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RME-3134

GEOLOGY AND MINERALOGY

UNITED STATES ATOMIC ENERGY COMMISSION

PEARSOL CREEK MONAZITE PLACER AREA, VALLEY COUNTY, IDAHO

By
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February 1954

Bureau of Mines
Washington, D. C.

Technical Information Service Extension, Oak Ridge, Tenn.

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by

M. H. Kline[1/] and E. J. Carlson[2/]

INTRODUCTION

The churn-drilling program in 1950 on the Big Creek deposit indicated that certain strata rich in monazite extended to the north under the area known as Pearsol Creek. Surface panning and auger samples to 5-foot depths in the early part of 1951 confirmed this belief that monazite-bearing formations extended northward beyond the apparent influence of the present Big Creek drainage. Where fine gravel, up to an inch in size, was exposed in road cuts or drainage ditches, the monazite content was found to run several pounds per cubic yard. Where only soils and clays were exposed, the monazite content was less apparent. The erratic distribution of monazite values in the variable surface materials indicated that a churn-drilling program would be needed to delineate the area. This program was proposed to the Atomic Energy Commission and approved early in 1951.

The objectives of the program were: (1) to determine the extent of the monazite-rich strata that extended northward from the Big Creek deposit; (2) to determine the size of the deposit; and (3) to determine the content of monazite and other potentially valuable minerals present in the deposit.

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SUMMARY AND CONCLUSIONS

The Pearsol Creek churn-drill exploration work in Valley County, Idaho, was started on July 25, 1951 and terminated on November 10. Sixty-five holes, ranging in depth from 30 to 120 feet and aggregating 3,898 feet, were drilled in the area. A total of 780 samples, weighing almost 36 tons, was taken for concentrating and analyzing in the Bureau's field laboratory in Boise. Later the composit samples were forwarded to the Bureau's analytical laboratories in Raleigh, North Carolina, for additional analyzing.

The area explored by churn drilling was found to be large and contain considerable gravel. About a third of the area, explored was found to contain better monazite content. This area is near the southern part of the field.

In addition to monazite, the black-sand concentrates were found to contain considerable ilmenite, and some magnetite, garnet, and zircon.

DESCRIPTION OF DEPOSIT

Location

The Pearsol Creek placer area is situated near the western edge of Valley County, Idaho, in T. 13 N. and T. 14 N., R. 4 E. of the Boise Meridian. The town of Cascade, the county seat of Valley County, lies 1-1/2 miles to the northwest of the deposit. The Big Creek placers,3/ where 3 bucket-line dredges have been operating to recover monazite, is contiguous to this area on the south.

3/ Kline, M. H.; Carlson, E. J.; and Storch, R. H., Big Creek Monazite Placers, Valley County, Idaho., RME-3131, April 1951.

State Highway No. 15, a hard-surfaced road, passes a quarter mile to the west of the deposit. From this highway, graveled county roads run east and north to cross the Pearsol Creek placer area. Cascade is 81 miles due north of Boise and 28 miles south of McCall, Idaho. Besides State Highway No. 15, the town of Cascade is served with a branch railroad of the Union Pacific. A main power line of Idaho Power Company traverses the Pearsol placer.

Size

The area drilled by the Bureau was large, a nearly rectangular block 2 miles in length in a north-south direction and 1-1/2 miles in width. The principal drilling was done in undulating farm lands between the 4,760- and 4,850-foot elevations. A few holes were drilled on the rolling hills along the eastern edge of the valley at an elevation of about 4,900 feet. No bedrock was encountered in any hole on either the farm lands or on the higher rolling hills. Holes were drilled from 30 to 120 feet in depth depending on the values indicated from panning the drill sludges during drilling operations. The average depth of the 65 holes was 60 feet; however, the calculated average minable depth to which fair monazite extended was 37 feet.

In this large drilled area, about one-third of it was found to contain the better monazite content. This area is near the southern part of the field.

Physical Features

The climate of the area is moderately severe in that winter snows are seldom gone from the wooded areas of the valley by the first of June, and light skiffs of snow can be expected during any month of the year. The residents of the area have designated August as the month of summer. The heavier snows generally begin in late October and continue on until April. In the open valley the snow will reach a depth of 4 feet or more, while in the surrounding mountains the snow may reach depths of 6 to 12 feet. The mountains to the west of Long Valley, which rise abruptly along a fault scarp to elevations of 8,000 feet, have visible snow on their slopes all the year round. Frost and freezing weather are not uncommon from June to September, and during the winter months the temperatures may drop to 20 degrees below zero for short periods of time. Thunderstorms with heavy rains or hail are common in the warmer months of the year. During the winter and spring of the year, periods of warmer weather or "Chinooks" alternate with the cold periods. These warm periods are often accompanied by rains which keep the snow from building up to great depths in the Long Valley area.

The greater part of the area drilled at Pearsol was on cultivated fields of grain, clover, and alfalfa. The rolling hills on the east side of the deposit are grazing lands with occasional clumps of pine trees. Clearing the land for mining operations would present few problems. Pearsol Creek, a small stream about 4 miles in length which drains the foothills east of the deposit, has insufficient water for a year-round dredging operation. Water could be stored in the valleys above, ditched from Big Creek 2 miles to the south, or pumped from the North Fork of the Payette River about half a mile to the west.

Geology

The richer strata of monazite-bearing alluvium of the Pearsol area are located on the east side of Long Valley and just north of the Big Creek placers. The concentrations of monazite appear to be in lenses of coarse sands and fine gravel -- up to an inch or two in size -- with the lenses varying in thickness from 2 to 30 feet. Samples from these lenses show a monazite content of 3 to 30 pounds per cubic yard. Between the lenses are beds of finer sands and beds of clay, all of which carry some monazite or between 0.1 and 1.0 pounds per cubic yard.

The Bureau drilling at Pearsol, and at nearby Big Creek, was on 800 to 1,600-foot grid intervals. At such great intervals it was impossible to correlate lenses and beds of alluvial material because of their short length and variable thickness as was later disclosed by the dredging in 1952 and 1953 at Big Creek. Some of the richer lenses dredged at Big Creek were found to be 8 to 10 feet thick but had little length and width -- less than 100 feet in some cases. Other lenses appeared to thin and thicken over distances of hundreds of feet. A lens may disappear at one horizon and appear at another at greater or lesser depth. A 100-foot drill hole may cut as many as 5 distinct monazite-rich lenses separated by beds of clays and/or fine sands. One Bureau hole drilled in 1950 at Big Creek showed poor monazite values of less than one pound per cubic yard of gravel, as no lenses were cut; however, subsequent dredging of this area disclosed rich monazite material surrounding the drill hole on all sides with one rich lens extending to within 10 feet of the hole. Likewise, some almost barren sections of ground were found between two or more Bureau holes which had a high monazite content. No attempts were made by the Bureau to define the extent of an individual lens as this would have necessitated drilling on a 50-foot grid pattern.

The source of the monazite at Pearsol and other deposits investigated in Long Valley is from the granitic rock of the Idaho Batholith. The rock consists of coarsely crystalline feldspar, quartz, biotite, and hornblende. The streams that enter southern Long Valley from the east carry varying amounts of monazite. Panning of the gruss, formed by weathering of the granite porphyry drained by these streams, shows monazite in the concentrates. Pegmetite and aplite dikes cut the granite porphry in many areas east of Long Valley. Some of these dikes contain considerable monazite; others contain lesser amounts while some are barren of monazite. Granite porphyry adjacent to pegmatite or aplite dikes may run high or low in monazite. Some of the best pannings of monazite were from granite porphyry where dikes were rare or absent; the richest indicated about $\frac{1}{4}$ pound of monazite per cubic yard of source rock. The general conclusion is that the monazite is related to the granite porphyry itself rather than to the late-stage dikes that cut it. The granite porphyry is a small part of a granite complex of regional extent. The manner of origin of the granitic rock, whether by forcible injection of a viscous melt or by metasomatic alteration of preexisting rocks, is a controversial problem.4/

4/ Mackin, J. Hoover, Reconnaissance Geology of the Monazite Placers of the Long Valley District: Trace Elements Memorandum Report 473.

Long Valley is a north-trending depression formed by late Tertiary and Pleistocene faulting. The monazite-bearing alluvium was carried into the fault troughs by streams from the east. An early depositional unit, rotated westward by renewed faulting, has been eroded into rolling topography along the east side. The general trend of the fault zone is N. 10° W. The maximum throw on the West Mountain fault is estimated at about 5,000 feet. Thus the mountains on the west side rise steeply from the valley floor, while on the east side, due to block faulting, they rise in a series of increasing heights to the granitic mountains which reach their highest elevations from 15 to 20 miles east of the valley.

The North Fork of the Payette River, heading in the 3 Payette lakes just north of McCall, meanders southward through Long Valley to form the main drainage system of the area. It was first suggested that it is a fault-controlled consequent stream, but its anomalous position relative to the fault blocks further south indicates it was formed prior to faulting.5/ This river carries only a trace of monazite, and its gravel consists of rock types distinctively different from those represented in the monazite placers. Stream-bed samples from the metamorphic and migmatite zone that borders Long Valley on the west carry little or no monazite.

Mineralogy

The alluvial material of the Pearsol placers has essentially the same composition as the granitic rocks to the east from which the alluvium was derived. Feldspar, quartz, hornblende, and biotite are

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5/ See footnote 4.

the principal minerals in the crystalline rocks. Quartz sands, iron-stained clays, and mica make up about 80 percent of the placer material with the remainder consisting of rounded fragments of granitic rocks and quartz, up to about 2 inches in diameter. No coarse gravel or boulders were found in the deposit.

Less than one percent of the alluvium consisted of heavy minerals. The 65 drill holes indicates the black-sand concentrates to range from 1.94 to 69.01 pounds per cubic yard of gravel. A few very fine colors of gold were occasionally found in pannings. Parts of the north end of the area drilled at Pearsol contained 10 to 30 percent magnetite in the black-sand concentrates, and invariably these holes were low in monazite content. Even in individual drill holes an increase in magnetite would show a decrease in monazite. An example of this is extracted from the log of drill hole P-20 as follows:

	Percent Mineral				
Sample Depth	Magnetite	Ilmenite	Garnet	Zircon	Monazite
From 10 to 15 feet	2	76	2	1	6
From 15 to 20 feet	2	68	1	1	10.5
From 20 to 25 feet	22	56	1	1	1.5
From 25 to 30 feet	10	47	1	1	2

At Pearsol, as at many other placer areas drilled by the Bureau, a moderate to high magnetite content in the heavy concentrates often indicates a low monazite content. The amount of garnet, zircon, or ferromagnesians does not appear to be related to the monazite content. However, samples having high ilmenite with low magnetite content have often contained the best monazite values. A typical example of this may be noted from a petrographic analysis of a selected composite sample of the black sands from drill hole P-1, as follows:

Specie	Percent Mineral
Ilmenite	80.5
Altered Ilmenite	1.0
Magnetite	0.7
Epidote	0.2
Fe-Mags	0.2
Garnet	1.6
Quartz	5.9
Zircon	0.1
Xenotime	0.1
Monazite	8.4

Trace amounts of radioactive opaque minerals were found in Pearsol concentrates. Some grains of monazite were observed to have fergusonite type inclusions. A few samples showed minor amounts of slightly active allanite. However, 95 percent or more of the radioactivity is due to the monazite and xenotime.

HISTORY

Near the headwaters of Pearsol Creek, and about 2 miles distant from the monazite placers, lie a few remnants of an older stream system which appears to have traversed the area from a northwest to a southeast direction prior to the major faulting that formed the present structural basin of Long Valley. Coarse gravels and large boulders of rocks foreign to the present granitic exposures make up the alluvium of the few remaining segments of this stream channel which is exposed among the ridges of granite porphyry 400 feet above the valley floor. Several attempts have been made in years long past to placer mine these older gravels for their gold content. A shortage of water, except for about a month or more in the spring of the year, handicapped these early operations. Two miners were killed at this spot by the savage Sheepeater Indians during the Bannock Indian wars of 1878. No attempts were made by the Bureau to sample the heavy alluvium of this old river due to the small yardage available in the deposit. The drilling by the Bureau in Long Valley directly below these old hydraulic workings did not indicate any increased gold content which could have resulted from the erosion of the major part of this older stream channel.

In the latter part of 1950 a bucket-line dredge was moved into the Big Creek placers, about 2 miles south of Pearsol, and mining of the alluvium for monazite was started in December 1950. During the last half of 1951, two additional dredges were placed in operation on the Big Creek field. These 3 dredges were originally designed to recover gold from placer materials. Monazite, with a density of about one-quarter that of gold, was found to be difficult to recover on the conventional gold-saving dredge equipment. Monazite recovery ran from 40 to 60 percent during the early months of their operations.

A Bureau of Mines program sponsored by the AEC was initiated to aid the operators and increase the monazite recovery. Automatic sampling devices were placed on the dredges and operated by skilled Bureau of Mines engineers and technicians. In addition, ore-dressing studies were made of monazite-bearing sands at Bureau stations at Albany, Oregon; Salt Lake City, Utah; Raleigh, North Carolina; and Tuscaloosa, Alabama. These sampling and laboratory studies, combined with cooperative efforts by the dredge operators, produced many changes in the general flow sheet and equipment design. The monazite beneficiation program was terminated in June 1953, at which time the dredges were recovering a very large percent of the monazite contained in the alluvium.

EXPLORATION

Preliminary Investigations

The 1950 churn-drilling program at Big Creek indicated that certain strata rich in monazite might extend northward under the rolling farm lands to an area designated as Pearsol Creek. In the late fall of 1950, engineers and samplers were sent with shovels and gold pans to test the surface materials on these adjoining properties to Big Creek. A gravel stratum exposed in the side of a small irrigation ditch near Pearsol Creek indicated about 15 pounds of monazite per cubic yard. Other pannings ran from a trace up to several pounds per yard. When only fine clays were exposed, the monazite values were low.

During the winter of 1950-51 a program to secure deeper grab samples was drawn up. This program consisted of putting down 5-foot-deep post auger holes at 500-foot intervals for the entire length of the east side of Long Valley from a point 3 miles north of Cascade to a point 8 miles south of the town. Two men sampled this area during March and April of 1951. When good monazite values were indicated by panning, auger holes were placed at 250-foot and 125-foot intervals. Not all of the 5-foot holes could penetrate the soils and clays of the surface, which resulted in extra holes being dug 100 feet to the right or left of the grab-sampling lines. A large representative sample, 50 to 70 pounds, was secured from each auger-hole site and concentrated in the Boise field laboratory. The laboratory concentrates of these grab samples were examined with 40-power lenses and a field geiger, and the results were tabulated and plotted on a map. The conclusions arrived at from the grab-sampling program indicated that two areas, Pearsol to the north of Big Creek and Corral Creek to the south of Big Creek, would warrant churn-drilling explorations. Both areas were proposed for investigation to the AEC and approved by them in the spring of 1951.

Churn Drilling

A section of land in the south-central part of the Pearsol area, where good monazite was indicated in the surface materials, was selected as the initial drill site. From these first holes a grid pattern was laid out with the holes on 800-foot centers. Drilling was extended to the north, south, east, and west depending upon the monazite values encountered in the previous hole. Some holes were omitted from the original grid pattern, and a few had to be offset because of steep hills or marshy ground. Where the best surface grab samples were taken, the monazite values did not extend to depth, as only a rich lens at the surface was encountered, though drilling continued to depths of 40 to 60 feet. Some of the holes containing better monazite values to appreciable depths contained little values at or near the surface.

Bedrock was not encountered in any hole, and no bedrock was visible in the grain fields nor on the higher rolling hills along the east edge of Pearsol. The depth of the alluvium is not known. Fair monazite values were found to a depth of 120 feet (drill hole No. P-42), but in most holes the depth of fair monazite values (Minable depth) was from 15 to 55 feet. It was reported that a water well drilled for a farmer on ground north and west of Pearsol was drilled to over 400 feet in alluvials without reaching bedrock material.

Churn drilling was initiated on July 24, 1951, and was terminated on November 10, 1951. The drilling was performed under contract No. Im-6569. One drill worked through the entire period, and a second drill was added on the project in September for the last two months of the program. Both churn drills were truck mounted and used 6-inch casing with a $7\frac{1}{4}$-inch drive shoe for drilling operations. The casing was driven $2\frac{1}{2}$ feet in two separate operations with the core sample removed after each drive. The two samples were then combined into one sample, which represented a 5-foot vertical section of core. A part of each 5-foot sample was panned at the drill site so that the supervising engineer could determine from the indicated monazite, which was recorded on the drill log, the depth to which the hole should be drilled. These pannings and pan concentrates were returned to the original sample, which was then dried and screened to 1/8-inch mesh by samplers near the drill site. The plus 1/8-inch material was checked with a field counter, weighted, recorded, and discarded. The minus 1/8-inch material was sacked for shipment to the Boise field laboratory.

The holes varied in depth from 30 to 120 feet, and the total footage drilled in the 65 holes was 3,898 feet. In all, 780 samples were taken which had a dry weight of 71,169 pounds. Of this weight, 3,599 pounds of plus 1/8-inch material was discarded at the drill sites, and the remainder was concentrated in the field laboratory. The sample concentrates were composited to minable depths, based on field estimates in the Boise laboratory, and the composite samples were forwarded to the analytical laboratories at Raleigh, North Carolina.

Drilling Data

Number of Drill Holes	Number of Samples	Actual Pounds of Sample Weight Recovered	Tons of Sample Weight Recovered
65	780	71,169	35.58

Mesh Size of Samples	Weight in Pounds	Percent of Size Recovered	Cumulative Percent of Size Recovered
+1/8 in.	3,599	5.1	5.1
-1/8 in. +16 mesh	12,675	17.8	22.9
Minus 16-mesh	54,895	77.1	100.0
Totals	71,169	100.0	

ANALYSES

Field Estimates

The dried, minus 1/8-inch drill-hole samples, upon arrival at the Boise field laboratory, were weighed and screened to minus 16-mesh size. The plus 16-mesh material was checked for radioactivity, weighed, and discarded, as no radioactivity was noticed in any material above 16-mesh size from Pearsol Creek.

The minus 16-mesh material was concentrated on laboratory shaking tables to remove 90 percent or more of the light-weight minerals which were principally quartz, feldspar, and mica. To produce a clean 99-percent pure concentrate on shaking tables would involve a loss of 10 to 20 percent of the finer-sized heavy-mineral particles. In small samples, or those containing small amounts of total heavy minerals, a wider cut had to be made on the tables to obtain all the heavy minerals; so many such concentrates contained 15 to 25 percent light-weight minerals.

A summary of field estimates for each drill hole follows:

SUMMARY OF FIELD ESTIMATES

Weighted Average to Minable Depth of Each Drill Hole

Hole No.	Total Depth, Feet	Minable Depth, Feet	Lbs. of Black Sand /Cu. Yd. Gravel	Percent Mineral Content in Black-Sand Concentrates: Magnetite	Ilmenite	Garnet	Zircon	Monazite
P- 1	65	55	16.88	2.0	72.8	3.4	1.0	9.3
2	45	35	7.96	5.0	51.6	3.7	3.1	8.9
3	60	20	27.90	.3	78.6	2.7	.5	9.2
4	50	40	13.54	1.1	72.1	4.2	1.1	5.9
5	105	95	22.99	.8	77.1	5.8	.5	7.5
6	80	70	28.13	.2	74.0	3.6	.2	10.1
7	40	15	27.44	.9	77.8	2.7	.1	8.4
8	80	60	50.58	.1	79.1	2.9	.1	8.1
9	80	70	20.85	1.2	69.1	4.8	.4	8.5
10	40	20	25.03	.3	68.4	2.4	.3	18.3
11	35	35	3.29	2.5	64.7	1.0	3.5	3.5
12	75	60	9.34	2.3	71.9	2.9	1.0	8.8
13	50	50	4.26	12.5	60.5	1.5	1.8	4.0
14	60	45	5.05	3.0	70.5	1.8	2.2	9.3
15	80	60	10.55	7.1	60.9	1.8	1.4	12.3
16	40	25	7.39	2.7	70.5	1.5	1.0	8.3
17	50	30	12.66	5.4	60.4	1.4	1.0	7.2
18	60	15	23.35	2.0	68.5	2.2	4.1	11.0
19	40	30	6.67	1.2	73.0	2.5	1.4	5.5
20	45	20	17.78	3.1	69.5	1.7	1.0	8.0
21	40	20	7.04	5.4	62.1	1.3	1.3	4.1
22	40	20	8.66	8.2	54.8	2.1	1.4	3.8
23	40	15	10.02	4.0	44.1	2.0	1.5	4.3
P-24	85	30	12.06	2.5	65.2	1.0	.3	2.0

SUMMARY OF FIELD ESTIMATES (Continued)

Hole No.	Total Depth, Feet	Min-able Depth, Feet	Lbs. of Black Sand /Cu. Yd. Gravel	Percent Mineral Content in Black-Sand Concentrates: Magnet-ite	Ilmen-ite	Gar-net	Zir-con	Mona-zite
P-25	40	15	12.93	.6	78.7	1.6	1.6	8.5
26	60	40	8.56	7.3	59.6	1.8	.6	2.1
27	40	35	5.31	1.9	55.5	1.6	2.5	2.5
28	40	15	9.97	5.0	65.1	1.2	1.6	2.5
29	45	15	24.02	2.2	72.3	3.2	.1	6.1
30	30	15	8.59	7.7	46.6	.8	1.1	1.7
31	60	15	19.94	1.3	65.5	2.5	.1	8.9
32	40	15	16.91	6.6	66.6	2.5	4.8	7.6
33	45	15	14.37	2.0	59.0	1.0	3.1	14.3
34	40	35	5.83	8.9	55.8	2.2	2.2	6.9
35	40	15	26.55	4.4	70.0	2.8	1.1	11.2
36	65	35	9.58	11.1	54.5	1.4	1.1	3.9
37	40	30	8.52	7.2	56.7	2.5	1.2	5.3
38	85	25	24.44	.8	75.4	2.8	.2	7.7
39	105	95	27.68	1.3	68.7	4.0	.3	10.2
40	85	60	6.38	2.9	49.0	6.1	2.9	3.4
41	53	15	35.37	.7	80.8	3.9	.4	6.6
42	120	120	7.96	2.0	70.7	3.2	.8	5.5
43	109	109	5.12	6.2	70.1	2.4	.7	7.3
44	60	25	13.97	1.9	73.1	3.0	.1	6.4
45	93	20	5.80	2.3	76.3	3.7	.1	6.4
46	70	40	69.01	.1	78.3	1.4	.7	10.9
47	47	15	22.99	3.0	71.1	2.9	.6	9.0
48	55	15	37.67	.1	74.8	3.0	.1	11.2
49	45	15	20.20	1.4	71.8	2.6	.5	8.1
50	60	60	4.71	.9	59.9	17.1	1.9	2.3
51	110	25	14.23	1.5	72.7	3.0	.5	9.1
52	70	55	12.39	1.0	69.3	3.7	.9	9.7
53	83	30	6.69	6.2	68.8	1.4	.5	7.1
54	60	15	5.43	6.6	66.0	1.5	2.3	4.9
55	65	65	6.82	2.7	62.6	6.3	2.8	3.4
56	60	15	8.15	12.0	63.5	1.0	2.1	4.5
57	45	45	3.72	7.8	51.1	3.3	4.0	2.0
58	60	15	12.90	8.4	74.5	1.0	.8	7.8
59	60	30	8.50	3.8	73.3	1.5	1.6	7.7
60	53	53	4.94	5.3	56.1	10.1	2.1	1.4
61	65	25	8.83	3.9	68.1	1.0	2.0	10.1
62	60	60	8.89	.7	67.7	6.0	.7	3.4
63	50	30	15.68	4.2	69.1	2.6	.3	8.8
64	45	45	1.94	5.9	61.0	5.4	2.2	4.1
P-66	55	55	4.40	1.7	54.8	20.4	3.0	3.0

A small amount of very fine gold was noticed when concentrating some of the drill-hole samples. No attempts were made to separate these fine colors, as even in the drill holes where the gold was most noticeable the total quantity would only amount to a fraction of one cent per cubic yard of gravel.

Chemical, Radiometric, and Mineralogical Analyses

The sample concentrates were composited as to minable depth of each drill hole at the Boise field laboratory, and these composites were shipped to the Raleigh, North Carolina, laboratories for final analyses.

At Raleigh representative fractions were split of each sample. One fraction was ground to minus 150-mesh size for chemical and radiometric analyses, and another fraction was retained in grain size for mineralogical analyses.

The failure to obtain good agreement, in some instances, between chemical, radiometric, and mineralogical monazite determinations is due to the presence of trace amounts of radioactive opaque minerals and of fergusonite-type inclusions in the monazite of some samples. In addition, slightly active allanite was observed in a few samples. Since the non-monazite activities are due principally to uranium, the calculation of monazite from chemical percent ThO_2 was believed to be the best figure to use.

A summary of laboratory analyses follows.

SUMMARY OF LABORATORY ANALYSES

Drill Hole No.	Chemical Analyses: Percent ThO_2	Chemical Analyses: Percent U_3O_8	Percent ThO_2 Equivalent: Calculated Chemical	Percent ThO_2 Equivalent: Radio-metric	Percent Monazite in Black Sands, By: Calculated Chemical	Percent Monazite in Black Sands, By: Radio-activity	Percent Monazite in Black Sands, By: Mineral-ogical
P- 1*	0.315	0.011	0.331	0.330	6.6	6.7	6.4
2	.329	.015	.392	.390	7.5	8.0	
3*	.423	.012	.473	.464	9.6	9.5	
4*	.234	.011	.280	.272	5.3	5.6	
5*	.277	.008	.311	.304	6.3	6.3	
6*	.382	.011	.428	.426	8.7	8.7	
7*	.367	.009	.405	.418	8.3	8.6	8.4
8*	.306	.009	.344	.348	6.9	7.1	
9*	.292	.009	.330	.320	6.6	6.6	
10*	.559	.024	.659	.624	12.7	12.8	
11	.154	.009	.192	.218	3.5	4.5	
12*	.341			.416	7.7	8.5	7.8
13	.213			.249	4.8	5.1	
14	.368	.013	.423	.423	8.4	8.7	8.3
15	.348			.393	7.9	8.1	
16	.373	.017	.444	.433	8.5	8.9	
17	.279			.360	6.3	7.4	6.5
18	.400			.489	9.1	10.0	
19	.217	.012	.267	.250	4.9	5.2	
20	.215	.015	.378	.363	7.1	7.4	
21	.138	.010	.180	.169	3.1	3.5	
22	.129			.168	2.9	3.4	2.9
23	.184			.231	4.2	4.7	
24	.071	.007	.100	.098	1.6	2.0	
25	.395	.018	.472	.463	9.0	9.5	
26	.071			.100	1.6	2.1	
27	.078			.106	1.6	2.2	
28	.082	.006	.107	.105	1.9	2.2	
29*	.298	.010	.340	.327	6.8	6.7	
30	.084	.006	.109	.121	1.9	2.5	
31*	.316	.011	.362	.359	7.2	7.4	
32	.287			.321	6.5	6.6	6.8
33*	.446	.015	.509	.508	10.1	10.4	
34	.274	.013	.329	.323	6.2	6.6	
35*	.425	.014	.484	.484	9.6	9.9	
36*	.185	.006	.210	.224	4.2	4.6	
37	.241	.008	.275	.282	5.5	5.8	
38*	.264			.286	6.0	5.9	
39*	.228			.274	5.2	5.6	
40	.272	.011	.318	.312	6.2	6.4	
41*	.369			.396	8.4	8.1	8.5
42*	.332			.375	7.5	7.7	
43	.384			.430	8.7	8.8	
44*	.257	.010	.299	.300	5.8	6.2	
P-45	0.281			0.318	6.4	6.5	

SUMMARY OF LABORATORY ANALYSES (Continued)

Drill Hole No.	Chemical Analyses: Percent ThO_2	Chemical Analyses: Percent U_3O_8	Percent ThO_2 Equivalent: Calculated Chemical	Percent ThO_2 Equivalent: Radiometric	Percent Monazite in Black Sands, By: Calculated Chemical	Percent Monazite in Black Sands, By: Radioactivity	Percent Monazite in Black Sands, By: Mineralogical
P-46 *	0.466			0.526	10.6	10.8	
47 *	.395	.013	.450	.447	9.0	9.2	
48 *	.459			.528	10.4	10.8	
49 *	.348	.011	.394	.405	7.9	8.3	
50	.185			.226	4.2	4.6	
51 *	.378			.443	8.6	8.7	
52 *	.382	.013	.437	.432	8.7	8.9	
53	.269			.311	6.1	6.4	
54	.291	.015	.354	.331	6.6	6.8	6.2
55	.157	.009	.195	.197	3.6	4.0	
56	.183	.011	.229	.213	4.1	4.4	3.6
57	.154	.011	.200	.203	3.5	4.2	
58	.258			.304	5.9	6.2	
59	.295	.014	.354	.350	6.7	7.2	
60	.114	.009	.152	.156	2.6	2.9	
61	.540			.629	12.2	12.9	
62	.144			.170	3.3	3.5	3.1
63 *	.346	.012	.396	.396	7.8	8.1	
64	.158			.191	3.6	3.9	
P-66	0.161			0.205	3.7	4.2	

* Area containing the better monazite values.

A part of the mineralogical analyses has already been discussed under the heading, Mineralogy, a subdivision of Description of Deposit.

BENEFICIATION AND ECONOMICS

About a third of the Pearsol area drilled, the southeast end of the area was found to contain comparable quantities of monazite and other heavy minerals to the Big Creek deposit which adjoins it on the south. The type of material, with an almost complete absence of even finer-size gravel, would make the deposit readily minable with dredges. Pearsol Creek could hardly supply sufficient water for dredging operations the year round. Some water could be obtained by diverting from

Big Creek by ditch, or by pumping from the nearby North Fork of the Payette River.

Recovery of the black sands on dredges and the subsequent separation of the monazite and other individual minerals would present few problems to an experienced operator.

In addition to monazite the black-sand concentrates contain magnetite, ilmenite, garnet, zircon, and other minerals. Of these, the ilmenite has the largest indicated tonnage and potential value.

ACKNOWLEDGMENTS

The Bureau of Mines wishes to express its appreciation to the following and others for their cooperation and courtesies extended to the staff and employees of the Bureau:

Forest E. Robb
D. W. Kennedy
Thomas Davis
David Little

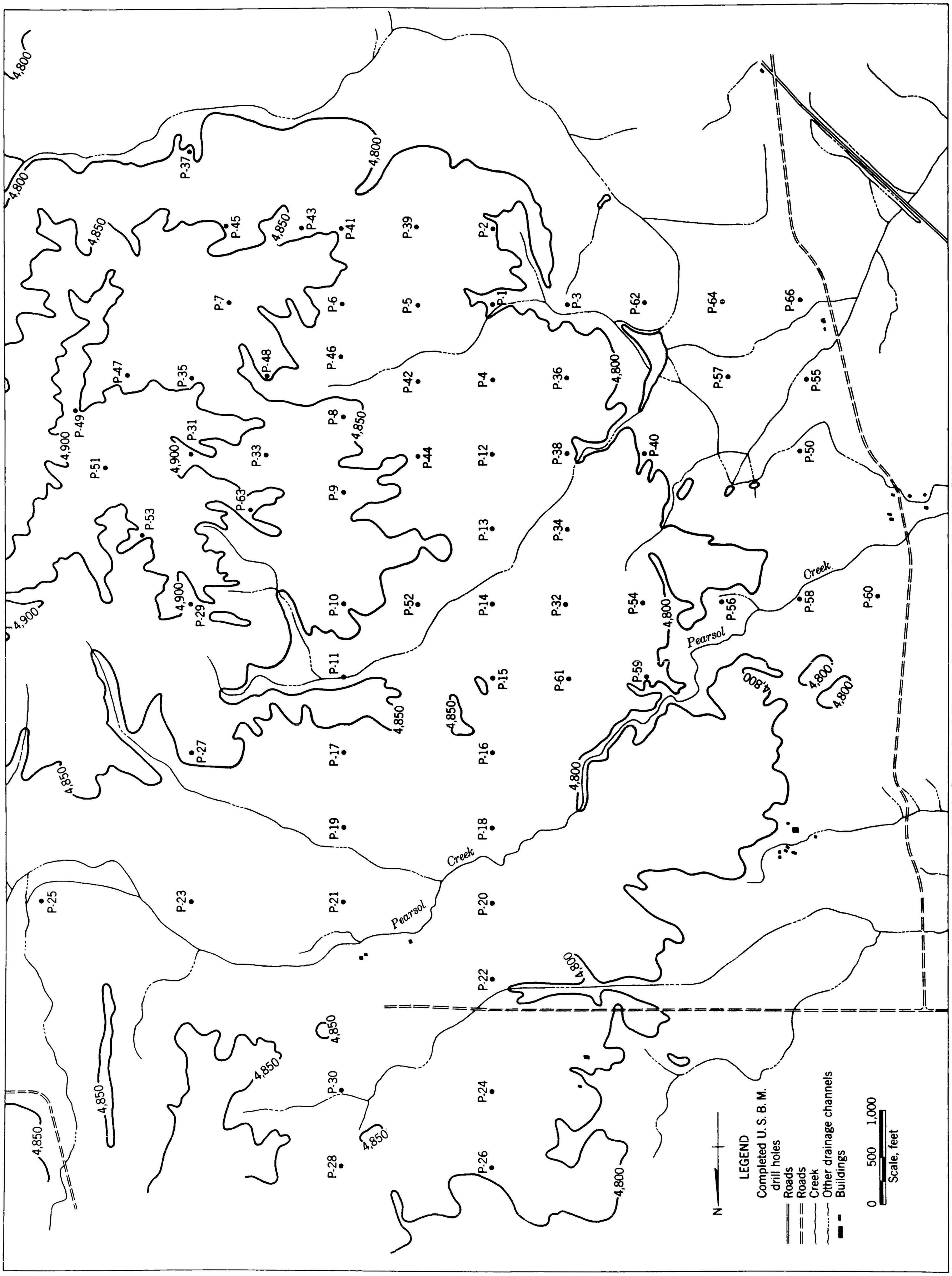

Plate 1.-Pearsol Creek Monazite Placer Area, Valley County, Idaho. RME-3134