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TERRITORY OF ALASKA
DEPARTMENT OF MINES

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REPORT ON THE EXAMINATION OF A VERMICULITE PROSPECT
IN THE FORTY MILE DISTRICT, EAGLE QUADRANGLE

by

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ABSTRACT

The Fortymile vermiculite prospect is in the southeastern part of the Eagle Quadrangle on Fortymile River three miles from the Canada-Alaska border. It is 20 miles by trail from the nearest road. The prospect is in a dike that is 200 feet wide and can be traced for two miles along its strike. Two samples from the prospect expanded to three times their original volume when heated in a laboratory furnace. Other samples expanded less or not at all. The greatest expansion obtained with these samples is less than that obtained with vermiculite that is suitable for building insulation, and the expanded product is too brittle and fragile to withstand much handling. It is unlikely that this deposit can be worked profitably at the present time, but there is a possibility that it may be of value in the future if markets develop locally for vermiculite for purposes other than building insulation.

INTRODUCTION

During the summer of 1958, James Hulbert and Julius Moor, both of Palmer, Alaska, prospected in the Fortymile district. A long-time resident of the district told them that years ago some specimens of vermiculite had been picked up in the country along Fortymile River. In the course of their prospecting, they discovered a large dike consisting mostly of mica, some of which would expand when heated by a blowtorch or a wood fire. After they had staked the deposit, they requested that the Department of Mines send an engineer to examine their prospect. In response to their request, the prospect was examined on September 19 to 21, 1958, by Robert H. Saunders, Territorial Mining Engineer. This report is written from notes that were made during that examination.

LOCATION AND ACCESSIBILITY

The vermiculite prospect is at $64^{\circ} 15'$ N latitude and $141^{\circ} 05'$ W longitude in the southeastern part of the Eagle Quadrangle. The easternmost outcrop is on the ridge on the left limit side of Smith Creek near its mouth, about three miles west of the Canada-Alaska border. From this outcrop the deposit can be traced upriver in a westerly direction for about two miles.

The prospect is about 20 miles by trail from the road at Boundary. A trail passable for four-wheel-drive vehicles goes from Boundary down Canyon Creek for some distance past the mouth of Hall Creek. A trail passable for crawler-type tractors goes up Hall Creek to the crest of the ridge between Canyon Creek and Smith Creek, follows northward along the ridge, and goes down into Smith Creek near its

mouth. This probably would be the best route to follow in freighting to and from the prospect by tractor.

There is an airstrip, Elden Field, suitable for use by small aircraft, about two miles down river from the east end of the prospect. There is another small airstrip at Boundary.

The only business establishment at Boundary is a roadhouse, and the proprietors of the roadhouse are the only permanent residents. From Boundary, by road, it is 106 miles to the Alaska Highway, 447 miles to Anchorage, and 325 miles to Fairbanks.

GEOLOGY AND MINERAL DEPOSITS

The geology of the district in which the prospect lies has been described in U. S. Geological Survey Bulletin 872, THE YUKON-TANANA REGION, ALASKA, by J. B. Mertie, Jr. The country rock in the vicinity of the prospect is pre-Cambrian Birch Creek schist.

The prospect is in a dike of basic igneous rock that has been intruded into the schist. The dike is about 200 feet wide where its full width is exposed along the river. It strikes N 80° W and dips vertically. There are at least seven large outcrops of this dike in a two-mile-long distance upstream from the mouth of Smith Creek. The locations of the outcrops are listed in Table I.

Near the river, where the outcrops are kept free from any accumulation of weathered material, the dike consists almost entirely of dark-green, coarsely crystalline biotite. In places, sheets of biotite two inches square may be split from the dike. This fresh, unaltered biotite will not expand. The material that does expand when heated is brown in color from the oxidation of the contained

iron, and it is found over the outcrops on slopes gentle enough to permit the accumulation of some weathered material.

Along the strike in an easterly direction from the easternmost outcrop, there is a deep cover of overburden for a mile or more. Westerly, beyond the westernmost outcrop, there are outcrops of the bedrock within a few hundred yards, but so far no trace of the dike has been found.

SAMPLES AND LABORATORY TESTS

Seven samples were taken during this examination. The locations from which they were taken are shown in Table II. Expansion tests and other tests were run on the samples at the Department of Mines Assay Office at College by Donald Stein, Assayer. The results of those tests are shown on the Assay Office returns included in the appendix.

Samples 15 and 20 were of material that had been tested for expansion in the field with wood fires and had failed to expand. In the laboratory tests, also, these samples failed to expand. Sample 19 was taken from the same general area as Samples 16, 17, and 18, but it consisted of fresher, less-altered material; it expanded very little. Sample 14 did not expand although it consisted of material that had the same general appearance as the material that did expand.

Samples 16, 17, and 18 gave the most expansion, however, the expansion ratio was much less than that of vermiculite that is being used commercially for building insulation; and, in each case, the product was so brittle that the pieces broke apart when handled.

The examination with a microscope of a piece of expanded vermiculite that is suitable for building insulation shows that the flakes tend to assume a pillow-like shape, apparently because some of the expansion takes place within the individual flakes. The expanded material from this prospect lacks the pillow-like shape of the flakes, and it appears that the expansion takes place by the flakes separating from one another. This is illustrated in Figures I and II.

Spectroanalyses were made of Samples 15 and 20; the results are shown in Table III.

At the westernmost outcrop below O'Harra Creek, there are several narrow dikes cutting across the large dike. These small dikes are mostly quartz; they contain small amounts of a blue mineral that was not identified in the field. A specimen from one of the dikes was submitted to the Assay Office for identification of the blue mineral. Positive identification was not made, but it was narrowed to three possibilities: glaucophane, riebeckite, or soda-tremolite. It is of no economic importance.

TABLE I
LOCATIONS OF OUTCROPS

Location	<u>Approximate Elevation</u>
The crest of the ridge on the left limit of Smith Creek.	1520
Other small ridges upstream from Smith Creek on the south side of the river.	1460
At the waters edge on both sides of the river below Discovery Creek.	1100
The west side of the ridgetop on the left limit of Discovery Creek.	1340
At Discovery Creek.	-
The ridge between O'Harra Creek and Discovery Creek.	-
At the waters edge on the northeast side of the river below O'Harra Creek.	1110

TABLE II
LOCATIONS OF SAMPLES

<u>Sample Number</u>	<u>Location</u>
14	The ridge on the left limit side of Discovery Creek.
15	The ridge on the left limit side of Smith Creek.
16	Small ridge 100 yards west of Sample 15.
17	Small ridge a few hundred yards west of Sample 16.
18	Same as Sample 17.
19	Same as Samples 17 and 18 but fresher, less-altered material.
20	At the river below O'Harra Creek.

TABLE III
SPECTROANALYSES OF TWO SAMPLES

	<u>Over 10%</u>	<u>1 to 10%</u>	<u>Under 1%</u>
Sample 15	sodium calcium silica	potassium magnesium iron	chromium barium lithium titanium manganese copper (0.1%) calcium fluoride (?)
Sample 20	sodium potassium silica magnesium	calcium iron chromium	lithium barium titanium manganese

The copper in Sample 15 probably was contained in a small amount of pyrite that was present in the sample. No aluminium was detected in either sample.

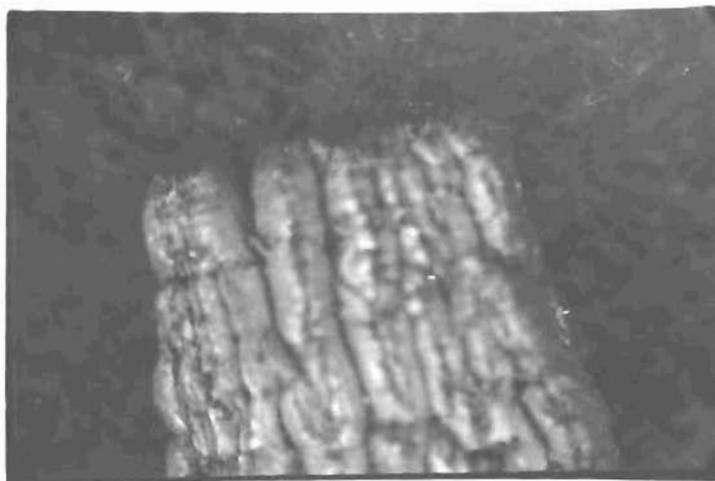


FIGURE I. Photomicrograph of a Piece of Expanded Vermiculite Suitable for Use as Building Insulation. 25X.

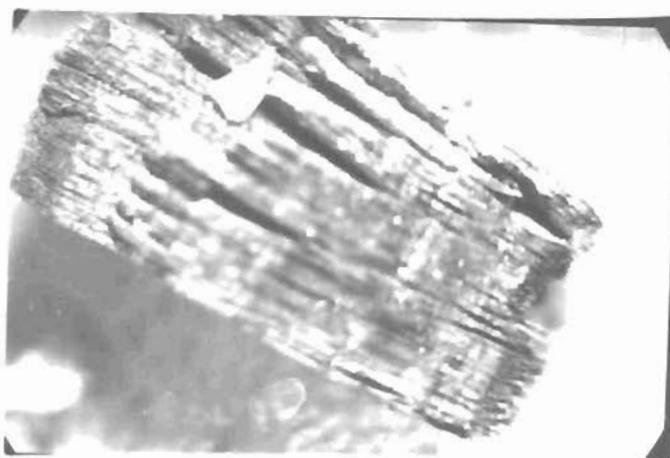


FIGURE II. Photomicrograph of a Piece of Expanded Vermiculite from the Fortymile Prospect. 25X.

Territory of Alaska
DEPARTMENT OF MINES

Assay Office

College, Alaska, Dec 29, 1958

REPORT OF ASSAY

On samples received from Mr. Robert Saunders

Address c/o TDM, College, Alaska

Assay No.	Mark on Sample	OUNCES PER TON		Value Per Ton	PERCENTAGE OF
		Gold	Silver		

24842	RHS 15-58	'Vermiculite' expansion is nil. Product is brittle. value- none
24843	RHS-19-58	'Vermiculite' expansion is very slight(1.2X) and product is brittle. Estimated value - none.
24844	RHS-20-58	'Vermiculite' expansion is nil. Product is brittle. Value-none.

The following vermiculite samples were crushed in a 1/2 inch product jaw crusher, dried at 108°C for one hour and at 300°C for 20 minutes, then expanded at 900-950°C for 5 minutes. The results below were noted. Your sample number is in ().

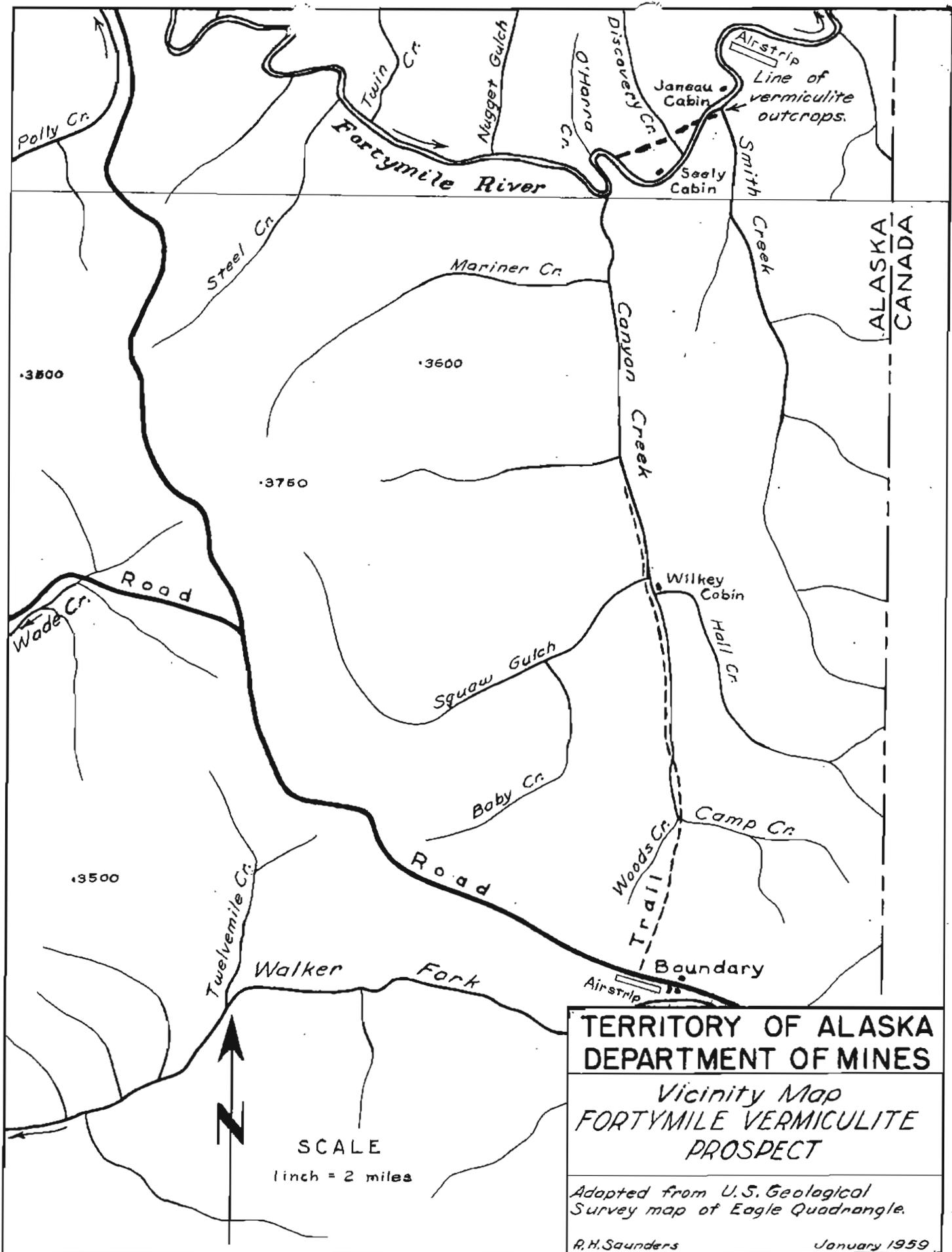
	% Moisture loss at 108°C (1 hr)	% Moisture loss at 300°C (20 min)	% Moisture loss at 900-950°C (five min.)	Total Moisture %	Volume Expansion	Product description
24845 (14)	0.26%	0.14%	0.41%	0.81%	nil	dry, brittle
24846 (16)	0.26%	1.40%	0.10%	1.76%	1.5 times	dry, brittle
24847 (17)	0.54%	0.50%	1.02%	2.06%	3.0 times	dry, brittle
24848 (18)	1.51%	0.62%	1.65%	3.42%	3.0 times	dry, brittle

Crushing characteristics were noted by placing the 1/2 inch crushed product in a nest of screens and vibrating it for a period of seven minutes. Results below. Product size on each screen is given in %.

Screen size	Sample # RHS-14-58 RHS-14-58	RHS-16-58	RHS-17-58	RHS-18-58
plus 1/2 inch	1.5%	9.9%	1.8%	0.6%
" 1/4 inch	38.2%	35.4%	25.1%	29.2%
" 20 mesh	43.8%	44.1%	55.4%	55.8%
" 65 mesh	11.7%	8.8%	12.4%	10.6%
Pan	4.5%	2.1%	5.1%	3.5%

Donald Stearn

Assayer



Territory of Alaska
DEPARTMENT OF MINES
Assay Office

College, Alaska, Dec 29, 1958

REPORT OF ASSAY

On samples received from Robert Saunders

Address c/o TDM, College, Alaska

Assay No.	Mark on Sample	OUNCES PER TON		Value Per Ton	PERCENTAGE OF
		Gold	Silver		

Vermiculite (cont'd) A good vermiculite must have sufficient water of crystallization so that sufficient and efficient expansion can occur and the resulting product still maintains a good strength. Vermiculite (or hydrous mica) contains from 10% (?) to 20% water. The samples tested do not contain sufficient water to be classed as a vermiculite.

Many tests were run on samples RHS 17 and 18-58 in which the temperature and time of the sample in the furnace were varied. Temperature variations were from 600 to 950°C, and time variations were from one thru five minutes. Not one of these tests produced a good product.

Donald Stein

Assayer