

Shumagin Planning Area (Alaska) – Province Summary

2006 Oil and Gas Assessment

Location

The Shumagin Shelf Planning Area lies offshore south of the Alaska Peninsula (fig.1). The oil and gas assessment province within the planning area (fig. 2) comprises the Federal offshore lands area on the continental shelf and slope on the Pacific side of the Alaska Peninsula southwest of Kodiak archipelago, landward of the Aleutian trench. The shoreward (northwestern) boundary is the 3-mile limit, and the southeastern boundary is loosely set at the 2,000 m isobath. The northeastern boundary is at 156° parallel, west longitude, which also marks the southwestern edge of the Kodiak Shelf Planning area (figs. 1, 2). The southwestern end of the assessment area extends just past the Sanak Islands, near the end of the Alaska Peninsula (fig. 2). The Shumagin shelf assessment area averages about 330 miles in length measuring northeast to southwest, and extends southeastward to about 85 miles offshore.

Leasing and Exploration History

There have been no lease sales held or OCS tracts leased in the Shumagin shelf assessment area. Consequently, there have been no exploratory oil and gas wells drilled. However, there have been six stratigraphic test wells drilled in the nearby Kodiak Shelf assessment area (fig. 2). The first three wells (KSST-1, 2, and 4a) constituted the Kodiak Shelf Stratigraphic Test Program. They were drilled in 1976 to shallow depths (4,000 feet or less) and obtained geologic information limited to the Pliocene-Pleistocene stratigraphic section. The remaining three wells (KSSD-1, 2, and 3) were drilled in 1977 under the Kodiak Shelf Stratigraphic Drilling Program. These

wells penetrated to depths of 8,000 to 10,000 feet and acquired appreciably more data, encountering strata as old as the early to middle Eocene (data summary provided in Turner and others, 1987). There were gas shows in two different intervals in the early to middle Miocene section of KSSD-2.

Geologic Setting

The Shumagin shelf assessment area is underlain by a broad accretionary complex that extends seaward from the Border Ranges fault system to the Aleutian trench (fig. 2). Offshore in both the Shumagin shelf area and the Kodiak shelf area to the northeast, the highly deformed rocks of the accretionary complex are truncated by a Miocene unconformity and overlain by Neogene strata that are relatively undeformed compared to the older strata. All of the undiscovered, conventionally recoverable oil and gas resources of the Shumagin and Kodiak shelf assessment areas are associated with this Neogene sequence. Older rocks are thought to offer negligible potential for conventionally recoverable hydrocarbon resources due to their structural complexity and lack of porosity and permeability.

Several Neogene forearc and trench-slope basin depocenters are superimposed on the accretionary complex, forming in response to northward subduction at the Aleutian Trench and stresses created by right-lateral motion along the Border Ranges fault (fig. 2) and possibly the Contact fault trend. These depocenters are filled with Miocene and younger strata and occur along the continental shelf and edge of the adjacent continental slope.

Seismic Stratigraphy

Three major stratigraphic sequences, A, B, and C, were defined for the Shumagin and Kodiak shelf assessment areas by integrating offshore seismic data, onshore outcrop data, and data from the six stratigraphic test wells (fig. 2) drilled on the Kodiak shelf (Fisher, 1980; Bruns and others, 1985; Turner and others, 1987; Horowitz and others, 1989). These sequences are correlated with the regional onshore stratigraphy in figure 3, and are described below.

Sequence A (Economic Basement): This sequence consists of a Cretaceous through Paleocene accretionary complex that underlies the continental shelf seaward of the Border Ranges fault. It includes the Chugach terrane and the Ghost Rocks Formation of the Prince William terrane (figs. 2, 3). These highly deformed rocks are metamorphosed and have no source-rock or reservoir-rock potential.

Sequence B (Source Rock): This sequence includes the Eocene to early Oligocene Sitkalidak Formation and offshore equivalent strata (fig. 3). These mostly volcanoclastic sedimentary rocks were deposited in a trench-slope setting, and are now generally highly deformed by subduction-related tectonism of the Kodiak and Shumagin shelf areas. Sequence B strata have a maximum total thickness of less than 6,000 feet.

Sequence C (Reservoir Rock): This sequence consists almost entirely of offshore equivalents of the Miocene Narrow Cape Formation and the Plio-Pleistocene Tugidak Formation (fig. 3). These rocks are principally Neogene sandstones and shales that were deposited at inner to outer neritic depths. They are more quartz-rich than underlying strata. Isolated deposits of

sediments equivalent to the non-marine late Oligocene Sitkinak Formation (fig. 3) may also be included at the base of the sequence, although Oligocene age strata have not been positively identified offshore.

Sequence C strata unconformably overlie sequence B, and in places are in unconformable contact with the underlying sequence A strata. Sequence C strata range from 2,000 to 20,000 feet in thickness. They typically thicken to the south, and thicken locally within structurally controlled basins on the shelf. Although rock sequences equivalent to both Sequences B and C are largely absent from the onshore section in the Shumagin shelf islands, such sequences (fig. 3) are shown by seismic data to cover a major portion of the area offshore (Turner and others, 1987; Horowitz and others, 1989).

Reservoir Formations and Potential Traps

The sediment accumulations that cover the shelf and fill the Neogene depocenters (Sequence C strata) appear to consist of marine turbidite-related sands, silts and shales deposited in deltaic complexes that prograded onto the shelf area (Turner and others, 1987). Reservoir rocks consist largely of Neogene prodeltaic turbidite sand packages associated with marine shelf distributary fan and channel deposition. Potential hydrocarbon traps consist of thrust-faulted and normal-faulted anticlines formed by Neogene tectonism, and possible stratigraphic traps formed by buried channels, lateral pinchouts and facies changes in the deltaic/turbidite environment. Seals consist of shaly units draping the turbidite sand sequences.

Source Rock Potential

Sequence B rocks are the best potential regional hydrocarbon sources, although COST well samples show them to be

organically lean (Turner and others, 1987). The woody-herbaceous nature of the organic material in samples collected from this source interval where it is less deeply buried in the Kodiak KSSD COST wells (fig. 2) suggests that it is markedly gas-prone and that the hydrocarbon endowment is largely thermogenic dry gas.

Potential hydrocarbon source rock units within the Neogene section (Sequence C) are thermally immature, organically lean, and gas-prone, with predominantly woody-herbaceous constituents. However, these constituents may form the basis of a secondary potential source of gas for the play by facilitating biogenic gas generation in the less deeply buried parts of the sequence - similar to the sourcing of the gas that is produced in upper Cook Inlet.

Migration

Thermogenic gas generated in Sequence B sediments buried deeply beneath Neogene depocenters (>20,000 feet) and shallower biogenic gas from Sequence C source rocks would migrate upward and laterally into structural and stratigraphic traps within and surrounding the Neogene basins.

Oil and Gas Resources of the Shumagin Assessment Province

The 2006 oil and gas assessment of the Shumagin shelf assessment area identified only one play, the Neogene Structural play, which was quantitatively assessed using the *GRASP* computer model. The Shumagin shelf assessment area is forecast to offer mean risked undiscovered technically recoverable resources of 100 Mmboe (summary in [tbl.1](#); detailed results in [tbls. 3](#) and [4](#)). Shumagin province assessment results are shown graphically in [figure 4](#). The area is considered to be gas prone, and this resource is predicted to consist of 0.49 Tcf of gas and 13 Mmb of condensate. At mean values, gas comprises 87 percent of

the undiscovered resource endowment. At fractile F05 (5% chance), gas resources range up to 2.04 Tcf and condensate resources range up to 53 Mmb.

Shumagin 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	100	416
Total Gas (Tcfg)	0.000	0.490	2.040
Total Liquids (Mmbo)	0	13	53
Free Gas** (Tcfg)	0.000	0.490	2.040
Solution Gas (Tcfg)	0.000	0.000	0.000
Oil (Mmbo)	0	0	0
Condensate (Mmbc)	0	13	53

* 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

The Neogene Structural play in the Shumagin shelf assessment area is estimated to contain a maximum of 35 pools, which are predicted to be entirely gas pools. The largest pool in the Shumagin shelf assessment area contains a mean conditional resource of 99 Mmboe ([tbl. 2](#)), with a maximum (F05) conditional resource of 304 Mmboe. Converting these volumes to an all-gas case, the largest pool in the Shumagin shelf assessment area contains a mean conditional resource of 0.56 Tcfge, with a maximum (F05) conditional resource of 1.7 Tcfge. None of the pools in the

Shumagin shelf assessment area have mean conditional resources exceeding 100 Mmboe (or 0.562 Tcfge).

Shumagin OCS Planning Area, Alaska, 2006 Assessment, Conditional BOE Sizes of Ten Largest Pools				
Assessment Results as of November 2005				
Pool Rank	Play Number	BOE Resources * (Mmboe)		
		F95	Mean	F05
1	1	23	99	304
2	1	13	46	99
3	1	9	30	66
4	1	6	22	47
5	1	4	17	36
6	1	2.9	13	29
7	1	2.2	11	24
8	1	1.8	9	20
9	1	1.5	8	18
10	1	1.3	7	15

* 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

References Cited

Bruns, T.R., von Heune, R., Cullota, R.C., and Lewis, S.D., 1985, Summary geologic report for the Shumagin Outer Continental Shelf (OCS)

planning area, Alaska: U.S. Geological Survey Open-File Report 85-32, 58 p.
 Fisher, M.A., 1980, Petroleum geology of the Kodiak Shelf, Alaska: American Association of Petroleum Geologists Bulletin, v. 64, p. 1140-1157.
 Horowitz, W.L., Steffy, D.A., and Hoose, P.J., 1989, Geologic report for the Shumagin planning area, western Gulf of Alaska: U.S. Minerals Management Service OCS Report MMS 89-0097, 148 p.
 Turner, R.F. (ed.), Lynch, M.B., Conner, T.A., Hallin, P.J., Hoose, P.J., Martin, G.C., Olson, D.L., Larson, J.A., Flett, T.O., Sherwood, K.W., and Adams, A.J., 1987, Geological and operational summary, Kodiak shelf stratigraphic test wells, Alaska: U.S. Minerals Management Service OCS Report MMS 87-0109, 341 p.

Links to Summaries for Individual Plays and Appended Items

[Play 1, Neogene Structural Play, Shumagin Planning Area, Assessment Summary Shumagin Plays-Assessment Results by Commodity \(Excel Format\)](#)
[Shumagin Plays-Input Data Tables \(Excel Format\)](#)
[Shumagin Plays-Pool Size Models \(Txt Format\)](#)
[Shumagin Plays-Simulation Pools-Statistics \(Excel Format\)](#)
[Shumagin Province-Assessment Results \(Excel Format\)](#)

2006 Assessment Results for Shumagin OCS Planning Area
 Risked, Undiscovered, Technically Recoverable Oil and Gas Resources, as of November 2005

Play Number	Play Name	BOE Resources (Mmbo)			Oil Resources (Mmbo)			Gas-Condensate Liquid Resources (Mmbo)			Free* Gas Resources (Tcfg)			Solution Gas Resources (Tcfg)			Total Liquid Resources (Mmbo)			Total Gas Resources (Tcfg)		
		F95	Mean	F05	F95	Mean	F05	F95	Mean	F05	F95	Mean	F05	F95	Mean	F05	F95	Mean	F05	F95	Mean	F05
1	Neogene-Structural	0	100	416	0	0	0	0	13	53	0.000	0.490	2.040	0.000	0.000	0.000	0	13	53	0.000	0.490	2.040
Sum of All Plays**		0	100	416	0	0	0	0	13	53	0.000	0.490	2.040	0.000	0.000	0.000	0	13	53	0.000	0.490	2.040

* Free gas, occurring as gas caps associated with oil and as oil-free gas pools (non-associated gas).

** Values as reported out of Basin Level Analysis-Geologic Scenario aggregation module in GRASP, "Volume Ordered" aggregation option. Total liquids and total gas values were obtained by summing resource values for means and fractiles of component commodities. Play resource values are rounded and may not sum to totals reported from basin aggregation.

BOE, total energy, in millions of barrels (5,620 cubic feet of gas per barrel of oil, energy-equivalent); Mmbo, millions of barrels of oil or liquids; Tcfg, trillions of cubic feet of natural gas

Table 3. Summary of Shumagin province assessment results for ultimate technically recoverable resources (UTRR). by play, 2006 assessment.

Province Resources - Technically Recoverable, Risked, By Product

Geological Resources Assessment Program-GRASP-Version 8.29.2005

The Current UAI AAAAAK
 is for
 World Level - World Level Resources
 Country Level - UNITED STATES OF AMERICA
 Region Level - MMS - ALASKA REGION
Basin Level - SHUMAGIN

Basin Level Aggregation of Risked, Technically Recoverable Resources By Product (Province Aggregation ".out" file)

Volume Ordered (Play Aggregation Method)

RandomSeed = 490570

Number of Trials = 10000

Greater Than Percentage	BOE (Mboe)	Oil (Mbo)	Condensate (Mbc)	Solution Gas (Mmcf)	Free (Gas Cap & Nonassociated) Gas (Mmcf)
99	0	0	0	0	0
98	0	0	0	0	0
97	0	0	0	0	0
96	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	12,413.05	0	1,501.94	0	61,320.46
35	101,341.34	0	12,735.21	0	497,966.42
30	142,025.20	0	17,510.32	0	699,773.61
25	181,258.62	0	23,186.96	0	888,362.76
20	220,112.87	0	27,585.36	0	1,082,004.64
15	264,942.20	0	33,491.77	0	1,300,751.42
10	325,807.32	0	41,111.55	0	1,599,990.23
5	415,757.20	0	52,838.22	0	2,039,604.69
4	441,522.98	0	59,526.47	0	2,146,820.37
3	475,861.90	0	60,208.93	0	2,335,969.69
2	525,064.20	0	68,908.71	0	2,563,593.87
1	617,835.01	0	77,143.48	0	3,038,686.42
Mean	99,929.24	0	12,741.61	0	489,994.49
Rep	99,962.62	0	13,896.32	0	483,692.59
Min	0	0	0	0	0
Max	1,799,919.24	0	180,722.68	0	9,099,884.68

Table 4. Detailed report of ultimate technically recoverable resources (UTRR), by commodity, as reported in province aggregation file by GRASP computer model, 2006 assessment.

2006 Shumagin Assessment Province and Alaska OCS

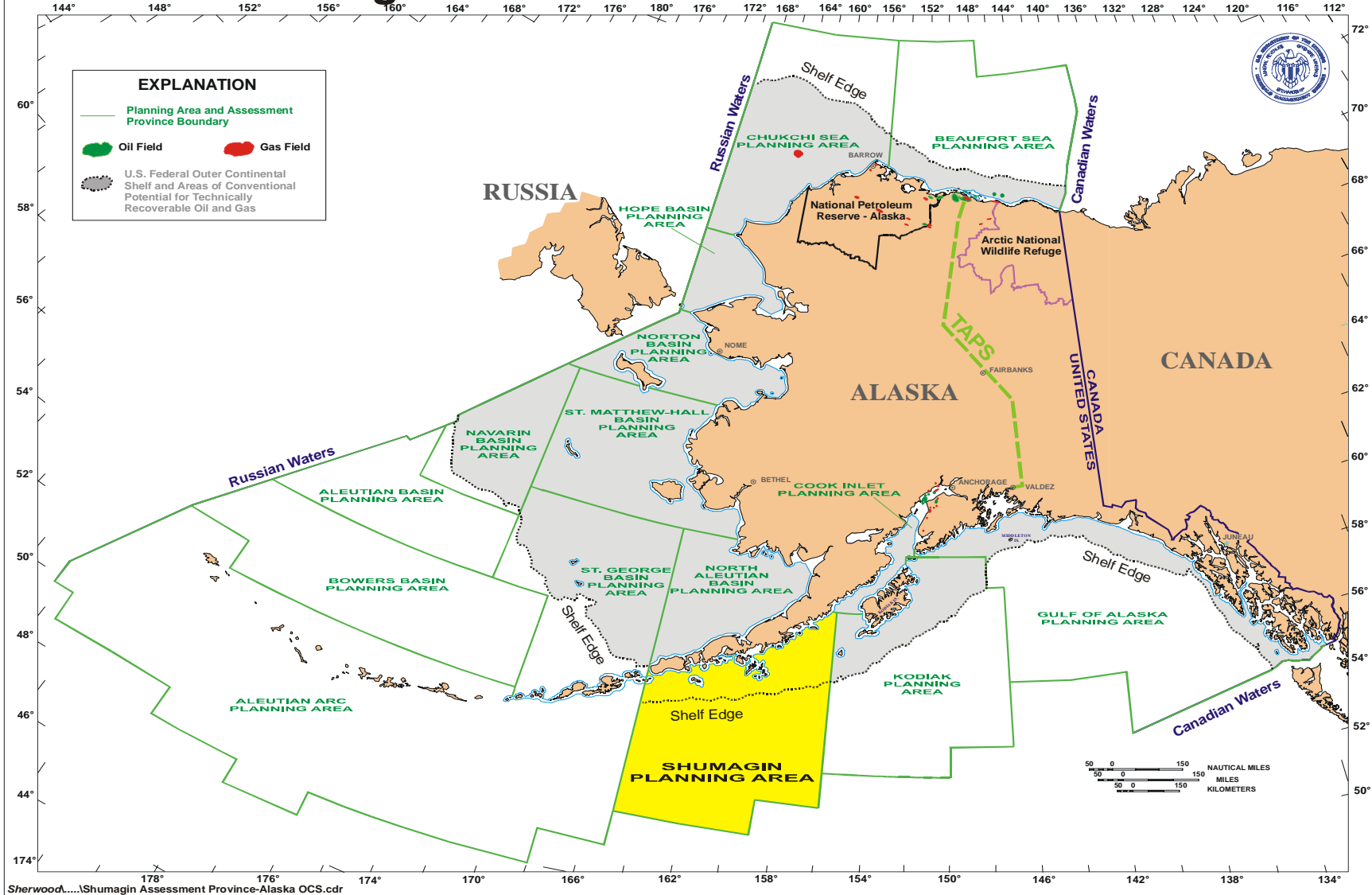


Figure 1. Location of Shumagin Planning Area and 2006 assessment province.

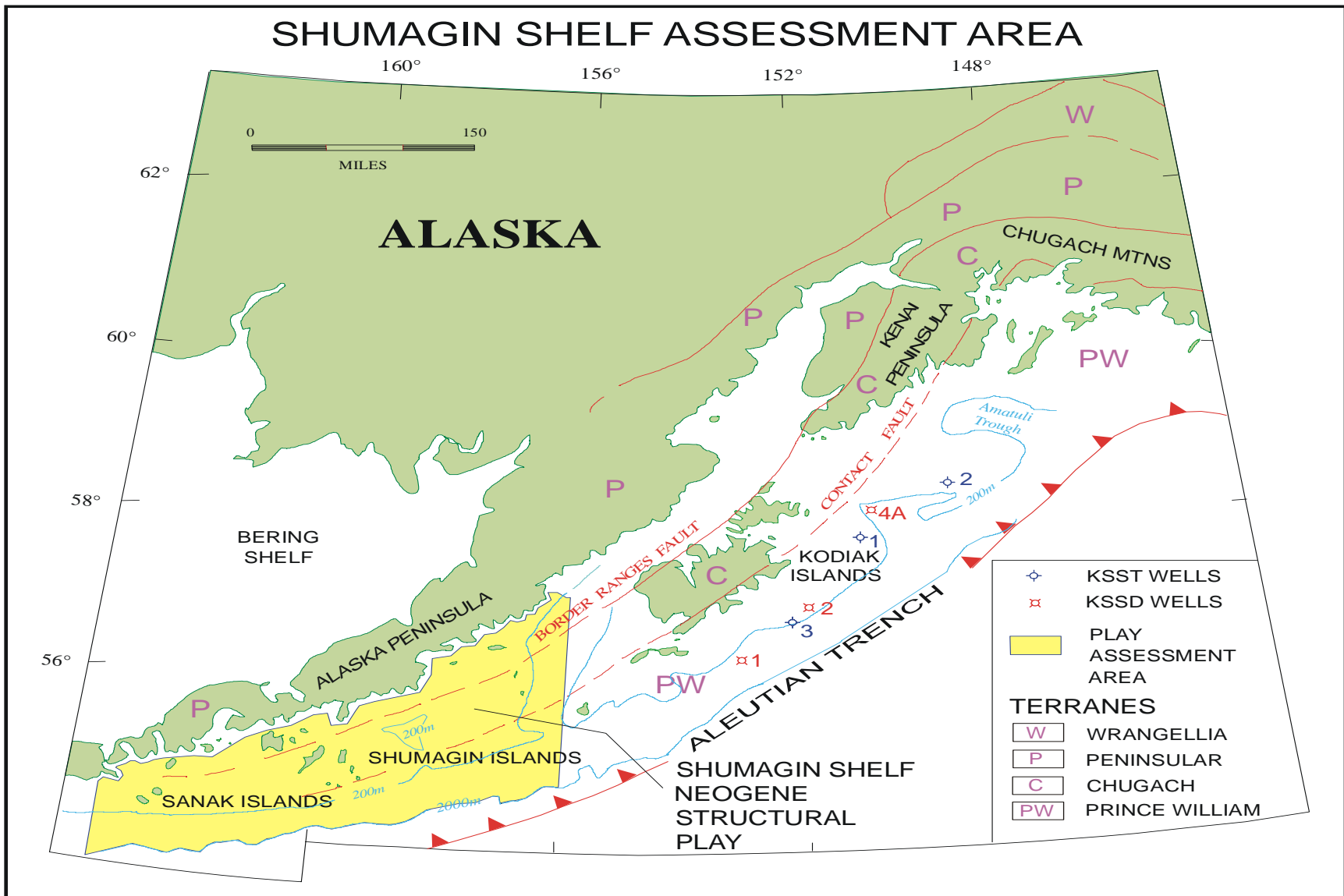


Figure 2. Map showing the location of Shumagin shelf play 1, the Neogene Structural play. Assessment of the area is based largely on onshore geologic data, data from 6 COST wells (3 KSST wells and 3 KSSD wells) drilled offshore of Kodiak Island in 1975 and 1976, and the delineation of three major seismic stratigraphic intervals in the Kodiak and Shumagin Shelf offshore areas.

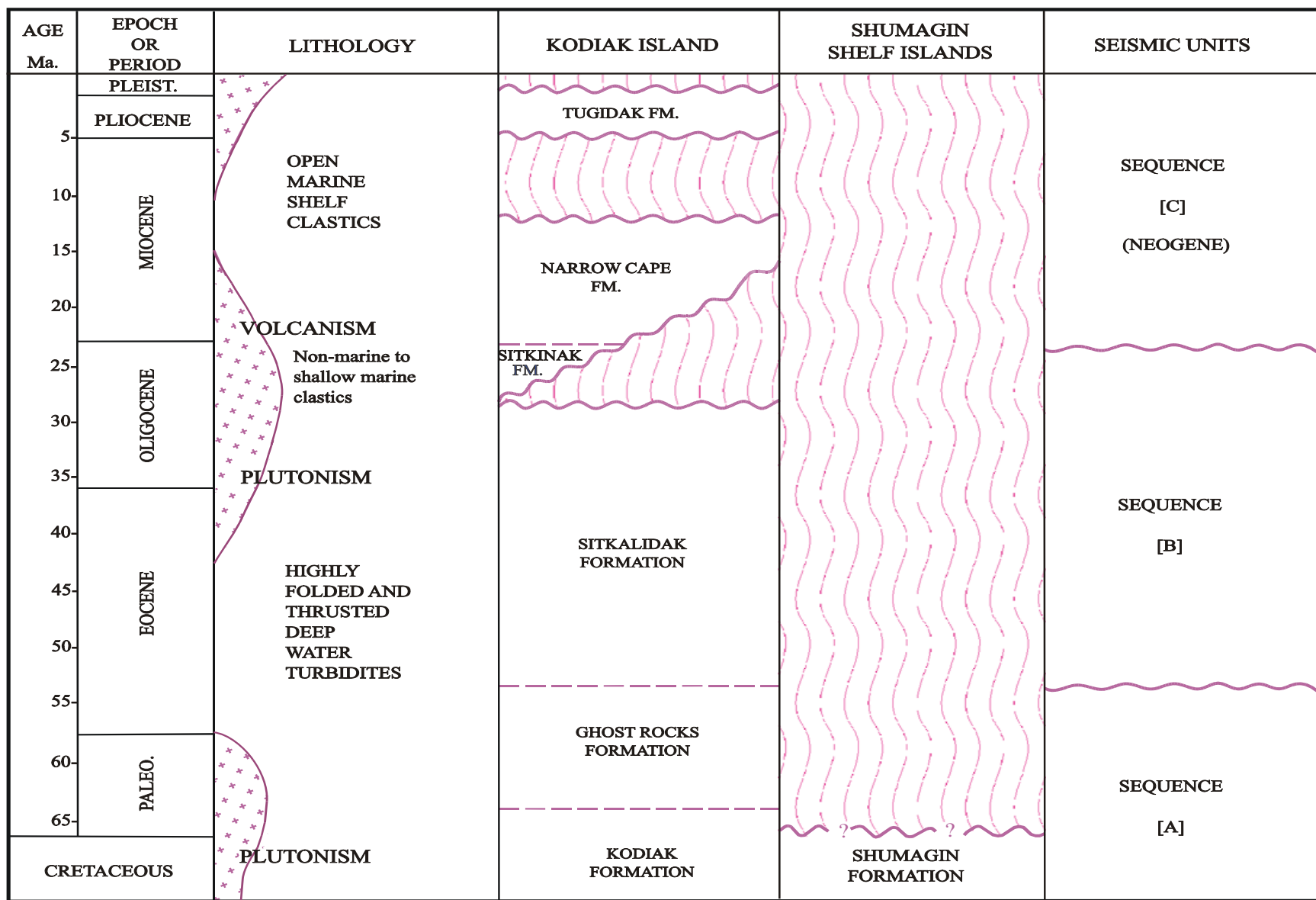


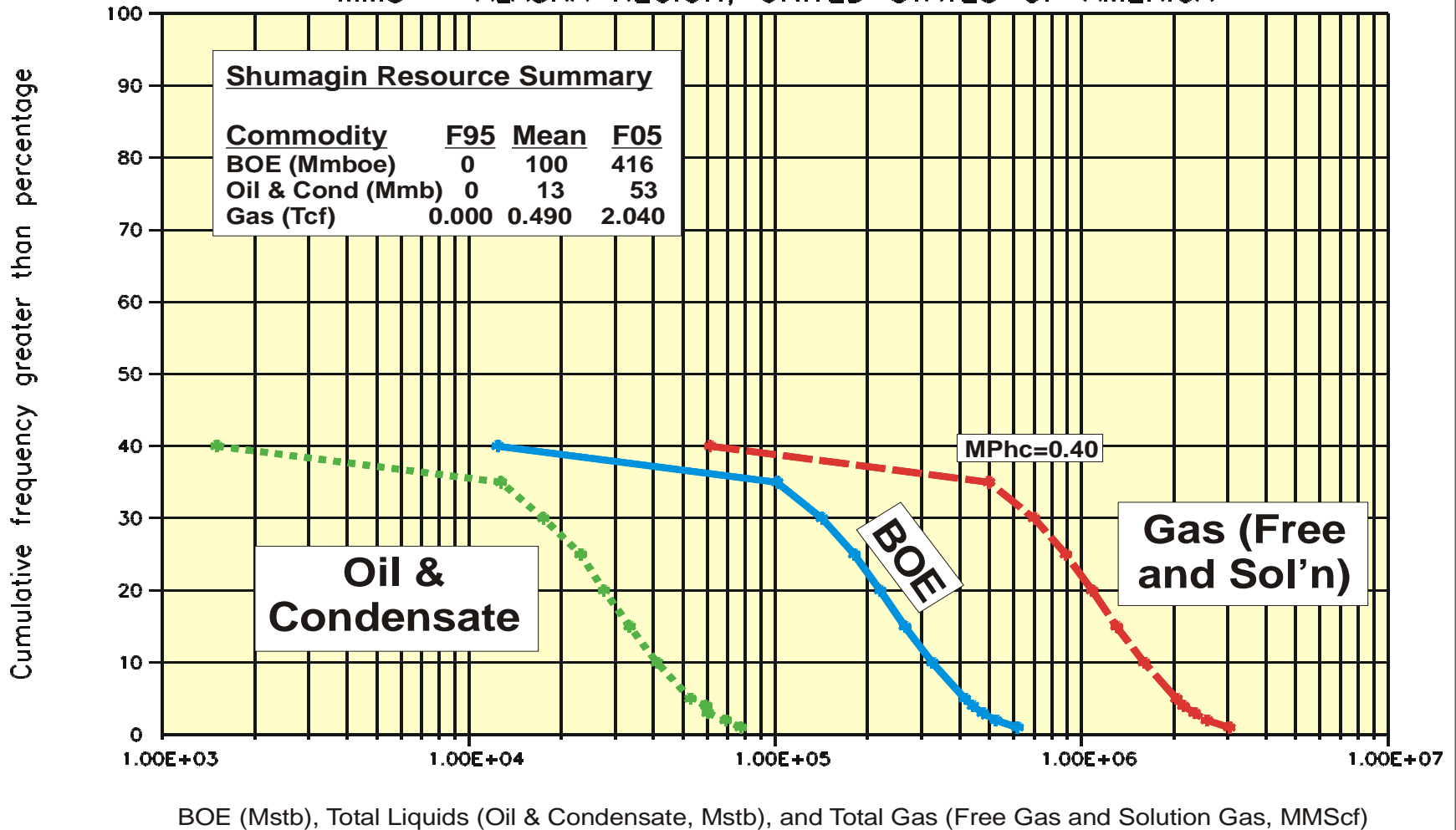
Figure 3. Diagram correlating onshore geologic events and stratigraphy with correlative offshore seismic sequences. All the estimated technically recoverable OCS hydrocarbon resource in the Shumagin shelf area is expected to be found in Neogene sandstone units of seismic sequence C.

Oil & Condensate, BOE, and Gas Resources

(Risky, Undiscovered, Technically Recoverable)

SHUMAGIN SHELF

MMS – ALASKA REGION, UNITED STATES OF AMERICA



Sherwood\...Ishumagin-CumulativeGraph-BOE-Oil-Gas.cdr

Figure 4. Cumulative probability plot for undiscovered, risky, technically recoverable oil and gas resources for the Shumagin Planning Area and assessment province, 2006 assessment.