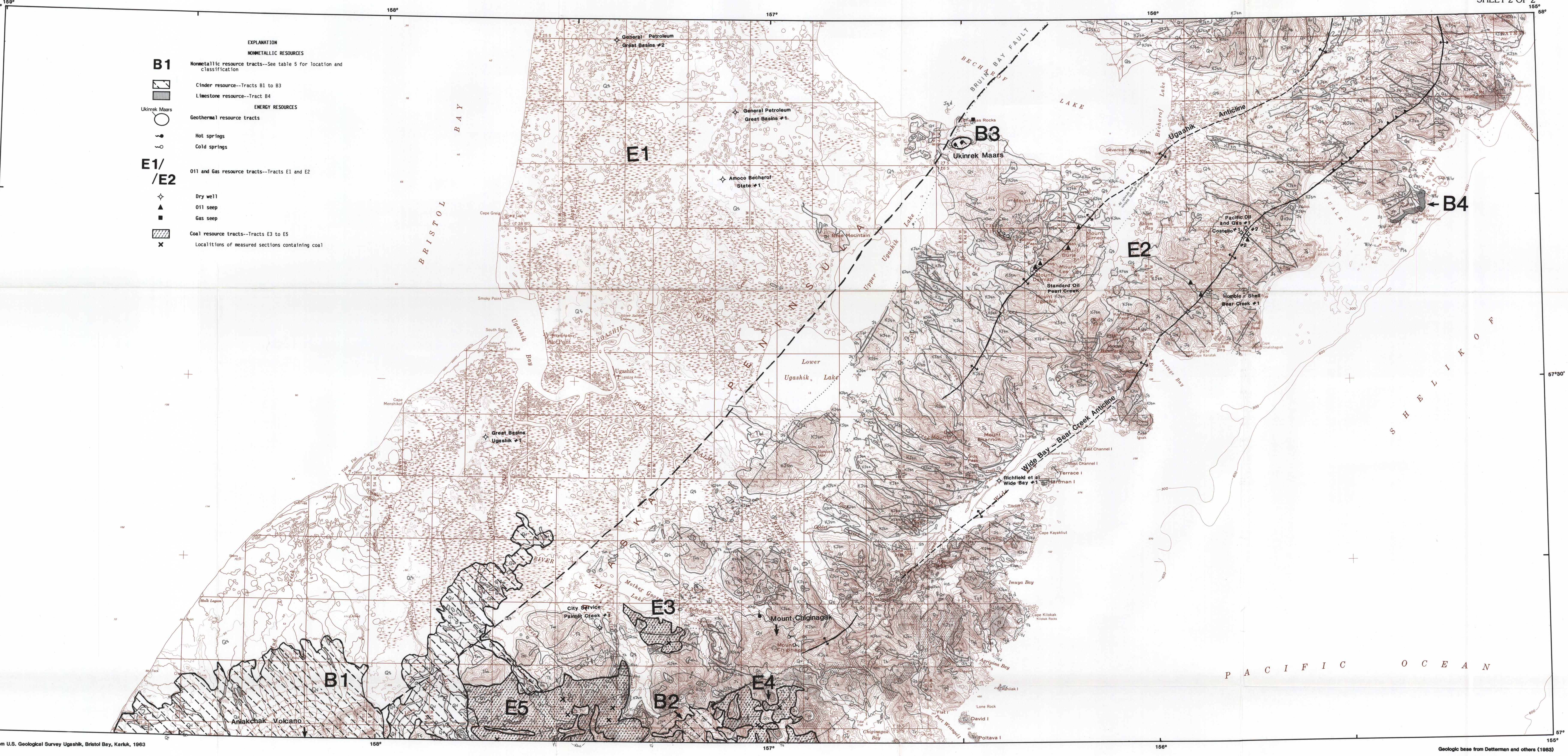


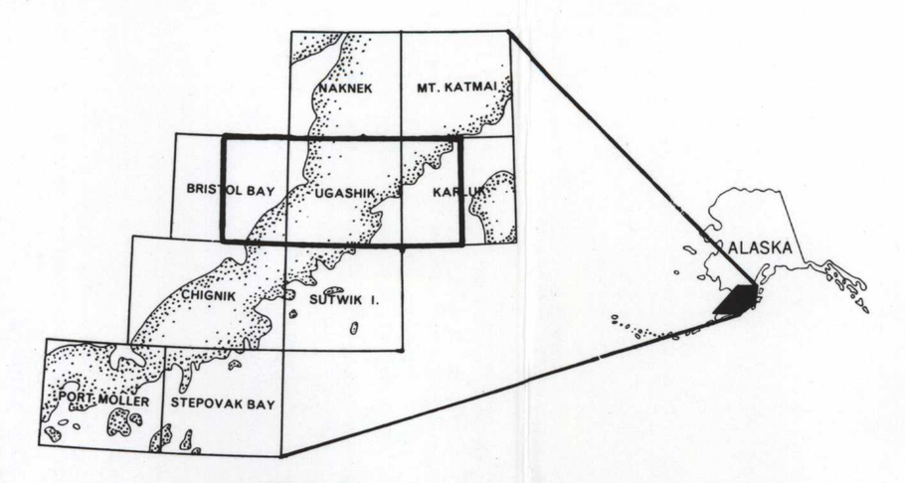
Base from U.S. Geological Survey Ugashik, Bristol Bay, Karluk, 1963

Geologic base from Detterman and others (1983)

Manuscript approved for publication March 15, 1989

SCALE 1:250 000

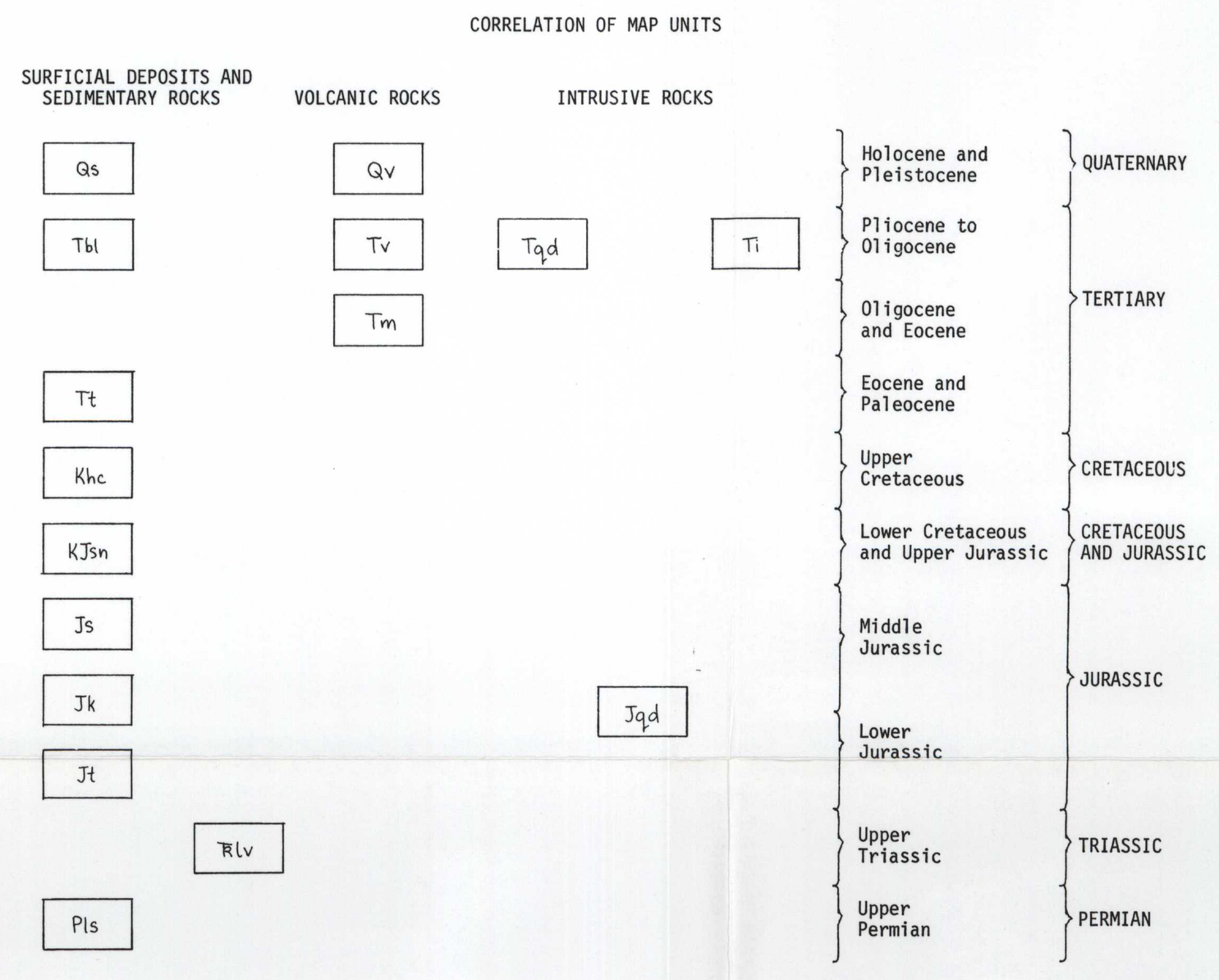
CONTOUR INTERVAL 200 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929



Map Area

MAP B.--ENERGY AND NONMETALLIC RESOURCES

CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

SURFICIAL DEPOSITS AND SEDIMENTARY ROCKS

Qs — SURFICIAL DEPOSITS (HOLOCENE AND PLEISTOCENE) - Unconsolidated alluvium, alluvial fans, and glacial, marine, lake, swamp, eolian, and landslide deposits; mainly silt, sand, gravel, pumice, and rock fragments

Tbl — BEAR LAKE FORMATION (MIOCENE) - Sandstone, siltstone, shale, minor coal, and conglomerate; nonmarine

Tt — TOLSTOI FORMATION (EOCENE AND PALEOCENE) - Sandstone, conglomerate, siltstone, shale, coal, and tuff; dominantly volcaniclastic and nonmarine

Khc — HOODOO AND CHIGNIK FORMATIONS, UNDIVIDED (UPPER CRETACEOUS) - Hoodoo Formation: dark rhythmically-bedded siltstone and shale, minor thin sandstone; deep-water marine. Chignik Formation: sandstone, conglomerate, siltstone, and shale; mainly shallow marine

KJsn — STANIUKOVICH AND NAKNEK FORMATIONS, UNDIVIDED (LOWER CRETACEOUS AND UPPER JURASSIC) - Staniukovich Formation of Late Jurassic and Early Cretaceous age: thin-bedded feldspathic sandstone, commonly laumontitic; minor siltstone and shale. Naknek Formation of Late Jurassic age: thin-bedded sandstone, siltstone, and dark shale with limestone concretions in upper part. Massive arkosic sandstone and conglomerate in lower part; abundant granitic- and metamorphic-rock clasts in conglomerate. Upper part marine; lower part nonmarine fluvial

Js — SHELIKOF FORMATION (MIDDLE JURASSIC) - Dark siltstone and shale with limestone concretions, sandstone, and conglomerate; nonmarine to near-shore marine, and deep-water turbidite

Jk — KIALAGVIK FORMATION (MIDDLE AND LOWER JURASSIC) - Sandstone, siltstone, mudstone, and shale; mainly shallow water marine

Jt — TALKEETNA FORMATION (LOWER JURASSIC) - Tuffaceous sandstone, siltstone, and limestone; minor bedded tuff

Pls — LIMESTONE (UPPER PERMIAN) - Light-gray massive crystalline limestone

SEDIMENTARY AND VOLCANIC ROCKS

Ŧlv — LIMESTONE AND VOLCANIC ROCKS (UPPER TRIASSIC) - Light- to dark-gray thin-bedded to massive limestone, limestone conglomerate, and basalt

VOLCANIC ROCKS

Qv — VOLCANIC ROCKS (HOLOCENE AND PLEISTOCENE) - Block and ash flows, debris flows, volcanic mud flows, cinder cones, and andesitic and dacitic lava flows; includes minor hypabyssal rocks

Tv — VOLCANIC ROCKS (PLIOCENE TO OLIGOCENE) - Basalt, andesite, and dacite lava flows, volcanic breccia, and rubble flows; locally includes hypabyssal rocks

Tm — MESHIK FORMATION (OLIGOCENE AND EOCENE) - Basalt flows, volcanic rubble flows, and lahars; locally minor volcanogenic sedimentary rocks

INTRUSIVE ROCKS

Tqd — QUARTZ DIORITE (PLIOCENE TO OLIGOCENE) - Agripina Bay pluton; hornblende-biotite and pyroxene-biotite quartz diorite; medium to coarse grained

Ti — INTRUSIVE ROCKS (PLIOCENE TO OLIGOCENE) - Diorite, quartz diorite, hypabyssal andesite and dacite

Jqd — QUARTZ DIORITE (MIDDLE AND LOWER JURASSIC) - Medium to coarse grained, hornblende and biotite bearing; part of the Alaska-Aleutian Range batholith

CONTACT--Dotted where concealed

FAULT--Dotted where concealed; queried where probable. U, upthrown side; D, downthrown side. Arrows indicate relative lateral movement

THRUST OR HIGH-ANGLE REVERSE FAULT--Dotted where concealed; sawteeth on upper plate

FOLDS--Showing trace of axial plane; dotted where concealed; queried where probable. Arrow indicates direction of plunge

Anticline

Syncline

LINEAMENT

VOLCANIC CRATER

VOLCANIC VENT OR CINDER CONE (OTHER THAN WITHIN CRATERS)

HORNFELS

ALTERATION--Includes sericitic alteration and silicification

Table 1.--Lode mineral occurrences in the Ugashik, Bristol Bay, and western Karluk quadrangles, Alaska

[Mineral abbreviations: py, pyrite; cpy, chalcopyrite; mly, molybdenite; gal, galena; sph, sphalerite; bar, barite; flu, fluorite; stib, stibnite; tet, tetrahedrite; mag, magnetite; --, no data]

Map No.	Geographic Locality	Location	Geologic Description	Minerals Present	Exploration Activity	Deposit Model Type (Cox and Singer, 1986)	Reference
1	Mike prospect	57°04'N 157°13'W	Mineralized rock occurs in a zone of silica flooding around and within a rhyolitic dome overlying a quartz monzonite stock. Sericitic alteration overlaps with the zone of SiO_2 and K_2O enrichment. Pyrite exceeds 5 percent over an area of about 3 km^2; molybdenite occurs as fine veinlets along quartz-filled fractures. A large breccia pipe occurs to the east of this main zone; a small Cu-skarn occurrence is also present.	py, cpy, mly, gal, sph, bar, flu	Three shallow drill holes by Bear Creek Mining Co. in 1977. (Kennecott Corporation, written commun., 1987).	Low-F porphyry molybdenum (deposit model 21b)	Church and others (1989).
2	Rex prospect	57°15'N 157°05'W	Mineralized rock occurs in hornfelsed rocks of the Chignik, Meshik, and Tolstoi Fms. overlying a pluton of Oligocene age. Chalcopyrite is present in both disseminations and stockwork, but molybdenite is present only in stockwork. Galena and sphalerite occur in the prophylitic zone that halos the prospect.	py, cpy, mly, gal, sph, bar, gold	Detailed geochemical exploration by Bear Creek Mining Co. in 1977 (Kennecott Corporation, written commun., 1987).	Porphyry copper-gold (deposit model 20c)	Church and others (1989).
3	Kanatak Lagoon	57°32'N 156°05'W	Lode claims for iron; MacKevett and Holloway (1977) suspect that they may be on magnetite segregations in or around this Pliocene (Wilson and Shew, 1988) granodiorite pluton. Case and others (1988) report very large magnetic anomalies associated with this intrusive. Geochemistry and mineralogy suggests possible Fe-skarn present.	mag	Unknown	Iron skarn(?) (deposit model 18d)	MacKevett and Holloway (1977); U.S. Bureau of Mines (1973).
4	Mount Becharof	57°32'N 156°10'W	---Do---	mag	--Do---	--Do---	---Do---
5	Ugashik River	57°40'N 156°18'W	Lode claim for copper(?) in "Naknek" Fm., possibly a contact zone along the margin of a dike.	--	--Do---	--Do---	---Do---
6	N. Fork Rex Creek	57°39'N 155°51'W	Lode claim for copper(?) in Shelikof Fm., possibly a contact zone along the margin of a dike.	--	--Do---	--Do---	---Do---
7	Sulfur Creek	57°42'N 155°47'W	---Do---	--	--Do---	--Do---	---Do---
8	Puale Bay (Cold Bay)	57°46'N 155°44'W	In 1920, an assay of a lode, consisting of chalcopyrite contained as much as 9.6 g gold, and 250 g silver per ton. This lode, located in rocks of the "Naknek" Fm. at the head of the bay, was reportedly traceable for about 1.5 km. We suspect this prospect is probably in a contact zone along the margin of a sill.	cpy	Location approximate; we were unable to verify this occurrence in the field. Some data in Berg and Cobb (1967).	--	Berg and Cobb (1967); U.S. Bureau of Mines (1973).
9	Cape Kubugalki	57°53'N 155°05'W	Quartz stringers in felsic dikes and Jurassic sedimentary rocks of the Shelikof Fm.	stib, mly, gal, tet, gold, mag	Some placer gold production (see table 2).	Polymetallic vein (deposit model 22c); carbonate-hosted gold (deposit model 26a)	Smith (1925); Cobb (1978).

Table 2.--Known placer occurrences in the Ugashik, Bristol Bay, and western Karluk quadrangles, Alaska

Map No.	Geographic Locality	Location	Commodity	Known Production	Reference
10	Cape Kubugakli	57°53'N 155°05'W	Au	Approx. 160 oz (5 kg)	Smith (1925)
11	Becharof Lake VABM "Marie"	57°55'N 155°57'W	Au	None	U.S. Bureau Mines (1973)
12	Margaret Creek	57°51'N 155°44'W	Au	----Do----	----Do----
13	Trail Creek	57°43'N 155°44'W	Au	----Do----	----Do----
14	Oil Creek	57°42'N 155°44'W	Au	----Do----	----Do----
15	Bear Creek	57°39'N 155°58'W	Au	----Do----	----Do----
16	Salmon Creek	57°38'N 155°59'W	Au	----Do----	----Do----
17	Salmon Creek	57°36'N 155°56'W	Au	----Do----	----Do----
18	Salmon Creek	57°39'N 156°03'W	Mo(?), U(?)	----Do----	----Do----
19	Moore Creek	57°35'N 156°28'W	Au	----Do----	----Do----
20	Pass Creek	57°24'N 156°22'W	Au	----Do----	----Do----
21	Bristol Bay coast Triangulation station "King"	57°53'N 157°38'W	Fe, Ti	----Do----	----Do----
22	Bristol Bay coast south of Cinder River	57°09'N 158°31'W	Fe, Ti, Au	----Do----	Berryhill (1963)

Table 4.--Metallic mineral resource tracts outlined in the Ugashik, Bristol Bay, and western Karluk quadrangles, Alaska

Tract (map A)	Geologic Summary	Summary of Deposit Types (Cox and Singer, (1986)	Mineral Deposit Model (Cox and Singer, (1986)
A1a	Mesozoic marine sedimentary rocks intruded by differentiated Pliocene pluton (Ti)	porphyry Mo, low-F polymetallic vein epithermal gold	21b 22c 25b
A1b	Tertiary nonmarine and volcanic rocks intruded by Oligocene to Pliocene hypabyssal dikes, stocks (Ti), and plutons (Tqd)	porphyry Cu volcanic-hosted Cu-As-Sb polymetallic veins epithermal gold	17 22a 22c 25d
A2	Mesozoic marine and early Tertiary nonmarine sedimentary rocks intruded by Oligocene hypabyssal dikes and plutons (Ti)	porphyry Cu-Au polymetallic veins epithermal gold	20c 22c 25b, 25d
A3	Mesozoic marine and early Tertiary nonmarine sedimentary rocks intruded by Oligocene hypabyssal dikes (Ti)	polymetallic veins epithermal gold	22c 25b, 25d
A4	Mesozoic marine sedimentary rocks intruded by Pliocene pluton (Tqd). Siltstone member of Shelikof Fm. contains some carbonate	porphyry Cu Fe-skarn polymetallic vein carbonate-hosted Au	17 18d 22c 26a
A5	Jurassic marine sedimentary rocks intruded by Miocene hypabyssal pluton (Tqd)	porphyry Cu polymetallic vein carbonate-hosted Au	17 22c 26a
A6	Jurassic marine sedimetary rocks intruded by Quaternary hypabyssal plugs (Qv)	porphyry Cu polymetallic vein epithermal vein	17 22c 25d
A7	Eroded Quaternary hypabyssal plug (Qv)	porphyry Cu epithermal gold	17 25d
A8	Jurassic marine sedimentary rocks intruded by late Cenozoic hypabyssal plutons, dikes, and sills (Qv)	porphyry Cu polymetallic vein epithermal gold	17 22c 25d

Table 3.--Geologic, geochemical, and geophysical attributes of several mineralized areas in the Ugashik, Bristol Bay, and wesern Karluk quadrangles, Alaska

[Mineralogical abbreviations: qtz, quartz; py, pyrite; cpy, chalcopyrite; mly, molybdenite; gal, galena; sph, sphalerite; bar, barite; mag, magnetite; hema, hematite; tour, tourmaline; sch, scheelite; flu, fluorite; stib, stibnite; tet, tetrahedrite; cin, cinnabar; --, no data]

Attributes	Tract A1a	Tract A1b				Tract A2	Tract A3	Tract A4	Tract A5	Tract A6a	Tract A8
	Mike prospect	Mt. Chiginagak-Chiginagak Bay	West side of Agripina Bay batholith	Kilokak Creek	David Island Poltava Island Ashiiak Island	Rex prospect	West of Painter Creek and east of Pumice Creek	Cape Igvak-Portage Bay	Cape Kubugakli	Kejulik volcanic rocks	Mt. Kialagvik
Geologic Environment											
Igneous texture and rock type	Qtz eye porphyritic dikes calc-alkaline pluton differentiated to rhyolitic plug	Porphyritic basalt to dacite	Adjacent to porphyritic qtz diorite	Hypabyssal andesite	Porphyritic andesite	Porphyritic qtz diorite	Porphyritic andesite	Medium-grained and porphyritic qtz diorite	Porphyritic andesite	Porphyritic basalt to dacite	Porphyritic andesite dikes
Age of igneous event[1]	Pliocene (2.8-4 Ma)	Late Miocene	Pliocene (2.8-4.2 Ma)	Oligocene (30 Ma)	--	Oligocene and Eocene(31-39 Ma)	Pliocene	Pliocene (2.4-5 Ma)	Miocene (15.6 Ma)	Quaternary	Oligocene (30 Ma)
Country rock[2]	KJsn, Khc, Tt	KJsn, Tt, Tv	KJsn	KJsn, Khc, Tv	Tv	Khc, Tt, Tm	Khc, Tt	Js, KJsn	Js	KJsn	Js, KJsn
Pyritic envelope (color anomaly)	Yes	Yes	Weak in country rock	Yes	No	Yes	Yes	--	--	Yes	Yes
Dike swarms	Yes	Yes	Yes	Yes	--	Yes	Yes	Yes	Yes	Yes	Yes
Tensional fracturing	Yes	--	--	--	No	Yes	--	Yes	--	--	--
Intrusive breccias	Breccia pipe and pebble dikes	No	No	Yes(?)	No	No	No	No	No	No	No
Igneous cupola	Yes	--	--	--	--	Yes	--	Yes	Yes	--	--
Level of erosion	Moderate	Shallow	Shallow to moderate	Shallow	Shallow	Shallow	Shallow	Shallow to moderate	Shallow	Shallow	Shallow
Type of alteration	Sericitic-phyllic surrounding silicified core area	Propylitic	Propylitic and sericitic in country rock	Propylitic and sericitic in country rock	Silicified and altered volcanic rock with quartz veins	Propylitic, phyllic, and potassic alteration	Sericitic	Propylitically altered intrusive, hornfelsed country rock; skarn mineralogical assemblage	Propylitic and sericitic hornsfelsed country rock	--	Propylitic
Observed form of mineralization	Cu-skarn, stockwork, disseminated sulfides, breccias, and vein mineralization	Disseminated	Disseminated in hornfelsed country rock	Disseminated in country rock	Massive pyritic lens	Stockwork and disseminated sulfides	Disseminated sulfides	Disseminated	Disseminated veins	Disseminated	Disseminated
Ore-related minerals observed in the rocks	py, mly, cpy, gal, sph, mag, hema flu	py	py	py, cpy	py, bar rutile	py, cpy, mly gal	py	py, cpy, epidote	py, stib, gal, tet, mly, mag, gold	py	py
Possible mineral deposit models[3]	21b, 22c, 25b	17, 22a, 22c, 25d	22c	17, 22c	22a, 25d	20c, 22c, 25b, 25d	22c, 25b, 25d	17, 18d, 22c, 26a	17, 22c, 26a	22c, 25b	17, 22c, 25b
Geochemical Expression											
Anomalous elemental concentrations in stream sediments[4]	Cu, Mo, Ag, Pb, Zn, B	Mo, Ag, Pb, Zn	Mo, Ag, Pb, Zn, B	Cu, Mo, Pb, Zn, B	--	Cu, Mo, Ag, Pb, Zn	Cu, Pb, Zn, B	Mo, Ag, Pb, Zn, B	Mo	--	Cu, Mo, Pb, Zn, B
Anomalous elemental concentrations in panned concentrates[5]	Cu, Mo, W, Ag, Pb, Zn, As, Cd, Ba, B, Bi, Au, Sn	Cu, Mo, W, Pb, Ag, Zn, B, As, Cd, Ba	Cu, Mo, W, Ag, Pb, Zn, B, As, Cd, Ba	Cu, Mo, Pb, As, Ag, Au, Ba	--	Cu, Mo, Pb, Ag, As, W, Au, Bi	Cu, Mo, Ag, Pb, Zn, B, As, Bi, Cd, Ba	Cu, Pb, Ag, Zn, B, As, W, Cd, Sn, Bi	Cu, B, Au, Ag, W	Cu, Mo, Ag, Sn, Cd	Cu, Pb, Zn, B, As, Bi, Ba
Mineralogy of the nonmagnetic heavy-mineral conentrates[6]	py, cpy, mly, sph, gal, tour, bar, cin, rutile	py, cpy, mly, tour, sph, bar	py, cpy, gal, cin, bar, tour, gold	py, cpy, tour, cin, bar, gold	--	py, cpy, sch, gold, tour	py, cpy, sph, cin, tour, bar	py, cpy, gal, sph, sch, tour, rutile, bar	py, cpy, tour, sch, gold	py, mly, gold, bar	py, bar
Anomalous elemental concentrations in rocks[7]	Cu, Mo, Pb, Zn, Ba, Au, Ag	Cu, Pb, Zn	Cu, Mo, Ba, Pb, Zn, Au	Cu, Pb, Ba, Au, Zn	Cu, Mo, Pb, Ag, As, Bi	Cu, Mo, Pb, Zn, Ag, Ba	Cu, Pb, Zn, Ba	Cu, Mo, Pb, Zn Ba, As, Ag	Cu, Mo, Pb, Zn, Au, Ag	--	Cu, Mo, Pb, Zn, Ba
Geophysical Expression											
Magnetic signature	Magnetic high to east of altered area underlain by pluton (area 17)[8].	Magnetic anomalies suggest buried plutons at depth; small hypabyssal plutons exposed (areas 19-22)[8].	Magnetic anomalies variable; band of magnetic anomalies along contact of intrusive (area 23)[8].	Magnetic high over Cape Kiloikak caused by intrusive; small lows may indicate hydrothermal alteration (area 23)[8].	Strong magnetic low occurs over altered volcanic rocks of David Island (area 24)[8].	Magnetic highs over pluton; magnetic low may be due to hydrothermal alteration (area 14)[8].	Magnetic high implies pluton at depth; magnetic low coincides with the altered area (area 16)[8].	Prominent magnetic high of more than 1000 gammas caused by quartz diorite pluton north of Cape Igvak (area 29)[8].	Prominent magnetic low of 200 gammas occurs over the Cape and extends off-shore to the east (area 32)[8].	Small magnetic anomalies probably associated with Kejulik volcanic flows (area 13)[8].	Highly variable magnetic signature over anomalous areas caused by volcanic rocks from Mt. Kialagvik (area 25)[8].

[1]Wilson and Shaw (1988)
[2]Detterman and others (1983)
[3]Cox and Singer (1986)
[4]Church and others (1988)
[5]Frisken, Church, Detra, and Willson (1988)
[6]Frisken, Church, and Willson (1988)
[7]Wilson and O'Leary (1986; 1987)
[8]Areas shown in description of magnetic signatures from Case and others (1988).

Table 5.--Localities and classification of nonmetallic resources in Ugashik, Bristol Bay, and western Karluk quadrangles, Alaska Peninsula

Tract No.	Geographic Area	Rock Type	Volume (10^6 m^3)	Resource Classification (U.S. Bureau of Mines and U.S. Geological Survey, 1980)	Commodity	Land Classification (U.S. Bureau Land Management, 1987)
B1	Aniakchak Volcano	Pyroclastic	1,300	Inferred; marginal	Pumice	Aniakchak National Monument and Preserve Alaska Peninsula National Wildlife Refuge
B2	Yantari Volcano	Pyroclastic	9	Inferred; subeconomic	Pumice	Alaska Peninsula National Wildlife Refuge
B3	Ukinrek Maars	Pyroclastic	5	Inferred; subeconomic	Cinders	Becharof National Wildlife Refuge
B4	Cape Kekurnoi	Limestone	220	Inferred; marginal	Limestone	Katmai National Park and Preserve

Table 6.--Data for assessment potential of Mesozoic rocks Ugashik and western Karluk quadrangles, Alaska

Stratigraphic unit	Lithology and Depositional Environment	Thickness, in meters	Porosity (%) Permeability (mD)	Average Organic Carbon (Wt.%)	Maturation Index	Remarks
Hoodoo Formation	Siltstone and shale; minor sandstone; marine.	<150	No data	3.6 from adjoining area (Detterman and others, 1984)	Mature.	Present only along Shelikof Strait; not thought to be prospective onshore; may be prospective under Shelikof Strait.
Chignik Formation	Thin-bedded sandstone, siltstone, mudstone and shale, limestone concretions; marine.	50-100	1.9-8% 0.26-2.06mD	13.2 from adjoining area (Detterman and others, 1984)	Mature.	Present locally; sandstones dirty and diagenetically altered; porosity and permeability probably less than in adjoining area; not considered prospective.
"Naknek" Formation	Upper part thin-bedded shelf sandstone; middle part siltstone; lower part sandstone and conglomerate, marine and nonmarine.	750-2,300	1.5-5.4% 0.08-0.39mD in lower part only	No data	Mature.	Numerous thick sandstones and conglomerate are prospective, but zeolite formation and alteration of feldspar to clay may have closed most pore space.
Shelikof Formation	Volcaniclastic sandstone, conglomerate, and siltstone; marine neritic to deep water.	1,000-1,500	1.3-11.9% Average 5.26% 0.01-1.17mD Average 0.19mD	3.3	Mature to supramature.	Thick sandstone and conglomerate locally with good porosity and permeability, but compaction and diagenetic alteration has greatly reduced both porosity and permeability.
Kialagvik Formation	Fine-grained sandstone, siltstone, shale, and minor amounts of conglomerate; marine.	700-900	No data	1.3	Mature to supramature.	High argillaceous content of sandstone and diagenetic alteration of minerals greatly reduced both porosity and permeability.
Talkeetna Formation	Calcareous and tuffaceous sandstone, siltstone, tuff, and minor amounts of limestone; marine.	200-300	3.4-6.1% 0.02-0.07mD	No data	Mature to supramature.	Diagenetic alteration of tuff has greatly reduced permeability; not considered prospective.
Triassic Limestones	Thin-bedded to massive limestone, shale, conglomerate, and minor amounts of volcanic rocks; inner shelf marine.	700-800	No data	0.91	Mature to supramature.	Fine-grained silicified, and partly recrystallized limestone not considered prospective. Local reef structures may have good porosity.

MINERAL AND ENERGY RESOURCE ASSESSMENT MAPS OF THE UGASHIK, BRISTOL BAY, AND WESTERN KARLUK QUADRANGLES, ALASKA

By

S. E. Church, R. L. Detterman, and F. H. Wilson

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