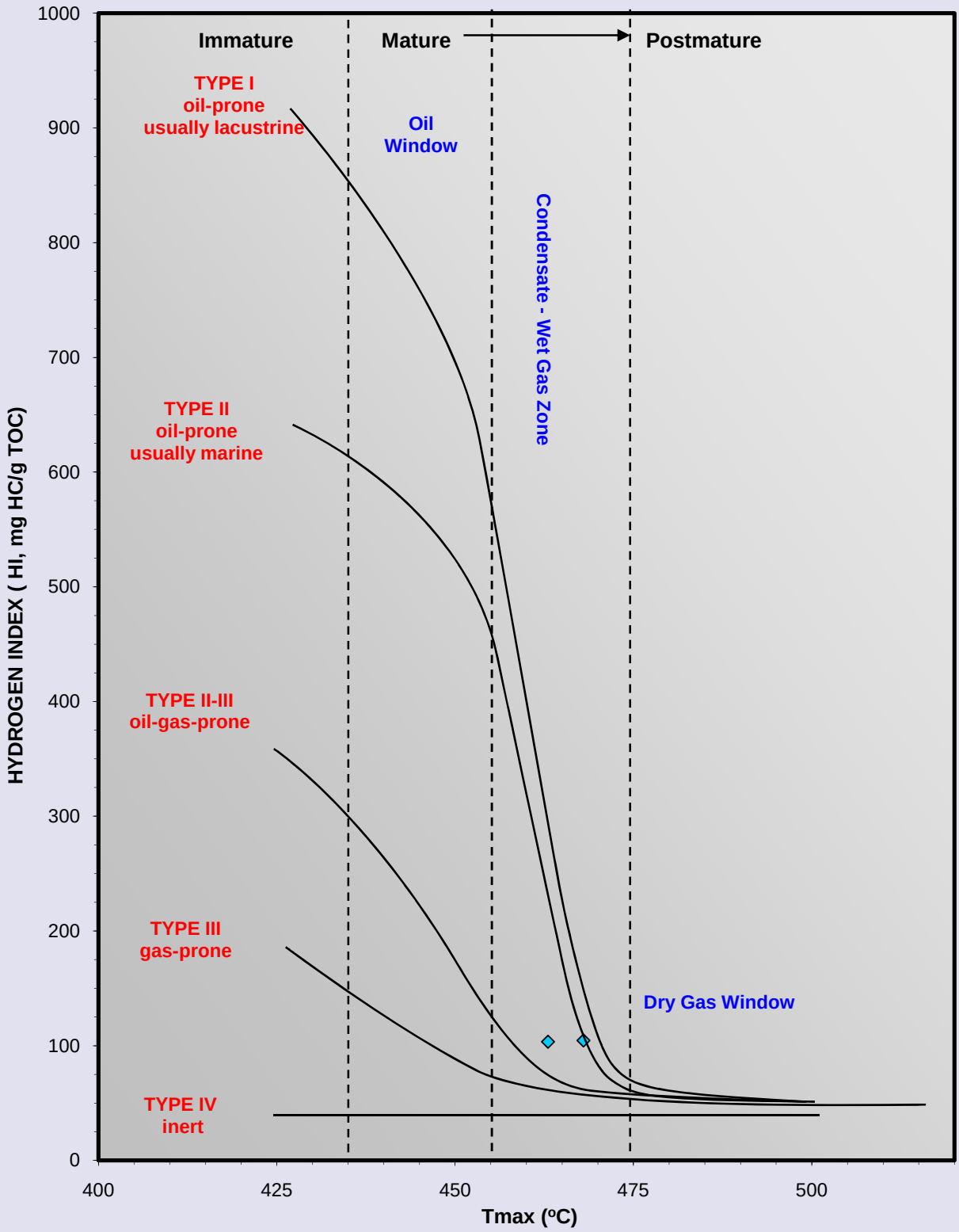
KEROGEN TYPE AND MATURITY (Tmax) - P. SMITH NO.1

Company: **Project #: HH-47676 / HH-47676**



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KEROGEN TYPE AND MATURITY (%Ro) - P. SMITH NO.1

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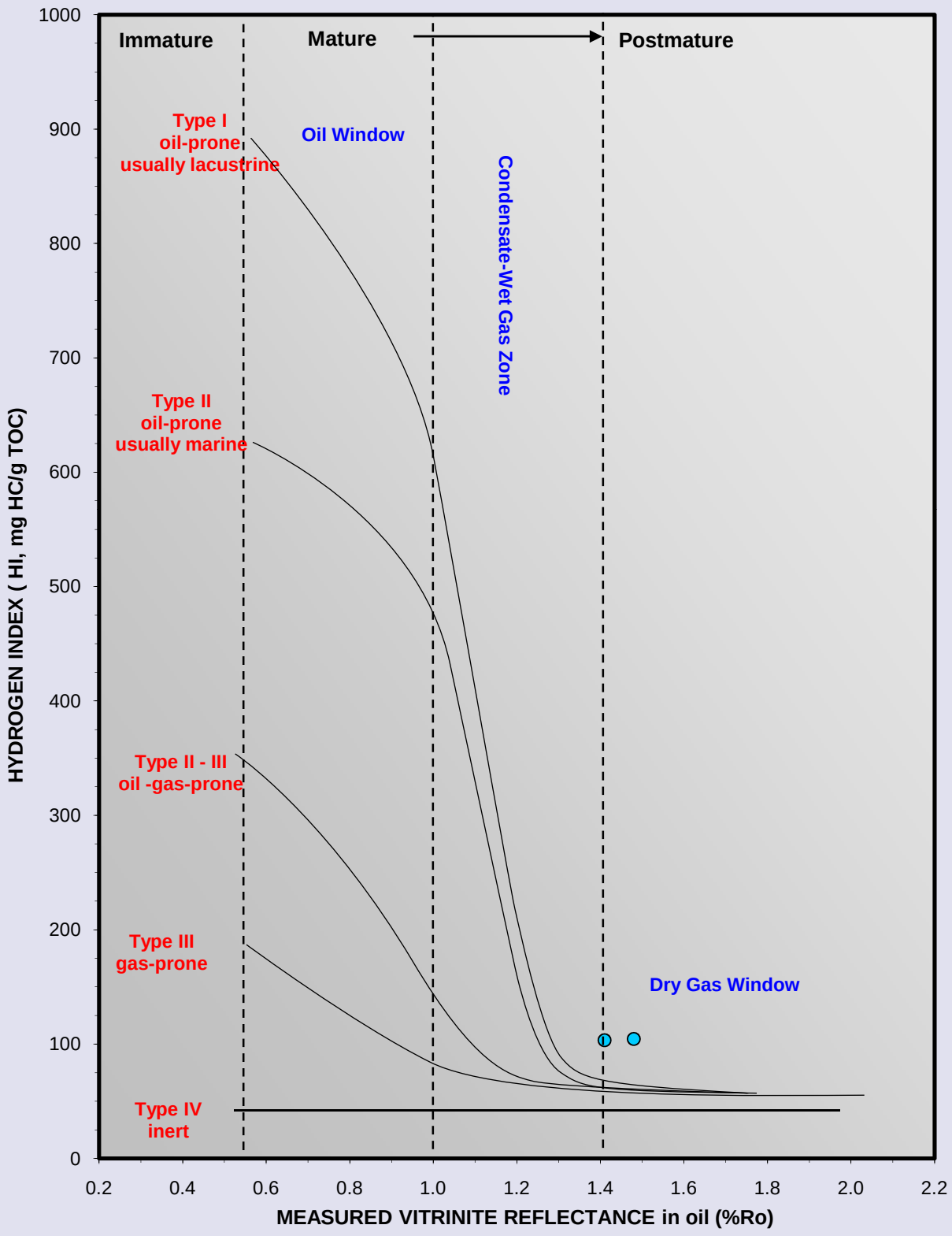

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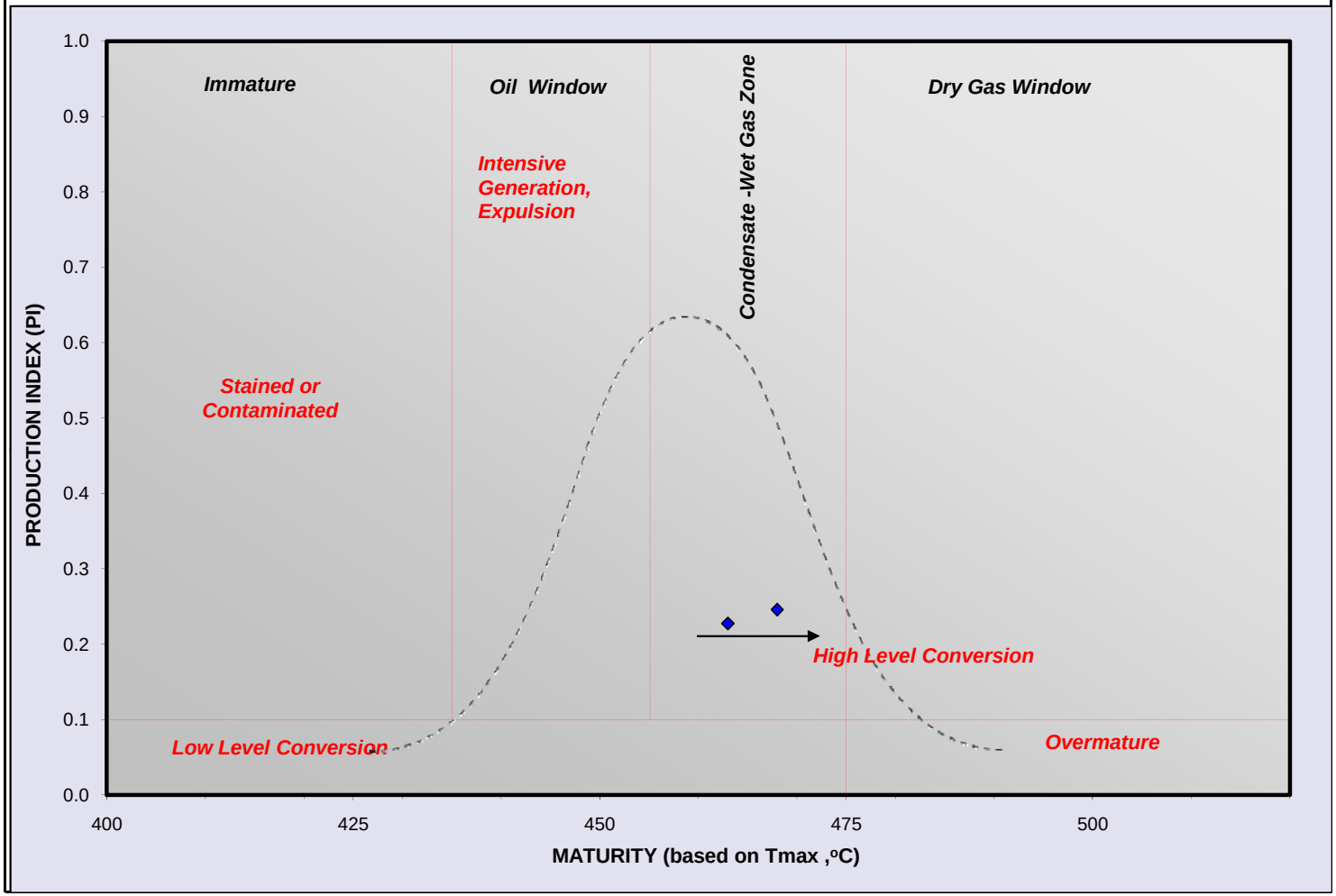
KEROGEN CONVERSION AND MATURITY (Tmax) - P. SMITH NO.1

Company:

Project #: HH-47676 / HH-47676



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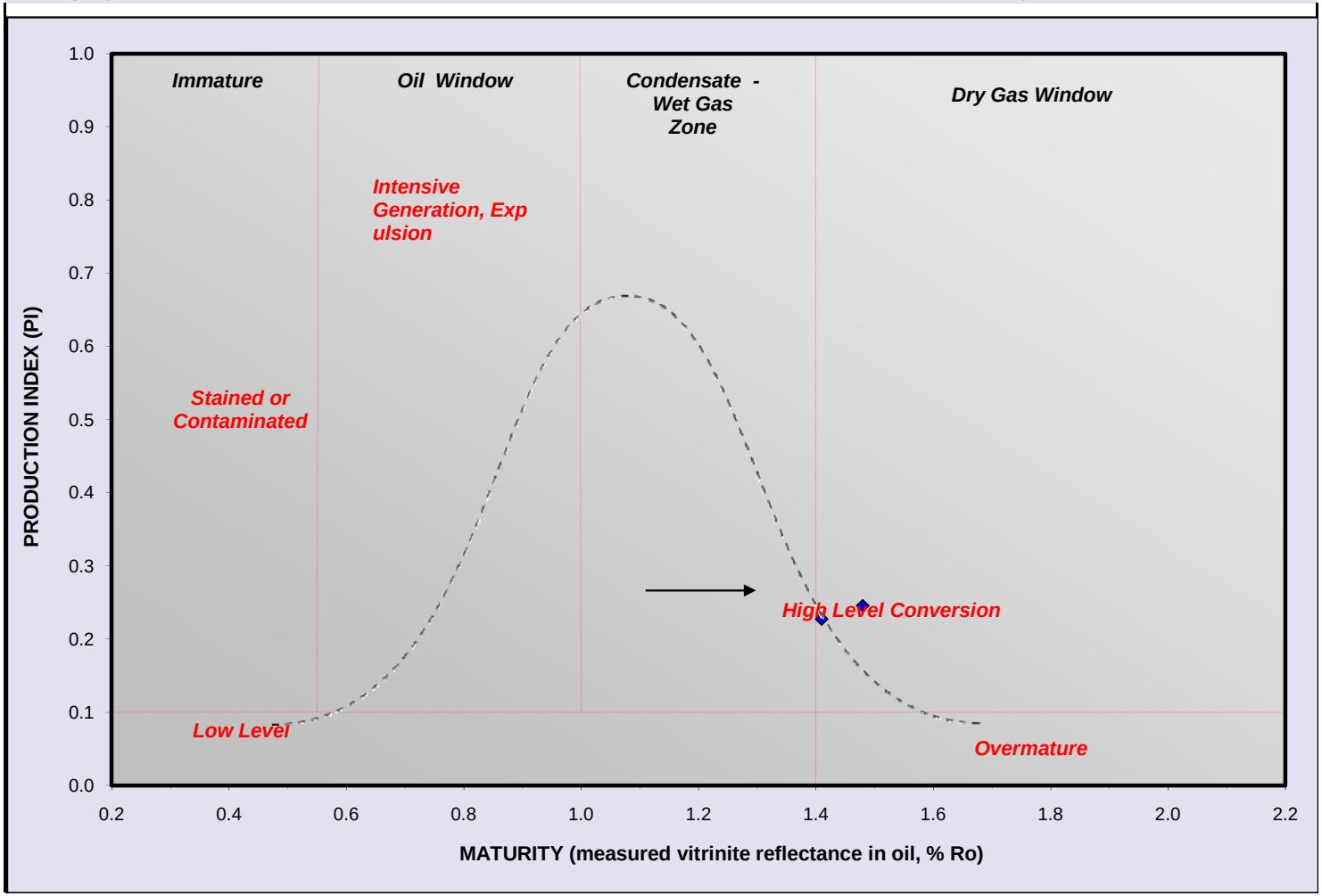

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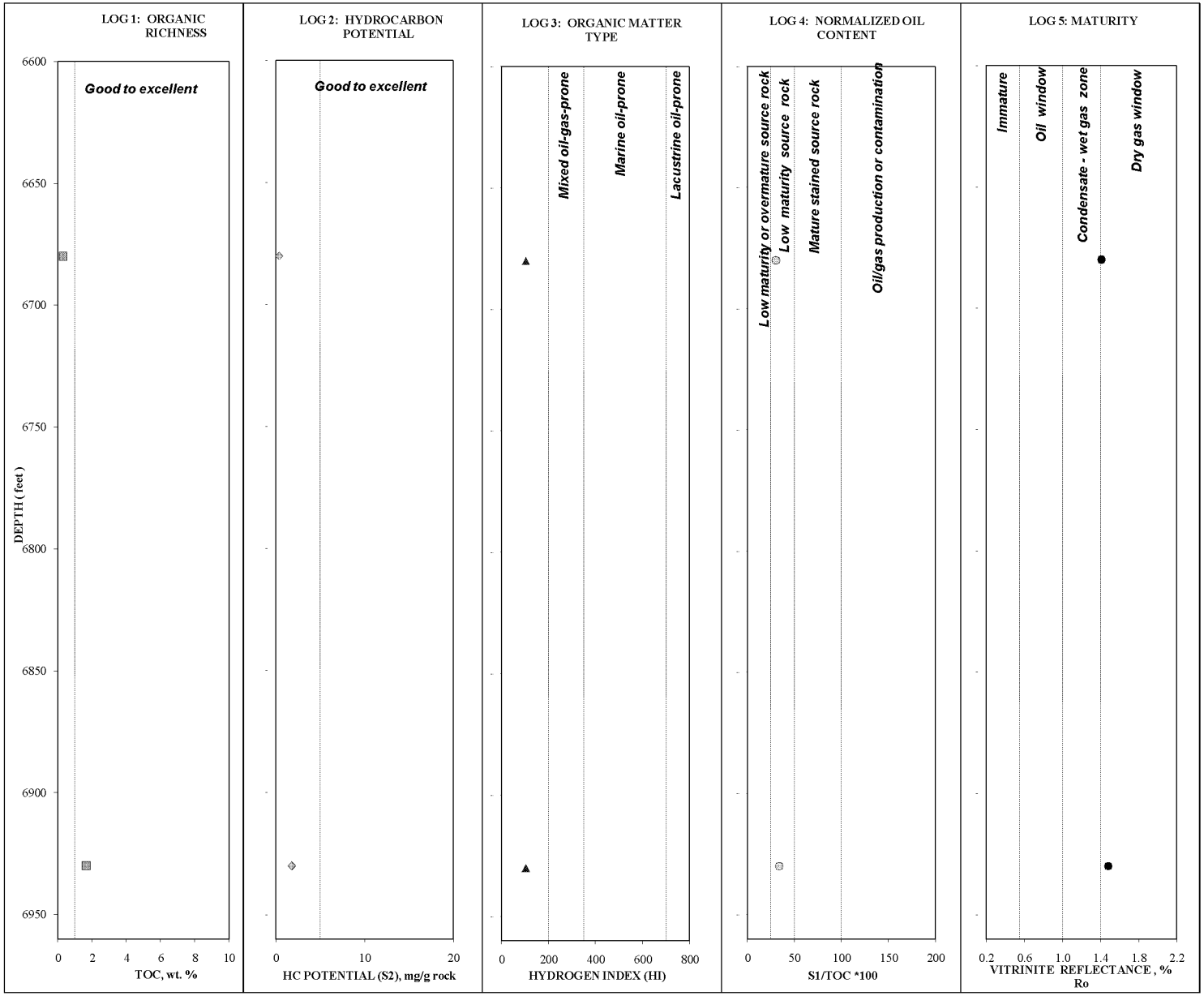

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