UNITED STATES DEPARTMENT OF THE INTERIOR

U.S. GEOLOGICAL SURVEY

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GEOLOGY AND LODE-GOLD DEPOSITS OF THE NUKA BAY AREA, KENAI PENINSULA, ALASKA

by

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Open-file report

1968

This report is preliminary
and has not been edited or
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Weld - Int. 2905

U. S. GEOLOGICAL SURVEY
Washington, D. C.
20242

For release JUNE 10, 1968

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1. Reconnaissance geologic map of the Tanacross quadrangle, Alaska, by Helen L. Foster. 13 p., 1 map and explanation, scale 1:250,000. Material from which copy can be made at private expense is available in the Alaskan Geology Branch, USGS, 345 Middlefield Rd., Menlo Park, Calif. 94025.

2. Preliminary geologic map of the Eagle B-1 and C-1 quadrangles, Alaska, by Helen L. Foster and Terry C. Keith. 1 map, scale 1:63,360. Material from which copy can be made at private expense is available in the Alaskan Geology Branch, USGS, 345 Middlefield Rd., Menlo Park, Calif. 94025.

3. Geology and lode gold deposits of the Nuka Bay area, Kenai Peninsula, Alaska, by Donald H. Richter. 52 p., 1 pl., 10 figs., 4 tables (map scale, 1:63,360). Material from which copy can be made at private expense is available in the Alaskan Geology Branch, USGS, 345 Middlefield Rd., Menlo Park, Calif. 94025.

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Kenai Peninsula, Alaska

By Donald H. Richter

Abstract

Nuka Bay is a deep, Y-shaped fiord on the southeast coast of the Kenai Peninsula approximately 60 miles southwest of the port of Seward. Gold-bearing quartz veins were discovered in the area in 1918, and between 1920 and 1940 several small mines were in operation around the North and West Arms of the bay. Estimated total production may have been as much as $166,000.

Bedrock in the Nuka Bay area is a thick Cretaceous section of interbedded slate and graywacke that has been regionally deformed into a series of relatively open, but overturned, folds plunging at low angles to the north-northeast. Except at the nose of folds, bedding and foliation (slaty cleavage) are parallel and dip steeply to the northwest. Small granodiorite dikes fill tensional cross joints in the folded sediments, and a few granodiorite sills are intruded along bedding and foliation planes.

Quartz veins are abundant throughout the region, but contain significant amounts of gold only in a relatively small area, 8 miles long and 6 miles wide, around North and ~~East~~ West Arms. The veins are generally less than 5 feet wide and 300 feet long and consist chiefly of massive white quartz. Arsenopyrite with minor amounts of other sulfides and native gold occurs as irregular masses and pods in the quartz. The larger and more productive veins dip steeply and strike east-west, almost normal to the regional structure, and appear to be confined to competent graywacke beds or dikes. Random channel sampling of the quartz veins indicates gold values as high as 9 ounces per ton across zones as wide as 2 feet.

A study of the stream sediments throughout the area disclosed several drainages with detectable gold; one, Babcock Creek, contained 0.5 ppm gold, the others from 0.02 to 0.07 ppm. No base metal anomalies were detected. The area appears to warrant further investigation as a potential producer of small amounts of gold. Diligent small-scale mining may be economically feasible.

Introduction

The former small gold-producing area at Nuka Bay on the Kenai Peninsula of Alaska was the scene of active exploration, development, and mining during the period 1920 through 1940. Following World War II and the resumption of domestic gold mining, however, interest in Nuka Bay never fully revived, and today the area has been virtually forgotten. This report, a result of investigations under the U.S. Geological Survey's Heavy Metals program, describes the geology and lode-gold deposits of the area and attempts to evaluate its future mineral potential.

Location, accessibility, and geography

Nuka Bay is a prominent Y-shaped embayment along the southeast coast of the Kenai Peninsula in south-central Alaska about 60 miles southwest of the port of Seward (fig. 1). The area investigated,

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Figure 1 near here

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which includes most of the known Nuka Bay lode-gold deposits, covers about 100 square miles around the West and North Arms of the bay and is within the Seldovia C-2 and B-2 15-minute quadrangles (U.S. Geol. Survey, Alaska Topographic Series, scale 1:63,360).

The area is accessible by boat or light aircraft. Seaworthy small craft can make the trip from Seward in about 6 to 8 hours, but running time may vary considerably depending on the size of the boat and condition of the sea. Float planes can land in most of the sheltered bays, and a privately maintained landing strip at the head of Beauty Bay is adequate for light, wheeled aircraft. Flight time from Homer, 35 miles to the west, is approximately 25 minutes.

From its wide mouth near the outermost Pye Islands, Nuka Bay trends northward for about 8 miles where it splits into two deep, narrow fiords. East Arm, the easternmost and largest of the fiords, extends northeast about 21 miles, penetrating deep into the rugged Kenai Mountains. West Arm and its continuation, North Arm, which together constitute the smaller fiord, extends north on an irregular course for about 12 miles. The mouth of Nuka Bay opens directly into the Gulf of Alaska, leaving much of the area within the Bay susceptible to rough water during periods of storm and strong onshore winds.

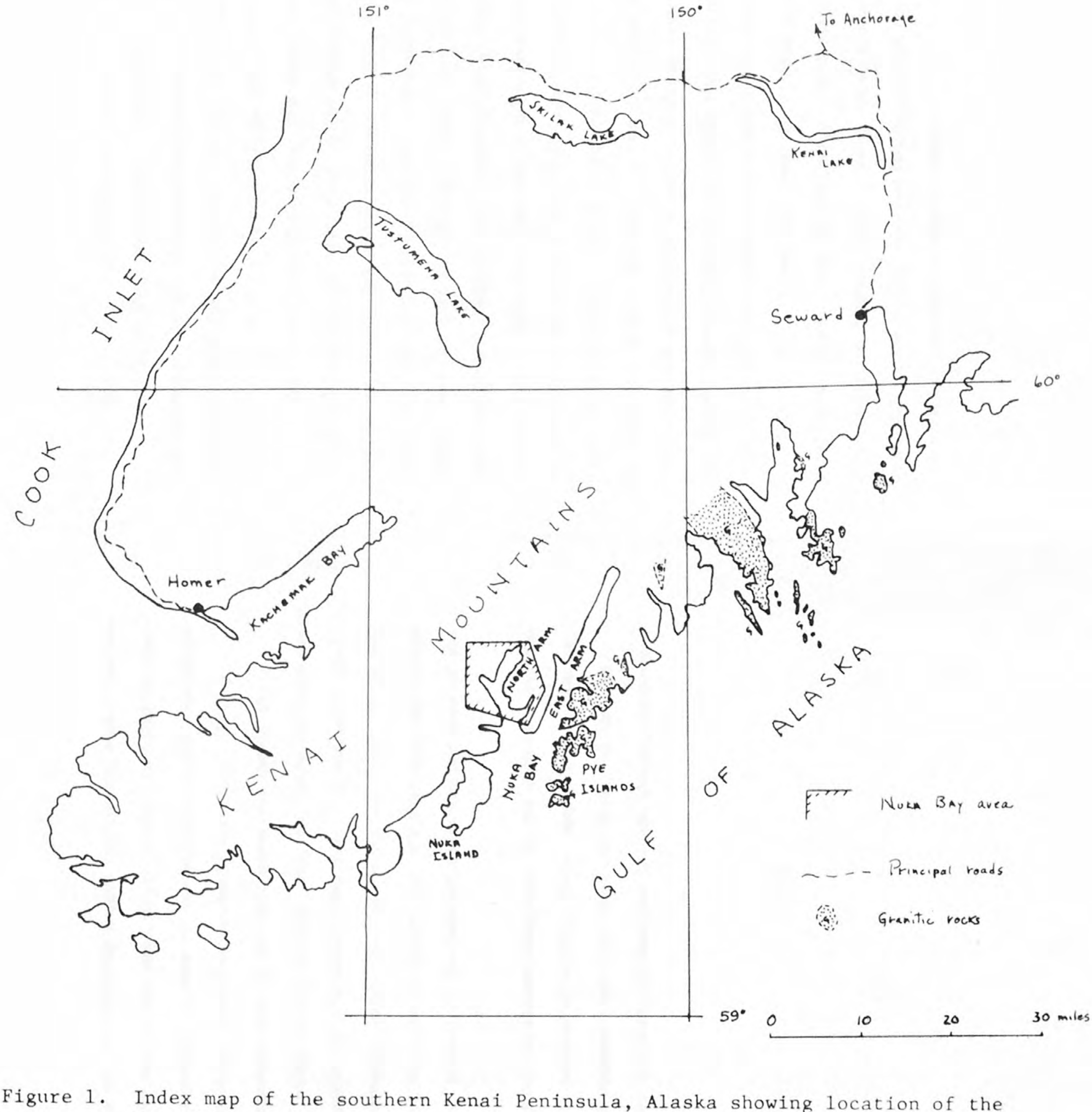

Figure 1. Index map of the southern Kenai Peninsula, Alaska showing location of the Nuka Bay area.

The country is one of extremely rugged topography, with a maximum relief of over 3,500 feet in the area investigated. Vertical to near-vertical cliffs are present on many of the mountain slopes throughout the area, making overland traverses extremely difficult. Valley glaciers, often extending down to 500 feet above sea level, still occupy many of the larger stream valleys, and ice fields and snow cover much of the more gentle terrain above 2,000 feet. An extensive plain of recent glacial outwash, only a few feet above sea level, fills the Nuka River valley at the head of Beauty Bay, off West Arm, and lesser outwash deposits are present at the head of North Arm and some of the larger bays.

Rock exposures are excellent along most of the shoreline but are locally inaccessible because of cliffs. Dense spruce forest mantles most of the bedrock between high-tide level and about 500 feet in elevation; but above 500 feet, if snow and ice are absent, exposures are generally good.

History of the area

In 1909, at the time of the U.S. Geological Survey's first reconnaissance of the southern Kenai Peninsula, at least three claims had been staked for gold in the Nuka Bay area (Martin and others, 1915, p. 229-230; Grant and Higgins, 1910, p. 174). Two of these claims were in East Arm and of no significance. The third, from the description of Grant and Higgins, was apparently on the granite dikes near locality 6, the former Rosness and Larson mine (see p. 33), on the west side of North Arm. However, it was not until about 1918, almost a decade later, that the gold is reported to have been discovered in the Nuka Bay area (Smith, 1938, p. 26). Shortly thereafter, many claims were staked, and by 1924 more than half a dozen properties were in the process of development including a mill under construction at the Alaska Hills mine. Peak activity in the area was reached in the early 1930's when at least four mines, each with its own mill, were producing gold. Toward the end of the 1930's, activity slowly waned, and by 1940 only two properties--the Nukalaska and Sonny Fox mines--were operating. A measure of the size, economy, and needs of the Nuka Bay mining community during its peak years was the finding of a 30-gallon whiskey still in a secluded cove in Beauty Bay. Evidently the community was large enough to support local industry whose products were not normally available in the mining camp and had progressed to the point where nonessential commodities were in demand.

Since World War II there has been very little activity in the Nuka Bay area. A group from Hawaii were apparently unsuccessful in attempts to reopen the Nukalaska mine sometime in the 1950's (according to local fishermen), and in 1959 and 1960 a party from Seward was working in the Beauty Bay area (Williams, 1959, 1960). In 1965 a mining group from Jamestown, Ohio, acquired the former Little Creek prospect (loc. 2); by the fall of 1967 a small mill had been constructed, and a limited amount of ore mined.

After Grant and Higgins' geological reconnaissance of the Kenai Peninsula in 1909, Nuka Bay was not examined again until after the discovery of gold. Pilgrim (1933) gives an account of reports on known deposits by territorial mining engineers who visited Nuka Bay in 1924, 1925, and 1931; an examination of the mines and prospects in the area by S. R. Capps of the U.S. Geological Survey in 1936 is described by Smith (1938). Both of these papers have been extremely helpful in the preparation of this paper.

A rough approximation of the total value of gold produced in the Nuka Bay area is about $166,000. Table 1 lists the five known gold

TABLE 1 NEAR HERE

producers in the area and their estimated production with some data on their underground workings and mill capacities. The production figures for the Alaska Hills mine, Goyne prospect, and for the first 6 years of operation at the Sonny Fox mine are from unofficial reports (Pilgrim, 1933). For the remaining mines and the last 9 years of operation at the Sonny Fox mine, the estimates are based on an average yearly production of 200 tons with an average grade of $25 per ton.

Table 1.--Principal mines and their estimated gold production

Locality No.	Name	Approximate total length of underground workings[1] (feet)	Capacity of mill (per day)	Years of production	Approximate value of gold produced (dollars)
1	Nukalaska mine	900	24 tons	1934-1940	[35,000]
3	Alaska Hills mine	900	Unknown	1924-1931	45,000
6	Rosness and Larson mine	170	4 tons	1931-1933	[15,000]
8	Goyne prospect	600	No mill	1931-1934	< 1,000
9	Sonny Fox mine	1,000	7 tons	1926-1931	25,000
				1932-1940	[45,000]
				Estimated total value of gold produced	$166,000

1/ Exclusive of raises, stopes, and shafts.

2/ Figures in brackets are estimates based on an average production of 200 tons per year with an average grade of $25 per ton.

Present study

Recent interest of private enterprise in the small lode-gold deposits of Nuka Bay and the lack of detailed geologic information in an area once known to have produced a limited yet significant amount of gold were the main factors which prompted this investigation.

Fieldwork occupied the period June 2-30, 1967. The investigation included: geologic mapping (scale 1:63,360) of about 35 miles of shoreline and 20 miles of overland traverses, geochemical sampling of 44 streams for trace-element analyses, and detailed mapping and sampling of the accessible gold deposits. Water travel in the area was by 14-foot skiff and outboard motor, which on a number of occasions proved too small to safely negotiate the rough waters of the bay. The writer was assisted by volunteer helper, Ronne C. Richter, throughout the entire period of field study and by geologic field assistant, Richard A. Brocklehurst, during the last half of the field study.

Geology

Regional setting

The Nuka Bay area is in the Chugach Mountains syncline, one of the major arcuate tectonic elements in south-central Alaska. Filling of the geosyncline with clastic marine sediments probably began as early as the late Early Cretaceous and continued up to the end of the Late Cretaceous (Payne, 1955). The bulk of the sedimentary deposits, however, are apparently middle Late Cretaceous and younger in age (Miller and others, 1959, p. 15). At the close of the Cretaceous, or possibly as late as the close of the Paleocene (Payne, 1955), the sedimentary rocks of the geosyncline were uplifted and strongly folded during the Laramide orogeny. Accompanying igneous activity resulted in the intrusion of many stocks and smaller bodies of crystalline rocks. Following the orogeny, uplift continued through the Tertiary and probably reached a maximum during Pliocene time.

Sedimentary rocks

The geosynclinal rocks in the Nuka Bay area consist of interbedded slate and graywacke with minor argillite, siltstone, locally calcareous, conglomerate, and phyllite. With the exception of some massive graywacke units and conglomerate beds, the rocks are thin bedded, ranging from a fraction of an inch to generally less than a few feet thick. The contacts between individual beds may be gradational or sharp; local disconformaties resulting from slump, scour, or other submarine erosion processes are common.

Graywacke, the predominant rock type in the area, ranges in color from light to dark gray and in grain size from fine to coarse. Weathered surfaces are lighter colored, giving the rock a bleached appearance. The massive graywacke units may be as much as a few thousand feet thick without obvious bedding or discernible change in texture. Along strike, beds characteristically thin, swell and pinch out. Some of the massive graywacke units can be traced for a few miles, apparently occurring as large lenses in the thinner bedded rocks. Lithic fragments appear to constitute a large bulk of the rock, and in some of the massive units, scattered clasts of slate or siltstone, as much as 5 inches in diameter, are common. Graded bedding is well developed in some of the thinner bedded units; individual graded beds range from less than an inch to more than a foot in thickness. A typical graded bed consists of a base of fine- to medium-grained graywacke that changes gradually upward to dark siltstone or slate. The graywacke beds are not foliated, and the more massive units tend to be coarse grained and homogeneous.

The dark, finer grained, clastic rocks are mostly slates and siltstones that generally exhibit a well-developed foliation (slaty cleavage). However, many of the coarser siltstones are not foliated, and occasionally dark massive argillites are present in the thin-bedded sections. Locally, in zones of strong shearing, the fine-grained rocks are phyllitic with visible secondary micaceous minerals. Along most of the north shore of Pilot Harbor (pl. 1), iron-stained phyllites are especially abundant--some coarse enough to be classified as dark micaceous schists.

Conglomerate beds are scattered throughout the section. Slaty conglomerates, with slightly stretched clasts of slate and coarser sediments, are locally present in most of the thin-bedded strata. Along the east side of Surprise Bay, beds of pebble-cobble conglomerate as much as 100 feet thick are especially common. These rocks are composed principally of clasts of reworked graywacke and siltstone set in a graywacke matrix.

Calcareous siltstones were observed along the northeast shore of Beauty Bay where a few thin beds are interbedded with slate, graywacke, and normal siltstone. These limy rocks weather brown in contrast to the gray weathered surfaces of the normal siltstones and graywackes.

Igneous rocks

Light-colored thin dikes and sills, chiefly of granodiorite, occur sporadically throughout the area; at two mines (locs. 1 and 8) they are the host rock for gold-bearing quartz veins. Most of the intrusive rocks occur as dikes, probably filling tensional cross joints formed during regional folding; a few occur as sills intruded along bedding and foliation planes in the slates and graywackes.

In hand specimen the dikes and sills are dense light-grey rocks generally exhibiting a few small altered amphibole and plagioclase phenocrysts. Under the microscope the rocks have a subhedral granular texture, locally trachytic, with a groundmass grain size ranging between 0.2 and 1 mm. A typical dike consists of small laths of sodic andesine (50-60 volume percent), interlath filling of potassium feldspar (10-20 volume percent), quartz (5-15 volume percent), and scattered opaque minerals (1-2 volume percent). Secondary chlorite, white mica, and carbonate are generally present in widely varying amounts and collectively may constitute as much as 20 volume percent of the rock.

The dike at the Goyne prospect (loc. 8), which is as much as 100 feet thick, is one of the coarsest grained intrusives (average grain size 1 mm) observed in the area. The rock is nonporphyritic and contains no primary mafic minerals, but abundant chlorite (10 volume percent) occurs in ill-defined patches and as scattered interstitial filling. Also abundant throughout the rock are veinlets of coarse-grained quartz, zoisite, and potassium feldspar.

No large intrusive bodies were observed in the mapped area. Abundant float of crystalline rock in the stream issuing from the glacier in the extreme northwest corner of the area (pl. 1, sample site 025) may be indicative of a large intrusive mass underlying the ice to the west. The rock is quartz diorite with a subhedral granular texture containing coarse-grained andesine (average grain size 3-5 mm), quartz, and minor potassium feldspar. Zones of strong granulation, containing comminuted mineral particles and locally replaced by abundant carbonate, are common throughout the rock. The large crystalline rock mass on the Pye Islands and on the east side of East Arm (fig. 1) mapped by Martin, Johnson, and Grant (1915) was not examined during this study.

The igneous rocks cut rocks as young as Late Cretaceous and therefore are considered to be Tertiary(?) in age.

Unconsolidated sedimentary deposits

Holocene unconsolidated glacial and glaciofluvial sedimentary deposits fill the heads of the bigger bays in North and West Arms (pl. 1). The largest of these outwash deposits forms an extensive plain more than 3 miles long and 1 mile wide at the head of Beauty Bay. The deposits are almost entirely glacial in origin but are now being reworked by present streams and, locally along the beaches, by wave and tide action. Remnants of moraines are scattered along the sides of the outwash flats, generally forming low ridges or mounds parallel to the mountain fronts.

Alluvial fans have developed at the mouths of some of the larger high-gradient streams, and talus covers many of the steeper slopes throughout the area.

Structure

Bedding and foliation (slaty cleavage) in the sedimentary rocks of the Nuka Bay area strikes between north and N. 40° E., giving rise to the pronounced northeast-trending structural grain of the country. These planar structures generally dip moderately to steeply northwest and are parallel except at the nose of folds or in local areas of strong shearing.

Based on many observations of minor folds and one major fold (from a distance) the rocks have apparently been deformed into a series of relatively open overturned folds with both limbs dipping northwest. Locally the minor folds are not overturned and probably represent gentle warps on the limbs of larger structures. Fold axes on most minor folds plunge at low angles (5°-15°) to the northeast. This folding is hypothetically depicted in the cross section in figure 2.

Figure 2 near here

No major faults were observed in the area, but they could easily be overlooked because of the monotony of section and absence of marker beds. Minor faults are common, especially in the more competent beds, and zones of strong shearing, with little or no discernible offset, are locally present in the slate or slate-graywacke units.

Jointing is conspicuous in many of the massive graywacke units. The principal joints strike about N. 60°-80° W. and dip vertically or steeply southward, normal to the fold axes. Many quartz veins and some dikes in the area have this same general orientation, which suggests that their formation was controlled in part by jointing.

Economic geology

Gold-bearing quartz veins

Quartz veins are ubiquitous throughout the Nuka Bay region, but they appear to contain significant amounts of gold only in a relatively small area approximately 8 miles long by 6 miles wide around North and West Arms. The salient physical characteristics of most of the known gold-bearing veins are listed in table 2; more detailed descriptions

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TABLE 2 NEAR HERE

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are presented in the section describing the individual mines and prospects.

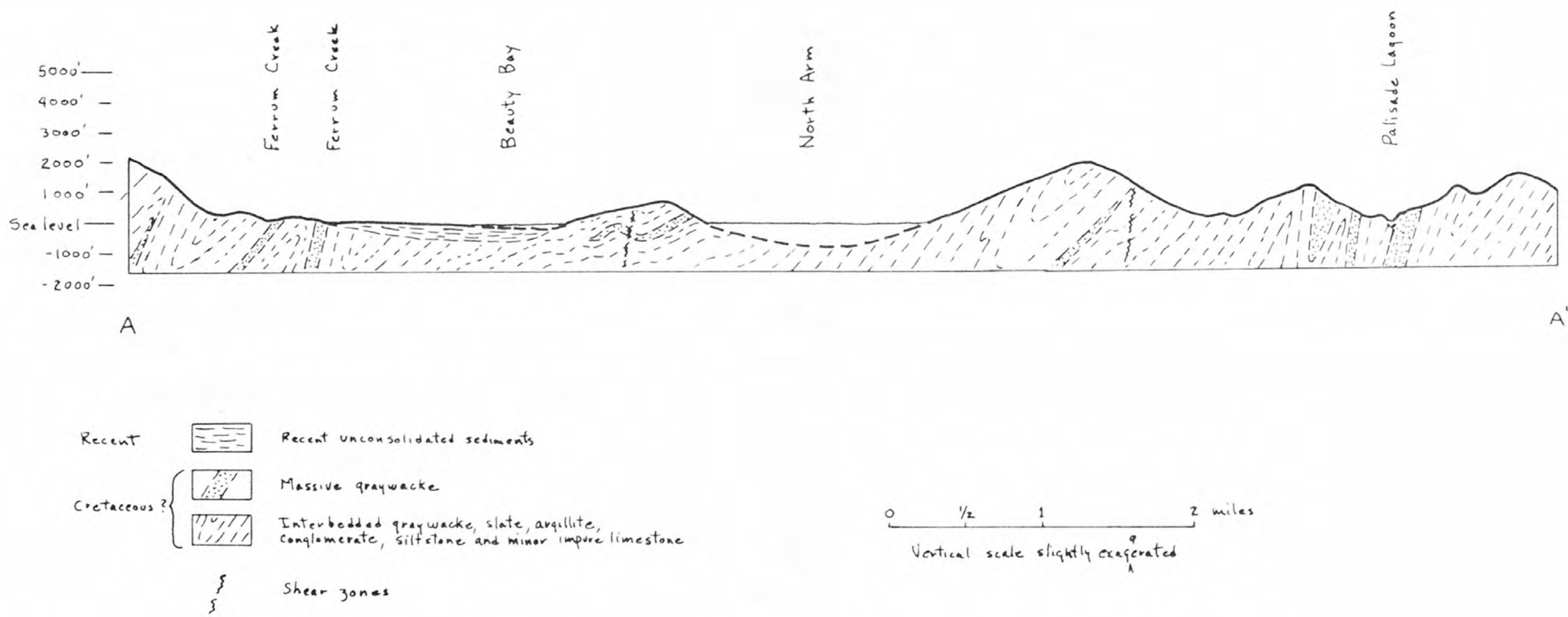

Figure 2. Hypothetical geologic section across Nuka Bay area, Alaska

Table 2.--Physical characteristics of the known principal veins

Locality No.	Locality Name	Elevation (feet above sea level)	Average attitude	Length[1] (feet)	Maximum width (feet)	Country rock
1	Nukalaska mine	2,150	E.-W.; 80° S.	375	1.5	Contact of dike and slate-graywacke
2	Glass-Heifner property	200-320	E.-W.; 40°-60° N.	350	5	Graywacke
			N. 80° W.; 85° N.	100	1	Graywacke
			N. 85° W.; 81° N.	150	4	Contact of graywacke and slate
3	Alaska Hills mine	375-570	E.-W.; 55° N.	200	2.5	Graywacke
			E.-W.; 55° N.	[75]	1.1	?
4	Nuka Bay mines prospects	1,120-1,400	N. 85° W.; 82° N.	[15]	2	Slate-graywacke
			N. 85° W.; 76° S.	[20]	.5	Graywacke-siltstone
5	Frank prospect	0	N. 52° E.; 79° N.	[50]	1.1	Slate
6	Rosness and Larson mine	0-100	N. 30° W.; 67° S.	[30]	.5	Graywacke
			E.-W.; 80° S.	[20]	?	Graywacke
7	Hatcher prospects	0-170	N. 70° W.; vert.	200	4	Graywacke-conglomerate-slate
			N. 80° W.; 70° N.	[20]	3	Graywacke-conglomerate
8	Goyne prospect	25-135	N. 85° E.; 75° S.	100	1.1	Dike
9	Sonny Fox mine	150-225	N. 75 E.; vert.	60	2	Slate
			N. 70° E.; 60° W.	300	5	Graywacke
10	Skinner prospect	0	N. 80° E.; 72° S.	[40]	4	Graywacke
11	Locality 11	0	N. 80° E.; 70° S.	[5]	2	Graywacke
12	Locality 12	0	N. 80° E.; vert.	[5]	2	Graywacke

[1] Figures in brackets are minimum lengths for veins of limited exposure in pits, adits, and poor outcrop.

The gold-bearing quartz veins are characteristically short and narrow, rarely longer than 350 feet or wider than 5 feet. Zones of veins, however, such as at the Goyne prospect (loc. 8) or the Golden Goose vein (p. 32), may be as much as a few thousand feet long. The larger and more productive veins appear to be confined to the competent massive graywacke beds and dike rocks or locally along the contact between these rocks and thin interbedded graywacke and slate. Typically the veins are very irregular and pinch and swell over short distances. They also frequently split and recombine, resulting in abundant inclusions of country rock in the vein system. All veins striking into slate or thin interbedded slate and greywacke from massive graywacke or dike rock splay into several thin quartz stringers that follow bedding or foliation planesin the thin-bedded strata a short distance before pinching out. Some vein structures consist of a relatively large, well-defined quartz vein with quartz stockworks along one or rarely both walls. Quartz stockworks unrelated to any larger vein structure and without any preferred trend are fairly common in some of the massive graywacke units.

Contacts between veins and country rock are sharp. Locally, the vein walls are slickensided; in a few cases a thin clay gouge zone may be present between vein and wallrock, but hydrothermal alteration is not apparent.

Most quartz veins in the Nuka Bay area strike east-west, almost normal to the regional structure, and dip steeply to vertically. Some stockworks, as mentioned above, however, show no particular orientation, and a few smaller veins follow bedding and foliation planes in the sedimentary rocks. A rose diagram of the strikes of the 19 principal veins listed in table 2 is shown in figure 3. Although constructed

Figure 3 near here

with data from a few observations, the diagram does illustrate the preferred orientation of the principal veins.

The mineralogy of the quartz veins is not complex. The veins are hydrothermal fissure-fillings and show no observable change in structure or mineralogy through a vertical range of more than 2,000 feet. Massive, crystalline, white to light-gray quartz, locally exhibiting a sheeted or layered structure, constitutes more than 95 percent of the vein material. Sulfides, chiefly arsenopyrite, occur as irregular masses, lenses, and stringers either scattered through the vein quartz or, if the vein is sheeted, in zones separating distinct layers of massive quartz. Minor and extremely variable amounts of pyrite, chalcopyrite, galena, and sphalerite associated with the arsenopyrite have been observed in polished sections. Capps (in Smith, 1938, p. 27) also reported that tetrahedrite, vocellite, and chalcopyrite are present. Native gold occurs principally as small wiry segregations or thin irregular plates generally in sulfide masses or in uartz near sulfides. Polished sections reveal some gold occurring in microscopic blebs in the arsenopyrite.

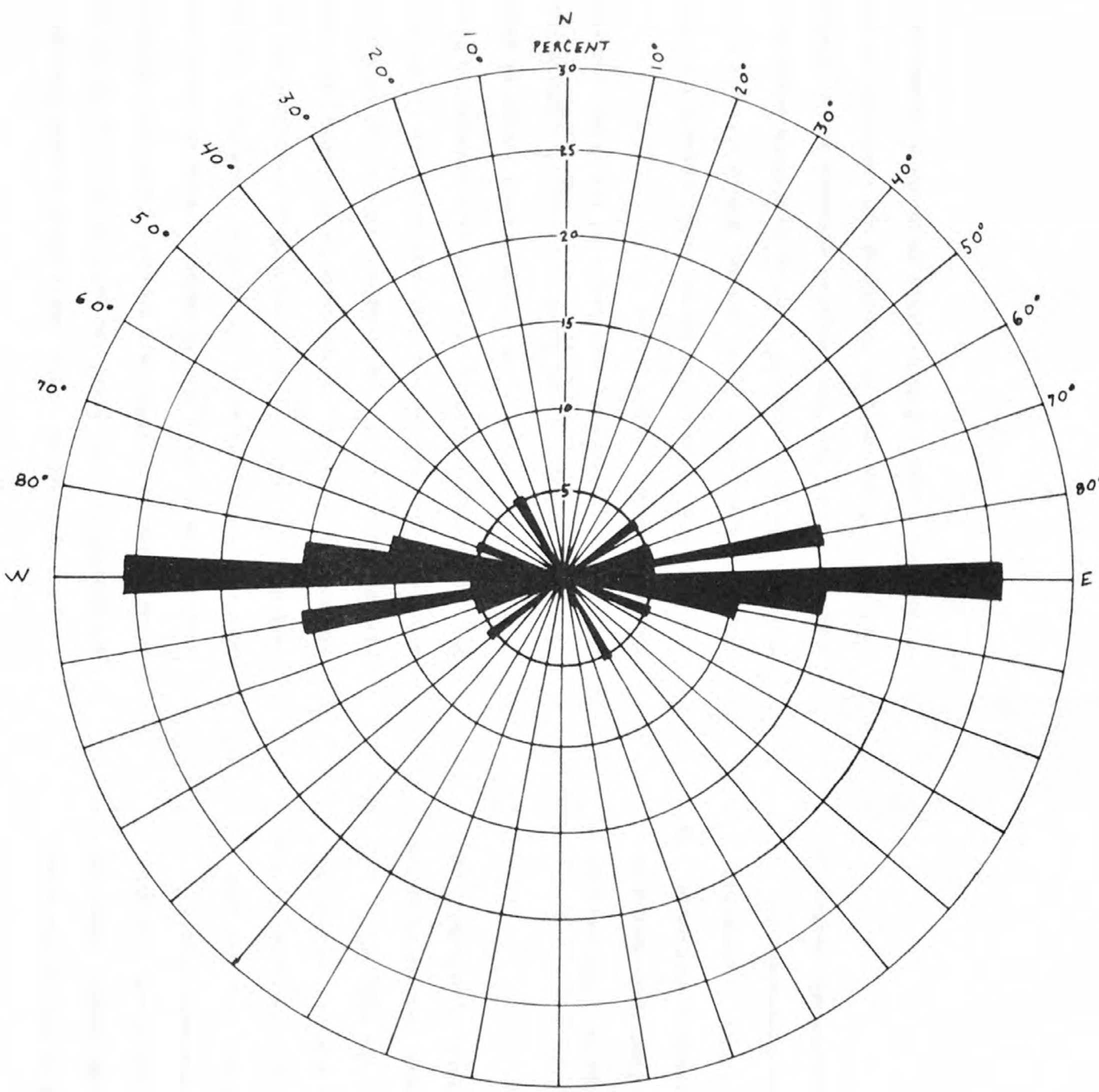

Figure 3. Rose diagram showing the average strikes of 19 principal quartz veins in the Nuka Bay area. Other data for these veins are given in Table 2.

Spectacular gold specimens have been found in many of the mines, and even some mine-run ore has had remarkably high tenor. Capps (in Smith, 1938, p. 26) mentioned a shipment of 5 tons of ore from the Sonny Fox mine yielding $530 a ton, and at the Nukalaska mine a several-weeks run of diluted ore averaging $100 per ton. The gold values are erratic and vary greatly from place to place along the same vein. Moreover, although a genetic relation is apparent between the gold and sulfides, the presence of abundant sulfides does not necessarily imply high gold values. Random channel samples collected during this study ran as high as 300 ppm gold (Table 3, ACH-061), or

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TABLE 3 NEAR HERE

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about 9 ounces per ton, and many were in the range of 1-200 ppm gold.

Oxidation has locally altered the sulfide minerals to depths as much as 200 feet, but there is no evidence of secondary enrichment. In areas of relatively strong oxidation, the arsenopyrite is generally enclosed in a shell of fine-grained yellowish-green decomposition products (scorodite?) and the vein quartz is conspicuously stained by limonite.

The hundreds of barren uartz veins exposed throughout the area are similar in form, size, and probably genesis, to the mineralized veins except no sulfides were observed. In figure 10 the larger barren quartz veins or areas with an unusual number of barren quartz veins have been noted. Veins in six of these areas have also been sampled (ACH-010, 013, 017, 024, 059, and 079) and analyzed for gold and trace elements in an attempt to determine if they show any significant metal values (table 3). Only two samples (ACH-059 and 079) contained detectable gold values, and none were anomalous in other elements. The two samples with detectable gold both contained 0.07 ppm; one (ACH-059) is a composite grab sample from a number of quartz veins exposed at an elevation of 2,000 feet west of locality 1 and the other (ACH-079) is a composite grab sample of six veins across 100 feet on the west side of Ariadne Island.

The orientation of the quartz veins suggests that they fill tensional cross joints formed during, and as a result of, the regional folding. The preponderance of veins in massive graywacke and dike rock suggests further that the tensional stresses during folding were relieved in these rocks by fracturing and mechanical deformation, whereas the slates and thin-bedded graywacke deformed plastically.

Table 3.--Semiquantitative spectrographic and chemical analyses of quartz veins

[In parts per million. Analysts: Semiquantitative spectrographic analyses, Arnold Farley, Jr.; atomic absorption (gold) and colorimetric (arsenic), W. L. Campbell, R. L. Miller, T. A. Roemer, and A. L. Meier. A, not detected. Numbers in parentheses under elements is lower limit of determination in ppm.]

Sample No.	Au[1/] (0.02)	As[2/] (10)	Ag (0.5)	B (10)	Ba (20)	Co (10)	Cr (10)	Cu (2)	Ni (2)	Pb (10)	Sb (100)	V (5)	Zn (200)
Mineralized Quartz Veins													
ACH-015	0.30	1,200	A	15	150	A	A	20	5	A	A	30	A
ACH-038	72	2,400	2	10	100	A	A	50	A	30	A	10	A
ACH-039	.02	6,000	A	10	150	10	A	200	10	A	A	20	A
ACH-040	2	1,200	A	15	300	15	A	50	10	70	200	50	300
ACH-041	1	4,000	A	20	200	20	20	10	30	A	300	30	A
ACH-048	A	15	A	10	100	<10	A	10	A	A	A	20	A
ACH-049	.62	6,000	1.5	10	150	10	A	7	20	300	150	20	A
ACH-050	.04	160	A	10	100	<10	A	10	A	A	A	15	A
ACH-051	.05	400	A	15	150	<10	A	10	<2	A	A	20	A
ACH-052	26	4,000	.7	20	300	10	30	20	2	70	A	70	300
ACH-060	8.8	2,400	1.5	10	150	A	A	150	5	300	A	30	A
ACH-061	304	2,400	3	15	150	A	A	150	2	150	A	15	A
ACH-062	.80	160	A	50	500	A	30	100	10	10	A	70	A
ACH-080	40	300	15	70	300	15	20	200	15	150	A	30	A
ACH-081	200	1,500	30	10	70	A	A	15	5	700	A	10	A
ACH-082	6.5	2,000	3	20	700	5	30	20	7	700	A	50	A
ACH-083	.2	10	3	20	200	10	15	150	15	1,500	A	30	700
ACH-084	.08	40	1	50	300	A	20	20	5	150	A	30	A
ACH-085	.1	10	1.5	70	700	5	70	100	10	300	A	100	A
Barren Quartz Veins													
ACH-010	A	40	A	15	150	A	20	15	10	A	A	30	A
ACH-013	A	10	A	10	100	10	A	7	5	A	A	15	A
ACH-017	A	10	A	10	100	A	A	7	5	A	A	30	A
ACH-024	A	10	A	30	500	<10	50	10	10	A	A	70	A
ACH-059	.07	20	A	20	200	A	20	20	10	10	A	70	A
ACH-079	.07	10	A	<10	1,000	A	7	3	2	A	A	20	<200

1/ Atomic absorption.

2/ Colorimetric.

Description of individual mines, prospects, and quartz veins

Locality 1 (Nukalaska Mining Company; Honolulu group)

The Nukalaska mine is on a precipitous north-facing mountain slope 1.2 miles southwest of the head of Shelter Cove in Beauty Bay at an elevation of about 2,150 feet above sea level. The caved portal of the mine is difficult to reach and extreme care must be used in the climb.

Although reportedly one of the richest deposits in the area, very little work was done on the vein after its discovery in 1926 (Smith, 1938, p. 28) until about 1933 when the Nukalaska Mining Company began active development. Production probably started in 1934 or 1935 and continued up to 1940, but the work was hampered by a fire in 1938 (Smith, 1939, p. 29) and heavy snowslides during the winter of 1938-39 (Smith, 1941, p. 25). After World War II, a group from Hawaii, locally referred to as the Honolulu group, attempted to reactivate the mine but the venture was apparently short-lived (comments by local fishermen). At the time of our visit in June 1967, the road from Shelter Cove to the mill and camp at an elevation of 150 feet was obscured, and the mill equipment and camp buildings had been destroyed by man and weather. An aerial tram, however, with a vertical drop of about 1,900 feet, that runs from the mine adit down to a terminus three-eighths of a mile west of the mill, was still standing. Southeast of the mill the remains of another aerial tram, or possibly one that was under construction in 1940, extends up the east face of the mountain.

Locally slickensided vein walls and minor gouge and breccia in the veins indicate some structural readjustment following vein deposition, but in general it appears that the veins were emplaced during the end period of folding. Dike intrusion probably occurred more or less contemporaneously with vein formation or just prior to vein formation.

The source of the ore solutions responsible for the deposition of the gold-bearing veins and the apparent confinement of veins to a relatively small area are probably related problems neither of which are well understood. The mineralogy and structure of the veins are characteristic of mesothermal-hypothermal deposits, implying deposition from magmatic solutions under high pressures and moderate to high temperatures. In the gold-bearing area, however, the only igneous rocks known are a few small dikes and sills, and although they are spatially related to some veins, they do not appear to be the immediate source of any ore solutions. The nearest known large crystalline rock mass is exposed on the east side of East Arm and the Pye Islands, approximately 5 miles from the southeast corner of the mapped area (fig. 1). This body of granite (Martin and others, 1915, p. 228) or more likely a hypothetical parent batholith underlying the western part of Nuka Bay may be the source of both the granodiorite dikes and the ore-bearing quartz veins in the area.

Two attempts to scale the mountain slope directly below the mine proved futile because of steep cliffs, and on one day, almost continuous snow avalanches. A third attempt, by a devious route up the valley to the snowfield south of Mount Diablo (see pl. 1) and then back down the ridge to the mine, was successful only to find the workings inaccessible due to caved timbers at the portal. Four hundred feet west of the mine at the end of a goat trail cut into the face of the cliff, a small bunkhouse still stands cabled on a narrow ledge.

As neither the underground workings nor the surface exposures could be examined during our visit, the following geologic information is quoted directly from Capps (in Smith, 1938, p. 28-29):

"The vein crops out on the crest of a high, rugged ridge that rises about 2,500 feet above sea level and is so steep as to be difficultly accessible. To mine it an adit was driven 30° W., into the face of a cliff 200 feet below the outcrop, and at a distance of 230 feet it encountered the vein, which strikes west and along which crosscuts were driven 175 feet westward and 200 feet eastward. East of the adit little profitable ore was encountered, but to the west a rich pay shoot was cut, and from it all the gold so far recovered has been taken. At the time of visit, in August 1936, eight ore chutes 20 feet apart had been opened up, showing a width of the ore shoot of 140 feet, and stoping was in progress up to a point 80 feet above the adit level. The ore shoot rakes considerably to the west, perhaps as much as 45°. Surface prospecting indicates that a second ore shoot exists some 250 feet east of the one now mined, but this shoot has not yet been encountered in the underground workings.

"The vein strikes about due east, almost at right angles to the east-northeastward-striking slate and graywacke of the country rock, dips 80° S., and lies parallel to and along the footwall of a 12-foot dike.

The vein ranges from 10 to 18 inches in thickness and consists of banded quartz, more or less oxidized to such depths as have so far been reaching by mining. Spurs from the vein branch diagonally eastward into the dike, but these are of lower grade than the main vein. Some small lenses of ore show at the surface in the slate on the hanging wall of the dike but have not been found underground. Both vein and dike are cut and displaced by a small northwestward-trending fault at a point 275 feet west from the main adit, but vein matter persists along the jog formed by the offset. * * *

"The dike rock, as examined in thin section, proves to be a quartz diorite in which the principal minerals are quartz, lime-soda feldspar, and calcite, with sericite and chlorite as secondary minerals. The ore consists of somewhat banded quartz, carrying visible particles of arsenopyrite, pyrite, chalcopyrite, galena, and free gold."

Locality 2 (Little Creek prospect; Earl Mount prospect; Glass and Heifner property)

This prospect, presently being developed by Messrs. Glass and Heifner of Jamestown, Ohio, is 0.9 mile northwest of the northwest corner of Beauty Bay at an elevation of 200 feet above sea level. A good road leads to the property from an airstrip on the Nuka River flats at the edge of the bay.

The gold-quartz veins on this property were discovered in 1924, and by 1925 a 50-foot adit had been driven and a number of opencuts and pits excavated (Pilgrim, 1933, p. 44-46). In 1932-34 the adit was driven another 400 feet and a raise extended to the surface (Smith, 1938, p. 32). This work reportedly failed to discover ore and since then until 1965, when the property came under control of Glass and Heifner, it apparently had lain idle. Glass and Heifner have erected a mill, machine shop, and comfortable bunkhouse; in 1967 they started surface mining the northernmost of the veins. The milling equipment consists of two jaw crushers, a 4-foot ball mill, and a Wilfley concentrating table.

A geologic map and section of the underground workings and surface exploration is shown on figures 4 and 5. All of the underground

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Figures 4 and 5 near here

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workings are in massive thick-bedded graywacke. Black slate and siltstone, with thin interbedded graywacke, is exposed on the surface in all the easternmost and southeasternmost pits. Foliation in the finer grained clastic rocks and bedding trends about N. 10°-30° E. and dips 50°-60° NW. Where the slate and massive graywacke are in contact, however, the slate is generally severely distorted. No dikes were observed.

At least three major quartz veins have been discovered and explored on the property. All the veins have an average east-west strike and dip vertically to 40° N. The veins are confined to the massive graywacke or graywacke slate contact; where they continue into the slate, they thin, split, and generally feather out.

The northernmost and probably the principal vein on the property is sporadically exposed in the surface workings for a distance of 350 feet and underground for 125 feet. At its western extremity, the vein has a consistent moderate dip (40°-67°) to the north, but toward the east steepens to more than 80° N. The vein ranges from less than 1 foot to as much as 5 feet in width. Locally the vein splits, or is sheeted, with horses of graywacke between the quartz. Many of the splits continue into the graywacke at angles of 10°-30° where they apparently pinch out. Slickensides on the hanging wall plunge 35° to the northeast. Massive sulfides, chiefly arsenopyrite, occur in lenses, sheets, and irregular masses throughout the vein system. Two samples (ACH-038 and ACH-039) cut at random across the vein in the drift assayed 72 and 0.2 ppm gold respectively (fig. 4).

A second and much shorter vein is exposed 100 feet south of the eastern half of the main vein in two surface trenches 100 feet apart. The vein dips 84°-87° N., is 0.3 to 1 foot wide and contains only minor amounts of sulfides. It apparently does not extend down to the level of the adit.

Sixty feet farther south a third vein is exposed in many pits and opencuts over a distance of 150 feet. The vein is also exposed underground along a short drift off the main adit and has been raised on from this drift to the surface. Underground the vein has a maximum width of about 2 feet, but near the raise the vein splits and appears to be pinching out to the west. At the face of the drift, 20 feet west of the raise, only the northernmost split, with a width of 0.5 feet, is present.

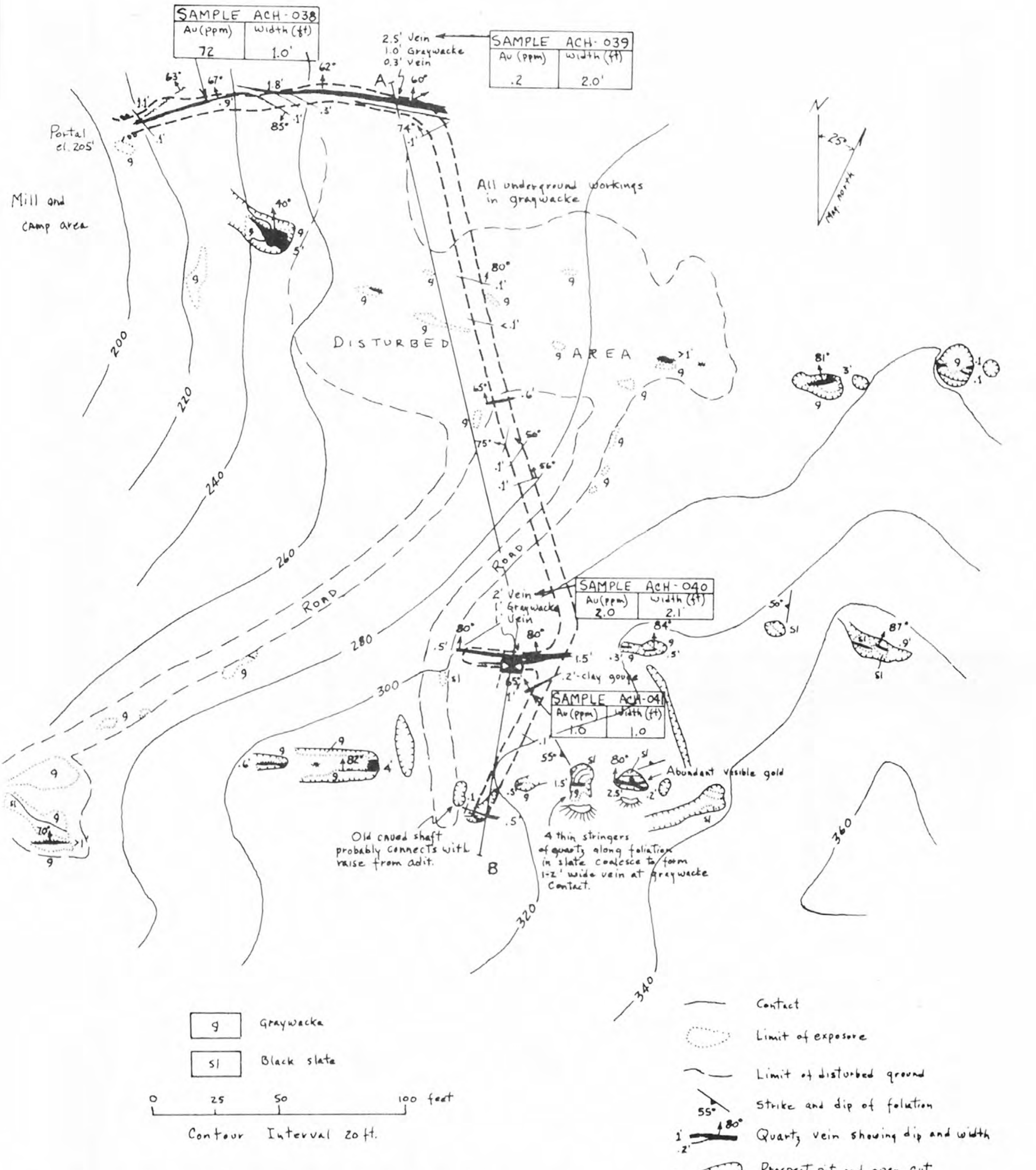

Figure 4. Geologic map of surface and mine workings at locality 2 (Glass and Heifner property), Nuka Bay area, Alaska

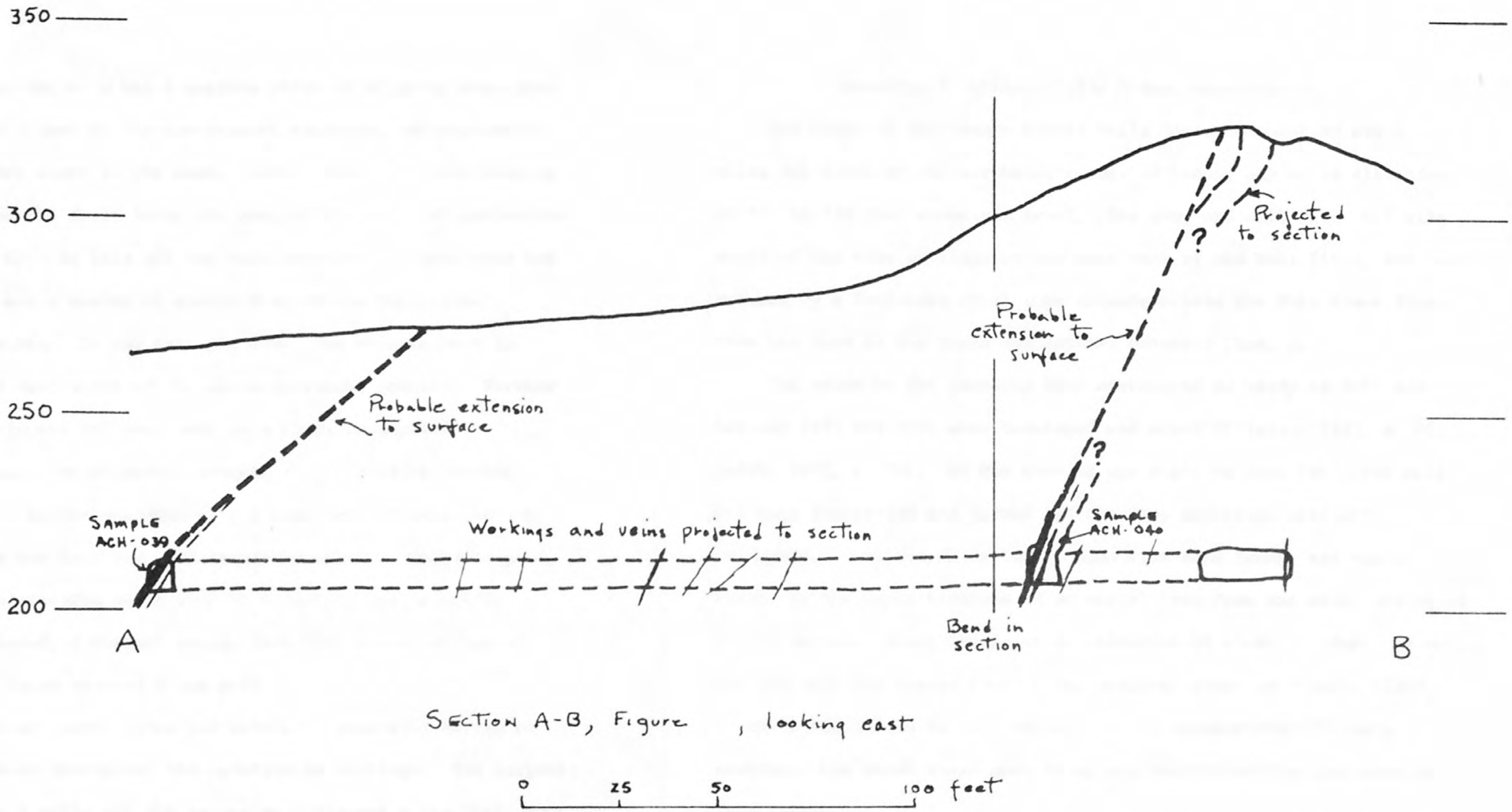

Figure 5. Section through mine workings at locality 2 (Glass and Heifner property), Nuka Bay area, Alaska

On the surface the vein has a maximum width of slightly more than 4 feet, thins to 0.6 feet at its westernmost exposure, and apparently pinches out in black slate to the east. Black slate forms the hanging wall of the vein in the first large pit east of the vertical projection of the adit (fig. 4). In this pit the vein averages 1.5 feet wide and extending from it are a number of splits that follow the curved foliation in the slate. In the next pit east, the vein is back in graywacke, about 3 feet south of the slate-graywacke contact. Farther to the east the vein was not seen, and only slate is exposed. Arsenopyrite is again the principal mineral in the sulfide-bearing parts of the vein. In the easternmost pit exposing the vein, native gold is relatively abundant and good specimens of wiry masses of gold, as much as three-sixteenths of an inch in diameter, can be easily obtained. Underground, a channel sample (ACH-040) across 2 feet of the vein near the raise assayed 2 ppm gold.

Numerous smaller quartz veins and veinlets, generally barren of sulfides, are exposed throughout the underground workings. The largest of these, probably a split off the larger vein exposed a few feet north in the raise drift, shows considerable clay gouge and sulfate efflorescences along its walls. A 1-foot channel sample (ACH-041) assayed 1 ppm gold.

Locality 3 (Alaska Hills Mines Corporation)

The mines of the former Alaska Hills Mines Corporation are 1.5 miles due north of the northeast corner of Beauty Bay at an elevation of 375 to 570 feet above sea level. The camp and mill site, 0.3 mile south of the mine workings on the east bank of the Nuka River, are best reached by a bulldozer trail that extends across the Nuka River flats from the road to the Glass and Heifner property (loc. 2).

The veins on the property were discovered as early as 1918 and between 1923 and 1931 were developed and mined (Pilgrim, 1933, p. 46; Smith, 1938, p. 29). At the time of our visit in June 1967, the mill had been dismantled and burned and the camp buildings were all collapsed. Only two adits in the mine area were found, and one of these, at the upper terminus of an aerial tram from the mill, was caved at the portal. These adits, at an elevation of about 375 feet, do not fit too well the description of the workings given by Pilgrim (1933, p. 46-48 and quoted in part below), but it appears that the main workings were above those seen by us and snow-covered at the time of our search.

The accessible adit, about 200 feet north of the adit at the terminus of the tram, is approximately 110 feet long and entirely in massive graywacke. The adit trends N. 80° E. for the first 75 to 90 feet and then swings slightly to an east-west course. No veins were observed. At the caved adit, vein quartz with arsenopyrite and pyrite was observed on the tailing pile and a grab sample of this material (ACH-015) assayed 0.3 ppm gold.

The following description of the underground workings and geology is quoted from Pilgrim (1933, p. 46-47):

"Development work has been carried on in four separate ~~channels~~ tunnels. The uppermost tunnel, which is at an elevation of 570 feet above tide level, has a length of 125 feet. Above this tunnel the vein has been mined to the surface and is not accessible for examination. The present operating tunnel, which is at an elevation of 495 feet, has a total length of about 5[illegible]0 feet. This tunnel intercepts the vein at a point 118 feet from the portal, at which point the vein is 6 inches in width, strikes easterly and dips 55° N. From this point the tunnel follows the vein for a distance of 50 feet to a fault, the strike of which is N. 5° E. and which cuts off the vein. At its intersection with the fault the vein is 30 inches in width. The vein quartz is white and crystalline and contains metallic sulphides in considerable quantity. At a point in the tunnel about 35 feet west of the fault a winze has been sunk on the vein to a depth of 40 feet. * * * From the point at which the vein is cut off by the fault the tunnel has been driven southerly along the fault plane for a distance of 55 feet and thence easterly, approximately normal to the fault plane, for a distance of about 100 feet where the faulted segment of the vein was intercepted. From this point a drift has been extended on the vein westerly for a distance of 50 feet, where the vein is cut off by a fault plane, and easterly about

40 feet, where the vein separates into scattered stringers and apparently terminates. The ore between the operating tunnel and the upper tunnel level has been stoped. The wall rock exposed in the operating tunnel is graywacke with the exception of that penetrated by the last 60 feet of the tunnel which is slate. Where the vein enters the slate it becomes narrower and, as stated above, gradually becomes dissipated into scattered stringers. * * *

"From a point about 280 feet northwesterly from the portal of the operating tunnel and at an elevation of 370 feet a crosscut tunnel has been driven a distance of 165 feet that is so directed as to intercept the vein at the lower horizon. [Authors note: This may be the adit at the terminus of the tram.] This objective has not yet been reached, * * *.

"About 350 feet northerly from the Alaska Hills vein, above described, is the Ehmswiler vein, upon which has been driven a tunnel 75 feet in length. This vein is said to have a width of from 6 inches to 20 inches and to be parallel to the Alaska Hills vein."

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Locality 4 (Nuka Bay Mines Company)

The prospects of the former Nuka Bay Mines Company are at an elevation between 1,120 and 1,400 feet above sea level and about one-half mile east of the northeast corner of Beauty Bay. A foot trail, now almost completely covered with growth, leads to the prospects from a collapsed cabin at the mouth of the first stream north of the bay.

Apparently all of the exploration and development work on the property was done before 1931 (Pilgrim, 1933, p. 49-50) and even by the time of Capps' visit in 1936, the buildings and equipment were showing the effects of exposure (Smith, 1938, p. 30). At the present time no buildings remain standing in the prospect area, and the tailing pile at the portal of the long exploration tunnel is largely grown over with alder.

A geologic sketch map of the observed surface and underground workings is shown in figure 6. At the time of our visit in June 1967,

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Figure 6 near here

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however, the mountain was covered by thick clouds, limiting visibility to less than 100 feet. Hence, it is very likely that some of the exposures mentioned by Pilgrim (1933) were missed, and that the relative positions of the observed workings as shown in figure 6 are in error.

The highest working found is in thin-bedded graywacke and slate at an elevation of about 1,400 feet on a 0.3- to 2-foot-wide quartz vein that strikes N. 85° W. and dips 82° N. The vein is exposed along 15 feet of opencut in front of a caved adit. Slickensides plunge 20° N. 80° E. on the hanging wall of the vein. The vein is strongly iron stained and contains scattered irregular lenses and stringers of sulfides, principally arsenopyrite and pyrite. A 1-foot channel sample (ACH-060) cut across a portion of the vein containing about 5 percent sulfides assayed 8.8 ppm gold.

About 500 feet S. 70° W. and at an elevation of approximately 1,180 feet, a quartz vein striking N. 85° W. and dipping 76° N. has been explored by a vertical shaft. The shaft is filled with water to within 1 or 2 feet of its collar but appears to be about 30 feet deep. The vein, which cuts thin-bedded graywacke and argillite striking N. 20° E. and dipping 30° NW., is exposed for a length of about 20 feet on the surface; it ranges between 1 and 2 feet in width and locally contains lenses of country rock within the quartz. A random channel sample (ACH-061) across 2 feet of vein, including some massive arsenopyrite, assayed 304 ppm gold, the highest gold value obtained during the investigation. A little more than 100 feet north and slightly higher, a second shaft, about 5 feet deep, has been dug on a vein, 0.5 foot wide, that strikes N. 80° W. and dips vertically. Only minor amounts of sulfides were observed in vein material on a small dump by the shaft.

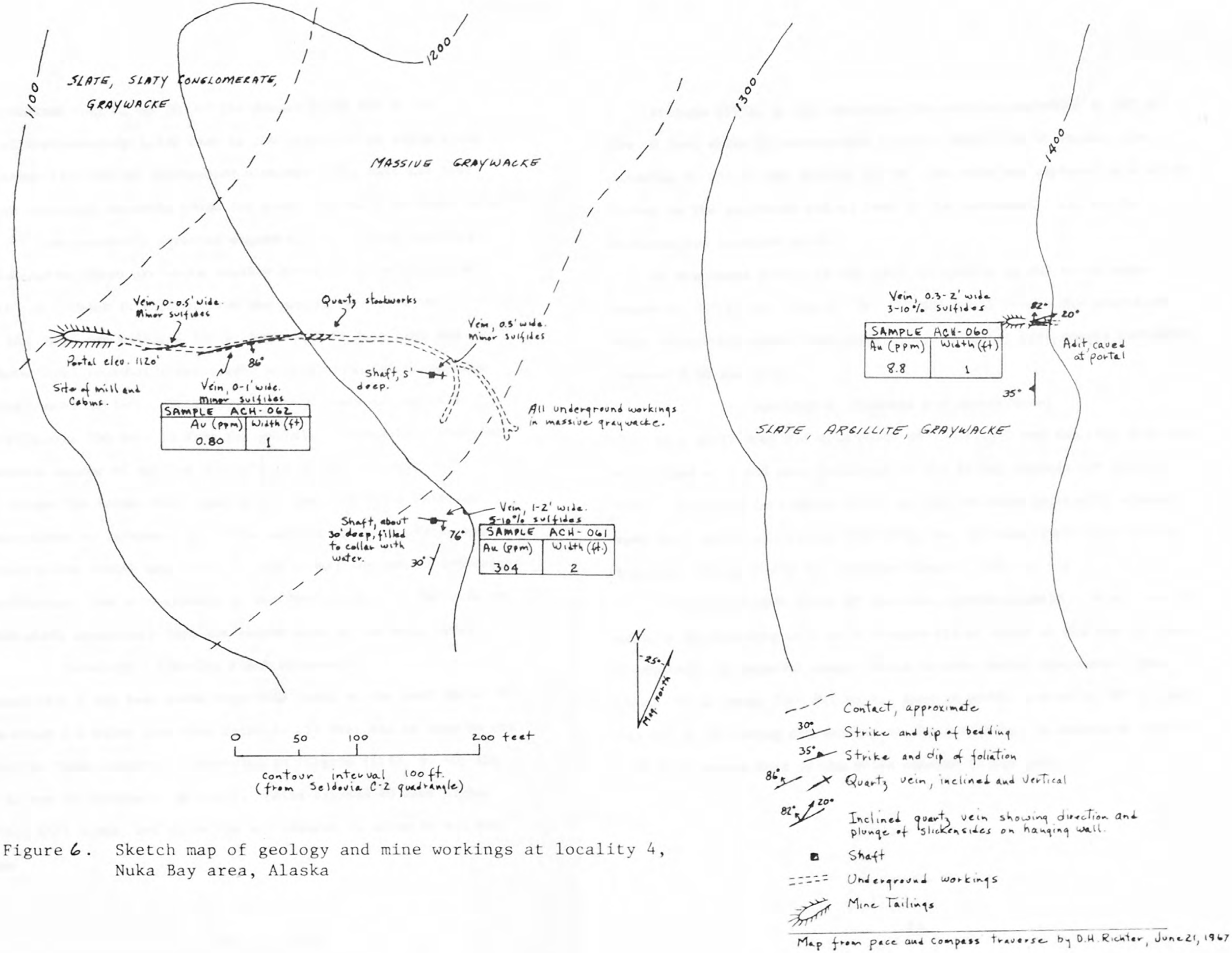

Figure 6. Sketch map of geology and mine workings at locality 4, Nuka Bay area, Alaska

Three hundred feet N. 60° W. of the deeper shaft and at an elevation of approximately 1,120 feet is the portal of an exploration adit with about 410 feet of underground workings. The adit has been driven on an irregular easterly trend for about 270 feet, at which point it splits into two southerly directed segments. All of the workings are in thick-bedded dense graywacke locally containing inclusions of black argillite. About 20 feet in from the portal, a quartz vein 0.5 foot wide, has been followed for 30 feet. At 65 feet from the portal a second and somewhat wider quartz vein dipping 86° S. has been followed for almost 80 feet. This larger vein appears to end in a stockwork of quartz 160 feet in from the portal. Neither vein contains any appreciable amount of sulfide minerals; a 1-foot channel sample (ACH-062) across the larger vein assayed 0.8 ppm gold. The adit was undoubtedly driven to intersect the veins exposed on the surface, but, as indicated by the sketch map (fig. 6), the tunnel was not of sufficient length to intersect the vein exposed in the deep shaft, and the vein in the shallow shaft apparently does not extend down to the adit level.

Locality 5 (Charles Frank prospect)

A caved adit a few feet above high-tide level on the west shore of North Arm about 1.8 miles from Moss Point is all that can be seen on the former Charles Frank property. According to Pilgrim (1933, p. 40) the adit was driven to intersect two quartz bodies exposed 40 feet higher on the steep hill slope, but which are now covered by slide debris and vegetation.

Pilgrim (1933, p. 40) describes the adit as extending N. 50° W. for 60 feet where it encountered a quartz vein 8 to 14 inches wide, trending N. 52° E. and dipping 79° N. The vein was explored by a drift 8 feet to the southwest and 43 feet to the northeast. All of the workings are in black slate.

At the caved portal of the adit, foliation in the black slate trends N. 25° E. and dips 35° NW. On the small dump a few pieces of vein quartz with minor arsenopyrite were found; a grab sample (ACH-050) assayed 0.04 ppm gold.

Locality 6 (Rosness and Larson mine)

In a small cove 0.2 mile north of locality 5 are the mine workings and ruined mill and camp buildings of the former Rosness and Larson mine. According to Pilgrim (1933, p. 41) the mine apparently produced some gold during the period 1931-1933, but by 1936, when Capps visited the area, the property was inactive (Smith, 1938, p. 32).

On the southwest shore of the cove, across a small stream from the mill, a 30-foot-long adit with a water-filled winze at the end follows a stockwork of parallel quartz veins in thin-bedded graywacke. The veins, which range from 0.1 to 0.5 foot in width, strike N. 30° W. and dip 67° S. following the bedding of the graywacke. A composite sample (ACH-052) across four of the veins assayed 26 ppm gold.

Two hundred feet to the northwest, just above the mill at an elevation of about 50 feet, is a caved adit with vein quartz, containing minor arsenopyrite and pyrite, on the dump. Selected samples (ACH-051) of this material assayed 0.05 ppm gold. This adit may be the 20-foot adit at an elevation of 110 feet referred to by Pilgrim (1933, p. 42) which was driven on a quartz vein trending east-west and dipping 80° S.

Slightly higher on the hillside and about 100 feet north of the caved adit is an opencut, now covered with vegetation, that according to Pilgrim (1933, p. 42) exposed a zone of brecciated graywacke containing many stringers of quartz striking N. 58° W. and dipping 80° S. Below the remains of this cut, a few feet above high-tide level, is an adit about 120 feet long which had been driven N. 70° W. apparently to intersect the veins exposed on the surface above. The adit is entirely in black slate with minor interbedded graywacke; no mineralization was observed.

A few hundred feet north of the mine workings on the north side of the cove are three light-colored pyritized dikes that trend N. 20° W. and dip steeply to the southwest. From west to east the dikes are approximately 20, 15, and 2 feet wide, respectively. These dikes are apparently the same granitic dikes described by Grant and Higgins (1910, p. 174) and on which a mining claim had been staked prior to their visit in 1909.

Locality 7 (Robert Hatcher prospects)

On the west side of North Arm just south of the entrance to Pilot Harbor, two old adits were found that were driven by Robert Hatcher about 1930. Both adits are on the steep rocky shore just at high-tide level, and at the time of our visit in June 1967, rough water prevented a close examination and sampling of the veins.

The first adit, just south of the entrance to Pilot Harbor, has been dug a few feet on the quartz vein 3-4 feet wide trending N. 70° W. and dipping vertically. Pilgrim (1933, p. 44) mentions that visible free gold was found in surface exposures of this vein 170 feet above sea level. The country rock is interbedded graywacke, conglomerate, and black slate containing a number of small barren quartz veins and veinlets. About 0.15 mile south of this adit, a longer adit (possibly 20 feet in length) has been driven on a 2- to 3-foot quartz vein trending N. 80° W. and dipping 70° N. in conglomerate and graywacke.

According to Pilgrim (1933, p. 42-43), Hatcher also worked on another vein (Utopia and North Gold claims) about 1 mile south of Pilot Harbor. He traced this vein by surface pits over the ridge into the Quartz Bay drainage(?). The vein reportedly strikes N. 75° W., dips 85° S., and ranges between 0.5 and 2.5 feet in width.

Locality 8 (Goyne prospect; Golden Horn mine)

The former Goyne property is on the west shore of Surprise Bay about 0.6 mile south of the narrows into Palisade Lagoon. A wave-demolished cabin on a small slate-pebble beach, about 300 feet north of a still-conspicuous tailings dump, is all that remains in the campsite area.

Exploration and development work at the prospect consists of two adits, approximately 25 and 135 feet above sea level, and a number of pits and trenches that have traced a series of mineralized quartz veins in a granodiorite dike from the bay to the top of the mountain ridge about 1,000 feet above sea level. Most of this exploration had been completed prior to 1934 (Pilgrim, 1933, p. 36-37; Smith, 1938, p. 30), and since that time the property appears to have lain idle. Sometime after World War II, however, interest revived and an unsuccessful attempt to work the deposit was made by the Golden Horn group. At the time of our visit in June 1967, both adits were still open and accessible. Some effort was made to examine the surface workings above the adits, but the combination of heavy alder growth and steep hillside proved too discouraging.

The country rock in the adit area is black slate that has been intruded by a very irregular and locally segmented dike (fig. 7).

Figure 7 near here

Foliation (slaty cleavage) in the slate strikes N. 5° W. to N. 10° E. and dips vertically. Near the dike and especially between segments of the dike, however, the foliation is generally concordant with the slate-dike contact. The dike has a general east-west trend, dips 65°-85° S. and is 30 feet to probably as much as 100 feet thick. In hand specimen the dike is light gray and dense with a medium-grained equigranular texture (see page).

Quartz veins, in places containing abundant arsenopyrite, appear to be confined to the dike or locally along the dike-slate contact. The veins are narrow and discontinuous and in general parallel the trend of the dike. Where a vein trends into the slate, it pinches out or splits into a number of thin quartz stringers that pinch out.

In the underground workings, the principal vein encountered is exposed on both levels and along a raise connecting the two levels (fig. 7). In the upper adit, this vein is about 70 feet long with a maximum width of 0.9 foot. It strikes N. 85° E. and dips 75° S. In the lower adit, about 110 feet below, the vein is probably about 100 feet long and has a maximum width of 1.1 feet. Two random channel samples across the vein indicate a fairly high gold content: 200 ppm gold across 0.9 foot in the upper adit (sample ACH-081) and 40 ppm gold across 1 foot in the lower adit (sample ACH-080).

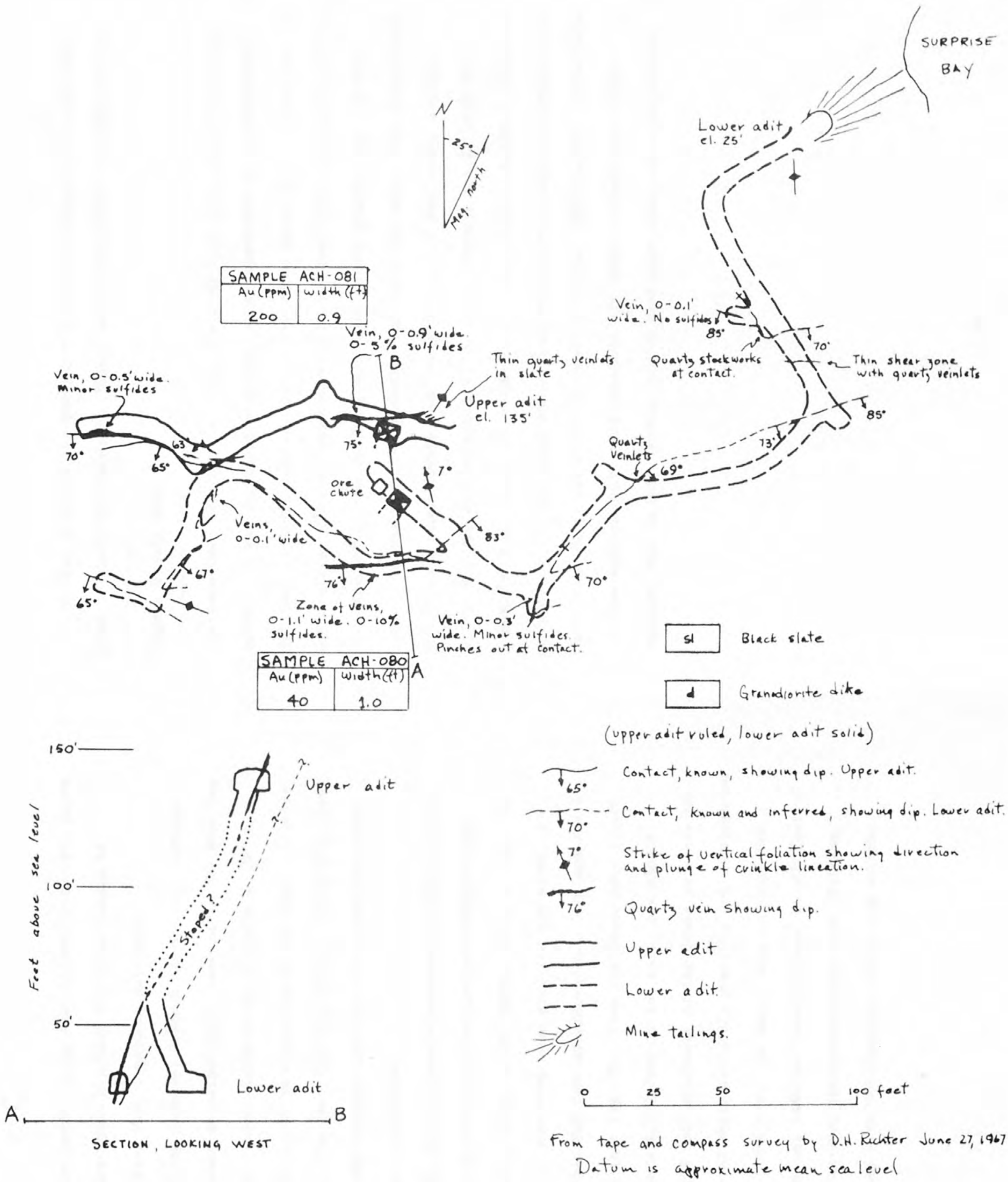

Figure 7. Geologic map and section of mine workings at locality 8, Nuka Bay area, Alaska

A number of much smaller quartz veins are exposed in the two adits. Many of these are nothing more than slightly thickened lenses of quartz and at most contain less than 1 percent sulfides.

Locality 9 (Sonny Fox Mining Company; Babcock and Downey property)

The Sonny Fox mine, former principal gold producer in the Nuka Bay area, is on the west side of Babcock Creek about 0.9 mile N. 30° E. from the head of Palisade Lagoon at an elevation of 200 feet. A well-graded trail extends to the mine camp from the Babcock Creek flat about 0.7 mile above the head of the lagoon, but the trail across the flat from the lagoon is no longer discernible.

The quartz veins on the property were discovered in 1924; active mining and production began in 1926 and continued virtually without interruption until 1940 (Smith, 1938, p. 27; Smith, 1941, p. 25). In the main mine area, the gold lodes have been explored and mined by three adits totaling more than 800 feet of underground workings and a number of opencuts and pits (see fig. 8). From the lower adit a rock and wood trestle extends south 1,000 feet to the mill, now almost completely ruined. About 250 feet southeast of the lower adit are the buildings of the camp, most of which are still standing and serviceable. Twelve hundred feet north of the mine, the small vein on which the original Sonny Fox discovery was made has been explored by 100 feet of tunnel on two levels and a 40-foot interconnecting raise (Pilgrim, 1933, p. 31). These workings were not examined during the present investigation.

A sketch map of the geology and mine workings in the main mine area is shown in figure 8. Three quartz veins have been explored in

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Figure 8 near here

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the immediate area but only one, the Lady Luck vein, was extensively mined. At the uppermost workings, at an elevation of approximately 225 feet, a large opencut exposes two veins about 25 feet apart in black slate. The westernmost vein is 3-4 feet wide, strikes N. 10° E., and dips 65° W. No sulfides were seen in the quartz, and a 4-foot channel sample (ACH-084) revealed only 0.08 ppm gold. The other vein, which shows considerable iron staining, is 1-2 feet wide, strikes N. 75° E., and dips vertically. A 2-foot channel sample (ACH-085) assayed 0.1 ppm gold. From the face of the opencut an adit, filled to a depth of 1-2 feet with water, follows this vein for a distance of 60 feet where it is cut off by a fault (Pilgrim, 1933, p. 32). This vein is also exposed in a small prospect pit about 40 feet east of the opencut, but in pits farther to the east only black slate is present.

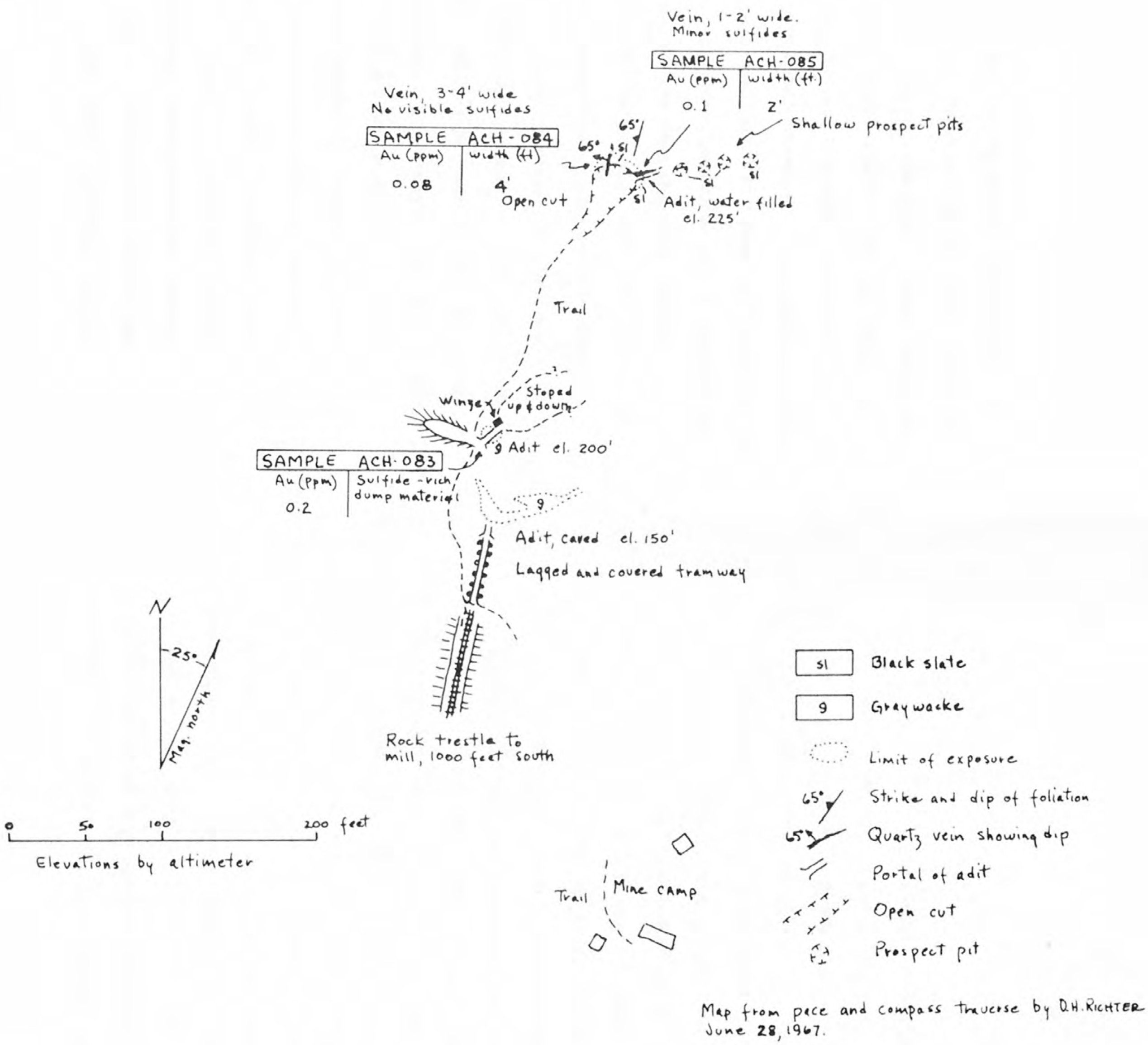

Figure 8. Sketch map of geology and mine workings at locality 9, Nuka Bay area, Alaska

About 200 feet south of the opencut and 25 feet lower in elevation is the adit which has been driven on the Lady Luck vein. The adit is accessible with difficulty for about 20 feet at which point a very irregular stope extending both up and down effectively blocks the way. In the adit, between the portal and the stope, the country rock is massive graywacke and no vein is exposed. Pilgrim (1933, p. 32) describes the vein and workings as follows:

"Initial mining operations on the Lady Luck vein were conducted on the outcrop at the discovery point in an open-cut 65 feet in length from which several hundred tons of high-grade ore was extracted. [This opencut has evidently been covered by later mining operations.] Subsequently, a tunnel 100 feet in length was driven on the vein below the outcrop exposure and at an elevation of 190 feet. At a point in this tunnel 40 feet from the portal a split in the vein occurs beyond which one branch of the vein strikes east and the other N. 45° E. At an elevation 40 feet below this tunnel is the present main working tunnel. On July 25, 1931, it had been driven a distance of 230 feet on the vein and stoping operations were being conducted on the northeast branch of the vein between the working tunnel level and the upper tunnel."

Later in 1936, Capps (in Smith, 1938, p. 27-28) reported:

"The present workings are on a vein which crops out near the camp and on which more than 800 feet of drifts have been driven on two levels, in addition to raises and stopes. The vein has a general northeasterly strike and dip of about 60° SE., though it varies considerably in both strike and dip within short distances. It ranges from 10 inches to [illegible] feet in thickness and averages about 2 feet. The quartz is white and locally shows banding. The most abundant metallic mineral is arsenopyrite; some pyrite, sphalerite, chalcopyrite, and galena are also present. Free gold is also present, often in coarse particles abundantly visible to the naked eye."

The lower adit or main working tunnel, as mentioned above by Pilgrim, is caved at the adit and not accessible. It was driven into a cliff of massive graywacke that shows no evidence of mineralization. Pilgrim (1933, p. 33) mentioned that where the vein is encountered in the lower adit, it ranges in width from a few inches to 4 feet and is offset by several minor southeast-trending right-lateral faults.

Locality 10 (Skinner prospect; Tidewater claim)

The former Skinner prospect is on the steep rocky east shore of Surprise Bay, about 1 mile south of the narrows into Palisade Lagoon. A short adit, which was at sea level prior to the 1964 earthquake, is now almost completely flooded during high tides.

The adit was driven sometime prior to 1931 by Frank Skinner on a strongly iron stained quartz vein. In 1966 the property was relocated as the Tidewater claim by Messrs. Suddath, Quackenbush, and Madison of Seward, Alaska. Slumping of the cliff at the portal of the adit has reduced its length from 42 to 25 feet (Pilgrim, 1933, p. 30). The vein exposed by the adit strikes N. 80° E. and dips 72° S. It consists of about 0.5 foot of sheeted quartz with scattered lenses of arsenopyrite along the footwall and as much as 4 feet of barren quartz stockworks in the hanging wall. The country rock is massive graywacke, which along the hanging wall had been strongly brecciated prior to the introduction of the quartz stockworks. A channel sample (ACH-082) across the 0.5 foot of iron-stained quartz assayed 6.[illegible] ppm gold.

Locality 11

A 4-foot-wide mineralized zone of vein quartz and fractured graywacke in massive graywacke is exposed along the sea cliff in a small cove on the south side of the entrance to Beauty Bay. The structure strikes N. 80° E. and dips 70° S. (fig. 9). Iron-stained

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Figure 9 near here

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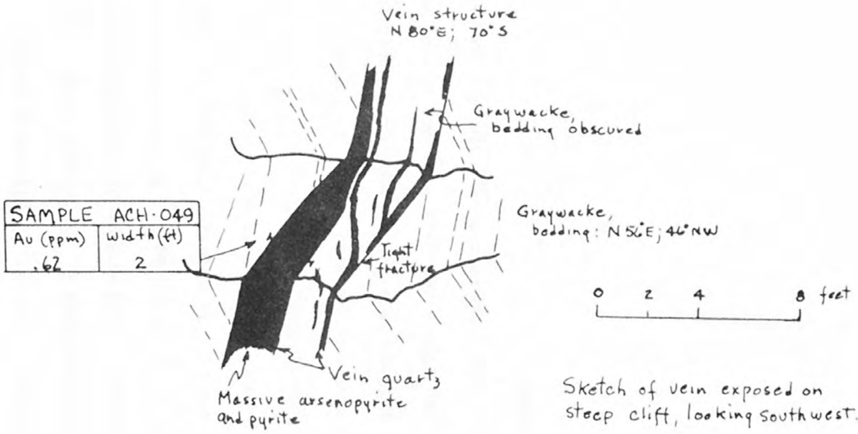
quartz containing lenses of arsenopyrite and pyrite ranging in width from 0.5 to 2 feet forms the footwall of the structure. The hanging wall consists principally of fractured graywacke and irregular, short, branching veins of quartz. A 2-foot channel sample (ACH-049) across the widest part of the mineralized footwall assayed 0.62 ppm gold.

Locality 12

About 0.3 mile north of locality 11 on the point east of Shelter Cove, a number of quartz veins are exposed in a cliff of graywacke. The largest and most mineralized (slight iron staining) of the veins strikes N. 80° E. and dips vertically (fig. 9). The vein is 2 feet wide with a thin clay gouge zone through its center and another along its north wall in contact with graywacke. A channel sample (ACH-048) across the entire vein assayed less than 0.02 ppm gold.

Other prospects not found

The Frank Long property described by Pilgrim (1933, p. 50-51) and the Skinner prospect described by Capps (in Smith, 1938, p. 31) are probably the same, although a number of discrepancies exist in regard to length of tunnels and orientation of the veins. This prospect is reportedly on the west shore of West Arm about 1½ miles south of the entrance to Beauty Bay and directly opposite Beautiful Island (see pl. 1). Diligent search along the coastline in this area during our visit, however, failed to reveal any workings, buildings, or even significant mineralization.



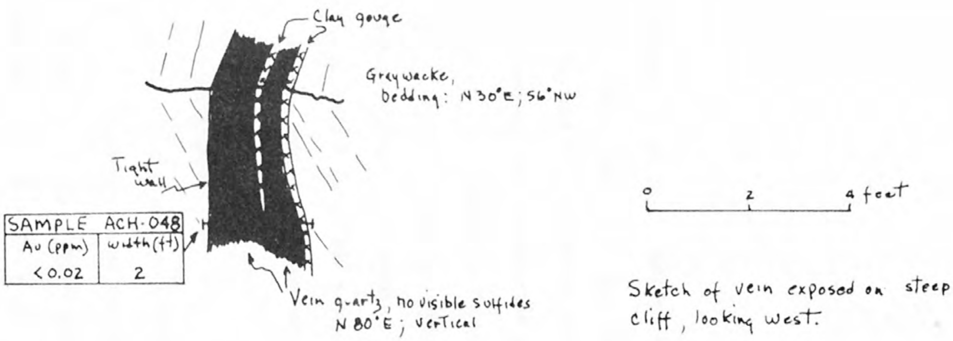


Figure 9. Sketch of veins at locality 11 (above) and locality 12 (below), Nuka Bay area, Alaska

The prospect was examined by territorial mining engineers in 1924, 1925, and 1931. Pilgrim (1933, p. 51), who made the last examination, reported:

"About 10 feet above high tide a tunnel has been driven on a vein that outcrops in a small gulch. The direction of the tunnel, which is also the strike of the vein, is S. 45° W. The vein is a well-defined fissure filled with white quartz containing considerable graywacke breccia. Arsenopyrite is the only sulphide observed in the quartz. The vein varies from 6 to 24 inches in width al ng the full length of the tunnel, which is 88 feet. The walls are slaty graywacke with a cleavage striking S. 30° E. A cross-cut in the graywacke has been driven for 39 feet in the direction of N. 33° W. from a point 27 feet in the tunnel. A sample taken from a pile containing about 8 tons of vein quartz, at the mouth of the tunnel, assayed gold 0.38 oz, silver 0.30 oz per ton. A log cabin is situated on the hillside above the tunnel. There is also a frame house on a leveled dump at the portal of the tunnel."

In 1936 Capps (in Smith, 1938, p. 31) described the prospect as: "* * * developed by a 50-foot tunnel at the cabin, just above high tide level * * *[which] follows a quartz vein in massive graywacke that strikes N. 20° W. and dips 75° SW. The vein, which is actually a stockwork of branching quartz veinlets, strikes N. 35° W. and dips 65° SW. and shows from 4 inches to 2 feet of quartz. It carried considerable quantities of sulphides, chief of which is arsenopyrite, with lesser amounts of pyrite, sphalerite, and galena."

Capps also mentions another vein on the property, the Golden Goose vein, which is said to have been traced on the surface for a distance of 2,600 feet. In 1934 a 300-foot adit was driven on the vein at an elevation of 400 feet, and assays as high as 4 oz of gold to the ton have been reported.

The Johnson and Degan property included a number of veins that apparently extended over the ridge from the head of Surprise Bay to Quartz Bay. Pilgrim (1933, p. 34-35) describes the veins that were exposed by trenching in the gulch trending northwestward from the head of Surprise Bay near the mouth of Palisade Lagoon. The veins, all in massive graywacke, are exposed at elevations of 370, 900, and 1,000 feet. Principal mineralization is at the upper exposure where the vein has a width of 40 inches and strikes N. 62° E. A 28-inch sample assayed 0.98 oz of gold per ton (32 ppm). Between the two upper exposures of the main vein, Pilgrim also described three cross veins ranging in width from 2 to 4 feet and locally containing abundant sulfides that join, but do not cross, the main vein at right angles. Slide debris and (or) snow apparently covered these exposures at the time of our visit in June 1967.

Many other veins have undoubtedly been prospected throughout the area, but since the days of active exploration, these have been covered by vegetation or rock debris.

One area containing known mineralized quartz veins that was not examined during this investigation is Yalik Bay, which extends west of West Arm opposite Harrington Point (pl. 1). Pilgrim (1933, p. 38-40) describes in detail the Sather prospects on the south side of Yalik Bay and also mentions the presence of mineralized veins on the north side of the bay.

Geochemistry of stream sediments

A total of 44 stream-sediment samples were collected throughout the area for trace-element analyses. Sediments from each stream were also panned at the sample site and examined for gold, and the panned concentrate saved for future heavy-mineral study. The sediments collected for trace-element study were dried, screened to -80 mesh, and analyzed for gold and other elements in the mobile field laboratory of the U.S. Geological Survey in Anchorage, Alaska. Gold was determined on a 10-gram sample by atomic absorption spectrophotometry, arsenic by colorimetric methods, and the remainder of the elements by semiquantitative emission spectrometry. The analytical results are listed in table 4 and shown graphically on the geochemical map in figure 10.

TABLE 4 NEAR HERE

Figure 10 near here

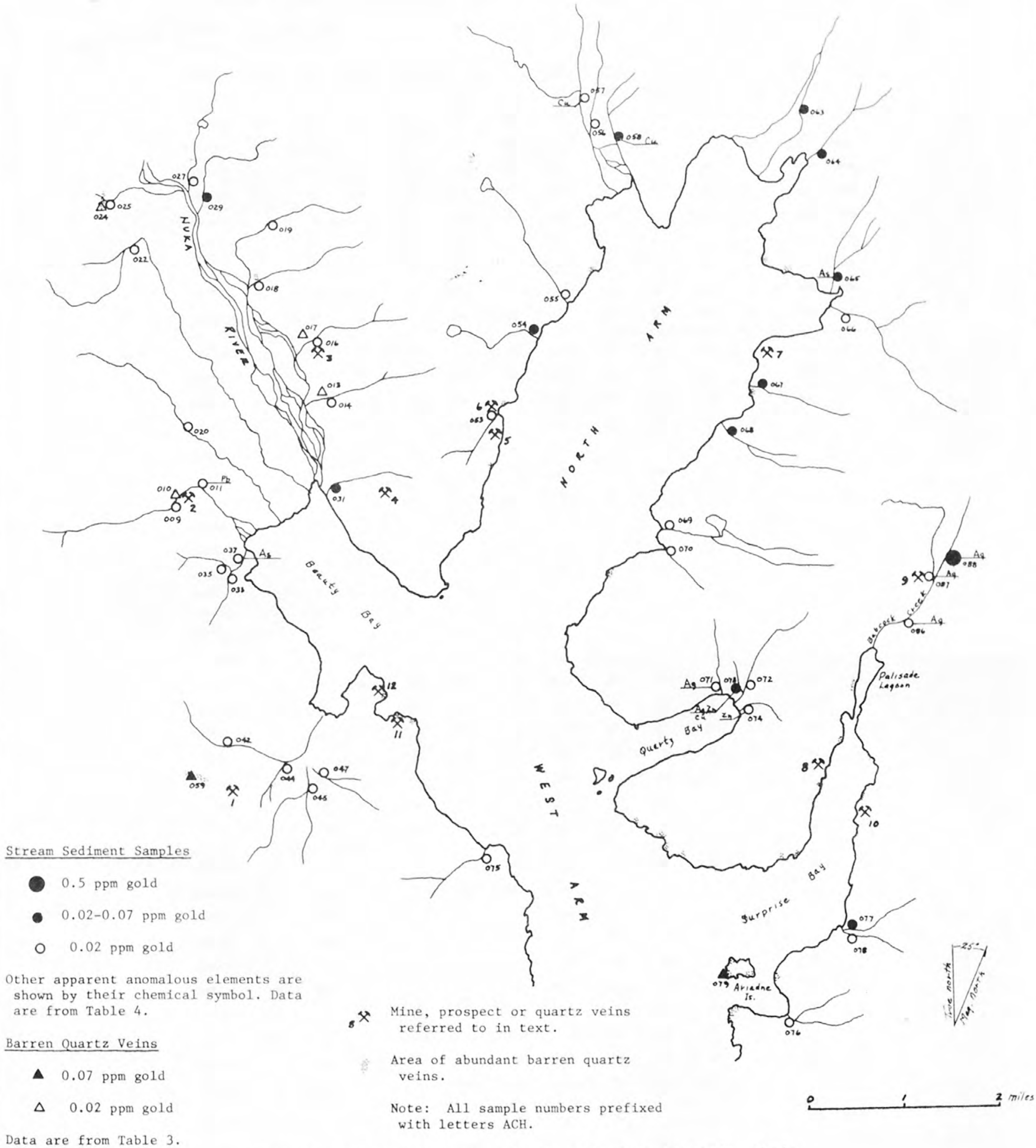


Figure 10. Geochemical map of Nuka Bay area, Kenai Peninsula, Alaska.

Table 4.--Semiquantitative spectrographic and chemical analyses of stream-sediment samples

[Parts per million. Analysts: Semiquantitative spectrographic analyses, Arnold Farley, Jr.; atomic absorption (gold) and colorimetric (arsenic), W. L. Campbell, R. L. Miller, T. A. Roemer, and A. L. Meier. A, not detected. Number in parentheses under elements is lower limit of determination in ppm]

Sample nos.	Au[1] (0.02)	As[2] (10)	Ag (0.5)	B (10)	Ba (20)	Co (10)	Cr (10)	Cu (2)	Ni (2)	Pb (10)	Sb (100)	V (5)	Zn (200)
ACH-009	A	40	A	70	700	10	70	20	20	20	A	150	A
ACH-011	A	40	A	100	700	20	150	30	30	50	A	150	<200
ACH-014	A	20	A	70	700	20	100	30	20	20	A	150	<200
ACH-016	A	80	A	30	700	30	150	30	15	20	A	150	<200
ACH-018	A	20	A	30	700	20	150	20	20	20	A	100	<200
ACH-019	A	20	A	30	700	15	100	30	15	A	A	100	<200
ACH-020	A	30	A	70	700	30	150	50	30	20	A	100	<200
ACH-022	A	30	A	70	700	20	100	30	20	A	A	100	<200
ACH-025	A	20	A	50	1,000	20	150	50	20	20	A	100	200
ACH-027	A	20	A	50	700	10	100	30	30	10	A	100	A
ACH-029	0.03	30	A	50	700	10	150	30	30	A	A	100	A
ACH-031	.02	40	A	70	700	15	150	30	30	15	A	100	A
ACH-033	A	20	A	70	700	15	100	30	30	A	A	100	A
ACH-035	A	15	A	70	700	20	100	30	30	A	A	150	A
ACH-037	A	150	A	10	150	A	10	7	A	A	A	30	A
ACH-042	A	40	A	70	700	15	100	50	30	10	A	150	<200
..CH-044	A	40	A	70	1,000	15	150	50	50	15	A	150	<200
ACH-045	A	40	A	50	1,000	15	150	50	50	15	A	150	<200
ACH-047	A	80	A	70	1,000	15	150	5	30	15	A	150	<200
ACH-053	A	30	A	70	700	10	150	30	30	20	A	100	A
ACH-054	.02	80	A	70	700	10	150	30	30	A	A	70	A
ACH-055	A	20	A	70	700	10	150	30	30	A	A	100	A
ACH-056	A	15	A	100	500	30	150	30	50	A	A	200	A
ACH-057	A	20	A	70	700	20	100	150	30	30	A	150	A
ACH-058	.04	30	A	70	700	30	200	100	30	10	A	150	A
ACH-063	.05	20	A	70	500	30	150	70	50	15	A	150	A
ACH-064	.04	30	A	70	700	15	150	70	30	20	A	150	A
ACH-065	.03	160	A	70	700	50	200	50	50	30	A	150	A
ACH-066	A	30	A	70	700	30	150	30	30	10	A	150	A
ACH-067	.02	30	A	100	700	30	150	30	30	A	A	150	A
ACH-068	.03	20	A	70	700	10	100	30	30	10	A	150	A
ACH-069	A	20	A	70	700	20	150	50	30	20	A	150	A
ACH-070	A	20	A	70	700	30	200	70	50	20	A	150	A
ACH-071	A	20	0.5	70	1,000	30	70	70	30	30	A	150	<200
ACH-072	A	40	A	150	700	30	70	70	30	15	A	150	<200
ACH-073	.04	20	.5	70	1,000	50	150	150	50	30	A	150	200
ACH-074	A	10	A	150	1,000	50	100	70	50	20	A	150	200
ACH-075	A	40	A	100	700	30	70	50	50	20	A	150	<200
ACH-076	A	10	A	100	700	50	70	70	50	15	A	150	<200
ACH-077	.07	20	A	70	700	20	70	70	50	15	A	300	<200
ACH-078	A	10	A	50	700	20	70	30	30	15	A	150	<200
ACH-086	A	20	<.5	70	700	7	100	70	20	20	A	150	<200
ACH-087	A	<10	.5	70	700	7	70	70	30	20	A	150	<200
ACH-088	.5	40	<.5	70	700	7	70	70	20	30	A	100	<200

[1]Atomic absorption

[2]Colorimetric

Free gold was not observed in any of the panned concentrates, but gold was detected by atomic absorption in 12 of the 44 stream-sediment samples from the area (table 4 and fig. 10). In all but one sample containing detectable gold, the gold content was low, ranging between 0.02 and 0.07 ppm; the exception (sample ACH-088) contained 0.5 ppm gold. However, because of the particulate nature of the gold and the relatively small size of the original field sample (approximately 5 pounds for panned concentrate sample and ½ to 1 pound for analytical sample), the gold values reported may not be representative. For example, the apparent lack of gold in all the panned concentrates and most of the analyzed samples may only reflect the fortuitous lack of a gold particle in the small sample collected. Conversely, the relatively high gold content of ACH-088 may be attributable to the presence of one gold particle or even a slightly larger than average gold particle in the sample. Hence with the data available it is difficult to assess how much importance should be placed on either the lack of gold or its presence in a stream-sediment sample. Possibly a better indicator of the gold potential within a stream drainage is the arsenic content of the stream sediment. In this case, however, only two streams (samples ACH-037 and ACH-065) show arsenic values which could be considered anomalous, and these show no obvious relation to the gold content of the samples.

Assuming, however, that the samples are representative and that the reported gold values reflect, at least to a fair degree, the availability of gold within a stream drainage, sample ACH-088 with 0.5 ppm gold may be significant. This sediment sample was collected from Babcock Creek at the head of Palisade Lagoon at an elevation of approximately 400 feet (fig. 10). The drainage of Babcock Creek above the sample site covers an area of less than a square mile immediately northeast of the former Sonny Fox mine and is underlain principally by massive graywacke (pl. 1). The combination of high gold values in the stream sediments, favorable host rock, and close proximity to the largest known gold deposit in the area, suggests the presence of additional gold-bearing veins in the drainage area.

No significant anomalies in the other trace elements of the stream sediments were detected. Copper appears to be slightly high in three samples (ACH-057, ACH-058, and ACH-073) and lead slightly high in one sample (ACH-011). One anomalously low sample (ACH-037) contains barely detectable amounts of most of the metallic elements except arsenic, which is relatively high.

Conclusions and recommendations

The lode-gold deposits in the Nuka Bay area produced approximately $166,000 during the period 1924-1940. The gold is chiefly free milling and occurs with arsenopyrite and minor amounts of base metal sulfides in short, discontinuous quartz veins and quartz stockworks. The more productive veins are confined to massive graywacke beds in a thick interbedded slate and graywacke assemblage of Cretaceous age and in thin granodiorite dikes. Most of the veins strike between east-west and N. 10° W., approximately normal to the structural grain of the folded sedimentary rocks. Sampling of the quartz veins indicates the presence of high-grade gold values (as much as 9 ~~ounces~~ oz per ton) in a number of the old mines and undeveloped prospects throughout the area. However, the veins are narrow, rarely exceeding 5 feet in width, and gold values appear to be erratically distributed within the veins.

The economics of developing and mining these deposits has not been investigated, but based on the apparent past successful performance of the area (especially prior to 1935 when gold was $20 per ounce) and the recent renewed interest in small gold lodes, it appears that diligent small-scale mining may be economically feasible and further prospecting warranted. Targets for concentrated prospecting are the massive graywacke beds and granodiorite dikes; veins in these rocks that trend east-west and contain sulfides are especially favorable and should be carefully examined. The gold anomaly on upper Babcock Creek may be significant and should be investigated.

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Quaternary

Qg — Glacial, glaciofluvial, fluvial and beach deposits.

Cretaceous

d — Granodiorite dike or sill.

Kg — Massive graywacke. May include minor interbedded slate.

Ksg — Interbedded slate, graywacke, siltstone and conglomerate. Includes minor argillite and phyllite.

Contact; approximate.

Strike and dip of bedding, arrow indicates direction of top of bed.

Strike of vertical bedding.

Strike and dip of foliation.

Strike of vertical foliation.

Strike and dip of prominent joint.

Overturned syncline showing trace of axial plane and plunge where known.

Minor fold showing plunge.

Shear zone.

Mine, prospect or quartz vein referred to in text.

Adit

0 1 2 3 Miles

CONTOUR INTERVAL 100 FEET
DATUM IS MEAN SEA LEVEL
DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS MEAN LOWER LOW WATER
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
THE AVERAGE RANGE OF TIDE IS APPROXIMATELY 9 FEET

APPROXIMATE MEAN DECLINATION, 1951

QUADRANGLE LOCATION

PLATE 1. GEOLOGIC MAP OF NUKA BAY AREA, KENAI PENINSULA, ALASKA

Geology by D. H. Richter, 1967