Beaufort Sea Play 1: Undeformed Pre-Mississippian Basement

Geological Assessment

Grasp UAI: AAAAABAC
Play Area: 289 square miles
Play Water Depth Range: 15 – 115 feet
Play Depth Range: 12,000 – 20,000 feet
Play Exploration Chance: 0.288

Play 1, Undeformed Pre-Mississippian Basement, Beaufort Sea OCS Planning Area, 2006 Assessment, Undiscovered Technically-Recoverable Oil & Gas

Assessment Results as of November 2005			
Resource Commodity (Units)	**Resources ***		
	F95	**Mean**	**F05**
BOE (Mmboe)	0	31	117
Total Gas (Tcfg)	0.000	0.083	0.320
Total Liquids (Mmbo)	0	16	60
Free Gas** (Tcfg)	0.000	0.066	0.260
Solution Gas (Tcfg)	0.000	0.016	0.060
Oil (Mmbo)	0	15	56
Condensate (Mmbc)	0	1	4

* Risked, Technically-Recoverable

** Free Gas Includes Gas Cap and Non-Associated Gas

F95 = 95% chance that resources will equal or exceed the given quantity

F05 = 5% chance that resources will equal or exceed the given quantity

BOE = total hydrocarbon energy, expressed in barrels-of-oil-equivalent, where 1 barrel of oil = 5,620 cubic feet of natural gas

Mmb = millions of barrels

Tcf = trillions of cubic feet

Table 1

Play 1, the Undeformed Pre-Mississippian Basement play contains the smallest resource endowment of the Beaufort plays assessed (31 MMbbl mean BOE) representing less than 1% of the Beaufort Sea province energy endowment. The overall assessment results for play 1 are shown in table 1. Approximately half of that endowment is from liquid hydrocarbons. Table 5 reports the detailed assessment results by commodity for play 1.

Table 3 summarizes the volumetric input data developed for the *GRASP* computer model of Beaufort Sea play 1. Table 4 reports the risk model used for play 1. The location of play 1 is shown in figure 1.

The Undeformed Pre-Mississippian Basement play consists of stratigraphic traps in carbonate or sandstone reservoirs in the pre-Mississippian basement complex near Point Thomson (Dolton and others, 1987, p. 238). Leaching of carbonates or carbonate cements in the sandstones may have created some porosity and fractures may enhance permeability development. Potential source rocks are the overlying Hue Shale and Canning Formation, which also act as the seal. No OCS wells have tested this play. In State waters, the Alaska State F-1 well tested 2.975 MMcf/day and 152 bbl/ day of 35.3° API gravity condensate from rocks in the non-Federal analog to play 1.

The primary risk of this play is due to uncertain pre-Mississippian reservoir facies and to the uncertain seal of the overlying Brookian units.

A maximum of 17 hypothetical pools is forecast by the aggregation of the risk model and the prospect numbers model for play 1. These pools range in mean conditional (un-risked) recoverable volumes from <1 Mmboe (pool rank 17) to 28 Mmboe (pool rank 1). Pool rank 1 ranges in possible conditional recoverable volumes from 1.08 Mmboe (F95) to 93 Mmboe (F05). Table 2 shows the conditional sizes of the 10 largest

pools in play 1.

Play 1, Undeformed Pre-Mississippian Basement, Beaufort Sea OCS Planning Area, 2006 Assessment, Conditional BOE Sizes of Ten Largest Pools			
Assessment Results as of November 2005			
Pool Rank	BOE Resources *		
	F95	Mean	F05
1	1.08	28	93
2	0.28	8	31
3	0.11	3	12
4	0.06	2	6
5	0.038	1.0	4
6	0.027	0.7	2.4
7	0.020	0.5	1.7
8	0.016	0.4	1.3
9	0.014	0.3	1.0
10	0.011	0.2	0.8
*Conditional, Technically-Recoverable, Millions of Barrels Energy-Equivalent (Mmboe), from "PSRK.out" file			
F95 = 95% chance that resources will equal or exceed the given quantity			
F05 = 5% chance that resources will equal or exceed the given quantity			
BOE = total hydrocarbon energy, expressed in barrels-of-oil-equivalent, where 1 barrel of oil = 5,620 cubic feet of natural gas			

Table 2

Table 6 reports statistics for the simulation pools developed in the *GRASP* computer model for play 1. In the computer simulation for play 1, a total of 36,995 "simulation pools" were sampled for size. These simulation pools can be grouped according to the USGS size class system in which sizes double with each successive class. Pool size class 6 contains the largest share (5,103, or 14%) of simulation pools (conditional, technically recoverable BOE resources) for play 1. Pool size class 6 ranges from 1 to 2 Mmboe. The largest pool among the 36,995 simulation pools falls within pool size class 14, which ranges in size from 256 to 512 Mmboe.

GRASP Play Data Form (Minerals Management Service-Alaska Regional Office)

Basin: Beaufort   **Assessor:** Johnson/Scherr   **Date:** 10/5/2005
Play Number: 01   **Play Name:** Undeformed Pre-Miss. Basement
Play UAI Number: AAAAABAC

Play Area: mi² (million acres) 289 (185.3)   **Play Depth Range: feet**   12000   15500   20000
Reservoir Thermal Maturity: % Ro   **Expected Oil Gravity: °API**   35
                                                         Play Water Depth Range: feet   15   60   115

POOLS Module (Volumes of Pools, Acre-Feet)

Fractile	F100	F95	F90	F75	F50	Mean/Std.Dev.	F25	F15	F10	F05	F02	F01	F00
Prospect Area (acres)-Model Input	1	12	39	197	609		1879			9505		10000	15000
Prospect Area (acres)-Model Output													
Fill Fraction (Fraction of Area Filled)	0.1	0.14		0.29	0.5		0.76			0.95		0.99	1
Productive Area of Pool (acres)	0	15	29	89	308	1230.55/2331.191	1125	2287	3534	5505			14064
Pay Thickness (feet)	14	41	50	70	100	115.804/68.193	143	174	198	241	300	347	731

MPRO Module (Numbers of Pools)

Play Level Chance	0.8		Prospect Level Chance	0.36		Exploration Chance	0.288

Risk Model	Play Chance	Petroleum System Factors	Prospect Chance
		Presence of Porosity	0.6
		Adequate Seal	0.6
	0.8	**Presence of Reservoir facies**	

Fractile	F99	F95	F90	F75	F50	Mean/Std. Dev.	F25	F15	F10	F05	F02	F01	F00
Numbers of Prospects in Play	7.00	8.14	8.90	10.20	12.00	12.85/2.97	14.00	15.40	16.40	18.00	19.70	20.90	21.00
Numbers of Pools in Play			0@79.49	2	4	3.70/2.59	5	6	7	8	9	10	17

Minimum Number of Pools	0	Mean Number of Pools	3.70	Maximum Number of Pools	17

POOLS/PSRK/PSUM Modules (Play Resources)

Fractile	F100	F95	F90	F75	F50	Mean/Std. Dev.	F25	F15	F10	F05	F02	F01	F00
Oil Recovery Factor (bbl/acre-foot)	11.3	26.7	31.0	39.7	52.4	57.099/24.889	69.1	80.1	88.6	102.9	121.6	136.0	242.0
Gas Recovery Factor (Mcfg/acre-foot)	74.0	143.4	160.9	194.8	241.0	253.506/83.314	298.1	334.2	361.1	404.9	460.6	502.0	779.0
Gas Oil Ratio (Sol'n Gas)(cf/bbl)	90	170	230	390	720	1075.25/1034.163	1350	1900	2300	3200	4700		6000
Condensate Yield ((bbl/Mmcfg)	0.147	1.548	2.337	4.653	10	18.332/23.706	21.493	32.406	42.794	64.621	102.76	140	143

Pool Size Distribution Statistics from *POOLS* (1,000 BOE):	μ (mu)=	7.451121	σ^2 (sigma squared)=	3.764581	Random Number Generator Seed=	302900

BOE Conversion Factor (cf/bbl)	5620	Probability Any Pool Contains Both Oil and Free Gas (Gas Cap)	1
Probability Any Pool is 100% Oil	0	Fraction of Pool Volume Gas-Bearing in Oil Pools with Gas Cap	0.5
Probability Any Pool is 100% Gas	0		

Table 3. Input data for Beaufort Sea play 1, 2006 assessment.

Risk Analysis Form - 2006 National Assessment		

Assessment Province:	Beaufort	Play Number, Name:	1, Undeformed Pre-Miss. Basement
Assessor(s):	Johnson/Scherr	Play UAI:	AAAAABAC
Date:	19-Oct-05		

For each component, a *quantitative* probability of success (i.e., between zero and one, where zero indicates no confidence and one indicates absolute certainty) based on consideration of the *qualitative* assessment of **ALL** elements within the component was assigned. This is the assessment of the probability that the minimum geologic parameter assumptions have been met or exceeded.

		Play Chance Factors	Averge Conditional Prospect Chance[1]
1. **Hydrocarbon Fill component** (1a * 1b * 1c)	**1**	*1.0000*	*1.0000*
a. **Presence of a Quality, Effective, Mature Source Rock**			
Probability of efficient source rock in terms of the existence of sufficient volume of mature source rock of adequate quality located in the drainage area of the reservoirs.	1a	1.00	1.00
b. **Effective Expulsion and Migration**			
Probability of effective expulsion and migration of hydrocarbons from the source rock to the reservoirs.	1b	1.00	1.00
c. **Preservation**			
Probability of effective retention of hydrocarbons in the prospects after accumulation.	1c	1.00	1.00
2. **Reservoir component** (2a * 2b)	**2**	*0.8000*	*0.6000*
a. **Presence of reservoir facies**			
Probability of presence of reservoir facies with a minimum net thickness and net/gross ratio (as specified in the resource assessment).	2a	0.80	1.00
b. **Reservoir quality**			
Probability of effectiveness of the reservoir, with respect to minimum effective porosity, and permeability (as specified in the resource assessment).	2b	1.00	0.60
3. **Trap component** (3a * 3b)	**3**	*1.0000*	*0.6000*
a. **Presence of trap**			
Probability of presence of the trap with a minimum rock volume (as specified in the resource assessment).	3a	1.00	1.00
b. **Effective seal mechanism**			
Probability of effective seal mechanism for the trap.	3b	1.00	0.60
Overall Play Chance (Marginal Probability of hydrocarbons, MPhc)		*0.8000*	
(1 * 2 * 3) *Product of All Subjective Play Chance Factors*			
Average Conditional Prospect Chance[1]			*0.3600*
(1 * 2 * 3) *Product of All Subjective Conditional Prospect Chance Factors*			
[1] **Assumes that the Play exists (where all play chance factors = 1.0)**			
Must be consistent with play chance and prospect distribution -- See discussion on Page 3 of Guide			
Exploration Chance		*0.2880*	
(Product of Overall Play Chance and Average Conditional Prospect Chance)			

Comments: *See guidance document for explanation of the Risk Analysis Form*

Table 4. Risk model for Beaufort Sea play 1, 2006 assessment.

GRASP - Geologic and Economic Resource Assessment Model - PSUM Module Results
Minerals Management Service - Alaska OCS Region
GRASP Model Version: 8.29.2005)
Computes the Geologic Resource Potential of the Play

Play UAI: AAAAABAC			**Play No.**		**1**		
World	Level	-	World	Level	Resources		
Country	Level	-	UNITED	STATES	OF	AMERICA	
Region	Level	-	MMS	-	ALASKA	REGION	
Basin	Level	-	**BEAUFORT**	**SHELF**			
Play	**Level**	**-**	**Play**		**1 Undeformed Pre-Mississippian**		
Geologist	Peter	Johnson			**Basement**		
Remarks	play		1	2005 assessment			
Run Date & Time:		Date	19-Sep-05 Time		13:47:15		

Summary of Play Potential

Product	MEAN	Standard Deviation
BOE (Mboe)	30,842	43,523
Oil (Mbo)	14,933	21,908
Condensate (Mbc)	1,177	2,566
Free (Gas Cap & Nonassociated) Gas (Mmcfg)	66,446	93,350
Solution Gas (Mmcfg)	16,348	33,123

10000 (Number of Trials in Sample)
0.7946 (MPhc [Probability] of First Occurrence of Non-Zero Resource)
Windowing Feature: used

Empirical Probability Distributions of the Products

Greater Than Percentage	BOE (Mboe)	Oil (Mbo)	Condensate (Mbc)	Free (Gas Cap & Nonassociated) Gas (Mmcfg)	Solution Gas (Mmcfg)
100	0	0	0	0	0
99.99	0	0	0	0	0
99	0	0	0	0	0
95	0	0	0	0	0
90	0	0	0	0	0
85	0	0	0	0	0
80	0	0	0	0	0
75	1,801	843	87	4,029	866
70	3,936	1,852	153	8,816	2,038
65	6,273	3,013	264	14,197	2,639
60	8,728	4,141	310	19,354	4,679
55	11,802	5,650	436	26,198	5,929
50	14,999	7,261	574	33,208	7,054
45	18,736	9,102	610	42,057	8,664
40	23,237	11,078	862	51,242	12,243
35	28,160	13,478	1,058	63,485	13,083
30	34,760	17,227	1,305	74,273	16,928
25	42,460	20,763	1,560	90,670	22,502
20	51,712	25,899	1,949	110,100	24,022
15	64,317	31,275	2,185	143,620	29,799
10	82,871	39,482	3,207	183,380	42,444
8	92,782	43,497	3,802	205,080	50,536
6	107,500	53,390	3,386	226,310	58,734
5	116,730	55,651	4,136	259,680	60,371
4	126,670	62,146	4,961	266,510	68,206
2	160,260	76,801	6,840	347,440	83,140
1	200,030	99,268	7,547	407,280	116,580
0.1	376,630	259,270	13,403	501,310	82,941
0.01	459,070	220,980	9,179	637,650	648,840
0.001	528,510	309,310	23,557	469,070	630,430

Table 5. Assessment results by commodity for Beaufort Sea play 1, 1006 assessment.

Basin: BEAUFORT SHELF
Play 01 - Undeformed Pre-Miss. Basement
UAI Key: AAAAABAC

Model Simulation "Pools" Reported by "Fieldsize.out" *GRASP* Module

	Classification and Size			Pool Count Statistics				Pool Types Count			Mixed Pool Range		Oil Pool Range		Gas Pool Range		Total Pool Range			Pool Resource Statistics (MMBOE)			
Class	Min (MMBOE)	Max (MMBOE)	Pool Count	Percentage	Trial Average	Trials w/Pool Avg		Mixed Pool	Oil Pool	Gas Pool	Min	Max	Min	Max	Min	Max	Min	Max		Min	Max	Total Resource	Average Resource
1	0.0312	0.0625	786	2.124611	0.0786	0.098905		786	0	0	1	2	0	0	0	0	1	2		0.031278	0.062445	36.488622	46.423182
2	0.0625	0.125	1583	4.278956	0.1583	0.199195		1583	0	0	1	3	0	0	0	0	1	3		0.062572	0.124977	148.365104	93.724005
3	0.125	0.25	2561	6.922557	0.2561	0.32226		2561	0	0	1	4	0	0	0	0	1	4		0.125051	0.249918	473.413125	184.854791
4	0.25	0.5	3800	10.271658	0.38	0.478168		3800	0	0	1	4	0	0	0	0	1	4		0.250051	0.499992	1385.506000	364.606857
5	0.5	1	4751	12.842276	0.4751	0.597836		4751	0	0	1	6	0	0	0	0	1	6		0.500213	0.999859	3473.318000	731.070936
6	1	2	5103	13.793756	0.5103	0.642129		5103	0	0	1	5	0	0	0	0	1	5		1.000059	1.999977	7372.056000	1.444651
7	2	4	4837	13.074739	0.4837	0.608657		4837	0	0	1	4	0	0	0	0	1	4		2.000507	3.999790	13900.604000	2.873807
8	4	8	4263	11.523179	0.4263	0.536429		4263	0	0	1	5	0	0	0	0	1	5		4.000509	7.997747	24362.191000	5.714799
9	8	16	3406	9.20665	0.3406	0.428589		3406	0	0	1	4	0	0	0	0	1	4		8.001239	15.999116	38297.436000	11.244109
10	16	32	2589	6.998243	0.2589	0.325783		2589	0	0	1	4	0	0	0	0	1	4		16.003245	31.980475	58427.160000	22.567463
11	32	64	1618	4.373564	0.1618	0.203599		1618	0	0	1	4	0	0	0	0	1	4		32.001797	63.997565	72337.630000	44.708054
12	64	128	699	1.889444	0.0699	0.087958		699	0	0	1	2	0	0	0	0	1	2		64.024015	127.984451	60889.435000	87.109352
13	128	256	129	0.348696	0.0129	0.016233		129	0	0	1	2	0	0	0	0	1	2		128.419014	249.137876	21674.891000	168.022415
14	256	512	16	0.043249	0.0016	0.002013		16	0	0	1	1	0	0	0	0	1	1		260.092719	440.254849	5628.708000	351.794250
15	512	1024	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0		0.000000	0.000000	0.000000	0.000000
16	1024	2048	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0		0.000000	0.000000	0.000000	0.000000
17	2048	4096	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0		0.000000	0.000000	0.000000	0.000000
18	4096	8192	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0		0.000000	0.000000	0.000000	0.000000
19	8192	16384	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0		0.000000	0.000000	0.000000	0.000000
20	16384	32768	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0		0.000000	0.000000	0.000000	0.000000
21	32768	65536	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0		0.000000	0.000000	0.000000	0.000000
22	65536	131072	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0		0.000000	0.000000	0.000000	0.000000
23	131072	262144	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0		0.000000	0.000000	0.000000	0.000000
24	262144	524288	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0		0.000000	0.000000	0.000000	0.000000
25	524288	1048576	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0		0.000000	0.000000	0.000000	0.000000
Not Classified			854	2.30842	0.0854	0.107462	Below Class	854	0	0									Below Class	0.000014	0.031220	13.715989	16.060878
	Totals		36995	99.999992	3.6995	4.655216	Above Class	0	0	0									Above Class	0.000000	0.000000	0.000000	0.000000

Min and Max refer to numbers of pools of the relevant size class that occur within any single trial in the simulation.

Min and Max refer to aggregate resources of the relevant size class that occur within any single trial in the simulation.

Number of Pools not Classified: 854
Number of Pools below Class 1: 854
Number of Trials with Pools: 7947

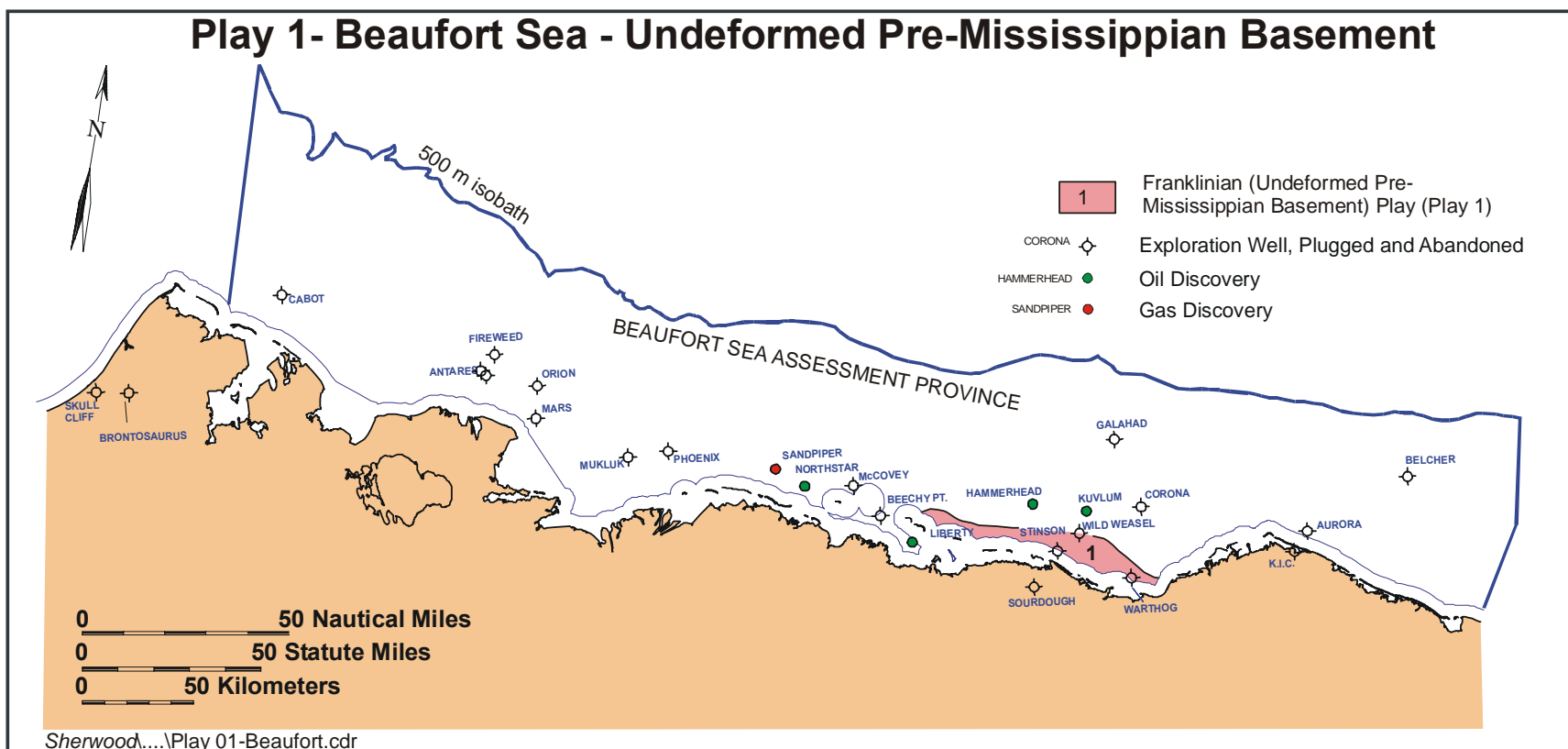**Table 6**. Statistics for simulation pools created in computer sampling run for Beaufort Sea play 1, 2006 assessment.

Figure 1. Map location of Beaufort Sea play 1, 2006 assessment.