Reservoir Quality of Tertiary Sandstones from Bristol Bay Basin, Alaska Peninsula: Preliminary Report

by

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by Kenneth P. Helmold (kph@dnr.state.ak.us) and Donald W. Brizzolara

INTRODUCTION

The State of Alaska will hold an areawide oil and gas lease sale for the Alaska Peninsula on October 26, 2005 (Figure 1). The sale will be the first for the area in two decades and represents new efforts to evaluate oil and gas resources in the region. In preparation for the sale, the Department of Natural Resources (DNR) has initiated several studies aimed at providing data necessary for the resource evaluation. This report documents one of these studies undertaken by the Division of Oil and Gas (DOG) to determine the quality of potential sandstone reservoirs.

Eighty-four (84) thin sections of siltstone and sandstone were examined from three exploratory wells (Arco North Aleutian COST #1, Amoco Becharof State #1 and General Petroleum Great Basins #1) on the Alaska Peninsula. 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 by personnel from the Division of Geological and Geophysical Surveys (DGGS). The Becharof State #1 and Great Basins #1 wells were sampled at the Alaska Geological Materials Center (GMC) in Eagle River, Alaska. Where possible (Becharof State #1 and North Aleutian COST #1), 1" diameter 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 DOG's well files to augment data collected during this study. Additional data from Tertiary and Mesozoic outcrops are also included for comparison.

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

Detailed modal (point-count) analyses were performed on forty-seven (47) samples to obtain quantitative estimates of detrital and authigenic mineralogies. X-ray diffraction (XRD) and scanning electron microscope (SEM) analyses were conducted on nineteen (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 preliminary report is primarily intended to release these data prior to the lease sale for use in the evaluation of the basin's petroleum potential. As such, detailed interpretation of the data and evaluation of regional trends of reservoir quality are limited. Recent work by the DGGS documents the sedimentology, stratigraphy and source-rock potential of Bristol Bay and Alaska Peninsula (Finzel and others, 2005).

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 psi) for at least 8 hours. This procedure insures 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 et al, 1964) and for carbonates with a combination of alizarin red S and potassium ferricyanide (Dickson, 1966). Thin sections were prepared by Mark Mercer (Petrographic Services) in 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) in Lakewood, Colorado.

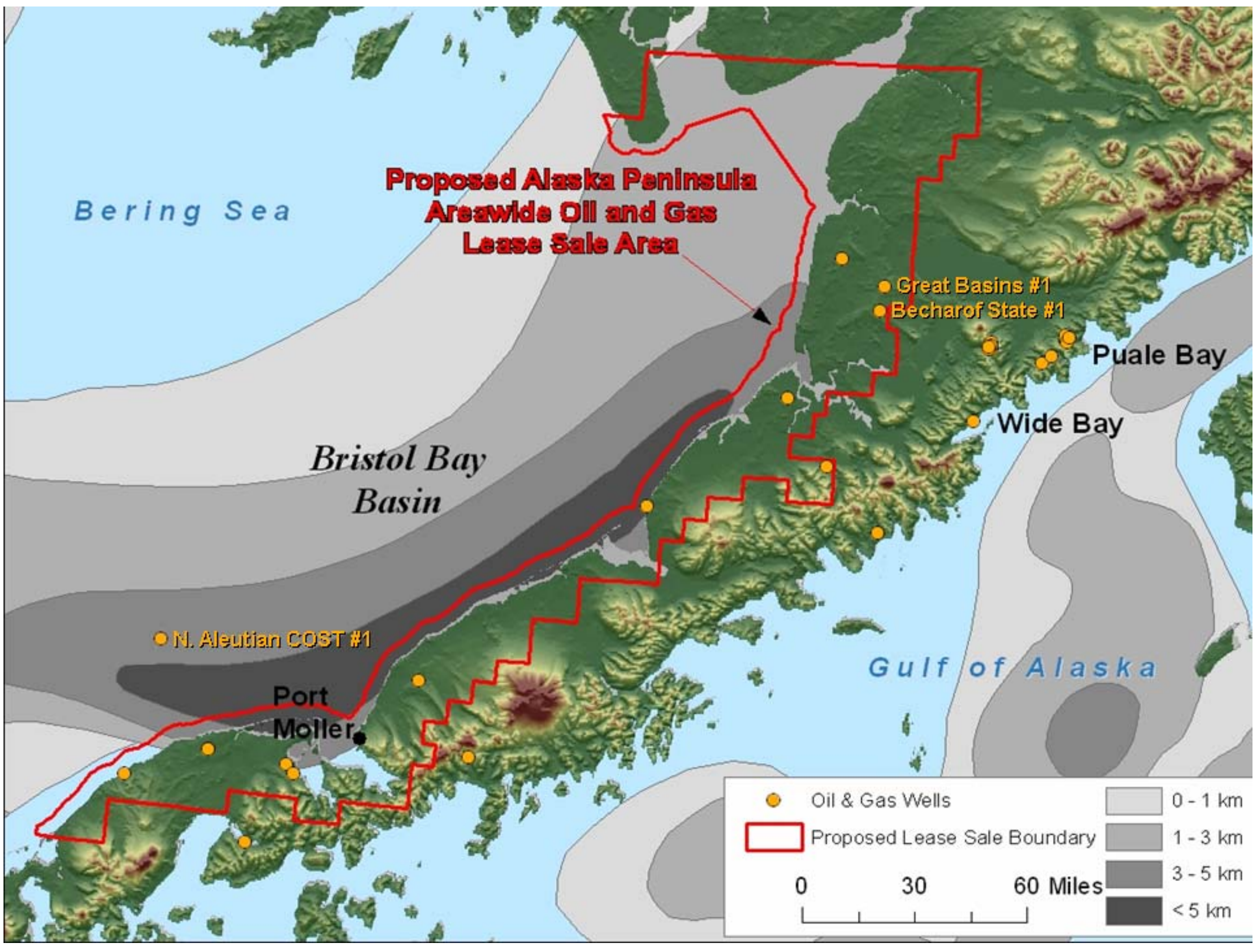


Figure 1. Shaded relief map of the Alaska Peninsula showing the proposed sale area and location of oil and gas wells.

X-ray Diffraction

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. 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.

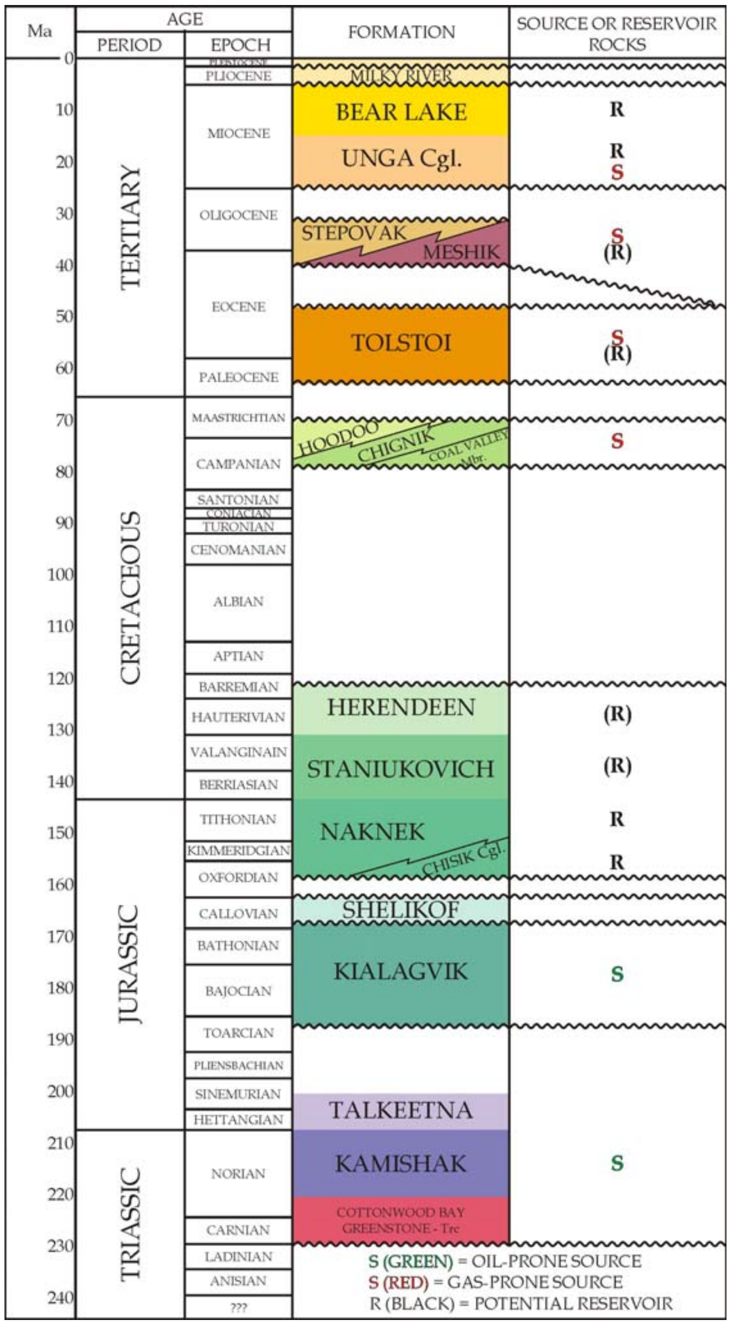


Figure 2. Composite stratigraphic column of Bristol Bay and the Alaska Peninsula (modified from Burk,1965 and Detterman and others, 1996).

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 two to sixty-five degrees two theta at a scan rate of one degree per minute. The glycol solvated oriented clay mounts were analyzed over an angular range of two to fifty degrees two theta at a rate of one and one half degrees per minute.

Semiquantitative determinations of whole-rock mineral amounts were accomplished 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.

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 done 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. Sample preparation, analyses and interpretations were performed by James B. Talbot (K/T GeoServices, Inc.) in Argyle, Texas.

SEM Microscopy

A split of sandstones that were X-rayed were also examined with a scanning electron microscope (SEM) to aid in the identification of authigenic components, particularly clay minerals, and to better visualize pore geometries. Standardless energy dispersive analyses of X-ray (EDX) were performed on several grains and pore-filling cements to confirm initial identifications based on crystal morphology. This work was performed at the Advanced Instrumentation Laboratory of the Department of Geology and Geophysics, University of Alaska, Fairbanks.

PETROGRAPHY

Interpretation of Ternary Diagrams

The composition of the sandstones determined via point-count analyses are summarized on a suite of ternary diagrams (Figure 3). The QFL diagram (Figure 3A) is used to illustrate the composition of the major detrital components. In this diagram monocrystalline (Qm) and polycrystalline (Qp) quartz are apportioned to the Q-pole to highlight chemical and mechanical stability. All feldspars (K-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 it's sedimentary origin. In a break from tradition (Dickinson, 1970; Dickinson and Suczek, 1979), intrabasinal components (e.g., glauconite, phosphate and pellets) are also included with the lithics. The closer a sandstone plots towards the Q-pole, the greater its mineralogical maturity. The QmPK diagram (Figure 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.

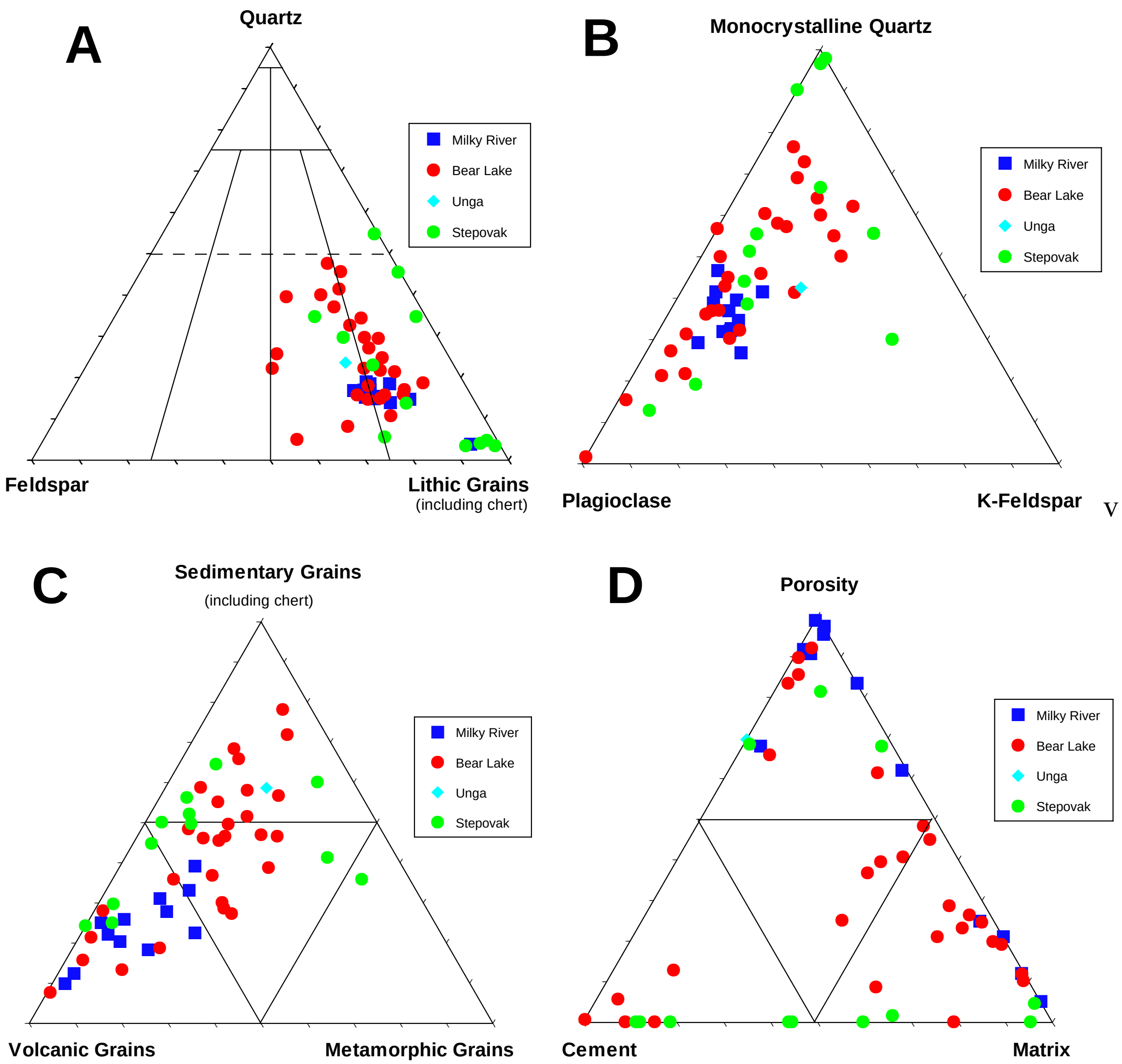


Figure 3. Ternary diagrams showing composition of Bristol Bay sandstones. A) QFL (Quartz-Feldspar-Lithics) diagram showing composition of detrital grains comprising the rock framework. All the sandstones are enriched in lithic grains. B) QmPK (Monocrystalline Quartz-Plagioclase-K-Feldspar) diagram showing monocrystalline composition of Bristol Bay sandstones. The sandstones are enriched in quartz and plagioclase with relatively less K-Feldspar. C) LsLvLm (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.

The LsLvLm diagram (Figure 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 (e.g., granite and diorite) are excluded from this diagram. The PCM diagram (Figure 3D) portrays the composition of the intergranular components (i.e., porosity, cements and matrix) of the rock. The higher the ratio of porosity to cement + 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). The framework grains are moderately to very well sorted (0.33 – 0.99), but the presence of detrital matrix results in the some rocks having very poor overall sorting (2.03). In general, the finer grained sandstones tend to be better sorted (Figure 4). The sandstones are highly lithic with an average framework composition of $Q_{22}F_{16}L_{61}$ (Figures 3A, 7-12, Table 2). Monocrystalline quartz (Qm, 15%) is more common than polycrystalline (Qp, 7%) varieties. Feldspars are common with plagioclase (12%) dominant over K-feldspar (4%). The average lithic composition of the sandstones is $Ls_{41}Lv_{43}Lm_{16}$ with grains consisting primarily 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% of the framework fraction and consists of chlorite, muscovite and biotite. Amphibole, pyroxene, epidote and garnet are the most common heavy minerals and are indicative of a immature, labile suite.

Detrital matrix varies in abundance, comprising from 0 to 16% of the sandstones (Tables 1, 3). It is particularly common in many of the Bear Lake samples (Figures 3D, 9-10). 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 over 40% 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% 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 cements (Figure 11), in particular quartz cement occurs in minor amounts in a few samples. The lack of silica cement is possibly caused by the low number of nucleation sites owing to the 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 9% of bulk rock) in a few samples but generally has little affect on reservoir quality in the majority of samples. Authigenic, pore-filling kaolinite occurs in several samples and is probably related to feldspar alteration. In a few Stepovak sandstones, where it comprises over 20% of the rocks, kaolinite seriously degrades reservoir quality.

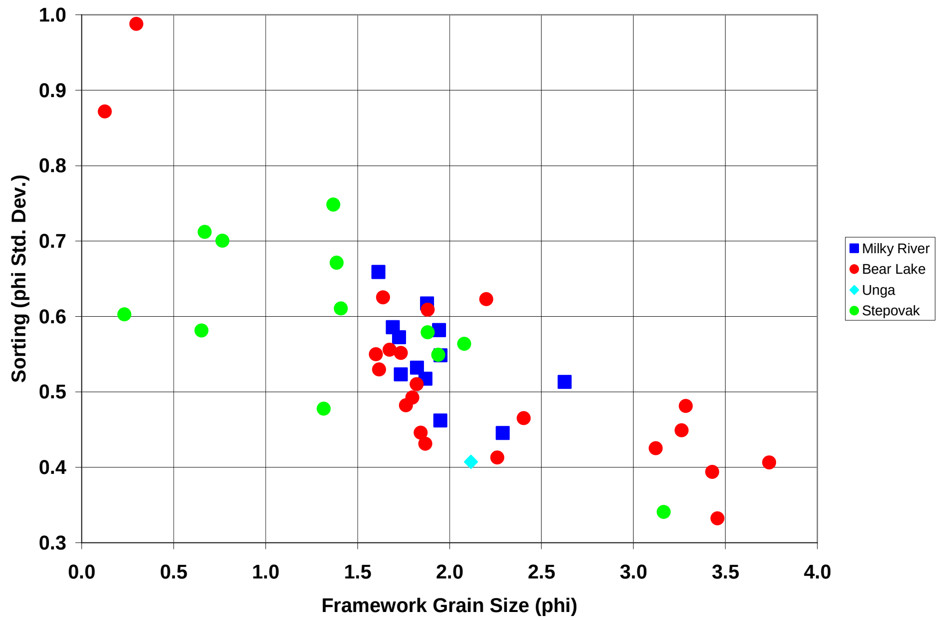


Figure 4. Grain size-sorting scatter plot of Bristol Bay sandstones by formation. Data are for grains greater than 30 µm in diameter and therefore exclude clay and very fine to medium silt. In general, the finer-grained rocks tend to be better sorted (note grain size is shown in phi units). Pearson correlation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

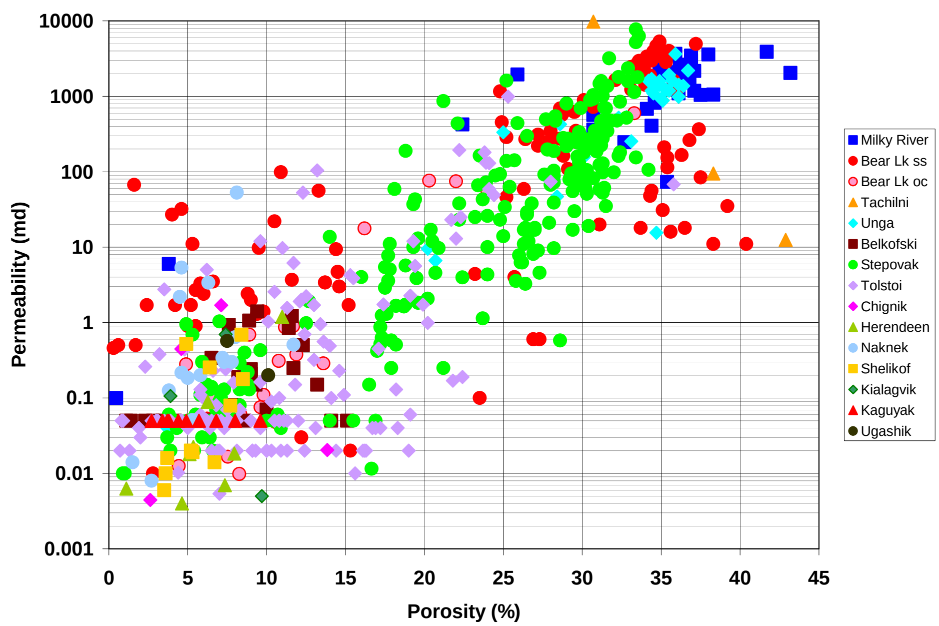


Figure 5. Porosity-permeability scatter plot of Bristol Bay sandstones by formation. Using a cutoff of 10% porosity and 1 md permeability, a large proportion of the samples have good to excellent reservoir quality. Most of the high-quality rocks are Tertiary subsurface samples while the majority of low-quality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

Reservoir quality of the Tertiary sandstones varies from excellent (φ > 30%, k > 100 md) to poor (φ < 10%, k < 1 md). In order to illustrate the regional porosity-permeability trend, data for Tertiary and Mesozoic sandstones were plotted together (Figure 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% porosity and 1 md permeability (suitable for liquid hydrocarbons), the majority of samples could be effective hydrocarbon reservoirs. Using lower φ-k cutoffs (e.g., 7% porosity and 0.1 md permeability), a significant number of additional samples could be effective gas reservoirs, particularly in the presence of a well developed fracture network.

There is a fairly systematic relationship between reservoir quality (porosity-permeability) and depth (Figure 6). Porosities in excess of 20% and permeabilities over 10 md are present at depths approaching 10,000 feet. It should be noted that a large portion of the data is from the North Aleutian COST #1 well, which 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.

We clearly recognize that petrographic data from a relatively small number of samples is not sufficient for a rigorous, reservoir-quality analysis of the Tertiary section. This study is viewed as the starting point for further, in-depth investigation of the basin. It does, however, show the potential exists for high-quality, Tertiary sandstone reservoirs.

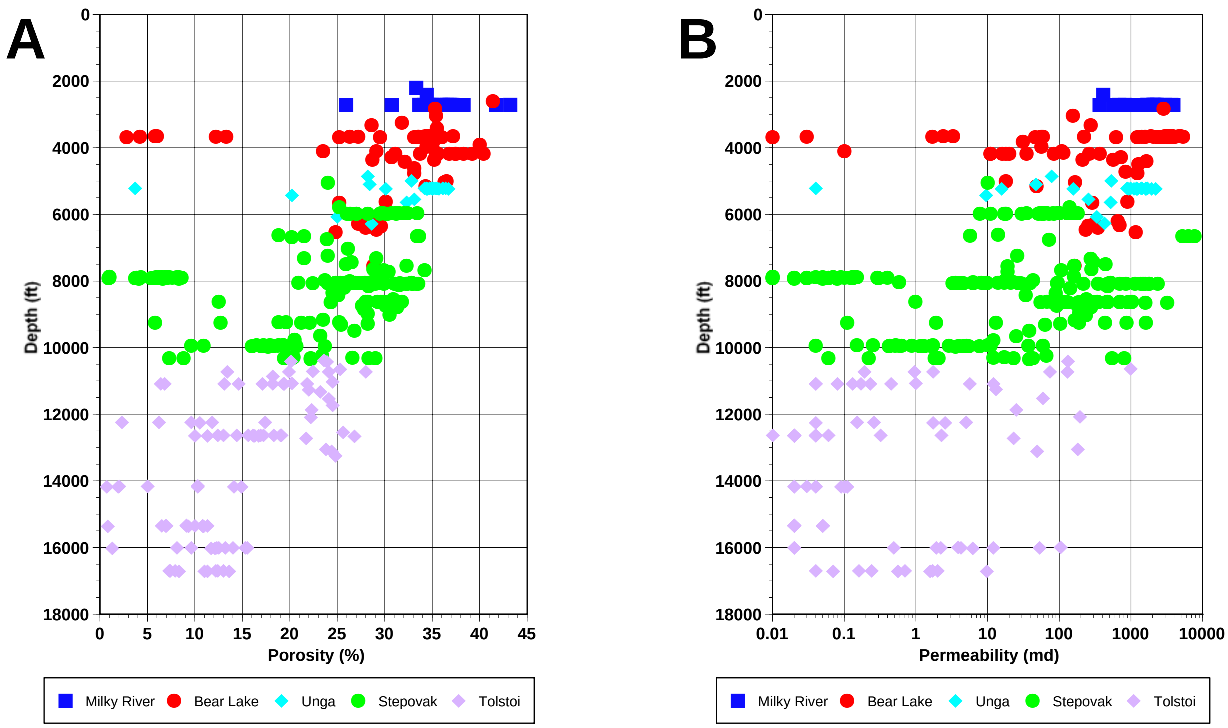


Figure 6. Reservoir quality-depth scatter plots of Bristol Bay sandstones by formation.. A) Porosity-depth trend. B) Permeability-depth trend. Table 4 lists data included in this plot.

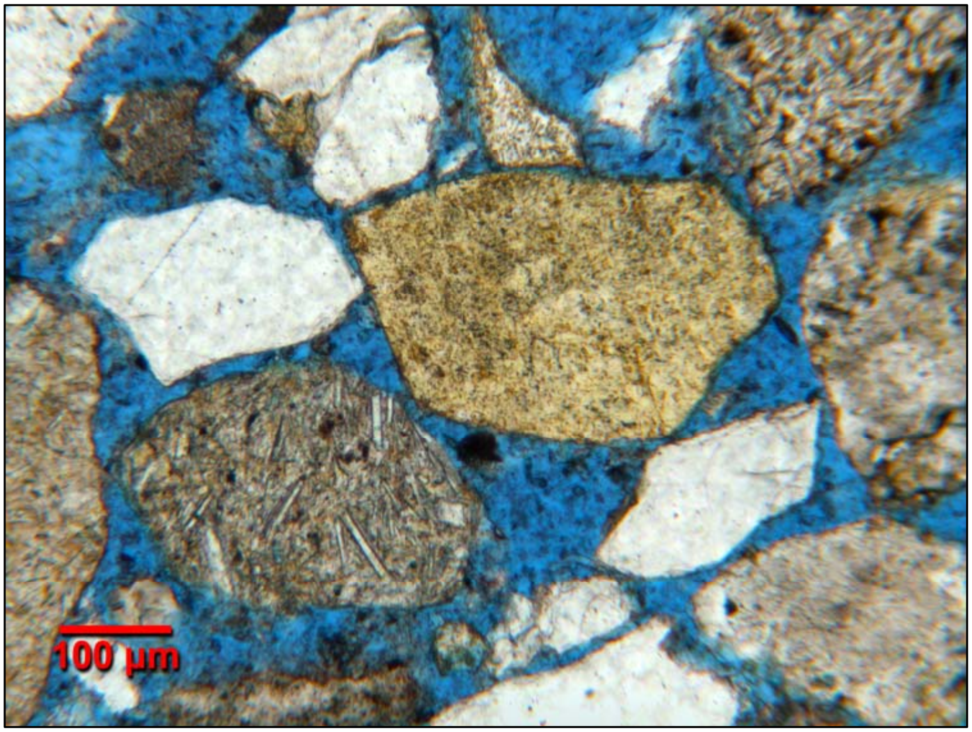


Figure 7. Photomicrograph of Milky River sandstone, Becharof State #1, 2734.5', φ = 36.9%, k = 3470 md.

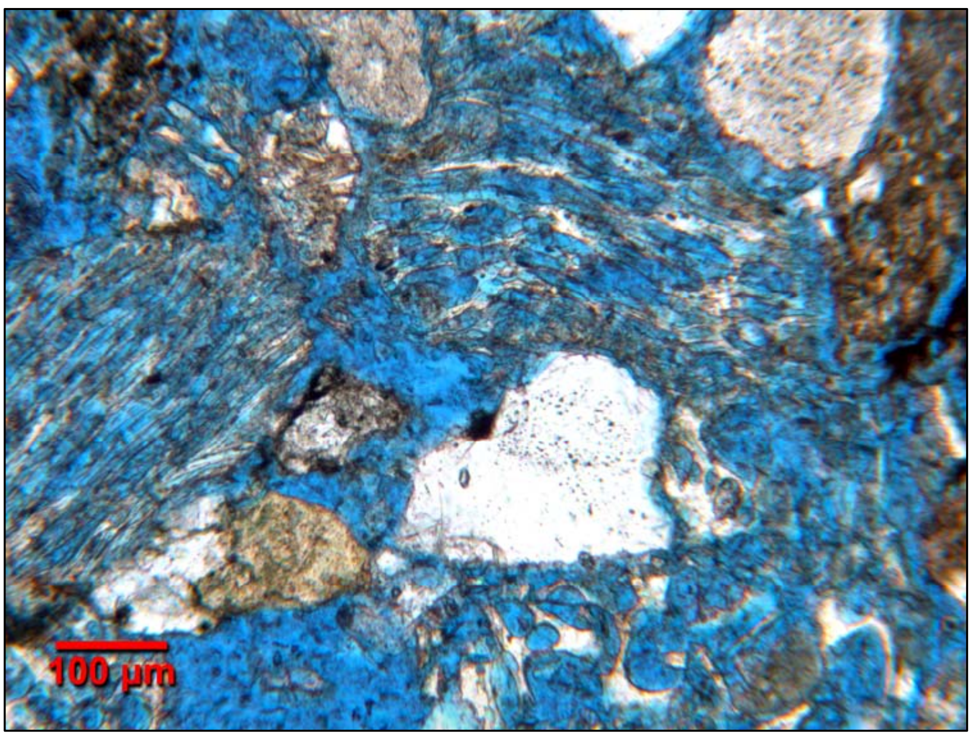


Figure 8. Photomicrograph of Milky River sandstone, Becharof State #1, 2726.5', φ = 43.2%, k = 2040 md. Samples is very pumiceous.

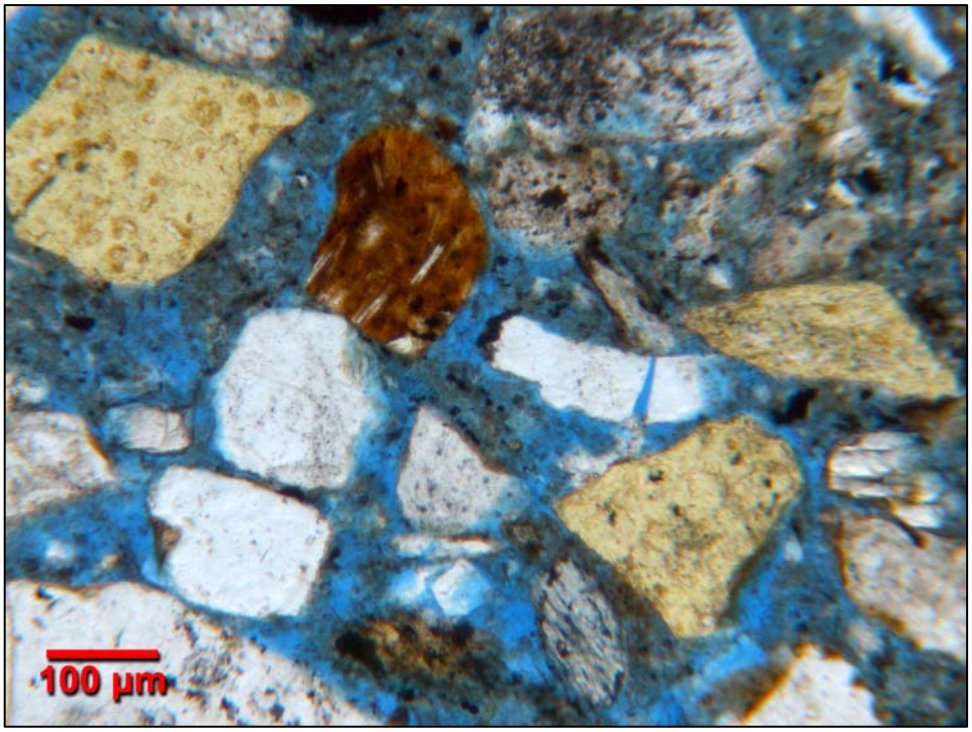


Figure 9. Photomicrograph of Bear Lake sandstone, North Aleutian COST #1, 4197.0', φ = 35.6%, k = 16 md. Low permeability is the result of extensive clay matrix.

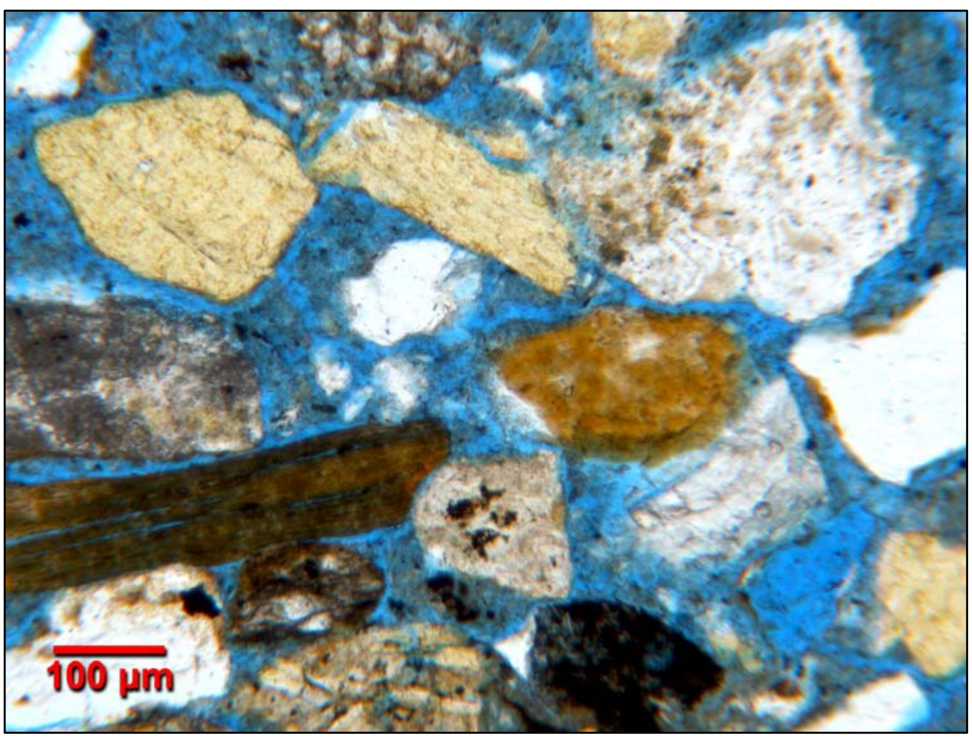


Figure 10. Photomicrograph of Bear Lake sandstone, North Aleutian COST #1, 4198.0', φ = 33.7%, k = 18 md. Low permeability is the result of extensive clay matrix.

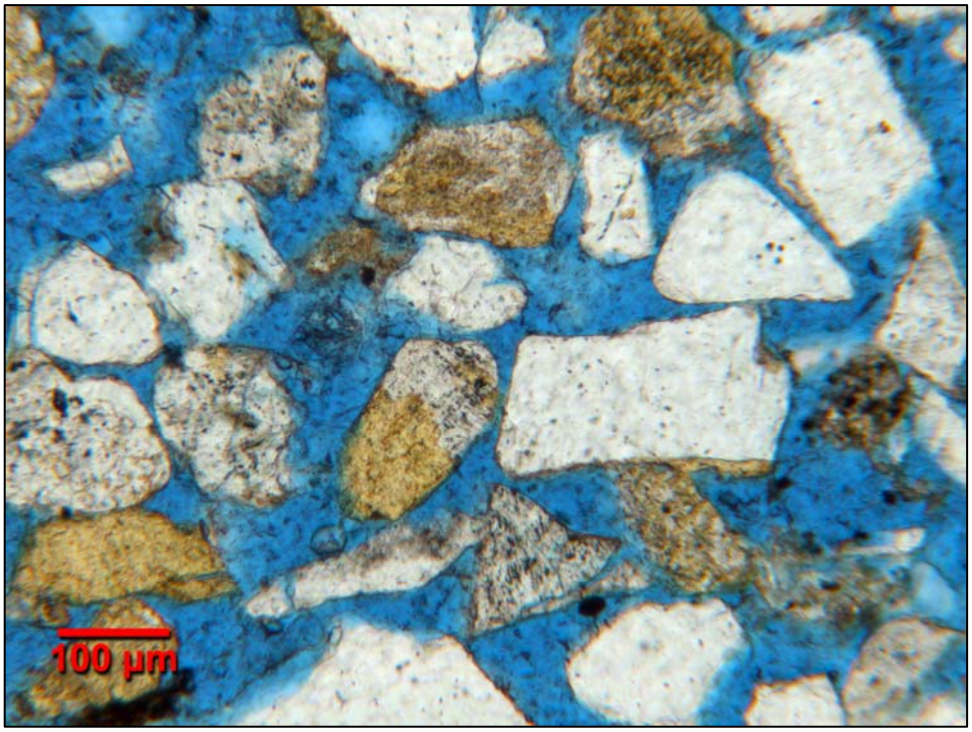
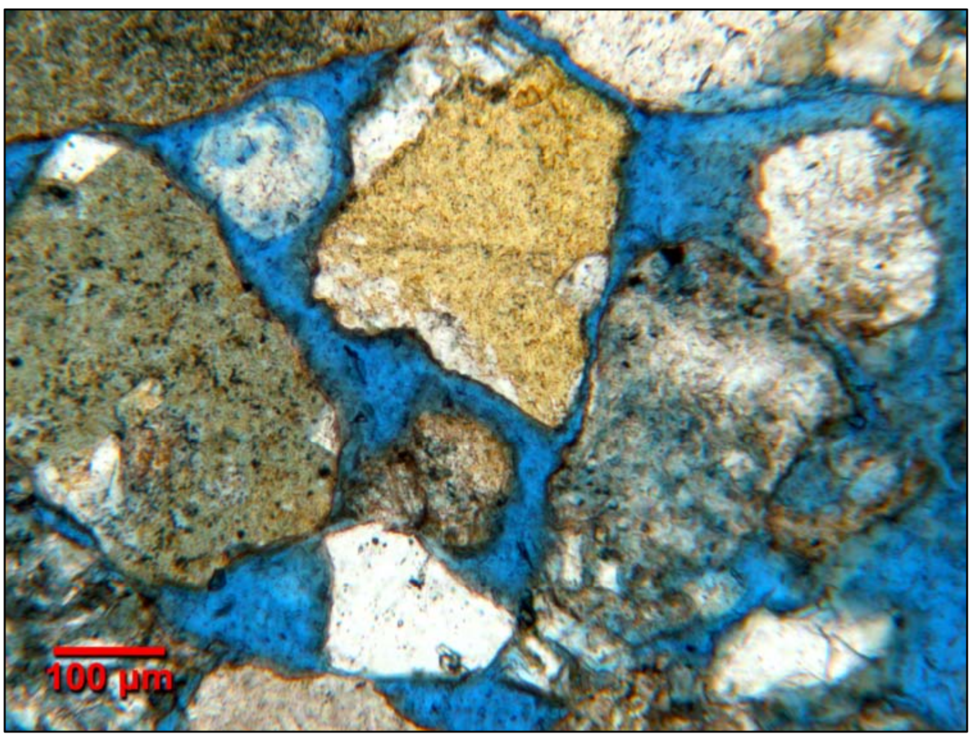


Figure 11. Photomicrograph of Stepovak sandstone, North Aleutian COST #1, 8087.0', φ = 32.9%, k = 2358 md.



12. Photomicrograph of Stepovak sandstone, North Aleutian COST #1, 8635.0', φ = 31.4%, k = 709 md.

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Table 1. Summary of petrographic analyses of Bristol Bay subsurface samples. Sheet 1 of 3

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.

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.

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)	0.28	0.30	0.27	0.23	0.38	0.11	0.24	0.40	0.26	0.26	0.26	0.26	0.27	0.21	0.16	0.27
Wentworth Size Class	mL	mL	mL	fU	mU	vfU	fU	mU	mL	mL	mL	mL	mL	fU	fL	mL
Visual Sorting (phi)	0.51	0.48	0.61	0.41	0.61	0.34	0.56	0.48	0.55	0.46	0.58	0.55	0.52	0.45	0.51	0.43
Folk's Sorting	mod.	well	mod.	well	mod.	v. well	mod.	well	mod.	well	mod.	mod.	mod.	well	mod.	well
Measured Grain Size (mm)	0.03	0.04	0.03	0.23	0.05	0.09	0.22	0.40	0.03	0.25	0.17	0.26	0.27	0.20	0.16	0.27
Wentworth Size Class	cs	cs	cs	fU	cs	vfL	fU	mU	cs	mL	fL	mL	mL	fU	fL	mL
Measured Sorting (phi)	3.56	3.45	3.17	0.41	3.56	1.65	1.00	0.48	3.33	0.55	2.27	0.55	0.52	0.45	0.51	0.43
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)	0.28	0.29	0.27	0.23	0.38	0.11	0.24	0.40	0.26	0.26	0.26	0.26	0.27	0.20	0.16	0.27
Wentworth Size Class	mL	mL	mL	fU	mU	vfU	fU	mU	mL	mL	mL	mL	mL	fU	fL	mL
Meas. Framewk. Sorting (phi)	0.51	0.48	0.61	0.41	0.61	0.34	0.56	0.48	0.55	0.46	0.58	0.55	0.52	0.45	0.51	0.43
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

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

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)	0.33	0.33	0.22	0.38	0.27	0.39	0.30	0.33	0.27	0.30	0.28	0.31	0.32	0.31	0.30	0.28
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	0.62	0.67	0.58	0.75	0.57	0.66	0.62	0.52	0.53	0.59	0.63	0.56	0.55	0.45
Folk's Sorting	mod.	mod.	mod.	mod.	mod.	mod.	mod.	mod.	mod.	mod.	mod.	mod.	mod.	mod.	mod.	well
Measured Grain Size (mm)	0.33	0.33	0.21	0.38	0.18	0.25	0.06	0.03	0.04	0.04	0.24	0.31	0.13	0.14	0.09	0.03
Wentworth Size Class	mL	mL	fU	mU	fL	mL	cs	cs	cs	cs	fU	mL	fL	fL	vfU	cs
Measured Sorting (phi)	0.53	0.55	1.03	0.67	2.23	2.32	3.50	3.47	3.28	3.48	1.52	0.59	3.14	2.98	3.13	3.47
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)	0.33	0.33	0.22	0.38	0.27	0.39	0.30	0.33	0.27	0.30	0.28	0.31	0.32	0.31	0.30	0.28
Wentworth Size Class	mL	mL	fU	mU	mL	mU	mL	mL	mL	mL	mL	mL	mL	mL	mL	mL
Meas. Framewk. Sorting (phi)	0.53	0.55	0.62	0.67	0.58	0.75	0.57	0.66	0.62	0.52	0.53	0.59	0.63	0.56	0.55	0.45
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

Table 2. Petrographic parameters and ternary compositions of Bristol Bay subsurface samples. Sheet 3 of 3

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)	0.29	0.09	0.10	0.19	0.21	0.12	0.10	0.08	0.09	0.81	0.92	0.63	0.64	0.59	0.85
Wentworth Size Class	mL	vfU	vfU	fU	fU	vfU	vfU	vfL	vfU	cU	cU	cL	cL	cL	cU
Visual Sorting (phi)	0.49	0.33	0.49	0.47	0.41	0.43	0.48	0.41	0.39	0.99	0.87	0.71	0.58	0.70	0.60
Folk's Sorting	well	v. well	well	well	well	well	well	well	well	mod.	mod.	mod.	mod.	mod.	mod.
Measured Grain Size (mm)	0.06	0.03	0.07	0.04	0.08	0.08	0.06	0.05	0.07	0.49	0.40	0.63	0.64	0.59	0.51
Wentworth Size Class	cs	cs	vfL	cs	vfL	vfL	cs	cs	vfL	mU	mU	cL	cL	cL	cL
Measured Sorting (phi)	3.67	3.18	2.12	3.37	3.05	2.03	2.37	1.97	1.79	2.54	3.02	0.71	0.58	0.70	2.56
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)	0.29	0.09	0.10	0.19	0.21	0.11	0.10	0.07	0.09	0.81	0.92	0.63	0.64	0.59	0.85
Wentworth Size Class	mL	vfU	vfU	fU	fU	vfU	vfU	vfL	vfU	cU	cU	cL	cL	cL	cU
Meas. Framewk. Sorting (phi)	0.49	0.33	0.45	0.47	0.41	0.43	0.48	0.41	0.39	0.99	0.87	0.71	0.58	0.70	0.60
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

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 illire/smectite

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

11	12	13	14	15	16	17	18	19
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
7931.8	1362-63	3890-91	4945-46	5464-65	6083-84	8236-37	9823-24	10582-83
Stepovak	Milky River	Bear Lake	Bear Lake	Bear Lake	Bear Lake	Bear Lake	Bear Lake	Stepovak
6.4	n.d.	n.d.	n.d.	n.d.	8.8	14.6	14.4	n.d.
0.13	n.d.	n.d.	n.d.	n.d.	2.40	1.70	9.40	n.d.
65.5	32.0	41.5	51.5	54.5	46.4	49.4	34.9	41.7
0.9	8.7	2.4	2.7	5.3	9.6	5.7	5.4	1.9
2.5	44.8	43.9	29.0	23.4	21.9	30.0	52.7	15.1
0.0	3.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.4
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.3	0.0	2.4	0.0	1.5	0.0	0.0	0.0	0.0
0.0	0.9	0.4	0.3	0.2	0.6	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	4.7	3.3	1.5	1.1	9.3	0.0	0.0	13.8
3.3	0.0	0.0	0.0	0.0	0.0	1.1	0.2	0.0
12.1	3.5	3.3	3.9	4.8	3.9	3.2	1.8	0.6
10.4	0.3	0.4	8.0	6.2	5.3	8.0	3.8	3.2
2.5	2.1	2.4	3.1	3.0	2.1	2.7	1.2	9.3
28.3	10.6	9.4	16.5	15.1	20.5	14.9	7.0	26.9
100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
0.0	44.4	35.0	9.1	7.0	45.4	0.0	0.0	51.3
11.7	0.0	0.0	0.0	0.0	0.0	7.2	3.0	0.0
42.7	32.9	35.2	23.5	31.9	18.8	21.4	25.8	2.3
36.8	3.1	4.4	48.5	41.0	25.6	53.5	54.3	12.0
8.9	19.6	25.4	18.9	20.1	10.2	17.9	16.9	34.4
100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
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 illire/smectite

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

Well	Core	Plug	Depth/Sample (ft)	K klink (md)	K air (md)	K probe (md)	Porosity (%)	So (%)	Sw (%)	Density (g/cc)	Type	Unit
N Aleutian COST 1	2	1	4191.6		262		36.8			2.66	CC	Bear Lake
N Aleutian COST 1	2	2	4192.3		367		37.4			2.65	CC	Bear Lake
N Aleutian COST 1	2	3	4193.3		84		37.5			2.65	CC	Bear Lake
N Aleutian COST 1	2	4	4194.6		35		39.2			2.64	CC	Bear Lake
N Aleutian COST 1	2	5	4195.8		11		40.4			2.66	CC	Bear Lake
N Aleutian COST 1	2	6	4196.7		11		38.3			2.67	CC	Bear Lake
N Aleutian COST 1	2	7	4197.4		16		35.6			2.66	CC	Bear Lake
N Aleutian COST 1	2	8	4198.4		18		33.7			2.65	CC	Bear Lake
N Aleutian COST 1	2	9	4200.3		20		31.1			2.65	CC	Bear Lake
N Aleutian COST 1	3	10	5227.3		1188		35.5			2.68	CC	Unga
N Aleutian COST 1	3	11	5228.6		1378		36.4			2.69	CC	Unga
N Aleutian COST 1	3	12	5229.6		988		36.1			2.71	CC	Unga
N Aleutian COST 1	3	13	5230.6		1419		36.1			2.68	CC	Unga
N Aleutian COST 1	3	14	5231.6		880		35.1			2.68	CC	Unga
N Aleutian COST 1	3	15	5232.8		1413		34.9			2.67	CC	Unga
N Aleutian COST 1	3	16	5233.5		1694		34.4			2.67	CC	Unga
N Aleutian COST 1	3	17	5234.6		1607		34.2			2.67	CC	Unga
N Aleutian COST 1	3	18	5235.4		0.04		3.7			2.71	CC	Unga
N Aleutian COST 1	3	19	5236.4		15.61		34.7			2.67	CC	Unga
N Aleutian COST 1	3	20	5237.0		1932		35.5			2.69	CC	Unga
N Aleutian COST 1	3	21	5238.5		1228		35.3			2.67	CC	Unga
N Aleutian COST 1	3	22	5239.2		1592		34.9			2.67	CC	Unga
N Aleutian COST 1	3	23	5240.3		2203		36.7			2.67	CC	Unga
N Aleutian COST 1	3	24	5241.5		1620		35.7			2.67	CC	Unga
N Aleutian COST 1	3	25	5242.7		1190		34.4			2.68	CC	Unga
N Aleutian COST 1	3	26	5244.3		1094		34.5			2.67	CC	Unga
N Aleutian COST 1	3	27	5245.3		926		35.0			2.67	CC	Unga
N Aleutian COST 1	4	28	5970.3		129		31.3			2.68	CC	Stepovak
N Aleutian COST 1	4	29	5971.7		58		31.1			2.71	CC	Stepovak
N Aleutian COST 1	4	30	5972.8		98		31.3			2.70	CC	Stepovak
N Aleutian COST 1	4	31	5973.4		61		31.4			2.70	CC	Stepovak
N Aleutian COST 1	4	32	5974.8		155		33.4			2.72	CC	Stepovak
N Aleutian COST 1	4	33	5975.5		53		31.3			2.70	CC	Stepovak
N Aleutian COST 1	4	34	5976.3		35		31.5			2.72	CC	Stepovak
N Aleutian COST 1	4	35	5977.5		181		32.4			2.68	CC	Stepovak
N Aleutian COST 1	4	36	5978.5		98		32.0			2.71	CC	Stepovak
N Aleutian COST 1	4	37	5979.4		66		29.8			2.69	CC	Stepovak
N Aleutian COST 1	4	38	5980.6		82		30.7			2.69	CC	Stepovak
N Aleutian COST 1	4	39	5981.5		67		29.8			2.69	CC	Stepovak
N Aleutian COST 1	4	40	5982.7		100		29.6			2.68	CC	Stepovak
N Aleutian COST 1	4	41	5983.6		93		29.7			2.68	CC	Stepovak
N Aleutian COST 1	4	42	5984.7		51		30.3			2.70	CC	Stepovak
N Aleutian COST 1	4	43	5985.4		61		30.2			2.68	CC	Stepovak
N Aleutian COST 1	4	44	5986.7		30		29.5			2.68	CC	Stepovak
N Aleutian COST 1	4	45	5987.4		57		31.2			2.69	CC	Stepovak
N Aleutian COST 1	4	46	5988.7		84		30.1			2.70	CC	Stepovak
N Aleutian COST 1	4	47	5990.8		72		28.2			2.68	CC	Stepovak
N Aleutian COST 1	4	48	5991.8		17		27.0			2.75	CC	Stepovak
N Aleutian COST 1	4	49	5992.5		7.8		26.0			2.73	CC	Stepovak
N Aleutian COST 1	4	50	5993.2		11		26.3			2.74	CC	Stepovak
N Aleutian COST 1	4	51	5994.5		18		26.4			2.72	CC	Stepovak
N Aleutian COST 1	4	52	5995.3		18		27.0			2.73	CC	Stepovak
N Aleutian COST 1	5	53	6665.3		7722		33.4			2.66	CC	Stepovak
N Aleutian COST 1	5	54	6666.6		6299		33.6			2.66	CC	Stepovak
N Aleutian COST 1	5	55	6668.4		5215		33.4			2.65	CC	Stepovak
N Aleutian COST 1	6	56	8050.9		0.58		28.6			2.68	CC	Stepovak
N Aleutian COST 1	6	57	8051.0				26.2			2.68	CC	Stepovak
N Aleutian COST 1	7	58	8055.1		6.24		26.2			2.69	CC	Stepovak
N Aleutian COST 1	7	59	8056.5				25.3			2.68	CC	Stepovak
N Aleutian COST 1	7	60	8057.8		10		24.0			2.65	CC	Stepovak
N Aleutian COST 1	7	61	8058.3		23		24.8			2.66	CC	Stepovak
N Aleutian COST 1	7	62	8059.7		3.56		25.8			2.69	CC	Stepovak
N Aleutian COST 1	7	63	8061.2		21		27.9			2.66	CC	Stepovak
N Aleutian COST 1	7	64	8062.3		17		29.4			2.68	CC	Stepovak
N Aleutian COST 1	7	65	8063.6		520		32.8			2.64	CC	Stepovak
N Aleutian COST 1	7	66	8064.3		95		29.3			2.66	CC	Stepovak
N Aleutian COST 1	7	67	8065.4		8.15		26.9			2.70	CC	Stepovak
N Aleutian COST 1	7	68	8066.3		14		25.0			2.67	CC	Stepovak
N Aleutian COST 1	7	69	8067.3		9.72		20.9			2.66	CC	Stepovak

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

Well	Core	Plug	Depth/Sample (ft)	K klink (md)	K air (md)	K probe (md)	Porosity (%)	So (%)	Sw (%)	Density (g/cc)	Type	Unit
N Aleutian COST 1	7	70	8068.8		9.71		28.2			2.71	CC	Stepovak
N Aleutian COST 1	7	71	8069.7		4.33		24.0			2.68	CC	Stepovak
N Aleutian COST 1	7	72	8070.6		6.29		26.1			2.68	CC	Stepovak
N Aleutian COST 1	7	73	8071.6		93		24.8			2.66	CC	Stepovak
N Aleutian COST 1	7	74	8072.3		3.97		22.4			2.71	CC	Stepovak
N Aleutian COST 1	7	75	8073.5		29		26.5			2.69	CC	Stepovak
N Aleutian COST 1	7	76	8074.2		27		26.5			2.68	CC	Stepovak
N Aleutian COST 1	7	77	8075.6				28.2			2.67	CC	Stepovak
N Aleutian COST 1	7	78	8076.4		4.59		27.3			2.69	CC	Stepovak
N Aleutian COST 1	7	79	8077.5		39		28.2			2.69	CC	Stepovak
N Aleutian COST 1	7	80	8078.3		9.02		27.2			2.69	CC	Stepovak
N Aleutian COST 1	7	81	8079.3		3.26		26.4			2.74	CC	Stepovak
N Aleutian COST 1	7	82	8080.4				26.3			2.68	CC	Stepovak
N Aleutian COST 1	7	83	8081.3		496		27.7			2.64	CC	Stepovak
N Aleutian COST 1	7	84	8082.6		697		29.9			2.66	CC	Stepovak
N Aleutian COST 1	7	85	8083.2		1372		31.6			2.64	CC	Stepovak
N Aleutian COST 1	7	86	8084.3		476		32.2			2.65	CC	Stepovak
N Aleutian COST 1	7	87	8085.8		1802		32.3			2.65	CC	Stepovak
N Aleutian COST 1	7	88	8086.5		1584		32.9			2.64	CC	Stepovak
N Aleutian COST 1	7	89	8087.3		2358		32.9			2.64	CC	Stepovak
N Aleutian COST 1	7	90	8088.5		1478		31.1			2.64	CC	Stepovak
N Aleutian COST 1	7	91	8089.4		1791		33.5			2.64	CC	Stepovak
N Aleutian COST 1	7	92	8090.3		1141		33.3			2.65	CC	Stepovak
N Aleutian COST 1	7	93	8091.2		849		32.4			2.64	CC	Stepovak
N Aleutian COST 1	7	94	8092.3				31.0			2.65	CC	Stepovak
N Aleutian COST 1	7	95	8092.9		217		29.0			2.65	CC	Stepovak
N Aleutian COST 1	8	96	8629.2		79		29.2			2.69	CC	Stepovak
N Aleutian COST 1	8	97	8629.3		109		29.8			2.69	CC	Stepovak
N Aleutian COST 1	8	98	8630.1		88		28.2			2.72	CC	Stepovak
N Aleutian COST 1	8	99	8631.5		340		31.3			2.68	CC	Stepovak
N Aleutian COST 1	8	100	8632.9		224		31.2			2.68	CC	Stepovak
N Aleutian COST 1	8	101	8633.8		1040		30.7			2.67	CC	Stepovak
N Aleutian COST 1	8	102	8634.4		78		29.6			2.71	CC	Stepovak
N Aleutian COST 1	8	103	8635.8		0.98		12.5			2.70	CC	Stepovak
N Aleutian COST 1	8	104	8636.7		709		31.4			2.68	CC	Stepovak
N Aleutian COST 1	8	105	8637.4		67		28.0			2.69	CC	Stepovak
N Aleutian COST 1	8	106	8638.9		468		31.2			2.69	CC	Stepovak
N Aleutian COST 1	8	107	8639.8		349		30.8			2.68	CC	Stepovak
N Aleutian COST 1	8	108	8640.5		291		30.7			2.69	CC	Stepovak
N Aleutian COST 1	8	109	8641.5		929		30.7			2.66	CC	Stepovak
N Aleutian COST 1	8	110	8642.8		303		31.1			2.69	CC	Stepovak
N Aleutian COST 1	8	111	8643.4		473		31.8			2.71	CC	Stepovak
N Aleutian COST 1	8	112	8644.9		695		31.5			2.67	CC	Stepovak
N Aleutian COST 1	8	113	8645.8		284		30.8			2.69	CC	Stepovak
N Aleutian COST 1	8	114	8646.3		325		30.9			2.69	CC	Stepovak
N Aleutian COST 1	8	115	8647.2		336		29.8			2.71	CC	Stepovak
N Aleutian COST 1	8	116	8648.5		55		29.4			2.71	CC	Stepovak
N Aleutian COST 1	8	117	8649.3		123		31.1			2.70	CC	Stepovak
N Aleutian COST 1	8	118	8650.1		186		30.9			2.67	CC	Stepovak
N Aleutian COST 1	8	119	8650.9		896		30.5			2.63	CC	Stepovak
N Aleutian COST 1	8	120	8651.5		1010		31.3			2.63	CC	Stepovak
N Aleutian COST 1	8	121	8651.9		132		29.8			2.67	CC	Stepovak
N Aleutian COST 1	8	122	8652.7		244		29.7			2.66	CC	Stepovak
N Aleutian COST 1	8	123	8653.2		460		31.5			2.65	CC	Stepovak
N Aleutian COST 1	8	124	8653.6		280		30.6			2.66	CC	Stepovak
N Aleutian COST 1	8	125	8654.4				24.3			2.75	CC	Stepovak
N Aleutian COST 1	8	126	8655.3		274		30.1			2.65	CC	Stepovak
N Aleutian COST 1	8	127	8656.1				29.4			2.71	CC	Stepovak
N Aleutian COST 1	8	128	8656.7		1594		31.2			2.68	CC	Stepovak
N Aleutian COST 1	8	129	8656.8		3193		31.7			2.65	CC	Stepovak
N Aleutian COST 1	9	130	9255.9		13		19.6			2.77	CC	Stepovak
N Aleutian COST 1	9	131	9256.2		1615		25.2			2.69	CC	Stepovak
N Aleutian COST 1	9	132	9257.2		189		18.8			2.70	CC	Stepovak
N Aleutian COST 1	9	133	9258.9		0.11		5.8			2.66	CC	Stepovak
N Aleutian COST 1	9	134	9259.9		1.91		12.7			2.68	CC	Stepovak
N Aleutian COST 1	9	135	9261.3		867		21.2			2.67	CC	Stepovak
N Aleutian COST 1	9	136	9263.9		436		22.1			2.69	CC	Stepovak
N Aleutian COST 1	10	137	9945.2		10		19.3			2.70	CC	Stepovak
N Aleutian COST 1	10	138	9946.4		0.15		16.5			2.72	CC	Stepovak

Well	Core	Plug	Depth/Sample (ft)	K klink (md)	K air (md)	K probe (md)	Porosity (%)	So (%)	Sw (%)	Density (g/cc)	Type	Unit
N Aleutian COST 1	10	139	9947.6		0.52		17.2			2.73	CC	Stepovak
N Aleutian COST 1	10	140	9948.5		0.25		17.9			2.74	CC	Stepovak
N Aleutian COST 1	10	141	9950.5		1.73		18.8			2.74	CC	Stepovak
N Aleutian COST 1	10	142	9952.5		0.58		17.9			2.72	CC	Stepovak
N Aleutian COST 1	10	143	9953.4		0.51		18.2			2.73	CC	Stepovak
N Aleutian COST 1	10	144	9954.6		0.43		9.6			2.46	CC	Stepovak
N Aleutian COST 1	10	145	9955.8		59		18.1			2.73	CC	Stepovak
N Aleutian COST 1	10	146	9957.2		0.87		17.2			2.73	CC	Stepovak
N Aleutian COST 1	10	147	9958.4		0.04		10.9			2.71	CC	Stepovak
N Aleutian COST 1	10	148	9960.6		5.08		17.8			2.71	CC	Stepovak
N Aleutian COST 1	10	149	9961.5		1.63		18.7			2.71	CC	Stepovak
N Aleutian COST 1	10	150	9963.2		0.63		17.3			2.71	CC	Stepovak
N Aleutian COST 1	10	151	9964.4		2.89		17.5			2.72	CC	Stepovak
N Aleutian COST 1	10	152	9965.6		11		17.8			2.71	CC	Stepovak
N Aleutian COST 1	10	153	9967.5		0.42		17.0			2.71	CC	Stepovak
N Aleutian COST 1	10	154	9968.5		1.24		17.3			2.72	CC	Stepovak
N Aleutian COST 1	10	155	9969.9		4		16.0			2.70	CC	Stepovak
N Aleutian COST 1	10	156	9971.1		7.72		17.7			2.69	CC	Stepovak
N Aleutian COST 1	10	157	9972.5		3.89		19.5			2.72	CC	Stepovak
N Aleutian COST 1	10	158	9973.5		4.57		20.7			2.70	CC	Stepovak
N Aleutian COST 1	10	159	9975.2		1.67		18.2			2.69	CC	Stepovak
N Aleutian COST 1	10	160	9976.3		1.3		17.6			2.70	CC	Stepovak
N Aleutian COST 1	10	161	9977.3		1.14		23.7			2.71	CC	Stepovak
N Aleutian COST 1	10	162	9979.2		5.43		17.5			2.69	CC	Stepovak
N Aleutian COST 1	10	163	9980.6		3.57		17.7			2.71	CC	Stepovak
N Aleutian COST 1	11	164	10326.8		1.83		19.6			2.69	CC	Stepovak
N Aleutian COST 1	11	165	10328.2		2.07		20.2			2.70	CC	Stepovak
N Aleutian COST 1	11	166	10329.7		0.22		8.8			2.69	CC	Stepovak
N Aleutian COST 1	11	167	10331.6		0.06		7.3			2.70	CC	Stepovak
N Aleutian COST 1	11	168	10332.8		23		22.2			2.68	CC	Stepovak
N Aleutian COST 1	11	169	10334.2		43		19.4			2.69	CC	Stepovak
N Aleutian COST 1	11	170	10336.2		802		29.0			2.66	CC	Stepovak
N Aleutian COST 1	11	171	10336.8		544		28.3			2.66	CC	Stepovak
N Aleutian COST 1	12	172	10732.8		0.19		22.4			2.70	CC	Tolstoi
N Aleutian COST 1	12	173	10737.3		130		24.1			2.68	CC	Tolstoi
N Aleutian COST 1	12	174	10737.5		0.95		13.4			2.68	CC	Tolstoi
N Aleutian COST 1	12	175	10738.3		1.73		19.9			2.94	CC	Tolstoi
N Aleutian COST 1	12	176	10739.9		74		28.0			2.66	CC	Tolstoi
N Aleutian COST 1	13	177	11085.7		0.99		20.2			2.68	CC	Tolstoi
N Aleutian COST 1	13	178	11089.7		0.13		18.2			2.67	CC	Tolstoi
N Aleutian COST 1	13	179	11091.7		0.08		6.8			2.65	CC	Tolstoi
N Aleutian COST 1	13	180	11093.7		5.63		19.4			2.68	CC	Tolstoi
N Aleutian COST 1	13	181	11095.9		0.23		14.6			2.69	CC	Tolstoi
N Aleutian COST 1	13	182	11097.3		0.45		17.1			2.66	CC	Tolstoi
N Aleutian COST 1	13	183	11100.2		12		19.3			2.64	CC	Tolstoi
N Aleutian COST 1	13	184	11100.6		0.04		13.1			2.64	CC	Tolstoi
N Aleutian COST 1	13	185	11101.7		0.17		21.8			2.62	CC	Tolstoi
N Aleutian COST 1	13	186	11102.9		0.04		6.4			2.52	CC	Tolstoi
N Aleutian COST 1	14	187	12249.0		0.26		2.3			2.60	CC	Tolstoi
N Aleutian COST 1	14	188	12249.5		0.15		11.8			2.74	CC	Tolstoi
N Aleutian COST 1	14	189	12251.8		5.02		6.2			2.75	CC	Tolstoi
N Aleutian COST 1	14	190	12256.4		0.04		9.6			2.73	CC	Tolstoi
N Aleutian COST 1	14	191	12257.5		1.74		17.4			2.70	CC	Tolstoi
N Aleutian COST 1	14	192	12266.4		2.56		10.5			2.73	CC	Tolstoi
N Aleutian COST 1	15	193	12638.8		2.27		19.1			2.68	CC	Tolstoi
N Aleutian COST 1	15	194	12640.8		0.32		13.0			2.70	CC	Tolstoi
N Aleutian COST 1	15	195	12641.3		0.02		12.4			2.68	CC	Tolstoi
N Aleutian COST 1	15	196	12642.8		0.06		19.1			2.71	CC	Tolstoi
N Aleutian COST 1	15	197	12643.5		0.04		17.2			2.72	CC	Tolstoi
N Aleutian COST 1	15	198	12644.7		0.02		19.0			2.69	CC	Tolstoi
N Aleutian COST 1	15	199	12645.5		0.04		18.3			2.71	CC	Tolstoi
N Aleutian COST 1	15	200	12646.7		0.02		16.1			2.71	CC	Tolstoi
N Aleutian COST 1	15	201	12647.4		0.01		15.6			2.78	CC	Tolstoi
N Aleutian COST 1	15	202	12648.5		0.02		14.4			2.77	CC	Tolstoi
N Aleutian COST 1	15	203	12649.7		0.04		16.9			2.75	CC	Tolstoi
N Aleutian COST 1	15	204	12650.6		0.04		16.7			2.72	CC	Tolstoi
N Aleutian COST 1	15	205	12651.5		0.02		16.2			2.73	CC	Tolstoi
N Aleutian COST 1	15	206	12654.9		0.02		10.0			2.73	CC	Tolstoi
N Aleutian COST 1	15	207	12655.5		0.02		16.3			2.73	CC	Tolstoi

Well	Core	Plug	Depth/Sample	K klink	K air	K probe	Porosity	So	Sw	Density	Type	Unit
			(ft)	(md)	(md)	(md)	(%)	(%)	(%)	(g/cc)		
N Aleutian COST 1	15	208	12656.4		0.02		11.3			2.71	CC	Tolstoi
N Aleutian COST 1	16	209	14165.6		0.02		10.3			2.66	CC	Tolstoi
N Aleutian COST 1	16	210	14171.3		0.04		5.0			2.65	CC	Tolstoi
N Aleutian COST 1	16	211	14174.9		0.03		2.0			2.53	CC	Tolstoi
N Aleutian COST 1	16	212	14178.9		0.09		10.3			2.67	CC	Tolstoi
N Aleutian COST 1	16	213	14182.2		0.02		0.7			2.53	CC	Tolstoi
N Aleutian COST 1	16	214	14182.7		0.04		1.9			2.54	CC	Tolstoi
N Aleutian COST 1	16	215	14184.8		0.11		14.9			2.71	CC	Tolstoi
N Aleutian COST 1	16	216	14185.7		0.1		14.1			2.71	CC	Tolstoi
N Aleutian COST 1	17	217	15347.3		0.02		9.1			2.71	CC	Tolstoi
N Aleutian COST 1	17	218	15348.1		0.02		9.1			2.70	CC	Tolstoi
N Aleutian COST 1	17	219	15350.2		0.02		6.5			2.69	CC	Tolstoi
N Aleutian COST 1	17	220	15352.4		0.02		7.0			2.68	CC	Tolstoi
N Aleutian COST 1	17	221	15354.2		0.02		10.0			2.69	CC	Tolstoi
N Aleutian COST 1	17	222	15356.2		0.05		10.8			2.68	CC	Tolstoi
N Aleutian COST 1	17	223	15358.2		0.05		10.8			2.71	CC	Tolstoi
N Aleutian COST 1	17	224	15359.9		0.05		11.3			2.71	CC	Tolstoi
N Aleutian COST 1	17	225	15361.8		0.02		6.9			2.69	CC	Tolstoi
N Aleutian COST 1	17	226	15363.2		0.02		10.9			2.70	CC	Tolstoi
N Aleutian COST 1	17	227	15364.5		0.02		9.3			2.74	CC	Tolstoi
N Aleutian COST 1	17	228	15365.8		0.05		0.8			2.68	CC	Tolstoi
N Aleutian COST 1	18	229	16006.5		104		13.2			2.66	CC	Tolstoi
N Aleutian COST 1	18	230	16007.3		3.88		15.5			2.72	CC	Tolstoi
N Aleutian COST 1	18	231	16011.1		12		9.6			2.70	CC	Tolstoi
N Aleutian COST 1	18	232	16013.2		2.23		12.5			2.74	CC	Tolstoi
N Aleutian COST 1	18	233	16014.8		0.02		8.1			2.76	CC	Tolstoi
N Aleutian COST 1	18	234	16018.1		0.49		14.0			2.74	CC	Tolstoi
N Aleutian COST 1	18	235	16018.3		4.25		15.3			2.77	CC	Tolstoi
N Aleutian COST 1	18	236	16020.9		53		12.3			2.70	CC	Tolstoi
N Aleutian COST 1	18	237	16022.2		0.02		1.3			2.84	CC	Tolstoi
N Aleutian COST 1	18	238	16022.5		1.91		12.1			2.73	CC	Tolstoi
N Aleutian COST 1	18	239	16027.2		6.18		11.7			2.66	CC	Tolstoi
N Aleutian COST 1	19	240	16702.8		0.7		12.4			2.72	CC	Tolstoi
N Aleutian COST 1	19	241	16703.4		1.7		13.0			2.70	CC	Tolstoi
N Aleutian COST 1	19	242	16704.8		0.24		7.4			2.76	CC	Tolstoi
N Aleutian COST 1	19	243	16706.8		0.16		7.9			2.70	CC	Tolstoi
N Aleutian COST 1	19	244	16708.4		2.01		12.2			2.65	CC	Tolstoi
N Aleutian COST 1	19	245	16710.6		0.04		7.3			2.78	CC	Tolstoi
N Aleutian COST 1	19	246	16716.8		9.72		11.0			2.66	CC	Tolstoi
N Aleutian COST 1	19	247	16719.9		1.57		11.3			2.70	CC	Tolstoi
N Aleutian COST 1	19	248	16720.4		0.56		13.6			2.66	CC	Tolstoi
N Aleutian COST 1	19	249	16720.6		0.07		8.3			2.72	CC	Tolstoi
N Aleutian COST 1		1	2214.0				33.3			2.61	PSWC	Milky River
N Aleutian COST 1		2	2427.0		408		34.4			2.66	PSWC	Milky River
N Aleutian COST 1		3	2610.0				41.4			2.66	PSWC	Bear Lake
N Aleutian COST 1		4	2836.0		2844		35.3			2.61	PSWC	Bear Lake
N Aleutian COST 1		5	3060.0		154		35.4			2.61	PSWC	Bear Lake
N Aleutian COST 1		6	3430.0				35.5			2.63	PSWC	Bear Lake
N Aleutian COST 1		7	3696.0		1218		36.0			2.64	PSWC	Bear Lake
N Aleutian COST 1		8	3918.0				40.0			2.63	PSWC	Bear Lake
N Aleutian COST 1		9	4117.0		109		29.1			2.66	PSWC	Bear Lake
N Aleutian COST 1		10	4160.0		114		35.4			2.65	PSWC	Bear Lake
N Aleutian COST 1		11	4290.0		722		30.7			2.64	PSWC	Bear Lake
N Aleutian COST 1		12	4426.0		1641		32.1			2.64	PSWC	Bear Lake
N Aleutian COST 1		13	4625.0				33.1			2.65	PSWC	Bear Lake
N Aleutian COST 1		14	4780.8		1233		33.1			2.65	PSWC	Bear Lake
N Aleutian COST 1		15	4876.0		78		28.2			2.63	PSWC	Unga
N Aleutian COST 1		16	5009.0		530		32.8			2.67	PSWC	Unga
N Aleutian COST 1		17	5112.0		47		28.4			2.66	PSWC	Unga
N Aleutian COST 1		18	5247.0		157		30.1			2.64	PSWC	Unga
N Aleutian COST 1		19	5444.0		9.52		20.2			2.69	PSWC	Unga
N Aleutian COST 1		20	5655.0		519		32.3			2.61	PSWC	Unga
N Aleutian COST 1		21	5805.0		139		25.2			2.67	PSWC	Stepovak
N Aleutian COST 1		22	6671.0				21.5			2.62	PSWC	Stepovak
N Aleutian COST 1		23	6695.0				20.2			2.69	PSWC	Stepovak
N Aleutian COST 1		24	6768.0		72		23.9			2.65	PSWC	Stepovak
N Aleutian COST 1		25	7055.0				26.1			2.60	PSWC	Stepovak
N Aleutian COST 1		26	7252.0		26		24.0			2.66	PSWC	Stepovak
N Aleutian COST 1		27	7330.0				21.5			2.63	PSWC	Stepovak

Well	Core	Plug	Depth/Sample (ft)	K klink (md)	K air (md)	K probe (md)	Porosity (%)	So (%)	Sw (%)	Density (g/cc)	Type	Unit
N Aleutian COST 1		28	7342.0		274		29.1			2.65	PSWC	Stepovak
N Aleutian COST 1		29	7446.0		298		26.5			2.63	PSWC	Stepovak
N Aleutian COST 1		30	7512.0		441		25.9			2.64	PSWC	Stepovak
N Aleutian COST 1		31	7552.0		162		32.3			2.63	PSWC	Stepovak
N Aleutian COST 1		32	7658.0		280		28.8			2.61	PSWC	Stepovak
N Aleutian COST 1		33	7691.0		106		34.2			2.61	PSWC	Stepovak
N Aleutian COST 1		34	7737.0		19		30.4			2.64	PSWC	Stepovak
N Aleutian COST 1		35	7869.0		159		29.7			2.62	PSWC	Stepovak
N Aleutian COST 1		36	8089.0		348		31.6			2.62	PSWC	Stepovak
N Aleutian COST 1		37	8136.0		452		31.5			2.63	PSWC	Stepovak
N Aleutian COST 1		38	8170.0		474		28.3			2.63	PSWC	Stepovak
N Aleutian COST 1		39	8224.0		142		25.7			2.62	PSWC	Stepovak
N Aleutian COST 1		40	8374.0		89		24.5			2.68	PSWC	Stepovak
N Aleutian COST 1		41	8446.0		34		25.1			2.67	PSWC	Stepovak
N Aleutian COST 1		42	8567.0		239		30.9			2.66	PSWC	Stepovak
N Aleutian COST 1		43	8658.0		105		30.3			2.67	PSWC	Stepovak
N Aleutian COST 1		44	8758.0		92		27.6			2.66	PSWC	Stepovak
N Aleutian COST 1		45	8764.0		180		30.1			2.68	PSWC	Stepovak
N Aleutian COST 1		46	8800.0		277		31.3			2.63	PSWC	Stepovak
N Aleutian COST 1		47	8863.0		197		27.8			2.63	PSWC	Stepovak
N Aleutian COST 1		48	8993.0		188		28.2			2.63	PSWC	Stepovak
N Aleutian COST 1		49	9038.0		234		30.5			2.63	PSWC	Stepovak
N Aleutian COST 1		50	9184.0		164		23.5			2.65	PSWC	Stepovak
N Aleutian COST 1		51	9293.0		103		28.2			2.65	PSWC	Stepovak
N Aleutian COST 1		52	9330.0		63		25.4			2.69	PSWC	Stepovak
N Aleutian COST 1		53	9511.0		38		26.8			2.66	PSWC	Stepovak
N Aleutian COST 1		54	9663.0		25		23.2			2.73	PSWC	Stepovak
N Aleutian COST 1		55	9786.0		12		20.5			2.69	PSWC	Stepovak
N Aleutian COST 1		56	9950.0		37		19.3			2.71	PSWC	Stepovak
N Aleutian COST 1		57	10252.0		66		23.4			2.72	PSWC	Stepovak
N Aleutian COST 1		58	10302.0		17		20.4			2.75	PSWC	Stepovak
N Aleutian COST 1		59	10316.0		12		26.6			2.70	PSWC	Stepovak
N Aleutian COST 1		60	10355.0		38		22.2			2.69	PSWC	Stepovak
N Aleutian COST 1		61	10390.0				23.6			2.69	PSWC	Tolstoi
N Aleutian COST 1		62	10417.0				20.1			2.84	PSWC	Tolstoi
N Aleutian COST 1		63	10427.0		132		23.9			2.67	PSWC	Tolstoi
N Aleutian COST 1		64	10654.0		989		25.3			2.62	PSWC	Tolstoi
N Aleutian COST 1		65	10870.0				18.2			2.71	PSWC	Tolstoi
N Aleutian COST 1		66	11032.0				24.5			2.69	PSWC	Tolstoi
N Aleutian COST 1		67	11268.0		13		22.0			2.72	PSWC	Tolstoi
N Aleutian COST 1		68	11337.0				23.2			2.68	PSWC	Tolstoi
N Aleutian COST 1		69	11541.0		59		24.1			2.63	PSWC	Tolstoi
N Aleutian COST 1		70	11735.0				24.5			2.62	PSWC	Tolstoi
N Aleutian COST 1		71	11878.0		25		22.3			2.69	PSWC	Tolstoi
N Aleutian COST 1		72	12093.0		194		22.2			2.76	PSWC	Tolstoi
N Aleutian COST 1		73	12548.0				25.6			2.67	PSWC	Tolstoi
N Aleutian COST 1		74	12659.0				26.8			2.69	PSWC	Tolstoi
N Aleutian COST 1		75	12729.0		23		21.7			2.66	PSWC	Tolstoi
N Aleutian COST 1		76	13060.0		181		23.8			2.70	PSWC	Tolstoi
N Aleutian COST 1		77	13124.0		49		24.4			2.69	PSWC	Tolstoi
N Aleutian COST 1		78	13254.0				24.8			2.82	PSWC	Tolstoi
Becharof State 1	1	1	2725.5		2311		33.6	0.0	97.1	2.62	CC	Milky River
Becharof State 1	1	2	2726.5		2040		43.2	0.0	98.8	2.53	CC	Milky River
Becharof State 1	1	3	2727.5		3649		35.9	0.0	98.1	2.63	CC	Milky River
Becharof State 1	1	4	2728.9		2176		37.1	0.0	97.2	2.62	CC	Milky River
Becharof State 1	1	5	2729.4		2046		36.1	0.0	99.3	2.62	CC	Milky River
Becharof State 1	1	6	2729.5		681		34.1	0.0	96.2	2.62	CC	Milky River
Becharof State 1	1	7	2729.6		819		34.6	0.0	85.6	2.63	CC	Milky River
Becharof State 1	1	8	2730.5		1698		36.8	0.0	95.4	2.62	CC	Milky River
Becharof State 1	1	9	2731.5		2301		34.9	0.0	97.1	2.61	CC	Milky River
Becharof State 1	1	10	2732.5		1659		34.6	0.0	97.2	2.61	CC	Milky River
Becharof State 1	1	11	2732.6		2986		36.9	0.0	98.5	2.62	CC	Milky River
Becharof State 1	1	12	2733.5		2098		36.5	0.0	99.2	2.67	CC	Milky River
Becharof State 1	1	13	2734.5		3470		36.9	0.0	98.7	2.62	CC	Milky River
Becharof State 1	1	14	2735.5		3575		38.0	0.0	98.2	2.63	CC	Milky River
Becharof State 1	1	15	2736.5		3893		41.7	0.0	98.8	2.62	CC	Milky River
Becharof State 1	1	16	2737.7		362		30.7	0.0	97.1	2.62	CC	Milky River
Becharof State 1	1	17	2738.5		565		30.7	0.0	98.6	2.64	CC	Milky River
Becharof State 1	1	18	2738.6		2129		35.3	0.0	97.1	2.63	CC	Milky River

Well	Core	Plug	Depth/Sample (ft)	K klink (md)	K air (md)	K probe (md)	Porosity (%)	So (%)	Sw (%)	Density (g/cc)	Type	Unit
Becharof State 1	1	19	2738.7		2181		35.2	0.0	96.8	2.64	CC	Milky River
Becharof State 1	1	20	2739.4		1989		35.1	0.0	97.3	2.65	CC	Milky River
Becharof State 1	1	21	2739.5		1680		35.8	0.0	97.5	2.64	CC	Milky River
Becharof State 1	1	22	2740.4		2623		36.2	0.0	98.3	2.64	CC	Milky River
Becharof State 1	1	23	2740.5		1950		25.9	0.0	98.8	2.64	CC	Milky River
Becharof State 1	1	24	2741.5		1096		36.1	0.0	98.3	2.65	CC	Milky River
Becharof State 1	1	25	2742.5		1183		37.1	0.0	98.6	2.65	CC	Milky River
Becharof State 1	1	26	2743.5		1043		37.5	0.0	99.0	2.65	CC	Milky River
Becharof State 1	1	27	2744.5		1052		38.3	0.0	97.7	2.65	CC	Milky River
Becharof State 1	1	28	2745.5		1386		35.8	0.0	97.7	2.62	CC	Milky River
Becharof State 1	2	29	3668.5		4663		34.7	0.0	97.9	2.64	CC	Bear Lake
Becharof State 1	2	30	3669.5		2978		34.4	0.0	96.1	2.62	CC	Bear Lake
Becharof State 1	2	31	3669.7		4969		37.2	0.0	98.7	2.65	CC	Bear Lake
Becharof State 1	2	32	3670.7		3378		34.7	0.0	96.5	2.64	CC	Bear Lake
Becharof State 1	2	33	3671.5		1892		34.3	0.0	98.0	2.64	CC	Bear Lake
Becharof State 1	2	34	3671.7		3843		35.1	0.0	97.7	2.62	CC	Bear Lake
Becharof State 1	2	35	3672.5		2.4		6.0	0.0	88.7	3.04	CC	Bear Lake
Becharof State 1	2	36	3673.3		3202		35.3	0.0	97.8	2.64	CC	Bear Lake
Becharof State 1	2	37	3673.5		3592		34.8	0.0	97.0	2.53	CC	Bear Lake
Becharof State 1	2	38	3674.5		3.3		5.8	0.0	82.6	2.69	CC	Bear Lake
Becharof State 1	2	39	3675.5		56		13.3	0.0	94.2	3.32	CC	Bear Lake
Becharof State 1	2	40	3676.5		1.7		4.2	0.0	93.3	3.26	CC	Bear Lake
Becharof State 1	2	41	3677.3		0.03		12.2	0.0	96.2	3.06	CC	Bear Lake
Becharof State 1	2	42	3678.7		1550		34.0	0.0	97.2	2.65	CC	Bear Lake
Becharof State 1	2	43	3679.5		1413		34.0	0.0	98.8	2.63	CC	Bear Lake
Becharof State 1	2	44	3679.6		2062		33.5	0.0	84.8	2.64	CC	Bear Lake
Becharof State 1	2	45	3680.6		59		26.3	0.0	95.7	2.67	CC	Bear Lake
Becharof State 1	2	46	3681.8		3437		34.4	0.0	82.0	2.65	CC	Bear Lake
Becharof State 1	2	47	3682.4		2941		33.6	0.0	83.9	2.63	CC	Bear Lake
Becharof State 1	2	48	3682.5		2829		34.0	0.0	92.9	2.64	CC	Bear Lake
Becharof State 1	2	49	3683.4		221		27.2	0.0	98.9	2.66	CC	Bear Lake
Becharof State 1	2	50	3683.5		2741		33.5	0.0	88.8	2.64	CC	Bear Lake
Becharof State 1	2	51	3684.5		4115		35.0	0.0	93.3	2.66	CC	Bear Lake
Becharof State 1	2	52	3684.6		3994		35.5	0.0	92.9	2.68	CC	Bear Lake
Becharof State 1	2	53	3686.5		1611		35.8	0.0	98.7	2.65	CC	Bear Lake
Becharof State 1	2	54	3687.5		5327		34.9	0.0	88.5	2.66	CC	Bear Lake
Becharof State 1	2	55	3688.5		3915		34.5	0.0	87.7	2.66	CC	Bear Lake
Becharof State 1	2	56	3689.5		46		25.2	0.0	98.3	2.67	CC	Bear Lake
Becharof State 1	2	57	3689.6		2378		33.9	0.0	89.5	2.68	CC	Bear Lake
Becharof State 1	2	58	3691.5		3365		34.1	0.0	90.8	2.66	CC	Bear Lake
Becharof State 1	2	59	3692.5		2439		33.1	0.0	94.0	2.66	CC	Bear Lake
Becharof State 1	2	60	3694.5		620		29.5	0.0	96.9	2.66	CC	Bear Lake
Becharof State 1	2	61	3696.5		0.01		2.8	0.0	75.0	3.07	CC	Bear Lake
Becharof State 1	3	1	7895.0		0.01		1.0	0.0	69.5	3.11	CC	Stepovak
Becharof State 1	3	2	7901.0		0.07		8.1	1.3	63.3	2.66	CC	Stepovak
Becharof State 1	3	3	7902.0		0.13		8.3	3.0	69.5	2.67	CC	Stepovak
Becharof State 1	3	4	7903.0		0.05		5.9	1.6	71.2	2.64	CC	Stepovak
Becharof State 1	3	5	7904.0		0.14		6.5	15.6	52.0	2.62	CC	Stepovak
Becharof State 1	3	6	7905.0		0.13		7.3	7.7	61.5	2.65	CC	Stepovak
Becharof State 1	3	7	7906.0		0.09		7.0	3.2	73.0	2.66	CC	Stepovak
Becharof State 1	3	8	7907.0		0.07		6.8	5.1	48.9	2.65	CC	Stepovak
Becharof State 1	3	9	7909.0		0.04		4.3	13.8	69.1	2.61	CC	Stepovak
Becharof State 1	3	10	7910.0		0.15		6.2	21.7	59.8	2.61	CC	Stepovak
Becharof State 1	3	11	7911.0		0.1		7.1	2.9	67.1	2.65	CC	Stepovak
Becharof State 1	3	12	7914.0		0.06		7.6	1.0	63.9	2.64	CC	Stepovak
Becharof State 1	3	13	7915.0		0.12		7.1	5.3	62.0	2.65	CC	Stepovak
Becharof State 1	3	14	7916.0		0.29		8.3	5.4	69.4	2.66	CC	Stepovak
Becharof State 1	3	15	7918.0		0.03		6.4	9.0	71.7	2.62	CC	Stepovak
Becharof State 1	3	16	7919.0		0.02		3.9	0.0	65.9	2.72	CC	Stepovak
Becharof State 1	3	17	7920.0		0.01		1.0	0.0	57.7	2.72	CC	Stepovak
Becharof State 1	3	18	7921.0		0.06		3.8	3.5	63.8	2.64	CC	Stepovak
Becharof State 1	3	19	7922.0		0.4		8.6	0.0	67.9	2.66	CC	Stepovak
Becharof State 1	3	20	7925.0		0.06		5.5	2.7	60.9	2.61	CC	Stepovak
Becharof State 1	3	21	7927.0		0.01		0.9	6.4	60.5	3.16	CC	Stepovak
Becharof State 1	3	22	7928.0		0.03		3.7	28.9	54.2	2.54	CC	Stepovak
Becharof State 1	3	23	7931.0		0.13		6.4	3.0	73.9	2.65	CC	Stepovak
Becharof State 1	3	24	7932.0		0.3		5.9	3.3	82.8	2.53	CC	Stepovak
Becharof State 1	3	25	7938.0		0.03		5.9	6.7	65.9	2.63	CC	Stepovak
Becharof State 1	3	26	7939.0		0.02		5.4	3.3	84.6	2.63	CC	Stepovak

Well	Core	Plug	Depth/Sample (ft)	K klink (md)	K air (md)	K probe (md)	Porosity (%)	So (%)	Sw (%)	Density (g/cc)	Type	Unit
Becharof State 1	3	27	7940.0		0.05		4.1	7.2	72.1	2.62	CC	Stepovak
Becharof State 1	3	28	7941.0		0.02		6.6	1.6	83.8	2.65	CC	Stepovak
Becharof State 1	3	29	7942.0		0.08		8.3	4.0	77.8	2.63	CC	Stepovak
Sandy River 1		1	3260.0				31.8	0.0	89.6		PSWC	Bear Lake
Sandy River 1		2	3339.0		275		28.6	0.0	93.0		PSWC	Bear Lake
Sandy River 1		3	3828.0		31		35.1	0.0	90.0		PSWC	Bear Lake
Sandy River 1		4	3982.0		56		34.4	0.0	84.6		PSWC	Bear Lake
Sandy River 1		5	4125.0		0.1		23.5	0.0	93.6		PSWC	Bear Lake
Sandy River 1		6	4370.0		564		28.7	0.0	85.7		PSWC	Bear Lake
Sandy River 1		7	4380.0		211		35.2	0.0	90.3		PSWC	Bear Lake
Sandy River 1		8	4503.0		1268						PSWC	Bear Lake
Sandy River 1		9	4735.0		842						PSWC	Bear Lake
Sandy River 1		10	5009.0		18		36.5	0.0	84.3		PSWC	Bear Lake
Sandy River 1		11	5049.0		166		36.3	0.0	91.2		PSWC	Bear Lake
Sandy River 1		12	5163.0		48		34.3	0.0	79.3		PSWC	Bear Lake
Sandy River 1		13	5557.0		254		33.1	0.0	89.1		PSWC	Unga
Sandy River 1		15	6083.0		333		25.0	0.0	76.0		PSWC	Unga
Sandy River 1		16	6289.0		425		28.6	0.0	85.3		PSWC	Unga
Sandy River 1		17	6624.0		14						PSWC	Stepovak
Sandy River 1		18	6650.0		5.7		18.8	0.0	77.7		PSWC	Stepovak
Sandy River 1		20	7575.0		19						PSWC	Stepovak
Sandy River 1		21	7692.0				29.9	0.0	91.0		PSWC	Stepovak
Sandy River 1		23	7990.0		43		23.7	0.0	62.4		PSWC	Stepovak
Sandy River 1		24	8018.0		17		26.3	0.0	86.7		PSWC	Stepovak
Port Heiden 1		1	5625.0		891		30.1				PSWC	Bear Lake
Port Heiden 1		2	5665.0		287		25.2				PSWC	Bear Lake
Port Heiden 1		3	6220.0		655		29.0				PSWC	Bear Lake
Port Heiden 1		4	6290.0		311		27.2				PSWC	Bear Lake
Port Heiden 1		5	6335.0		692		28.6				PSWC	Bear Lake
Port Heiden 1		6	6350.0		253		27.9				PSWC	Bear Lake
Port Heiden 1		7	6370.0		348		29.6				PSWC	Bear Lake
Port Heiden 1		8	6415.0		346		28.0				PSWC	Bear Lake
Port Heiden 1		9	6475.0		234		29.1				PSWC	Bear Lake
Port Heiden 1		10	6545.0		1165		24.8				PSWC	Bear Lake
Port Heiden 1		11	7550.0		163		28.8				PSWC	Bear Lake
Great Basins 1	5	1	2857.0	393.0	423		22.4				CC	Milky River
Great Basins 1	6	1	3365.5	0.1	0.1		0.5				CC	Milky River
Great Basins 1	6	2	3366.3	4.5	6		3.8				CC	Milky River
Great Basins 1	7	1	3894.0	423.0	453		24.9				CC	Bear Lake
Great Basins 1	8	1	4413.0	264.0	270		26.4				CC	Bear Lake
Great Basins 1	11	1	6075.0	27.0	32		4.6				CC	Bear Lake
Great Basins 1	11	2	6077.0	1.9	2.7		5.5				CC	Bear Lake
Great Basins 1	11	3	6082.0	1.2	1.7		5.2				CC	Bear Lake
Great Basins 1	11	4	6086.0	1.7	2.4		8.8				CC	Bear Lake
Great Basins 1	11	5	6088.0	22.0	27		4.0				CC	Bear Lake
Great Basins 1	11	6	6089.0	7.6	9.8		9.5				CC	Bear Lake
Great Basins 1	11	7	6090.0	1.0	1.4		9.8				CC	Bear Lake
Great Basins 1	11	8	6091.0	2.5	3.5		6.6				CC	Bear Lake
Great Basins 1	15	9	7227.0	2.9	4		25.7	3.5	84.9		CC	Bear Lake
Great Basins 1	15	10	7228.0	0.4	0.6		27.3	1.8	85.8		CC	Bear Lake
Great Basins 1	15	11	7230.0	0.4	0.6		26.9	1.9	74.3		CC	Bear Lake
Great Basins 1	15	12	7232.0	1.4	2		9.0				CC	Bear Lake
Great Basins 1	15	13	7234.0	0.9	1.3		9.4				CC	Bear Lake
Great Basins 1	15	14	7236.0	1.2	1.7		2.4				CC	Bear Lake
Great Basins 1	15	15	7238.0	0.7	0.9		5.5				CC	Bear Lake
Great Basins 1	15	16	7240.0	0.7	0.9		5.0				CC	Bear Lake
Great Basins 1	15	17	7242.0	58.0	67		1.6				CC	Bear Lake
Great Basins 1	15	18	7244.0	7.9	11		5.3				CC	Bear Lake
Great Basins 1	15	19	7246.0	0.3	0.5		0.6				CC	Bear Lake
Great Basins 1	16	20	8223.0	0.1	0.46		0.3				CC	Bear Lake
Great Basins 1	16	21	8225.0	2.7	3.7		11.6				CC	Bear Lake
Great Basins 1	16	22	8227.0	3.3	4.4		23.2				CC	Bear Lake
Great Basins 1	16	23	8229.0	2.5	3.4		13.7				CC	Bear Lake
Great Basins 1	16	24	8231.0	2.5	3.4		13.7				CC	Bear Lake
Great Basins 1	16	25	8233.0	0.3	0.5		1.7				CC	Bear Lake
Great Basins 1	16	26	8235.0	3.5	4.7		14.5				CC	Bear Lake
Great Basins 1	16	27	8237.0	2.2	3		14.6				CC	Bear Lake
Great Basins 1	16	28	8239.0	1.2	1.7		15.2				CC	Bear Lake
Great Basins 1	17	29	9820.0	0.0	0.02		15.3				CC	Bear Lake

Well	Core	Plug	Depth/Sample (ft)	K klink (md)	K air (md)	K probe (md)	Porosity (%)	So (%)	Sw (%)	Density (g/cc)	Type	Unit
Great Basins 1	17	30	9823.0	7.3	9.4		14.4				CC	Bear Lake
Great Basins 1	17	31	9825.0	88.0	99		10.9				CC	Bear Lake
Great Basins 1	17	32	9826.0	18.0	22		10.5				CC	Bear Lake
Bristol Bay Outcrop		1	04RR138	0.004	0.012		16.6			2.70	OUT	Stepovak
Bristol Bay Outcrop		2	04RR139C			1.080	11.6			2.64	OUT	Herendeen
Bristol Bay Outcrop		3	041RR139D	0.793	1.188		11.0			2.68	OUT	Herendeen
Bristol Bay Outcrop		4	04RR140C	0.613	0.898		11.7			2.53	OUT	Bear Lake
Bristol Bay Outcrop		5	04RR141B	0.008	0.020		13.8			2.69	OUT	Chignik
Bristol Bay Outcrop		6	04RR148B	0.063	0.110		9.8			2.68	OUT	Bear Lake
Bristol Bay Outcrop		7	04RR153D			0.180	9.2			2.71	OUT	Bear Lake
Bristol Bay Outcrop		8	04RR154B				42.0			2.81	OUT	Milky River
Bristol Bay Outcrop		9	04RR155B	0.002	0.005		7.0			2.71	OUT	Tolstoi
Bristol Bay Outcrop		10	04RR155B	0.099	0.163		9.6			2.72	OUT	Tolstoi
Bristol Bay Outcrop		11	SD1-64	0.024	0.048		10.6			2.69	OUT	Bear Lake
Bristol Bay Outcrop		12	HS1-8.5	0.007	0.018		5.1			2.60	OUT	Herendeen
Bristol Bay Outcrop		13	HS1-12	0.009	0.022		5.3			2.68	OUT	Herendeen
Bristol Bay Outcrop		14	HS1-16	0.002	0.007		7.3			2.67	OUT	Herendeen
Bristol Bay Outcrop		15	HS1-2.5	0.007	0.018		7.9			2.70	OUT	Herendeen
Bristol Bay Outcrop		16	HS1-5.5	0.049	0.088		6.3			2.73	OUT	Herendeen
Bristol Bay Outcrop		17	LH1-2	0.474	0.691		8.9			2.68	OUT	Bear Lake
Bristol Bay Outcrop		18	LH1-66.5	0.055	0.098		6.5			2.67	OUT	Bear Lake
Bristol Bay Outcrop		19	LH1-98			0.065	16.9			2.69	OUT	Bear Lake
Bristol Bay Outcrop		20	LH1-120	0.032	0.061		8.3			2.67	OUT	Bear Lake
Bristol Bay Outcrop		21	LH1-164	0.005	0.013		4.4			2.73	OUT	Bear Lake
Bristol Bay Outcrop		22	LH1-182			0.037	11.3			2.62	OUT	Bear Lake
Bristol Bay Outcrop		23	SR1-3.5	222.139	245.875		32.7			2.68	OUT	Milky River
Bristol Bay Outcrop		24	SR2-6	62.237	73.113		35.4			2.75	OUT	Milky River
Bristol Bay Outcrop		25	SR2-89.5	3425.436	3553.977		35.3			2.70	OUT	Milky River
Bristol Bay Outcrop		26	SD1-10	0.191	0.310		10.8			2.66	OUT	Bear Lake
Bristol Bay Outcrop		27	SD1-41			0.08	10.0			2.68	OUT	Bear Lake
Bristol Bay Outcrop		28	SD1-56	0.003	0.010		8.3			2.71	OUT	Bear Lake
Bristol Bay Outcrop		29	SD1-86	0.184	0.280		4.9			2.68	OUT	Bear Lake
Bristol Bay Outcrop		30	04RR142B			1.950	12.4			2.68	OUT	Chignik
Bristol Bay Outcrop		31	04RR149B	0.308	0.447		4.6			2.71	OUT	Chignik
Bristol Bay Outcrop		32	04RR150B	0.001	0.004		2.6			2.71	OUT	Chignik
Bristol Bay Outcrop		33	04RR151C	1.230	1.694		7.1			2.66	OUT	Chignik
Bristol Bay Outcrop		34	04RR152C	0.242	0.377		11.9			2.72	OUT	Bear Lake
Bristol Bay Outcrop		35	04RR156B	0.001	0.004		4.6			2.70	OUT	Herendeen
Bristol Bay Outcrop		36	04RR156D	0.002	0.006		1.1			2.68	OUT	Herendeen
Bristol Bay Outcrop		37	04RR157B	44.113	52.914		8.1			2.59	OUT	Naknek
Bristol Bay Outcrop		38	04RR158C			125.000	35.0			2.73	OUT	Milky River
Bristol Bay Outcrop		39	04RR158G			76.600	35.6			2.63	OUT	Milky River
Bristol Bay Outcrop		40	04RR163C			0.448	14.1			2.73	OUT	Bear Lake
Bristol Bay Outcrop		41	CP1-11	0.190	0.288		13.6			2.66	OUT	Bear Lake
Bristol Bay Outcrop		42	CP1-26	0.582	0.870		11.2			2.64	OUT	Bear Lake
Bristol Bay Outcrop		43	CP1-38	0.027	0.053		6.2			2.66	OUT	Bear Lake
Bristol Bay Outcrop		44	CP1-92	0.041	0.076		9.6			2.69	OUT	Bear Lake
Bristol Bay Outcrop		45	CP1-138	0.006	0.017		7.5			2.71	OUT	Bear Lake
Bristol Bay Outcrop		46	CP1-178			0.870	11.2			2.66	OUT	Bear Lake
Bristol Bay Outcrop		47	04RR168B	0.004	0.010		4.4			2.75	OUT	Tolstoi
Bristol Bay Outcrop		48	04RR8B			41.4	36.1			2.63	OUT	Bear Lake
Bristol Bay Outcrop		49	04RR8D			0.251	39.6			2.49	OUT	Bear Lake
Bristol Bay Outcrop		50	04RR8E			0.066	38.4			2.46	OUT	Bear Lake
Bristol Bay Outcrop		51	04RR9B	0.001	0.005		9.7			2.77	OUT	Kialagvik
Bristol Bay Outcrop		52	04RR11D	0.06	0.106		3.9			2.63	OUT	Kialagvik
Bristol Bay Outcrop		53	04TJR08	0.444	0.698		7.4			2.76	OUT	Kialagvik
Bristol Bay Outcrop		54	04DS04B			0.021	4.9			2.70	OUT	Kialagvik
Bristol Bay Outcrop		55	04DS09C			0.053	4.8			2.74	OUT	Kialagvik
Bristol Bay Outcrop		56	04RR3B			0.027	13.4			2.70	OUT	Kialagvik
Bristol Bay Outcrop		57	04RR6B	0.002	0.008		2.7			2.51	OUT	Naknek
Bristol Bay Outcrop		58	04RR23A	0.005	0.014		1.5			2.68	OUT	Naknek
Bristol Bay Outcrop		59	04TJR09	0.026	0.051		5.3			2.52	OUT	Naknek
Bristol Bay Outcrop		60	04RR2C	0.074	0.126		3.8			2.63	OUT	Naknek
Bristol Bay Outcrop		61	04RR12B	0.114	0.184		5.0			2.61	OUT	Naknek
Bristol Bay Outcrop		62	04RR2D	0.137	0.216		4.6			2.60	OUT	Naknek
Bristol Bay Outcrop		63	04RR7D	1.562	2.195		4.5			2.56	OUT	Naknek
Bristol Bay Outcrop		64	04RR19B	2.433	3.382		6.3			2.62	OUT	Naknek
Bristol Bay Outcrop		65	04RR26B	3.829	5.366		4.6			2.61	OUT	Naknek
Bristol Bay Outcrop		66	04RR20B			0.223	13.9			2.74	OUT	Naknek

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

Well	Core	Plug	Depth/Sample	K klink	K air	K probe	Porosity	So	Sw	Density	Type	Unit
			(ft)	(md)	(md)	(md)	(%)	(%)	(%)	(g/cc)		
Bristol Bay Outcrop		67	04RR22B			48.1	6.5			2.56	OUT	Naknek
Bristol Bay Outcrop		68	04RR6D			20	7.2			2.71	OUT	Naknek
Bristol Bay Outcrop		69	04RR7B			37.7	7.2			2.57	OUT	Naknek
Bristol Bay Outcrop		70	04RR30B	0.002	0.006		3.5			2.70	OUT	Shelikof
Bristol Bay Outcrop		71	04RR18B	0.004	0.01		3.6			2.62	OUT	Shelikof
Bristol Bay Outcrop		72	04RR1D	0.005	0.014		6.7			2.63	OUT	Shelikof
Bristol Bay Outcrop		73	04RR16B	0.006	0.016		3.7			2.73	OUT	Shelikof
Bristol Bay Outcrop		74	04RR15G	0.008	0.019		5.3			2.73	OUT	Shelikof
Bristol Bay Outcrop		75	04RR29A	0.008	0.02		5.2			2.65	OUT	Shelikof
Bristol Bay Outcrop		76	04RR28B	0.043	0.079		7.7			2.80	OUT	Shelikof
Bristol Bay Outcrop		77	04RR15B	0.11	0.178		8.5			2.73	OUT	Shelikof
Bristol Bay Outcrop		78	04RR15D	0.165	0.254		6.4			2.71	OUT	Shelikof
Bristol Bay Outcrop		79	04RR13B	0.374	0.522		4.9			2.69	OUT	Shelikof
Bristol Bay Outcrop		80	04RR18D	0.446	0.689		8.4			2.73	OUT	Shelikof
Bristol Bay Outcrop		81	04RR30D			0.462	10.1			2.70	OUT	Shelikof
Bristol Bay Outcrop		82	CT1000		12.46		42.9			2.72	OUT	Tachilni
Bristol Bay Outcrop		83	SL2149		95		38.3			2.68	OUT	Tachilni
Bristol Bay Outcrop		84	SL2154		9785		30.7			2.76	OUT	Tachilni
Bristol Bay Outcrop		85	NSF2118		17.7		16.2			2.69	OUT	Bear Lake
Bristol Bay Outcrop		86	MR2041		55.6		24.0			2.63	OUT	Bear Lake
Bristol Bay Outcrop		87	MR2045		76.3		20.3			2.61	OUT	Bear Lake
Bristol Bay Outcrop		88	MR2051		74.7		22.0			2.54	OUT	Bear Lake
Bristol Bay Outcrop		89	SL2167		599		33.3			2.60	OUT	Bear Lake
Bristol Bay Outcrop		90	MP3102		6.64		20.7			2.69	OUT	Unga
Bristol Bay Outcrop		91	NUI3030		3640		35.9			2.61	OUT	Unga
Bristol Bay Outcrop		92	ZB3039		20.1		51.7			2.70	OUT	Unga
Bristol Bay Outcrop		93	LUL2183		0.2		10.1			2.66	OUT	Ugashik
Bristol Bay Outcrop		94	LUL2189		0.57		7.5			2.61	OUT	Ugashik
Bristol Bay Outcrop		95	BR5000		1.23		11.6			2.75	OUT	Belkofski
Bristol Bay Outcrop		96	BR5002		0.05		1.1			2.71	OUT	Belkofski
Bristol Bay Outcrop		97	BR5004		0.21		9.0			2.63	OUT	Belkofski
Bristol Bay Outcrop		98	BR5008		0.05		8.6			2.69	OUT	Belkofski
Bristol Bay Outcrop		99	BR5014		0.05		1.4			2.61	OUT	Belkofski
Bristol Bay Outcrop		100	BR5016		0.05		7.7			2.71	OUT	Belkofski
Bristol Bay Outcrop		101	BR5018		0.85		11.4			2.60	OUT	Belkofski
Bristol Bay Outcrop		102	BC4000		0.05		6.5			2.68	OUT	Belkofski
Bristol Bay Outcrop		103	KA5021		0.05		2.3			2.73	OUT	Belkofski
Bristol Bay Outcrop		104	KA5022		0.05		3.4			2.72	OUT	Belkofski
Bristol Bay Outcrop		105	KA5023		0.05		7.1			2.75	OUT	Belkofski
Bristol Bay Outcrop		106	KA5024		0.05		4.2			2.64	OUT	Belkofski
Bristol Bay Outcrop		107	KA5025		0.05		2.8			2.71	OUT	Belkofski
Bristol Bay Outcrop		108	KA5026		0.05		6.2			2.66	OUT	Belkofski
Bristol Bay Outcrop		109	KA5027		0.08		7.8			2.70	OUT	Belkofski
Bristol Bay Outcrop		110	KA5028		0.05		6.4			2.68	OUT	Belkofski
Bristol Bay Outcrop		111	KA5029		0.05		6.4			2.72	OUT	Belkofski
Bristol Bay Outcrop		112	SC3007		0.93		7.6			2.57	OUT	Belkofski
Bristol Bay Outcrop		113	SC3008		0.34		6.5			2.58	OUT	Belkofski
Bristol Bay Outcrop		114	SC3009		1.06		8.9			2.60	OUT	Belkofski
Bristol Bay Outcrop		115	SC3010		1.4		9.4			2.61	OUT	Belkofski
Bristol Bay Outcrop		116	SC3011		0.5		12.3			2.53	OUT	Belkofski
Bristol Bay Outcrop		117	SC3013		0.25		11.7			2.66	OUT	Belkofski
Bristol Bay Outcrop		118	SC3014		0.15		9.3			2.61	OUT	Belkofski
Bristol Bay Outcrop		119	SC3016		0.19		8.2			2.63	OUT	Belkofski
Bristol Bay Outcrop		120	SC3018		0.05		15.1			2.70	OUT	Belkofski
Bristol Bay Outcrop		121	SC3023		0.15		13.2			2.68	OUT	Belkofski
Bristol Bay Outcrop		122	SC3024		0.07		10.0			2.59	OUT	Belkofski
Bristol Bay Outcrop		123	SC3025		0.24		9.0			2.64	OUT	Belkofski
Bristol Bay Outcrop		124	SFP3000		0.05		5.4			2.68	OUT	Belkofski
Bristol Bay Outcrop		125	SFP3002		0.05		14.1			2.78	OUT	Belkofski
Bristol Bay Outcrop		126	UI1026		13.7		14.0			2.68	OUT	Stepovak
Bristol Bay Outcrop		127	AB5180		0.05		10.0			2.69	OUT	Stepovak
Bristol Bay Outcrop		128	AB5182		0.05		3.9			2.69	OUT	Stepovak
Bristol Bay Outcrop		129	AB5183		1.04		7.0			2.68	OUT	Stepovak
Bristol Bay Outcrop		130	AB5188		0.05		6.5			2.72	OUT	Stepovak
Bristol Bay Outcrop		131	AB5190		0.05		5.3			2.75	OUT	Stepovak
Bristol Bay Outcrop		132	AB5192		0.05		3.8			2.69	OUT	Stepovak
Bristol Bay Outcrop		133	AB6009		0.95		4.9			2.77	OUT	Stepovak
Bristol Bay Outcrop		134	CB5057		0.05		11.1			2.67	OUT	Stepovak
Bristol Bay Outcrop		135	CB5075		0.15		8.8			2.69	OUT	Stepovak

Well	Core	Plug	Depth/Sample (ft)	K klink (md)	K air (md)	K probe (md)	Porosity (%)	So (%)	Sw (%)	Density (g/cc)	Type	Unit
Bristol Bay Outcrop		136	CB5078		0.05		14.0			2.72	OUT	Stepovak
Bristol Bay Outcrop		137	CB5088		0.05		15.5			2.65	OUT	Stepovak
Bristol Bay Outcrop		138	MP3057		0.05		16.9			2.68	OUT	Stepovak
Bristol Bay Outcrop		139	MP3062		0.06		10.7			2.65	OUT	Stepovak
Bristol Bay Outcrop		140	MP3077		0.13		8.9			2.71	OUT	Stepovak
Bristol Bay Outcrop		141	MR2115		0.25		21.2			2.89	OUT	Stepovak
Bristol Bay Outcrop		142	MsR4080		0.05		10.4			2.75	OUT	Stepovak
Bristol Bay Outcrop		143	MsR4083		0.69		5.3			2.65	OUT	Stepovak
Bristol Bay Outcrop		144	MsR4105		0.05		5.0			2.72	OUT	Stepovak
Bristol Bay Outcrop		145	PB4016		0.05		3.9			2.66	OUT	Tolstoi
Bristol Bay Outcrop		146	PB4022		0.05		9.0			2.66	OUT	Tolstoi
Bristol Bay Outcrop		147	PB4024		0.05		6.8			2.72	OUT	Tolstoi
Bristol Bay Outcrop		148	PB4025		0.05		6.9			2.68	OUT	Tolstoi
Bristol Bay Outcrop		149	PB4027		0.05		10.5			2.70	OUT	Tolstoi
Bristol Bay Outcrop		150	PB4028		0.1		10.8			2.68	OUT	Tolstoi
Bristol Bay Outcrop		151	PB4032		0.05		11.1			2.72	OUT	Tolstoi
Bristol Bay Outcrop		152	PB4033		0.05		8.1			2.68	OUT	Tolstoi
Bristol Bay Outcrop		153	PB4035		0.05		7.1			2.70	OUT	Tolstoi
Bristol Bay Outcrop		154	PB4036		0.05		4.6			2.75	OUT	Tolstoi
Bristol Bay Outcrop		155	PB4039		0.05		7.6			2.75	OUT	Tolstoi
Bristol Bay Outcrop		156	PB4041		0.05		5.1			2.71	OUT	Tolstoi
Bristol Bay Outcrop		157	PB4050		0.05		12.0			2.69	OUT	Tolstoi
Bristol Bay Outcrop		158	PB4053		0.05		6.2			2.66	OUT	Tolstoi
Bristol Bay Outcrop		159	KI2000		0.09		6.2			2.70	OUT	Tolstoi
Bristol Bay Outcrop		160	IB2004		0.05		3.5			2.72	OUT	Tolstoi
Bristol Bay Outcrop		161	IB2008		0.05		3.0			2.69	OUT	Tolstoi
Bristol Bay Outcrop		162	IB2016		0.44		4.8			2.67	OUT	Tolstoi
Bristol Bay Outcrop		163	IB2017		0.13		5.8			2.70	OUT	Tolstoi
Bristol Bay Outcrop		164	IB2019		2.75		3.5			2.66	OUT	Tolstoi
Bristol Bay Outcrop		165	IB2025		0.38		3.2			2.68	OUT	Tolstoi
Bristol Bay Outcrop		166	IB2028		0.23		6.6			2.73	OUT	Tolstoi
Bristol Bay Outcrop		167	IB2030		1.03		10.1			2.70	OUT	Tolstoi
Bristol Bay Outcrop		168	IB2136		0.06		5.8			2.67	OUT	Tolstoi
Bristol Bay Outcrop		169	IB2147		68.1		35.8			2.70	OUT	Tolstoi
Bristol Bay Outcrop		170	MsR4111		0.05		0.9			2.71	OUT	Tolstoi
Bristol Bay Outcrop		171	MsR4119		0.05		6.5			2.67	OUT	Tolstoi
Bristol Bay Outcrop		172	MsR4120		0.05		5.9			2.67	OUT	Tolstoi
Bristol Bay Outcrop		173	MsR4122		0.05		5.7			2.69	OUT	Tolstoi
Bristol Bay Outcrop		174	MsR5108		0.05		3.8			2.69	OUT	Tolstoi
Bristol Bay Outcrop		175	MsR5116		0.05		3.1			2.67	OUT	Tolstoi
Bristol Bay Outcrop		176	MsR5120		0.05		6.2			2.67	OUT	Tolstoi
Bristol Bay Outcrop		177	MsR5124		0.05		2.7			2.70	OUT	Tolstoi
Bristol Bay Outcrop		178	MsR5132		0.07		7.5			2.61	OUT	Tolstoi
Bristol Bay Outcrop		179	MsR5139		0.05		4.5			2.68	OUT	Tolstoi
Bristol Bay Outcrop		180	MsR5141		0.11		5.8			2.71	OUT	Tolstoi
Bristol Bay Outcrop		181	K2258		0.05		2.7			2.72	OUT	Kaguyak
Bristol Bay Outcrop		182	K2261		0.05		3.8			2.73	OUT	Kaguyak
Bristol Bay Outcrop		183	K2264		0.05		3.4			2.73	OUT	Kaguyak
Bristol Bay Outcrop		184	K2267		0.05		4.9			2.72	OUT	Kaguyak
Bristol Bay Outcrop		185	K2272		0.05		4.4			2.71	OUT	Kaguyak
Bristol Bay Outcrop		186	K2275		0.05		8.0			2.72	OUT	Kaguyak
Bristol Bay Outcrop		187	K2278		0.05		6.8			2.71	OUT	Kaguyak
Bristol Bay Outcrop		188	K2281		0.05		5.7			2.70	OUT	Kaguyak
Bristol Bay Outcrop		189	K2284		0.05		3.7			2.72	OUT	Kaguyak
Bristol Bay Outcrop		190	K2287		0.05		9.6			2.71	OUT	Kaguyak
Bristol Bay Outcrop		191	CC3154		0.2		5.8			2.64	OUT	Naknek
Bristol Bay Outcrop		192	KH3147		0.51		11.7			2.65	OUT	Naknek
Bristol Bay Outcrop		193	KH3150		0.64		8.0			2.64	OUT	Naknek
Bristol Bay Outcrop		194	KH3151		0.3		7.3			2.64	OUT	Naknek
Bristol Bay Outcrop		195	KH3152		0.34		7.2			2.68	OUT	Naknek
Bristol Bay Outcrop		196	KH3153		0.3		7.8			2.65	OUT	Naknek