

## **Beaufort Sea Play 12: Brookian Faulted Eastern Topset**

### **Geological Assessment:**

*Grasp UAI: AAAAABAT*

*Play Area: 5,476 square miles*

*Play Water Depth Range: 100 – 1600 feet*

*Play Depth Range: 2,000 – 14,000 feet*

*Play Exploration Chance: 0.354*

<b>Play 12, Brookian Faulted Eastern Topset, Beaufort Sea OCS Planning Area, 2006 Assessment, Undiscovered Technically-Recoverable Oil &amp; Gas</b>			
Assessment Results as of November 2005			
<b>Resource Commodity (Units)</b>	<b>Resources *</b>		
	<b>F95</b>	<b>Mean</b>	<b>F05</b>
BOE (Mmboe)	0	2,831	7,114
Total Gas (Tcfg)	0.000	9.991	22.860
Total Liquids (Mmbo)	0	1,053	3,046
Free Gas** (Tcfg)	0.000	9.855	22.439
Solution Gas (Tcfg)	0.000	0.135	0.421
Oil (Mmbo)	0	615	1,999
Condensate (Mmbc)	0	438	1,047

\* 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 12, the “Brookian Faulted Eastern Topset” play, is ranked third in total undiscovered resources in the Beaufort Assessment Province with 22% of the province energy endowment (2,831 Mmbo mean BOE). The overall assessment results for play 12 are shown in [table 1](#). This is primarily a gas play with natural gas

comprising 63% of the plays mean resources. Of the liquid resources, 42% are gas condensate. This is by far the largest condensate play in the Beaufort province representing 42% of the province’s total condensate endowment.

The large resource endowment in this play is due to a combination of large pool areas, large prospect numbers, and high oil and gas yields. [Table 5](#) reports the detailed assessment results by commodity for play 12.

[Table 3](#) summarizes the volumetric input data developed for the GRASP computer model of Beaufort Sea play 12. [Table 4](#) reports the risk model used for play 12. The location of play 12 is shown in [figure 1](#).

Play 12 includes deltaic-topset facies of the Tertiary Sagavanirktok Formation and the Upper Cretaceous Colville Group. It is located within the hinge line fault zone across the central part of the province. Abundant structural closures along these faults provide most of the prospects in the play. Sagavanirktok Formation sandstones offer excellent reservoir characteristics. Potential source rocks are organic-rich marine shales within the Canning Formation that reach thermal maturity north of the hinge line fault zone in the Nuwuk and Kaktovik basins. There is also potential for oil generation from Beaufortian sequence source rocks deeply buried within the Dinkum graben. The latter source rocks have passed completely through the oil generation window. Seal continuity may be a risk factor for many prospects due to the high sandstone content of the Sagavanirktok Formation. Adequate source rock and adequate migration pathways are also risk

factors. One offshore well, Galahad, was drilled in the play area and encountered a gas-sand that yielded frothy brown oil in DST.

“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 11 contains the largest share (22,997 or 16%) of simulation pools (conditional, technically recoverable BOE resources) for play 12. Pool size class 11 ranges from 32 to 64 Mmboe. The largest pool among the 141,482 simulation pools falls within pool size class 19, which ranges in size from 8,192 to 16,384 Mmboe.

<b>Play 12, Brookian Faulted Eastern Topset, Beaufort Sea OCS Planning Area, 2006 Assessment, Conditional BOE Sizes of Ten Largest Pools</b>			
Assessment Results as of November 2005			
Pool Rank	BOE Resources *		
	F95	Mean	F05
1	296	1602	4553
2	167	672	1591
3	110	407	928
4	78	276	659
5	56	198	447
6	42	148	327
7	30	114	255
8	22	89	201
9	16	70	161
10	11	56	130

\* 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**

A maximum of 39 hypothetical pools is forecast by the aggregation of the risk model and the prospect numbers model for play 12. These pools range in mean conditional (un-risked) recoverable volumes from 2 Mmboe (pool rank 39) to 1,602 Mmboe (pool rank 1). Pool rank 1 ranges in possible conditional recoverable volumes from 269 Mmboe (F95) to 4,553 Mmboe (F05). [Table 2](#) shows the conditional sizes of the 10 largest pools in play 12.

[Table 6](#) reports statistics for the simulation pools developed in the GRASP computer model for play 12. In the computer simulation the play, a total of 141,482

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

**Basin:** Beaufort  
**Play Number:** 12  
**Play UAI Number:** AAAAABAT

**Assessor:** Johnson/Scherr  
**Play Name:** Brookian Faulted Eastern Topset

**Date:** 10/14/2005

**Play Area:** mi<sup>2</sup> ( million acres) 5476 (3504.7)  
**Reservoir Thermal Maturity:** % Ro

**Play Depth Range:** feet 2000 5,300 14000  
**Expected Oil Gravity:** ° API 25  
**Play Water Depth Range:** feet 100 500 1600

**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	38	241	597	2165	5300		12978			47067		80000	81000
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)	5	212	374	927	2590	7400.925/12928.8	7410	12799	19177	29560			80648
Pay Thickness (feet)	13	36	43	57	80	90.584/48.474	112	133	150	180	220	252	500

**MPRO Module (Numbers of Pools)**

Play Level Chance	0.8	Prospect Level Chance	0.442	Exploration Chance	0.3536
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Risk Model	Play Chance	Petroleum System Factors	Prospect Chance
	0.8	Adequate Source	0.8
		Adequate Seal	0.65
		Adequate Migration	0.85

Fractile	F99	F95	F90	F75	F50	Mean/Std. Dev.	F25	F15	F10	F05	F02	F01	F00
Numbers of Prospects in Play	30.00	32.50	34.00	36.50	39.00	40.02/4.64	42.50	44.00	45.50	47.50	49.50	51.00	60.00
Numbers of Pools in Play			0@F80	12	16	14.15/7.83	19	21	22	24	25	27	39

Minimum Number of Pools	0	Mean Number of Pools	14.15	Maximum Number of Pools	39
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**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)	133	249	278	333	408	427.126/ 133.288	500	557	600	669	756	820	1248
Gas Recovery Factor (Mcfg/acre-foot)	211	534	629	826	1117	1237.918/595.436	1511	1778	1984	2335	2805	3170	5918
Gas Oil Ratio (Sol'n Gas)(cf/bbl)	38	96	113	148	200	221.428 /105.929	270	318	354	417	500	565	1051
Condensate Yield ((bbl)/Mmcfg)	8	19	23	30	40	44.286/ 21.197	54	64	71	83	100	113	210

Pool Size Distribution Statistics from POOLS (1,000 BOE):  $\mu$  (mu)= 10.9254252  $\sigma^2$  (sigma squared)= 2.86234117 Random Number Generator Seed= 446248

BOE Conversion Factor (cf/bbl)	5620	Probability Any Pool Contains Both Oil and Free Gas (Gas Cap)	0.2
Probability Any Pool is 100% Oil	0	Fraction of Pool Volume Gas-Bearing in Oil Pools with Gas Cap	0.25
Probability Any Pool is 100% Gas	0.8		

Table 3. Input data for Beaufort Sea play 12, 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: AAAABAT**                      **Play No. 12**

World Level - World Level Resources  
 Country Level - UNITED STATES OF AMERICA  
 Region Level - MMS ALASKA REGION  
 Basin Level - **BEAUFORT SHELF**  
**Play Level - 12 Brookian Eastern**      **Faulted Topset**

Geologist Peter Johnson  
 Remarks Play 12 2005 Assessment  
 Run Date & Time: Date 19-Sep-05 Time 13:49:28

**Summary of Play Potential**

Product	MEAN	Standard Deviation
<b>BOE (Mboe)</b>	2,830,600	2,343,200
<b>Oil (Mbo)</b>	614,610	938,380
<b>Condensate (Mbc)</b>	438,330	409,060
<b>Free (Gas Cap &amp; Nonassociated) Gas (Mmcfg)</b>	9,855,300	8,420,100
<b>Solution Gas (Mmcfg)</b>	135,350	217,710

10000 (Number of Trials in Sample)  
 0.8002 (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	237,640	39,785	38,217	888,440	8,709
75	1,188,900	234,760	182,870	4,280,600	53,990
70	1,529,600	229,170	252,290	5,841,300	49,359
65	1,815,300	388,490	273,980	6,392,400	86,394
60	2,064,700	329,320	334,130	7,803,300	71,663
55	2,298,000	454,460	358,000	8,241,700	107,120
50	2,539,800	512,280	390,060	9,090,200	112,540
45	2,806,500	588,900	436,150	9,879,900	131,680
40	3,078,600	645,220	479,710	10,831,000	148,900
35	3,376,300	560,090	572,950	12,489,000	118,310
30	3,685,500	774,790	573,230	12,956,000	180,460
25	4,064,800	962,840	603,110	13,840,000	203,580
20	4,504,100	762,660	739,120	16,698,000	174,640
15	5,083,000	1,032,100	829,490	17,868,000	236,700
10	5,849,500	1,379,800	910,160	19,704,000	300,640
8	6,267,400	1,557,100	949,280	20,795,000	341,760
6	6,802,500	1,587,200	1,011,900	23,266,000	357,360
5	7,113,800	1,998,700	1,047,400	22,439,000	421,100
4	7,512,200	1,790,300	1,142,300	25,357,000	380,160
2	8,794,700	1,954,200	1,316,200	30,590,000	456,090
1	10,079,000	2,294,600	1,661,700	33,919,000	488,870
0.1	14,539,000	5,309,200	1,545,800	42,032,000	1,154,300
0.01	20,476,000	15,280,000	894,010	22,056,000	2,124,200
0.001	22,932,000	16,784,000	1,088,300	25,977,000	2,458,900

**Table 5.** Assessment results by commodity for Beaufort Sea play 12, 2006 assessment.

Basin: BEAUFORT SHELF Play 12 - Brookian Faulted Eastern Topset UAI Key: AAAAABAT				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	18	0.012722	0.0018	0.002249	1	0	17	1	1	0	0	1	1	1	1	1	1	0.033928	0.061985	0.953234	52.957460	
2	0.0625	0.125	98	0.069267	0.0098	0.012245	10	0	88	1	1	0	0	1	1	1	1	1	1	0.065496	0.124932	9.791649	99.914789	
3	0.125	0.25	244	0.17246	0.0244	0.030489	29	0	215	1	1	0	0	1	2	1	2	1	2	0.125926	0.249171	43.995679	180.310160	
4	0.25	0.5	505	0.356936	0.0505	0.063101	63	0	442	1	1	0	0	1	2	1	3	1	3	0.251213	0.499205	190.257816	376.748145	
5	0.5	1	971	0.686306	0.0971	0.12133	112	0	859	1	1	0	0	1	2	1	2	1	2	0.500488	0.997211	731.895227	753.754079	
6	1	2	2077	1.468031	0.2077	0.259528	242	0	1835	1	2	0	0	1	3	1	4	1	4	1.000058	1.998658	3152.509000	1.517819	
7	2	4	4421	3.124779	0.4421	0.552418	537	0	3884	1	3	0	0	1	5	1	5	1	5	2.000674	3.999808	13393.089000	3.029425	
8	4	8	8577	6.062255	0.8577	1.071723	1153	0	7424	1	3	0	0	1	5	1	7	1	7	4.000905	7.999421	51076.006000	5.954997	
9	8	16	14749	10.424647	1.4749	1.842934	2284	0	12465	1	4	0	0	1	8	1	8	1	8	8.000669	15.999335	173747.971000	11.780322	
10	16	32	20129	14.227251	2.0129	2.515182	3712	0	16417	1	5	0	0	1	10	1	10	1	10	16.001027	31.995117	470655.933000	23.381983	
11	32	64	22997	16.254364	2.2997	2.873547	4583	0	18414	1	5	0	0	1	9	1	10	1	10	32.001100	63.999985	1068919.000000	46.480782	
12	64	128	22069	15.598451	2.2069	2.757591	4781	0	17288	1	7	0	0	1	10	1	10	1	10	64.000765	127.998214	2028549.000000	91.918503	
13	128	256	18245	12.895634	1.8245	2.27977	4247	0	13988	1	5	0	0	1	8	1	8	1	8	128.009168	255.987604	3313410.000000	181.606461	
14	256	512	13003	9.190568	1.3003	1.624766	3218	0	9785	1	4	0	0	1	7	1	8	1	8	256.014515	511.913526	4703303.000000	361.709045	
15	512	1024	7712	5.45087	0.7712	0.963639	1975	0	5737	1	3	0	0	1	5	1	6	1	6	512.028473	1023.994000	5509190.000000	714.365906	
16	1024	2048	4034	2.851246	0.4034	0.504061	1161	0	2873	1	3	0	0	1	4	1	5	1	5	1024.461000	2046.237000	5721584.000000	1.418340	
17	2048	4096	1351	0.954892	0.1351	0.168812	459	0	892	1	3	0	0	1	3	1	3	1	3	2048.263000	4084.098000	3698236.000000	2.737406	
18	4096	8192	263	0.185889	0.0263	0.032863	99	0	164	1	2	0	0	1	2	1	2	1	2	4116.815000	8153.016000	1385735.000000	5.268956	
19	8192	16384	15	0.010602	0.0015	0.001874	6	0	9	1	1	0	0	1	1	1	1	1	1	8288.863000	15951.275000	164483.845000	10.965590	
20	16384	32768	0	0	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	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	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	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	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	0	0.000000	0.000000	0.000000	0.000000	
Not Classified			4	0.002827	0.0004	0.0005	Below Class	0	0	4				Below Class	0	0	4			Below Class	0.029472	0.029472	0.117887	29.471641
Totals			141482	100.000008	14.1482	17.678621	Above Class	0	0	0				Above Class	0	0	0			Above Class	0.000000	0.000000	0.000000	0.000000

Number of Pools not Classified: 4	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 below Class 1: 4		
Number of Trials with Pools: 8003		

**Table 6.** Statistics for simulation pools created in computer sampling run for Beaufort Sea play 12, 2006 assessment.

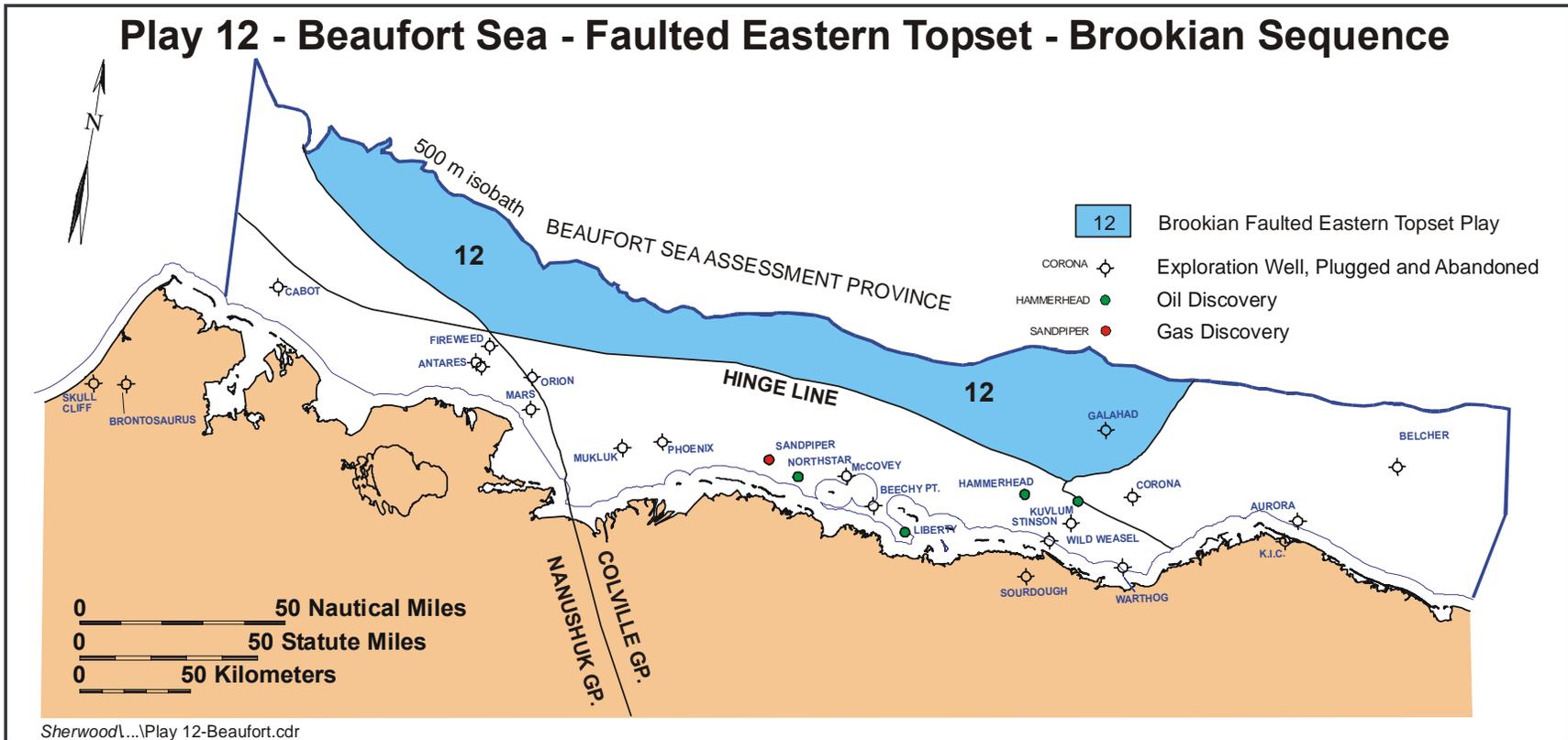


Figure 1. Map location of Beaufort Sea play 12, 2006 assessment.