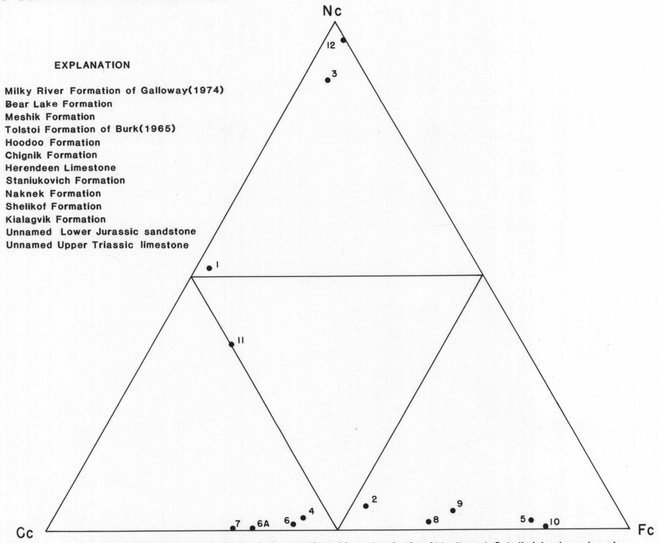
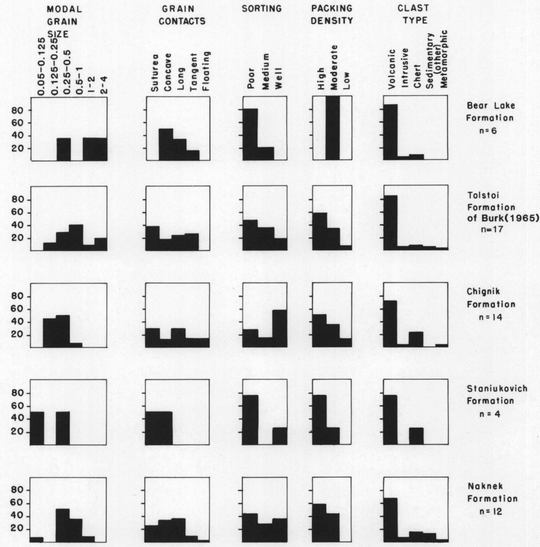
DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

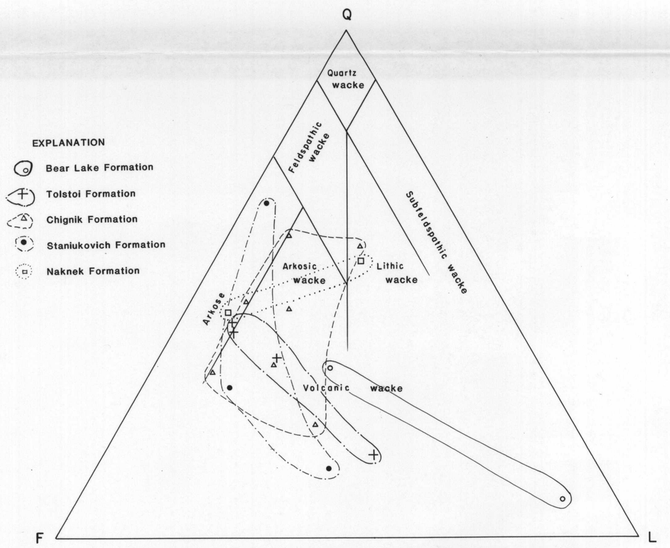
FOLIO OF CHIGNIK AND SUTWIK ISLAND QUADRANGLE, ALASKA
MISCELLANEOUS FIELD STUDIES MAP MF-1053-L
SHEET 2 OF 2
DETTERMAN AND OTHERS—ENERGY RESOURCES



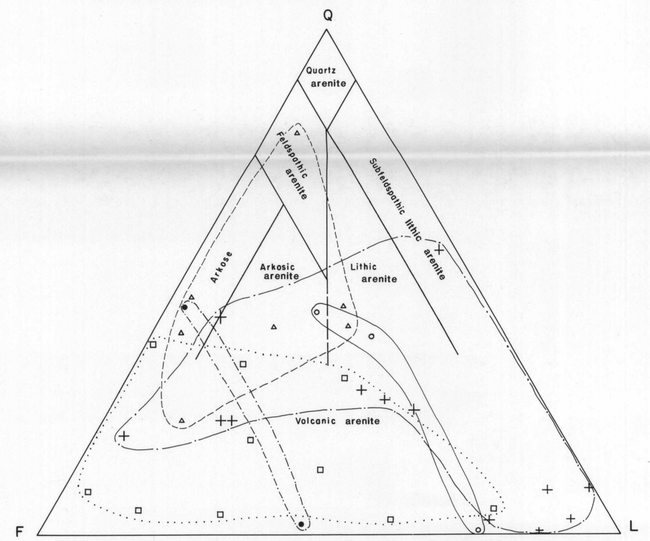
Ternary plot showing composition of the stratigraphic units in the Chignik and Sutwik Island quadrangles, Cc, coarse clastic rocks; Fc, fine clastic rocks; Nc, non-clastic rocks.



Histograms showing textural properties of surface sandstones from selected formations in the Chignik and Sutwik Island quadrangles, Alaska. The more favorable reservoir chacteristics for each textural category appear towards the right of each parameter shown. n, number of samples.



Ternary plots for wackes from surface exposures of Mesozoic and Tertiary rocks in the Chignik and Sutwik Island quadrangles, Alaska. Classification system for wackes from Williams, Turner, and Gilbert (1958). Q, monocrystalline and polycrystalline quartz, quartzite, and chert, F, feldspar, L, lithic grains.



Ternary plot for arenites from surface exposures of Mesozoic and Tertiary rocks in the Chignik and Sutwik Island quadrangles, Alaska. Symbols and lines the same as used for wackes. Classification system for arenites from Williams, Turner. and Gilbert (1958). Q, monocrystalline and polycrystalline quartz, quartzite, and chert F. feldspar, L, lithic grains

Table 3.--Estimated undiscovered oil and gas in the Chignik and Sutwik Island quadrangles, Alaska

AREA	PLAY	TRAP	OIL AND GAS IN PLACE Max.	OIL AND GAS IN PLACE Min.	OIL AND GAS IN PLACE Most likely	ESTIMATED PRIMARY RECOVERY FACTOR	AVERAGE DEPTH OF POTENTIAL RESOURCE (m)
1	Tertiary: Bear Lake Formation Tolstoi Formation of Burk (1965)	Channel sandstone, unconformity, slight structural high.	40 X 10^6 bbls., 30 X 10^9 ft^3	4 X 10^6 bbls., 5 X 10^9 ft^3	12 X 10^6 bbls., 30 X 10^9 ft^3	35% 75%	3,600
2	Tertiary: Bear Lake Formation Tolstoi Formation of Burk (1965)	Structural high, unconformity.	35 X 10^6 bbls., 40 X 10^9 ft^3	3 X 10^6 bbls., 5 X 10^9 ft^3	8 X 10^6 bbls., 20 X 10^9 ft^3	35% 75%	3,000
3	Mesozoic: Chignik Formation Lower part of Naknek Formation Unnamed Lower Jurassic sandstone	Structural high, unconformity.	35 X 10^6 bbls., 50 X 10^9 ft^3	3 X 10^6 bbls., 5 X 10^9 ft^3	10 X 10^6 bbls., 20 X 10^9 ft^3	25% 60%	2,700

Table 2.--Data on lithologic characteristics and organic content of the stratigraphic units in the Chignik and Sutwik Island quadrangles, Alaska

Stratigraphic unit	Lithology and environment of deposition	Thickness (m)	Sand-shale ratio	Clastic ratio	Porosity-permeability (%) (mD)	Reservoir characteristics and potential	Source bed potential	Maturation index	Organic carbon	Potential plays and trap type	Remarks
Milky River Formation of Galloway (1974)	Volcanoclastic sedimentary and volcanic rocks. Nonmarine fluvial.	500-800	4-16; increases to south.	Average about 13; increases to north; non-clastic rocks all volcanic.	No data	Abundant tuffaceous material and zeolites. Fair.	Poor; minor woody and coaly material.	Immature; soft brown coaly material.	No data	Not prospective	Depth of burial not sufficient to produce hydrocarbons; may contain local pockets of biogenic gas. May be prospective with greater sediment overburden in offshore Bristol Bay.
Bear Lake Formation	Inner neritic to nonmarine fluvial sandstone, conglomerate, siltstone, shale, and coal.	1,440-2,360	0.5-1.6; increases to south.	Average 75; increases to south; non-clastic rocks all volcanic.	29.5%, 263 mD; avg 17 subsurface samples. 33.3%, 426 mD; avg 3 surface samples.	Considerable tuffaceous material, little diagenetic alteration; overall. Excellent.	Moderate; abundant coaly and woody material.	Immature to marginally mature; hard lignite to subbituminous.	Ranges from 0.25 to 13% from well data in adjoining area (McLean, 1977).	Areas 1 and 2; channel pinch out, structural high.	Lower part of formation probably most prospective; rocks mature and capable of producing hydrocarbons; numerous channel sandstones and conglomerates that have good porosity and permeability; potential greater offshore in Bristol Bay. Analog: Cook Inlet.
Meshik Formation	Volcanic flows, tuffs, and breccias; minor volcanoclastic sedimentary rocks.	1,400-1,700	1.5	0.09; non-clastic rocks all volcanic.	No data	Poor	Poor; minor woody and coaly material.	Immature to marginally mature.	No data	Not prospective	Primarily a volcanic rock unit with little or no source bed or reservoir potential. May serve locally as a seal for underlying reservoirs.
Tolstoi Formation of Burk (1965)	Mainly nonmarine fluvial sandstone, conglomerate, siltstone, shale, and coal.	800-1,500	0.75-1.5; increases to north.	78; non-clastic rocks all volcanic.	2.2-4.4%, 0.07 to 1.79 mD; outcrop samples.	Considerable tuffaceous material. Fair to good.	Moderate; mainly woody and coaly.	Marginally mature to mature; subbituminous to bituminous.	Avg 6.9% from outcrop samples, 9.6% from subsurface data in adjoining area (McLean, 1977).	Areas 1 and 2; channel and lenticular bed pinch out, structural high.	Channel sandstones and conglomerate in middle part of section most prospective; abundant tuffaceous material in upper part severely reduces porosity and permeability. Analog: Cook Inlet.
Hoodoo Formation	Dark siltstone and shale; minor sandstone; deep-water turbidite.	0-550	0.25	100% clastic rocks	No data	Dirty, fine grained. Poor.	Moderate to good; woody to amorphous sapropel.	Mature	3.6% from limited outcrop samples.	Not prospective; source bed potential only.	Stratigraphic unit occurs only along Pacific coast of the Alaska Peninsula. Structural position and abundant, associated intrusive rocks preclude any potential for hydrocarbons. May have some potential in offshore areas.
Chignik Formation	Inner neritic to nonmarine fluvial sandstone, conglomerate, siltstone, shale, and coal.	About 100 to 490; thins to northeast.	1.15	100% clastic rocks	1.9-8%, 0.26 to 2.06 mD; outcrop samples.	Some diagenetic alteration and cementation. Fair to good.	Moderate to good; mainly woody and coaly.	Mature; high volatile B-bituminous.	Avg 13.2% from surface outcrops.	Area 3; anticline and unconformity.	Good sandstones in upper part of section may be truncated in area 3 by unconformity at base of Tolstoi Formation. Sandstone oil saturated at Chignik Lagoon. Analog: Cook Inlet, San Joaquin Valley, Calif
Herendeen Limestone	Calcarenite composed of Inoceramus prisms; shallow water, high energy.	0 to about 30; present only locally.	10	100% clastic rocks	No data	Probably good	Poor	Mature	No data	Not prospective	Restricted to a few small areas. Believed to have been removed from most of the Chignik and Sutwik Island area by erosion predating deposition of the Chignik Formation. May be present in subsurface in the southwestern part of the Chignik quadrangle.
Staniukovich Formation	Thin, feldspathic to arkosic sandstone with laumontite; some siltstone and shale. Inner neritic.	About 100 to 300; thins to northeast.	1.75	100% clastic rocks	No data	Fair due to laumontite	Poor	Mature	No data	Not prospective	Laumontite and other zeolite minerals markedly reduce visual porosity. In many areas, has been removed by erosion predating deposition of the Chignik Formation.
Naknek Formation	Upper part: offshore, marine; dark siltstone and shale, some sandstone. Lower part: mainly nonmarine fluvial sandstone and conglomerate.	About 1,200 to 1,800; thicker and coarser grained to NE.	Upper part: 0.5-0.8; lower part: 1.5-1.9	About 95 to 98; rest limestone.	1.1-1.9%, 0.01 to 0.99 mD; lower part.	Considerable recementation of grains. Upper part: poor; lower part: fair to good.	Upper part good; lower part poor. Mainly woody debris.	Mature	Ranges from 0.1 to 0.5% from well data in adjoining area (McLean, 1977).	Area 3; anticline, unconformity, lenses, channels, onlap.	Siltstone and shale in upper part of unit are potential source beds; reservoir potential restricted to channel sandstone and conglomerate in the lower part of unit; diagenetic alteration may substantially reduce porosity and permeability. Analog: Cook Inlet, Sacramento Basin, Calif.
Shelikof Formation	Mainly thin, dark siltstone and shale with massive conglomerate lenses. Deep-water turbidite.	220 exposed; probably about 1,000 in subsurface.	About 0.18 to 0.35 in adjoining area.	About 50; non-clastic rocks all limestone.	Avg 5.1%, 0.16 mD; from adjoining area. Magoon (written commun., 1980).	Sandstone and conglomerate, very dirty. Generally poor, may be good locally.	Fair to moderate	Mature to supramature	Avg 0.57% from adjoining area (Magoon, written commun., 1980).	Not prospective; source bed potential only.	Rocks generally very argillaceous and fine grained. Sandstone and conglomerate lenses formed by deep-sea fan deposits may have some potential, but lack of exposures and subsurface data in quadrangles make prediction of their occurrence impossible.
Kialagvik Formation (Probably present in subsurface)	Mainly thin-bedded siltstone and shale containing dirty sandstone interbeds. Deep water to outer neritic.	600-730	Avg 0.06-0.13 from adjoining area.	Minor non-clastic rocks all limestone.	Avg 6.9%, 0.26 mD; from adjoining area. Magoon (written commun., 1980).	Rock diagenetically altered and recemented. Poor.	Moderate	Mature to supramature; semi-anthracite coaly fragments.	Avg 1.04% from adjoining area (Magoon, written commun., 1980).	Not prospective; source bed potential only.	Rocks generally dirty and fine-grained deep-water deposits. Few sandstone and conglomerate lenses formed as part of deep-water fan deposits may have potential for hydrocarbons, but lack of subsurface data makes the prediction of the occurrence impossible.
Unnamed Lower Jurassic sandstone (Probably present in subsurface)	Medium-bedded to massive calcareous and tuffaceous sandstone. Outer to inner neritic.	250-600	About 18 from adjoining area.	About 6.5; non-clastic rocks all volcanic.	Avg 4.4%, 0.03 mD; from adjoining area. Magoon (written commun., 1980).	Considerable tuffaceous material and zeolites. Moderate.	Fair	Mature to supramature	Avg 0.4% from adjoining area (Magoon, written commun., 1980).	Area 3; anticline.	Rocks not exposed in area, but data from adjoining areas indicate they probably are present; subsurface data lacking.
Unnamed Upper Triassic limestone (probably present in sursurface)	Thin-bedded to massive limestone with interbedded flows and tuffs. Inner shelf.	500-800	0	0; about 75% limestone and 25% volcanic rocks.	No data	Limestone very dense and in part recrystallized and silicified. Poor.	Moderate to good	Mature to supramature	Avg 1.5% from adjoining area (Magoon, written commun., 1980).	Not prospective; source bed potential only.	The fine-grained, dense, silicified, and partly recrystallized limestone present in outcrop indicate this unit is probably not a reservoir for hydrocarbons. Expected to be a source of oil and gas in overlying rock units.

TABLES, TERNARY PLOTS, AND HISTOGRAMS OF ROCK UNITS.

MAP SHOWING ONSHORE ENERGY RESOURCES OF THE CHIGNIK AND SUTWIK ISLAND QUADRANGLES, ALASKA

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