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RECONNAISSANCE FOR RADIOACTIVE DEPOSITS IN THE VICINITY OF TELLER AND CAPE NOME, SEWARD PENINSULA, ALASKA, 1946-47

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PART 1. --RECONNAISSANCE IN THE VICINITY OF TELLER, 1946

By M. G. White

ABSTRACT

Placer-mining areas and bedrock exposures near Teller on the Seward Peninsula, Alaska, were investigated in June and July, 1946, for possible sources of radioactive materials. The areas that were investigated are: Dese Creek, southeast of Teller; Bluestone River basin, south and southeast of Teller; Sunset Creek and other small streams flowing south into Grantley Harbor, northeast of Teller; and, also northeast of Teller, Swanson Creek and its tributaries, which flow north into the Agiapuk River basin.

No significant amount of radioactive material was found, either in the stream gravels or in the bedrock of any of the areas. A heavy-mineral fraction obtained from a granite boulder probably derived from a bench gravel on Gold Run contains 0.017 percent equivalent uranium, but the radioactivity is due to allanite and zircon.

The types of bedrock tested include schist, slate, and greenstone. Readings on fresh surfaces of rock were the same as, or only slightly above the background count. The maximum radioactivity in stream concentrates is 0.004 percent equivalent uranium in a sluice concentrate from Sunset Creek.

INTRODUCTION

Purpose and scope of investigation

One of the early aims of the Geological Survey's reconnaissance for radioactive materials was to test concentrates from all the placer-mining areas in Alaska for radioactivity. Field investigation in the vicinity of Teller was undertaken early in 1946 because no samples from placer-gold mining in surrounding areas were available for testing and because of the presence of radioactive materials in placers to the west, north, and east on the Seward Peninsula. At that time, work in the Teller area could be conveniently fitted in with the schedule of work elsewhere on the Seward Peninsula by the same party.

The field investigation was carried on from June 27 to July 17, 1946 by a party consisting of Max G. White, geologist, and R. D. Hamilton, camphand. Frank Keelick, Edward Keelick, and Solomon Kopok, Eskimos, were employed individually for short periods during the investigation.

A portable gamma Survey meter designed by the Geological Survey was used in the field for the determination of radioactivity in the stream gravels and bedrock outcrops or talus.

Location of area

The Teller area, (pl. 1) latitude approximately 65° N., longitude approximately 166° W., is on the west coast of the Seward Peninsula, 60 miles southeast of Cape Prince of Wales and 50 miles northwest of Nome. Teller, population 125, is the trading center for the nearby placer mines. The area is accessible most conveniently by plane from Nome.

Specific areas investigated. --Two placer-mining areas to the southeast and two areas northeast of Teller were investigated for radioactive materials (pl. 1).

One of the placer-mining areas southeast of Teller is the Bluestone River basin, about 13 miles from Teller. The principal headwater streams within the area are Right Fork and Gold Run that unite to form the Bluestone River. The other placer-mining area is Dese Creek, about 6 miles southeast of Teller. This creek flows into Grantley Harbor. These two areas are accessible by truck on the narrow dirt road that extends along Dese Creek to within 1 mile of Right Fork. South of this point the old Teller-to-Nome trail can be travelled by tractor.

The areas that were investigated northeast of Teller are: the north shore of Grantley Harbor where several small streams empty and Swanson Creek and some of its tributaries that flow northward into the Agiapuk River.

All the older mining localities as well as all the present mining operations were visited during the investigation. The principal sites of operations southeast of Teller in the Bluestone basin include: Gold Run from its mouth to about 2 miles above Sullivan; Alder Creek, a tributary of Gold Run at Sullivan; and the headwater portion of Igloo Creek, a tributary of the Right Fork of the Bluestone River. In recent years Gold Run was dredged from a point within a few hundred feet of Right Fork to a point about 1 mile above Sullivan. In 1946, mining in the Bluestone River basin was confined to pick and shovel work on Alder Creek by Henning Johnson, caretaker for the Bartholomae Oil Corp., owners of the mining property on Gold Run; ground sluicing by Olie Martinson and the Fidgeland brothers at the mouth of Bull Pup on Gold Run; and hydraulic mining by the Tweet brothers on Igloo Creek at the mouth of Bering Creek.

A dredge was operated on Dese Creek in recent years from a point 1 mile below Soda Creek to about a quarter of a mile above.

Northeast of Teller, only Sunset, Offield, and Swanson Creeks were ever mined extensively. The gravels on Sunset Creek were worked by dredge and dragline in the past, but are now operated by hydraulic mining by Frank Rice. Former mining on Offield Creek was confined to the western headwater tributary, and in recent years some of the gravel has been reworked. The Swanson Creek gravel has been dredged twice, and at present the ground is leased to Bernard Vogen who is mining the gravel above the highest point reached by the dredges.

GEOLOGY

Types of bedrock

The general geology of the Teller area has never been studied in detail. All that is known has been acquired from brief examinations during reconnaissance of the placer deposits. Brooks[1] in 1900, Collier[2] in 1902, and Collier and others[3] in 1908 summarized the general geology of the Bluestone River basin and the area north of Grantley Harbor.

The bedrock of the area is considered a part of the lower undifferentiated portion of the Nome group. These rocks are mainly sedimentary in origin and are probably early Paleozoic in age. The lithologic types present are mica and chlorite schist, limestone, gray and black slate, and intrusive greenstone sills. The gray slate and the schist differ mainly in the greater metamorphism of the schist. Much of the schist is garnetiferous. Calcareous schist grades into limestone in the walls of the Bluestone River canyon. Highly graphitic schist crops out opposite the mouth of Tom Gulch in Gold Run. Black slate is moderately widespread north and south of Grantley Harbor and is especially well exposed on Coyote Creek 2 miles east of Teller. At this locality the slate appears partly baked, through close proximity to a basaltic dike, and bears a resemblance to coal. It is not abundant in the Bluestone River basin, although it is present in the vicinity of the junction of Gold Run and Right Fork. The greenstone caps many but not all the higher hills in the area.

Quartz veins and stringers are common in the schist, slate, and greenstone, both crossing the cleavage and parallel to it. The quartz is milky white and most of the veins are apparently barren of mineralization. Nevertheless, some of the minerals found in the stream gravels must have their source in the quartz veins.

[1] Brooks, A. H., and others, 1901, Reconnaissance in the Cape Nome and Norton Bay regions (Alaska) in 1900: U. S. Geol. Survey Special Pub., pp. 14, 128-132.

[2] Collier, A. J., 1902, A reconnaissance of the northwestern portion of the Seward Peninsula, Alaska: U. S. Geol. Survey Prof. Paper 2, p. 45.

[3] Collier, A. J., and others, 1908, The gold placers of parts of the Seward Peninsula, Alaska: U. S. Geol. Survey Bull. 328, pp. 270-271, 274, 276.

Mukacharni Mountain, at the head of Sunset Creek north of Grantley Harbor, and two adjacent peaks are basaltic volcanic necks of pre-Pleistocene age. Lava flows of like age cover the area between the peaks and California Creek to the west. These rocks were not examined during the 1946 investigation.

Concentrates from stream gravels

Sampling.--A total of 35 samples representing the gravels of 21 different streams were collected for radioactivity tests. Of these, 25 samples are from the Bluestone River basin, one from Dese Creek, seven from the creeks entering Grantley Harbor from the north, and two from Swanson Creek.

Dredge and sluice concentrates were taken from all placer-mining operations except that on Offield Creek and, thus, represent the pay streak in the lower part of the gravels. All other samples were taken by panning the upper part of the creek gravels in bars or creek banks. Most of the samples consisted of 20 to 40 pounds of gravel and were panned only to a semiconcentrate (about 25 cubic inches) comparable in volume to a radioactive field standard used in the determination of the equivalent uranium content.

The data for all the samples collected in the Teller area in 1946 are given in table 1. The concentration ratios listed in the table refer to the amount of heavy minerals recovered from the stream concentrates by using the heavy liquids, bromoform or methylene iodide. The ratios indicate that 6 to 84 pounds of heavy minerals per cubic yard can be recovered from the gravels in the creeks southeast of Teller, and 3 to 20 pounds can be recovered from the gravels in the creeks north of Teller. However, a considerable amount of the heavy concentrate consists of fragments of schist and greenstone. The densities of these rocks are sufficiently high to allow them to sink in heavy liquids; thus, the actual amount of clean heavy minerals present in the gravel is somewhat less than the pounds of concentrate given in the table.

Mineralogy of the concentrates.--In addition to platy fragments of schist and rounded grains of greenstone composed of amphibole and chlorite altered from pyroxene, metamorphic minerals such as garnet, mica, epidote, and clinozoisite are abundant in heavy-mineral fraction of the concentrates.

RADIOACTIVITY

Tests of bedrock

Although the principal stress in the field investigations in the Teller area was on determination of radioactivity in the stream gravels, every opportunity was taken in all traverses to test the radioactivity of outcrops and talus of bedrock. Readings of gamma-ray activity were made with the probe placed against fresh surfaces of rock. No significant amount of radioactive material was found in any of the bedrock.

Survey meter readings on greenstone, gray slate, and schist gave counts the same as, or only slightly above the background count. Highly graphitic schist showed no radioactivity. Black slate was tested at several localities and generally exhibited little or no radioactivity. A laboratory reading of 0.004 percent equivalent uranium was obtained from a bromoform concentrate of sample no. 46AWe 2a. This sample was taken from talus of a black slate outcrop 1,000 feet above Gold Run on the Right Fork of the Bluestone River (pl. 1).

Tests of concentrates

No significant amount of radioactivity was detected in any of the stream gravels in the Teller area in the course of the field investigations.

In order to check the lack of significant radioactivity as determined in the field, all samples (semiconcentrates) were further concentrated in the laboratory by using the heavy liquids, bromoform and methylene iodide. The equivalent uranium content of the heavy-mineral fractions was then determined radiometrically in the laboratory.

A content of 0.004 percent equivalent uranium was found in one sample from Sunset Creek (no. 46AWe 33), north of Grantley Harbor. The samples from Offield Creek and Igloo Creek, also north of Grantley Harbor; from Windy Creek and Little Windy Creek on the Right Fork of the Bluestone River; and from Alder Creek on Gold Run all contain 0.002 percent equivalent uranium. The remaining samples contain 0.001 percent or less equivalent uranium.

In the gravels of Gold Run granite boulders were noted. These boulders, ranging from 3 to 10 inches in diameter, are well-rounded and somewhat weathered. They are probably derived from an old bench deposit, as Gold Run does not traverse any granite in its present course. An 8-inch boulder of the granite was crushed, and the sample brought in from the field for examination. A radiometric analysis of the mineral fraction heavier-than-bromoform shows 0.017 percent equivalent uranium. The minerals in this fraction are biotite, allanite, magnetite, garnet, and zircon, in order of decreasing abundance. The radioactivity is attributed primarily to the allanite and secondarily to the zircon.

CONCLUSION

On the basis of the information obtained during the investigation of the Teller area, it is assumed that there are no significant deposits of radioactive materials in the localities examined.

Table 1.--Data on samples from the Teller area

[Except those otherwise indicated, samples are semiconcentrates of stream gravel]

Sample no.	File no.	Location	Concentration ratio	Radioactivity of heavy-mineral-fraction (percent eU)[1]
46AWe 11	1584	Ruby Creek at the mouth of Elizabeth Creek-----	158:1	<0.001
12	1585	Ruby Creek, 1 mile above Elizabeth Creek-------	201:1	.001
13	1586	Elizabeth Creek, 1 mile above Ruby Creek-------	508:1	.001
14	1587	Gold Standard Creek, 300 feet below junction of headwater forks.	485:1	<.001
26	1588	Bluestone canyon, $\frac{1}{4}$ mile above lower end of canyon.	64:1	<.001
1	1589	Junction of Right Fork and Gold Run------------	<138:1	<.001
2a	1590	Right Fork, 1,000 feet above junction with Gold Run. Black slate talus.	1,032:1	.004
2b	1591	Stream concentrate at same location as 2a------	64:1	<.001
16	1592	Right Fork, 300 feet below Slate Creek---------	36:1	.001
15	1593	Slate Creek, 1,000 feet above mouth------------	259:1	<.001
5	1594	Right Fork at mouth of Windy Creek-------------	259:1	<.001
6	1595	Right Fork, 400 feet above Windy Creek---------	94:1	.001
7	1596	Junction of Little Windy Creek and Windy Creek--	183:1	.002
8	1597	Windy Creek, 500 feet above Little Windy Creek--	224:1	.002
9	1598	Windy Creek, 1 mile above Little Windy Creek---	180:1	.001
10	1599	Little Windy Creek, half way between mouth and head.	456:1	.002
25	1600	Igloo Creek sluice-box concentrate, a split from cleanup at Tweet mine.	-----	.001
30	1601	Gold Run at Potter Pup Creek-------------------	115:1	.001
19	1602	Gold Run at Tom Gulch--------------------------	51:1	<.001
18	1603	Tom Gulch, 600 feet above mouth----------------	105:1	<.001
23	1604	McDame Creek at mouth--------------------------	38:1	<.001
31	1605	Alder Creek, near mouth, 1 pan concentrate from H. Johnson's cut, 1946.	158:1	.002
28	1606	Gold Run below Bull Pup Creek, from Martinsen-Fidgeland pits, 1946.	138:1	<.001
24a	1607	Gold Run dredge concentrate, minus 20-mesh------	-----	.001
24b	1608	Gold Run dredge concentrate, plus 20-mesh-------	-----	--
29	1609	Gold Run at upper end of dredge operations, $\frac{1}{2}$ mile above Sullivan.	59:1	<.001
32	1610	Dese Creek dredge concentrate donated by Tweets of Teller.	-----	.001
33	1611	Sunset Creek, fine sluice-box concentrate, donated by Frank Rice.	-----	.004
34	1612	Sunset Creek, coarse sluice-box concentrate-----	-----	<.001
35	1613	----do--	-----	<.001
36	1614	Igloo Creek, north of Grantley Harbor, $1\frac{1}{2}$ miles above mouth.	148:1	.002
37	1615	McKinley Creek, 2 miles from mouth-------------	190:1	.001
38	1616	Offield Creek at junction of the two main headwater forks.	277:1	.001
39	1617	Offield Creek, 300 feet above lagoon at mouth---	875:1	.002
44	1618	Swanson Creek, $\frac{3}{4}$ mile below Saturday Creek------	182:1	.001
45	1619	Swanson Creek, $\frac{1}{2}$ mile below Saturday Creek------	157:1	.001
----	1760	Swanson Creek, sluice-box concentrate donated by B. Vogen from his placer cut, June 1947.	-----	--

[1] Equivalent uranium.

PART 2. --RECONNAISSANCE IN THE VICINITY OF CAPE NOME, 1947

By W. S. West and J. J. Matzko

ABSTRACT

An early report on the Cape Nome area, Seward Peninsula, Alaska, stated that granitic rocks there contain allanite as a common accessory mineral. Results of studies in 1947 indicate that very little allanite is present, and that the slight amount of radioactivity of the granitic complex is attributable to the accessory minerals zircon and sphene.

INTRODUCTION

Location of area

Cape Nome is 15 miles east of Nome, Alaska, on Norton Sound (pl. 2). The area in the vicinity of Cape Nome as described in this report covers about 8 square miles and is bounded on the south by Norton Sound, on the west by Hastings Creek, and on the east by a large lagoon and the estuary of the Flambeau and Eldorado Rivers. The area extends about 4 miles inland from the seacoast. A gravel road connects the Cape Nome area with Nome.

Purpose and scope of investigation

In June 1947, a Geological Survey field party made a brief reconnaissance in the Cape Nome area. The reconnaissance was undertaken for three reasons:

1) An early report claimed that the granitic complex at Cape Nome contains allanite as a common accessory mineral.[4] In 1946 a trace elements examination disclosed concentrations of radioactive minerals associated with allanite in late-stage pegmatitic zones in granite at the head of Hot Springs Creek, a tributary of the Serpentine River, in northwestern Seward Peninsula.[5] The possibility existed, therefore, that the granitic complex at Cape Nome might also contain associated late-stage concentrations of radioactive materials.

2) Although samples from stream gravels and placer-gold-mining localities in the Nome area were essentially nonradioactive, the nearby granite mass at Cape Nome, aside from its reported allanite content, seemed to be one of the types of bedrock in the general area most likely to contain radioactive minerals and warranted study from this standpoint alone.

3) The granite mass at Cape Nome is also one of the more accessible intrusive bodies of the Seward Peninsula and thus could be examined with relative ease.

GEOLOGY

Field work in the Cape Nome area during the season of 1947 was confined to the granitic complex. Plate 2 shows the approximate extent of the intrusive mass as well as other formations. Because outcrops are few and all contacts are covered with tundra, the position of the formational boundaries on the map are only approximate.

The western 3-3/4 miles of the granitic complex at Cape Nome, as described by Moffit[6] is made up of granite, gneiss, and schist. The original granite has undergone varying degrees of metamorphism that have resulted mainly in the formation of gneiss but have also produced schist, especially toward the northern and eastern boundaries of the mass. Greenstone and a coarse dark-gray porphyritic rock containing feldspar phenocrysts as much as 2 inches in length intrude both the granite and gneiss. The porphyritic intrusion is cut by a later granite. These various intrusives probably belong to several widely separated periods, possibly ranging from the Paleozoic in the Mesozoic.

The granitic rocks generally are gray in color, tending to weather slightly yellow, and have a fine to medium texture. Nearly all the granitic rocks are rich in muscovite and biotite. Chlorite is a common secondary mineral. Mineralogical determinations disclosed that allanite is only a sparse accessory mineral.

Table 2 gives the mineralogy of some of the heavier-than-bromoform fractions of the samples collected during this investigation. Sample locations are shown on plate 2. (The only locations of rock samples shown on this map are for those samples that have been studied in the laboratory.)

RADIOACTIVITY

Radiometric readings were made in the field with a beta-gamma probe attached to a standard make

[4] Moffit, F. H., 1913, Geology of the Nome and Grand Central quadrangles, Alaska: U. S. Geol. Survey Bull. 533, p. 33.

[5] Moxham, R. M., and West, W. S., 1949, Trace elements investigations in the Serpentine-Kougarok area, Seward Peninsula, Alaska: U. S. Geol. Survey Trace Elements Inv. Rept. 39. [Unpublished.]

[6] Moffit, F. H., op. cit., pp. 33, 34.

of a portable survey meter on bedrock outcrops, talus, and the finer types of mantle rock. The average background in the area is 25 to 30 counts per minute. A considerable amount of traversing was attempted, but the results were unsatisfactory as the instrument is not sufficiently sensitive for successful traversing. Seven stream and beach concentrates, one sample of slope wash, and many other rock samples were collected for testing in the field and laboratory.

Granite talus and bedrock gave relatively high readings on the outcrop, apparently a result of mass effect; but individual rock samples from the same talus blocks and bedrock outcrops gave counts that were not appreciably above background.

The equivalent uranium content of the heavier-than-bromoform (specific gravity 2.8) fractions of the rock samples ranges from less than 0.001 to 0.012 percent, and the heavier-than-bromoform fractions of the stream and beach panned concentrates contain between 0.001 and 0.003 percent equivalent uranium (table 2). The heavier-than-bromoform fraction of a sample panned from slope wash contains 0.006 percent equivalent uranium.

Radiometric tests on the bromoform-heavy fraction of the slope-wash sample show that a very small amount of the radioactive mineral can be concentrated by sizing to minus 150-mesh material as shown below:

Mesh size	Percent eU[1]	Concentration ratio
-20 (whole sample)	0.006	1:1
-20 to +60	.004	2:1
-60 to +100	.006	4:1
-100 to +150	.007	9:1
-150 to +250	.020	14:1
-250	.025	41:1

[1] Equivalent uranium.

The heavy minerals in the slope wash are garnet, glaucophane, muscovite, epidote, sphene, chlorite, tourmaline, zircon, biotite, ilmenite, magnetite, and hematite. Probably the sphene and zircon contain the radioactive elements, and because the minus 250-mesh material gave negative bead tests for uranium, it is assumed that the radioactive element is thorium. This same conclusion may be applied to the rock, stream, and beach concentrates although the presence of minor amounts of allanite in a few of the samples may account for some of the radioactivity.

CONCLUSIONS

The granite mass at Cape Nome contains very little allanite. No concentrations of radioactive minerals were found in the talus blocks or in the exposed bedrock. Although talus and tundra blanket most of the area, samples panned from places where heavy minerals would tend to concentrate contain no significant amounts of radioactive minerals. These facts indicate the probability that no radioactive deposits of commercial value occur in the Cape Nome area.

Table 2.--Mineralogy and equivalent uranium content of the heavier-than-bromoform fractions of samples from the Cape Nome area

Sample no.	Nature of sample and location	Percent equivalent uranium	Heavier-than-bromoform fraction Mineralogy (minerals listed in decreasing order of abundance; percentages by approximate volume)
	Stream sample:		
2440	Right tributary to estuary of Flambeau and Eldorado Rivers.	0.001	-----
2441	Tributary to Hastings Creek.	.001	-----
2442	Goldengate Creek, just above old dam site.	.001	-----
2443	Goldengate Creek---------------	.003	-----
2444	Goldengate Creek, near mouth on new beach and below old placer workings of W. A. E. Cramer.	.001	-----
2445	Slope-wash sample: From sea cliff on south side of granite mass, along Norton Sound, near Cape Nome.	.006	Garnet (29.9) Glaucophane (22.7) Muscovite, Epidote, Sphene, Chlorite, Tourmaline, Zircon, Biotite (46.8) *Ilmenite (0.2) Magnetite (0.4) Hematite (tr.) Tungstates (tr.)
2446	Beach sample: Fifty yards west of sample 2445, Norton Sound, near Cape Nome.	.001	-----
2447	Stream sample: Tributary to lagoon.	.001	-----
	Crushed granite gneiss float sample:		
3273	West of limestone outcrop------	.010	Muscovite Biotite Chlorite Secondary hematite Sericite Sphene Zircon(?) Rutile(?)
3274	From highest point in area about 1 mile northeast of Cape Nome.	.008	Muscovite Biotite Chlorite Sericite Goethite Sphene Chromite Garnet Fluorite
3275	Crushed coarse-grained granite sample: From outcrop along coast of Norton Sound near Cape Nome.	.007	-----

Table 2.--Mineralogy and equivalent uranium content of the heavier-than-bromoform fractions of the samples from the Cape Nome area--Continued

Sample no.	Nature of sample and location	Percent equivalent uranium	Heavier-than-bromoform fraction Mineralogy (minerals listed in decreasing order of abundance; percentages by approximate volume)
	Crushed granite sample:		
3276	From sea cliff along Norton Sound near Cape Nome.	0.007	-----
3277	From sea cliff along Norton Sound east of Cape Nome.	.007	-----
	Crushed granite gneiss sample:		
3278	From sea cliff along Norton Sound east of Cape Nome.	.006	-----
3279	From highest point on granitic hill northeast of Snow Gulch.	.008	-----
3280	Northeast slope of granite hill to the west and north of Goldengate Creek.	.012	Muscovite, Chlorite, Secondary hematite, Sericite, Goethite, Magnetite, Epidote, Zircon, Sphene, Spinel, Fluorite
3281	Crushed granite sample: From west slope of hill east of Goldengate Creek (near headwaters).	.007	-----
3282	Crushed pegmatite float sample: From pit between limestone outcrop and road to camp of Civil Aeronautics Authority.	.002	-----
	Crushed granite sample:		
3287	From furthest granitic hill north of Cape Nome.	.012	Biotite, Muscovite, Hematite, Sphene, Epidote, Garnet, Allanite, Zircon
3288	-----do-----------------------------	.012	Muscovite, Biotite, Hornblende (tr.), Epidote, Fluorite, Allanite
3289	Crushed greenstone sample: From saddle north of highest granite hill in Cape Nome area, about 1½ miles north of Cape Nome.	.001	-----
3290	Crushed fine-grained granite sample: From sea cliff along Norton Sound near Cape Nome.	.003	-----

* Flux test indicates traces of niobium(?).

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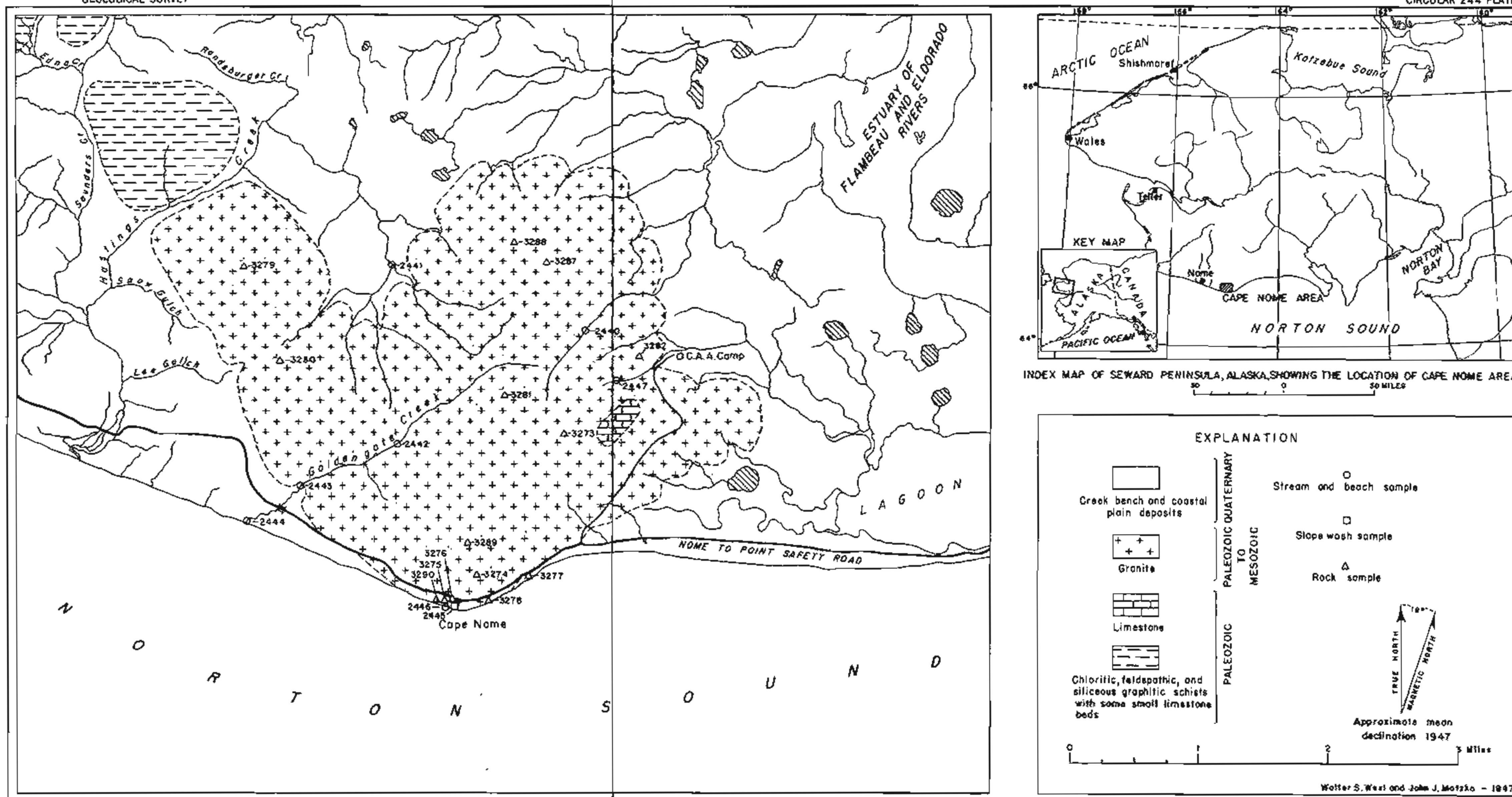

GEOLOGIC SKETCH MAP OF THE CAPE NOME AREA, SEWARD PENINSULA, ALASKA