RESERVOIR QUALITY OF 84 TERTIARY SANDSTONES FROM THREE EXPLORATORY WELLS, BRISTOL BAY BASIN, ALASKA PENINSULA

by
Kenneth P. Helmold[1], Donald W. Brizzolara[1], and Rocky R. Reifenstuhl[2]

INTRODUCTION

The State of Alaska began holding areawide oil and gas lease sales for the Alaska Peninsula on October 26, 2005 (fig. 1). The Department of Natural Resources (DNR) has instituted several studies aimed at providing data necessary for the resource evaluation. This report documents one of these studies undertaken by DOG to determine the quality of potential Tertiary sandstone reservoirs.

Eighty-four thin sections of siltstone and sandstone were examined from three exploratory wells: Arco North Aleutian COST #1 (30 km [18.6 mi] offshore), Amoco Becharof State #1, and General Petroleum Great Basins #1, on the Alaska Peninsula (fig. 1). The wells were chosen for study because conventional cores or conventional core chips were readily accessible. Wells with only cuttings were excluded from study but may be examined in future efforts. The North Aleutian COST #1 well was sampled at the ConocoPhillips Bayview core facility in Anchorage, Alaska, by Division of Geological & Geophysical Surveys (DGGS) personnel. The Becharof State #1 and Great Basins #1 wells were sampled at the Alaska Geologic Materials Center (GMC) in Eagle River, Alaska. Where possible (Becharof State #1 and North Aleutian COST #1), 2.5-cm- (1-inch-) diameter

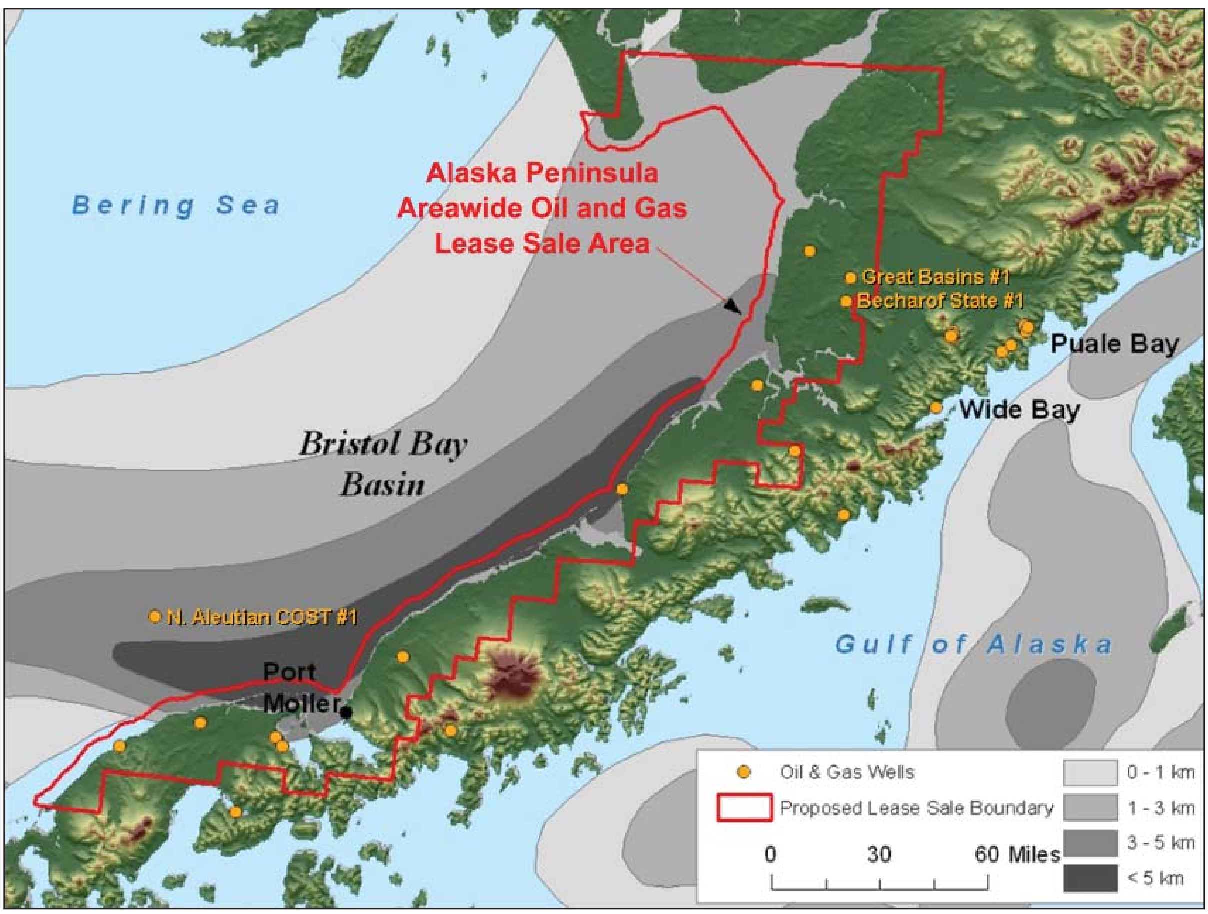

Figure 1. Shaded relief map of the Alaska Peninsula showing the lease sale area and location of oil and gas wells.

[1]Alaska Division of Oil & Gas, 550 W. 7th Ave., Suite 800, Anchorage, Alaska 99501
[2]Alaska Division of Geological & Geophysical Surveys, 3354 College Rd., Fairbanks, Alaska 99709-3707

plugs were drilled from the conventional cores to obtain thin sections and porosity–permeability (φ-k) measurements from the same sample. Only small core chips were available for the Great Basins #1 well, so no φ-k measurements could be obtained. Routine φ-k data for exploratory wells on the Alaska Peninsula were compiled from the State of Alaska Division of Oil & Gas's (DOG) well files to augment data collected during this study. Additional previously-reported porosity and permeability data from Tertiary and Mesozoic outcrop samples (Reifenstuhl and others, 2005; Strauch and others, 2006) are included for comparison (table 4).

The samples are primarily from the upper Paleogene and Neogene portion of the stratigraphic section. They encompass the Oligocene Stepovak, Miocene Bear Lake (including the Unga Member), and Pliocene Milky River Formations (fig. 2). These units were purposefully chosen for initial investigation because of their high likelihood for containing reservoirs of good to excellent quality due to their relatively young age.

Detailed modal (point-count) analyses were performed on 47 samples to obtain quantitative estimates of detrital and authigenic mineralogies. X-ray diffraction (XRD) and scanning electron microscope (SEM) analyses were conducted on 19 samples to identify and quantify the clay mineralogy of the sandstones. The SEM micrographs are also useful for estimating the type and distribution of porosity and cements. This report is primarily intended to release these data in a timely manner for use in the evaluation of the basin's petroleum potential with the hope they might encourage future exploration. As such, detailed interpretation of the data and evaluation of regional trends of reservoir quality are limited. Recent work by DGGS documents various aspects of the structural geology, sedimentology, stratigraphy, and petroleum geology of Bristol Bay and the Alaska Peninsula (Reifenstuhl and others, 2005; Finzel and others, 2005; Decker and others, 2005; Strauch and others, 2006; Loveland and others, 2007).

METHODS

THIN SECTIONS

All samples were impregnated with blue-dyed epoxy in a vacuum for 30 minutes followed by the application of high pressure (1,500–2,000 pounds per square inch or psi) for at least 8 hours. This procedure ensures complete impregnation of even the most impermeable samples and facilitates the recognition of pore types. All thin sections were stained for K-feldspar with potassium cobaltinitrate (Laniz and others, 1964) and for carbonates with a combination of alizarin red S and potassium ferricyanide (Dickson, 1965, 1966; Lindholm and Finkelman, 1972). Thin sections were prepared by Mark Mercer (Petrographic Services, Montrose, Colorado). Point-count analyses consisting of 300 points per sample for composition and 200 detrital grains for size were conducted by Michael D. Wilson (Wilson & Associates, Lakewood, Colorado). Petrographic results are provided in tables 1 and 2.

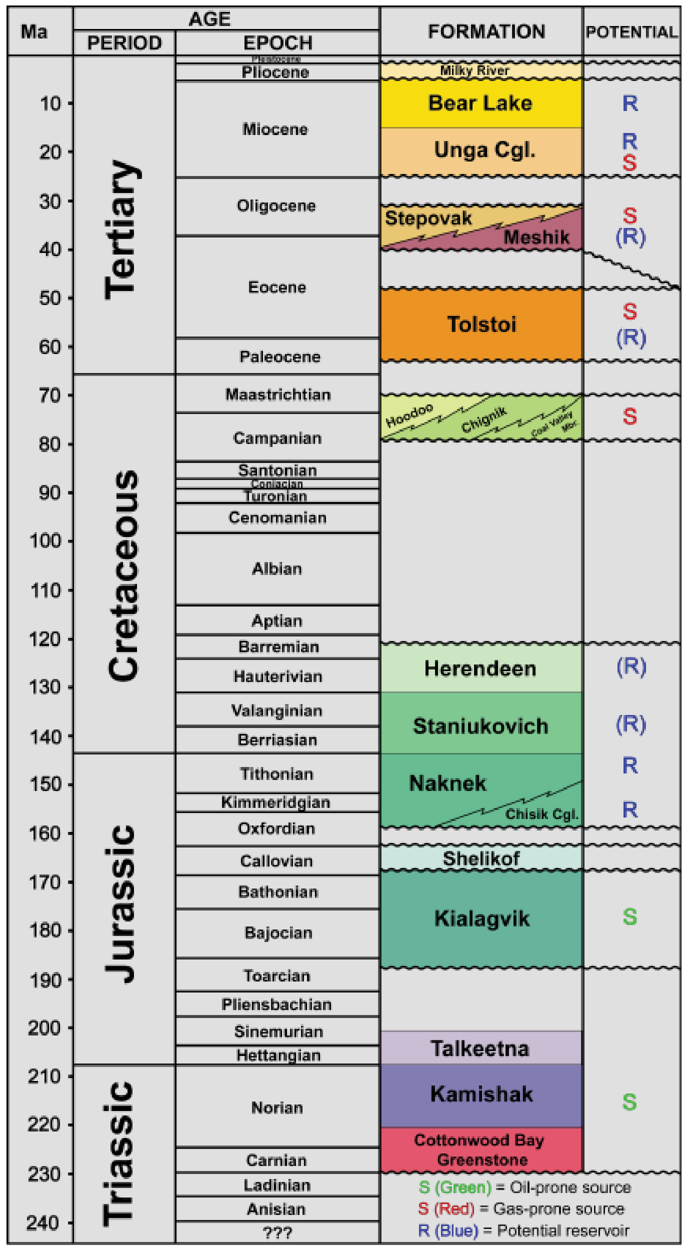

Figure 2. Composite stratigraphic column of Bristol Bay and the Alaska Peninsula (modified from Burk, 1965, and Detterman and others, 1996).

Table 1. Summary of petrographic analyses of Bristol Bay subsurface samples.

WELL	N. Aleutian 1	N. Aleutian 1	N. Aleutian 1	N. Aleutian 1	N. Aleutian 1	N. Aleutian 1	N. Aleutian 1	N. Aleutian 1	N. Aleutian 1	Becharof St 1	Becharof St 1	Becharof St 1	Becharof St 1	Becharof St 1	Becharof St 1	Becharof St 1
CORE DEPTH	4195.0	4197.0	4198.0	5234.0	5993.0	8063.0	8087.0	8635.0	9957.5	2726.5	2729.7	2734.5	2738.6	2741.5	2744.7	3678.4
LOG DEPTH	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
UNIT	Bear Lake	Bear Lake	Bear Lake	Unga	Stepovak	Stepovak	Stepovak	Stepovak	Stepovak	Milky River	Milky River	Milky River	Milky River	Milky River	Milky River	Bear Lake
SAMPLE TYPE	CCPE	CCPE	CCPE	CCPE	CCPE	CCPE	CCPE	CCPE	CCPE	CCPE	CCPE	CCPE	CCPE	CCPE	CCPE	CCPE
PLOT NUMBER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
FRAMEWORK PERCENTAGES:																
Monocrystalline Quartz	21.8	12.8	23.6	15.7	12.9	25.6	20.6	9.0	3.3	2.8	11.1	7.6	13.1	9.8	13.2	9.4
Polycrystalline Quartz	9.5	7.4	11.4	6.6	9.4	5.0	7.2	4.5	2.0	0.8	6.5	8.5	3.3	4.9	4.4	3.4
Plagioclase	10.9	10.8	12.2	12.1	12.9	16.4	15.8	10.9	20.5	4.9	15.3	15.2	15.9	14.2	13.7	16.7
K-Feldspar	5.4	7.4	4.9	9.1	3.5	4.1	3.8	3.6	2.0	1.2	3.7	5.7	4.2	4.4	1.5	4.9
Plutonic RF	6.1	3.4	1.6	3.5	5.9	0.9	4.3	4.1	2.0	0.8	2.3	3.3	4.7	3.9	3.9	5.9
Volcanic RF	13.6	12.2	8.1	8.6	22.9	12.8	29.2	46.6	49.7	76.1	39.4	22.3	22.9	25.5	36.8	23.2
Metamorphic RF	7.5	9.5	10.6	9.6	1.8	2.7	1.4	3.6	0.0	2.4	3.2	8.1	5.1	11.8	9.3	16.3
Sedimentary RF	6.8	4.1	2.4	6.6	2.9	3.7	1.4	5.0	0.7	3.6	2.3	2.8	2.8	6.4	3.4	6.4
Chert	10.2	15.5	11.4	16.7	11.2	9.1	7.7	11.8	7.3	1.6	9.3	16.1	8.9	4.4	6.4	8.4
Mica	0.0	2.0	2.4	0.0	1.2	2.7	1.9	0.0	1.3	0.0	0.0	0.9	0.5	2.5	2.0	1.0
Heavy Mineral	2.7	5.4	3.3	3.5	1.8	0.9	0.0	0.0	0.0	0.8	1.9	4.3	15.0	7.8	1.0	0.5
Organic material	0.7	1.4	0.0	0.0	0.6	2.7	3.8	0.0	2.0	3.2	0.5	0.0	0.0	0.0	0.5	0.0
Glauconite	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Phosphate	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other Intrabasinal	0.7	2.0	2.4	2.5	10.0	1.4	0.0	0.0	6.0	0.0	0.0	0.5	0.9	0.0	0.0	0.0
Undifferentiated grain	4.1	5.4	5.7	5.6	2.9	11.9	1.4	0.9	3.3	1.6	4.6	4.7	2.8	4.4	3.9	2.5
WHOLE ROCK PERCENTAGES:																
Monocrystalline Quartz	10.7	6.3	9.7	10.3	7.3	18.7	14.3	6.7	1.7	2.3	8.0	5.3	9.3	6.7	9.0	6.3
Polycrystalline Quartz	4.7	3.7	4.7	4.3	5.3	3.7	5.0	3.3	1.0	0.7	4.7	6.0	2.3	3.3	3.0	2.3
Plagioclase	5.3	5.3	5.0	8.0	7.3	12.0	11.0	8.0	10.3	4.0	11.0	10.7	11.3	9.7	9.3	11.3
K-Feldspar	2.7	3.7	2.0	6.0	2.0	3.0	2.7	2.7	1.0	1.0	2.7	4.0	3.0	3.0	1.0	3.3
Plutonic RF	3.0	1.7	0.7	2.3	3.3	0.7	3.0	3.0	1.0	0.7	1.7	2.3	3.3	2.7	2.7	4.0
Volcanic RF	6.7	6.0	3.3	5.7	13.0	9.3	20.3	34.3	25.0	62.7	28.3	15.7	16.3	17.3	25.0	15.7
Metamorphic RF	3.7	4.7	4.3	6.3	1.0	2.0	1.0	2.7	0.0	2.0	2.3	5.7	3.7	8.0	6.3	11.0
Sedimentary RF	3.3	2.0	1.0	4.3	1.7	2.7	1.0	3.7	0.3	3.0	1.7	2.0	2.0	4.3	2.3	4.3
Chert	5.0	7.7	4.7	11.0	6.3	6.7	5.3	8.7	3.7	1.3	6.7	11.3	6.3	3.0	4.3	5.7
Mica	0.0	1.0	1.0	0.0	0.7	2.0	1.3	0.0	0.7	0.0	0.0	0.7	0.3	1.7	1.3	0.7
Heavy Mineral	1.3	2.7	1.3	2.3	1.0	0.7	0.0	0.0	0.0	0.7	1.3	3.0	10.7	5.3	0.7	0.3
Undifferentiated grain	2.0	2.7	2.3	3.7	1.7	8.7	1.0	0.7	1.7	1.3	3.3	3.3	2.0	3.0	2.7	1.7
Organic material	0.3	0.7	0.0	0.0	0.3	2.0	2.7	0.0	1.0	2.7	0.3	0.0	0.0	0.0	0.3	0.0
Glauconite	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Phosphate	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other Intrabasinal	0.3	1.0	1.0	1.7	5.7	1.0	0.0	0.0	3.0	0.0	0.0	0.3	0.7	0.0	0.0	0.0
Detrital Matrix	5.0	11.7	9.0	0.0	7.3	6.7	1.0	0.3	9.0	0.7	10.3	0.0	1.0	0.3	1.0	1.0
Silica Cement	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Feldspar Cement	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Carbonate Cement	0.0	0.0	0.0	8.3	0.0	0.0	0.0	0.0	0.0	4.3	0.0	0.3	0.0	2.0	1.7	3.0
Clay Cement	0.0	0.0	0.0	0.0	0.7	0.3	2.7	8.0	2.0	0.7	0.3	0.0	0.0	0.3	0.3	0.7
Analcite Cement	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other Cement	0.3	0.7	0.7	2.0	0.0	0.3	0.0	0.0	0.3	0.0	0.0	0.0	0.3	0.0	0.0	0.0
Porosity	6.0	9.7	6.0	23.7	2.0	18.3	24.7	18.0	0.0	12.0	17.3	29.3	27.3	29.3	29.0	27.7
Laminae/Burrow-Fill	39.7	28.7	43.3	0.0	33.3	1.3	2.0	0.0	38.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 1. Summary of petrographic analyses of Bristol Bay subsurface samples–continued.

WELL	Becharof St 1	Becharof St 1	Becharof St 1	Becharof St 1	Becharof St 1	Becharof St 1	Great Basins 1	Great Basins 1	Great Basins 1	Great Basins 1	Great Basins 1	Great Basins 1	Great Basins 1	Great Basins 1	Great Basins 1	Great Basins 1
CORE DEPTH	3688.6	3691.3	3694.4	7904.0	7915.0	7931.8	1354.0	1356.0	1360.0	1362.0	1814.0	2854.0	3890.0	3893.0	3898.0	3899.0
LOG DEPTH	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
UNIT	Bear Lake	Bear Lake	Bear Lake	Stepovak	Stepovak	Stepovak	Milky River	Milky River	Milky River	Milky River	Milky River	Milky River	Bear Lake	Bear Lake	Bear Lake	Bear Lake
SAMPLE TYPE	CCPE	CCPE	CCPE	CCPE	CCPE	CCPE	CCC	CCC	CCC	CCC	CCC	CCC	CCC	CCC	CCC	CCC
PLOT NUMBER	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
FRAMEWORK PERCENTAGES:																
Monocrystalline Quartz	10.3	11.1	10.1	20.8	18.2	19.4	11.1	13.9	10.8	9.4	9.0	9.1	13.0	9.0	11.3	17.1
Polycrystalline Quartz	3.9	4.5	4.0	31.4	13.8	23.2	2.3	4.1	5.1	4.3	5.6	4.8	6.7	1.4	4.1	5.7
Plagioclase	15.3	9.6	20.2	0.4	2.0	0.0	15.2	17.2	17.8	15.2	18.8	9.1	11.9	14.2	11.9	13.0
K-Feldspar	2.5	3.5	2.0	0.4	0.0	0.4	2.3	2.5	5.1	4.3	3.0	3.8	1.0	4.7	2.1	0.0
Plutonic RF	6.9	7.6	4.5	1.5	2.4	0.0	5.3	4.9	11.5	6.5	4.7	3.8	9.3	5.7	3.1	7.3
Volcanic RF	24.1	24.7	20.2	4.2	7.1	3.8	42.1	39.3	28.7	31.9	26.1	28.0	12.4	19.4	25.3	22.0
Metamorphic RF	15.3	15.2	10.1	21.6	20.6	15.6	1.8	1.6	3.8	3.6	7.3	10.2	9.3	8.1	6.2	5.7
Sedimentary RF	6.4	6.1	8.6	0.4	3.6	5.5	4.7	1.6	2.5	0.7	2.6	3.2	9.8	19.4	20.6	1.6
Chert	9.4	11.1	9.1	11.7	10.7	22.8	6.4	4.1	5.1	9.4	9.4	15.6	18.1	10.9	7.2	12.2
Mica	0.5	0.0	2.0	0.8	9.1	1.7	0.0	1.6	0.6	1.4	0.4	2.2	0.5	0.5	1.0	1.6
Heavy Mineral	2.0	3.5	1.5	0.0	0.0	0.4	2.9	4.9	3.2	4.3	9.0	5.9	2.1	0.9	3.6	4.1
Organic material	0.0	0.0	0.0	2.3	3.2	0.8	1.8	0.0	0.6	2.2	0.9	0.0	1.0	0.9	0.0	1.6
Glauconite	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Phosphate	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other Intrabasinal	0.0	0.0	0.0	0.0	2.0	0.0	1.8	0.0	0.0	0.0	0.0	0.0	1.0	2.4	1.5	0.0
Undifferentiated grain	2.5	2.0	7.1	4.5	7.5	6.3	2.3	4.1	5.1	6.5	3.4	4.3	2.6	2.4	2.1	8.1
WHOLE ROCK PERCENTAGES:																
Monocrystalline Quartz	7.0	7.3	6.7	18.3	15.3	15.3	6.3	5.7	5.7	4.3	7.0	5.7	8.3	6.3	7.3	7.0
Polycrystalline Quartz	2.7	3.0	2.7	27.7	11.7	18.3	1.3	1.7	2.7	2.0	4.3	3.0	4.3	1.0	2.7	2.3
Plagioclase	10.3	6.3	13.3	0.3	1.7	0.0	8.7	7.0	9.3	7.0	14.7	5.7	7.7	10.0	7.7	5.3
K-Feldspar	1.7	2.3	1.3	0.3	0.0	0.3	1.3	1.0	2.7	2.0	2.3	2.3	0.7	3.3	1.3	0.0
Plutonic RF	4.7	5.0	3.0	1.3	2.0	0.0	3.0	2.0	6.0	3.0	3.7	2.3	6.0	4.0	2.0	3.0
Volcanic RF	16.3	16.3	13.3	3.7	6.0	3.0	24.0	16.0	15.0	14.7	20.3	17.3	8.0	13.7	16.3	9.0
Metamorphic RF	10.3	10.0	6.7	19.0	17.3	12.3	1.0	0.7	2.0	1.7	5.7	6.3	6.0	5.7	4.0	2.3
Sedimentary RF	4.3	4.0	5.7	0.3	3.0	4.3	2.7	0.7	1.3	0.3	2.0	2.0	6.3	13.7	13.3	0.7
Chert	6.3	7.3	6.0	10.3	9.0	18.0	3.7	1.7	2.7	4.3	7.3	9.7	11.7	7.7	4.7	5.0
Mica	0.3	0.0	1.3	0.7	7.7	1.3	0.0	0.7	0.3	0.7	0.3	1.3	0.3	0.3	0.7	0.7
Heavy Mineral	1.3	2.3	1.0	0.0	0.0	0.3	1.7	2.0	1.7	2.0	7.0	3.7	1.3	0.7	2.3	1.7
Undifferentiated grain	1.7	1.3	4.7	4.0	6.3	5.0	1.3	1.7	2.7	3.0	2.7	2.7	1.7	1.7	1.3	3.3
Organic material	0.0	0.0	0.0	2.0	2.7	0.7	1.0	0.0	0.3	1.0	0.7	0.0	0.7	0.7	0.0	0.7
Glauconite	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Phosphate	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other Intrabasinal	0.0	0.0	0.0	0.0	1.7	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.7	1.7	1.0	0.0
Detrital Matrix	0.3	0.7	2.3	4.0	7.0	4.0	10.0	3.3	8.7	6.3	2.0	1.0	7.3	8.7	5.3	10.0
Silica Cement	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Feldspar Cement	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Carbonate Cement	2.7	4.0	9.0	2.7	2.0	3.7	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.7	0.7	0.7
Clay Cement	0.3	1.0	0.3	3.0	4.3	3.3	0.7	0.0	0.0	0.0	0.0	0.0	0.7	0.3	0.3	0.3
Analcite Cement	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other Cement	0.0	0.0	0.0	0.3	0.0	0.0	0.7	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.7
Porosity	29.0	28.3	22.3	0.0	0.0	0.3	10.7	3.0	5.7	11.3	18.3	37.0	16.0	14.3	8.7	11.7
Laminae/Burrow-Fill	0.0	0.0	0.0	1.3	2.3	9.7	21.0	53.0	33.0	36.3	1.7	0.0	11.0	5.7	20.3	35.7

Table 1. Summary of petrographic analyses of Bristol Bay subsurface samples–continued.

WELL	Great Basins 1	Great Basins 1	Great Basins 1	Great Basins 1	Great Basins 1	Great Basins 1	Great Basins 1	Great Basins 1	Great Basins 1	Great Basins 1	Great Basins 1	Great Basins 1	Great Basins 1	Great Basins 1	Great Basins 1
CORE DEPTH	3902.0	4945.0	5464.0	6080.0	6083.0	6090.0	8216.0	8227.0	8236.0	9823.0	9825.0	10580.0	10581.0	10582.0	10672.0
LOG DEPTH	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
UNIT	Bear Lake	Bear Lake	Bear Lake	Bear Lake	Bear Lake	Bear Lake	Bear Lake	Bear Lake	Bear Lake	Bear Lake	Bear Lake	Stepovak	Stepovak	Stepovak	Stepovak
SAMPLE TYPE	CCC	CCC	CCC	CCC	CCC	CCC	CCC	CCC	CCC	CCC	CCC	CCC	CCC	CCC	CCC
PLOT NUMBER	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
FRAMEWORK PERCENTAGES:															
Monocrystalline Quartz	11.5	26.8	15.2	24.6	18.7	21.3	35.4	38.1	31.0	10.3	9.6	2.1	1.6	2.6	1.7
Polycrystalline Quartz	6.4	10.0	5.2	4.2	7.7	6.7	8.6	4.8	7.9	9.9	14.6	0.5	1.0	1.6	1.3
Plagioclase	17.8	8.9	6.3	4.8	6.7	6.2	8.2	8.7	9.2	32.3	32.9	0.5	1.0	0.5	5.9
K-Feldspar	2.5	8.9	8.9	10.2	8.6	5.8	4.9	3.0	4.8	5.2	2.7	0.5	2.6	1.6	1.3
Plutonic RF	7.6	0.0	3.7	5.4	6.7	2.2	1.2	0.4	1.7	30.2	30.6	3.1	4.7	3.6	3.0
Volcanic RF	19.1	6.8	13.6	16.8	15.3	11.1	4.9	1.7	2.6	4.3	5.0	33.3	30.2	21.2	43.2
Metamorphic RF	7.0	3.2	13.6	8.4	8.6	6.2	7.0	4.3	6.1	1.3	0.9	8.3	4.7	6.2	3.4
Sedimentary RF	8.9	0.5	4.7	5.4	4.3	4.4	5.8	5.2	5.7	0.0	0.0	3.1	7.3	5.2	5.1
Chert	11.5	14.7	17.8	13.8	16.7	24.4	9.5	13.9	13.1	0.9	0.5	38.0	37.5	44.6	32.6
Mica	1.9	4.7	3.7	1.8	1.4	2.2	5.8	10.4	7.0	1.3	0.9	0.5	0.0	1.0	0.8
Heavy Mineral	3.2	1.1	0.0	0.0	0.0	0.0	0.8	0.9	1.3	0.0	0.0	0.5	0.0	1.0	0.0
Organic material	1.3	6.3	1.0	1.8	2.4	4.0	0.4	1.7	2.6	0.4	0.5	0.0	0.0	0.0	0.0
Glauconite	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Phosphate	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other Intrabasinal	0.6	0.0	0.5	0.0	0.0	0.4	0.0	0.9	0.9	0.0	0.0	0.0	0.0	0.0	0.0
Undifferentiated grain	0.6	7.9	5.8	3.0	2.9	4.9	7.4	6.1	6.1	2.6	0.5	8.9	8.3	10.9	1.3
WHOLE ROCK PERCENTAGES:															
Monocrystalline Quartz	6.0	17.0	9.7	13.7	13.0	16.0	28.7	29.3	23.7	8.0	7.0	1.3	1.0	1.7	1.3
Polycrystalline Quartz	3.3	6.3	3.3	2.3	5.3	5.0	7.0	3.7	6.0	7.7	10.7	0.3	0.7	1.0	1.0
Plagioclase	9.3	5.7	4.0	2.7	4.7	4.7	6.7	6.7	7.0	25.0	24.0	0.3	0.7	0.3	4.7
K-Feldspar	1.3	5.7	5.7	5.7	6.0	4.3	4.0	2.3	3.7	4.0	2.0	0.3	1.7	1.0	1.0
Plutonic RF	4.0	0.0	2.3	3.0	4.7	1.7	1.0	0.3	1.3	23.3	22.3	2.0	3.0	2.3	2.3
Volcanic RF	10.0	4.3	8.7	9.3	10.7	8.3	4.0	1.3	2.0	3.3	3.7	21.3	19.3	13.7	34.0
Metamorphic RF	3.7	2.0	8.7	4.7	6.0	4.7	5.7	3.3	4.7	1.0	0.7	5.3	3.0	4.0	2.7
Sedimentary RF	4.7	0.3	3.0	3.0	3.0	3.3	4.7	4.0	4.3	0.0	0.0	2.0	4.7	3.3	4.0
Chert	6.0	9.3	11.3	7.7	11.7	18.3	7.7	10.7	10.0	0.7	0.3	24.3	24.0	28.7	25.7
Mica	1.0	3.0	2.3	1.0	1.0	1.7	4.7	8.0	5.3	1.0	0.7	0.3	0.0	0.7	0.7
Heavy Mineral	1.7	0.7	0.0	0.0	0.0	0.0	0.7	0.7	1.0	0.0	0.0	0.3	0.0	0.7	0.0
Undifferentiated grain	0.3	5.0	3.7	1.7	2.0	3.7	6.0	4.7	4.7	2.0	0.3	5.7	5.3	7.0	1.0
Organic material	0.7	4.0	0.7	1.0	1.7	3.0	0.3	1.3	2.0	0.3	0.3	0.0	0.0	0.0	0.0
Glauconite	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Phosphate	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other Intrabasinal	0.3	0.0	0.3	0.0	0.0	0.3	0.0	0.7	0.7	0.0	0.0	0.0	0.0	0.0	0.0
Detrital Matrix	3.3	16.3	15.3	6.3	12.0	6.0	7.7	10.7	9.7	5.7	10.3	6.7	4.3	4.0	5.0
Silica Cement	0.0	0.0	0.0	0.0	0.3	0.0	0.3	0.0	0.0	0.3	0.3	0.0	0.0	0.0	0.3
Feldspar Cement	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Carbonate Cement	2.7	1.0	6.0	8.3	0.7	0.0	0.3	0.7	0.3	0.0	0.0	8.3	8.0	6.3	1.3
Clay Cement	0.7	0.7	1.7	1.0	1.0	1.7	1.7	2.0	3.7	6.7	8.7	20.7	23.7	23.0	10.3
Analcite Cement	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other Cement	0.3	0.0	0.0	0.0	0.3	0.0	0.3	0.0	0.0	0.3	0.0	0.3	0.0	2.3	0.0
Porosity	13.7	9.7	13.3	0.0	7.0	15.3	4.0	9.3	9.3	5.7	2.3	0.0	0.0	0.0	0.0
Laminae/Burrow-Fill	27.0	9.0	0.0	28.7	9.0	2.0	4.7	0.3	0.7	4.0	5.3	0.0	0.0	0.0	4.3

Table 2. Petrographic parameters and ternary compositions of Bristol Bay subsurface samples.

WELL	N. Aleutian 1	N. Aleutian 1	N. Aleutian 1	N. Aleutian 1	N. Aleutian 1	N. Aleutian 1	N. Aleutian 1	N. Aleutian 1	N. Aleutian 1	Becharof St 1	Becharof St 1	Becharof St 1	Becharof St 1	Becharof St 1	Becharof St 1	Becharof St 1
CORE DEPTH	4195.0	4197.0	4198.0	5234.0	5993.0	8063.0	8087.0	8635.0	9957.5	2726.5	2729.7	2734.5	2738.6	2741.5	2744.7	3678.4
LOG DEPTH	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
UNIT	Bear Lake	Bear Lake	Bear Lake	Unga	Stepovak	Stepovak	Stepovak	Stepovak	Stepovak	Milky River	Milky River	Milky River	Milky River	Milky River	Milky River	Bear Lake
SAMPLE TYPE	CCPE	CCPE	CCPE	CCPE	CCPE	CCPE	CCPE	CCPE	CCPE	CCPE	CCPE	CCPE	CCPE	CCPE	CCPE	CCPE
PLOT NUMBER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
PETROLOGIC PARAMETERS:																
Intergranular Volume (IGV, %)	6.3	10.3	6.7	34.0	2.7	19.0	27.3	26.0	2.3	17.0	17.7	29.7	27.7	31.7	31.0	31.3
Measured Porosity (%)	40.4	35.6	33.7	34.2	26.3	32.8	32.9	12.5	17.2	43.2	34.6	36.9	35.3	36.1	38.3	34.0
Measured Permeability (md)	11.00	6.00	18.00	1607.00	11.00	520.00	2358.00	0.98	0.87	2040.00	819.00	3470.00	2129.00	1096.00	1052.00	1550.00
Visual Grain Size (mm)	0.283	0.295	0.271	0.231	0.376	0.111	0.237	0.402	0.261	0.259	0.26	0.259	0.274	0.205	0.162	0.274
Wentworth Size Class	mL	mL	mL	fU	mU	vfU	fU	mU	mL	mL	mL	mL	mL	fU	fL	mL
Visual Sorting (phi)	0.51	0.482	0.609	0.407	0.611	0.341	0.564	0.478	0.549	0.462	0.582	0.549	0.517	0.445	0.513	0.431
Folk's Sorting	mod.	well	mod.	well	mod.	v. well	mod.	well	mod.	well	mod.	mod.	mod.	well	mod.	well
Measured Grain Size (mm)	0.035	0.039	0.032	0.231	0.054	0.086	0.221	0.402	0.034	0.255	0.167	0.259	0.274	0.205	0.162	0.274
Wentworth Size Class	cs	cs	cs	fU	cs	vfL	fU	mU	cs	mL	fL	mL	mL	fU	fL	mL
Measured Sorting (phi)	3.559	3.447	3.175	0.408	3.555	1.655	1.000	0.479	3.328	0.554	2.269	0.550	0.519	0.446	0.514	0.432
Folk's Sorting	v. poor	v. poor	v. poor	well	v. poor	poor	poor	well	v. poor	mod.	v. poor	mod.	mod.	well	mod.	well
Meas. Framewk. Grain Size (mm)	0.283	0.295	0.271	0.231	0.376	0.111	0.237	0.402	0.261	0.259	0.260	0.259	0.274	0.205	0.162	0.274
Wentworth Size Class	mL	mL	mL	fU	mU	vfU	fU	mU	mL	mL	mL	mL	mL	fU	fL	mL
Meas. Framewk. Sorting (phi)	0.510	0.482	0.609	0.407	0.611	0.341	0.564	0.478	0.549	0.462	0.582	0.549	0.517	0.445	0.513	0.431
Folk's Sorting	mod.	well	mod.	well	mod.	v. well	mod.	well	mod.	well	mod.	mod.	mod.	well	mod.	well
Grain Roundness	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Ductile Grain Index (DGI)	0.27	0.30	0.27	0.27	0.26	0.23	0.15	0.16	0.31	0.14	0.09	0.16	0.13	0.28	0.21	0.31
Ductility Index (DI)	0.66	0.67	0.73	0.27	0.61	0.34	0.19	0.16	0.69	0.14	0.23	0.16	0.14	0.28	0.23	0.32
Ductile Grain Index 1 (DGI1)	0.81	0.79	0.86	0.00	0.78	0.41	0.27	0.03	0.80	0.06	0.69	0.00	0.13	0.02	0.08	0.06
Ductility Index 1 (DI1)	0.81	0.79	0.86	0.00	0.78	0.41	0.27	0.03	0.80	0.06	0.69	0.00	0.13	0.02	0.08	0.06
Ductile Grain Index 2 (DGI2)	0.22	0.24	0.22	0.20	0.21	0.18	0.12	0.14	0.24	0.13	0.07	0.12	0.10	0.22	0.18	0.24
Ductility Index 2 (DI2)	0.60	0.59	0.67	0.20	0.55	0.27	0.15	0.14	0.61	0.13	0.19	0.12	0.11	0.22	0.19	0.25
C/Q+	0.25	0.43	0.25	0.43	0.33	0.23	0.21	0.46	0.58	0.31	0.34	0.50	0.35	0.23	0.27	0.37
Qp/Q	0.30	0.35	0.33	0.30	0.42	0.16	0.25	0.33	0.38	0.22	0.37	0.53	0.20	0.33	0.25	0.24
P/F	0.67	0.59	0.71	0.57	0.79	0.80	0.80	0.75	0.91	0.80	0.80	0.73	0.79	0.76	0.90	0.77
Lv/L	0.28	0.22	0.19	0.17	0.39	0.35	0.59	0.66	0.72	0.86	0.67	0.38	0.38	0.41	0.58	0.38
TERNARY PARAMETERS:																
Q+/F/L-	43/17/40	39/19/42	49/18/33	41/22/36	35/17/48	45/23/32	37/20/43	26/15/60	13/23/64	5/6/88	28/20/52	34/22/44	26/21/53	20/19/61	25/16/59	23/22/55
Q/F/L	33/17/50	22/19/59	37/18/45	24/22/54	23/17/60	35/23/42	30/20/50	14/15/72	5/23/71	4/6/90	18/20/62	17/22/61	17/21/63	15/19/65	18/16/66	15/22/63
Qm/F/Lt	23/17/60	14/19/67	25/18/57	17/22/61	13/17/70	29/23/48	21/20/59	9/15/76	3/23/73	3/6/91	12/20/68	8/22/70	13/21/66	10/19/70	14/16/70	10/23/68
Q+/P/K	72/19/9	67/20/14	73/19/8	65/20/15	67/26/7	66/27/7	65/28/7	64/27/9	36/58/6	46/43/11	59/33/8	61/29/11	56/35/9	51/38/12	61/35/4	51/38/11
Q/P/K	66/23/11	53/28/19	67/23/9	51/28/21	58/33/9	60/32/8	60/32/8	48/39/13	19/74/7	38/50/13	48/42/10	44/41/15	45/44/12	44/43/13	54/42/4	40/47/14
Qm/P/K	57/29/14	41/35/24	58/30/12	42/33/25	44/44/12	55/36/9	51/39/10	38/46/15	13/79/8	32/55/14	37/51/12	27/53/20	39/48/13	34/50/16	47/48/5	30/54/16
Ls+/Li/Lm	40/43/16	48/32/20	44/27/29	54/26/20	45/52/3	51/41/8	27/70/3	24/71/5	24/76/0	10/88/3	21/73/6	37/48/15	28/61/11	21/57/23	17/67/15	25/48/27
Ls+/Lv/Lm	47/34/19	52/27/21	47/23/30	59/20/22	50/46/4	52/39/8	30/67/3	25/70/5	24/76/0	10/87/3	22/72/6	39/45/16	31/56/13	22/53/24	18/65/17	27/43/30
Ls-/Lv/Lm	28/47/26	26/42/33	21/34/45	33/31/35	35/60/5	33/55/12	15/81/4	9/84/7	15/85/0	8/89/3	6/87/7	10/66/24	12/72/16	15/58/27	8/74/19	14/51/35
F/C/M	52/0/48	55/1/45	44/1/56	86/14/0	58/1/41	89/1/10	92/4/4	90/10/0	50/2/47	94/6/1	87/0/13	100/0/0	98/0/1	96/3/0	96/3/1	94/5/1
P/C/M	12/1/88	19/1/80	10/1/89	70/30/0	5/2/94	68/2/30	81/9/10	68/30/1	0/5/95	68/28/4	62/1/37	99/1/0	95/1/3	92/7/1	91/6/3	86/11/3
R/D/M	34/12/54	33/14/53	27/10/62	73/27/0	39/14/47	66/20/14	81/14/5	84/16/1	31/14/56	86/13/1	77/7/16	84/16/0	86/13/2	72/28/1	77/21/2	68/31/2
R1/D1/M1	40/11/49	41/13/46	33/10/58	80/20/0	45/12/43	73/16/11	85/11/4	86/14/0	39/12/49	87/13/1	81/6/13	88/12/0	89/9/1	78/21/1	81/18/2	75/24/1
R2/D2/M2	40/11/49	41/13/46	33/10/58	80/20/0	45/12/43	73/16/11	85/11/4	86/14/0	39/12/49	87/13/1	81/6/13	88/12/0	89/9/1	78/21/1	81/18/2	75/24/1

F/C/M = Framework Grains / Cement / Matrix
P/C/M = Porosity / Cement / Matrix
R/D/M = Rigid Grains / Ductile Grains / Matrix
R1/D1/M1 = More conservative estimate of ductile grain abundance
R2/D2/M2 = More liberal estimate of ductile grain abundance

Table 2. Petrographic parameters and ternary compositions of Bristol Bay subsurface samples–continued.

WELL	Becharof St 1	Becharof St 1	Becharof St 1	Becharof St 1	Becharof St 1	Becharof St 1	Great Basins 1	Great Basins 1	Great Basins 1	Great Basins 1	Great Basins 1	Great Basins 1	Great Basins 1	Great Basins 1	Great Basins 1	Great Basins 1
CORE DEPTH	3688.6	3691.3	3694.4	7904.0	7915.0	7931.8	1354.0	1356.0	1360.0	1362.0	1814.0	2854.0	3890.0	3893.0	3898.0	3899.0
LOG DEPTH	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
UNIT	Bear Lake	Bear Lake	Bear Lake	Stepovak	Stepovak	Stepovak	Milky River	Milky River	Milky River	Milky River	Milky River	Milky River	Bear Lake	Bear Lake	Bear Lake	Bear Lake
SAMPLE TYPE	CCPE	CCPE	CCPE	CCPE	CCPE	CCPE	CCC	CCC	CCC	CCC	CCC	CCC	CCC	CCC	CCC	CCC
PLOT NUMBER	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
PETROLOGIC PARAMETERS:																
Intergranular Volume (IGV, %)	32.0	33.3	31.7	6.7	6.3	7.3	12.0	3.0	6.0	11.3	18.3	37.0	17.3	15.3	9.7	13.3
Measured Porosity (%)	34.5	34.1	29.5	6.5	7.1	6.4	n.d.	n.d.	n.d.	n.d.	n.d.	22.4	n.d.	24.9	n.d.	n.d.
Measured Permeability (md)	3915.00	3365.00	620.00	0.14	0.12	0.13	n.d.	n.d.	n.d.	n.d.	n.d.	423.00	n.d.	453.00	n.d.	n.d.
Visual Grain Size (mm)	0.326	0.33	0.218	0.382	0.271	0.387	0.302	0.327	0.272	0.3	0.283	0.31	0.321	0.313	0.3	0.279
Wentworth Size Class	mL	mL	fU	mU	mL	mU	mL	mL	mL	mL	mL	mL	mL	mL	mL	mL
Visual Sorting (phi)	0.53	0.55	0.623	0.671	0.579	0.748	0.572	0.659	0.617	0.523	0.532	0.586	0.625	0.556	0.552	0.446
Folk's Sorting	mod.	mod.	mod.	mod.	mod.	mod.	mod.	mod.	mod.	mod.	mod.	mod.	mod.	mod.	mod.	well
Measured Grain Size (mm)	0.326	0.330	0.206	0.382	0.177	0.253	0.060	0.027	0.044	0.043	0.236	0.310	0.127	0.138	0.091	0.033
Wentworth Size Class	mL	mL	fU	mU	fL	mL	cs	cs	cs	cs	fU	mL	fL	fL	vfU	cs
Measured Sorting (phi)	0.531	0.551	1.033	0.673	2.234	2.323	3.496	3.470	3.278	3.475	1.519	0.587	3.141	2.985	3.131	3.466
Folk's Sorting	mod.	mod.	poor	mod.	v. poor	v. poor	v. poor	v. poor	v. poor	v. poor	poor	mod.	v. poor	v. poor	v. poor	v. poor
Meas. Framewk. Grain Size (mm)	0.326	0.330	0.218	0.382	0.271	0.387	0.302	0.327	0.272	0.300	0.283	0.310	0.321	0.313	0.300	0.279
Wentworth Size Class	mL	mL	fU	mU	mL	mU	mL	mL	mL	mL	mL	mL	mL	mL	mL	mL
Meas. Framewk. Sorting (phi)	0.530	0.550	0.623	0.671	0.579	0.748	0.572	0.659	0.617	0.523	0.532	0.586	0.625	0.556	0.552	0.446
Folk's Sorting	mod.	mod.	mod.	mod.	mod.	mod.	mod.	mod.	mod.	mod.	mod.	mod.	mod.	mod.	mod.	well
Grain Roundness	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Ductile Grain Index (DGI)	0.36	0.33	0.39	0.20	0.38	0.24	0.40	0.44	0.29	0.32	0.31	0.17	0.28	0.49	0.40	0.16
Ductility Index (DI)	0.36	0.33	0.42	0.25	0.45	0.36	0.64	0.80	0.67	0.70	0.35	0.18	0.46	0.60	0.60	0.66
Ductile Grain Index 1 (DGI1)	0.02	0.04	0.11	0.24	0.24	0.44	0.63	0.81	0.79	0.80	0.17	0.11	0.56	0.35	0.55	0.90
Ductility Index 1 (DI1)	0.02	0.04	0.11	0.24	0.24	0.44	0.63	0.81	0.79	0.80	0.17	0.11	0.56	0.35	0.55	0.90
Ductile Grain Index 2 (DGI2)	0.29	0.28	0.29	0.20	0.38	0.24	0.32	0.34	0.22	0.25	0.23	0.14	0.23	0.39	0.33	0.13
Ductility Index 2 (DI2)	0.29	0.29	0.32	0.25	0.44	0.36	0.57	0.73	0.58	0.62	0.27	0.15	0.41	0.50	0.52	0.61
C/Q+	0.38	0.40	0.38	0.18	0.25	0.35	0.32	0.19	0.24	0.41	0.39	0.53	0.47	0.51	0.32	0.35
Qp/Q	0.26	0.27	0.28	0.60	0.43	0.54	0.17	0.23	0.32	0.32	0.38	0.35	0.33	0.14	0.27	0.25
P/F	0.86	0.73	0.91	0.50	1.00	0.00	0.87	0.88	0.78	0.78	0.86	0.71	0.92	0.75	0.85	1.00
Lv/L	0.37	0.36	0.36	0.10	0.12	0.08	0.63	0.68	0.51	0.53	0.43	0.41	0.20	0.28	0.37	0.39
TERNARY PARAMETERS:																
Q+/F/L-	25/18/57	28/13/58	26/24/51	67/1/32	46/2/52	70/0/30	20/18/62	23/21/56	22/24/54	25/21/54	25/23/53	31/13/56	40/13/47	22/19/59	23/14/63	38/14/48
Q/F/L	16/18/66	17/13/70	16/24/60	55/1/44	35/2/63	45/0/54	14/18/68	19/21/61	17/24/59	15/21/64	15/23/62	15/13/72	21/13/65	11/19/70	16/14/70	25/14/61
Qm/F/Lt	11/18/71	11/14/75	11/24/65	22/1/77	20/2/78	21/0/79	11/18/71	15/21/65	11/24/64	10/21/69	9/23/68	10/13/77	13/13/73	9/19/71	12/14/74	19/14/67
Q+/P/K	58/36/6	68/23/9	52/44/4	99/1/1	96/4/0	99/0/1	53/41/6	53/41/6	48/41/12	54/36/10	52/41/7	70/22/9	75/23/2	53/35/12	62/32/6	73/27/0
Q/P/K	46/46/7	56/32/12	40/55/5	99/1/1	94/6/0	99/0/1	43/49/8	48/46/7	41/46/13	41/46/13	40/52/8	52/34/14	62/35/3	35/48/16	53/40/7	64/36/0
Qm/P/K	37/54/9	46/40/15	31/63/6	96/2/2	90/10/0	98/0/2	39/53/8	41/51/7	32/53/15	33/53/15	29/61/10	41/41/17	50/46/4	32/51/17	45/47/8	57/43/0
Ls+/Li/Lm	25/50/25	27/50/23	34/47/19	35/14/52	39/19/42	60/8/32	23/74/3	11/86/3	16/77/7	23/71/7	25/61/14	31/52/17	49/36/15	50/38/12	46/44/10	31/58/11
Ls+/Lv/Lm	29/44/28	30/43/27	37/42/21	36/10/54	41/15/44	60/8/32	25/72/3	12/84/4	20/70/9	26/67/8	28/56/16	33/49/18	58/24/18	55/32/13	48/42/10	36/51/13
Ls-/Lv/Lm	14/53/33	13/54/33	22/52/26	9/15/76	24/20/57	25/15/61	16/81/3	4/92/4	9/80/11	8/83/9	9/71/20	8/68/25	35/37/28	45/39/16	41/47/12	11/71/18
F/C/M	95/4/0	92/7/1	85/12/3	88/7/5	84/6/9	79/7/14	64/1/35	42/0/58	55/0/44	52/0/48	96/0/4	98/0/2	77/2/22	82/1/17	71/1/28	46/2/52
P/C/M	90/9/1	83/15/2	66/27/7	0/56/44	0/40/60	2/33/65	25/3/72	5/0/95	12/1/87	21/0/79	83/0/17	97/0/3	45/4/51	48/3/48	25/3/73	20/3/77
R/D/M	64/35/1	67/32/1	58/37/5	75/19/6	55/34/11	64/20/16	36/24/41	20/15/65	33/14/53	30/14/56	65/29/6	82/16/2	54/20/26	40/39/21	40/27/33	34/6/59
R1/D1/M1	71/29/1	71/28/1	68/28/4	75/19/6	56/34/11	64/20/16	43/21/36	27/14/59	42/12/46	38/12/50	73/22/5	85/14/2	59/18/23	50/33/17	48/24/29	39/6/55
R2/D2/M2	71/29/1	71/28/1	68/28/4	75/19/6	56/34/11	64/20/16	43/21/36	27/14/59	42/12/46	38/12/50	73/22/5	85/14/2	59/18/23	50/33/17	48/24/29	39/6/55

F/C/M = Framework Grains / Cement / Matrix
P/C/M = Porosity / Cement / Matrix
R/D/M = Rigid Grains / Ductile Grains / Matrix
R1/D1/M1 = More conservative estimate of ductile grain abundance
R2/D2/M2 = More liberal estimate of ductile grain abundance

Table 2. Petrographic parameters and ternary compositions of Bristol Bay subsurface samples–continued.

WELL	Great Basins 1	Great Basins 1	Great Basins 1	Great Basins 1	Great Basins 1	Great Basins 1	Great Basins 1	Great Basins 1	Great Basins 1	Great Basins 1	Great Basins 1	Great Basins 1	Great Basins 1	Great Basins 1	Great Basins 1
CORE DEPTH	3902.0	4945.0	5464.0	6080.0	6083.0	6090.0	8216.0	8227.0	8236.0	9823.0	9825.0	10580.0	10581.0	10582.0	10672.0
LOG DEPTH	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
UNIT	Bear Lake	Bear Lake	Bear Lake	Bear Lake	Bear Lake	Bear Lake	Bear Lake	Bear Lake	Bear Lake	Bear Lake	Bear Lake	Stepovak	Stepovak	Stepovak	Stepovak
SAMPLE TYPE	CCC	CCC	CCC	CCC	CCC	CCC	CCC	CCC	CCC	CCC	CCC	CCC	CCC	CCC	CCC
PLOT NUMBER	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
PETROLOGIC PARAMETERS:															
Intergranular Volume (IGV, %)	17.3	11.3	21.0	9.3	9.3	17.0	6.7	12.0	13.3	13.0	11.3	29.3	31.7	31.7	12.0
Measured Porosity (%)	n.d.	n.d.	n.d.	5.2	8.8	9.8	n.d.	23.2	14.6	14.4	10.7	n.d.	n.d.	n.d.	n.d.
Measured Permeability (md)	n.d.	n.d.	n.d.	1.70	2.40	1.40	n.d.	4.40	1.70	9.40	99.00	n.d.	n.d.	n.d.	n.d.
Visual Grain Size (mm)	0.287	0.091	0.104	0.189	0.209	0.115	0.103	0.075	0.093	0.813	0.916	0.629	0.636	0.588	0.851
Wentworth Size Class	mL	vfU	vfU	fU	fU	vfU	vfU	vfL	vfU	cU	cU	cL	cL	cL	cU
Visual Sorting (phi)	0.493	0.332	0.49	0.465	0.413	0.425	0.481	0.406	0.394	0.988	0.872	0.712	0.581	0.7	0.603
Folk's Sorting	well	v. well	well	well	well	well	well	well	well	mod.	mod.	mod.	mod.	mod.	mod.
Measured Grain Size (mm)	0.057	0.029	0.070	0.039	0.076	0.082	0.062	0.053	0.069	0.490	0.405	0.629	0.636	0.588	0.506
Wentworth Size Class	cs	cs	vfL	cs	vfL	vfL	cs	cs	vfL	mU	mU	cL	cL	cL	cL
Measured Sorting (phi)	3.667	3.180	2.116	3.367	3.053	2.031	2.372	1.965	1.792	2.545	3.017	0.714	0.583	0.702	2.557
Folk's Sorting	v. poor	v. poor	v. poor	v. poor	v. poor	v. poor	v. poor	poor	poor	v. poor	v. poor	mod.	mod.	mod.	v. poor
Meas. Framewk. Grain Size (mm)	0.287	0.091	0.104	0.189	0.209	0.115	0.103	0.075	0.093	0.813	0.916	0.629	0.636	0.588	0.851
Wentworth Size Class	mL	vfU	vfU	fU	fU	vfU	vfU	vfL	vfU	cU	cU	cL	cL	cL	cU
Meas. Framewk. Sorting (phi)	0.493	0.332	0.449	0.465	0.413	0.425	0.481	0.406	0.394	0.988	0.872	0.712	0.581	0.700	0.603
Folk's Sorting	well	v. well	well	well	well	well	well	well	well	mod.	mod.	mod.	mod.	mod.	mod.
Grain Roundness	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Ductile Grain Index (DGI)	0.32	0.18	0.26	0.19	0.17	0.20	0.24	0.28	0.27	0.09	0.08	0.33	0.28	0.22	0.18
Ductility Index (DI)	0.61	0.47	0.44	0.54	0.39	0.29	0.36	0.39	0.38	0.24	0.31	0.40	0.33	0.28	0.27
Ductile Grain Index 1 (DGI1)	0.70	0.75	0.53	0.80	0.68	0.39	0.44	0.38	0.39	0.69	0.80	0.26	0.22	0.24	0.42
Ductility Index 1 (DI1)	0.70	0.75	0.53	0.80	0.68	0.39	0.44	0.38	0.39	0.69	0.80	0.26	0.22	0.24	0.42
Ductile Grain Index 2 (DGI2)	0.25	0.14	0.22	0.16	0.14	0.18	0.21	0.25	0.23	0.06	0.06	0.33	0.27	0.22	0.16
Ductility Index 2 (DI2)	0.53	0.40	0.38	0.49	0.35	0.26	0.32	0.35	0.33	0.16	0.22	0.39	0.32	0.27	0.25
C/Q+	0.39	0.29	0.47	0.32	0.39	0.47	0.18	0.24	0.25	0.04	0.02	0.92	0.91	0.91	0.91
Qp/Q	0.36	0.27	0.26	0.15	0.29	0.24	0.20	0.11	0.20	0.46	0.57	0.17	0.29	0.38	0.38
P/F	0.88	0.50	0.41	0.32	0.44	0.52	0.63	0.74	0.66	0.86	0.92	0.50	0.29	0.25	0.82
Lv/L	0.31	0.18	0.23	0.31	0.28	0.20	0.14	0.04	0.06	0.11	0.13	0.38	0.36	0.26	0.49
TERNARY PARAMETERS:															
Q+/F/L-	29/21/50	56/19/25	41/16/43	44/15/41	44/16/40	55/13/32	58/14/28	60/12/27	55/15/30	23/38/38	26/36/38	45/1/54	45/4/51	55/2/43	36/7/56
Q/F/L	18/21/62	40/19/41	22/16/62	30/15/55	27/16/57	29/13/58	48/14/38	46/12/42	41/15/44	22/38/39	26/36/39	3/1/95	4/4/92	5/2/93	3/7/89
Qm/F/Lt	12/21/68	29/19/51	16/16/68	25/15/59	19/16/65	22/13/65	38/14/48	41/12/47	33/15/52	11/39/50	10/36/54	2/1/97	2/4/94	3/2/95	2/7/91
Q+/P/K	59/36/5	74/13/13	72/12/17	74/8/18	74/11/15	81/10/9	80/12/7	83/13/4	79/14/7	37/54/9	42/53/4	98/1/1	92/2/6	96/1/3	83/14/3
Q/P/K	47/47/7	67/16/16	57/18/25	66/11/23	63/16/21	70/16/14	77/14/9	79/16/6	74/17/9	36/55/9	42/54/4	75/13/13	50/14/36	67/8/25	32/56/12
Qm/P/K	36/56/8	60/20/20	50/21/29	62/12/26	55/20/25	64/19/17	73/17/10	77/17/6	69/20/11	22/68/11	21/73/6	67/17/17	30/20/50	56/11/33	19/67/14
Ls+/Li/Lm	40/48/13	68/22/10	44/31/25	41/43/16	43/41/16	63/25/12	54/21/24	77/8/15	68/13/19	3/93/3	2/95/2	48/42/10	53/41/6	62/31/8	43/53/4
Ls+/Lv/Lm	46/39/14	68/22/10	47/27/27	45/36/18	49/32/18	66/22/12	57/18/25	78/6/16	72/8/20	19/63/19	13/73/13	50/40/10	56/38/6	64/28/8	45/51/4
Ls-/Lv/Lm	29/52/19	41/41/19	19/41/41	22/52/26	22/50/28	34/42/24	34/27/39	56/13/31	51/15/34	7/71/21	7/79/14	7/74/19	17/72/11	16/65/19	10/84/7
F/C/M	61/4/35	70/2/28	73/9/18	56/9/35	75/3/23	89/2/9	84/3/13	85/3/12	84/4/11	82/8/10	75/9/16	64/29/7	64/32/4	64/32/4	79/12/9
P/C/M	29/8/64	26/5/69	37/21/42	0/21/79	23/8/69	61/7/32	21/14/65	41/12/48	39/17/44	25/32/43	9/33/58	0/81/19	0/88/12	0/89/11	0/56/44
R/D/M	39/18/43	53/12/35	56/20/23	46/11/43	61/12/27	71/18/11	64/20/16	61/24/15	62/23/15	76/7/17	69/6/24	60/30/10	67/26/7	72/21/7	73/16/11
R1/D1/M1	47/16/37	60/10/30	62/18/20	51/10/39	65/11/24	74/16/10	68/18/14	65/22/13	67/20/13	84/5/11	78/5/18	61/29/10	68/25/7	73/20/7	75/15/11
R2/D2/M2	47/16/37	60/10/30	62/18/20	51/10/39	65/11/24	74/16/10	68/18/14	65/22/13	67/20/13	84/5/11	78/5/18	61/29/10	68/25/7	73/20/7	75/15/11

F/C/M = Framework Grains / Cement / Matrix
P/C/M = Porosity / Cement / Matrix
R/D/M = Rigid Grains / Ductile Grains / Matrix
R1/D1/M1 = More conservative estimate of ductile grain abundance
R2/D2/M2 = More liberal estimate of ductile grain abundance

X-RAY DIFFRACTION (XRD)

Samples submitted for whole rock and clay mineral XRD analyses were cleaned of obvious contaminants and disaggregated in a mortar and pestle. A split of each sample was transferred to deionized water and pulverized using a McCrone micronizing mill. The resultant powder was dried, disaggregated, and pressure-packed into an aluminum sample holder to produce random whole-rock mounts. A separate split of each sample was dispersed in a dilute sodium phosphate solution using a sonic probe. The suspensions were centrifugally size fractionated to isolate clay-size (<4 micron equivalent spherical diameter) materials for a separate clay mount. A <4 micron cutoff was employed to include all authigenic clays, some of which, particularly kaolinite, are coarser than 2 microns. The suspensions were vacuum-deposited on nylon membrane filters to produce oriented clay mineral aggregates. Membrane mounts were attached to glass slides and exposed to ethylene glycol vapor for a minimum of 24 hours.

X-ray diffraction analyses of the samples were performed using a Rigaku automated powder diffractometer equipped with a copper X-ray source (40kV, 35mA) and a scintillation X-ray detector. The whole rock samples were analyzed over an angular range of 2 to 65° 2Θ at a scan rate of one degree per minute. The glycol-solvated oriented clay mounts were analyzed over an angular range of 2 to 50° 2Θ at a rate of 1.5° per minute.

Semiquantitative determinations of whole-rock mineral amounts were obtained utilizing integrated peak areas (derived from peak-decomposition/profile-fitting methods) and empirical reference intensity ratio (RIR) factors determined specifically for the diffractometer used in data collection. The total phyllosilicate (clay and mica) abundance of the samples was determined on the whole-rock XRD patterns using combined {00l} and {hkl} clay mineral reflections and suitable empirical RIR factors.

X-ray diffraction (XRD) patterns from glycol-solvated clay-fraction samples were analyzed using techniques similar to those described above. The relative amounts of phyllosilicate minerals were determined from the patterns using profile-fitted integrated peak intensities and combined empirical and calculated RIR factors. Determinations of mixed-layer clay ordering and expandability were made by comparing experimental diffraction data from the glycol-solvated clay aggregates with simulated one-dimensional diffraction profiles generated using the program NEWMOD written by R.C. Reynolds (Moore and Reynolds, 1989). Sample preparation, analyses and interpretations were performed by James B. Talbot (K/T GeoServices, Inc., Argyle, Texas; see www.ktgeo.com for details of analytical procedure). X-ray diffraction results are provided in table 3.

SCANNING ELECTRON MICROSCOPY (SEM)

A split of sandstones that were X-rayed were also examined with an ISI DS-130 scanning electron microscope (SEM) to aid in the identification of authigenic components, particularly clay minerals, and to better visualize pore geometries (figs. 13–16). Standardless energy dispersive analyses of X-rays (EDX) were performed on several grains and pore-filling cements to confirm initial identifications based on crystal morphology. The analyses were conducted using a Kevex Delta 5 system attached to the SEM. This work was performed at the Advanced Instrumentation Laboratory, University of Alaska Fairbanks.

RESULTS

INTERPRETATION OF TERNARY DIAGRAMS

The composition of the sandstones determined via point-count analyses (tables 1 and 2) are summarized on a suite of ternary diagrams (fig. 3). The QFL (Quartz–Feldspar–Lithic) diagram (fig. 3A) is used to illustrate the composition of the major detrital components. In this diagram monocrystalline quartz (Qm) and polycrystalline quartz (Qp) are apportioned to the Q-pole to highlight chemical and mechanical stability. All feldspars (potassium–feldspar and plagioclase) are apportioned to the F-pole, with the remaining lithic components (including chert) plotted at the L-pole. Chert is included with the lithics to emphasize its sedimentary origin. In a break from tradition (Dickinson, 1970; Dickinson and Suczek, 1979), intrabasinal components (that is, glauconite, phosphate, and pellets) are included with the lithics due to their potential for compaction, which negatively affects reservoir quality. In this diagram, the closer a sandstone plots towards the Q-pole, the greater its mineralogical maturity. The QmPK diagram (fig. 3B) is intended to show the composition of the monocrystalline components (quartz and feldspar) of the rocks, therefore all lithic fragments (including Qp) are excluded from the diagram. As in the QFL diagram, the closer a sandstone plots towards the Q-pole, the greater its mineralogical maturity.

The LsLvLm diagram (fig. 3C) shows the composition of the aphanitic polycrystalline (lithic) components of the rock. Sedimentary rock fragments (SRF) including chert are included at the Ls-pole. Volcanic rock fragments (VRF) are apportioned to the Lv-pole, while metamorphic rock fragments (MRF) are included at the Lm-pole. Phaneritic plutonic rock fragments (for example, granite and diorite) are excluded from this diagram. The PCM diagram (fig. 3D) portrays the

Table 3. X-ray diffraction analyses of Bristol Bay subsurface samples.

Sample Number	1	2	3	4	5	6	7	8	9	10
Well	N. Aleutian 1	N. Aleutian 1	N. Aleutian 1	N. Aleutian 1	N. Aleutian 1	Becharof St 1	Becharof St 1	Becharof St 1	Becharof St 1	Becharof St 1
Measured Depth	4197	5993	8063	8635	9957.5	2734.5	2741.5	3678.4	3694.4	7904
Unit	Bear Lake	Stepovak	Stepovak	Stepovak	Stepovak	Milky River	Milky River	Bear Lake	Bear Lake	Stepovak
Porosity (%)	35.6	26.3	32.8	12.5	17.2	36.9	36.1	34.0	29.5	6.5
Permeability (md)	6.00	11.00	520.00	0.98	0.87	3470.00	1096.00	1550.00	620.00	0.14
Whole Rock Mineralogy:										
Quartz	46.7	33.6	36.4	45.4	28.2	35.0	30.4	33.5	35.4	62.0
K-Feldspar	7.9	6.3	2.9	5.9	6.2	6.2	8.6	4.9	4.6	1.3
Plagioclase	28.8	37.7	43.4	36.8	48.2	48.0	48.7	44.8	37.6	3.5
Amphibole	0.0	6.1	0.6	0.0	0.0	1.0	0.0	0.0	0.0	1.1
Calcite	0.0	0.0	0.9	0.0	1.1	0.0	0.0	0.0	1.5	0.0
Dolomite	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0
Ankerite	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.4
Siderite	0.0	0.0	0.0	0.0	0.0	0.0	2.3	5.5	10.5	1.9
Pyrite	0.0	1.0	0.2	0.2	1.2	0.2	0.0	0.0	0.0	0.0
Gypsum	0.7	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
R0 M-L I/S*	5.7	8.5	10.8	8.0	7.4	0.6	2.0	1.3	0.9	0.0
R1 M-L I/S**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Illite & Mica	6.8	3.2	2.6	2.1	2.6	3.7	4.3	4.9	4.4	13.6
Kaolinite	0.6	0.6	0.3	0.3	1.1	0.4	0.6	0.3	0.4	10.6
Chlorite	2.8	2.8	2.0	1.3	4.1	3.9	3.0	4.7	4.7	2.7
Total Layer Silicates	15.9	15.1	15.6	11.7	15.1	8.7	10.0	11.3	10.4	26.8
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Layer Silicate Mineralogy:										
R0 M-L I/S*	35.6	56.0	69.1	68.4	48.8	7.2	20.4	11.7	8.6	0.0
R1 M-L I/S**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Illite & Mica	42.8	21.5	16.6	17.9	17.2	42.6	43.5	43.7	42.5	50.5
Kaolinite	4.0	4.1	1.8	2.8	7.0	5.1	5.9	2.9	3.6	39.5
Chlorite	17.5	18.4	12.5	10.9	27.0	45.1	30.2	41.7	45.3	10.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
%S in M-L I/S***	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	0.0

* RO M-L I/S = Randomly ordered mixed layer illite/smectite
** R1 M-L I/S = Ordered mixed-layer illite/smectite
*** %S in M-L I/S = Percent smectite in mixed-layer illite/smectite
n.d. = no data

Table 3. X-ray diffraction analyses of Bristol Bay subsurface samples–continued.

Sample Number	11	12	13	14	15	16	17	18	19
Well	Becharof St 1	Great Basins 1	Great Basins 1	Great Basins 1	Great Basins 1	Great Basins 1	Great Basins 1	Great Basins 1	Great Basins 1
Measured Depth	7931.8	1362-63	3890-91	4945-46	5464-65	6083-84	8236-37	9823-24	10582-83
Unit	Stepovak	Milky River	Bear Lake	Bear Lake	Bear Lake	Bear Lake	Bear Lake	Bear Lake	Stepovak
Porosity (%)	6.4	n.d.	n.d.	n.d.	n.d.	8.8	14.6	14.4	n.d.
Permeability (md)	0.13	n.d.	n.d.	n.d.	n.d.	2.40	1.70	9.40	n.d.
Whole Rock Mineralogy:									
Quartz	65.5	32.0	41.5	51.5	54.5	46.4	49.4	34.9	41.7
K-Feldspar	0.9	8.7	2.4	2.7	5.3	9.6	5.7	5.4	1.9
Plagioclase	2.5	44.8	43.9	29.0	23.4	21.9	30.0	52.7	15.1
Amphibole	0.0	3.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
Calcite	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.4
Dolomite	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ankerite	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Siderite	1.3	0.0	2.4	0.0	1.5	0.0	0.0	0.0	0.0
Pyrite	0.0	0.9	0.4	0.3	0.2	0.6	0.0	0.0	0.0
Gypsum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
R0 M-L I/S*	0.0	4.7	3.3	1.5	1.1	9.3	0.0	0.0	13.8
R1 M-L I/S**	3.3	0.0	0.0	0.0	0.0	0.0	1.1	0.2	0.0
Illite & Mica	12.1	3.5	3.3	3.9	4.8	3.9	3.2	1.8	0.6
Kaolinite	10.4	0.3	0.4	8.0	6.2	5.3	8.0	3.8	3.2
Chlorite	2.5	2.1	2.4	3.1	3.0	2.1	2.7	1.2	9.3
Total Layer Silicates	28.3	10.6	9.4	16.5	15.1	20.5	14.9	7.0	26.9
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Layer Silicate Mineralogy:									
R0 M-L I/S*	0.0	44.4	35.0	9.1	7.0	45.4	0.0	0.0	51.3
R1 M-L I/S**	11.7	0.0	0.0	0.0	0.0	0.0	7.2	3.0	0.0
Illite & Mica	42.7	32.9	35.2	23.5	31.9	18.8	21.4	25.8	2.3
Kaolinite	36.8	3.1	4.4	48.5	41.0	25.6	53.5	54.3	12.0
Chlorite	8.9	19.6	25.4	18.9	20.1	10.2	17.9	16.9	34.4
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
%S in M-L I/S***	30.0	90.0	90.0	90.0	90.0	90.0	40.0	40.0	90.0

* RO M-L I/S = Randomly ordered mixed layer illite/smectite
** R1 M-L I/S = Ordered mixed-layer illite/smectite
*** %S in M-L I/S = Percent smectite in mixed-layer illite/smectite
n.d. = no data

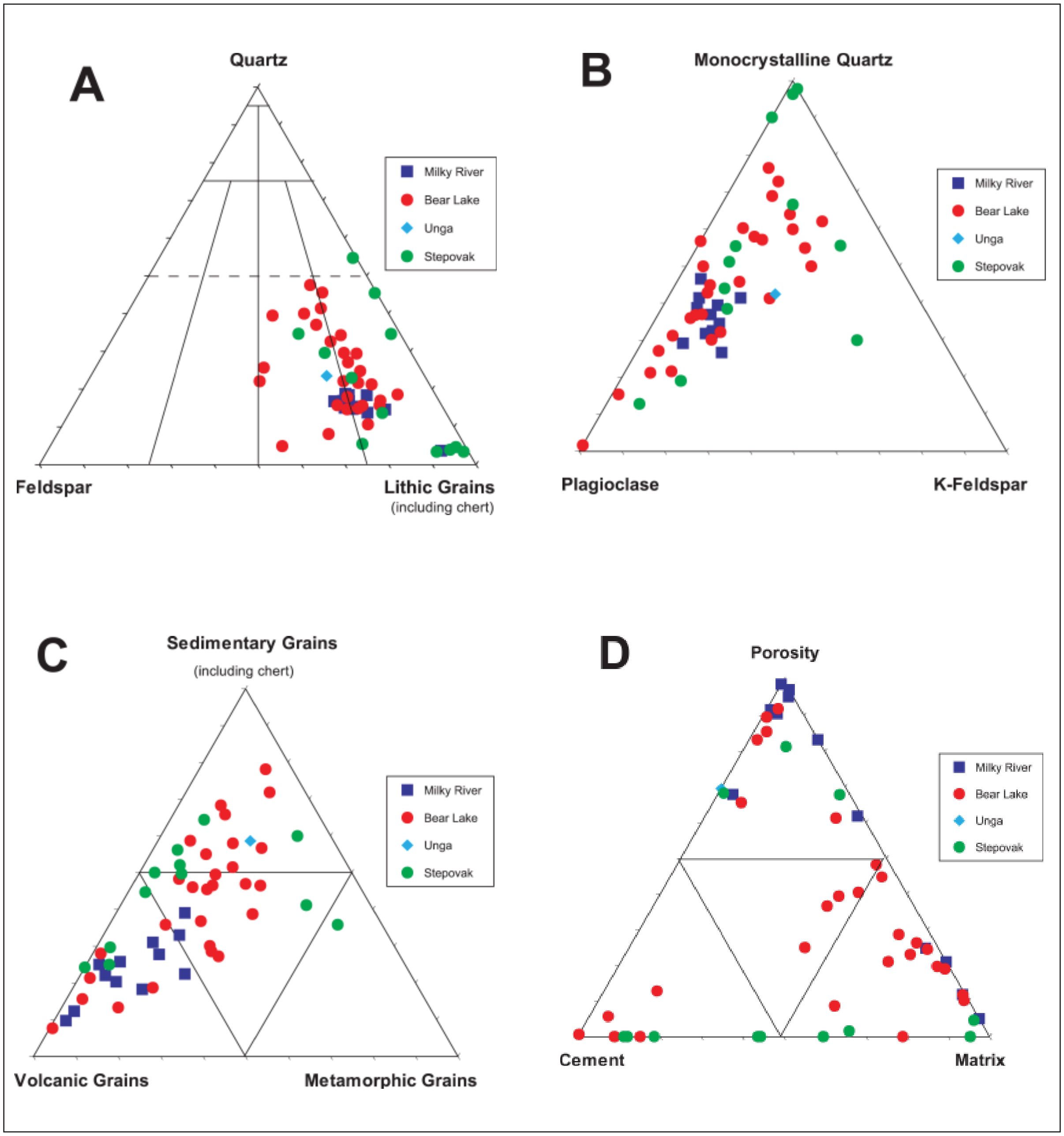

Figure 3. Ternary diagrams showing composition of Bristol Bay sandstones. **A.** *QFL (Quartz–Feldspar–Lithics) diagram showing composition of detrital grains comprising the rock framework. All the sandstones are enriched in lithic grains.* **B.** *QmPK (Monocrystalline Quartz–Plagioclase–K-Feldspar) diagram showing monocrystalline composition of Bristol Bay sandstones. The sandstones are enriched in quartz and plagioclase with relatively less K-Feldspar.* **C.** *Ls+LvLm (Sedimentary Lithics+Chert–Volcanic Lithics–Metamorphic Lithics) diagram showing lithic composition of Bristol Bay sandstones. Milky River sandstones are typically enriched in volcanic lithics.* **D.** *PCM (Porosity–Cement–Matrix) diagram showing composition of the intergranular components of the sandstones. Detrital matrix is present in some of the sandstones and is a primary factor controlling permeability in those rocks. Tables 1 and 2 list all data included in these diagrams.*

composition of the intergranular components (that is, porosity, cements, and matrix) of the rock. The higher the ratio of porosity to cement plus matrix, the better the reservoir quality of the rock.

TERTIARY SANDSTONES

The Tertiary sandstones vary in grain size from lower very fine grained (fL, 70 µm) to upper coarse-grained (cU, 920 µm) (table 2). The framework grains are moderately to very well sorted (0.33–0.99 standard deviation in phi units of just the framework grains; Measured Framework Sorting in table 2) but the presence of detrital matrix results in some rocks having very poor overall sorting (>2.0 standard deviation in phi units of entire rock, framework grains + matrix; Measured Sorting in table 2). In general, the finer-grained sandstones tend to be better sorted (fig. 4). The sandstones are highly lithic with an average framework composition of $Q_{22}F_{16}L_{61}$ (fig. 3A). Monocrystalline quartz (Qm, 15 percent) is more common than polycrystalline (Qp, 7 percent) varieties. Feldspar is common with plagioclase (12 percent) dominant over K-feldspar (4 percent). The average lithic composition of the sandstones is $Ls_{41}Lv_{43}Lm_{16}$ with grains consisting of felsic and mafic volcanic fragments, chert, phyllite, schist, quartzite, felsic plutonic fragments, mudstone, and siltstone (table 1). The Milky River samples are more volcanogenic than the other Tertiary sandstones with an average composition of $Ls_{24}Lv_{65}Lm_{11}$. Micas average 2 percent of the framework fraction and consist of chlorite, muscovite, and biotite. Amphibole, pyroxene, epidote, and garnet are the most common heavy minerals and are indicative of an immature, labile suite.

Detrital matrix varies in abundance, comprising from 0 to 16 percent of the sandstones (table 1). It is particularly common in many of the Bear Lake samples (fig. 3D). The matrix consists predominantly of clay minerals with lesser amounts of detrital silt. Clay laminae are common in many of the samples, particularly the Milky River and Bear Lake sandstones (table 1). Together, detrital matrix and clay laminae account for more than 40 percent of the bulk volume of several sandstones. X-ray diffraction analyses suggest these clays largely consist of illite and mixed-layer illite/smectite (table 3). The mixed-layer clay consists dominantly of smectite with only 10 percent illite layers. Because these clays are highly smectitic, the matrix could exhibit significant swelling if exposed to fresh water.

The majority of the sandstones generally lack significant cement (table 1; figs. 7–12). Quartz cement occurs in minor amounts in a few samples, due in part to the lack of nucleation sties and relatively low abundance of detrital quartz. The extensive matrix in some of the samples also retards cementation by inhibiting nucleation of overgrowths. Carbonate cement, particularly siderite and calcite, occur in variable amounts (up to 10.5 percent of bulk rock) in a few samples but generally has little effect on reservoir quality in the majority of samples. Authigenic, pore-filling kaolinite (fig. 15) occurs in several samples and is probably related to feldspar altera-

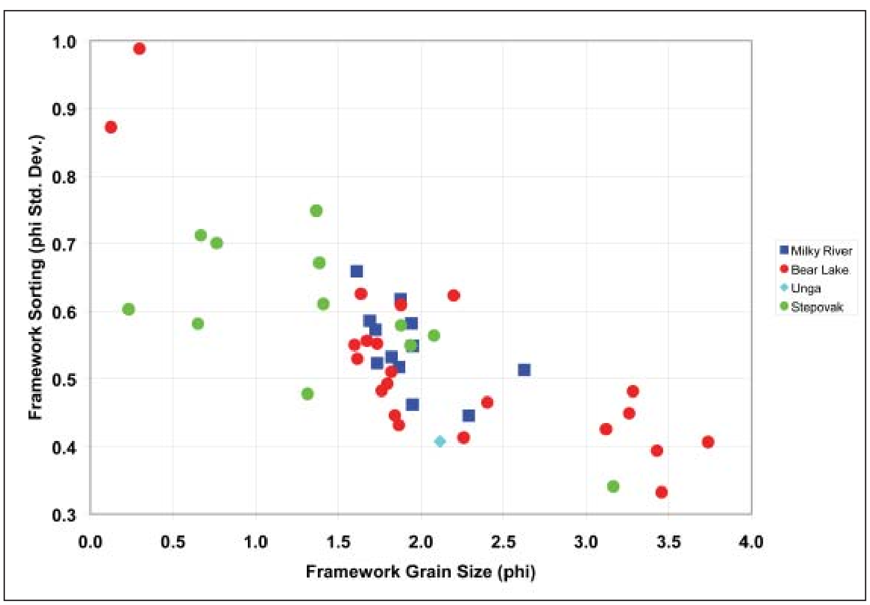

Figure 4. Grain size-sorting scatter plot of Bristol Bay sandstones by formation. Data are for grains greater than 30 µm in diameter and therefore exclude clay and very fine to medium silt. In general, the finer-grained rocks tend to be better sorted (note grain size is shown in phi units). Pearson correlation coefficient is -0.77.

tion. In a few sandstones where it comprises more than 10 percent of the rocks, kaolinite significantly degrades reservoir quality. Representative photomicrographs are presented in figures 7–12.

RESERVOIR QUALITY

Reservoir quality of the Tertiary sandstones varies from excellent (φ > 30 percent, k > 100 md) to poor (φ < 10 percent, k < 1 md). In order to illustrate the regional porosity–permeability trend, data for Tertiary and Mesozoic sandstones were plotted together (fig. 5). Most of the high-quality sandstones are Tertiary subsurface samples; the majority of low-quality rocks are from Mesozoic outcrops. Using an economic cutoff of 10 percent porosity and 1 md permeability (suitable for liquid hydrocarbons), the majority of samples could be effective hydrocarbon reservoirs. Using lower φ-k cutoffs (7 percent porosity and 0.1 md permeability), a significant number of additional samples could be effective gas reservoirs.

There is a fairly systematic relationship between reservoir quality (porosity–permeability) and depth (fig. 6). Porosities in excess of 20 percent and permeabilities higher than 10 md are present at depths approaching 10,000 feet. It should be noted that much of the data are from the North Aleutian COST #1 well that was drilled offshore in a deep portion of the basin. It is unclear if similar trends exist for the shallower, onshore portion of the basin. Additional data are needed before regional porosity-depth and permeability-depth trends can be established with certainty.

CONCLUSION

Based on detailed point-count analyses, conventional core analyses, and SEM examination of samples from three exploratory wells, sandstones with favorable reservoir properties are present in the Milky River, Bear Lake, and Stepovak Formations and may yield economically viable petroleum reservoirs. Sandstones in older, more deeply buried strata are likely to be of lower reservoir quality.

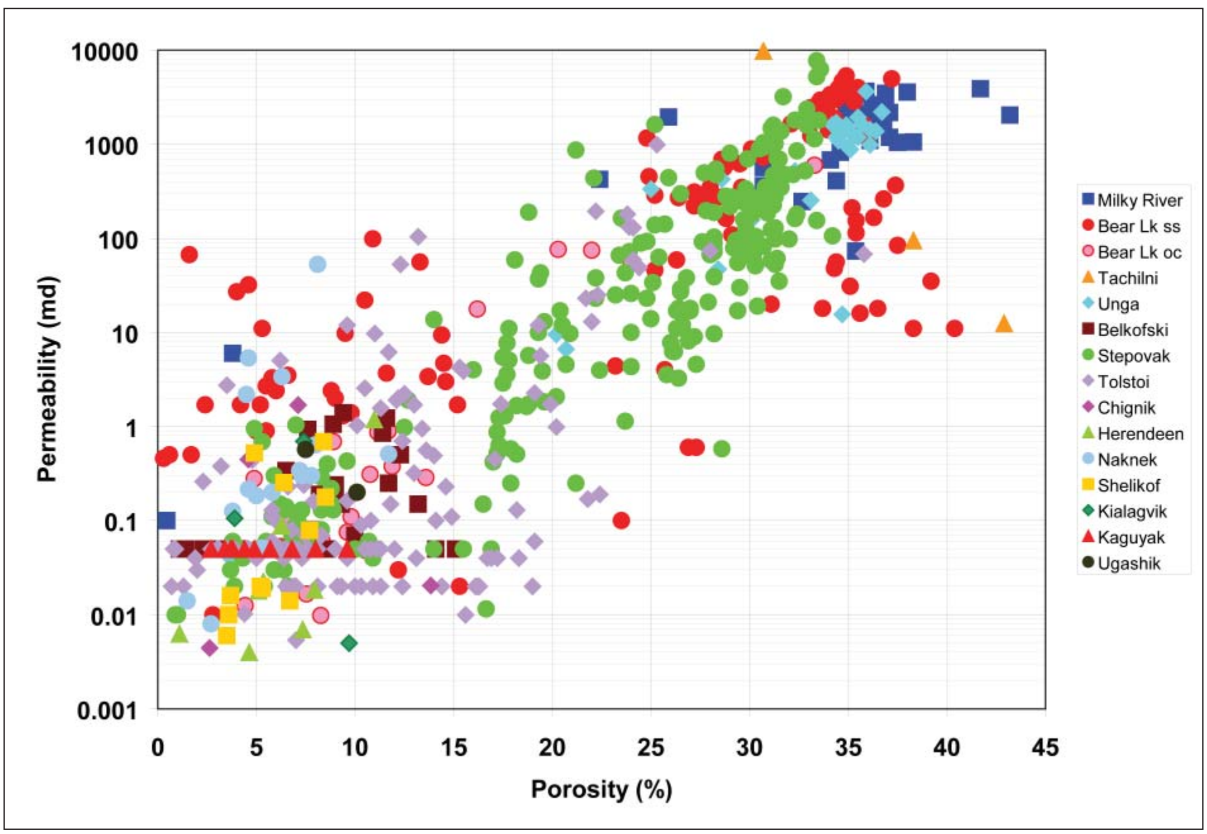

Figure 5. Porosity–permeability scatter plot of Bristol Bay sandstones by formation. Using a cutoff of 10 percent porosity and 1 md permeability, a large proportion of the samples have good to excellent reservoir quality. Most of the high-quality rocks are Tertiary subsurface samples while the majority of low-quality rocks are from Mesozoic outcrops. Table 4 lists all data included in this plot.

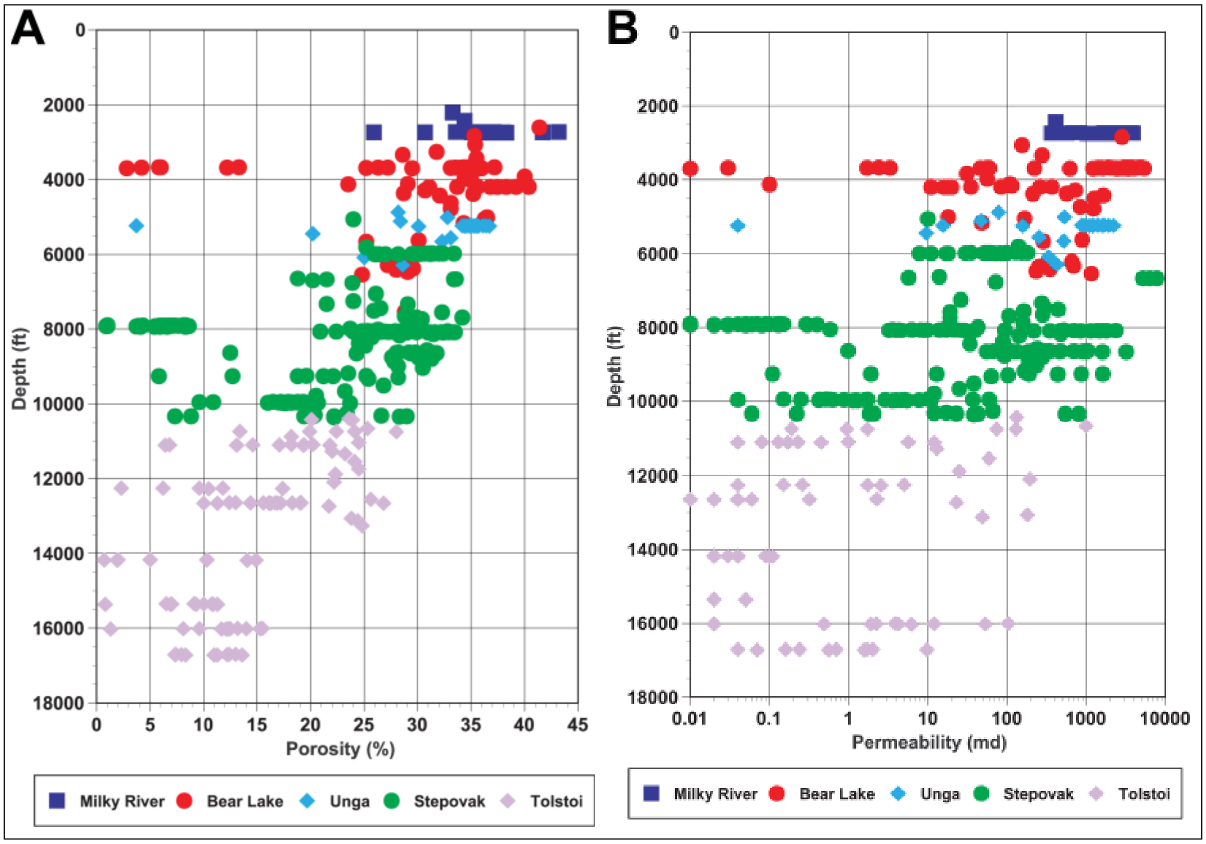

Figure 6. Reservoir quality–depth scatter plots of Bristol Bay sandstones by formation. **A.** *Porosity–depth trend.* **B.** *Permeability–depth trend. Table 4 lists data included in this plot.*

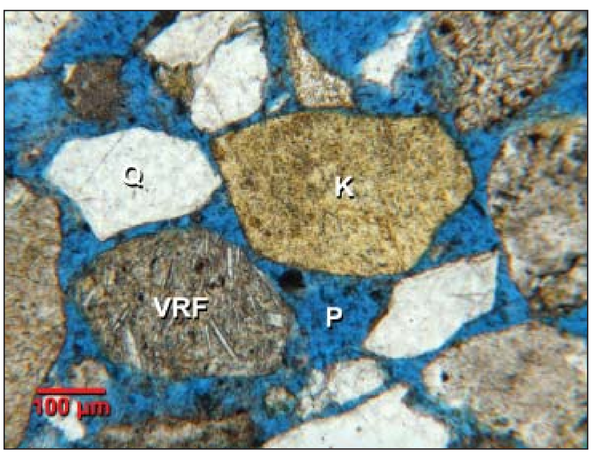

Figure 7. Photomicrograph of Milky River sandstone showing well-developed intergranular porosity (P). Framework grains include quartz (Q), K-feldspar (K), and volcanic rock fragments (VRF). Becharof State #1, 2,734.5', φ = 36.9 percent, k = 3,470 md.

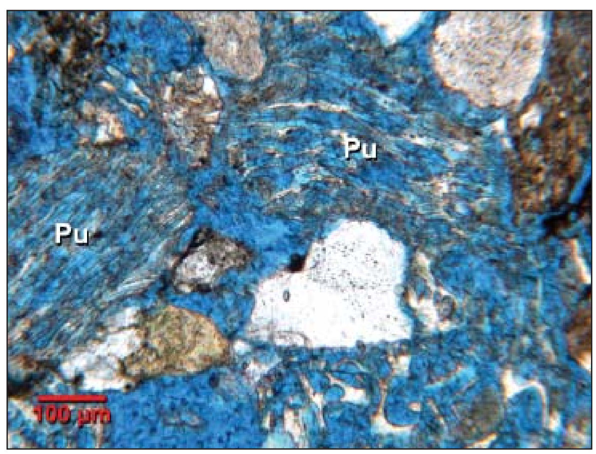

Figure 8. Photomicrograph of Milky River sandstone showing substantial mesoporosity in vesicular pumice fragments (Pu). Becharof State #1, 2,726.5', φ = 43.2 percent, k = 2,040 md. Sample contains much pumice.

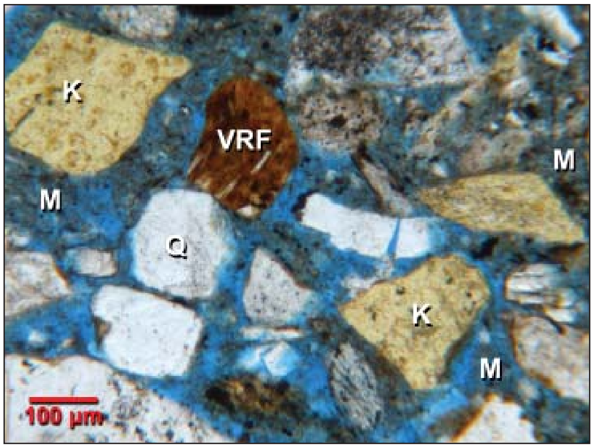

Figure 9. Photomicrograph of Bear Lake sandstone showing detrital clay matrix (M) partially occluding intergranular pores. Framework grains include quartz (Q), K-feldspar (K), and volcanic rock fragments (VRF). North Aleutian COST #1, 4,197.0', φ = 35.6 percent, k = 16 md. Low permeability is the result of extensive clay matrix.

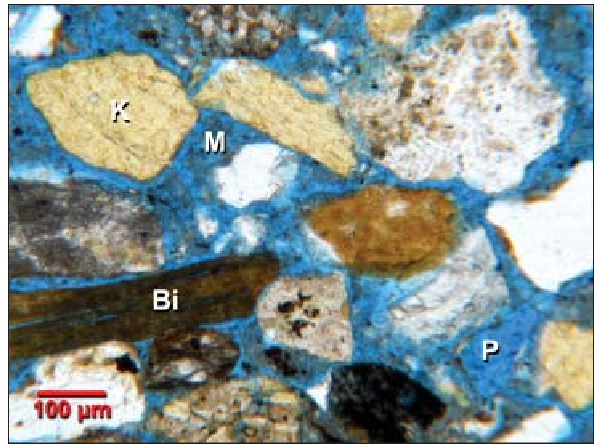

Figure 10. Photomicrograph of Bear Lake sandstone showing clay matrix (M) sporadically filling intergranular pores (P). Framework grains include K-feldspar (K) and biotite (Bi). North Aleutian COST #1, 2,734.5', φ = 33.7 percent, k = 18 md. Low permeability is the result of extensive clay matrix.

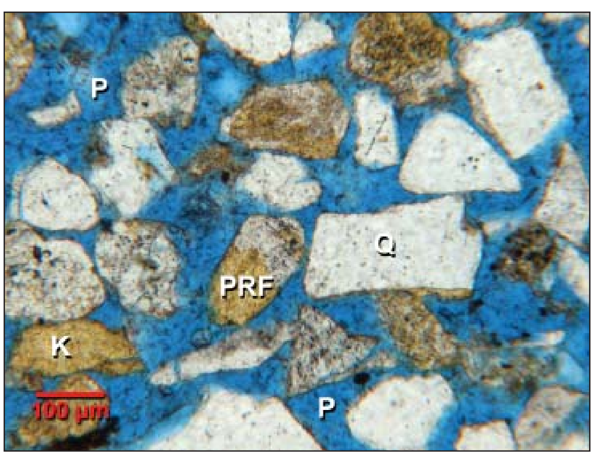

Figure 11. Photomicrograph of Stepovak sandstone showing well-developed intergranular porosity (P). Framework grains include quartz (Q), K-feldspar (K), and plutonic rock fragments (PRF). North Aleutian COST #1, 8,087.0', φ = 32.9 percent, k = 2,358 md.

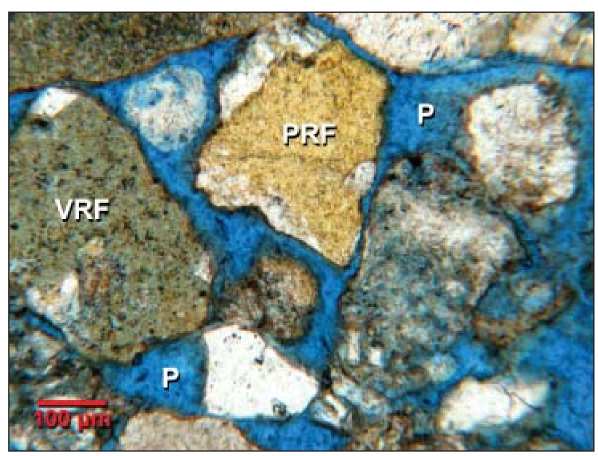

Figure 12. Photomicrograph of Stepovak sandstone showing both point and long contacts between grains. Intergranular porosity (P) is common. Framework grains include volcanic (VRF) and plutonic (PRF) rock fragments. North Aleutian COST #1, 8,635.0', φ = 31.4 percent, k = 709 md.

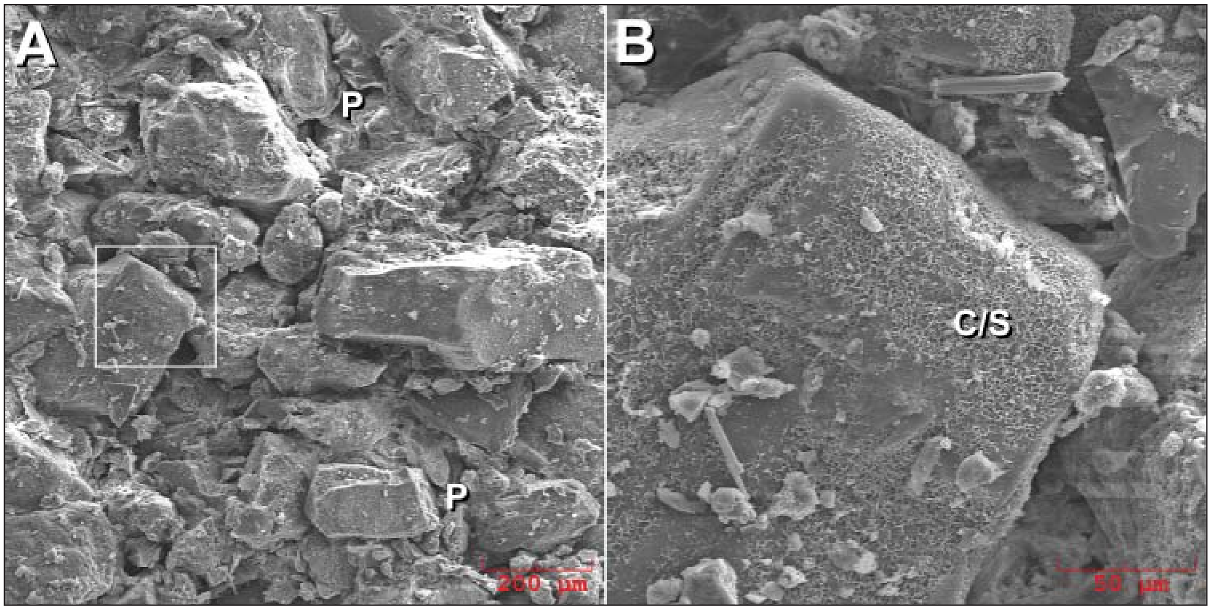

Figure 13. SEM photomicrograph of sandstone from the Milky River Formation, Amoco Becharof State #1, 2,735.5'. **A.** *General view showing angular nature of detrital grains and abundant intergranular porosity (P).* **B.** *Enlarged view of outlined area showing authigenic clay, probably mixed-layer chlorite–smectite (C/S), coating detrital grain.*

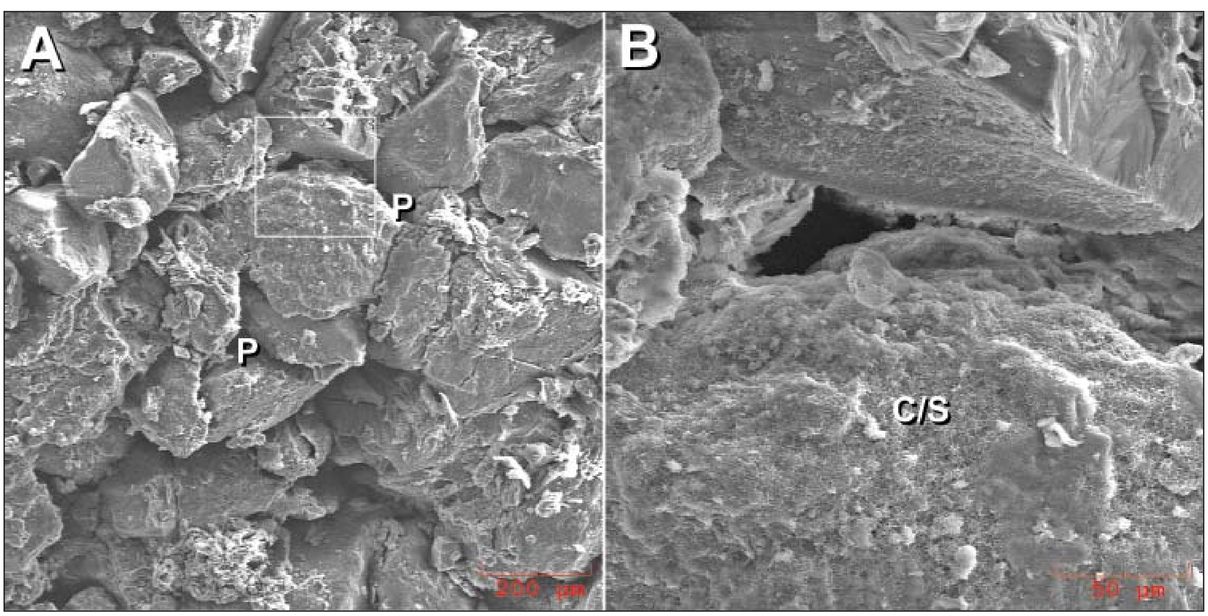

Figure 14. SEM photomicrograph of sandstone from the Bear Lake Formation, Amoco Becharof State #1, 3,678.4'. **A.** *General view showing abundant intergranular pores connected by open pore throats (P).* **B.** *Enlarged view of outlined area showing authigenic clay, probably mixed-layer chlorite–smectite (C/S), coating detrital grain and lining intergranular pore.*

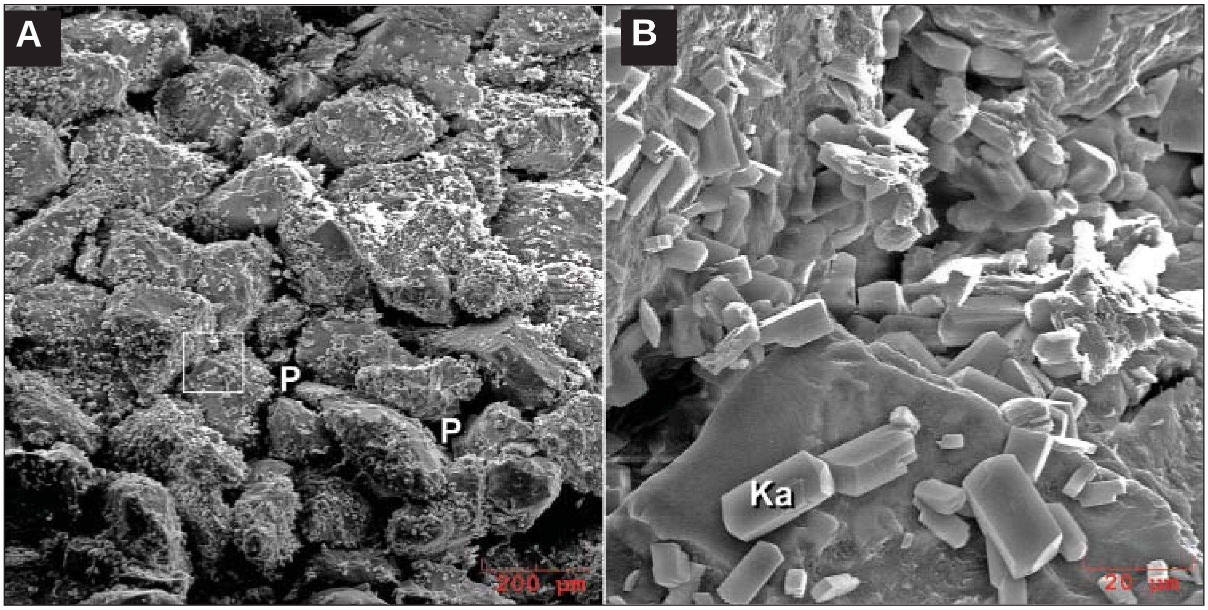

Figure 15. SEM photomicrograph of sandstone from the Unga Formation, ARCO North Aleutian COST #1, 5,234.0'. **A.** *General view showing abundant intergranular porosity (P) and detrital grains coated with kaolinite.* **B.** *Enlarged view of outlined area showing authigenic kaolinite (Ka) filling intergranular pore. Microporosity is common between clay platelets.*

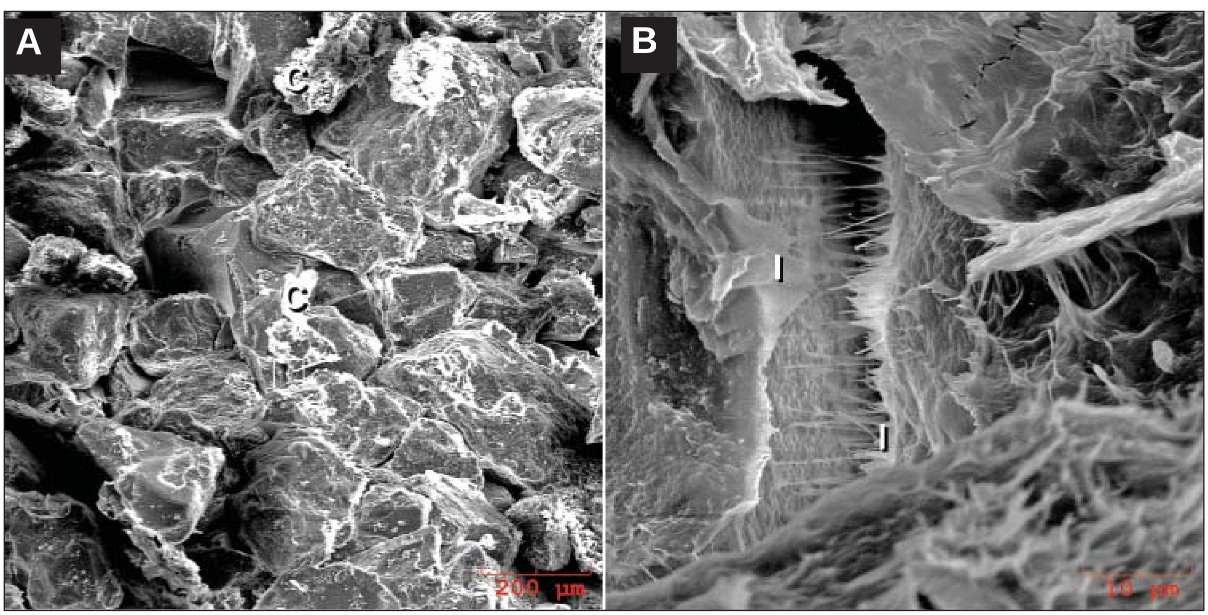

Figure 16. SEM photomicrograph of sandstone from the Stepovak Formation, ARCO North Aleutian COST #1, 8,087.0'. **A.** *General view showing angular nature of detrital grains. Bright patches are small areas of authigenic clay (C) coating grains.* **B.** *Enlarged view of outlined area showing fibrous authigenic clay, probably illite (I), lining small intergranular pore.*

Table 4. Porosity, permeability, and saturation data for Bristol Bay sandstones.

Well or outcrop sample	Latitude or location (section, township, range)	Longitude or location (quadrangle)	Core	Plug	Depth of sample (ft)	K klink (md)	K air (md)	K probe (md)	Porosity (%)	So (%)	Sw (%)	Density (g/cc)	Type	Unit
N Aleutian COST 1	56.27332	-161.97850	2	1	4,191.6		262.000		36.80			2.66	CC	Bear Lake
N Aleutian COST 1	56.27332	-161.97850	2	2	4,192.3		367.000		37.40			2.65	CC	Bear Lake
N Aleutian COST 1	56.27332	-161.97850	2	3	4,193.3		84.000		37.50			2.65	CC	Bear Lake
N Aleutian COST 1	56.27332	-161.97850	2	4	4,194.6		35.000		39.20			2.64	CC	Bear Lake
N Aleutian COST 1	56.27332	-161.97850	2	5	4,195.8		11.000		40.40			2.66	CC	Bear Lake
N Aleutian COST 1	56.27332	-161.97850	2	6	4,196.7		11.000		38.30			2.67	CC	Bear Lake
N Aleutian COST 1	56.27332	-161.97850	2	7	4,197.4		16.000		35.60			2.66	CC	Bear Lake
N Aleutian COST 1	56.27332	-161.97850	2	8	4,198.4		18.000		33.70			2.65	CC	Bear Lake
N Aleutian COST 1	56.27332	-161.97850	2	9	4,200.3		20.000		31.10			2.65	CC	Bear Lake
N Aleutian COST 1	56.27332	-161.97850	3	10	5,227.3		1188.000		35.50			2.68	CC	Unga
N Aleutian COST 1	56.27332	-161.97850	3	11	5,228.6		1378.000		36.40			2.69	CC	Unga
N Aleutian COST 1	56.27332	-161.97850	3	12	5,229.6		988.000		36.10			2.71	CC	Unga
N Aleutian COST 1	56.27332	-161.97850	3	13	5,230.6		1419.000		36.10			2.68	CC	Unga
N Aleutian COST 1	56.27332	-161.97850	3	14	5,231.6		880.000		35.10			2.68	CC	Unga
N Aleutian COST 1	56.27332	-161.97850	3	15	5,232.8		1413.000		34.90			2.67	CC	Unga
N Aleutian COST 1	56.27332	-161.97850	3	16	5,233.5		1694.000		34.40			2.67	CC	Unga
N Aleutian COST 1	56.27332	-161.97850	3	17	5,234.6		1607.000		34.20			2.67	CC	Unga
N Aleutian COST 1	56.27332	-161.97850	3	18	5,235.4		0.040		3.70			2.71	CC	Unga
N Aleutian COST 1	56.27332	-161.97850	3	19	5,236.4		15.610		34.70			2.67	CC	Unga
N Aleutian COST 1	56.27332	-161.97850	3	20	5,237.0		1932.000		35.50			2.69	CC	Unga
N Aleutian COST 1	56.27332	-161.97850	3	21	5,238.5		1228.000		35.30			2.67	CC	Unga
N Aleutian COST 1	56.27332	-161.97850	3	22	5,239.2		1592.000		34.90			2.67	CC	Unga
N Aleutian COST 1	56.27332	-161.97850	3	23	5,240.3		2203.000		36.70			2.67	CC	Unga
N Aleutian COST 1	56.27332	-161.97850	3	24	5,241.5		1620.000		35.70			2.67	CC	Unga
N Aleutian COST 1	56.27332	-161.97850	3	25	5,242.7		1190.000		34.40			2.68	CC	Unga
N Aleutian COST 1	56.27332	-161.97850	3	26	5,244.3		1094.000		34.50			2.67	CC	Unga
N Aleutian COST 1	56.27332	-161.97850	3	27	5,245.3		926.000		35.00			2.67	CC	Unga
N Aleutian COST 1	56.27332	-161.97850	4	28	5,970.3		129.000		31.30			2.68	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	4	29	5,971.7		58.000		31.10			2.71	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	4	30	5,972.8		98.000		31.30			2.70	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	4	31	5,973.4		61.000		31.40			2.70	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	4	32	5,974.8		155.000		33.40			2.72	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	4	33	5,975.5		53.000		31.30			2.70	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	4	34	5,976.3		35.000		31.50			2.72	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	4	35	5,977.5		181.000		32.40			2.68	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	4	36	5,978.5		98.000		32.00			2.71	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	4	37	5,979.4		66.000		29.80			2.69	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	4	38	5,980.6		82.000		30.70			2.69	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	4	39	5,981.5		67.000		29.80			2.69	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	4	40	5,982.7		100.000		29.60			2.68	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	4	41	5,983.6		93.000		29.70			2.68	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	4	42	5,984.7		51.000		30.30			2.70	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	4	43	5,985.4		61.000		30.20			2.68	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	4	44	5,986.7		30.000		29.50			2.68	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	4	45	5,987.4		57.000		31.20			2.69	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	4	46	5,988.7		84.000		30.10			2.70	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	4	47	5,990.8		72.000		28.20			2.68	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	4	48	5,991.8		17.000		27.00			2.75	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	4	49	5,992.5		7.800		26.00			2.73	CC	Stepovak

Outcrop data from Reifenstuhl and others (2005) and Loveland and others (2007).
Bristol Bay Outcrop* = data and locations from Bristol Bay Native Corporation archive files based on industry work
Type: CC = Conventional core; PSWC = Percussion sidewall core; OUT = Outcrop sample

Table 4. Porosity, permeability, and saturation data for Bristol Bay sandstones–continued.

Well or outcrop sample	Latitude or location (section, township, range)	Longitude or location (quadrangle)	Core	Plug	Depth of sample (ft)	K klink (md)	K air (md)	K probe (md)	Porosity (%)	So (%)	Sw (%)	Density (g/cc)	Type	Unit
N Aleutian COST 1	56.27332	-161.97850	4	50	5,993.2		11.000		26.30			2.74	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	4	51	5,994.5		18.000		26.40			2.72	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	4	52	5,995.3		18.000		27.00			2.73	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	5	53	6,665.3		7722.000		33.40			2.66	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	5	54	6,666.6		6299.000		33.60			2.66	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	5	55	6,668.4		5215.000		33.40			2.65	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	6	56	8,050.9		0.580		28.60			2.68	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	6	57	8,051.0				26.20			2.68	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	7	58	8,055.1		6.240		26.20			2.69	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	7	59	8,056.5				25.30			2.68	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	7	60	8,057.8		10.000		24.00			2.65	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	7	61	8,058.3		23.000		24.80			2.66	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	7	62	8,059.7		3.560		25.80			2.69	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	7	63	8,061.2		21.000		27.90			2.66	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	7	64	8,062.3		17.000		29.40			2.68	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	7	65	8,063.6		520.000		32.80			2.64	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	7	66	8,064.3		95.000		29.30			2.66	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	7	67	8,065.4		8.150		26.90			2.70	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	7	68	8,066.3		14.000		25.00			2.67	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	7	69	8,067.3		9.720		20.90			2.66	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	7	70	8,068.8		9.710		28.20			2.71	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	7	71	8,069.7		4.330		24.00			2.68	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	7	72	8,070.6		6.290		26.10			2.68	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	7	73	8,071.6		93.000		24.80			2.66	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	7	74	8,072.3		3.970		22.40			2.71	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	7	75	8,073.5		29.000		26.50			2.69	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	7	76	8,074.2		27.000		26.50			2.68	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	7	77	8,075.6				28.20			2.67	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	7	78	8,076.4		4.590		27.30			2.69	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	7	79	8,077.5		39.000		28.20			2.69	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	7	80	8,078.3		9.020		27.20			2.69	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	7	81	8,079.3		3.260		26.40			2.74	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	7	82	8,080.4				26.30			2.68	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	7	83	8,081.3		496.000		27.70			2.64	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	7	84	8,082.6		697.000		29.90			2.66	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	7	85	8,083.2		1372.000		31.60			2.64	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	7	86	8,084.3		476.000		32.20			2.65	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	7	87	8,085.8		1802.000		32.30			2.65	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	7	88	8,086.5		1584.000		32.90			2.64	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	7	89	8,087.3		2358.000		32.90			2.64	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	7	90	8,088.5		1478.000		31.10			2.64	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	7	91	8,089.4		1791.000		33.50			2.64	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	7	92	8,090.3		1141.000		33.30			2.65	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	7	93	8,091.2		849.000		32.40			2.64	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	7	94	8,092.3				31.00			2.65	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	7	95	8,092.9		217.000		29.00			2.65	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	8	96	8,629.2		79.000		29.20			2.69	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	8	97	8,629.3		109.000		29.80			2.69	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	8	98	8,630.1		88.000		28.20			2.72	CC	Stepovak

Outcrop data from Reifenstuhl and others (2005) and Loveland and others (2007).
Bristol Bay Outcrop* = data and locations from Bristol Bay Native Corporation archive files based on industry work
Type: CC = Conventional core; PSWC = Percussion sidewall core; OUT = Outcrop sample

Table 4. Porosity, permeability, and saturation data for Bristol Bay sandstones–continued.

Well or outcrop sample	Latitude or location (section, township, range)	Longitude or location (quadrangle)	Core	Plug	Depth of sample (ft)	K klink (md)	K air (md)	K probe (md)	Porosity (%)	So (%)	Sw (%)	Density (g/cc)	Type	Unit
N Aleutian COST 1	56.27332	-161.97850	8	99	8,631.5		340.000		31.30			2.68	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	8	100	8,632.9		224.000		31.20			2.68	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	8	101	8,633.8		1040.000		30.70			2.67	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	8	102	8,634.4		78.000		29.60			2.71	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	8	103	8,635.8		0.980		12.50			2.70	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	8	104	8,636.7		709.000		31.40			2.68	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	8	105	8,637.4		67.000		28.00			2.69	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	8	106	8,638.9		468.000		31.20			2.69	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	8	107	8,639.8		349.000		30.80			2.68	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	8	108	8,640.5		291.000		30.70			2.69	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	8	109	8,641.5		929.000		30.70			2.66	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	8	110	8,642.8		303.000		31.10			2.69	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	8	111	8,643.4		473.000		31.80			2.71	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	8	112	8,644.9		695.000		31.50			2.67	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	8	113	8,645.8		284.000		30.80			2.69	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	8	114	8,646.3		325.000		30.90			2.69	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	8	115	8,647.2		336.000		29.80			2.71	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	8	116	8,648.5		55.000		29.40			2.71	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	8	117	8,649.3		123.000		31.10			2.70	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	8	118	8,650.1		186.000		30.90			2.67	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	8	119	8,650.9		896.000		30.50			2.63	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	8	120	8,651.5		1010.000		31.30			2.63	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	8	121	8,651.9		132.000		29.80			2.67	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	8	122	8,652.7		244.000		29.70			2.66	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	8	123	8,653.2		460.000		31.50			2.65	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	8	124	8,653.6		280.000		30.60			2.66	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	8	125	8,654.4				24.30			2.75	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	8	126	8,655.3		274.000		30.10			2.65	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	8	127	8,656.1				29.40			2.71	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	8	128	8,656.7		1594.000		31.20			2.68	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	8	129	8,656.8		3193.000		31.70			2.65	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	9	130	9,255.9		13.000		19.60			2.77	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	9	131	9,256.2		1615.000		25.20			2.69	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	9	132	9,257.2		189.000		18.80			2.70	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	9	133	9,258.9		0.110		5.80			2.66	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	9	134	9,259.9		1.910		12.70			2.68	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	9	135	9,261.3		867.000		21.20			2.67	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	9	136	9,263.9		436.000		22.10			2.69	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	10	137	9,945.2		10.000		19.30			2.70	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	10	138	9,946.4		0.150		16.50			2.72	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	10	139	9,947.6		0.520		17.20			2.73	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	10	140	9,948.5		0.250		17.90			2.74	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	10	141	9,950.5		1.730		18.80			2.74	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	10	142	9,952.5		0.580		17.90			2.72	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	10	143	9,953.4		0.510		18.20			2.73	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	10	144	9,954.6		0.430		9.60			2.46	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	10	145	9,955.8		59.000		18.10			2.73	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	10	146	9,957.2		0.870		17.20			2.73	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	10	147	9,958.4		0.040		10.90			2.71	CC	Stepovak

Outcrop data from Reifenstuhl and others (2005) and Loveland and others (2007).
Bristol Bay Outcrop* = data and locations from Bristol Bay Native Corporation archive files based on industry work
Type: CC = Conventional core; PSWC = Percussion sidewall core; OUT = Outcrop sample

Table 4. Porosity, permeability, and saturation data for Bristol Bay sandstones–continued.

Well or outcrop sample	Latitude or location (section, township, range)	Longitude or location (quadrangle)	Core	Plug	Depth of sample (ft)	K klink (md)	K air (md)	K probe (md)	Porosity (%)	So (%)	Sw (%)	Density (g/cc)	Type	Unit
N Aleutian COST 1	56.27332	-161.97850	10	148	9,960.6		5.080		17.80			2.71	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	10	149	9,961.5		1.630		18.70			2.71	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	10	150	9,963.2		0.630		17.30			2.71	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	10	151	9,964.4		2.890		17.50			2.72	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	10	152	9,965.6		11.000		17.80			2.71	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	10	153	9,967.5		0.420		17.00			2.71	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	10	154	9,968.5		1.240		17.30			2.72	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	10	155	9,969.9		4.000		16.00			2.70	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	10	156	9,971.1		7.720		17.70			2.69	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	10	157	9,972.5		3.890		19.50			2.72	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	10	158	9,973.5		4.570		20.70			2.70	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	10	159	9,975.2		1.670		18.20			2.69	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	10	160	9,976.3		1.300		17.60			2.70	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	10	161	9,977.3		1.140		23.70			2.71	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	10	162	9,979.2		5.430		17.50			2.69	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	10	163	9,980.6		3.570		17.70			2.71	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	11	164	10,326.8		1.830		19.60			2.69	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	11	165	10,328.2		2.070		20.20			2.70	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	11	166	10,329.7		0.220		8.80			2.69	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	11	167	10,331.6		0.060		7.30			2.70	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	11	168	10,332.8		23.000		22.20			2.68	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	11	169	10,334.2		43.000		19.40			2.69	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	11	170	10,336.2		802.000		29.00			2.66	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	11	171	10,336.8		544.000		28.30			2.66	CC	Stepovak
N Aleutian COST 1	56.27332	-161.97850	12	172	10,732.8		0.190		22.40			2.70	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	12	173	10,737.3		130.000		24.10			2.68	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	12	174	10,737.5		0.950		13.40			2.68	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	12	175	10,738.3		1.730		19.90			2.94	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	12	176	10,739.9		74.000		28.00			2.66	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	13	177	11,085.7		0.990		20.20			2.68	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	13	178	11,089.7		0.130		18.20			2.67	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	13	179	11,091.7		0.080		6.80			2.65	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	13	180	11,093.7		5.630		19.40			2.68	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	13	181	11,095.9		0.230		14.60			2.69	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	13	182	11,097.3		0.450		17.10			2.66	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	13	183	11,100.2		12.000		19.30			2.64	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	13	184	11,100.6		0.040		13.10			2.64	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	13	185	11,101.7		0.170		21.80			2.62	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	13	186	11,102.9		0.040		6.40			2.52	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	14	187	12,249.0		0.260		2.30			2.60	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	14	188	12,249.5		0.150		11.80			2.74	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	14	189	12,251.8		5.020		6.20			2.75	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	14	190	12,256.4		0.040		9.60			2.73	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	14	191	12,257.5		1.740		17.40			2.70	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	14	192	12,266.4		2.560		10.50			2.73	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	15	193	12,638.8		2.270		19.10			2.68	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	15	194	12,640.8		0.320		13.00			2.70	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	15	195	12,641.3		0.020		12.40			2.68	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	15	196	12,642.8		0.060		19.10			2.71	CC	Tolstoi

Outcrop data from Reifenstuhl and others (2005) and Loveland and others (2007).
Bristol Bay Outcrop* = data and locations from Bristol Bay Native Corporation archive files based on industry work
Type: CC = Conventional core; PSWC = Percussion sidewall core; OUT = Outcrop sample

Table 4. Porosity, permeability, and saturation data for Bristol Bay sandstones–continued.

Well or outcrop sample	Latitude or location (section, township, range)	Longitude or location (quadrangle)	Core	Plug	Depth of sample (ft)	K klink (md)	K air (md)	K probe (md)	Porosity (%)	So (%)	Sw (%)	Density (g/cc)	Type	Unit
N Aleutian COST 1	56.27332	-161.97850	15	197	12,643.5		0.040		17.20			2.72	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	15	198	12,644.7		0.020		19.00			2.69	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	15	199	12,645.5		0.040		18.30			2.71	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	15	200	12,646.7		0.020		16.10			2.71	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	15	201	12,647.4		0.010		15.60			2.78	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	15	202	12,648.5		0.020		14.40			2.77	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	15	203	12,649.7		0.040		16.90			2.75	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	15	204	12,650.6		0.040		16.70			2.72	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	15	205	12,651.5		0.020		16.20			2.73	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	15	206	12,654.9		0.020		10.00			2.73	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	15	207	12,655.5		0.020		16.30			2.73	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	15	208	12,656.4		0.020		11.30			2.71	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	16	209	14,165.6		0.020		10.30			2.66	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	16	210	14,171.3		0.040		5.00			2.65	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	16	211	14,174.9		0.030		2.00			2.53	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	16	212	14,178.9		0.090		10.30			2.67	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	16	213	14,182.2		0.020		0.70			2.53	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	16	214	14,182.7		0.040		1.90			2.54	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	16	215	14,184.8		0.110		14.90			2.71	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	16	216	14,185.7		0.100		14.10			2.71	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	17	217	15,347.3		0.020		9.10			2.71	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	17	218	15,348.1		0.020		9.10			2.70	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	17	219	15,350.2		0.020		6.50			2.69	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	17	220	15,352.4		0.020		7.00			2.68	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	17	221	15,354.2		0.020		10.00			2.69	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	17	222	15,356.2		0.050		10.80			2.68	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	17	223	15,358.2		0.050		10.80			2.71	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	17	224	15,359.9		0.050		11.30			2.71	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	17	225	15,361.8		0.020		6.90			2.69	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	17	226	15,363.2		0.020		10.90			2.70	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	17	227	15,364.5		0.020		9.30			2.74	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	17	228	15,365.8		0.050		0.80			2.68	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	18	229	16,006.5		104.000		13.20			2.66	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	18	230	16,007.3		3.880		15.50			2.72	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	18	231	16,011.1		12.000		9.60			2.70	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	18	232	16,013.2		2.230		12.50			2.74	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	18	233	16,014.8		0.020		8.10			2.76	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	18	234	16,018.1		0.490		14.00			2.74	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	18	235	16,018.3		4.250		15.30			2.77	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	18	236	16,020.9		53.000		12.30			2.70	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	18	237	16,022.2		0.020		1.30			2.84	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	18	238	16,022.5		1.910		12.10			2.73	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	18	239	16,027.2		6.180		11.70			2.66	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	19	240	16,702.8		0.700		12.40			2.72	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	19	241	16,703.4		1.700		13.00			2.70	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	19	242	16,704.8		0.240		7.40			2.76	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	19	243	16,706.8		0.160		7.90			2.70	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	19	244	16,708.4		2.010		12.20			2.65	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	19	245	16,710.6		0.040		7.30			2.78	CC	Tolstoi

Outcrop data from Reifenstuhl and others (2005) and Loveland and others (2007).
Bristol Bay Outcrop* = data and locations from Bristol Bay Native Corporation archive files based on industry work
Type: CC = Conventional core; PSWC = Percussion sidewall core; OUT = Outcrop sample

Table 4. Porosity, permeability, and saturation data for Bristol Bay sandstones–continued.

Well or outcrop sample	Latitude or location (section, township, range)	Longitude or location (quadrangle)	Core	Plug	Depth of sample (ft)	K klink (md)	K air (md)	K probe (md)	Porosity (%)	So (%)	Sw (%)	Density (g/cc)	Type	Unit
N Aleutian COST 1	56.27332	-161.97850	19	246	16,716.8		9.720		11.00			2.66	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	19	247	16,719.9		1.570		11.30			2.70	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	19	248	16,720.4		0.560		13.60			2.66	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850	19	249	16,720.6		0.070		8.30			2.72	CC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850		1	2,214.0				33.30			2.61	PSWC	Milky River
N Aleutian COST 1	56.27332	-161.97850		2	2,427.0		408.000		34.40			2.66	PSWC	Milky River
N Aleutian COST 1	56.27332	-161.97850		3	2,610.0				41.40			2.66	PSWC	Bear Lake
N Aleutian COST 1	56.27332	-161.97850		4	2,836.0		2844.000		35.30			2.61	PSWC	Bear Lake
N Aleutian COST 1	56.27332	-161.97850		5	3,060.0		154.000		35.40			2.61	PSWC	Bear Lake
N Aleutian COST 1	56.27332	-161.97850		6	3,430.0				35.50			2.63	PSWC	Bear Lake
N Aleutian COST 1	56.27332	-161.97850		7	3,696.0		1218.000		36.00			2.64	PSWC	Bear Lake
N Aleutian COST 1	56.27332	-161.97850		8	3,918.0				40.00			2.63	PSWC	Bear Lake
N Aleutian COST 1	56.27332	-161.97850		9	4,117.0		109.000		29.10			2.66	PSWC	Bear Lake
N Aleutian COST 1	56.27332	-161.97850		10	4,160.0		114.000		35.40			2.65	PSWC	Bear Lake
N Aleutian COST 1	56.27332	-161.97850		11	4,290.0		722.000		30.70			2.64	PSWC	Bear Lake
N Aleutian COST 1	56.27332	-161.97850		12	4,426.0		1641.000		32.10			2.64	PSWC	Bear Lake
N Aleutian COST 1	56.27332	-161.97850		13	4,625.0				33.10			2.65	PSWC	Bear Lake
N Aleutian COST 1	56.27332	-161.97850		14	4,780.8		1233.000		33.10			2.65	PSWC	Bear Lake
N Aleutian COST 1	56.27332	-161.97850		15	4,876.0		78.000		28.20			2.63	PSWC	Unga
N Aleutian COST 1	56.27332	-161.97850		16	5,009.0		530.000		32.80			2.67	PSWC	Unga
N Aleutian COST 1	56.27332	-161.97850		17	5,112.0		47.000		28.40			2.66	PSWC	Unga
N Aleutian COST 1	56.27332	-161.97850		18	5,247.0		157.000		30.10			2.64	PSWC	Unga
N Aleutian COST 1	56.27332	-161.97850		19	5,444.0		9.520		20.20			2.69	PSWC	Unga
N Aleutian COST 1	56.27332	-161.97850		20	5,655.0		519.000		32.30			2.61	PSWC	Unga
N Aleutian COST 1	56.27332	-161.97850		21	5,805.0		139.000		25.20			2.67	PSWC	Stepovak
N Aleutian COST 1	56.27332	-161.97850		22	6,671.0				21.50			2.62	PSWC	Stepovak
N Aleutian COST 1	56.27332	-161.97850		23	6,695.0				20.20			2.69	PSWC	Stepovak
N Aleutian COST 1	56.27332	-161.97850		24	6,768.0		72.000		23.90			2.65	PSWC	Stepovak
N Aleutian COST 1	56.27332	-161.97850		25	7,055.0				26.10			2.60	PSWC	Stepovak
N Aleutian COST 1	56.27332	-161.97850		26	7,252.0		26.000		24.00			2.66	PSWC	Stepovak
N Aleutian COST 1	56.27332	-161.97850		27	7,330.0				21.50			2.63	PSWC	Stepovak
N Aleutian COST 1	56.27332	-161.97850		28	7,342.0		274.000		29.10			2.65	PSWC	Stepovak
N Aleutian COST 1	56.27332	-161.97850		29	7,446.0		298.000		26.50			2.63	PSWC	Stepovak
N Aleutian COST 1	56.27332	-161.97850		30	7,512.0		441.000		25.90			2.64	PSWC	Stepovak
N Aleutian COST 1	56.27332	-161.97850		31	7,552.0		162.000		32.30			2.63	PSWC	Stepovak
N Aleutian COST 1	56.27332	-161.97850		32	7,658.0		280.000		28.80			2.61	PSWC	Stepovak
N Aleutian COST 1	56.27332	-161.97850		33	7,691.0		106.000		34.20			2.61	PSWC	Stepovak
N Aleutian COST 1	56.27332	-161.97850		34	7,737.0		19.000		30.40			2.64	PSWC	Stepovak
N Aleutian COST 1	56.27332	-161.97850		35	7,869.0		159.000		29.70			2.62	PSWC	Stepovak
N Aleutian COST 1	56.27332	-161.97850		36	8,089.0		348.000		31.60			2.62	PSWC	Stepovak
N Aleutian COST 1	56.27332	-161.97850		37	8,136.0		452.000		31.50			2.63	PSWC	Stepovak
N Aleutian COST 1	56.27332	-161.97850		38	8,170.0		474.000		28.30			2.63	PSWC	Stepovak
N Aleutian COST 1	56.27332	-161.97850		39	8,224.0		142.000		25.70			2.62	PSWC	Stepovak
N Aleutian COST 1	56.27332	-161.97850		40	8,374.0		89.000		24.50			2.68	PSWC	Stepovak
N Aleutian COST 1	56.27332	-161.97850		41	8,446.0		34.000		25.10			2.67	PSWC	Stepovak
N Aleutian COST 1	56.27332	-161.97850		42	8,567.0		239.000		30.90			2.66	PSWC	Stepovak
N Aleutian COST 1	56.27332	-161.97850		43	8,658.0		105.000		30.30			2.67	PSWC	Stepovak
N Aleutian COST 1	56.27332	-161.97850		44	8,758.0		92.000		27.60			2.66	PSWC	Stepovak
N Aleutian COST 1	56.27332	-161.97850		45	8,764.0		180.000		30.10			2.68	PSWC	Stepovak

Outcrop data from Reifenstuhl and others (2005) and Loveland and others (2007).
Bristol Bay Outcrop* = data and locations from Bristol Bay Native Corporation archive files based on industry work
Type: CC = Conventional core; PSWC = Percussion sidewall core; OUT = Outcrop sample

Table 4. Porosity, permeability, and saturation data for Bristol Bay sandstones–continued.

Well or outcrop sample	Latitude or location (section, township, range)	Longitude or location (quadrangle)	Core	Plug	Depth of sample (ft)	K klink (md)	K air (md)	K probe (md)	Porosity (%)	So (%)	Sw (%)	Density (g/cc)	Type	Unit
N Aleutian COST 1	56.27332	-161.97850		46	8,800.0		277.000		31.30			2.63	PSWC	Stepovak
N Aleutian COST 1	56.27332	-161.97850		47	8,863.0		197.000		27.80			2.63	PSWC	Stepovak
N Aleutian COST 1	56.27332	-161.97850		48	8,993.0		188.000		28.20			2.63	PSWC	Stepovak
N Aleutian COST 1	56.27332	-161.97850		49	9,038.0		234.000		30.50			2.63	PSWC	Stepovak
N Aleutian COST 1	56.27332	-161.97850		50	9,184.0		164.000		23.50			2.65	PSWC	Stepovak
N Aleutian COST 1	56.27332	-161.97850		51	9,293.0		103.000		28.20			2.65	PSWC	Stepovak
N Aleutian COST 1	56.27332	-161.97850		52	9,330.0		63.000		25.40			2.69	PSWC	Stepovak
N Aleutian COST 1	56.27332	-161.97850		53	9,511.0		38.000		26.80			2.66	PSWC	Stepovak
N Aleutian COST 1	56.27332	-161.97850		54	9,663.0		25.000		23.20			2.73	PSWC	Stepovak
N Aleutian COST 1	56.27332	-161.97850		55	9,786.0		12.000		20.50			2.69	PSWC	Stepovak
N Aleutian COST 1	56.27332	-161.97850		56	9,950.0		37.000		19.30			2.71	PSWC	Stepovak
N Aleutian COST 1	56.27332	-161.97850		57	10,252.0		66.000		23.40			2.72	PSWC	Stepovak
N Aleutian COST 1	56.27332	-161.97850		58	10,302.0		17.000		20.40			2.75	PSWC	Stepovak
N Aleutian COST 1	56.27332	-161.97850		59	10,316.0		12.000		26.60			2.70	PSWC	Stepovak
N Aleutian COST 1	56.27332	-161.97850		60	10,355.0		38.000		22.20			2.69	PSWC	Stepovak
N Aleutian COST 1	56.27332	-161.97850		61	10,390.0				23.60			2.69	PSWC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850		62	10,417.0				20.10			2.84	PSWC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850		63	10,427.0		132.000		23.90			2.67	PSWC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850		64	10,654.0		989.000		25.30			2.62	PSWC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850		65	10,870.0				18.20			2.71	PSWC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850		66	11,032.0				24.50			2.69	PSWC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850		67	11,268.0		13.000		22.00			2.72	PSWC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850		68	11,337.0				23.20			2.68	PSWC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850		69	11,541.0		59.000		24.10			2.63	PSWC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850		70	11,735.0				24.50			2.62	PSWC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850		71	11,878.0		25.000		22.30			2.69	PSWC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850		72	12,093.0		194.000		22.20			2.76	PSWC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850		73	12,548.0				25.60			2.67	PSWC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850		74	12,659.0				26.80			2.69	PSWC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850		75	12,729.0		23.000		21.70			2.66	PSWC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850		76	13,060.0		181.000		23.80			2.70	PSWC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850		77	13,124.0		49.000		24.40			2.69	PSWC	Tolstoi
N Aleutian COST 1	56.27332	-161.97850		78	13,254.0				24.80			2.82	PSWC	Tolstoi
Becharof State 1	57.78412	-157.10980	1	1	2,725.5		2311.000		33.60	0.0	97.1	2.62	CC	Milky River
Becharof State 1	57.78412	-157.10980	1	2	2,726.5		2040.000		43.20	0.0	98.8	2.53	CC	Milky River
Becharof State 1	57.78412	-157.10980	1	3	2,727.5		3649.000		35.90	0.0	98.1	2.63	CC	Milky River
Becharof State 1	57.78412	-157.10980	1	4	2,728.9		2176.000		37.10	0.0	97.2	2.62	CC	Milky River
Becharof State 1	57.78412	-157.10980	1	5	2,729.4		2046.000		36.10	0.0	99.3	2.62	CC	Milky River
Becharof State 1	57.78412	-157.10980	1	6	2,729.5		681.000		34.10	0.0	96.2	2.62	CC	Milky River
Becharof State 1	57.78412	-157.10980	1	7	2,729.6		819.000		34.60	0.0	85.6	2.63	CC	Milky River
Becharof State 1	57.78412	-157.10980	1	8	2,730.5		1698.000		36.80	0.0	95.4	2.62	CC	Milky River
Becharof State 1	57.78412	-157.10980	1	9	2,731.5		2301.000		34.90	0.0	97.1	2.61	CC	Milky River
Becharof State 1	57.78412	-157.10980	1	10	2,732.5		1659.000		34.60	0.0	97.2	2.61	CC	Milky River
Becharof State 1	57.78412	-157.10980	1	11	2,732.6		2986.000		36.90	0.0	98.5	2.62	CC	Milky River
Becharof State 1	57.78412	-157.10980	1	12	2,733.5		2098.000		36.50	0.0	99.2	2.67	CC	Milky River
Becharof State 1	57.78412	-157.10980	1	13	2,734.5		3470.000		36.90	0.0	98.7	2.62	CC	Milky River
Becharof State 1	57.78412	-157.10980	1	14	2,735.5		3575.000		38.00	0.0	98.2	2.63	CC	Milky River
Becharof State 1	57.78412	-157.10980	1	15	2,736.5		3893.000		41.70	0.0	98.8	2.62	CC	Milky River
Becharof State 1	57.78412	-157.10980	1	16	2,737.7		362.000		30.70	0.0	97.1	2.62	CC	Milky River

Outcrop data from Reifenstuhl and others (2005) and Loveland and others (2007).
Bristol Bay Outcrop* = data and locations from Bristol Bay Native Corporation archive files based on industry work
Type: CC = Conventional core; PSWC = Percussion sidewall core; OUT = Outcrop sample

Table 4. Porosity, permeability, and saturation data for Bristol Bay sandstones–continued.

Well or outcrop sample	Latitude or location (section, township, range)	Longitude or location (quadrangle)	Core	Plug	Depth of sample (ft)	K klink (md)	K air (md)	K probe (md)	Porosity (%)	So (%)	Sw (%)	Density (g/cc)	Type	Unit
Becharof State 1	57.78412	-157.10980	1	17	2,738.5		565.000		30.70	0.0	98.6	2.64	CC	Milky River
Becharof State 1	57.78412	-157.10980	1	18	2,738.6		2129.000		35.30	0.0	97.1	2.63	CC	Milky River
Becharof State 1	57.78412	-157.10980	1	19	2,738.7		2181.000		35.20	0.0	96.8	2.64	CC	Milky River
Becharof State 1	57.78412	-157.10980	1	20	2,739.4		1989.000		35.10	0.0	97.3	2.65	CC	Milky River
Becharof State 1	57.78412	-157.10980	1	21	2,739.5		1680.000		35.80	0.0	97.5	2.64	CC	Milky River
Becharof State 1	57.78412	-157.10980	1	22	2,740.4		2623.000		36.20	0.0	98.3	2.64	CC	Milky River
Becharof State 1	57.78412	-157.10980	1	23	2,740.5		1950.000		25.90	0.0	98.8	2.64	CC	Milky River
Becharof State 1	57.78412	-157.10980	1	24	2,741.5		1096.000		36.10	0.0	98.3	2.65	CC	Milky River
Becharof State 1	57.78412	-157.10980	1	25	2,742.5		1183.000		37.10	0.0	98.6	2.65	CC	Milky River
Becharof State 1	57.78412	-157.10980	1	26	2,743.5		1043.000		37.50	0.0	99.0	2.65	CC	Milky River
Becharof State 1	57.78412	-157.10980	1	27	2,744.5		1052.000		38.30	0.0	97.7	2.65	CC	Milky River
Becharof State 1	57.78412	-157.10980	1	28	2,745.5		1386.000		35.80	0.0	97.7	2.62	CC	Milky River
Becharof State 1	57.78412	-157.10980	2	29	3,668.5		4663.000		34.70	0.0	97.9	2.64	CC	Bear Lake
Becharof State 1	57.78412	-157.10980	2	30	3,669.5		2978.000		34.40	0.0	96.1	2.62	CC	Bear Lake
Becharof State 1	57.78412	-157.10980	2	31	3,669.7		4969.000		37.20	0.0	98.7	2.65	CC	Bear Lake
Becharof State 1	57.78412	-157.10980	2	32	3,670.7		3378.000		34.70	0.0	96.5	2.64	CC	Bear Lake
Becharof State 1	57.78412	-157.10980	2	33	3,671.5		1892.000		34.30	0.0	98.0	2.64	CC	Bear Lake
Becharof State 1	57.78412	-157.10980	2	34	3,671.7		3843.000		35.10	0.0	97.7	2.62	CC	Bear Lake
Becharof State 1	57.78412	-157.10980	2	35	3,672.5		2.400		6.00	0.0	88.7	3.04	CC	Bear Lake
Becharof State 1	57.78412	-157.10980	2	36	3,673.3		3202.000		35.30	0.0	97.8	2.64	CC	Bear Lake
Becharof State 1	57.78412	-157.10980	2	37	3,673.5		3592.000		34.80	0.0	97.0	2.53	CC	Bear Lake
Becharof State 1	57.78412	-157.10980	2	38	3,674.5		3.300		5.80	0.0	82.6	2.69	CC	Bear Lake
Becharof State 1	57.78412	-157.10980	2	39	3,675.5		56.000		13.30	0.0	94.2	3.32	CC	Bear Lake
Becharof State 1	57.78412	-157.10980	2	40	3,676.5		1.700		4.20	0.0	93.3	3.26	CC	Bear Lake
Becharof State 1	57.78412	-157.10980	2	41	3,677.3		0.030		12.20	0.0	96.2	3.06	CC	Bear Lake
Becharof State 1	57.78412	-157.10980	2	42	3,678.7		1550.000		34.00	0.0	97.2	2.65	CC	Bear Lake
Becharof State 1	57.78412	-157.10980	2	43	3,679.5		1413.000		34.00	0.0	98.8	2.63	CC	Bear Lake
Becharof State 1	57.78412	-157.10980	2	44	3,679.6		2062.000		33.50	0.0	84.8	2.64	CC	Bear Lake
Becharof State 1	57.78412	-157.10980	2	45	3,680.6		59.000		26.30	0.0	95.7	2.67	CC	Bear Lake
Becharof State 1	57.78412	-157.10980	2	46	3,681.8		3437.000		34.40	0.0	82.0	2.65	CC	Bear Lake
Becharof State 1	57.78412	-157.10980	2	47	3,682.4		2941.000		33.60	0.0	83.9	2.63	CC	Bear Lake
Becharof State 1	57.78412	-157.10980	2	48	3,682.5		2829.000		34.00	0.0	92.9	2.64	CC	Bear Lake
Becharof State 1	57.78412	-157.10980	2	49	3,683.4		221.000		27.20	0.0	98.9	2.66	CC	Bear Lake
Becharof State 1	57.78412	-157.10980	2	50	3,683.5		2741.000		33.50	0.0	88.8	2.64	CC	Bear Lake
Becharof State 1	57.78412	-157.10980	2	51	3,684.5		4115.000		35.00	0.0	93.3	2.66	CC	Bear Lake
Becharof State 1	57.78412	-157.10980	2	52	3,684.6		3994.000		35.50	0.0	92.9	2.68	CC	Bear Lake
Becharof State 1	57.78412	-157.10980	2	53	3,686.5		1611.000		35.80	0.0	98.7	2.65	CC	Bear Lake
Becharof State 1	57.78412	-157.10980	2	54	3,687.5		5327.000		34.90	0.0	88.5	2.66	CC	Bear Lake
Becharof State 1	57.78412	-157.10980	2	55	3,688.5		3915.000		34.50	0.0	87.7	2.66	CC	Bear Lake
Becharof State 1	57.78412	-157.10980	2	56	3,689.5		46.000		25.20	0.0	98.3	2.67	CC	Bear Lake
Becharof State 1	57.78412	-157.10980	2	57	3,689.6		2378.000		33.90	0.0	89.5	2.68	CC	Bear Lake
Becharof State 1	57.78412	-157.10980	2	58	3,691.5		3365.000		34.10	0.0	90.8	2.66	CC	Bear Lake
Becharof State 1	57.78412	-157.10980	2	59	3,692.5		2439.000		33.10	0.0	94.0	2.66	CC	Bear Lake
Becharof State 1	57.78412	-157.10980	2	60	3,694.5		620.000		29.50	0.0	96.9	2.66	CC	Bear Lake
Becharof State 1	57.78412	-157.10980	2	61	3,696.5		0.010		2.80	0.0	75.0	3.07	CC	Bear Lake
Becharof State 1	57.78412	-157.10980	3	1	7,895.0		0.010		1.00	0.0	69.5	3.11	CC	Stepovak
Becharof State 1	57.78412	-157.10980	3	2	7,901.0		0.070		8.10	1.3	63.3	2.66	CC	Stepovak
Becharof State 1	57.78412	-157.10980	3	3	7,902.0		0.130		8.30	3.0	69.5	2.67	CC	Stepovak
Becharof State 1	57.78412	-157.10980	3	4	7,903.0		0.050		5.90	1.6	71.2	2.64	CC	Stepovak

Outcrop data from Reifenstuhl and others (2005) and Loveland and others (2007).
Bristol Bay Outcrop* = data and locations from Bristol Bay Native Corporation archive files based on industry work
Type: CC = Conventional core; PSWC = Percussion sidewall core; OUT = Outcrop sample

Table 4. Porosity, permeability, and saturation data for Bristol Bay sandstones–continued.

Well or outcrop sample	Latitude or location (section, township, range)	Longitude or location (quadrangle)	Core	Plug	Depth of sample (ft)	K klink (md)	K air (md)	K probe (md)	Porosity (%)	So (%)	Sw (%)	Density (g/cc)	Type	Unit
Becharof State 1	57.78412	-157.10980	3	5	7,904.0		0.140		6.50	15.6	52.0	2.62	CC	Stepovak
Becharof State 1	57.78412	-157.10980	3	6	7,905.0		0.130		7.30	7.7	61.5	2.65	CC	Stepovak
Becharof State 1	57.78412	-157.10980	3	7	7,906.0		0.090		7.00	3.2	73.0	2.66	CC	Stepovak
Becharof State 1	57.78412	-157.10980	3	8	7,907.0		0.070		6.80	5.1	48.9	2.65	CC	Stepovak
Becharof State 1	57.78412	-157.10980	3	9	7,909.0		0.040		4.30	13.8	69.1	2.61	CC	Stepovak
Becharof State 1	57.78412	-157.10980	3	10	7,910.0		0.150		6.20	21.7	59.8	2.61	CC	Stepovak
Becharof State 1	57.78412	-157.10980	3	11	7,911.0		0.100		7.10	2.9	67.1	2.65	CC	Stepovak
Becharof State 1	57.78412	-157.10980	3	12	7,914.0		0.060		7.60	1.0	63.9	2.64	CC	Stepovak
Becharof State 1	57.78412	-157.10980	3	13	7,915.0		0.120		7.10	5.3	62.0	2.65	CC	Stepovak
Becharof State 1	57.78412	-157.10980	3	14	7,916.0		0.290		8.30	5.4	69.4	2.66	CC	Stepovak
Becharof State 1	57.78412	-157.10980	3	15	7,918.0		0.030		6.40	9.0	71.7	2.62	CC	Stepovak
Becharof State 1	57.78412	-157.10980	3	16	7,919.0		0.020		3.90	0.0	65.9	2.72	CC	Stepovak
Becharof State 1	57.78412	-157.10980	3	17	7,920.0		0.010		1.00	0.0	57.7	2.72	CC	Stepovak
Becharof State 1	57.78412	-157.10980	3	18	7,921.0		0.060		3.80	3.5	63.8	2.64	CC	Stepovak
Becharof State 1	57.78412	-157.10980	3	19	7,922.0		0.400		8.60	0.0	67.9	2.66	CC	Stepovak
Becharof State 1	57.78412	-157.10980	3	20	7,925.0		0.060		5.50	2.7	60.9	2.61	CC	Stepovak
Becharof State 1	57.78412	-157.10980	3	21	7,927.0		0.010		0.89	6.4	60.5	3.16	CC	Stepovak
Becharof State 1	57.78412	-157.10980	3	22	7,928.0		0.030		3.70	28.9	54.2	2.54	CC	Stepovak
Becharof State 1	57.78412	-157.10980	3	23	7,931.0		0.130		6.40	3.0	73.9	2.65	CC	Stepovak
Becharof State 1	57.78412	-157.10980	3	24	7,932.0		0.300		5.90	3.3	82.8	2.53	CC	Stepovak
Becharof State 1	57.78412	-157.10980	3	25	7,938.0		0.030		5.90	6.7	65.9	2.63	CC	Stepovak
Becharof State 1	57.78412	-157.10980	3	26	7,939.0		0.020		5.40	3.3	84.6	2.63	CC	Stepovak
Becharof State 1	57.78412	-157.10980	3	27	7,940.0		0.050		4.10	7.2	72.1	2.62	CC	Stepovak
Becharof State 1	57.78412	-157.10980	3	28	7,941.0		0.020		6.60	1.6	83.8	2.65	CC	Stepovak
Becharof State 1	57.78412	-157.10980	3	29	7,942.0		0.080		8.30	4.0	77.8	2.63	CC	Stepovak
Sandy River 1	56.21499	-160.17310		1	3,260.0				31.80	0.0	89.6		PSWC	Bear Lake
Sandy River 1	56.21499	-160.17310		2	3,339.0		275.000		28.60	0.0	93.0		PSWC	Bear Lake
Sandy River 1	56.21499	-160.17310		3	3,828.0		31.000		35.10	0.0	90.0		PSWC	Bear Lake
Sandy River 1	56.21499	-160.17310		4	3,982.0		56.000		34.40	0.0	84.6		PSWC	Bear Lake
Sandy River 1	56.21499	-160.17310		5	4,125.0		0.100		23.50	0.0	93.6		PSWC	Bear Lake
Sandy River 1	56.21499	-160.17310		6	4,370.0		564.000		28.70	0.0	85.7		PSWC	Bear Lake
Sandy River 1	56.21499	-160.17310		7	4,380.0		211.000		35.20	0.0	90.3		PSWC	Bear Lake
Sandy River 1	56.21499	-160.17310		8	4,503.0		1268.000						PSWC	Bear Lake
Sandy River 1	56.21499	-160.17310		9	4,735.0		842.000						PSWC	Bear Lake
Sandy River 1	56.21499	-160.17310		10	5,009.0		18.000		36.50	0.0	84.3		PSWC	Bear Lake
Sandy River 1	56.21499	-160.17310		11	5,049.0		166.000		36.30	0.0	91.2		PSWC	Bear Lake
Sandy River 1	56.21499	-160.17310		12	5,163.0		48.000		34.30	0.0	79.3		PSWC	Bear Lake
Sandy River 1	56.21499	-160.17310		13	5,557.0		254.000		33.10	0.0	89.1		PSWC	Unga
Sandy River 1	56.21499	-160.17310		15	6,083.0		333.000		25.00	0.0	76.0		PSWC	Unga
Sandy River 1	56.21499	-160.17310		16	6,289.0		425.000		28.60	0.0	85.3		PSWC	Unga
Sandy River 1	56.21499	-160.17310		17	6,624.0		14.000						PSWC	Stepovak
Sandy River 1	56.21499	-160.17310		18	6,650.0		5.700		18.80	0.0	77.7		PSWC	Stepovak
Sandy River 1	56.21499	-160.17310		20	7,575.0		19.000						PSWC	Stepovak
Sandy River 1	56.21499	-160.17310		21	7,692.0				29.90	0.0	91.0		PSWC	Stepovak
Sandy River 1	56.21499	-160.17310		23	7,990.0		43.000		23.70	0.0	62.4		PSWC	Stepovak
Sandy River 1	56.21499	-160.17310		24	8,018.0		17.000		26.30	0.0	86.7		PSWC	Stepovak
Port Heiden 1	56.96777	-158.69040		1	5,625.0		891.000		30.10				PSWC	Bear Lake
Port Heiden 1	56.96777	-158.69040		2	5,665.0		287.000		25.20				PSWC	Bear Lake
Port Heiden 1	56.96777	-158.69040		3	6,220.0		655.000		29.00				PSWC	Bear Lake

Outcrop data from Reifenstuhl and others (2005) and Loveland and others (2007).
Bristol Bay Outcrop* = data and locations from Bristol Bay Native Corporation archive files based on industry work
Type: CC = Conventional core; PSWC = Percussion sidewall core; OUT = Outcrop sample

Table 4. Porosity, permeability, and saturation data for Bristol Bay sandstones–continued.

Well or outcrop sample	Latitude or location (section, township, range)	Longitude or location (quadrangle)	Core	Plug	Depth of sample (ft)	K klink (md)	K air (md)	K probe (md)	Porosity (%)	So (%)	Sw (%)	Density (g/cc)	Type	Unit
Port Heiden 1	56.96777	-158.69040		4	6,290.0		311.000		27.20				PSWC	Bear Lake
Port Heiden 1	56.96777	-158.69040		5	6,335.0		692.000		28.60				PSWC	Bear Lake
Port Heiden 1	56.96777	-158.69040		6	6,350.0		253.000		27.90				PSWC	Bear Lake
Port Heiden 1	56.96777	-158.69040		7	6,370.0		348.000		29.60				PSWC	Bear Lake
Port Heiden 1	56.96777	-158.69040		8	6,415.0		346.000		28.00				PSWC	Bear Lake
Port Heiden 1	56.96777	-158.69040		9	6,475.0		234.000		29.10				PSWC	Bear Lake
Port Heiden 1	56.96777	-158.69040		10	6,545.0		1165.000		24.80				PSWC	Bear Lake
Port Heiden 1	56.96777	-158.69040		11	7,550.0		163.000		28.80				PSWC	Bear Lake
Great Basins 1	57.87942	-157.08520	5	1	2,857.0	393.0	423.000		22.40				CC	Milky River
Great Basins 1	57.87942	-157.08520	6	1	3,365.5	0.1	0.100		0.46				CC	Milky River
Great Basins 1	57.87942	-157.08520	6	2	3,366.3	4.5	6.000		3.80				CC	Milky River
Great Basins 1	57.87942	-157.08520	7	1	3,894.0	423.0	453.000		24.90				CC	Bear Lake
Great Basins 1	57.87942	-157.08520	8	1	4,413.0	264.0	270.000		26.40				CC	Bear Lake
Great Basins 1	57.87942	-157.08520	11	1	6,075.0	27.0	32.000		4.60				CC	Bear Lake
Great Basins 1	57.87942	-157.08520	11	2	6,077.0	1.9	2.700		5.50				CC	Bear Lake
Great Basins 1	57.87942	-157.08520	11	3	6,082.0	1.2	1.700		5.20				CC	Bear Lake
Great Basins 1	57.87942	-157.08520	11	4	6,086.0	1.7	2.400		8.80				CC	Bear Lake
Great Basins 1	57.87942	-157.08520	11	5	6,088.0	22.0	27.000		4.00				CC	Bear Lake
Great Basins 1	57.87942	-157.08520	11	6	6,089.0	7.6	9.800		9.50				CC	Bear Lake
Great Basins 1	57.87942	-157.08520	11	7	6,090.0	1.0	1.400		9.80				CC	Bear Lake
Great Basins 1	57.87942	-157.08520	11	8	6,091.0	2.5	3.500		6.60				CC	Bear Lake
Great Basins 1	57.87942	-157.08520	15	9	7,227.0	2.9	4.000		25.70	3.5	84.9		CC	Bear Lake
Great Basins 1	57.87942	-157.08520	15	10	7,228.0	0.4	0.600		27.30	1.8	85.8		CC	Bear Lake
Great Basins 1	57.87942	-157.08520	15	11	7,230.0	0.4	0.600		26.90	1.9	74.3		CC	Bear Lake
Great Basins 1	57.87942	-157.08520	15	12	7,232.0	1.4	2.000		9.00				CC	Bear Lake
Great Basins 1	57.87942	-157.08520	15	13	7,234.0	0.9	1.300		9.40				CC	Bear Lake
Great Basins 1	57.87942	-157.08520	15	14	7,236.0	1.2	1.700		2.40				CC	Bear Lake
Great Basins 1	57.87942	-157.08520	15	15	7,238.0	0.7	0.900		5.50				CC	Bear Lake
Great Basins 1	57.87942	-157.08520	15	16	7,240.0	0.7	0.900		5.00				CC	Bear Lake
Great Basins 1	57.87942	-157.08520	15	17	7,242.0	58.0	67.000		1.60				CC	Bear Lake
Great Basins 1	57.87942	-157.08520	15	18	7,244.0	7.9	11.000		5.30				CC	Bear Lake
Great Basins 1	57.87942	-157.08520	15	19	7,246.0	0.3	0.500		0.60				CC	Bear Lake
Great Basins 1	57.87942	-157.08520	16	20	8,223.0	0.1	0.460		0.30				CC	Bear Lake
Great Basins 1	57.87942	-157.08520	16	21	8,225.0	2.7	3.700		11.60				CC	Bear Lake
Great Basins 1	57.87942	-157.08520	16	22	8,227.0	3.3	4.400		23.20				CC	Bear Lake
Great Basins 1	57.87942	-157.08520	16	23	8,229.0	2.5	3.400		13.70				CC	Bear Lake
Great Basins 1	57.87942	-157.08520	16	24	8,231.0	2.5	3.400		13.70				CC	Bear Lake
Great Basins 1	57.87942	-157.08520	16	25	8,233.0	0.3	0.500		1.70				CC	Bear Lake
Great Basins 1	57.87942	-157.08520	16	26	8,235.0	3.5	4.700		14.50				CC	Bear Lake
Great Basins 1	57.87942	-157.08520	16	27	8,237.0	2.2	3.000		14.60				CC	Bear Lake
Great Basins 1	57.87942	-157.08520	16	28	8,239.0	1.2	1.700		15.20				CC	Bear Lake
Great Basins 1	57.87942	-157.08520	17	29	9,820.0	0.0	0.020		15.30				CC	Bear Lake
Great Basins 1	57.87942	-157.08520	17	30	9,823.0	7.3	9.400		14.40				CC	Bear Lake
Great Basins 1	57.87942	-157.08520	17	31	9,825.0	88.0	99.000		10.90				CC	Bear Lake
Great Basins 1	57.87942	-157.08520	17	32	9,826.0	18.0	22.000		10.50				CC	Bear Lake
Outcrop	55.99835	-159.95333		1	04RR138	0.004	0.012		16.65			2.70	OUT	Stepovak
Outcrop	55.86117	-160.49365		2	04RR139C			1.080	11.60			2.64	OUT	Herendeen
Outcrop	55.86117	-160.49365		3	04RR139D	0.793	1.188		10.97			2.68	OUT	Herendeen
Outcrop	55.86046	-160.59232		4	04RR140C	0.613	0.898		11.68			2.53	OUT	Bear Lake

Outcrop data from Reifenstuhl and others (2005) and Loveland and others (2007).
Bristol Bay Outcrop* = data and locations from Bristol Bay Native Corporation archive files based on industry work
Type: CC = Conventional core; PSWC = Percussion sidewall core; OUT = Outcrop sample

Table 4. Porosity, permeability, and saturation data for Bristol Bay sandstones–continued.

Well or outcrop sample	Latitude or location (section, township, range)	Longitude or location (quadrangle)	Core	Plug	Depth of sample (ft)	K klink (md)	K air (md)	K probe (md)	Porosit y (%)	So (%)	Sw (%)	Density (g/cc)	Type	Unit
Outcrop	55.81506	-160.75445		5	04RR141B	0.008	0.020		13.84			2.69	OUT	Chignik
Outcrop	55.82106	-160.75302		6	04RR148B	0.063	0.110		9.80			2.68	OUT	Bear Lake
Outcrop	55.98597	-159.99297		7	04RR153D			0.180	9.16			2.71	OUT	Bear Lake
Outcrop	56.04404	-159.89347		8	04RR154B				41.96			2.81	OUT	Milky River
Outcrop	55.48712	-161.47603		9	04RR155B	0.002	0.005		7.01			2.71	OUT	Tolstoi
Outcrop	55.48712	-161.47603		10	04RR155B	0.099	0.163		9.60			2.72	OUT	Tolstoi
Outcrop	55.81693	-160.31337		11	SD1-64	0.024	0.048		10.55			2.69	OUT	Bear Lake
Outcrop	55.85998	-160.49368		12	HS1-8.5	0.007	0.018		5.11			2.60	OUT	Herendeen
Outcrop	55.85998	-160.49368		13	HS1-12	0.009	0.022		5.35			2.68	OUT	Herendeen
Outcrop	55.85998	-160.49368		14	HS1-16	0.002	0.007		7.35			2.67	OUT	Herendeen
Outcrop	55.85998	-160.49368		15	HS1-2.5	0.007	0.018		7.94			2.70	OUT	Herendeen
Outcrop	55.85998	-160.49368		16	HS1-5.5	0.049	0.088		6.27			2.73	OUT	Herendeen
Outcrop	55.87441	-160.34538		17	LH1-2	0.474	0.691		8.90			2.68	OUT	Bear Lake
Outcrop	55.87441	-160.34538		18	LH1-66.5	0.055	0.098		6.47			2.67	OUT	Bear Lake
Outcrop	55.87441	-160.34538		19	LH1-98			0.065	16.94			2.69	OUT	Bear Lake
Outcrop	55.87441	-160.34538		20	LH1-120	0.032	0.061		8.33			2.67	OUT	Bear Lake
Outcrop	55.87441	-160.34538		21	LH1-164	0.005	0.013		4.43			2.73	OUT	Bear Lake
Outcrop	55.87441	-160.34538		22	LH1-182			0.037	11.33			2.62	OUT	Bear Lake
Outcrop	56.06151	-159.91139		23	SR1-3.5	222.139	245.875		32.67			2.68	OUT	Milky River
Outcrop	56.06010	-159.91490		24	SR2-6	62.237	73.113		35.38			2.75	OUT	Milky River
Outcrop	56.06010	-159.91490		25	SR2-89.5	3425.436	3553.977		35.31			2.70	OUT	Milky River
Outcrop	55.81693	-160.31337		26	SD1-10	0.191	0.310		10.77			2.66	OUT	Bear Lake
Outcrop	55.81693	-160.31337		27	SD1-41			0.08	10.01			2.68	OUT	Bear Lake
Outcrop	55.81693	-160.31337		28	SD1-56	0.003	0.010		8.27			2.71	OUT	Bear Lake
Outcrop	55.81693	-160.31337		29	SD1-86	0.184	0.280		4.89			2.68	OUT	Bear Lake
Outcrop	55.81390	-160.75302		30	04RR142B			1.950	12.36			2.68	OUT	Chignik
Outcrop	55.72546	-160.66745		31	04RR149B	0.308	0.447		4.59			2.71	OUT	Chignik
Outcrop	55.73109	-160.67883		32	04RR150B	0.001	0.004		2.63			2.71	OUT	Chignik
Outcrop	55.78552	-160.87170		33	04RR151C	1.230	1.694		7.11			2.66	OUT	Chignik
Outcrop	55.78132	-160.78056		34	04RR152C	0.242	0.377		11.89			2.72	OUT	Bear Lake
Outcrop	55.80278	-160.75218		35	04RR156B	0.001	0.004		4.64			2.70	OUT	Herendeen
Outcrop	55.80278	-160.75218		36	04RR156D	0.002	0.006		1.10			2.68	OUT	Herendeen
Outcrop	55.75607	-160.69526		37	04RR157B	44.113	52.914		8.11			2.59	OUT	Naknek
Outcrop	55.06233	-159.91165		38	04RR158C			125.000	35.04			2.73	OUT	Milky River
Outcrop	55.06233	-159.91165		39	04RR158G			76.600	35.62			2.63	OUT	Milky River
Outcrop	56.03701	-159.87989		40	04RR163C			0.448	14.12			2.73	OUT	Bear Lake
Outcrop	55.78596	-160.87172		41	CP1-11	0.190	0.288		13.60			2.66	OUT	Bear Lake
Outcrop	55.78596	-160.87172		42	CP1-26	0.582	0.870		11.16			2.64	OUT	Bear Lake
Outcrop	55.78596	-160.87172		43	CP1-38	0.027	0.053		6.23			2.66	OUT	Bear Lake
Outcrop	55.78596	-160.87172		44	CP1-92	0.041	0.076		9.61			2.69	OUT	Bear Lake
Outcrop	55.78596	-160.87172		45	CP1-138	0.006	0.017		7.54			2.71	OUT	Bear Lake
Outcrop	55.78596	-160.87172		46	CP1-178			0.870	11.21			2.66	OUT	Bear Lake
Outcrop	55.74076	-160.45229		47	04RR168B	0.004	0.010		4.39			2.75	OUT	Tolstoi
Outcrop	57.57675	-156.74220		48	04RR8B			41.4	36.10			2.63	OUT	Bear Lake
Outcrop	57.57675	-156.74220		49	04RR8D			0.251	39.60			2.49	OUT	Bear Lake
Outcrop	57.57675	-156.74220		50	04RR8E			0.066	38.40			2.46	OUT	Bear Lake
Outcrop	57.39350	-156.37367		51	04RR9B	0.001	0.005		9.70			2.77	OUT	Kialagvik
Outcrop	57.30629	-156.42686		52	04RR11D	0.06	0.106		3.90			2.63	OUT	Kialagvik
Outcrop	57.30766	-156.43205		53	04TJR08	0.444	0.698		7.40			2.76	OUT	Kialagvik

Outcrop data from Reifenstuhl and others (2005) and Loveland and others (2007).
Bristol Bay Outcrop* = data and locations from Bristol Bay Native Corporation archive files based on industry work
Type: CC = Conventional core; PSWC = Percussion sidewall core; OUT = Outcrop sample

Table 4. Porosity, permeability, and saturation data for Bristol Bay sandstones–continued.

Well or outcrop sample	Latitude or location (section, township, range)	Longitude or location (quadrangle)	Core	Plug	Depth of sample (ft)	K klink (md)	K air (md)	K probe (md)	Porosity (%)	So (%)	Sw (%)	Density (g/cc)	Type	Unit
Outcrop	57.73551	-156.40000		54	04DS04B			0.021	4.90			2.70	OUT	Kialagvik
Outcrop	57.30723	-156.43266		55	04DS09C			0.053	4.80			2.74	OUT	Kialagvik
Outcrop	57.73318	-156.39858		56	04RR3B			0.027	13.40			2.70	OUT	Kialagvik
Outcrop	57.65384	-156.27242		57	04RR6B	0.002	0.008		2.70			2.51	OUT	Naknek
Outcrop	57.76330	-155.63304		58	04RR23A	0.005	0.014		1.50			2.68	OUT	Naknek
Outcrop	57.53558	-156.75181		59	04TJR09	0.026	0.051		5.30			2.52	OUT	Naknek
Outcrop	59.79255	-155.60508		60	04RR2C	0.074	0.126		3.80			2.63	OUT	Naknek
Outcrop	57.53561	-156.75188		61	04RR12B	0.114	0.184		5.00			2.61	OUT	Naknek
Outcrop	59.79255	-155.60508		62	04RR2D	0.137	0.216		4.60			2.60	OUT	Naknek
Outcrop	57.66677	-156.37852		63	04RR7D	1.562	2.195		4.50			2.56	OUT	Naknek
Outcrop	57.41407	-156.50631		64	04RR19B	2.433	3.382		6.30			2.62	OUT	Naknek
Outcrop	57.74717	-155.68050		65	04RR26B	3.829	5.366		4.60			2.61	OUT	Naknek
Outcrop	57.41584	-156.50539		66	04RR20B			0.223	13.90			2.74	OUT	Naknek
Outcrop	57.76649	-155.63527		67	04RR22B			48.1	6.50			2.56	OUT	Naknek
Outcrop	57.65384	-156.27242		68	04RR6D			20	7.20			2.71	OUT	Naknek
Outcrop	57.66677	-156.37852		69	04RR7B			37.7	7.20			2.57	OUT	Naknek
Outcrop	57.71912	-155.68790		70	04RR30B	0.002	0.006		3.50			2.70	OUT	Shelikof
Outcrop	57.39030	-156.43261		71	04RR18B	0.004	0.010		3.60			2.62	OUT	Shelikof
Outcrop	57.78810	-155.55492		72	04RR1D	0.005	0.014		6.70			2.63	OUT	Shelikof
Outcrop	57.62120	-155.86636		73	04RR16B	0.006	0.016		3.70			2.73	OUT	Shelikof
Outcrop	57.70040	-155.75723		74	04RR15G	0.008	0.019		5.30			2.73	OUT	Shelikof
Outcrop	57.72128	-155.69423		75	04RR29A	0.008	0.020		5.20			2.65	OUT	Shelikof
Outcrop	57.73912	-155.68372		76	04RR28B	0.043	0.079		7.70			2.80	OUT	Shelikof
Outcrop	57.70040	-155.75723		77	04RR15B	0.11	0.178		8.50			2.73	OUT	Shelikof
Outcrop	57.70040	-155.75723		78	04RR15D	0.165	0.254		6.40			2.71	OUT	Shelikof
Outcrop	57.79295	-155.58232		79	04RR13B	0.374	0.522		4.90			2.69	OUT	Shelikof
Outcrop	57.39030	-156.43261		80	04RR18D	0.446	0.689		8.40			2.73	OUT	Shelikof
Outcrop	57.71912	-155.68790		81	04RR30D			0.462	10.10			2.70	OUT	Shelikof
Outcrop*	5-61S-90S	False Pass (D-3)		82	CT1000		12.460		42.90			2.72	OUT	Tachilni
Outcrop*	4,5-48S-68W	Chignik (A-6)		83	SL2149		95.000		38.30			2.68	OUT	Tachilni
Outcrop*	4,5-48S-68W	Chignik (A-6)		84	SL2154		9785.000		30.70			2.76	OUT	Tachilni
Outcrop*	29-48S-66W	Stepovak Bay (D-5)		85	NSF2118		17.700		16.20			2.69	OUT	Bear Lake
Outcrop*	26,27,34,35-48S-69W	Port Moller (D-1)		86	MR2041		55.600		24.00			2.63	OUT	Bear Lake
Outcrop*	26,27,34,35-48S-69W	Port Moller (D-1)		87	MR2045		76.300		20.30			2.61	OUT	Bear Lake
Outcrop*	26,27,34,35-48S-69W	Port Moller (D-1)		88	MR2051		74.700		22.00			2.54	OUT	Bear Lake
Outcrop*	4,5-48S-68W	Chignik (A-6)		89	SL2167		599.000		33.30			2.60	OUT	Bear Lake
Outcrop*	1-55S-77W	Port Moller (B-4)		90	MP3102		6.640		20.70			2.69	OUT	Unga
Outcrop*	19 & 29 55S-74W	Port Moller (B-3)		91	NUI3030		3640.000		35.90			2.61	OUT	Unga
Outcrop*	5-56S-74W	Port Moller (B-3)		92	ZB3039		20.100		51.70			2.70	OUT	Unga
Outcrop*	32S-47W & 32S-48W	Ugashik (B-3) & (B-4)		93	LUL2183		0.200		10.10			2.66	OUT	Ugashik
Outcrop*	32S-47W & 32S-48W	Ugashik (B-3) & (B-4)		94	LUL2189		0.570		7.50			2.61	OUT	Ugashik
Outcrop*	14-58S-85W	Cold Bay (A-1)		95	BR5000		1.230		11.60			2.75	OUT	Belkofski
Outcrop*	14-58S-85W	Cold Bay (A-1)		96	BR5002		0.050		1.10			2.71	OUT	Belkofski
Outcrop*	14-58S-85W	Cold Bay (A-1)		97	BR5004		0.210		9.00			2.63	OUT	Belkofski
Outcrop*	11,12-58S-85W	Cold Bay (A-1)		98	BR5008		0.050		8.60			2.69	OUT	Belkofski
Outcrop*	11,12-58S-85W	Cold Bay (A-1)		99	BR5014		0.050		1.40			2.61	OUT	Belkofski
Outcrop*	11,12-58S-85W	Cold Bay (A-1)		100	BR5016		0.050		7.70			2.71	OUT	Belkofski
Outcrop*	11,12-58S-85W	Cold Bay (A-1)		101	BR5018		0.850		11.40			2.60	OUT	Belkofski
Outcrop*	16,17-59S-85W	Cold Bay (A-1)		102	BC4000		0.050		6.50			2.68	OUT	Belkofski

Outcrop data from Reifenstuhl and others (2005) and Loveland and others (2007).
Bristol Bay Outcrop* = data and locations from Bristol Bay Native Corporation archive files based on industry work
Type: CC = Conventional core; PSWC = Percussion sidewall core; OUT = Outcrop sample

Table 4. Porosity, permeability, and saturation data for Bristol Bay sandstones–continued.

Well or outcrop sample	Latitude or location (section, township, range)	Longitude or location (quadrangle)	Core	Plug	Depth of sample (ft)	K klink (md)	K air (md)	K probe (md)	Porosit y (%)	So (%)	Sw (%)	Density (g/cc)	Type	Unit
Outcrop*	24-58S-85W	Cold Bay (A-1)		103	KA5021		0.050		2.30			2.73	OUT	Belkofski
Outcrop*	24-58S-85W	Cold Bay (A-1)		104	KA5022		0.050		3.40			2.72	OUT	Belkofski
Outcrop*	24-58S-85W	Cold Bay (A-1)		105	KA5023		0.050		7.10			2.75	OUT	Belkofski
Outcrop*	24-58S-85W	Cold Bay (A-1)		106	KA5024		0.050		4.20			2.64	OUT	Belkofski
Outcrop*	24-58S-85W	Cold Bay (A-1)		107	KA5025		0.050		2.80			2.71	OUT	Belkofski
Outcrop*	24-58S-85W	Cold Bay (A-1)		108	KA5026		0.050		6.20			2.66	OUT	Belkofski
Outcrop*	24-58S-85W	Cold Bay (A-1)		109	KA5027		0.080		7.80			2.70	OUT	Belkofski
Outcrop*	24-58S-85W	Cold Bay (A-1)		110	KA5028		0.050		6.40			2.68	OUT	Belkofski
Outcrop*	24-58S-85W	Cold Bay (A-1)		111	KA5029		0.050		6.40			2.72	OUT	Belkofski
Outcrop*	21-58S-85W	Cold Bay (A-1)		112	SC3007		0.930		7.60			2.57	OUT	Belkofski
Outcrop*	21-58S-85W	Cold Bay (A-1)		113	SC3008		0.340		6.50			2.58	OUT	Belkofski
Outcrop*	21-58S-85W	Cold Bay (A-1)		114	SC3009		1.060		8.90			2.60	OUT	Belkofski
Outcrop*	21-58S-85W	Cold Bay (A-1)		115	SC3010		1.400		9.40			2.61	OUT	Belkofski
Outcrop*	21-58S-85W	Cold Bay (A-1)		116	SC3011		0.500		12.30			2.53	OUT	Belkofski
Outcrop*	21-58S-85W	Cold Bay (A-1)		117	SC3013		0.250		11.70			2.66	OUT	Belkofski
Outcrop*	21-58S-85W	Cold Bay (A-1)		118	SC3014		0.150		9.30			2.61	OUT	Belkofski
Outcrop*	21-58S-85W	Cold Bay (A-1)		119	SC3016		0.190		8.20			2.63	OUT	Belkofski
Outcrop*	21-58S-85W	Cold Bay (A-1)		120	SC3018		0.050		15.10			2.70	OUT	Belkofski
Outcrop*	21-58S-85W	Cold Bay (A-1)		121	SC3023		0.150		13.20			2.68	OUT	Belkofski
Outcrop*	21-58S-85W	Cold Bay (A-1)		122	SC3024		0.070		10.00			2.59	OUT	Belkofski
Outcrop*	21-58S-85W	Cold Bay (A-1)		123	SC3025		0.240		9.00			2.64	OUT	Belkofski
Outcrop*	4-58S-85W	Cold Bay (A-1)		124	SFP3000		0.050		5.40			2.68	OUT	Belkofski
Outcrop*	4-58S-85W	Cold Bay (A-1)		125	SFP3002		0.050		14.10			2.78	OUT	Belkofski
Outcrop*	14-58S-76W	Port Moller (A-3)		126	UI1026		13.700		14.00			2.68	OUT	Stepovak
Outcrop*	5,8,17,20-52S-70W	Port Moller (C-1)		127	AB5180		0.050		10.00			2.69	OUT	Stepovak
Outcrop*	5,8,17,20-52S-70W	Port Moller (C-1)		128	AB5182		0.050		3.90			2.69	OUT	Stepovak
Outcrop*	5,8,17,20-52S-70W	Port Moller (C-1)		129	AB5183		1.040		7.00			2.68	OUT	Stepovak
Outcrop*	5,8,17,20-52S-70W	Port Moller (C-1)		130	AB5188		0.050		6.50			2.72	OUT	Stepovak
Outcrop*	5,8,17,20-52S-70W	Port Moller (C-1)		131	AB5190		0.050		5.30			2.75	OUT	Stepovak
Outcrop*	5,8,17,20-52S-70W	Port Moller (C-1)		132	AB5192		0.050		3.80			2.69	OUT	Stepovak
Outcrop*	5,8,17,20-52S-70W	Port Moller (C-1)		133	AB6009		0.950		4.90			2.77	OUT	Stepovak
Outcrop*	26,27,32,33-55S-79W	Port Moller (B-5)		134	CB5057		0.050		11.10			2.67	OUT	Stepovak
Outcrop*	26,27,32,33-55S-79W	Port Moller (B-5)		135	CB5075		0.150		8.80			2.69	OUT	Stepovak
Outcrop*	26,27,32,33-55S-79W	Port Moller (B-5)		136	CB5078		0.050		14.00			2.72	OUT	Stepovak
Outcrop*	26,27,32,33-55S-79W	Port Moller (B-5)		137	CB5088		0.050		15.50			2.65	OUT	Stepovak
Outcrop*	17,20,30,31-54S-76W	Port Moller (B-3 & B-4)		138	MP3057		0.050		16.90			2.68	OUT	Stepovak
Outcrop*	17,20,30,31-54S-76W	Port Moller (B-3 & B-4)		139	MP3062		0.060		10.70			2.65	OUT	Stepovak
Outcrop*	17,20,30,31-54S-76W	Port Moller (B-3 & B-4)		140	MP3077		0.130		8.90			2.71	OUT	Stepovak
Outcrop*	26,27,34,35-48S-29W	Port Moller (D-1)		141	MR2115		0.250		21.20			2.89	OUT	Stepovak
Outcrop*	13,24,25-55S-79W	Port Moller (B-4)		142	MsR4080		0.050		10.40			2.75	OUT	Stepovak
Outcrop*	13,24,25-55S-79W	Port Moller (B-4)		143	MsR4083		0.690		5.30			2.65	OUT	Stepovak
Outcrop*	12,13-55S-79W	Port Moller (B-4)		144	MsR4105		0.050		5.00			2.72	OUT	Stepovak
Outcrop*	2,11,14,23-55S-80W	Port Moller (B-5)		145	PB4016		0.050		3.90			2.66	OUT	Tolstoi
Outcrop*	2,11,14,23-55S-80W	Port Moller (B-5)		146	PB4022		0.050		9.00			2.66	OUT	Tolstoi
Outcrop*	2,11,14,23-55S-80W	Port Moller (B-5)		147	PB4024		0.050		6.80			2.72	OUT	Tolstoi
Outcrop*	2,11,14,23-55S-80W	Port Moller (B-5)		148	PB4025		0.050		6.90			2.68	OUT	Tolstoi
Outcrop*	2,11,14,23-55S-80W	Port Moller (B-5)		149	PB4027		0.050		10.50			2.70	OUT	Tolstoi
Outcrop*	2,11,14,23-55S-80W	Port Moller (B-5)		150	PB4028		0.100		10.80			2.68	OUT	Tolstoi
Outcrop*	2,11,14,23-55S-80W	Port Moller (B-5)		151	PB4032		0.050		11.10			2.72	OUT	Tolstoi

Outcrop data from Reifenstuhl and others (2005) and Loveland and others (2007).
Bristol Bay Outcrop* = data and locations from Bristol Bay Native Corporation archive files based on industry work
Type: CC = Conventional core; PSWC = Percussion sidewall core; OUT = Outcrop sample

Table 4. Porosity, permeability, and saturation data for Bristol Bay sandstones–continued.

Well or outcrop sample	Latitude or location (section, township, range)	Longitude or location (quadrangle)	Core	Plug	Depth of sample (ft)	K klink (md)	K air (md)	K probe (md)	Porosity (%)	So (%)	Sw (%)	Density (g/cc)	Type	Unit
Outcrop*	2,11,14,23-55S-80W	Port Moller (B-5)		152	PB4033		0.050		8.10			2.68	OUT	Tolstoi
Outcrop*	2,11,14,23-55S-80W	Port Moller (B-5)		153	PB4035		0.050		7.10			2.70	OUT	Tolstoi
Outcrop*	2,11,14,23-55S-80W	Port Moller (B-5)		154	PB4036		0.050		4.60			2.75	OUT	Tolstoi
Outcrop*	2,11,14,23-55S-80W	Port Moller (B-5)		155	PB4039		0.050		7.60			2.75	OUT	Tolstoi
Outcrop*	2,11,14,23-55S-80W	Port Moller (B-5)		156	PB4041		0.050		5.10			2.71	OUT	Tolstoi
Outcrop*	2,11,14,23-55S-80W	Port Moller (B-5)		157	PB4050		0.050		12.00			2.69	OUT	Tolstoi
Outcrop*	2,11,14,23-55S-80W	Port Moller (B-5)		158	PB4053		0.050		6.20			2.66	OUT	Tolstoi
Outcrop*	21-55S-71W	Port Moller (B-1)		159	KI2000		0.090		6.20			2.70	OUT	Tolstoi
Outcrop*	2,3,10,15-50S-66W	Stepovak Bay (D-5)		160	IB2004		0.050		3.50			2.72	OUT	Tolstoi
Outcrop*	2,3,10,15-50S-66W	Stepovak Bay (D-5)		161	IB2008		0.050		3.00			2.69	OUT	Tolstoi
Outcrop*	2,3,10,15-50S-66W	Stepovak Bay (D-5)		162	IB2016		0.440		4.80			2.67	OUT	Tolstoi
Outcrop*	2,3,10,15-50S-66W	Stepovak Bay (D-5)		163	IB2017		0.130		5.80			2.70	OUT	Tolstoi
Outcrop*	2,3,10,15-50S-66W	Stepovak Bay (D-5)		164	IB2019		2.750		3.50			2.66	OUT	Tolstoi
Outcrop*	2,3,10,15-50S-66W	Stepovak Bay (D-5)		165	IB2025		0.380		3.20			2.68	OUT	Tolstoi
Outcrop*	2,3,10,15-50S-66W	Stepovak Bay (D-5)		166	IB2028		0.230		6.60			2.73	OUT	Tolstoi
Outcrop*	2,3,10,15-50S-66W	Stepovak Bay (D-5)		167	IB2030		1.030		10.10			2.70	OUT	Tolstoi
Outcrop*	2,3,10,15-50S-66W	Port Moller (D-5)		168	IB2136		0.060		5.80			2.67	OUT	Tolstoi
Outcrop*	2,3,10,15-50S-66W	Port Moller (D-5)		169	IB2147		68.100		35.80			2.70	OUT	Tolstoi
Outcrop*	12,13-55S-79W	Port Moller (B-4)		170	MsR4111		0.050		0.90			2.71	OUT	Tolstoi
Outcrop*	12,13-55S-79W	Port Moller (B-4)		171	MsR4119		0.050		6.50			2.67	OUT	Tolstoi
Outcrop*	12,13-55S-79W	Port Moller (B-4)		172	MsR4120		0.050		5.90			2.67	OUT	Tolstoi
Outcrop*	12,13-55S-79W	Port Moller (B-4)		173	MsR4122		0.050		5.70			2.69	OUT	Tolstoi
Outcrop*	1-55S-79W	Port Moller (B-4) & (B-5)		174	MsR5108		0.050		3.80			2.69	OUT	Tolstoi
Outcrop*	1-55S-79W	Port Moller (B-4) & (B-5)		175	MsR5116		0.050		3.10			2.67	OUT	Tolstoi
Outcrop*	1-55S-79W	Port Moller (B-4) & (B-5)		176	MsR5120		0.050		6.20			2.67	OUT	Tolstoi
Outcrop*	1-55S-79W	Port Moller (B-4) & (B-5)		177	MsR5124		0.050		2.70			2.70	OUT	Tolstoi
Outcrop*	35-54S-79W	Port Moller (B-4) & (B-5)		178	MsR5132		0.070		7.50			2.61	OUT	Tolstoi
Outcrop*	35-54S-79W	Port Moller (B-4) & (B-5)		179	MsR5139		0.050		4.50			2.68	OUT	Tolstoi
Outcrop*	35-54S-79W	Port Moller (B-4) & (B-5)		180	MsR5141		0.110		5.80			2.71	OUT	Tolstoi
Outcrop*	18S-28W & 18S-27W	Afognak (C-6)		181	K2258		0.050		2.70			2.72	OUT	Kaguyak
Outcrop*	18S-28W & 18S-27W	Afognak (C-6)		182	K2261		0.050		3.80			2.73	OUT	Kaguyak
Outcrop*	18S-28W & 18S-27W	Afognak (C-6)		183	K2264		0.050		3.40			2.73	OUT	Kaguyak
Outcrop*	18S-28W & 18S-27W	Afognak (C-6)		184	K2267		0.050		4.90			2.72	OUT	Kaguyak
Outcrop*	18S-28W & 18S-27W	Afognak (C-6)		185	K2272		0.050		4.40			2.71	OUT	Kaguyak
Outcrop*	18S-28W & 18S-27W	Afognak (C-6)		186	K2275		0.050		8.00			2.72	OUT	Kaguyak
Outcrop*	18S-28W & 18S-27W	Afognak (C-6)		187	K2278		0.050		6.80			2.71	OUT	Kaguyak
Outcrop*	18S-28W & 18S-27W	Afognak (C-6)		188	K2281		0.050		5.70			2.70	OUT	Kaguyak
Outcrop*	18S-28W & 18S-27W	Afognak (C-6)		189	K2284		0.050		3.70			2.72	OUT	Kaguyak
Outcrop*	18S-28W & 18S-27W	Afognak (C-6)		190	K2287		0.050		9.60			2.71	OUT	Kaguyak
Outcrop*	21-19S-28W	Afognak (C-6)		191	CC3154		0.200		5.80			2.64	OUT	Naknek
Outcrop*	7-14S-28W	Mt. Katmai (D-1)		192	KH3147		0.510		11.70			2.65	OUT	Naknek
Outcrop*	7-14S-28W	Mt. Katmai (D-1)		193	KH3150		0.640		8.00			2.64	OUT	Naknek
Outcrop*	7-14S-28W	Mt. Katmai (D-1)		194	KH3151		0.300		7.30			2.64	OUT	Naknek
Outcrop*	30-14S-28W	Mt. Katmai (D-1)		195	KH3152		0.340		7.20			2.68	OUT	Naknek
Outcrop*	30-14S-28W	Mt. Katmai (D-1)		196	KH3153		0.300		7.80			2.65	OUT	Naknek

Outcrop data from Reifenstuhl and others (2005) and Loveland and others (2007).
Bristol Bay Outcrop* = data and locations from Bristol Bay Native Corporation archive files based on industry work
Type: CC = Conventional core; PSWC = Percussion sidewall core; OUT = Outcrop sample

REFERENCES CITED

Burk, C.A., 1965, Geology of the Alaska Peninsula—Island Arc and Continental Margin: The Geological Society of America Memoir 99, 250 p., 3 sheets.

Decker, P.L., Finzel, E.S., Ridgway, K.D., Reifenstuhl, R.R., and Blodgett, R.B., 2005, Preliminary summary of the 2005 field season; Port Moller, Herendeen Bay, and Dillingham areas, Bristol Bay Basin, Alaska Peninsula: Alaska Division of Geological & Geophysical Surveys Preliminary Interpretive Report 2005-7, 55 p., 2 sheets.

Detterman, R.L., Case, J.E., Miller, J.W., Wilson, F.H., and Yount, M.E., 1996, Stratigraphic framework of the Alaska Peninsula: U.S. Geological Survey Bulletin 1969-A, 74 p.

Dickinson, W.R., 1970, Interpreting detrital modes of graywacke and arkose, Journal of Sedimentary Petrology, v. 40, p. 695–707.

Dickinson, W.R. and Suczek, C.A., 1979, Plate tectonics and sandstone compositions: American Association of Petroleum Geologists, v. 63, p. 2,164–2,182.

Dickson, J.A.D., 1965, A modified staining technique for carbonates in thin section: Nature, v. 205, p.587.

Dickson, J.A.D., 1966, Carbonate identification and genesis as revealed by staining: Journal of Sedimentary Petrology, v. 36, p. 491–505.

Finzel, E.S., Reifenstuhl, R.R., Decker, P.L., and Ridgway, K.D., 2005, Sedimentology, stratigraphy, and hydrocarbon reservoir-source rock potential, using surface and subsurface data, of Tertiary and Mesozoic strata, Bristol Bay Basin and Alaska Peninsula: Alaska Division of Geological & Geophysical Surveys Preliminary Interpretive Report 2005-4, 67 p.

Laniz, R.V., Stevens, R.E., and Norman, M.B., 1964, Staining of plagioclase feldspar and other minerals: U.S. Geological Survey Professional Paper 501-B, p. B152–B153.

Lindholm, R.C., and Finkelman, R.B., 1972, Calcite staining; Semiquantitative determination of ferrous iron: Journal of Sedimentary Petrology, v. 42, p. 239–242.

Loveland, A.M., Reifenstuhl, R.R., Gillis, R.J., and Decker, P.L., 2007, Outcrop sample results from mercury injection capillary pressure analyses, Bristol Bay, Alaska Peninsula: Alaska Division of Geological & Geophysical Surveys Raw Data File 2007-3, 11 p.

Moore, D.M., and Reynolds, R.C., Jr., 1989, X-ray diffraction and the identification and analysis of clay minerals: Oxford University Press, 332 p.

Reifenstuhl, R.R., Bailey, R.D., and Finzel, E.S., 2005, Bristol Bay and Alaska Peninsula 2004; Fieldwork and sample analyses compilation report: Alaska Division of Geological & Geophysical Surveys Preliminary Interpretive Report 2005-1, 20 p.

Strauch, A.L., Gillis, R.J., Reifenstuhl, R.R., and Decker, P.L., 2006, 2006 Bristol Bay, Alaska Peninsula field summary and outcrop sample results from porosity & permeability and mercury injection capillary pressure analyses: Alaska Division of Geological & Geophysical Surveys Raw Data File 2006-1, 65 p.