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RECONNAISSANCE FOR RADIOACTIVE DEPOSITS IN THE NIXON FORK MINING DISTRICT, MEDFRA QUADRANGLE, CENTRAL ALASKA, 1949*

By

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By Max G. White and John M. Stevens

ABSTRACT

Reconnaissance for radioactive deposits in the Nixon Fork mining district, Medfra quadrangle, central Alaska, in 1949 disclosed the occurrence of allanite in samples containing as much as 0.05 percent equivalent uranium from the dump of the Whalen mine; the presence of radioactive parisite (a rare-earth fluocarbonate) in a highly altered limestone containing about 0.025 percent equivalent uranium near the Whalen shaft; and radioactive idocrase in samples of altered garnet rock with about 0.025 percent equivalent uranium, from the Crystal shaft of the Nixon Fork mine. This radioactivity is due mostly to thorium rather than uranium. Placer concentrates from Ruby and Eagle Creeks contain 0.078 and 0.26 percent equivalent uranium respectively, in which the radioactivity is due chiefly to uraniferous thorianite. The bedrock source of the uraniferous thorianite was not located primarily because much of the area is overlain by a relatively thick mantle of vegetation (mostly moss) which limited the effectiveness of radiometric surveying. The uraniferous thorianite is believed to occur in a restricted zone or zones at or near the contact of limestone with monzonite similar to the gold-copper ores of the district and the deposits of radioactive parisite and garnet rock at the Whelan and Crystal shafts respectively.

INTRODUCTION

The Nixon Fork mining district (fig. 1) is in a low range of hills of the Kuskokwim Mountains, about 12 miles north of Medfra, a small settlement on the Kuskokwim River 95 miles upstream from McGrath, in central Alaska. Access to the area is by boat or airplane from McGrath to Medfra, and from Medfra to the mines by truck.

The term "Nixon Fork mines" has long been used for both lode and placer mines in the district. Most of the lode-mining property is held by the Nixon Fork Mining Co., whose principal owners are the Mespelt brothers of McGrath. Their property is called the Nixon Fork mine. The only other lode-mining property of any importance is the Whalen mine, adjacent to and south of the Nixon Fork mine property.

Some of the radioactive placer concentrates from the Nixon Fork mining district available in the Geological Survey's Alaskan Geology Branch placer concentrate file before 1949 (table 1) contain uraniferous thorianite associated with bismuth and copper minerals. This association suggested that the district was favorable for the occurrence of a uranium-bearing lode deposit. Therefore, in 1949, a Geological Survey party conducted a reconnaissance in the district to determine its uranium possibilities. Approximately three weeks were required for the investigation, of which one and a half days were spent at a gold-lode prospect on Eagle Creek, about 5 to 7 miles south of the main Nixon Fork mines (fig. 1). The party consisted of M. G. White and J. M. Stevens, geologists, and Egil Salveson and R. D. Olson, camp assistants. This work was done on behalf of the Division of Raw Materials of the U. S. Atomic Energy Commission.

Table 1.--Data on concentrates collected in the Nixon Fork mining district before 1949.

Samples File no.	Field no.	Location and description	Percent equivalent uranium
10	33AMt 68	Nixon Fork mine; mill concentrates	$\angle$ 0.001
11	70	Birch Gulch, 1/4 mile above mouth; placer concentrate	.014
50	73	Hidden Creek, above Dry Gulch; placer concentrate	.031
134	--	Holmes Gulch(?); probably sluice-box concentrate	.086
900	45AW 59	Greer Gulch; placer concentrate	.003
901	57	Holmes Gulch; placer concentrate	.008
902	57A	Holmes Gulch; placer concentrate	.015
903	51	Whistling Gulch; placer concentrate	.006
904	53	Nixon Fork mine; mill concentrates	< .001
905	44	Ruby Creek; placer concentrate	.012
906	56	Birch Gulch; placer concentrate	.007
907	54	Hidden Creek, between Whistling and Dry Gulches; placer concentrate	.013
908	50	Whistling Gulch; placer concentrate	.006
909	58	Puzzle Creek; placer concentrate	.002
910	57B	Holmes Gulch; placer concentrate	--
911	47	Encio Gulch; placer concentrate	.005
912	48	Hidden Creek, below Encio Gulch; placer concentrate	.012
913	60	Mystery Creek; placer concentrate	.004
914	45	Ruby Creek; placer concentrate	.005
915	46	Ruby Creek; placer concentrate	.007
916	49	Hidden Creek, above Encio Gulch; placer concentrate	.010
917	52	Nixon Fork mine; concentrate from mill tailings	.002
923	55	Dry Gulch; placer concentrate	.001
926	61	Submarine Creek; placer concentrate	.002

GEOLOGY, MINERAL DEPOSITS, AND RADIOACTIVITY INVESTIGATIONS

The low range of hills on which the Nixon Fork mines are located is composed of Paleozoic limestone and Upper Cretaceous sandstone, shale, and slate. The rocks are intruded by quartz monzonite that is probably Eocene in age. The lode deposits in the district are an enrichment in limestone along contact metamorphic zones between the limestone and monzonite. Most of the mineral deposits are apparently restricted to the valleys of the tributaries of Hidden Creek and the slopes around the north headwater fork of Ruby Creek (fig. 1). No mineral deposits of any note have been found along the eastern edge of the monzonite.

Placer gold was found on Ruby Creek in the winter of 1917, and shortly thereafter, the lode deposits at the head of Crystal Gulch were located. In 1920 a 10-stamp mill was installed at the head of Ruby Creek to process the highly oxidized copper-gold ores from the various shafts and prospects in the district. Mining and milling has been carried on in the district intermittantly since 1920.

More detailed descriptions of the geology, mineral deposits, and mining of the Nixon Fork district are contained in reports by Martin (1922), Brown (1926), and Mertie (1936).

As is the case with much of interior Alaska, the area around the Nixon Fork mines is thickly covered with underbrush of willow, alder, spruce and birch, and by moss, which averages about 3 feet in thickness. These conditions make the results of radiometric traversing at best inconclusive, except in the localities where recent mining developments have uncovered sufficient bedrock for direct examination.

The mineral deposits on the properties of the Nixon Fork Mining Co. and at the Whalen mine contain both copper and gold, and occur along the contact between

the limestone and monzonite. The highly mineralized part of the contact zone is exposed by a large number of shafts and prospect pits, and, hence, was examined in some detail. Much of the remainder of the contact could not be examined because of the moss cover.

Hidden Creek area

Some of the samples in the Nixon Fork district with the greatest concentration of thorianite come from Encio Gulch, a tributary of Hidden Creek (fig. 1). However, radiometric traverses around the head of Hidden Creek and its headwater tributaries gave negative results. The results are negative, not so much because of the lack of any radioactive materials, which may be perfectly possible, but probably because the valley is covered almost completely by a thick shielding cover of moss and low brush. Concentrates from stream gravels collected during the 1949 investigations are listed in table 2. They are somewhat lower in radioactivity than the pre-1949 samples because the latter were obtained when placer operations were active in the valley. The occurrence of bismuth in the placers is apparently restricted to the valley of Hidden Creek above Dry Gulch, and, because it is thought that all of that portion of the valley of Hidden Creek is underlain by monzonite, it is likely that the bismuth is restricted to the monzonite.

Whalen mine

The main shaft of the Whalen mine is located at the head of Homes Gulch very near the contact between the limestone and monzonite. The limestone forms an island surrounded by monzonite (fig. 1). At this shaft boulders of limestone on the waste

Table 2.--Data on placer concentrates collected from Hidden Creek and its tributaries in 1949.

Samples File no.	Field no.	Location	Concentration ratio	Percent equivalent uranium in heavy-mineral fraction _/
3574	49ASv 108	Hidden Creek, above Encio Gulch	145:1	0.009
3575	109	Hidden Creek, left limit tributary above Encio Gulch	400:1	.006
3576	110	Hidden Creek, extreme head, 1,000 feet below road	120:1	.006
3577	111	Do.	310:1	.007
3578	112	Hidden Creek, prospect hole	275:1	.006
3579	113	Birch Gulch, 1,000 feet above mouth	360:1	.012
3580	114	Dry Gulch, 1,500 feet above mouth	630:1	.003
3581	115	Hidden Creek, 1/2 mile above Birch Gulch	150:1	.005
3582	116	Hidden Creek, 1/2 mile above Birch Gulch; tailings pile	90:1	.005
3583	117	Whistling Gulch, near mouth	190:1	.007
3584	118	Holmes Gulch, left headwaters fork	270:1	.005
3584	119	Encio Gulch, left headwaters fork	60:1	.004
3585	120	Encio Gulch, right headwaters fork	90:1	.005
3586	121	Encio Gulch, near mouth	80:1	.006

_/ That greater than 2.8 specific gravity

dump are radioactive and contain a high percentage of a black mineral. The equivalent uranium content of the boulders is 0.05 percent, but fluorometric analysis indicates a uranium content of only 0.004 percent (table 3). It is assumed, therefore, that most of the radioactivity of these rocks is due to thorium. The heavy-mineral concentrate (that greater than 2.8 specific gravity) of the rock consists of 98 percent allanite (the radioactive mineral) and 2 percent zircon, kyanite and scheelite. These heavy minerals constitute about 25 percent of the rock.

A short distance east of the main shaft is a large depression about 40 feet deep formed as the result of a cave-in on the 40-foot level of the mine. Most of the material of the cave-in was high-grade gold ore and was mined out, leaving a "glory hole". Along the walls of the glory hole is exposed highly weathered metamorphic rock consisting mainly of quartz and limestone that has an average content of about 0.025 percent equivalent uranium (table 3). However, chemical analyses show only 0.002 percent uranium in this rock. The radioactive mineral is parisite (a rare-earth fluocarbonate) that makes up about 95 percent of the heavy-mineral fraction of the rock.

The main shaft of the Whalen mine is 200 feet deep and is inclined at an 85 degree angle down the contact. This shaft could not be examined because it was filled with ice to within 12 feet of the top.

There are between 150 and 200 small shafts and prospect pits along the contact between the limestone and monzonite in the vicinity of the Whalen mine. Approximately 80 of the prospect pits were cleaned out and tested radiometrically in an effort to discover any additional concentrations of radioactive minerals. A few of the holes tested have a higher than normal radioactivity and were sampled for further study (table 3). Radiometric analyses of these samples indicate an equivalent uranium content ranging from 0.001 to 0.006 percent (table 3). The radioactive

Table 3.--Data on samples collected from the Whalen mine and vicinity

Samples			Crushed rock		Heavy-mineral fraction 3/	
File no.	Field no.	Location and description	eU 1/ (percent)	U 2/ (percent)	eU (percent)	Concentration ratio
		Samples collected at Whalen mine				
3619	49AWe 127	Whalen mine tailings dump; limestone with large amount of metamorphic minerals	0.05	0.004	0.081	4:1
3620	128	Same as sample 3619; concentrate from panning crushed rock	--	--	.08	4:1
3621	129	Whalen mine "glory hole"; wash from west side rim	--	--	.06	900:1
3622	130	"Glory hole"; rock along contact between highly weathered limestone and highly leached limestone, panned concentrate	--	--	.14	850:1
3623	132	Same as sample 3622; highly weathered limestone	.03	.002	.14	35:1
3624	133	Same as 3623; panned concentrate	--	--	.14	160:1
3625	134	Same as 3622; weathered limestone	.02	.002	.10	400:1
3626	135	"Glory hole"; combination of the rock types of samples 3623 and 3625	.03	.002	.12	30:1
3627	150	Slope east of Whalen mine shaft; decomposed limestone; panned concentrate	--	--	.019	2,400:1
3628	151	Same as sample 3627; unconcentrated rock	.005	.002	.04	640:1

1/ eU - equivalent uranium
2/ U - uranium
3/ that greater than 2.8 specific gravity

Table 3.--Data on samples collected from the Whalen mine and vicinity--Continued.

Samples			Crushed rock		Heavy-mineral fraction 3/	
File no.	Field no.	Location and description	eU 1/ (percent)	U 2/ (percent)	eU (percent)	Concentration ratio
		Samples collected from some of the prospect holes along the contact between the monzonite and limestone in the vicinity of the Whalen mine.				
3629	49AWe 153	Hole no. 21; limestone	0.004	--	0.010	170:1
3630	154	Hole no. 24; monzonite	.003	--	.010	90:1
3631	155	Hole no. 25; monzonite	.003	--	.004	40:1
3632	156	Hole no. 32; limestone	.000	--	.001	50:1
3633	157	Hole no. 51; limestone	.002	--	.004	40:1
3634	158	Hole no. 52; limestone	.006	--	.018	20:1
3635	159	Hole no. 54; monzonite	.002	--	.004	20:1
3636	160	Hole no. 56; monzonite	.003	--	.008	50:1
3637	161	Hole no. 60; monzonite	.001	--	.003	25:1
3638	162	Hole no. 61; limestone	.005	--	.019	300:1
3639	163	Hole no. 65; monzonite	.001	--	.003	30:1
3640	164	Hole no. 68; limestone	.004	--	.006	60:1
3641	164	Hole no. 74; monzonite	.005	--	.007	25:1

1/ eU - equivalent uranium
2/ U - uranium
3/ that greater than 2.8 specific gravity

minerals in these samples are allanite, hematite, zircon, and sphene.

Ruby Creek area

Samples from Ruby Creek are not plotted on figure 1, but their locations are described in table 4. The most radioactive sample obtained in the Ruby Creek drainage (no. 3570, table 4) contains 0.078 percent equivalent uranium. The sample is a sluice-box concentrate from the Strand placer mine on Ruby Creek at the foot of the headwaters gradient of Crystal Gulch. Most of the lode deposits on the Nixon Fork Mining Co. property are located at the head of this gulch. The percentages of the minerals in the fraction greater than 2.8 specific gravity of this concentrate are given in table 5. Most of the radioactivity in this sample is probably due to the thorianite. The unknown secondary minerals were analysed spectrographically. The yellow mineral contains bismuth, lead, copper, iron, vanadium, and silicon as major constituents, and calcium, aluminum, arsenic and antimony as minor constituents. The green mineral contains copper, bismuth, silicon, calcium, iron, and lead as major constituents, and aluminum, vanadium and phosphorous as minor constituents. The source of neither the thorianite nor the secondary uranium-bearing minerals was found, though search was extended to all the slopes of Ruby Creek along the contact and in the monzonite, where these slopes were not thickly covered by moss. It is possible that these minerals are derived from a restricted zone at or close to the contact, much as the parisite-bearing zone at the contact in the Whalen mine "glory hole". The radioactivity in all the concentrates and rock samples from the head of Ruby Creek is probably due mainly to the minerals zircon and sphene as thorianite was not found in them.

Table 4.--Data on bedrock samples and concentrates collected in the Ruby Creek area in 1949.

Samples File no.	Samples Field no.	Location and description	Crushed rock eU 1/ (percent)	Crushed rock U 2/ (percent)	Heavy-mineral fraction 3/ eU (percent)	Heavy-mineral fraction 3/ Concentration ratio
3558	49ASv 91	Head of Ruby Creek; placer concentrate above mill and mill tailings dump	--	--	0.007	300:1
3567	100	Ruby Creek; placer concentrate at foot of headwaters gradient	--	--	.006	130:1
3568	101	Same as sample 3567	--	--	.008	290:1
3569	102	Crystal Gulch; concentrate from head of placer workings	--	--	.02	650:1
3570	103	Ruby Creek; sluice-box concentrate from Strand placer workings	--	--	.078	very high
3593	49AWe 89	Along trail on left limit of Crystal Gulch; monzonite	0.004	--	.005	15:1
3594	91	Along road from mill to Garnet Shaft; monzonite	.003	--	.006	9:1
3596	94	Bench on right limit of Ruby Creek above Strand placer mine; disintegrated monzonite	--	--	.011	690:1
3597	95	Same as sample 3596; undisintegrated rock	.003	--	.005	10:1
3598	97	At mouth of Crystal Gulch in Strand placer mine; shattered monzonite	--	--	.004	650:1
3599	98	On north side of Strand placer mine; panned concentrate from disintegrated granitic dike in monzonite	--	--	.013	2,270:1
3600	99	Same as sample 3599; quartz veins paralleling granitic dike	.002	--	.010	220:1

1/ eU - equivalent uranium
2/ U - uranium (determined chemically)
3/ that greater than 2.8 specific gravity

Table 4.--Data on bedrock samples and concentrates collected in the Ruby Creek area in 1949--Continued.

Samples: File no.	Samples: Field no.	Location and description	Crushed rock: eU 1/ (percent)	Crushed rock: U 2/ (percent)	Heavy-mineral fraction 3/: eU (percent)	Heavy-mineral fraction 3/: Concentration ratio
3601	49AWe 101	On south side of Strand placer mine; panned concentrate of disintegrated granitic dike	--	--	0.032	780:1
3602	102	Same as sample 3601; undisintegrated rock	0.003	--	.016	80:1
3603	104	Strand placer mine; inclusions in monzonite	.002	--	.003	5:1
3604	105	Middle Crystal Gulch; bedrock from contact zone	.002	--	.007	70:1
3607	111	Same as sample 3594; panned concentrate from disintegrated monzonite	--	--	.015	1,800:1
3608	112	Same as sample 3594; panned concentrate of disintegrated granitic dike in monzonite	--	--	.033	2,270:1
3609	113	Same as sample 3594; undisintegrated granitic dike in monzonite	.008	0.004	.021	100:1

1/ eU - equivalent uranium
2/ U - uranium (determined chemically)
3/ that greater than 2.8 specific gravity

Table 5.--Mineralogy and radioactivity of three placer concentrates from the Nixon Fork mining district.

Minerals	Sample no. 3570	Sample no. 3642	Sample no. 3850
Allanite	--	3* 1/	1*
Azurite	tr	--	--
Cassiterite	3	--	--
Common rock-forming minerals	4	2	--
Fluorite	tr	1	tr
Garnet	--	5	4
Gold	a 2/	--	--
Hematite	a*	tr*	--
Ilmenite	70	85	80
Malachite	tr*	--	--
Magnetite	13	tr	8
Monazite	--	--	tr
Powellite	--	--	tr
Pyrite	--	--	tr
Scheelite	5	3	4
Sphene	a*	tr*	--
Thorianite	a*	1*	1*
Unknown secondary green mineral	tr*	--	--
Unknown secondary yellow mineral	tr*	--	--
Uraninite	--	--	1*
Zircon	a*	tr	tr
Equivalent uranium content (percent)	0.078	0.26	0.18
Uranium content (percent)	n.d.	n.d.	.06

1/ Estimated volume percent; the asterisk indicates that the mineral is uranium-bearing as determined by a sodium fluoride flux test.

2/ a indicates that these five minerals total 5 percent of the sample.

Nixon Fork mine

Almost all the ore that was processed from all the shafts and prospect pits in the vicinity of the Nixon Fork mine was processed at the stamp mill located at the head of Ruby Creek (fig. 1). The tailings from the milling operation, crushed to fine silt size, were dammed up at the rear of the mill in the expectation that with further refinement of the milling processes additional gold could be recovered from these tailings. Radiometric tests of these tailings in the field indicated no appreciable radioactivity. However, in order to determine whether any radioactive minerals had been carried over into the tailings during milling operations, the mill tailings pile was sampled both across the surface or top (with holes 3 to 4 feet deep) and across the base. As the equivalent uranium content of the heavy-mineral fractions (those greater than 2.8 specific gravity) of these samples ranges only from 0.002 to 0.008 percent (table 6), it is obvious that very little radioactive material occurs in the tailings.

Samples of ore were collected and tested from various ore and concentrate bins in and near the mill. The maximum equivalent uranium content of any of these samples is 0.019 percent. The radioactivity is apparently associated with iron oxides in the ore. Table 6 lists the data on all the samples collected in and near the mill.

Crystal shaft.--The Crystal shaft (fig. 1) of the Nixon Fork mine is located in a highly metamorphosed zone of rock that probably includes both monzonite and limestone. About 50 feet northeast of the shaft a massive garnet rock underlies garnet-bearing, marmorized limestone and contains as much as 0.025 percent equivalent uranium. Study of samples from this locality (table 7) shows that the radioactivity is associated with garnet rock that is somewhat impure and weathered. The fresh, unweathered garnet is nonradioactive. The impurity in the garnet occurs in

Table 6.--Data on ore, mill, and tailings samples from the Nixon Fork mine, 1949.

Samples File no.	Samples Field no.	Location and description	Crushed rock eU (percent) 1/	Heavy-mineral fraction 2/ eU (percent)	Heavy-mineral fraction 2/ Concentration ratio
3542	49ASv 75	Nixon Fork mill; mill tailings	--	0.002	1,950:1
3543	76	Small stream along side of Nixon Fork mine; mill tailings	--	.004	370:1
3544	77	Nixon Fork mine mill; mill tailings	--	.003	590:1
3545	78	Do.	--	.008	3,400:1
3546	79	Do.	--	.005	620:1
3547	80	Do.	--	.004	120:1
3548	81	Do.	--	.002	1,360:1
3549	82	Do.	--	.003	1,360:1
3550	83	Do.	--	.002	560:1
3551	84	Do.	--	.003	750:1
3552	85	Nixon Fork mine mill; crushed ore, partly concentrated	--	.003	?
3553	86	Do.	--	.003	?
3554	87	Do.	--	.006	?
3555	88	Do.	--	.004	?
3556	89	Do.	--	.004	?
3557	90	Nixon Fork mine mill; mill tailings	--	.002	1,360:1
3559	92	Do.	--	.002	500:1
3560	93	Do.	--	.002	2,700:1
3561	94	Do.	--	.004	270:1
3562	95	Do.	--	.002	450:1
3563	96	Do.	--	.002	210:1
3564	97	Do.	--	.002	500:1
3565	98	Do.	--	.003	900:1
3566	99	Do.	--	.002	380:1

1/ eU - equivalent uranium

2/ that greater than 2.8 specific gravity

Table 6.--Data on ore, mill, and tailings samples from the Nixon Fork mine, 1949--Continued.

Samples File no.	Samples Field no.	Location and description	Crushed rock eU (percent) 1/	Heavy-mineral fraction 2/ eU (percent)	Heavy-mineral fraction 2/ Concentration ratio
3588	49AWe 81	Nixon Fork mine; gold ore	0.000	0.001	3:1
3589	82	Nixon Fork mine; oxidized ore	.007	.007	2:1
3590	83	Do.	.009	.012	3:1
3591	85	Do.	.006	.008	3:1
3592	86	Do.	.019	.019	2:1
3595	93	Nixon Fork mine; partly milled ore from Garnet shaft	.002	.006	?
3605	107	Nixon Fork mine; malachite ore from Crystal shaft	.002	--	--
3606	109	Nixon Fork mine; malachite ore from Garnet shaft	.006	--	--

1/ eU - equivalent uranium
2/ that greater than 2.8 specific gravity

Table 7.--Data on samples of garnet rock from the vicinity of the Crystal shaft, Nixon Fork mine.

Samples: File no.	Samples: Field no.	Description	Crushed rock: eU (percent) 1/	Crushed rock: U (percent) 2/	Heavy-mineral fraction 3/: eU (percent)	Heavy-mineral fraction 3/: Concentration ratio
3610	49AWe 115	Surface wash on contact between limestone and monzonite 50 feet northeast of Crystal shaft; panned concentrate	--	--	0.014	270:1
3611	116	Random fragments of garnet rock showing high radioactivity	0.018	0.008	--	--
3612	117	Clean, unweathered garnet rock from shaft	.000	--	--	--
3613	118	Do.	.000	--	--	--
3614	119	Selected specimen of garnet rock showing strongest radioactivity	.025	.008	--	--
3615	120	Garnet rock showing strong radioactivity	.017	.006	.026	10:1
3617	122	Monzonite at contact with garnet rock	.003	--	.006	25:1
3618	123	Same as sample 3617; concentrate obtained by panning crushed rock	--	--	.012	60:1

1/ eU - equivalent uranium
2/ U - uranium (determined chemically)
3/ that greater than 2.8 specific gravity

thin beds or irregular masses and is well coated with hydrous iron oxides. The composition of the garnet rock, exclusive of the hydrous iron oxides, is 65 percent garnet, 20 percent idocrase, 12 percent common rock-forming minerals, 3 percent sphene, and traces of zircon and magnetite. The radioactive minerals are idocrase and sphene. In a field inspection the radioactive material in the garnet appears to be mainly an iron-oxide coating and filling in fractures and fissures in the rock.

No significant radioactivity was detected at any of the numerous other prospect pits and shafts on the property of the Nixon Fork mine.

Other localities examined

Mystery, Puzzle, and Submarine Creeks

Three concentrates were collected from gravels in Mystery and Puzzle Creeks to supplement the samples from these creeks previously available in the Alaskan Geology Branch concentrate file (table 1). The radioactivity of the three samples is given below:

Samples			Heavy-mineral fraction	
File no.	Field no.	Location	eU (percent)	Concentration ratio
3571	49ASv 104	Mystery Creek	0.006	125:1
3572	105	Mystery Creek	.018	3,025:1
3573	106	Puzzle Creek	.003	130:1

Radiometric traverses were made around the heads of these two creeks as well as Submarine Creek, particularly along the ridge of which Strand and Jumbo Peaks are a part (fig. 1). No radioactivity anomalies were found.

Eagle Creek

Eagle Creek, a tributary of Crooked Creek, is located about 5 to 7 miles south of the Nixon Fork mines (fig. 1). B. A. Stone of Medfra operates a small gold-

lode mine on the headwater slopes of the creek near the contact between the limestone country rock and a small monzonite mass. The heavy-mineral fraction (that greater than 2.8 specific gravity) of a sluice-box concentrate (sample no. 3642) from a placer operation on Eagle Creek owned by Stone contains 0.26 percent equivalent uranium. The mineral composition of the Eagle Creek sluice-box concentrate is given in table 5. The radioactivity appears to be due chiefly to the uraniferous thorianite, although the allanite, hematite, and sphene are also radioactive. Radiometric traverses along the headwater slopes of Eagle and Skookum Creeks (fig. 1) failed to find the bedrock source of the radioactive minerals. A sample (no. 3644) of the monzonite on Eagle Creek contains only 0.003 percent equivalent uranium and a sample (no. 3643) of garnet rock from the lode mine contains less than 0.001 percent equivalent uranium. Again, however, the negative radiometric data obtained in traversing is not conclusive because of the thick vegetation cover over most of the area.

In 1950 a placer concentrate containing 0.18 percent equivalent uranium and 0.06 percent uranium was received from a prospector, who indicated only that it came from western Alaska; information obtained later suggests that it is probably from a placer mine in the Nixon Fork district. The mineralogy of this sample (no. 3850) is compared with two other placer concentrates from the Nixon Fork district in table 5. The marked similarity of this concentrate to that from Eagle Creek (no. 3642) suggests the probability that it also is from Eagle Creek rather than elsewhere in the district. Of note is the occurrence of uraninite as well as the uraniferous thorianite.

SUMMARY AND CONCLUSIONS

A summary of significant radioactivity data obtained in the Nixon Fork mining district in 1949 is given in table 8. The only radioactive mineral of major importance is uraniferous thorianite, although such minerals as allanite, parisite, idocrase, sphene, zircon, malachite, and two unidentified secondary polymetal minerals are also radioactive. Uraninite has been identified in a concentrate that may have come from a placer mine in the district. The bedrock source of the uraniferous thorianite has not been located, but is believed to occur, at least in part, in a restricted zone or zones at or near the contact between limestone and monzonite similar to the gold-copper ores of the district and the radioactive parisite zone at the Whelan mine and the radioactive garnet rock zone at the Crystal shaft of the Nixon Fork mine.

Search for bedrock sources of the radioactive minerals in the district by radiometric surveying is hampered considerably by the shielding effect of the heavy moss cover so prevalent through much of interior Alaska.

It is suggested that geochemical prospecting techniques, such as the analysis of samples of disintegrated material taken from auger holes through the shielding moss cover may prove more successful in locating the bedrock source of the uranium- and thorium-oxide minerals than surface radiometric traversing. Such sampling might well be supplemented by the radiometric logging of the auger holes with a survey meter such as a portable scaler. Much study on the application of geochemical prospecting techniques in Arctic and sub-Arctic regions is needed, however, before a routine can be developed.

Table 8.--Summary of significant radioactivity data obtained in the Nixon Fork mining district, 1949.

Location and type of material tested	Radioactive minerals	Maximum radioactivity Percent eU	Percent U
	Placers		
Hidden Creek and tributaries	Uraniferous thorianite	0.012	--
Ruby Creek area			
Sluice-box concentrate from Strand placer mine	Uraniferous thorianite, hematite, zircon, sphene, malachite, and two unidentified secondary minerals	.078	--
Mystery Creek and tributaries	Not determined	.018	--
Eagle Creek			
Sluice-box concentrate from Stone placer mine	Uraniferous thorianite, allanite, and sphene	.26	--
Placer concentrate, location unknown but possibly from Eagle Creek (submitted by prospector in 1950)	Uraninite, uraniferous thorianite, and allanite	.18	0.06
	Bedrock		
Whalen mine			
Metamorphosed limestone on waste dump	Allanite	.05	.004
Altered limestone in "glory hole"	Parisite	.03	.002
Limestone and monzonite in prospect holes	Allanite, hematite, zircon, and sphene	.006	--

Table 8.--Summary of significant radioactivity data obtained in the Nixon Fork mining district, 1949--Continued.

Location and type of material tested	Radioactive minerals	Maximum radioactivity Percent eU	Percent U
	Bedrock		
Ruby Creek area			
Monzonite	Zircon and sphene	0.004	--
Granitic dike in monzonite	Zircon and sphene	.008	--
Nixon Fork mine			
Mill tailings concentrates	Not determined	.008	--
Ore samples from ore bins in mill	Iron oxides	.019	--
Altered garnet rock from Crystal shaft	Idocrase, sphene, and iron oxides	.025	0.008
Fresh garnet rock from Crystal shaft	--	.000	--
Eagle Creek			
Monzonite	Not determined	.003	--
Garnet rock	Not determined	.001	--

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