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SCOTT VALLEY AND HORSETHIEF BASIN MONAZITE PLACERS, VALLEY COUNTY, IDAHO

By
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by
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INTRODUCTION

Scott Valley placer area, drained by Big Creek, and Horsethief Basin placer area, drained by Horsethief Creek, are in Valley County, Idaho. Both placers are near each other and separated by a low granite ridge. Late in 1949, a preliminary examination of these areas was made by Bureau of Mines engineers who were searching for radioactive minerals. This preliminary work consisted of hand panning and taking grab samples from the stream bars and gravel banks along Big Creek and Horsethief Creek. The results obtained from this work were favorable, so a proposal was made by the Bureau to do some churn drilling and sampling in the areas. This exploration work was done in 1950 on behalf of the Division of Raw Materials of the U. S. Atomic Energy Commission.

The objectives of the churn drill exploration were: (1) to determine the quantities of monazite and other black-sand minerals in the gravels, and (2) to determine extent of the placers.

SUMMARY AND CONCLUSIONS

The alluvial gravels in Scott Valley and Horsethief Basin were explored for monazite and other heavy minerals by the Bureau of Mines in 1950. Sixteen churn-drill holes, ranging in depth from

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5 to 68 feet, were drilled in the Scott Valley area, and three holes, ranging in depth from 10 to 59 feet were drilled in the Horsethief Basin area. A total of 171 samples weighing about 8.5 tons was recovered for testing and analyzing.

Scott Valley area was found to be extensive and have a very large volume of gravel. The Horsethief Basin placer deposits, although much smaller than the Scott Valley area, was found to contain smaller quantities of black sands, but larger quantities of monazite per cubic yard of gravel. A small amount of the radioactivity in the concentrates from both areas was due to xenotime, radioactive zircon, and possibly very small quantities of euxenite. The black sands also contained ilmenite, magnetite, garnet, zircon, and other minerals. Much more ilmenite per cubic yard of gravel was found in the Scott Valley gravels than in the Horsethief Basin gravels.

DESCRIPTION OF DEPOSIT

Location

The Scott Valley Placer area and the Horsethief Placer area are situated approximately 7 miles east of Cascade, Valley County, Idaho, in T. 14N., R. 4 and 5 E. Cascade may be reached from Boise, the state capital, over State Highway No. 15, a distance of 80 miles. The road is hard-surfaced. From Cascade, the nearest point of rail transportation, a graveled county road crosses Long Valley and enters the low foothills to the east. The road climbs several hundred feet, passes over a low summit, and descends a

short distance to enter Scott Valley at an altitude of about 5,150 feet. The road continues in a northeasterly direction following the right limit of Scott Valley for a distance of 5 miles. Leaving the valley, the road climbs steeply and passes over Big Creek summit at an altitude of 6,600 feet before continuing eastward to the mining town of Stibnite, a total distance of 70 miles from Cascade. The county road between Cascade and Stibnite is kept open for traffic the year around.

In addition to the county road which follows the west side of Scott Valley, there is an old railroad bed abandoned by a lumber company several years ago that follows the east side of the valley. This road bed also extends southward over the low divide between Scott Valley and Horsethief Basin, making the latter easily accessible. At the lower end of Scott Valley a good dirt road connects the county road with the old railroad bed. As a result, any part of either Scott Valley or Horsethief Basin is or could be made reasonably accessible throughout the year.

Physical Features and Climate

The Scott Valley Placer area lies in a high mountain basin. It is drained by Big Creek, one of the principal tributaries of the North Fork of the Payette River. The valley is about 5 miles in length and ranges in width from 300 to 3,000 feet. The stream gradient of Big Creek in the valley averages 2.5 percent. The general directional trend of the valley is S. 40° W. At the lower end of the valley, Big Creek turns more sharply to the west before entering a steep and narrow boulder-strewn gorge. The hard, granite walls of the

gorge stand almost vertically. The stream flows through the gorge for a distance of 3 miles before entering and traversing Long Valley to join the North Fork of the Payette River. Several tributary streams, heading in the surrounding, high, timber-covered mountains, empty into Big Creek in Scott Valley. Much of the valley floor is covered with thick brush and second-growth timber including pine, fir, spruce, and larch. There is, however, one large meadow comprising 100 acres or more which produces hay and provides summer pasture for a limited number of sheep and cattle. Other meadow-like areas are marshy and grow only swamp grasses. These areas provide spring grazing for bands of sheep enroute to the higher mountains during the summer months.

Horsetheif Basin lies one-half mile south of Scott Valley and is separated from the latter by a low ridge of soft decomposed granite. Horsethief Creek, carrying about one-third as much water as Big Creek, drains Horsethief Basin. After leaving the basin through a narrow gorge, this stream flows southwestward for 2 miles before emptying into Big Creek. The Horsethief Basin area, whose length is 6,000 feet and maximum width 2,000 feet, represents approximately one-fourth the area found in Scott Valley. The mountains surrounding the basin have a more gradual slope than those of Scott Valley. Whereas Scott Valley is generally marshy and quite heavily timbered, Horsethief Basin is almost devoid of trees. The floor of the basin is dry and covered with sagebrush except at the extreme upstream and downstream portions. The upstream part has scattered

clumps oi coniferous trees and considerable buck brush. The lower end of the basin develops into a meadow comprising 40 or 50 acres of excellent summer pasture for sheep.

The climate of Scott Valley and that vicinity is comparatively cool and dry throughout the summer months. The winters, however, bring snow to depths of 6 or 8 feet and sub-zero temperatures reaching 30° below zero for short periods. Dredging operations during one or two winter months would be subject to some hardships.

Geology

Scott Valley and Horsethief Basin are situated within the Idaho Batholith near its western edge. The absence of any mining activity in this locality in the past has resulted in little, if any, geological study of the area. As a result, there is no known source of geological literature for reference in compiling this section of the report. The nearest operating mine of importance is the Yellow Knife located at Stibnite approximately 70 miles to the northeast.

It appears evident that Scott Valley and Horsethief Basin represent structural valleys formed as a result of local orogenic processes. It is suspected that Scott Valley follows rather closely the strike of an old structural fault. The texture and nature of most of the granite bedrock exposed in upper Scott Valley and that bordering the full length of the west side of the valley is different from that bedrock exposed on the east side. The former is very hard, fine-grained, and resistant to weathering; whereas, most of the latter is comparatively soft, coarser-grained, and weathers in place. This

difference in rock composition and texture is suggested as supporting evidence that Scott Valley occupies a faulted structure. Faulting action could have intermittently and partially sealed both Horsethief Creek and Big Creek causing these streams to change their courses abruptly at what is now the lower end of these two basin areas. The forming of these obstructions resulted in the development of lakes which were ultimately filled with alluvium derived from the weathering and erosion of the surrounding granitic mountains. As indicated from the Bureau of Mines drilling, the presence of the interbedded strata of clay, sand, and gravel found in these basin areas suggest that the rate of deposition was not constant, being regulated in part by the rise and fall of the impounded lakes.

It is probable that upper Scott Valley was at one time occupied by a valley glacier. However, conclusive evidence is difficult to obtain because of the lack of foreign rocks in the area and the fact that any glacial deposited debris of granitic material would weather so rapidly and completely as to destroy all evidence of its origin.

Mineralogy

The alluvium contained in Scott Valley and Horsethief Basin as far as was ascertained, is composed of clays, sands, and gravels derived almost entirely from the granitic rocks of the surrounding region. With the exception of an occasional quartz cobble 5 or 6 inches in diameter, the bulk of material in the deposit was less than one inch in diameter.

The black-sand concentrates found in the deposit were usually concentrated just above a number of interbedded layers of clay which acted as a false bedrock during the process of their deposition. The black sands, including monazite, ilmenite, garnet, zircon, and magnetite, are accessory minerals of the granitic rocks that are exposed throughout the region.

The mineral content of the black sands as determined petrographically at the Mt. Weather laboratory is as follows:

Scott Valley

Mineral	Percent
Ilmenite	73.0
Quartz	11.0
Garnet	5.0
Monazite	3.8
Zircon	1.8
Unidentified Opaques*	2.5
Fe-Mag	0.8
Xenotime	0.2
Magnetite	<0.1
Biotite	<0.1
Epidote	<0.1

* Includes minor amounts of columbium-tantalum minerals, probably euxenite, which accounts for a small percentage of the total activity of the samples.

Horsethief Basin

Mineral	Percent
Ilmenite	50.9
Quartz	20.9
Monazite	11.5
Pyrite	3.0
Garnet	3.0
Altered Rutile	2.6
Epidote	2.1
Magnetite	2.0
Fe-Mag	1.5
Zircon	0.8
Xenotime	0.2

HISTORY

The history of Scott Valley and the Horsethief Basin areas is linked to the founding and development of the early-day settlements which were established in Long Valley to the westward. Mining, as a local industry, was never of importance in the region. Courthouse records show a few mining claims on Gold Fork River and Pearsol Creek, but these gold-placer workings were short-lived and contributed very little to the development of the region.

The principal early-day industries, as they are at present, were primarily lumbering, cattle and sheep raising, and other agricultural pursuits. The first settlement in Long Valley was Crawford founded in 1882 by Hiram Crawford in the vicinity of Cascade.4/ This town was followed by the competitive village of Van Wyck and later in 1900 by the town of Thunder. Upon completion of a branch line of the Union Pacific Railroad into the valley in 1913 which by-passed all three towns, Cascade was established at its present site replacing the older settlements. It was during the early 1900's that logging and a lumber industry were initiated in Long Valley by a company, later through a merger, to become the Boise Payette Lumber Company. This company acquired the principal timber-covered areas in the region including Scott Valley and Horsethief Basin.

A logging railroad was extended from Long Valley into Scott Valley via Horsethief Basin, and logging commenced in these areas in 1929. By 1935, the timber was cut and the rail tracks

4/ Fisher, Vardis, The Idaho Encyclopedia by Federal Writer's Project of Works Progress Administration, 1938.

torn up and removed. Boise Payette Lumber Company, however, still retains the forested land in the area which is part of their program for sustaining a perpetual yield of timber. With the advent of logging in the region, Scott Valley and Horsethief Basin areas are now used principally for summer pasture for sheep and cattle.

EXPLORATION

A transit survey of Scott Valley and Horsethief Basin was made in deep snow during April and May 1950. Because of the snow and resultant mires it was not practical to construct access roads and prepare drill-hole sites until June. This work was completed with a rented bulldozer with an operator.

Churn-drill exploration of the alluvial gravels in Scott Valley and Horsethief Basin was begun by the Bureau of Mines on June 30, 1950. This program was initiated as a result of the preliminary field sampling and laboratory testing conducted during the fall and winter of 1949. Drilling in these areas was completed August 4, 1950. Laboratory concentration and field estimate tests for the black-sand content of all samples from the region under investigation were completed August 15 of that year.

Churn Drilling

The churn drilling was performed under Contract No. Im-5927 which became effective April 17, 1950.

Three holes were drilled in Horsethief Basin, ranging in depth from 10 to 59 feet, and 16 holes in Scott Valley, ranging from

5 to 68 feet in depth. The total footage involved for each area was 119 feet and 644 feet, respectively. Bedrock was encountered in one drill hole in Horsethief Basin at 10 feet and in 5 drill holes in less than 20 feet in upper Scott Valley.

A total of 171 samples, representing about 8.5 tons by dry weight of material, was recovered. Of this amount, almost 7 tons of samples were transferred to the Boise laboratory for concentration where field estimates were made of the minerals contained in the black-sand concentrates. Sample concentrates from the Boise laboratory were shipped to the Bureau of Mines laboratory at Mt. Weather, Virginia. The laboratory at Mt. Weather made chemical, radiometric, and petrographic analyses of all individual or composite samples received. A little less than 2 tons of material, representing slimes and plus 1/8-inch oversize gravel, was discarded in the field after their individual weights were recorded for use in later computations relating to drill-hole evaluations.

The drill casing used was the 6-inch heavy-duty type equipped with a $7\frac{1}{2}$-inch drive shoe. The core from each of two $2\frac{1}{2}$-foot drives was combined as one sample representing a 5-foot vertical drill-hole section. Each sample was dried and screened in the field producing plus 1/8-inch and minus 1/8-inch material.

The plus 1/8-inch product was discarded after the weight had been recorded. The minus 1/8-inch product was sacked and its weight logged before being tagged for shipment to the Boise laboratory. The slimes from each drill hole were impounded in a pit of known

dimensions. A known volume of these slimes, representing a percentage of the total slimes, was dried, weighed, and logged preparatory for shipment with the drill-hole sand samples to the laboratory for testing and inclusion in the complete drill-hole calculations. Drill-hole calculations were based upon the recovered dry weight of sample by using a predetermined factor of 2,700 pounds per cubic yard for the purpose of converting weight into volume.

The actual core recovery as compared to the calculated theoretical volume averaged 72.8 percent for the 16 holes drilled in Scott Valley and 68.0 percent for the 3 holes drilled in Horsethief Basin. A log was prepared in the field for each hole drilled. A copy of the log accompanied the samples to the Boise laboratory for reference and aid in preparation of a laboratory drill-hole inventory sheet. Copies of all drill logs and corresponding laboratory drill-hole inventory sheets accompanied the sample concentrates to the Mt. Weather laboratory where final and complete analyses were made.

Prospecting by means of shafts and trenches in either Scott Valley or Horsethief Basin was not considered practical because of the physical characteristics of these deposits. Any factual information derived from these prospecting methods would entail excessive costs as compared to prospecting by churn drilling.

There are at present no placer mining operations in either Scott Valley or Horsethief Basin.

Tabulated data pertains to the drilling program conducted by the Bureau of Mines in the Scott Valley and Horsethief Basin areas during 1950 is shown on the following page.

Scott Valley

Number of Samples	Percent Theoretical Volume Recovered	Mesh Size	Actual tons Recovered, Dry Wt.	Percent Arithmetical Average Recovered	Cumulative Percent
145	72.8	+1/8"	0.50	6.93	6.93
		-1/8" +16M	1.15	15.95	22.88
		-16M	4.46	61.86	84.74
		Slimes	1.10	15.26	
		Total	7.21	100.00	100.00

Horsethief Basin

Number of Samples	Percent Theoretical Volume Recovered	Mesh Size	Actual tons Recovered, Dry Wt.	Percent Arithmetical Average Recovered	Cumulative Percent
26	68.0	+1/8"	0.08	6.90	6.90
		-1/8" +16M	0.26	22.41	29.31
		-16M	0.70	60.35	89.66
		Slimes	0.12	10.34	
		Total	1.16	100.00	100.00

ANALYSES

Feild Estimates

The following procedure was employed in the Boise laboratory for the treatment of the samples arriving from the drilling operations. The samples were first weighed, before being screened dry to minus 16-mesh on a vibrating screen. The weights of the two products were recorded before discarding the oversize material. The individual samples of minus 16-mesh sands were run over first a large, then a small laboratory table producing an 85 to 95 percent black-sand

concentrate. Each sample concentrate was dried and weighed and a 10-gram sample cut for examination. The magnetite was removed from the 10-gram sample by means of a hand magnet. The magnetite was weighed and recorded in terms of percent. The remainder of the sample was examined with a 40X Penscope and an estimate in percent was made of the monazite, ilmenite, garnet, and zircon. A further check of the percentage of zircon was made with the use of a Mineralight. A radiometric check of the entire sample was then made with a field counter against a monazite standard prepared from the particular field under investigation.

Tabulated field estimates of the black-sand concentrates for each drill hole in the areas are shown on the following page:

Summary of Field Estimates

Drill Hole Number	Total Depth, Feet	Minable Depth, Feet	Pounds per Cubic Yard of Gravel					
			Black Sands	Magnet-ite	Ilmen-ite	Gar-net	Zir-con	Mona-zite
Scott Valley Drilling								
SV- 1	19.0	15.0	10.14	0.66	4.72	1.56	0.59	0.73
2	18.0	15.0	9.78	1.95	3.44	1.29	0.42	0.49
3	22.0	20.0	31.22	6.80	14.91	1.38	0.60	0.64
4*	5.0	-	-	-	-	-	-	-
5	56.0	55.0	23.06	1.61	9.33	3.43	0.38	1.52
6	63.0	63.0	19.00	0.64	10.66	4.15	0.45	1.02
9	18.0	15.0	19.35	0.17	12.09	2.54	1.11	1.40
11	55.0	55.0	17.58	0.20	11.20	2.13	1.03	1.11
13	68.0	68.0	12.92	0.51	7.21	1.60	0.71	0.73
16	50.0	20.0	25.24	0.45	15.67	2.36	1.33	1.60
17	50.0	50.0	5.15	0.66	2.15	0.47	0.55	0.21
18	50.0	25.0	16.93	0.51	12.23	1.20	0.53	0.67
19	40.0	40.0	15.48	0.20	10.41	1.93	0.49	0.88
20	45.0	45.0	10.24	0.23	6.14	1.14	0.52	0.46
21	45.0	40.0	19.77	0.28	14.08	1.90	0.55	0.65
SV-24	40.0	40.0	12.31	0.26	8.79	1.33	0.47	0.46
Horsethief Basin Drilling								
HB- 1	10.0	10.0	4.57	0.42	1.37	0.09	0.08	0.61
HB- 2	59.0	59.0	7.79	0.37	2.84	0.28	0.34	1.63
HB- 3	50.0	50.0	9.45	0.15	3.75	0.47	0.55	1.68

* Drill hole not included in value calculations

Radiometric Analyses

The samples, upon arrival at the Mt. Weather laboratory, were combined into composite samples for each drill hole. A representative fraction of each composite was cut and ground to about 80 percent minus 150-mesh. Radiometric analyses were then run on each sample against prepared thoria standards. Below are tabulated the percent thoria equivalent and the calculated percent monazite for all the composite drill samples.

Sample	Percent ThO_2 Equiv.	Percent Monazite Equiv.
Scott Valley		
SV- 1	0.179	3.70
2	.251	5.19
3	.111	2.29
4	.706	14.59
5	.220	4.55
6	.202	4.17
9	.264	5.45
11	.256	5.29
13	.191	3.95
16	.229	4.73
17	.228	4.71
18	.158	3.29
19	.263	5.43
20	.212	4.38
21	.165	3.41
SV-24	0.144	2.98
Horsethief Basin		
HB- 1	0.439	8.4
HB- 2	.662	12.7
HB- 3	0.568	10.9

Chemical Analyses

Selected samples of concentrates and monazite from each area were analyzed for ThO_2 and U_3O_8, and the results are shown below:

Sample	Percent ThO_2	Percent U_3O_8
Scott Valley		
SV- 5	0.165	0.008
11	.170	.016
16	.178	.010
18	.112	.010
SV-19	.204	.011
Monazite	4.11*	0.167*
Horsethief Basin		
HB-1	0.363	0.010
HB-2	.578	.013
HB-3	.488	.008
Monazite	4.74	0.105

* Average analyses of monazite concentrated from three different samples.

Petrographic Analyses

Petrographic analyses of selected concentrate samples follow:

Sample	Percent Monazite (Weight)	Percent Xenotime(Weight)
Scott Valley		
SV- 5	4.0*	
11	4.7*	
16	4.5*	
18	2.3	0.25
SV-19	4.7	0.11
Horsethief Basin		
HB-2	13.2	0.3
HB-3	11.6	0.1

* Includes Xenotime

The radioactivity of the Scott Valley samples is due largely to monazite. Xenotime appears to account for five to ten percent of the total, with zircon contributing a negligible part. The activity not accounted for by these minerals is apparently due to euxenite. Since no concentration of this mineral could be made, it is not listed in the mineralogic breakdown. A reasonable estimate would be about 0.1 percent euxenite in the black sands.

The radioactivity of the Horsethief Basin samples is due almost entirely to monazite and xenotime. The small amounts of zircon and possible traces of euxenite contribute only negligible activity.

Comparison of Analyses

Sample	Percent Monazite Equivalent		Percent Monazite*
	Radiometric	Chemical	Mineralogical
Scott Valley			
SV- 5	4.55	4.13	4.0
11	5.29	4.96	4.7
16	4.73	4.59	4.5
18	3.29	3.22	2.55
SV-19	5.43	5.21	4.81
Horsethief Basin			
HB-1	8.4	7.8	-
HB-2	12.7	12.0	13.5
HB-3	10.9	10.1	11.7

* Includes Xenotime

ECONOMICS AND BENEFICIATION

Large quantities of black-sand minerals, including monazite, ilmenite, garnet, and zircon, were indicated from the drilling done by the Bureau of Mines in the Scott Valley and Horsethief Basin areas.

Both deposits are accessible by road from Cascade, Idaho, which is also the nearest point of rail transportation. Sufficient water for mining purposes is available for dredging. The removal of second-growth timber in the Scott Valley area would be an added expense which would not occur in the Horsethief Basin area.

Based on the results obtained from a limited number of holes drilled in the areas, it appears that the Horsethief Basin area has smaller quantities of black-sand concentrates per cubic yard of gravel than the Scott Valley area, but within this smaller quantity of black-sands, the quantity of monazite is greater, ilmenite much samller, and qarnet and zircon smaller than the Scott Valley gravels.

Any mining operation to recover black-sand concentrates from the gravels would require a wash plant. In addition to such an operation, a minerals separation plant would also be needed or have the concentrates custom-treated in other plants.

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Earl Huskey

Boise Payette Lumber Company

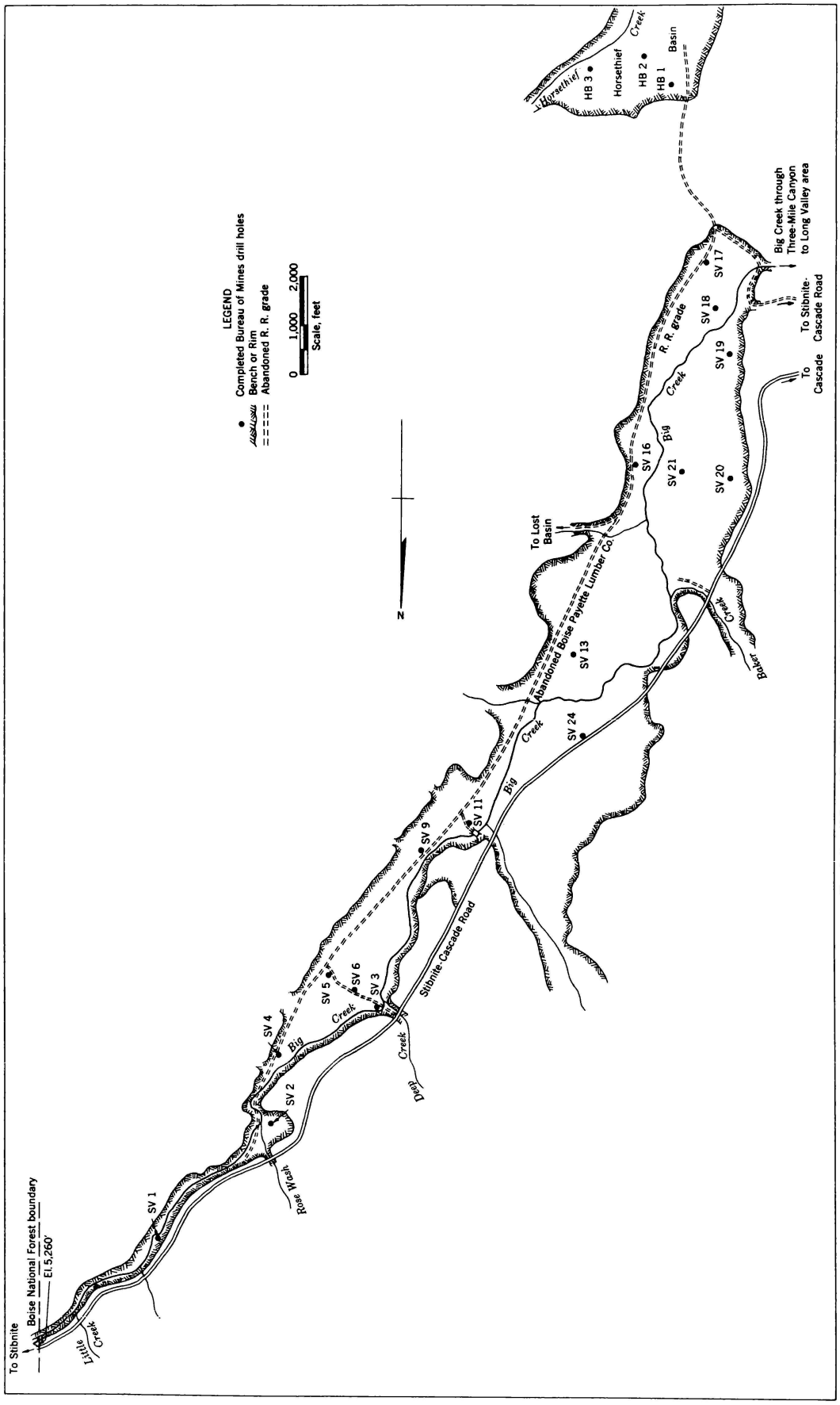

Plate 1. Scott Valley and Horsethief Basin Monazite Placers, Valley County, Idaho.
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