Preliminary Geologic Investigations of Western St. Lawrence Island, Alaska

GEOLOGICAL SURVEY PROFESSIONAL PAPER 684-C

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By WILLIAM W. PATTON, Jr., *and* BÉLA CSEJTEY, Jr.

SHORTER CONTRIBUTIONS TO GENERAL GEOLOGY

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PRELIMINARY GEOLOGIC INVESTIGATIONS OF WESTERN ST. LAWRENCE ISLAND, ALASKA

By William W. Patton, Jr., and Béla Csejtey, Jr.

ABSTRACT

Reconnaissance geologic mapping indicates that western St. Lawrence Island is underlain by a wide variety of volcanic, plutonic, and sedimentary rocks ranging in age from middle Paleozoic to late Cenozoic. The oldest rocks are dolomite of Devonian age and limestone and chert of Mississippian age; these rocks crop out in the northeastern part of the Putgut Plateau. They are overlain by a poorly exposed sequence of mudstone, black shale, chert, and limestone—a sequence which is at least in part, Triassic but which may also include rocks as old as Mississippian and as young as Cretaceous. Overlying this sequence is a widespread unit of andesitic and latitic flows and volcaniclastic rocks of Cretaceous age. Small patches of early Tertiary felsic flows occur on the Putgut Plateau, and terrigenous coal-bearing deposits of middle Tertiary age crop out around Niyrakpak Lagoon. Late Tertiary(?) and Quaternary basalt flows of the Kookooligit Mountains sequence crop out along the southeast flank of the Poovoot Range. Gabbro and diabase of probable Permian age are exposed in a narrow belt extending northwestward from Powooiliak Point, and quartz monzonite of Cretaceous age underlies about one-third of the mapped area in two large plutons, the Sevuokuk and Taphook.

Geochemical sampling indicates that disseminated molybdenite is widespread in the Sevuokuk pluton. A small low-grade porphyry copper deposit was discovered in a satellitic stock of quartz monzonite in the Poovoot Range, and five separate deposits of lead-zinc-silver sulfides were found along a belt that extends northeastward across the island from Southwest Cape.

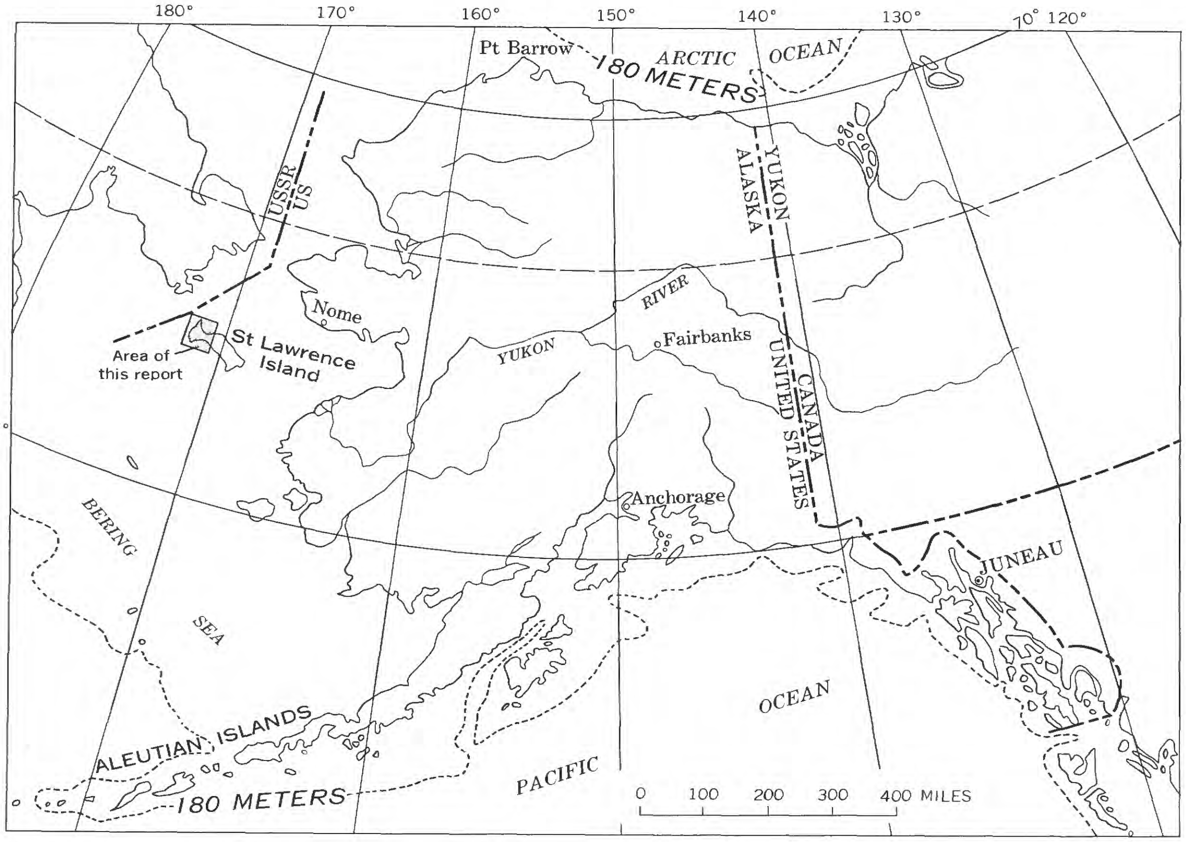


Figure 1.—Location of St. Lawrence Island and area of this report.

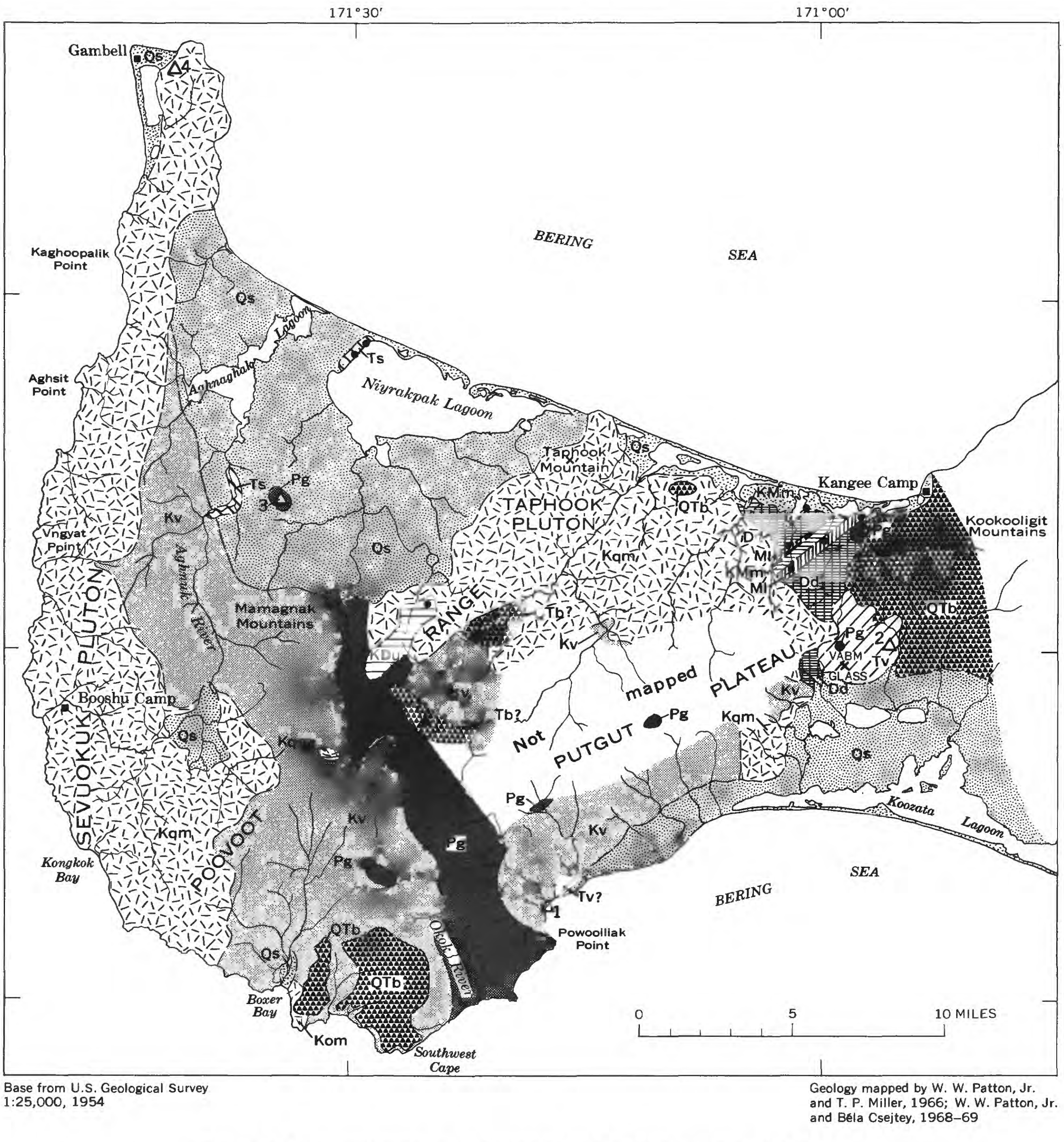
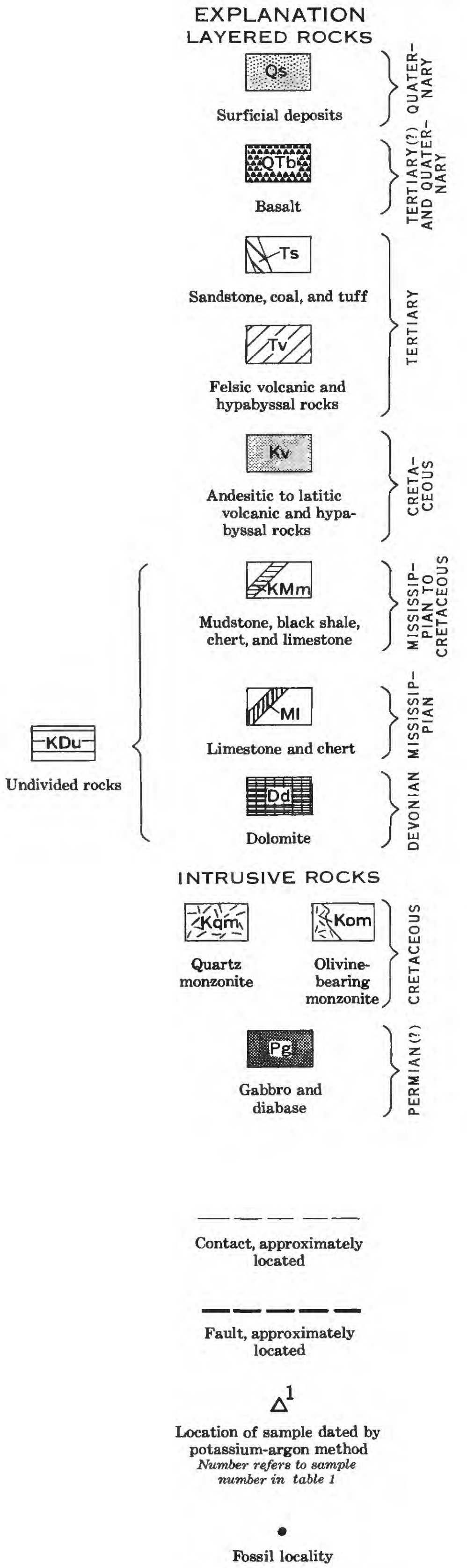


FIGURE 2.—Reconnaissance geologic map of western St. Lawrence Island.

INTRODUCTION

St. Lawrence Island, about 2,000 square miles in area, is in the northern Bering Sea 130 miles west of mainland Alaska and 40 miles southeast of the Chukotsk Peninsula, U.S.S.R. This report covers about 600 square miles of the western part of the island (fig. 1).

Reconnaissance geologic mapping of this area is part of a long-range program to investigate the mineral resources of the Bering Sea shelf. The purpose of these investigations is not only to assess the mineral potential of the island itself but also to provide basic geologic information needed in the interpretation of offshore geo-



physical data. In addition, the geology of St. Lawrence Island is of special interest because it furnishes a critical tie-point for regional correlations between Alaska and northeastern Siberia.

The western part of St. Lawrence Island is dominated by the Poovoot Range, a group of barren, rubble-covered hills that extend from near Kongkok Bay and Boxer Bay on the southwest coast to Taphook Mountain on the north coast (fig. 2). The range is flanked on the southeast by the Putgut Pleateau, a nearly flat, lake-dotted, tundra-covered surface 100–200 feet above sea level. The west and southwest coasts from Gambell to Powooiliak Point are marked by rugged cliffed headlands and narrow boulder-strewn beaches (fig. 3). The north coast and the south coast east of Powooiliak Point are bordered by broad coastal lowlands, tidal lagoons, and barrier beaches.

Bedrock exposures on western St. Lawrence Island are limited to sea cliffs and a few scattered cutbanks along locally incised streams. Interior parts of the island below 400 feet elevation are almost completely blanketed by tundra vegetation and above that elevation by frost-riven rock rubble. Trees and shrubs do not grow more than a few feet high anywhere on the western part of the island.

The island has no all-weather roads or trails. During the summer, overland transportation is limited to tracked or other type vehicles capable of traveling over water-saturated tundra. The lagoons and the larger lakes are suitable for float-plane landings after spring breakup, which generally occurs in mid-June. Coastal areas can be reached by small boat from Gambell when surf and wind allow. Gambell, the only settlement on western St. Lawrence Island, is served by scheduled airline from Nome.

The reconnaissance geologic mapping and geochemical sampling were conducted by Patton and T. P. Miller during the summer of 1966 and by Patton and Csejtey during the summers of 1968 and 1969. Transportation on the island was by small tracked vehicles and float plane. Approximately 250 stream-sediment and rock samples were collected and were analyzed by semiquantitative spectrographic and atomic-absorption methods. The authors were assisted in the field by V. A. Frizzell, M. B. Estlund, and A. F. White, geological assistants, W. T. Booshu, camphand, and J. K. Patton, volunteer helper.

Previous reports of the geology of St. Lawrence are confined to early exploratory surveys along the coast (Dawson, 1894; Emerson, 1904, p. 38–42; Collier, 1906), an archeological investigation by O. T. Geist and F. G. Rainey (1936), and an unpublished geological reconnaissance map compiled by E. H. Muller (Dutro and Payne, 1957).

A

B

LAYERED ROCKS

DEVONIAN

The oldest rocks on western St. Lawrence Island comprise a sparsely exposed sequence of dolomite and subordinate dolomitic limestone in the northeastern part of the Putgut Plateau (fig. 2). Much of the dolomite has been recrystallized to a light-tan and gray sugary-textured marble as a result of contact metamorphism by the nearby Taphook pluton. A few scattered exposures of unaltered dolomite, however, occur on small incised drainages along the north edge of the plateau. Gray massive laminated locally brecciated dolomite and dolomitic limestone in the lower part of the sequence grade into sooty-black thin-bedded fine-grained dolomite in the upper part.

These dolomitic rocks are believed to be Devonian in age and to correlate with the dolomitic sequence along the Seknak River in eastern St. Lawrence Island described by Patton and Dutro (1969). A Devonian age for these rocks is also suggested by the discovery of brachiopods of Devonian age in an isolated patch of rubble of silicified coquina on the shore of a lagoon 4 miles west of Kangee Camp. J. T. Dutro, Jr., who examined this collection, reports

> brachiopod shells, predominantly atrypids (both *Atrypa* and *Spinatrypa*) ; also a few spiriferoids including a possible *Kozlowskiellina* and a *Mucrospirifer?* sp. The age is definitely Devonian, no younger than Frasnian on the basis of atrypids. If the *Kozlowskiellina* is correctly identified, overlapping ranges would suggest an Emsian (late Early Devonian) or possibly early Eifelian (early Middle Devonian) age.

MISSISSIPPIAN

Stratigraphically above the Devonian dolomite is an estimated 1,500 feet of gray crinoidal limestone containing abundant black nodular chert. These rocks crop out on several small incised streams in the northeastern part of the Putgut Plaueau and appear to be localized along two narrow northeast-trending bands (fig. 2). The limestone contains abundant but poorly preserved fragmental debris of crinoids, corals, and brachiopods of probable Mississippian age. Both the faunal assemblage and the lithology indicate a strong correlation between these limestone and chert beds and the Upper Mississippian strata in the Ongoveyuk River area of eastern St. Lawrence Island (Patton and Dutro, 1969).

FIGURE 3.—Exposures of Sevuokuk pluton along west coast of St. Lawrence Island. *A*. Cliffed headlands of quartz monzonite south of Booshu Camp. Cliffs in middle ground are 15–30 feet high. *B*. Jointed quartz monzonite in wave-cut bench near Booshu Camp. Quartz monzonite contains molybdenite in sparsely disseminated grains.

MISSISSIPPIAN TO CRETACEOUS

Overlying the Mississippian limestone and chert is a diverse assemblage of rocks including dark pyritiferous mudstone, black shale, chert, thin-bedded dark limestone, and subordinate amounts of graywacke, tuff, and breccia. Scattered talus banks and rubble patches of this rock assemblage were found on the northeastern part of the Putgut Plateau and in a small roof pendant that lies within the Taphook pluton, 8 miles southwest of Taphook Mountain (fig. 2). In addition, a few isolated patches of rubble (too small to be shown in fig. 2) occur in the belt of gabbro and diabase of Permian(?) age that trends northwestward from Powooiliak Point.

The stratigraphic relationships of the various rock types included in this assemblage are uncertain owing to structural complexities and poor exposures, and the age of most of the strata cannot be fixed more closely than Mississippian to Cretaceous. Some black-shale–chert–limestone beds, however, appear to correlate with Middle and Upper Triassic strata on the eastern part of the island (Patton and Dutro, 1969). Fragmentary flat clams of probable Triassic age were found in a rubble patch of these strata, 6 miles southwest of Taphook Mountain.

CRETACEOUS

Andesitic and latitic volcanic and hypabyssal rocks underlie more than 120 square miles of western St. Lawrence Island. They occur mainly in two broad belts: one just east of the Sevuokuk pluton and the other along the southern part of the Putgut Plateau (fig. 2). These rocks are best exposed in steep but largely inaccessible sea cliffs in the vicinity of Boxer Bay. Inland exposures consist of patches of frost-riven rubble, sparse erosional knobs, and a few stream cutbanks, chiefly along the south edge of the Putgut Plateau.

The unit includes a wide variety of flows, hypabyssal intrusives, and volcaniclastic rocks. The flows and intrusives range in composition from andesites to latites, but basalts, quartz latites, and rhyolites are locally present. The volcaniclastic rocks include andesitic and latitic lithic and crystal tuffs, breccias, and volcanic conglomerates and graywackes. Adjacent to the quartz monzonite plutons, the volcanic rocks have been metamorphosed to hornblende hornfels and albite-epidote hornfels. All the volcanic rocks are devitrified and altered in varying degree to a greenish-gray aggregate of chlorite, epidote, sericite, clay minerals, calcite, and pyrite.

TABLE 1.—*Potassium-argon age determinations*

[Argon analyses and age calculations by J. C. Von Essen and Joan Engels; potassium analyses by L. B. Schlocker. Decay constants for K^{40}: $\lambda_e=0.585\times10^{-10}$ year^{-1}; $\lambda_\beta=4.72\times10^{-10}$ year^{-1}. Atomic abundance of $K^{40}=1.19\times10^{-4}$]

Sample	Mineral	K_2O (percent)	K_2O (average percent)	Ar^{40}_{rad} (10^{-10} moles per g)	Ar^{40}_{rad} / Ar^{40}_{total}	Apparent age (m.y.)
1 (69APa187b)	Biotite	5.96 5.98	5.97	8.009	0.76	88.7±3
2 (66APa242)	Sanidine	6.24 6.25	6.245	5.894	.92	62.8±1.9
	Hornblende	.955 .990	.972	.8837	.52	60.5±1.8
3 (69APa229a)	Hornblende	.890 .895	.892	3.348	.87	238±7
4 (66AMm211)	Biotite	4.77 4.72	4.745	7.606	.95	106±3

1. Andesitic crystal tuff, near Powooiliak Point.
2. Trachyte, near VABM Glass.
3. Gabbro, north of Mamagnak Mountains.
4. Quartz monzonite, east of Gambell.

The volcanic rocks are assigned a Cretaceous age on the basis of a potassium-argon age determination of 88.7±3 m.y. (million years) from a crystal tuff near Powooiliak Point (table 1, sample 1). Although this age determination dates the sampled rocks as Late Cretaceous (Harland and others, 1964), some of the volcanic rocks included in this assemblage clearly cannot be younger than Early Cretaceous as they are intruded and altered by mid-Cretaceous (106±3 m.y.) quartz monzonite of the Sevuokuk pluton.

TERTIARY

FELSIC VOLCANIC AND HYPABYSSAL ROCKS

Felsic volcanic and hypabyssal rocks crop out at the east edge of the Putgut Plateau near VABM Glass and in a small area along the beach about 2 miles north of Powooiliak Point (fig. 2). Near VABM Glass the rocks are typically light-gray to drab unaltered trachyte flows composed of large phenocrysts of twinned sanidine and reddish-brown hornblende in a fine-grained trachytic groundmass. Float of lignite, presumably from interbedded coaly layers, was found along a small drainage that flows northward from VABM Glass. The rocks north of Powooiliak Point include light-gray fine- to medium-grained massive quartz latite crystal tuffs, and a small hypabyssal intrusive of light-gray fine-grained rhyolite. Thin seams and disseminated particles of carbonaceous material occur in the fine-grained tuffs.

The trachyte flows at VABM Glass are assigned a Paleocene age on the basis of a potassium-argon determination of 62.8±1.9 m.y. and 60.5±1.8 m.y. on the mineral pair sanidine and hornblende (table 1, sample 2). The rocks north of Powooiliak Point have not been isotopically dated, but their general lithologic character and apparent stratigraphic position above the andesitic and latitic volcanic rocks of Cretaceous age suggest that they too are probably early Tertiary.

SANDSTONE, COAL, AND TUFF

Terrigenous coal-bearing deposits of Tertiary age are exposed in bluffs along the west shore of Niyrakpak Lagoon and in scattered cutbanks on the lower Aghnuk River (fig. 2). These deposits are composed of poorly consolidated calcareous sandtsone, grit, and conglomerate, carbonaceous mudstone, ashy tuff, volcanic breccia, and seams of lignitic coal as much as 2 feet thick. Exposures of these deposits are so badly slumped that little can be determined about their thickness and structure. Plant fossils from the Niyrakpak Lagoon exposures, originally assigned an Eocene age by Chaney (1930), are now regarded as Oligocene by J. A. Wolfe (oral commun., 1968).

TERTIARY(?) AND QUATERNARY

Nearly flat-lying basalt flows of late Cenozoic age, which form the main mass of the Kookooligit Mountains, are exposed near the east edge of the mapped area. Small patches of these basalts also occur on the northwestern part of the Putgut Plateau and cap upland surfaces between Boxer Bay and the Okok River (fig. 2). Most of the flows are composed of fresh medium- to dark-gray vesicular olivine basalt containing large rounded crystals of strained olivine in a fine-grained intergranular groundmass of labradorite, augite (probably titanaugite), olivine, and magnetite. Some vesicles are filled with zeolites. Pyroclastics, including tuff-breccias and lithic tuffs, are interlayered with the flows at the base of the Kookooligit Mountain sequence. Clasts in the pyroclastic rocks consist of a dark-gray to black fresh fine-grained to cryptocrystalline basalt and range in diameter from less than 1 inch to as much as 10 inches. Olivine is lacking, and only a few clasts are vesicular. The matrix of the pyroclastics is cryptocrystalline, probably glass in part, and is partly altered to chlorites and possibly chlorophaeite.

The fresh, unaltered character of some of the flows and volcanic cones in the Kookooligit Mountains suggests that the latest extrusion took place not more than a few thousand years ago, and probably most, if not all, of the olivine basalt flows are of Quaternary age. The basal pyroclastic rocks, however, may be as old as late Tertiary.

QUATERNARY

Unconsolidated deposits of gravel, sand, silt, and peat underlie the coastal lowlands and are exposed in scattered bluffs along the seashore and around the lagoons. Terrace gravels as much as 100 feet thick crop out in bluffs near Kangee Camp and on the lagoons that fringe the north edge on the Putgut Plateau.

About 30 feet of deformed marine silt and sand overlain by scattered patches of glacial drift containing striated boulders is exposed on a spit at the east end of Niyrakpak Lagoon (D. S. McCulloch, oral commun., 1970). The source of the drift is uncertain, but two possibilities are suggested: (1) it was derived from a small Pleistocene cirque glacier on nearby Taphook Mountain or (2) it was deposited by a vast ice sheet which covered the Bering Strait region and large parts of the western Seward Peninsula during the Pleistocene (Sainsbury, 1967). Morainal deposits (not mapped on figure 2) also were found in two places near Kongkok Bay, but these clearly had their source in small Pleistocene cirque glaciers on the northwest flank of the Poovoot Range.

INTRUSIVE ROCKS

PERMIAN(?)

Gabbro and diabase underlie about 40 square miles, primarily along a belt that trends northwestward across the island from Powooiliak Point (fig. 2). Isolated patches of rubble were also found on the southern and eastern parts of the Putgut Plateau. Outcrops of the gabbro and diabase can be seen in accessible sea cliffs along the coast near the mouth of the Okok River and in cutbanks along the lower course of the Okok River.

The bulk of this unit is composed of dark-greenish-gray rusty-weathering massive gabbro and diabase. Also included in this unit are minor amounts of siliceous mudstone and finely laminated tuff, which occur in isolated outcrop within the belt of gabbro and diabase.

Thin-section study shows that the gabbro and diabase are composed of augite, plagioclase (chiefly sodic labradorite), hornblende, opaque minerals, potash feldspar, and quartz as well as accessory apatite and zircon. The texture is intergranular and grades into subophitic in the diabase. Hornblende occurs in reaction rims around augite; potash feldspar and quartz are interstitial and form graphic intergrowths. Point counts on six stained rock slabs (600–900 counts per slab) indicate the following modal composition ranges in volume percent: plagioclase, 30–48; mafic minerals, 43–54; magnetite and subordinate ilmenite and chalcopyrite, 3–14; potash feldspar, 1–6; quartz, 0–5; and pyrite, $<$1–2. All the feldspars are altered in varying degree to sericite, clay minerals, and calcite, and the mafic minerals are altered to chlorites, biotite, and magnetite.

This unit is assigned a tentative Permian age on the basis of a potassium-argon age determination of 238 ± 7 m.y. (table 1, sample 3) from gabbro collected in an isolated exposure north of the Mamagnak Mountains.

CRETACEOUS

QUARTZ MONZONITE

Quartz monzonite underlies about 150 square miles of western St. Lawrence Island in two large intrusive bodies: the Sevuokuk pluton along the western coast and the Taphook pluton in the north-central part of the mapped area (fig. 2). The Sevuokuk pluton is well exposed in nearly continuous wave-cut cliffs and benches along the west coast from Gambell to Boxer Bay (fig. 3).

The quartz monzonite is light brownish gray to light gray, medium to coarse grained, and commonly porphyritic. A fine-grained dark-brownish-gray phase occurs along the borders of the plutons. Aplite dikes and xenoliths of mafic hornfels are locally abundant. Two sets of vertical joints striking northeast and northwest are conspicuous in every coastline exposure.

Point counts on five stained rock slabs (1,000 counts per slab) from the Sevuokuk and Taphook plutons give the following modal ranges in volume percent: plagioclase (calcic oligoclase to sodic andesine), 35–43; potash feldspar, 26–40; quartz, 10–27; biotite, 4–8; hornblende, 0–5; accessory minerals (opaque and nonopaque), 0.6–1.

Both the Sevuokuk and Taphook plutons are discordant and are characterized by lack of linear and planar structures. No essential lithologic differences were noted between the two plutons, and it seems likely that they are comagmatic and possibly coextensive at depth. Both plutons are assigned a Cretaceous age on the basis of a potassium-argon determination of 106 ± 3 m.y. on biotite from a sample near Gambell (table 1, sample 4).

OLIVINE-BEARING MONZONITE

A small stock of olivine-bearing monzonite, less than 1 square mile in area, crops out along the east shore of Boxer Bay. Massive sea-cliff exposures of the stock fringe the coastline but are accessible on foot in only a few places.

The olivine-bearing monzonite is medium to dark greenish gray, coarse to medium grained, and granitic textured. Hand specimens show crystals of twinned plagioclase, as long as 15 mm, dark-greenish-gray pyroxene, and flakes of reddish-brown biotite. Point counts on four thin sections (2,000 counts per section) and one rock slab (1,000 counts) indicate the following modal-composition ranges in volume percent: plagioclase, 53–64; potassium feldspar, 22–29; augite, 4–10; biotite, 3–7; olivine, 1–3; magnetite, 1–3; and apatite, about 1. Most of the plagioclase is sodic labradorite. Olivine forms small anhedral crystals, partly altered to biotite and magnetite, and occurs poikilitically enclosed in feldspars.

The olivine-bearing monzonite is thought to be of Cretaceous age and to be related to the intrusion of the nearby Sevuokuk pluton. Both bodies intrude the andesitic and latitic volcanic unit of Cretaceous age.

STRUCTURE

Very little structural information is obtainable on western St. Lawrence Island owing to the scarcity of bedrock exposures. The few outcrops available, chiefly along sea cliffs and stream cutbanks, indicate that all pre-Tertiary rocks are intensely deformed and faulted. Gross distribution of the major rock units seems to suggest that regional trends are N. 40°–50° E. in the eastern part of the mapped area and north to N. 25° W. in the western part (fig. 2). Aerial photographs show two prominent sets of lineaments, probably faults, trending N. 25°–45° E. and N. 25° W.

MINERAL OCCURRENCES

Reconnaissance geochemical sampyling of the stream sediments and rock units was carried out as a first step toward appraising the mineral resources of western St. Lawrence Island. All samples were analyzed for 30 elements by semiquantitative spectrographic and atomic absorption methods. Analytical results for molybdenum, copper, lead, zinc, and silver are shown in figures 5–9 and table 2. Complete analytical results for the stream-sediment samples have been reported in open file (Patton and Csejtey, 1970).

The reconnaissance sampling has served to outline several broad target areas that appear to warrant further mineral investigations. It should be emphasized, however, that the mineral deposits found during this survey were not examined in detail and little is known about their lateral extent or structural setting.

MOLYBDENUM

The presence of molybdenite near Booshu Camp on the west coast of St. Lawrence Island has been known

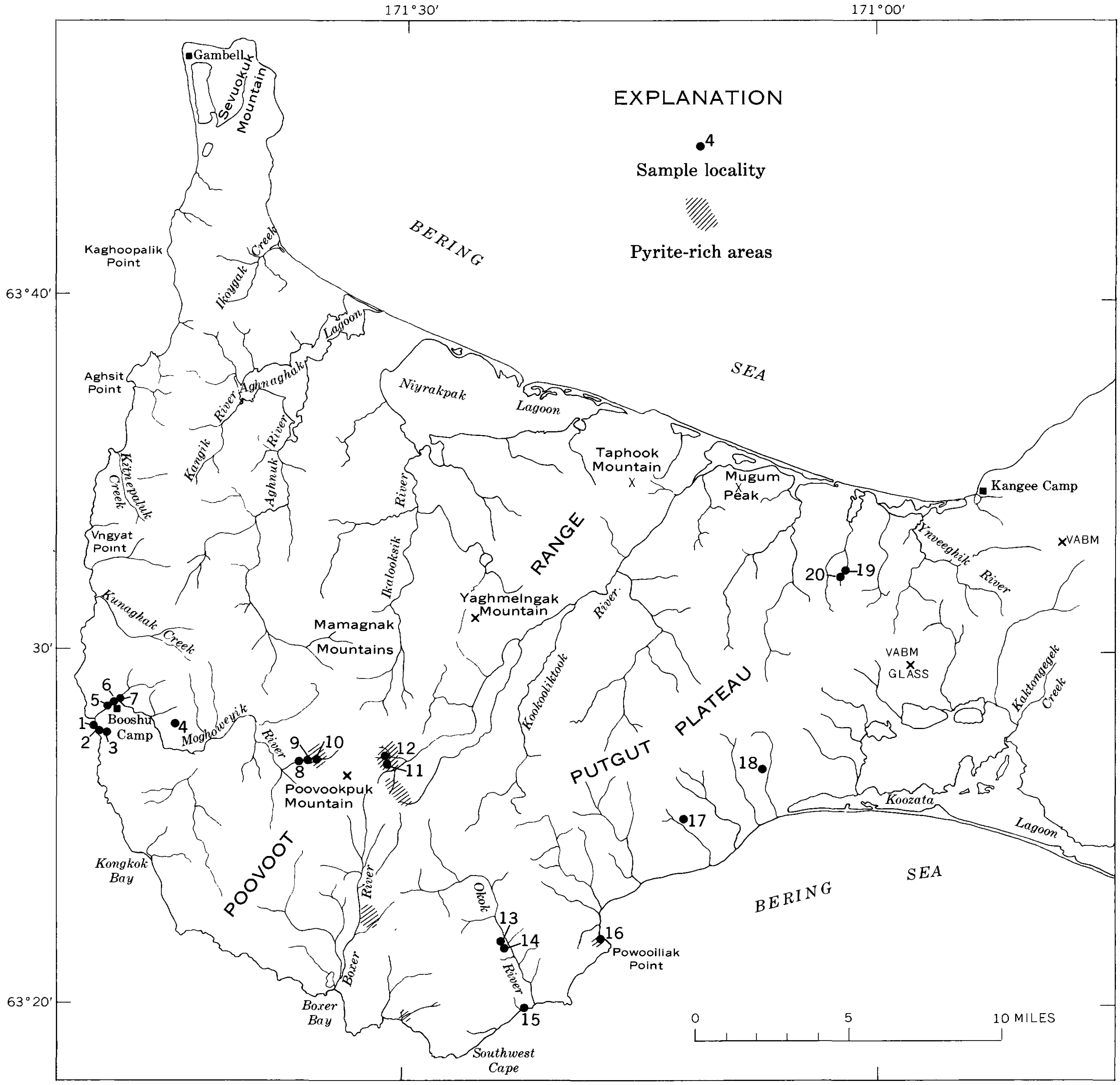
TABLE 2.—*Semiquantitative spectrographic analyses of selected grab samples of sulfide-bearing rocks from western St. Lawrence Island.*

[Results reported in parts per million in the series 1, 0.7, 0.5, 0.3, 0.2, 0.15, 0.1. N, not detected; G, greater than value shown; L, detected but below limit of determination. Sample localities shown in figure 4. Analysts: K. J. Curry, C. L. Forn, A. Farley, Jr.]

Sample locality	Field No.	Ag	Cu	Mo	Pb	Zn	Remarks
1	69APa–38c	N	300	150	L	N	Disseminated molybdenite and chalcopyrite in quartz monzonite.
2	69APa–38e	N	10	700	L	L	Molybdenite and vein quartz in altered quartz monzonite.
3	66AMm–239	N	30	1, 000	30	N	Molybdenite disseminated in quartz monzonite.
4	69APa–49b	1. 5	1, 000	15	30	N	Disseminated pyrite and chalcopyrite in quartz monzonite.
5	69APa–51b	1	700	7	L	N	Pyritiferous quartz monzonite.
6	69APa–51d	N	150	500	20	N	Thin veinlet of molybdenite in pyritiferous quartz monzonite.
7	69APa–514	N	15	1, 500	10	N	Irregular masses of molybdenite in monzonite.
8	69APa–83b	N	20	500	N	N	Molybdenite and pyrite in drusy quartz vein.
9	69APa–84c	2	150	500	30	N	Pyritiferous and silicified quartz monzonite with veinlets of molybdenite.
10	69APa–84d	1. 5	1, 000	7	70	N	Pyritiferous quartz monzonite.
11	69APa–212	10	1, 500	30	L	L	Pyritiferous altered volcanic rock.
12	69APa–219b	1	3, 000	L	70	N	Disseminated malachite, chalcopyrite, and pyrite in quartz monzonite porphyry.
13	69APa–202b	N	700	N	N	L	Disseminated magnetite, ilmenite, pyrite, and chalcopyrite in gabbro.
14	69APa–203b	N	700	N	N	L	Disseminated magnetite, ilmenite, pyrite, and chalcopyrite in gabbro.
15	66AMm–227a	1, 000	10, 000	L	G20, 000	G10, 000	Galena, sphalerite, chalcopyrite, and pyrite in calcite veinlet in gabbro.
16	69ACy–212	1. 5	30	N	2, 000	N	Galena and pyrite in volcanic rock.
17	69ACy–181	L	L	N	15	700	Pyritiferous volcanic rock.
18	68ACy–75b	10	150	N	2, 000	3, 000	Galena and sphalerite in quartz veins in volcanic rock.
19	69APa–132b	15	15	N	G20, 000	200	Galena in contact marble.
20	69APa–132d	70	700	N	G20, 000	G10, 000	Galena and sphalerite in contact marble.

by the local inhabitants for many years and was reported by Anderson (1947) and by Berg and Cobb (1967). Additional deposits were found during the present investigations, and these together with some anomalously high stream-sediment sample values, indicate that the distribution of molybdenite in and around the Sevuokuk pluton is far more widespread than formerly recognized. In all occurrences, however, the molybdenite is sparsely disseminated, and the deposits appear to be low grade.

The deposit near Booshu Camp (Anderson, 1947) is on a wave-cut bench of quartz monzonite half a mile south of the outlet of the Moghoweyik River (fig. 3) (locs. 1, 2, 3 in fig. 4). The molybdenite occurs as dis-



Base from U.S. Geological Survey
1:25,000, 1954

FIGURE 4.—Location of analyzed bedrock samples listed in table 2.

seminated grains and thin scaly fracture fillings, along with minor amounts of chalcopyrite and pyrite. Sulfide mineralization appears to have been accompanied by addition of small amounts of quartz and partial sericitization of feldspars.

Molybdenite was also found on the north bank of the Moghoweyik River three-quarters of a mile above the mouth (locs. 5, 6, 7 in fig. 4). Here thin veinlets of molybdenite occur in highly oxidized pyritiferous quartz monzonite which is cut by aplite dikes and quartz veins. A pan concentrate from the riverbed gravels at this locality yielded 70 ppm (parts per million) molybdenum and 5,000 ppm tungsten.

Another deposit was found on the upper Moghoweyik River along the east edge of the Sevuokuk pluton (locs. 8, 9, 10 in fig. 4). In this deposit the molybdenite is

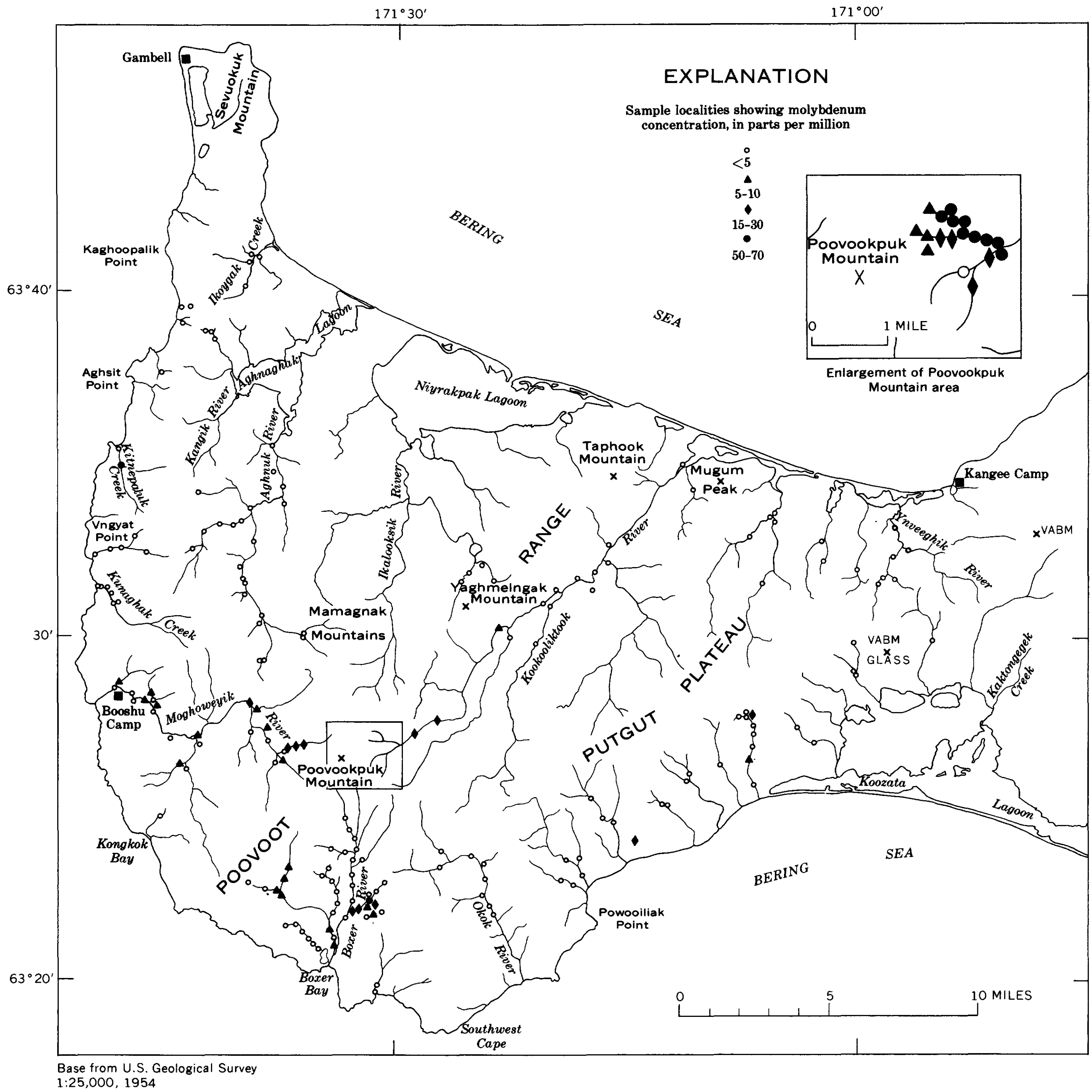
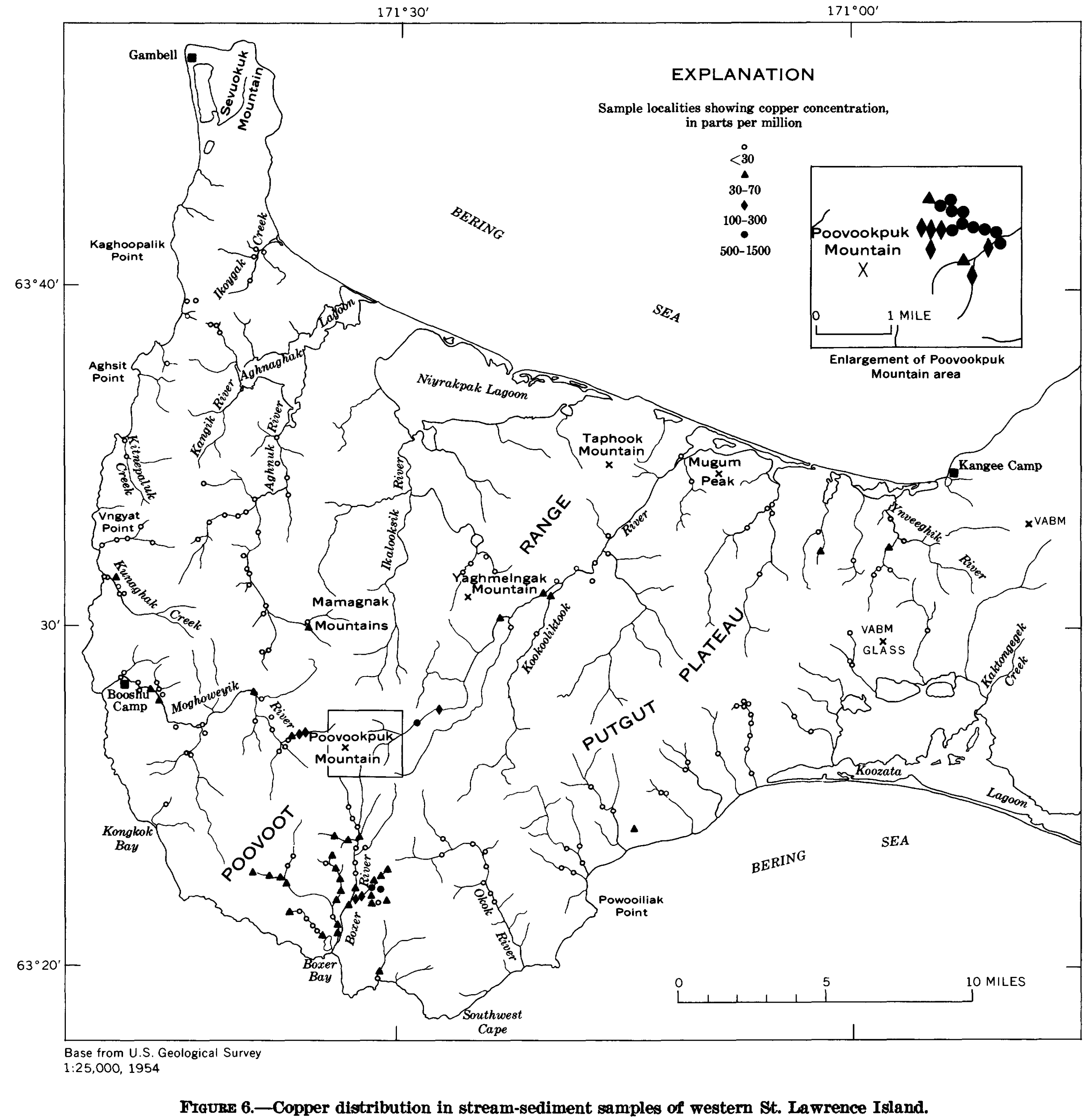


FIGURE 5.—Molybdenum distribution in stream-sediment samples of western St. Lawrence Island.

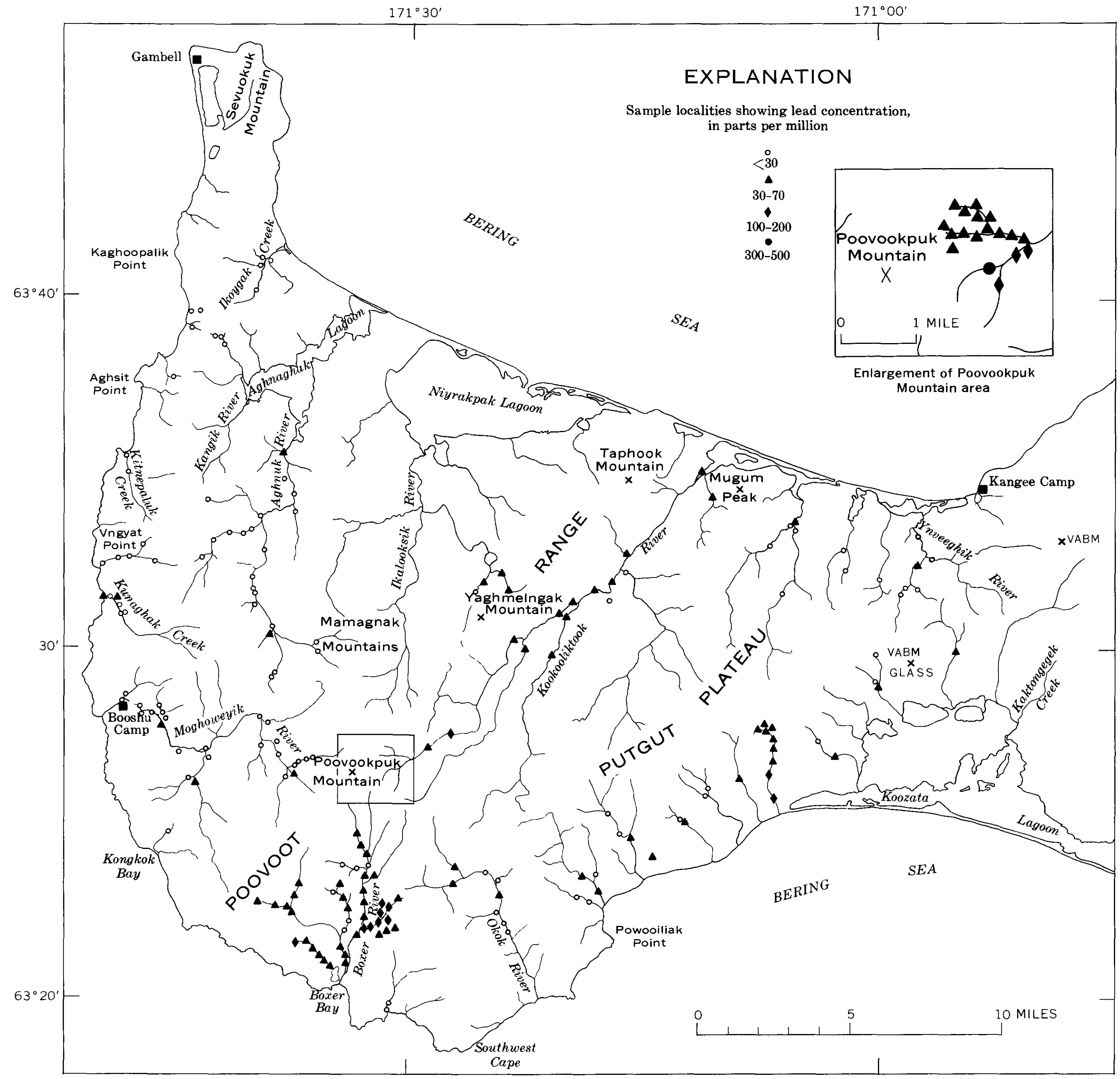
sparsely distributed throughout a half-mile-wide zone of heavily oxidized limonite-stained pyritiferous quartz monzonite near the contact with volcanic rocks of Cretaceous age. The molybdenite occurs as scales and thin veinlets along fine fractures in the quartz manzonite and as large euhedral crystals in drusy quartz veins.

Anomalous molybdenum contents (15 ppm or greater) were found in sediment samples from several streams draining the Sevuokuk pluton and the bordering volcanic rocks (figs. 2, 5). Contents as high as 70 ppm were found on tributaries of the Kookooliktook River which drain a large pyrite gossan and a small



Base from U.S. Geological Survey 1:25,000, 1954

FIGURE 6.—Copper distribution in stream-sediment samples of western St. Lawrence Island.



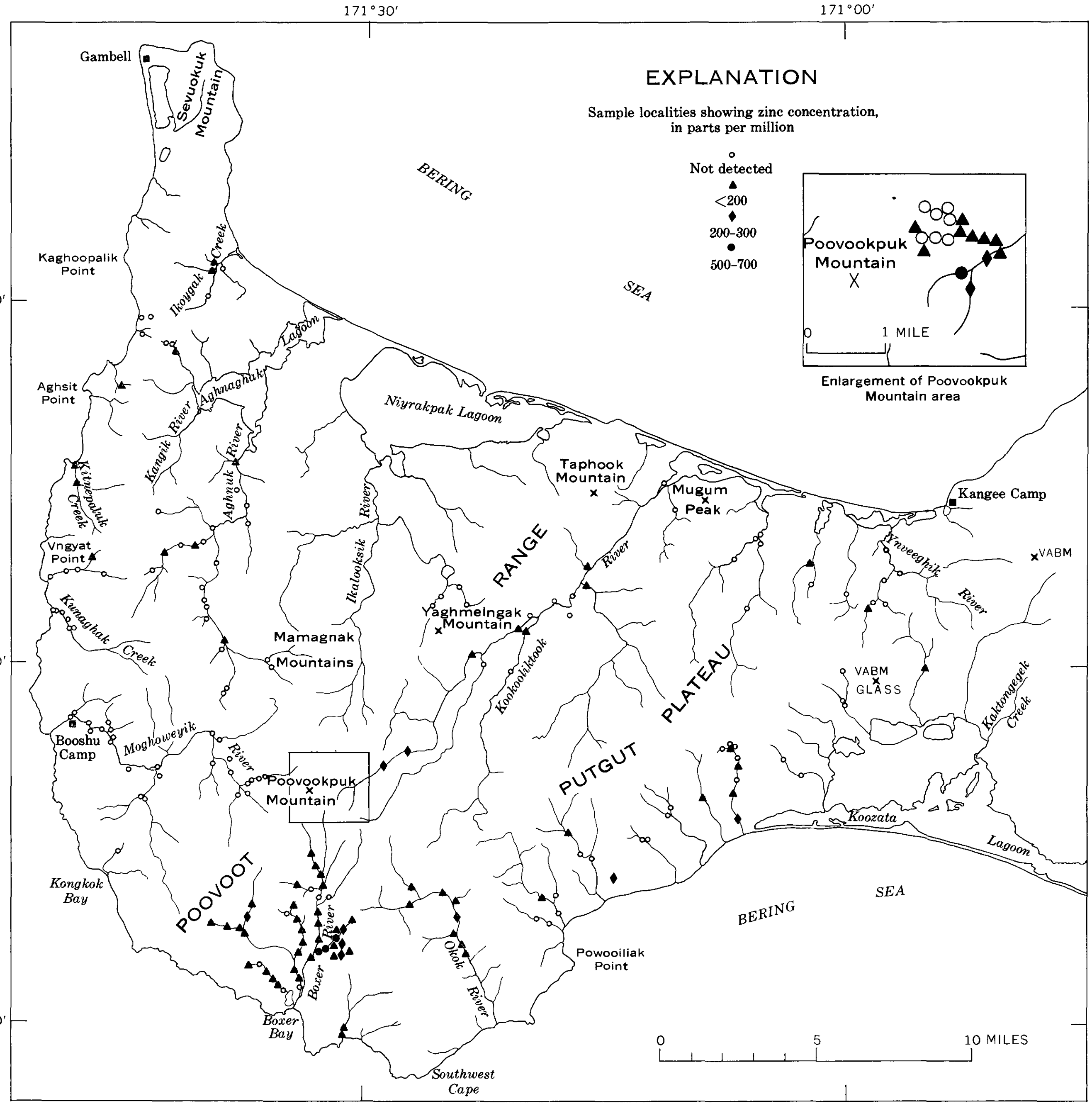
Base from U.S. Geological Survey
1:25,000, 1954

FIGURE 7.—Lead distribution in stream-sediment samples of western St. Lawrence Island.

mineralized quartz monzonite porphyry stock. Small flecks of molybdenite are visible in the quartz monzonite, but none were seen in the pyrite-rich volcanic rock.

Stream-sediment samples with molybdenum ranging from 15 to 50 ppm were obtained on an eastern tributary of the Boxer River, 2½ miles north of Boxer Bay. The source of the molybdenum is believed to be a nearby pyrite gossan in the volcanic rocks (fig. 4).

A single stream-sediment sample from Kitnepaluk Creek, which drains the Sevuokuk pluton 14 miles south of Gambell, yielded 70 ppm molybdenum (fig. 5).



Base from U.S. Geological Survey
1:25,000, 1954

FIGURE 8.—Zinc distribution in stream-sediment samples of western St. Lawrence Island.

COPPER

Finely disseminated chalcopyrite, malachite, pyrite, and minor molybdenite occur in a small stock of quartz monzonite porphyry in the Poovoot Range near Poovookpuk Mountain (loc. 12 in fig. 4). The stock, which is roughly half a mile across, intrudes Cretaceous volcanic rocks. The sulfide minerals, although spread over a large part of the stock, are sparsely disseminated. Selected grab samples of the mineralized rock yielded as much as 3,000 ppm copper, but composite chip samples randomly collected on foot traverses across the stock contained 700 ppm copper or less. The Cretaceous

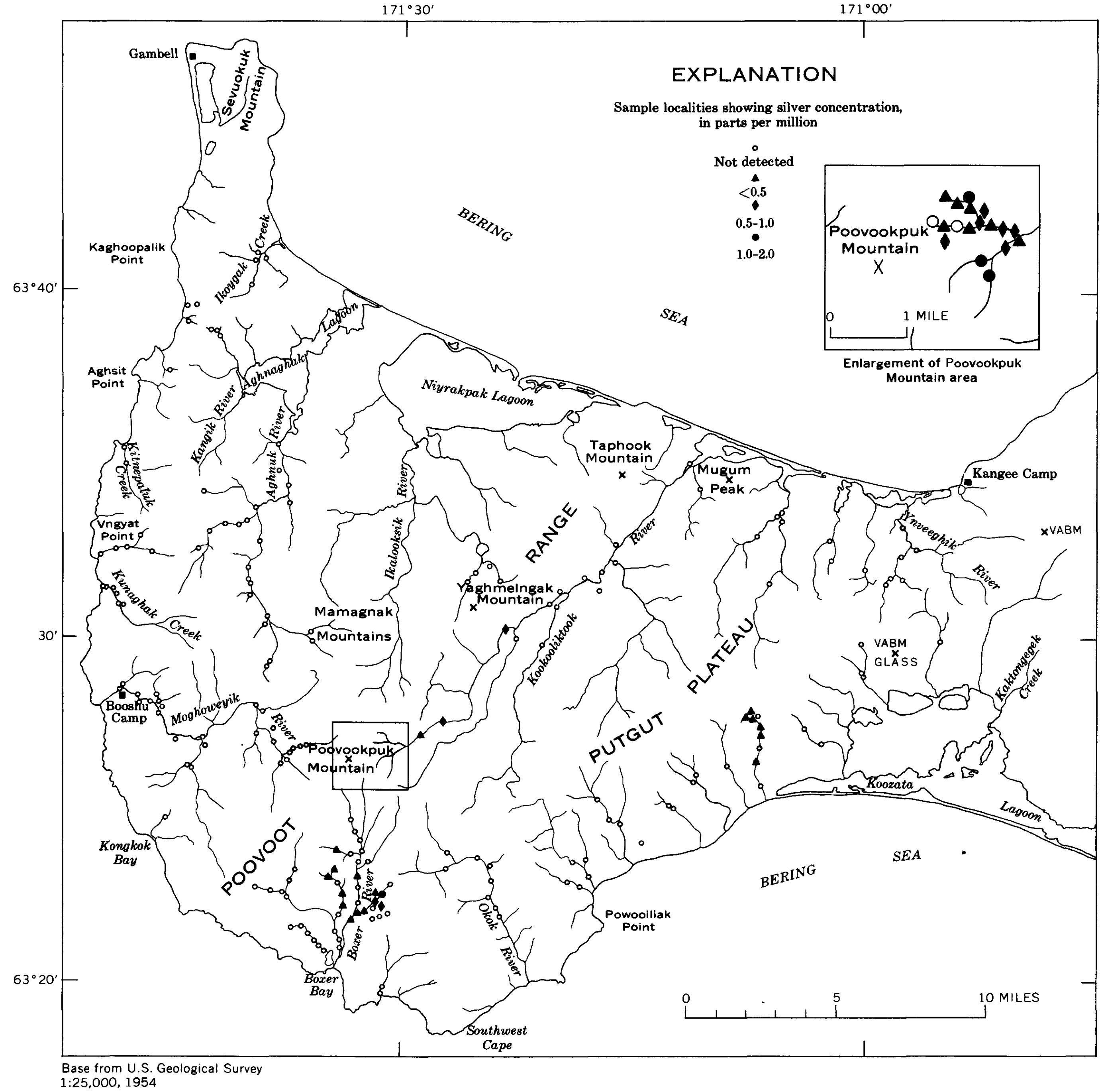


FIGURE 9.—Silver distribution in stream-sediment samples of western St. Lawrence Island.

volcanic rocks are heavily pyritized and extensively oxidized over a broad area in the vicinity of the porphyry stock. No sulfides other than pyrite were identified in the volcanics, but a selected grab sample of massive pyritized volcanic rock near the intrusive contact contained 1,500 ppm copper and 10 ppm silver (loc. 11 in fig. 4). Stream-sediment samples from several small tributaries of the Kookooliktook River that drain the stock and the surrounding altered volcanic rocks contained as much as 70 ppm molybdenum, 1,500 ppm copper, 500 ppm lead, 700 ppm zinc, and 1.5 ppm silver (figs. 5, 6, 7, 8, 9).

Several grab samples of gabbro from the Okok River yielded 700 ppm copper (locs. 13, 14 in fig. 4). No copper sulfides are visible in hand specimens of the gabbro, but polished sections reveal finely disseminated blebs of chalcopyrite.

A small amount of native copper was found in float of a mafic volcanic hornfels 4½ miles northeast of Vngyat Point.

LEAD, ZINC, AND SILVER

Small sulfide deposits of lead, zinc, and silver were found along a belt trending northeastward from the Okok River on the south coast to near Kangee Camp on the north coast (locs. 15 to 20 in fig. 4 and the following table). None of these deposits appear to be of economic significance, but their apparent structural alinement suggests that a careful search for additional deposits along this belt may be warranted.

Locality	*Minerals*	*Remarks*
15	Galena, sphalerite, chalcopyrite, pyrite.	Sulfides in 1- to 2-inch-wide calcite vein cutting fine-grained gabbro. Vein strikes about N. 35°E. Exposed on wave-cut bench in tidal zone.
16	Pyrite, galena	Sulfides in irregular quartz veins cutting kaolinized limonite-stained lithic tuff. Well exposed along bench, at base of wave-cut cliff.
17	Pyrite	Pyrite containing 700 ppm Zn, in silicified fine-grained volcanic rock. Exposed in streambed.
18	Galena, sphalerite	Sulfides in quartz veins cutting altered andesitic volcanic rocks.
19, 20	Galena, sphalerite, pyrite.	Irregular stringers in marble near contact with Taphook pluton. Exposed in streambed.

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