

Chukchi Sea Play 22: Upper Brookian Intervalley Highs

Geological Assessment

GRASP UAI: AAAAA DAW

Play Area: 5,711 square miles

Play Water Depth Range: 115-180 feet

Play Depth Range: 1,600-7,500 feet

Play Exploration Chance: 0.21728

Play 22, Upper Brookian Inter-Valley Highs, Chukchi 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	410	1,125
Total Gas (Tcfg)	0.000	0.519	1.158
Total Liquids (Mmbo)	0	318	919
Free Gas** (Tcfg)	0.000	0.401	0.809
Solution Gas (Tcfg)	0.000	0.118	0.349
Oil (Mmbo)	0	296	873
Condensate (Mmbc)	0	22	46
* 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 22, the “Upper Brookian Intervalley Highs” play, is the 14th-ranking play (of 29 plays) in the Chukchi Sea OCS Planning Area, with 1.4% (410 Mmboe) of the Planning Area energy endowment (29,041 Mmboe). The overall assessment results for play 22 are shown in [table 1](#). Oil and gas-condensate liquids form 77% of the

hydrocarbon energy endowment of play 22.

[Table 5](#) reports the detailed assessment results by commodity for play 22.

[Table 3](#) summarizes the volumetric input data developed for the *GRASP* computer model of Chukchi Sea play 22. [Table 4](#) reports the risk model used for play 22. The location of play 22 is shown in [figure 1](#).

Potential reservoirs include transgressive-lag sandstones of Paleocene age deposited on wrench-fault-bounded structural ridges or horsts in the course of submergence and burial. Because of the transgressive nature of the sandstones and the low inclination of flooding surfaces at the crests of intervalley uplifts, reservoirs are modeled as thin relative to play 21. The play is modeled as predominantly charged by the Hanna trough play charging system. This play was not tested by any well.

A maximum of 21 hypothetical pools is forecast by the aggregation of the risk model and the prospect numbers model for play 22. These 21 pools range in mean conditional (un-risked) recoverable volumes from 7 Mmboe (pool rank 21) to 247 Mmboe (pool rank 1). Pool rank 1 ranges in possible conditional recoverable volumes from 49 Mmboe (F95) to 653 Mmboe (F05). [Table 2](#) shows the conditional sizes of the 10 largest pools in play 22.

Play 22, Upper Brookian Intervalley Highs, Chukchi 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	49	247	653
2	23	115	279
3	13	71	169
4	9	49	117
5	7	36	87
6	6	28	68
7	5.1	23	56
8	4.6	20	47
9	4.2	17	41
10	3.9	16	36
<p>* Conditional, Technically-Recoverable, Millions of Barrels Energy-Equivalent (Mmboe), from "PSRK.out" file</p> <p>F95 = 95% chance that resources will equal or exceed the given quantity</p> <p>F05 = 5% chance that resources will equal or exceed the given quantity</p> <p>BOE = total hydrocarbon energy, expressed in barrels-of-oil-equivalent, where 1 barrel of oil = 5,620 cubic feet of natural gas</p>			

Table 2

In the computer simulation for play 22 a total of 45,488 “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 (10,973, or 24%) of simulation pools (conditional, technically recoverable BOE resources) for play 22. Pool size class 11 ranges from 32 to 64 Mmboe. The largest 2 simulation pools for play 22 fall within pool size class 17, which ranges in size from 2,048 to 4,096 Mmboe. [Table 6](#) reports statistics for the simulation pools developed in the GRASP computer model for play 22.

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

Basin: Chukchi Sea Planning Area

Play Number: 22

Play UAI Number: AAAAA DAW

Assessor: K.W. Sherwood

Play Name: Upper Brookian - Intervalley Highs

Date: January 2005

Play Area: mi² (million acres)

5,711 (3.655)

Reservoir Thermal Maturity: % Ro

0.43 - 0.51

Play Depth Range: feet

1,600 - 7,500 (mean = 4038)

Expected Oil Gravity: ° API

30

Play Water Depth Range: feet

115 - 180 (mean = 150)

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*	1585		2059		7772	13300/18467			29338				78398
Prospect Area (acres)-Model Output**	1586	2152	2681	4603	8593	13055/12850	16467	23217	29085	40423			78134
Fill Fraction (Fraction of Area Filled)	0.18	0.30	0.33	0.37	0.43	0.44/0.10	0.50	0.54	0.57	0.62			1.00
Productive Area of Pool (acres)***	419	889	1130	1965	3749	5782/5994	7205	10247	13086	18273	23000	25000	49597
Pay Thickness (feet)	20	30	34	41	50	52/16	61	68	74	82	93	101	150

* model fit to prospect area data in *BESTFIT*

** output from @RISK after aggregation with fill fraction

*** from @RISK aggregation of probability distributions for prospect area and fill fraction

MPRO Module (Numbers of Pools)

Input Play Level Chance	0.8
Output Play Level Chance*	0.7979

Prospect Level Chance	0.2716
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Exploration Chance	0.21728
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* First Occurrence of Non Zero Pools As Reported in PSUM Module

Risk Model	Play Chance	Petroleum System Factors	Prospect Chance
		Trap Integrity (numerous faults)	0.7
0.8		Seal Presence (very sandy section)	
		Chance Porosity > 10%	0.97
		Migration (Paleocene or younger traps may post-date migration)	0.5
		Preservation (shallow traps subject to biodegradation)	0.8

Fractile	F99	F95	F90	F75	F50	Mean/Std. Dev.	F25	F15	F10	F05	F02	F01	F00
Numbers of Prospects in Play	13	15	16	18	20	20.94/3.84	22	25	26	27	29	30	39
Numbers of Pools in Play				2	5	4.55/3.06	7	8	8	9	11	11	21

Zero Pools at F79.81

Minimum Number of Pools	2 (F75)	Mean Number of Pools	4.55	Maximum Number of Pools	21
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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)	53	122	154	217	311	340/166	431	508	563	653	720	780	1264
Gas Recovery Factor (Mcfg/acre-foot)	140	319	398	533	715	753/298	933	1063	1167	1294	1400	1500	2275
Gas Oil Ratio (Sol'n Gas)(cf/bbl)	200	320	340	370	400	400/55	435	450	465	485	505	515	600
Condensate Yield ((bbl/Mmcfg)	13	29	33	40	50	54/19	64	72	79	90	105	120	200

Pool Size Distribution Statistics from *POOLS* (1,000 BOE):

μ (mu)= 10.821 σ^2 (sigma squared)= 1.211

Random Number Generator Seed= 685878

BOE Conversion Factor (cf/bbl)	5620	Probability Any Pool Contains Both Oil and Free Gas (Gas Cap)	0.6
Probability Any Pool is 100% Oil	0.2	Fraction of Pool Volume Gas-Bearing in Oil Pools with Gas Cap	0.3
Probability Any Pool is 100% Gas	0.2		

Table 3. Input data for Chukchi Sea play 22, 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: AAAADAW	Play No. 22
World Level -	World Level Resources
Country Level -	UNITED STATES OF AMERICA
Region Level -	MMS - ALASKA REGION
Basin Level -	CHUKCHI SEA SHELF
Play Level -	22 Upper Brookian Intervalley Highs
Geologist Kirk W.	Sherwood
Remarks 2005 Assessment	
Run Date & Time: Date	19-Sep-05 Time 13:56:36

Summary of Play Potential

Product	MEAN	Standard Deviation
BOE (Mboe)	410,050	382,340
Oil (Mbo)	295,980	303,800
Condensate (Mbc)	21,643	25,686
Free (Gas Cap & Nonassociated) Gas (Mmcfg)	401,110	447,880
Solution Gas (Mmcfg)	118,340	122,390

10000 (Number of Trials in Sample)

0.7979 (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	3,977	2,241	330	6,994	911
75	110,290	62,455	10,180	186,850	24,763
70	168,410	107,100	12,425	232,050	42,675
65	214,900	144,860	14,180	255,970	57,949
60	258,500	176,010	15,737	304,340	70,865
55	300,280	204,250	18,806	351,510	82,507
50	342,780	230,070	21,714	418,660	92,767
45	386,490	263,120	24,281	450,920	105,920
40	430,320	305,740	23,983	442,870	122,470
35	482,650	340,070	27,218	513,510	134,830
30	536,370	378,900	30,749	560,240	151,980
25	598,950	425,000	34,687	612,740	169,950
20	673,330	501,400	31,396	586,330	203,520
15	770,660	567,980	37,034	708,600	222,360
10	908,130	670,990	44,662	815,710	266,040
8	976,350	744,690	41,315	769,340	300,350
6	1,067,500	783,570	52,969	985,260	312,880
5	1,125,100	872,670	46,413	808,840	348,930
4	1,198,800	910,360	51,801	964,830	364,850
2	1,445,000	1,126,600	58,406	1,010,000	450,780
1	1,703,800	1,338,500	63,612	1,159,200	536,710
0.1	2,267,100	1,925,000	44,760	863,380	807,460
0.01	3,016,100	2,522,400	67,150	1,303,500	1,093,700
0.001	3,549,000	2,769,500	138,370	2,471,000	1,132,400

Table 5. Assessment results by commodity for Chukchi Sea play 22, 2006 assessment.

Basin: CHUKCHI SEA SHELF Play 22 - U. Brookian - Intervalley Ridges UAI Key: AAAADAW							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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000000	0.000000		
2	0.0625	0.125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000000	0.000000		
3	0.125	0.25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000000	0.000000		
4	0.25	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000000	0.000000		
5	0.5	1	2	0.004397	0.0002	0.000251	0	1	1	0	0	1	1	1	1	1	1	1	1	0.881268	0.884574		
6	1	2	37	0.08134	0.0037	0.004637	3	9	25	1	1	1	1	1	1	1	1	1	1	1.100396	1.980116		
7	2	4	384	0.844179	0.0384	0.04812	118	58	208	1	2	1	1	1	1	2	1	2	2	2.001903	3.991122		
8	4	8	1727	3.796606	0.1727	0.216416	786	234	707	1	3	1	2	1	2	1	2	1	3	4.000541	7.997477		
9	8	16	4860	10.684136	0.486	0.609023	2627	747	1486	1	4	1	3	1	4	1	4	1	5	8.001133	15.999176		
10	16	32	8591	18.886299	0.8591	1.076566	4982	1515	2094	1	6	1	4	1	4	1	4	1	8	16.000046	31.997757		
11	32	64	10973	24.122845	1.0973	1.375063	6718	2070	2185	1	7	1	4	1	4	1	4	1	9	32.002617	63.991728		
12	64	128	9718	21.363876	0.9718	1.217795	6180	2035	1503	1	6	1	3	1	4	1	4	1	8	64.000027	127.995701		
13	128	256	6036	13.269434	0.6036	0.756391	3843	1531	662	1	5	1	4	1	3	1	3	1	6	128.021807	255.999320		
14	256	512	2437	5.357457	0.2437	0.305388	1572	702	163	1	4	1	3	1	2	1	2	1	4	256.046731	511.599658		
15	512	1024	637	1.400369	0.0637	0.079825	389	219	29	1	3	1	2	1	1	1	1	1	3	512.107587	1022.615000		
16	1024	2048	84	0.184664	0.0084	0.010526	52	32	0	1	1	1	1	0	0	0	1	1	1	1026.043000	1969.174000		
17	2048	4096	2	0.004397	0.0002	0.000251	1	1	0	1	1	1	1	0	0	0	1	1	1	2048.086000	2101.924000		
18	4096	8192	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000000	0.000000		
19	8192	16384	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000000	0.000000		
20	16384	32768	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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		
22	65536	131072	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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		
24	262144	524288	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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		
Not Classified			0	0	0	0	Below Class			Below Class								Below Class					
Totals			45488	99.999992	4.5488	5.700251	Above Class			Above Class								Above Class					
Number of Pools not Classified: 0																							
Number of Pools below Class 1: 0																							
Number of Trials with Pools: 7980																							
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.																							

Table 6. Statistics for simulation pools created in computer sampling run for Chukchi Sea play 22, 2006 assessment.

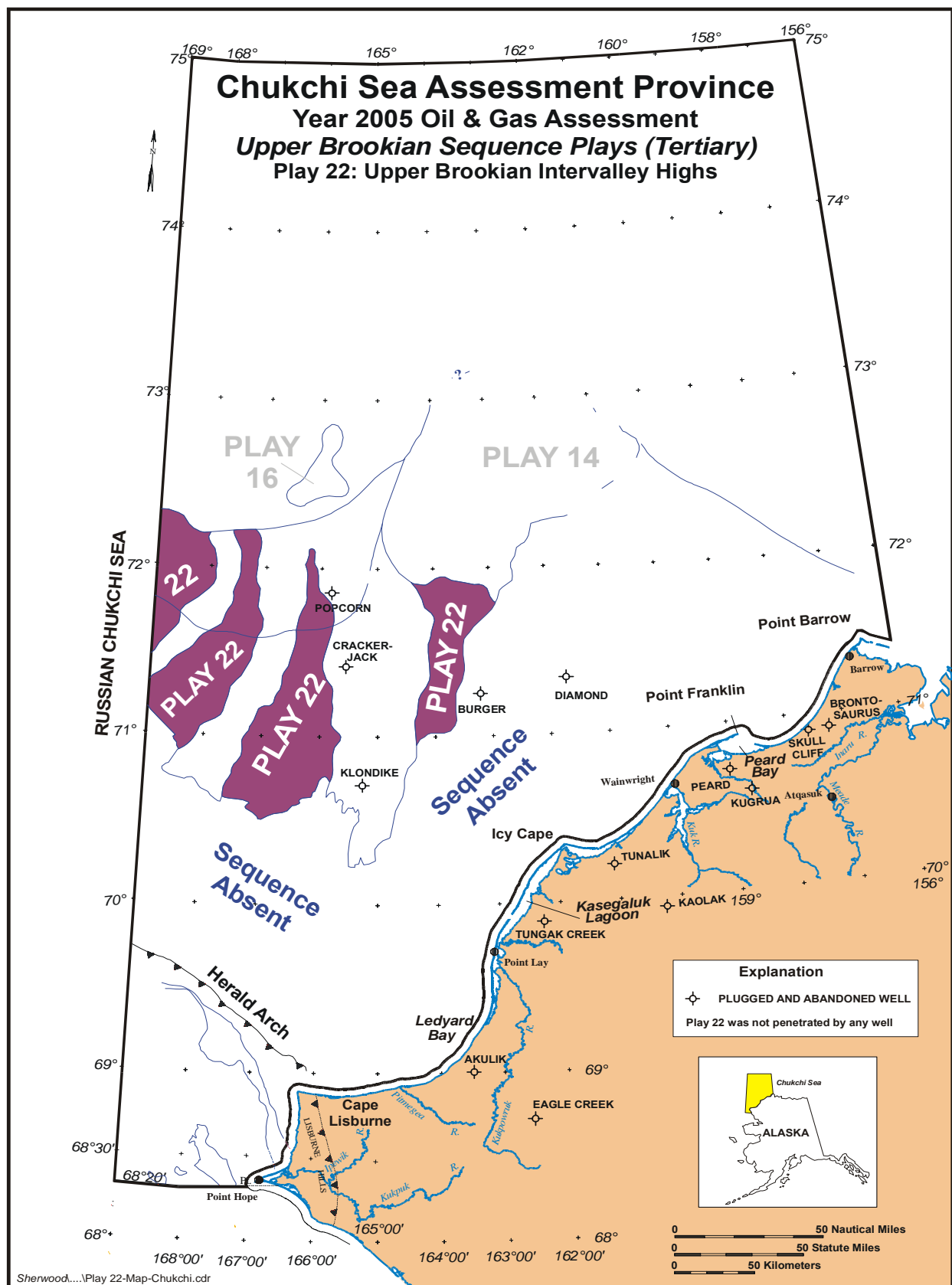


Figure 1. Map location of Chukchi Sea play 22, 2006 assessment.