

GEOLOGY AND THORIUM-BEARING  
DEPOSITS OF THE LEMHI PASS  
AREA, LEMHI COUNTY, IDAHO,  
AND BEAVERHEAD COUNTY,  
MONTANA

by William N. Sharp and Wayne S. Cavender

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Trace Elements Investigations Report 599

UNITED STATES DEPARTMENT OF THE INTERIOR  
GEOLOGICAL SURVEY



UNITED STATES  
DEPARTMENT OF THE INTERIOR  
GEOLOGICAL SURVEY  
WASHINGTON 25, D. C.

January 29, 1960

AEC-28/0

Mr. Robert D. Niningger  
Assistant Director for Exploration  
Division of Raw Materials  
U. S. Atomic Energy Commission  
Washington 25, D. C.

Dear Bob:

Transmitted herewith are three copies of TEI-599, "Geology and thorium-bearing deposits of the Lemhi Pass area, Lemhi County Idaho, and Beaverhead County, Montana," by William N. Sharp and Wayne S. Cavender, July 1959.

This report consists of the abstract and tables of analytical data of a paper with the same title that is planned for publication as a Geological Survey bulletin. In addition this report contains a table, not to be published, giving reserves for individual deposits.

Sincerely yours,

*Tom H. Eric*

for Montis R. Klepper  
Assistant Chief Geologist

(200)  
T6-12  
no. 599

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TEI-599

UNITED STATES DEPARTMENT OF THE INTERIOR  
GEOLOGICAL SURVEY

GEOLOGY AND THORIUM-BEARING DEPOSITS OF THE  
LEMHI PASS AREA, LEMHI COUNTY, IDAHO,  
AND BEAVERHEAD COUNTY, MONTANA \*

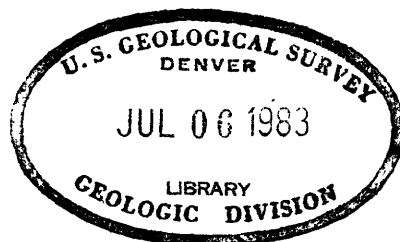
By

William N. Sharp and Wayne S. Cavender

July 1959

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\*This report concerns work done on behalf of the Division of Raw Materials of the U. S. Atomic Energy Commission.

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GEOLOGY AND THORIUM-BEARING DEPOSITS OF THE LEMHI PASS AREA,  
LEMHI COUNTY, IDAHO, AND BEAVERHEAD COUNTY, MONTANA

by William N. Sharp and Wayne S. Cavender

ABSTRACT

The study of the Lemhi Pass area in the Beaverhead Mountains, Lemhi County, Idaho, and Beaverhead County, Montana, was undertaken to determine the geologic relations within the area and to evaluate the area as a potential source of thorium.

The Continental Divide in the vicinity of Lemhi Pass is underlain by dark-gray to greenish-gray subgraywackes and argillites of the Belt series of Precambrian age. Certain quartz veins in these rocks are known to contain thorite as an important constituent.

Tertiary volcanic rocks that range in composition from olivine basalt to rhyolite porphyry overlie the subgraywackes on remnants of a well developed erosional surface. Diorite dikes are the only intrusive rocks in the area. Faults are numerous in the Lemhi Pass area. Two major fault systems bound the district on the north and west.

Quartz veins in the area are grouped into four classes: (1) quartz-hematite-thorite veins, (2) quartz-copper-bearing sulfide-thorite veins, (3) quartz-copper-bearing sulfide veins, and (4) quartz-hematite veins. The veins range in size from a few inches wide and a hundred feet long to thirty feet wide and several hundred feet long. The  $\text{ThO}_2$  content of the veins ranges from 0.1 percent to as high as 2.0 percent in local concentrations.

The thorite-bearing quartz veins are associated spatially, and possibly genetically, with the diorite dikes. A brief examination of most of the deposits shows that except for three localities the deposits are small and have limited economic significance.

The three major deposits--the Last Chance, the Wonder Lode, and the Trapper-Lucky Strike claims--have been explored to some extent and may become economic sources of thorium if a demand for thorium should develop.

Table 1.--Data on samples collected in the Lemhi Pass area, Idaho and Montana

Samples marked with "T" (526176<sup>T</sup>) analyzed by Lindsey Chemical Co., W. Chicago, Ill., all other samples by U. S. Geological Survey.

Analysts: U. S. Geological Survey

Radiation - J. N. Rosholt, Jr., S. P. Furman, and B. A. McCall

Chemical - James S. Wahlberg, Harry Ievine, E. C. Mallory, Jr., J. P. Schuch,  
Jesse W. T. Meadows, R. F. DuFour and Wayne Mountjoy.

Spectrographic - K. E. Valentine, Charles S. Annell, and Joseph Haffty.

Serial number	Sample number	eU (percent)	U (percent)	ThO <sub>2</sub> (percent)	RE <sub>2</sub> O <sub>3</sub> (percent)	Ra (gr/gr)	Location	Remarks
<u>Wonder Lode vein</u>								
77755	Won-C-1	0.054	0.002	0.23			Cut No. 1, east side of creek.	5-ft sample across vein.
77756	-2	.027	<.001	.14			Cut No. 2, east side	2-ft sample across vein.
77757	-3	.071	.001	.27			Cut No. 3, east side	4-ft sample across vein.
77758	-4	.19	.001	1.20			Cut No. 4, east side	8-ft sample across vein.
77759	-5	.012	.001	.03			Cut No. 5, east side	2.5-ft sample across vein.
77760	-6	.17	.001	.96			Cut No. 6, east side	1-ft sample across branch vein.
77761	-7	.16	.001	.90			Cut No. 7, east side	6-in. composite sample of 6 small veins.
77762	-8	.31	.001	1.50			Cut No. 8, east side	1-ft composite samples of 3 small veins.
77763	-9	.17	.001	1.20			Cut No. 9, east side	1.5-ft sample across branch vein

ANALYST: H. Levine, U.S.G.S.

Table 1.--Data on samples collected in the Lemhi Pass area, Idaho and Montana--Continued.

Serial Sample number	eU (percent)	U (percent)	ThO <sub>2</sub> (percent)	Re <sub>2</sub> O <sub>3</sub> (percent)	Ra (gr/gr)	Location	Remarks
AFT-S18-50	0.031	0.003	0.17*			Adit No. 1, lower adit, west side of creek.	Grab sample
AFT-S19-50	.12	.002	.67*			Adit No. 2, west side	Grab sample
AFT-S20-50	.12	.004	.67*			Adit No. 3, west side	Grab sample
AFT-S21-50	.57	.002	3.2 *			Adit No. 1, lower adit	Grab sample
74431 W-122-50	.042	.003	.03	<u>0.04</u>		From caved pit on vein, west side of creek.	3-1/2-ft sample across vein.
74432 W-124-50	.49	.001	2.56	<u>2.36</u>		Adit No. 4, cut No. 4, east side.	1-1/2-ft grab sample from rich part of vein.
CQ-M1-50	.061	.002	.02	<u>.25</u>		Mill heads from west side of creek.	Grab sample of ore at mill
<u>Last Chance vein</u>							
70652 LC-B	.008	.001	.05	<u>.06</u>		Pit on satellite vein NW of road cut.	Chip sample across 3- to 4-ft vein.
70653 LC-E	.021	.001	.06	<u>.05</u>		Prominent enlargement of vein NW of road cut.	Chip sample across 20-ft vein outcrop.
70654 LC-G	.19	.005	.93	<u>1.70</u>		First trench NW of "E" location.	Chip sample across 3- to 4-ft vein.
70655 LC-H	.017	.001	.05	<u>.05</u>		Second trench NW of "E" location	Chip sample across 4-ft vein.



Table 1.--Data on samples collected in the Lemhi Pass area, Idaho and Montana--Continued.

Serial number	Sample number	eU (percent)	U (percent)	ThO <sub>2</sub> (percent)	RE <sub>2</sub> O <sub>3</sub> (percent)	Ra (gr/gr)	Location	Remarks
54266	KW-1C-1	0.059	0.001	0.31		3x10 <sup>-12</sup>		Chip samples east to west across 10-ft vein 3 ft
54267	-2	.10	.002	.53		7x10 <sup>-12</sup>	Road cut across vein	3 ft
54268	-3	.41	.003	2.1		1.4x10 <sup>-11</sup>		4 ft
54269	KW-1C-5	.36	.002	1.8		2.0x10 <sup>-11</sup>	Outcrop, 30 ft SE of road cut.	Channel sample across 8-ft outcrop.
54270	-6	.32	.003	1.7		2.5x10 <sup>-11</sup>	Small pit on prominent outcrop; 150 ft SE. of road cut.	Grab sample from pit.
44638	AFT-S24-50	.10	.003	.6*			Small pit on prominent outcrop; 150 ft SE. of road cut.	Grab sample from cherty lens.
44639	-S25-	.43	.005	2.1*		1.5x10 <sup>-11</sup>	Small pit on prominent outcrop; 210 ft SE of road cut.	Chip sample across 1 ft of vein.
44640	-S26--	.44	.004	2.1*			Outcrop of vein 60 ft SE. of road cut.	Chip sample across 1 ft of vein
46746	-S32-	.15	.002	.79		4.4x10 <sup>-12</sup>	Road cut across vein	Chip sample across 5 ft of footwall side of vein.
46747	-S33-	.041	.001	.23*			Road cut across vein	Chip sample across 5 ft hanging-wall side.
46748	-S34-	.009	.001	.05*			Prominent enlargement of vein NW of road cut.	Chip sample across 25 ft of vein.

Table 1.--Data on samples collected in the Lemhi Pass area, Idaho and Montana--Continued.

Serial Sample number	eU (percent)	U (percent)	ThO <sub>2</sub> (percent)	RE <sub>2</sub> O <sub>3</sub> (percent)	Ra (gr/gr)	Location	Remarks
46749 APT-S35-50	0.014	0.001	0.07*			SE. end of vein outcrop	Chip sample across 40 ft of vein.
526176 <sup>T</sup> IC-DDH-1A			0.3	<u>0.5</u>		Diamond drill hole no. 1	Core interval ) 224.0-226.4 ft. )
526177 <sup>T</sup> -1B			---	<u>.07</u>		Diamond drill hole no. 1	226.4-227.1
526178 <sup>T</sup> -1C			N.D.	N.D.		Diamond drill hole no. 1	227.1-229.2
526179 <sup>T</sup> -1D			N.D.	N.D.		Diamond drill hole no. 1	229.2-231.2
526180 <sup>T</sup> -1E			.3	<u>.5</u>		Diamond drill hole no. 1	233.0-239.0
526181 <sup>T</sup> IC-DDH-3A			.4	<u>.4</u>		Diamond drill hole no. 3	264.6-266.2
526182 <sup>T</sup> -3B			.2	<u>.3</u>		Diamond drill hole no. 3	266.2-267.5
526183 <sup>T</sup> -3C			N.D.	<u>.2</u>		Diamond drill hole no. 3	267.5-269.0
526184 <sup>T</sup> -3D				N.D.		Diamond drill hole no. 3	269.0-271.2
526185 <sup>T</sup> -3E				N.D.		Diamond drill hole no. 3	271.2-273.0
526186 <sup>T</sup> -3F				N.D.		Diamond drill hole no. 3	273.0-274.6
526187 <sup>T</sup> -3G				N.D.		Diamond drill hole no. 3	274.6-275.3
526188 <sup>T</sup> -3H				N.D.		Diamond drill hole no. 3	275.3-277.0
526189 <sup>T</sup> -3I			N.D.	N.D.		Diamond drill hole no. 3	277.0-277.6
526190 <sup>T</sup> -3J			N.D.	.2		Diamond drill hole no. 3	277.6-284.6
D-74436 ID-DDH-1S	.046	.001	.04	<u>.23</u>		Diamond drill hole no. 1	Bottom sludge sand

Table 1.--Data on samples collected in the Lemhi Pass area, Idaho and Montana.--Continued.

Serial Sample number	Sample number	eU (percent)	U (percent)	ThO <sub>2</sub> (percent)	RE <sub>2</sub> O <sub>3</sub> (percent)	Ra (gr/gr)	Location	Remarks
<u>Lucky Strike claims</u>								
D-74438	LS-PT-1	0.028	0.001	0.02	<u>0.07</u>		Lucky Strike No. 1 claim. Large promi- nent outcrop of quartz- ose rock near state line.	Chip sample across 45 ft of outcrop.
-74439	-2	.004	<.001	.01	<u>.01</u>		Silicified zone 150 ft SE of sample LS-PT-1, Lucky Strike No. 1	Chip sample across 45 ft of outcrop.
-74440	-3	.008	<.001	.01	<u>.01</u>		Quartzose zone 50 ft W. of sample LS-PT-2 Lucky Strike No. 1	Chip sample across 28 ft of outcrop
-74441	-4	.033	.001	.01	<u>.13</u>		Quartzose zone in small outcrop 210 ft NW of sample LS-PT-3, Lucky Strike No. 1	Chip sample across 20 ft of outcrop
-74442	-5	.030	.003	.02	<u>.45</u>		Southernmost outcrop of quartzose rock, near mine road, Lucky Strike No. 1	Chip sample across 45 ft of 65-ft outcrop.
-74443	-6	.012	.001	.01	<u>.04</u>		do.	Chip sample across 20 ft of outcrop; adjoins sample above
D-74437	LS-64	.13	.006	.6	<u>.64</u>		Quartzose zone in NW part of area near LS-PT-4.	Grab sample of area of high radioacti- vity

Table 1.--Data on samples collected in the Lemhi Pass area, Idaho and Montana--Continued.

Serial number	Sample number	eU (percent)	U (percent)	ThO <sub>2</sub> (percent)	RE <sub>2</sub> O <sub>3</sub> (percent)	Ra (gr/gr)	Location	Remarks
	AFT-LS-1	.21	.002	.1*			Near samples LS-PT-5 and -6 above.	Grab samples from outcrop.
	-2	.20	.001	.1*			Lucky Strike No. 2 claim vein 200 ft. NW of NW corner, Lucky Strike No. 1.	Grab sample from pit.
<u>Trapper No. 1</u>								
69520	T-1A	0.009	0.000	0.02	0.09		Edge of creek below main outcrop.	Sample of soil.
	T-WA-1	.67	---	3.1			Prospect pit in SE. block of quartzose vein.	Grab sample of very radioactive zone.
	AFT-S36-50	.12	.006	.66			NE corner of NW block of quartzose vein.	Chip sample of vein.
	-S37-	.023	.002	.1*			NW block of quartzose vein.	Composite chip sample from south- dipping fracture surfaces.
	-S38-	.13	.006	.56			SE block of quartzose vein.	Chip sample across east part of vein.
	-S39-	.13	.006	.68			SE block; discovery pit.	Chip sample across west part of vein.
	-S40-	.029	.002	.15*			NW block of quartzose vein.	Composite chip sample of surface outcrop.

Table 1.--Data on samples collected in the Lemhi Pass area, Idaho and Montana.--Continued.

Serial number	Sample number	eU (percent)	U (percent)	ThO <sub>2</sub> (percent)	RE <sub>2</sub> O <sub>3</sub> (percent)	Ra (gr/gr)	Location	Remarks
	AFT-S46-	0.014	0.001	0.07*			NW. block; bulldozer trench on south side.	Composite chip sample of hanging wall.
	-S47-	.025	.001	.14*			Upper bulldozer trench above NW. block.	Composite grab sample of small outlier veins.
	-S48-	.004	.002	.01*			NW. block; bulldozer trench on south side.	Grab sample of gouge on hanging wall of vein.
	-S49-50	0.074	0.002	0.4*			Upper bulldozer trench above NW. block	Grab sample of small vein.
<u>Trapper No. 4</u>								
69521	T-4A	.38	.007	2.11	3.60		Main bulldozer cut along quartz vein.	Grab sample of loose limonite from vein <del>at</del> fault.
	AFT-S60-50	.016	.002	.08*			Discovery pit at south end of main dozer cut.	Grab sample of gougy material along vein.
	-S61-	.10	.006	.56*			Discovery pit at south end of main dozer cut.	Chip sample across 1.5-ft vein.
	-S63-	.011	.001	.05*			East wall of main bull- dozer trench.	Chip sample across 15 ft of fault gouge.
	-S64-	.005	.001	.02*			Floor of main bull- dozer trench.	Grab sample of Fe- oxide streaks in fault zone.
<u>Buffalo claims</u>								
77770	B-Ad-1	.061	.001	.34*			Adit on Buffalo claim.	Grab sample, composite of vein in adit.

Table 1.--Data on samples collected in the Lemhi Pass area, Idaho and Montana--Continued.

Serial number	Sample number	eU (percent)	U (percent)	ThO <sub>2</sub> (percent)	RE <sub>2</sub> O <sub>3</sub> (percent)	Ra (gr/gr)	Location	Remarks
77771	B-192	0.008	0.001	0.04*			Cut across vein above Buffalo adit.	Chip sample across 28-ft vein.
	AFT-B1	.085	.006	.45*			Prospect on Buffalo No. 1 claim.	Grab sample across 5-in. vein.
D-77768	B-A-150	0.010	0.001	0.056*			Prospect on Buffalo Lode claim.	Grab sample.
	AFT-S15-50	.18	.008	1.0			Prospect pit at Buffalo No. 1 location marker.	Grab sample from pit dump.
<u>Radio claim</u>								
	AFT-S-23-50	.26	.008	1.5*			Prospect pit, southern part of claim area.	Grab sample of vein material from dump.
<u>Brown Bear claim</u>								
	AFT-S30-50	.017	.001	.09*			Outcrop of vein 150- ft NW. of NW. trench.	Chip sample across 3 ft of vein.
	-319-50	1.25		7.0*			NE. trench	Selected composite sample of 6-in. vein.
<u>Black Bull claim</u>								
D-74433	W-135	.11	.001	.29	.22		Black Bull No. 2 claim; tunnel on vein at edge of So. Fork of Agency Creek.	Composite grab sample of 2- to 3-in quartz vein.
-74434	QQ-134	.035	.002	.02	.02		Black Bull No. 2 claim; adit 200 ft N. of tunnel by Copper Queen road.	Grab sample of 2-in. carbonate vein.

Table 1.--Data on samples collected in the Lemhi Pass area, Idaho and Montana--Continued.

Serial number	Sample number	eU (percent)	U (percent)	ThO <sub>2</sub> (percent)	RE <sub>2</sub> O <sub>3</sub> (percent)	Ra (gr/gr)	Location	Remarks
D-74428	BlBu-133	0.030	0.005	0.03	0.44		Black Bull No. 2 claim; nose south side of mouth of So. Fork of Agency Creek.	Grab sample of 1- to 2-in. quartz- carbonate vein.
-74429	BlBu-136	0.010	0.003	0.03	0.09		Black Bull No. 3 claim; 1/4 mi. W. of cabin on Lemhi Pass road.	Grab sample of fluorescent coating on tuffaceous rock.
-74430	BB-A-149	.018	<.001	.04	.03		Black Bull Fraction; discovery pit.	Grab sample of quartzose rock from pit. 4-ft sample.
-77764	BB-A-149C	.018	<.001	.08			Black Bull Fraction	Composite sample across 40 ft of quartzose ore rock.
<u>Uranium Queen claim</u>								
D-77766	UQ-W-162	.038	.001	.21*			Discovery pit	Chip sample across 2-ft quartz vein.
<u>Three-and-One claim</u>								
D-77767	3 and 1-W- 162	.021	.001	.11*			Discovery pit	Grab sample from 6- inch to 1-ft quartz vein.
<u>Copper Queen mine</u>								
D-77769	CQ-Ad-1	.034	.005	.17*			Copper Queen mine; main adit level; 350 ft from portal.	Chip sample across 6-in. radioactive quartz vein.

Table 1.--Data on samples collected in the Lemhi Pass area, Idaho and Montana--Continued.

Serial Sample number	eU (percent)	U (percent)	ThO <sub>2</sub> (percent)	RE <sub>2</sub> O <sub>3</sub> (percent)	Ra (gr/gr)	Location	Remarks
<u>Last Chance adit on Lemhi River</u>							
69522	IC-1(FC)	0.008	0.006	0.03		Adit No. 2	Grab sample from quartz vein.
<u>Silver Queen group of claims</u>							
D-77765	RUK-1	.014	.001	.062		On Pattee Creek.	Grab sample from 2-in. quartz vein.

Note \*: Calculated with factor of 5.6

Underline: Percent RE<sub>2</sub>O<sub>3</sub> + ThO<sub>2</sub>



## Estimate of reserves of thorium

An estimate of total reserves, indicated and inferred, of thorium in the Lemhi Pass area is about 1,000,000 tons of quartz vein rock that contains better than 0.04 percent  $\text{ThO}_2$ . About 800,000 tons of this total reserve figure contain 0.1 percent  $\text{ThO}_2$  or better.

The tonnage value for indicated reserves was calculated from surface measurements of outcrops, detailed maps of deposits, exposures in bulldozer trenches, and limited drilling data. The figure for inferred ore is based on geologic evidence compiled during detailed plane-table mapping.

The grade was established by analyses of samples, and, at a few deposits where sampling was insufficient, radioactivity data were utilized to estimate grade.

The following table is a compilation of the individual tonnage and grade estimations for the district.

Estimate of reserves of thorium in individual deposits in Lemhi Pass area  
Lemhi County, Idaho, and Beaverhead County, Montana

Deposit	Depth (feet)	Grade by weight percent ThO <sub>2</sub>	Reserves (indicated) (short tons)	Reserves (inferred)	Calculated ThO <sub>2</sub> (short tons)
Last Chance	350	.1	500,000 (1)		500
Wonder Lode	650 (1/2 length)	.6	200,000 (2)		1,200
Trapper No. 1	50	.4	16,900 (1)		67
Lucky Strike	50	.1		52,800 (1)	52.8
		.014	43,500 (1)		6.1
		.01		265,000 (1)	26.5
Trapper No. 4	50	.04	1,250 (1)		.5
Buffalo Group	50	.15	16,500 (1)		25.
Black Bull Fraction	50	.08	41,500 (1)		33.2
Black Bull No. 2	50	.16	200 (2)		.32
Brown Bear	50	.08	2,000 (1)		1.6
Frying Pan	50	.10	6,200 (2)		6.2
Radio	50	.5	1,500 (2) 829,550		7.5 1926.72
				317,800	

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(1) 12 ft<sup>3</sup> /ton  
(2) 10 ft<sup>3</sup> /ton