

Hope Basin Play 2: Early Sequence (Eocene) Correlative to Chukchi Sea Play 27

Geological Assessment

GRASP UAI: AAAAA FAC

Play Area: 5,138 square miles

Play Water Depth Range: 30-180 feet

Play Depth Range: 2,000-11,500 feet

Play Exploration Chance: 0.05376

Play 2, Early Sequence (Eocene), Hope Basin 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	165	714
Total Gas (Tcfg)	0.000	0.772	3.332
Total Liquids (Mmbo)	0	28	121
Free Gas** (Tcfg)	0.000	0.762	3.288
Solution Gas (Tcfg)	0.000	0.010	0.044
Oil (Mmbo)	0	9	39
Condensate (Mmbc)	0	19	82
<p>* Risked, Technically-Recoverable</p> <p>** Free Gas Includes Gas Cap and Non-Associated Gas</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> <p>Mmb = millions of barrels</p> <p>Tcf = trillions of cubic feet</p>			

Table 1

Play 2, the “Early Sequence” play, is a subordinate play in the Hope Basin OCS Planning Area, with 20% (165 Mmboe) of the Planning Area energy endowment (821 Mmboe). The overall assessment results for play 2 are shown in [table 1](#). Oil and gas-condensate liquids form 17% of the

hydrocarbon energy endowment of play 2.

[Table 5](#) reports the detailed assessment results by commodity for play 2.

[Table 3](#) summarizes the volumetric input data developed for the *GRASP* computer model of Hope basin play 2. [Table 4](#) reports the risk model used for play 2. The location of play 2 is shown in [figure 1](#).

Play 2 consists mostly of Eocene(?) rocks. The Kotzebue basin wells penetrated rocks of Eocene age that are highly volcanoclastic and that have suffered extensive porosity destruction by diagenetic processes and compaction in reaction to deep burial. Therefore, the reservoir potential of the Early Sequence play is modeled as considerably lower than that of the Late Sequence play. We speculate that reservoirs consist primarily of fluvial-deltaic sands and conglomerates deposited along the edges of rift grabens formed during the early fault-driven phase of Hope basin subsidence in Eocene time. Organic matter in samples of the Early Sequence from the Kotzebue basin wells is cellulosic, with hydrogen indices generally below 200 mgHC/gTOC and total organic carbon values averaging <0.5%. The source potential of these rocks is therefore gas prone and very poor overall. The Early Sequence reaches thermal maturity in the central areas of both Hope and Kotzebue basins. Most of the Early Sequence sediments reached thermal maturity late in the deposition of the overlying Late Sequence (Pliocene and later), after most fault traps in both plays 1 and 2 had formed. Rocks correlative to play 2 were penetrated by the Cape Espenberg

and Nimiuk Point wells in Kotzebue Sound.

Play 2, Early Sequence, Hope Basin 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	42	162	400
2	22	87	184
3	13	59	127
4	9	44	97
5	7	34	77
6	5	28	64
7	5	24	54
8	4	21	48
9	4	18	42
10	3	17	38
* 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 34 hypothetical pools is forecast by the aggregation of the risk model and the prospect numbers model for play 2. These 34 pools range in mean conditional (un-risked) recoverable volumes from 4 Mmboe (pool rank 34) to 162 Mmboe (pool rank 1). Pool rank 1 ranges in possible conditional recoverable volumes from 42 Mmboe (F95) to 400 Mmboe (F05), or in a gas case from 0.24 Tcfge (F95) to 2.25 Tcfge (F05). [Table 2](#) shows the conditional sizes of the 10 largest pools in play 2.

In the computer simulation for play 2 a total of 28,110 "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 (7,251, or 26%) of

simulation pools (conditional, technically recoverable BOE resources) for play 2. Pool size class 11 ranges from 32 to 64 Mmboe. The largest two simulation pools for play 2 fall within pool size class 16, which ranges in size from 1,024 to 2,048 Mmboe (or 6 to 12 Tcfge). [Table 6](#) reports statistics for the simulation pools developed in the *GRASP* computer model for play 2.

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

Basin: Hope Basin Planning Area
Play Number: 02
Play UAI Number: AAAAA FAC

Assessor: K.W. Sherwood
Play Name: Early Sequence (Eocene)

Date: January 2005

Play Area: mi² (million acres) 8,028 (5.138)
Reservoir Thermal Maturity: % Ro 0.25 - 1.02

Play Depth Range: feet 2,000 - 11,500 (mean = 8,000)
Expected Oil Gravity: ° API 40
Play Water Depth Range: feet 30 - 180 (mean = 165)

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*	1620		3659		10530	14798/14610			30308				65960
Prospect Area (acres)-Model Output**	1639	2931	3815	6228	10735	14045/11156	18124	24036	29083	38319			65904
Fill Fraction (Fraction of Area Filled)	0.04	0.09	0.10	0.12	0.15	0.16/0.05	0.18	0.21	0.23	0.25			0.50
Productive Area of Pool (acres)***	100	392	524	883	1608	2211/1962	2845	3843	4687	6228	7300	8000	15832
Pay Thickness (feet)	30	66	73	89	110	116/37	136	152	165	185	210	229	360

* 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	0.4	Prospect Level Chance	0.1344	Exploration Chance	0.05376
Output Play Level Chance*	0.3987				

* First Occurrence of Non Zero Pools As Reported in PSUM Module

Risk Model	Play Chance	Petroleum System Factors	Prospect Chance
		Trap Integrity (highly faulted)	0.7
		Reservoir Presence (unknown)	0.8
		Chance Porosity > 10%	0.6
0.5		Source Presence	
0.8		Source Maturity (generative volume limited to very small part of basin)	
		Migration (mostly vertical up faults; risk of diversion to surface and no access for much of basin away from generation area)	0.4

Fractile	F99	F95	F90	F75	F50	Mean/Std. Dev.	F25	F15	F10	F05	F02	F01	F00
Numbers of Prospects in Play	26	30	33	40	50	52.23/16.40	60	67	71	80	90	95	156
Numbers of Pools in Play						2.81/4.02	6	8	9	11	13	14	34

Zero Pools at F39.89

Minimum Number of Pools	3 (F35)	Mean Number of Pools	2.81	Maximum Number of Pools	34
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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)	34	85	106	152	223	244/122	312	366	406	472	530	600	1028
Gas Recovery Factor (Mcfg/acre-foot)	190	480	578	777	1056	1109/443	1376	1574	1711	1910	2100	2300	3369
Gas Oil Ratio (Sol'n Gas)(cf/bbl)	650	965	1010	1090	1175	1173/147	1265	1315	1345	1400	1450	1480	1700
Condensate Yield ((bbl/Mmcfg)	13	18	19	22	25	25/5	28	30	31	33	36	38	50

Pool Size Distribution Statistics from *POOLS* (1,000 BOE): μ (mu)= 10.496 σ^2 (sigma squared)= 1.067 Random Number Generator Seed= 634980

BOE Conversion Factor (cf/bbl)	5620	Probability Any Pool Contains Both Oil and Free Gas (Gas Cap)	0.1
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	0.9		

Table 3. Input data for Hope basin play 2, 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: AAAAAFAC		Play No. 2		
World	Level -	World	Level	Resources
Country	Level -	UNITED	STATES	OF AMERICA
Region	Level -	MMS	-	ALASKA REGION
Basin	Level -	HOPE	BASIN	
Play	Level -	Play		2 Early Sequence (Eocene)
Geologist	Kirk W.	Sherwood		
Remarks	2005 Assessment			
Run Date & Time:	Date	19-Sep-05 Time		14:04:33

Summary of Play Potential

Product	MEAN	Standard Deviation
BOE (Mboe)	165,200	263,630
Oil (Mbo)	8,585	29,770
Condensate (Mbc)	19,168	30,841
Free (Gas Cap & Nonassociated) Gas (Mmcfg)	762,340	1,217,800
Solution Gas (Mmcfg)	10,124	36,112

10000 (Number of Trials in Sample)

0.3987 (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	0	0	0	0	0
70	0	0	0	0	0
65	0	0	0	0	0
60	0	0	0	0	0
55	0	0	0	0	0
50	0	0	0	0	0
45	0	0	0	0	0
40	5,356	111	664	25,602	140
35	144,210	5,034	16,669	682,730	5,753
30	218,630	10,400	25,537	1,014,900	11,783
25	290,940	16,723	33,557	1,332,800	19,734
20	367,870	16,595	43,108	1,712,200	19,717
15	444,760	19,132	52,502	2,075,300	21,681
10	545,680	25,035	63,857	2,538,400	28,764
8	601,090	26,867	69,681	2,803,100	32,408
6	668,750	34,906	77,350	3,086,600	40,926
5	713,940	38,623	82,377	3,287,900	44,441
4	763,870	40,953	89,408	3,512,100	48,252
2	909,850	42,358	107,890	4,218,800	50,214
1	1,046,500	74,709	117,970	4,711,700	86,608
0.1	1,679,600	71,287	189,060	7,901,700	74,487
0.01	2,361,900	63,503	288,100	11,216,000	81,966
0.001	2,520,500	261,300	287,020	10,835,000	248,180

Table 5. Assessment results by commodity for Hope basin play 2, 2006 assessment.

Basin: HOPE BASIN Play 02 - Early Tertiary Sequence UAI Key: AAAAAFAC							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	1	0.003557	0.0001	0.000251	0	0	1	0	0	0	0	1	1	1	1	1	1	0.238801	238.801226				
4	0.25	0.5	1	0.003557	0.0001	0.000251	0	0	1	0	0	0	0	1	1	1	1	1	1	0.366729	366.729051				
5	0.5	1	22	0.078264	0.0022	0.005517	3	0	19	1	1	0	0	1	1	1	1	1	1	0.605968	792.108893				
6	1	2	137	0.487371	0.0137	0.034353	8	0	129	1	1	0	0	1	2	1	2	1	2	1.023023	1.571135				
7	2	4	520	1.849875	0.052	0.130391	32	0	488	1	1	0	0	1	2	1	3	1	3	2.009237	3.094082				
8	4	8	1482	5.272145	0.1482	0.371615	99	0	1383	1	2	0	0	1	4	1	4	1	4	4.007655	6.100895				
9	8	16	3846	13.681964	0.3846	0.964393	326	0	3520	1	2	0	0	1	7	1	8	1	8	8.001515	12.069995				
10	16	32	6347	22.579153	0.6347	1.591525	629	0	5718	1	3	0	0	1	8	1	9	1	9	16.003813	23.569565				
11	32	64	7251	25.795092	0.7251	1.818205	734	0	6517	1	3	0	0	1	11	1	11	1	11	32.000074	46.098942				
12	64	128	5528	19.6656	0.5528	1.386158	581	0	4947	1	3	0	0	1	9	1	10	1	10	64.020907	89.121124				
13	128	256	2416	8.594806	0.2416	0.605817	285	0	2131	1	2	0	0	1	6	1	7	1	7	128.004030	172.195801				
14	256	512	501	1.782284	0.0501	0.125627	60	0	441	1	2	0	0	1	3	1	3	1	3	256.668894	328.939514				
15	512	1024	56	0.199217	0.0056	0.014042	10	0	46	1	1	0	0	1	1	1	1	1	1	512.144696	619.896118				
16	1024	2048	2	0.007115	0.0002	0.000502	1	0	1	1	1	0	0	1	1	1	1	1	1	1127.159000	1.331287				
17	2048	4096	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000000	0.000000				
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			28110	100.000008	2.811	7.048646	Above Class			Above Class								Above Class							
Number of Pools not Classified: 0							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: 0																									
Number of Trials with Pools: 3988																									

Table 6. Statistics for simulation pools created in computer sampling run for Hope basin play 2, 2006 assessment.

HOPE BASIN

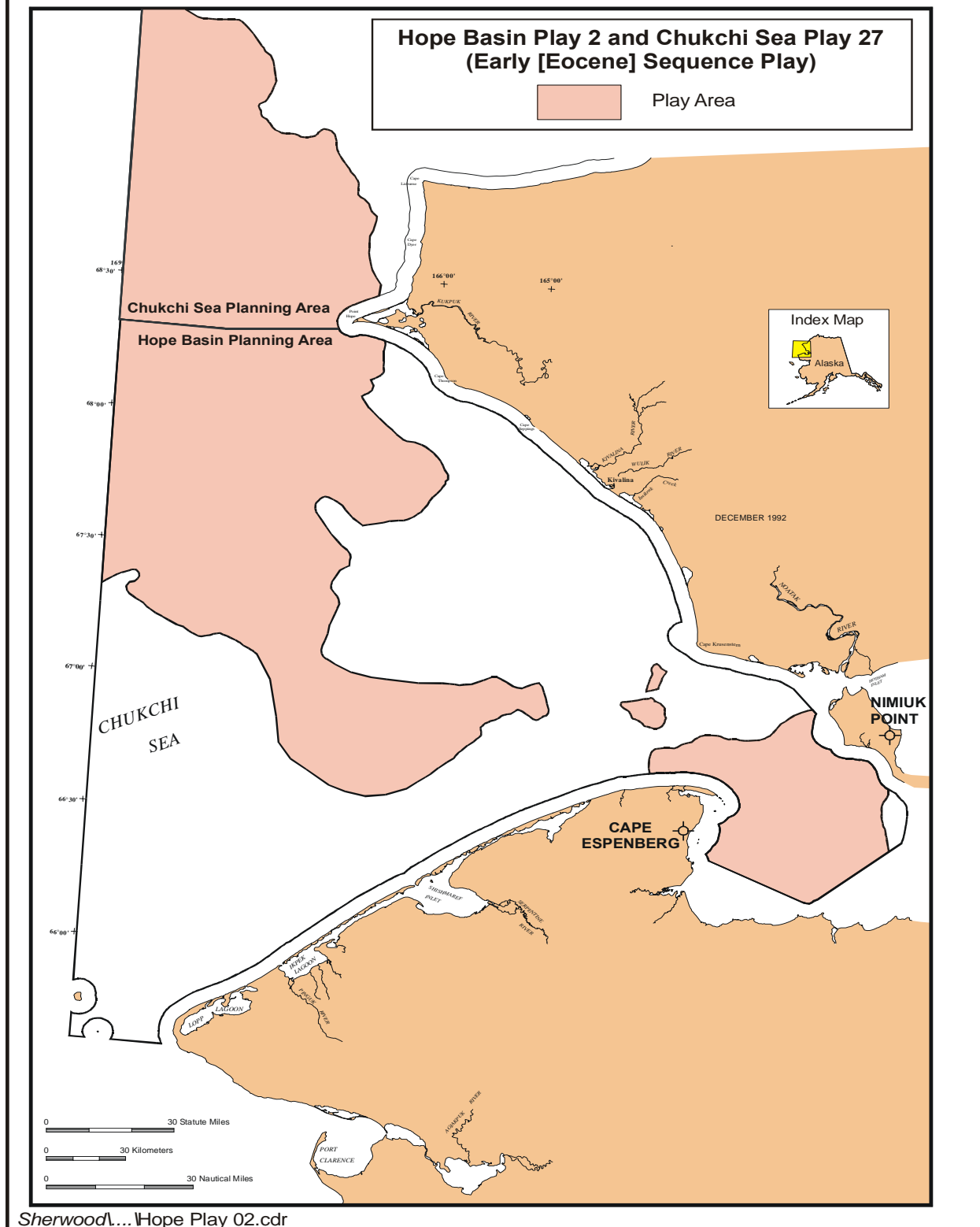


Figure 1. Map location of Hope basin play 2, 2006 assessment.