

PRELIMINARY REPORT ON SOME PUMICITE DEPOSITS  
KATMAI NATIONAL MONUMENT, ALASKA \*

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by

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INTRODUCTION AND PURPOSE

Pumice and pumicite deposits have been known to exist within the boundaries of Katmai National Monument since the early investigations of the National Geographic Society that followed the discovery of the Valley of Ten Thousand Smokes. These investigations revealed the origin of the pumice, found in the Valley of Ten Thousand Smokes and the pumicite that mantles the greater portion of the Monument, as having been from the eruption of Mt. Katmai, Volcano. 1

Credit is due the U. S. Army and Navy for the first extensive use of pumicite in Alaska at the beginning of World War II. This use of pumicite came about as a result of their policies of utilizing available raw materials at selected sites of construction. Pumicite was used in building military roads and airfields at certain sites where it was readily available. Pumicite, as an aggregate, was found to have particular features superior to ordinary gravel and sand. Hence, since the war, interest has developed in the use of pumicite as an aggregate in making building blocks for various types of construction in Alaska. Two companies have been organized and have started experimental production at Anchorage, Alaska.

The utilization of pumice and pumicite, both as an aggregate and as blocks employed in the building industry, would offer a solution to the urgent problem of supplying suitable building materials for Alaska. At this date no favorable source of pumice or pumicite of superior quality that would meet required specifications had been located.

The purpose of this preliminary investigation by the writer, along the Pacific Coast boundary of Katmai National Monument, was two-fold:

First, an attempt was made to find a source of pumicite, favorably situated as to transportation, and of a quality to meet the specifications of the pumice block industry of Anchorage.

Second, an attempt to secure data for use in recommending further geological investigations directed toward locating the best type of pumice and pumicite available in the region.

The writer visited the Valley of Ten Thousand Smokes in 1939, during preliminary investigations for the Territorial Department of Mines. The great abundance of pumice and pumicite was noted and reported. 2

1 Fenner, C. N., the origin and mode of emplacement of the great buff deposit of the Valley of Ten Thousand Smokes: Katmai Series No. 1, National Geographic Society, 1923.

2 Roehm, J. C., Preliminary report of investigations of the Kvichak District, Alaska...1939.

\* Unpublished report.

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## ACKNOWLEDGEMENTS

The writer wishes to acknowledge the help and information received from Mr. Don Goodman of the Pumice Building Block Company of Anchorage, Alaska. The appended report of tests made on the Takli Island pumicite by the Northwest Laboratories of Seattle, Washington was furnished by Mr. Goodman, who also granted permission for its use in this report.

To Mr. Gus Sutherland, President of the Alaska Katmalite Corporation of Anchorage, Alaska, the writer wishes to extend appreciation for his time and information given during the investigation of the deposits. Mr. Sutherland has produced pumicite blocks in California and had spent considerable time in prospecting the pumicite deposits in Katmai National Monument and on Augustine Island. Weather conditions and lack of time prevented the writer from examining the pumicite deposits on Augustine Island, from which the Katmalite Corporation is at present obtaining its material. Mr. Larry Dahners, Engineer and Assayer for the Territorial Department of Mines, later visited these deposits.

## LOCATIONS OF AREAS VISITED AND SCOPE OF REPORT

Six small areas containing pumicite deposits were examined by the writer, all of which are accessible to transportation by water, and all of which are confined within the boundaries of Katmai National Monument. This National Monument lies in longitude 154° to 155°40' W. and latitudes 57°53' to 59° N. on the Alaska Peninsula, and approximately 280 miles via water from Anchorage. Five areas examined were adjacent to harbors and protected bays along the Pacific Coast or south boundary of the Monument. One area was confined to the north coast of Takli Island, which lies two miles offshore from the Peninsula opposite the entrance to Geographic Harbor. This island is also within the established boundaries of the Monument.

Pumicite was deposited in more or less blanket form upon the existing topography of the entire Monument and surrounding area, during and following the eruption of Mt. Katmai. The present deposits are accumulations of this same material in depressions, stream and river valleys, slopes of the mountains and hills, and along the shore benches and beaches. The agencies accounting for these accumulations have been mainly winds, with the help of gravity, running water, wave and tidal action. Great amounts of pumicite apparently fell upon the surface of the ocean following the eruption. A certain percent of this sank to the ocean floor, and a large portion was deposited along the beaches by wind, wave and tidal action. The material of these beach deposits has a slightly higher density than the material found on the benches, slopes and valleys back from the beach. This greater density is due to the material having been saturated and exposed to salt water and spray, and the vesicles having become more or less filled with salt. This beach pumicite has been subjected to great weathering and decomposition. The presence of salt contained in the beach-exposed pumicite acts as a deteriorative element in the mixture with portland cement. For this reason, beach deposits which have been exposed to salt water were not considered in the present investigation.

A very brief general description of the six areas and deposits visited is herein contained. Time did not allow for an extensive investigation in order to make tonnage estimates. The purpose was more to obtain samples from apparently extensive deposits in the hope of finding one suitable for the industry. Simple tests were made of the pumicite in many localities. A reliable hand-test of pumicite for block use consists of squeezing in the palm of the hand a handful of moist material. If, after squeezing, the pumicite becomes consolidated, it is considered

favorable. Care has to be taken in this test to note that the pumicite does not contain some impurity such as clay, mud or other material which would also cause a consolidation. Sizes of pieces and of grains were noted, as also were the visible impurities. Samples that ranged from 5 to 15 pounds in weight, depending on thickness, were taken from each favorable deposit. The samples were obtained by first digging with a shovel a hole through the deposit and then obtaining a uniform amount of material down the side of the hole. Care has to be exercised that mud and soil is not taken in with the sample material. The samples were later dried in the Territorial Assay Office at Anchorage. Mechanical screen tests were then made to determine percentages of the various sized grains present. The screen tests were supplemented by microscopic examination of the screened material. The kinds of impurities present and the grain size were thus both determined.

Only deposits favorably situated for mining and accessible to water transportation are herein considered. Summer-time transportation only from these deposits is recommended, because of the frequent storms and heavy waves known to prevail in this part of the Pacific Ocean during the other three seasons. The present method of transporting pumicite in open barge and open power-barge is none too satisfactory because of exposure of the pumicite to salt water spray.

The pumaceous tuff deposits of the Valley of Ten Thousand Smokes are recommended for further investigation. These deposits consist of several layers of tuff and pumicite in consolidated form. They extend in the Valley for a length of 20 miles and from 3 to 5 miles in width. Portions of these deposits may be utilized in the manufacture of sawed pumice bricks. Building blocks made by sawing natural pumice of good quality and structural strength, are superior to those manufactured from pumicite. In the preliminary report<sup>3</sup>, only those localities where pumice and pumicite are known to occur on the Alaska Peninsula, are mentioned.

There are many technical problems and features related to securing a pumice or pumicite deposit that have to be considered in order that a superior material may be obtained. Several of these were taken into consideration during this investigation. Some of the problems and feature are mentioned, however, it is not the purpose nor within the scope of this report to deal with them at length. For more information relative to these features, the reader is referred to Report of Investigations No. 15, "Pumice And Pumicite Occurrences of Washington" by Ward Carithers, Division of Mines and Geology, Dept. of Conservation and Development, Olympia, Washington.

#### Area No. 1, Hidden Harbor, Kinack Bay, Katmai National Monument:

Hidden Harbor is a small embayment at the head of Kinack Bay. It is connected with Kinack Bay by a narrow rocky passage three to four fathoms in depth. The harbor is well protected but is filled with pumicite, which makes it rather difficult to hold at anchor and is only deep enough for shallow draft boats. Two areas of pumicite are very accessible to this harbor. One lies to the northeast in a low pass consisting of benches and small rolling hills. The benches, the hills and the inter-veining gulches are mantled with light gray pumicite. The other area lies to the northwest and consists of accumulations of pumicite extending up the slopes of the mountains from the toe to 400-500 feet. The pumicite deposits of both areas are accumulations by strong winds from the north and west. The slope deposits of both areas are barren and extend from 100-300 feet in elevation. The bench and hill deposits are sparsely covered with grass and alders. The hills resemble sand dunes and the winds account for the barrenness of the tops and the windward sides. The slope deposits begin within 300 feet of the beach and the bench deposits begin immediately up from the beach. Both types are favorably situated for machine mining.

3 Op. Cit, page 2

The pumicite of both types appears to be similar. The average size of the larger pumicite pieces is 3/8- inch in diameter. There appears to be considerable fines in the lower portions. The bench deposits range from 4 to six feet in thickness, while the slope deposits are over 10 feet at the bottom and gradually become thinner up the slopes. The pumicite is speckled with both red and black cinder and sand grains which amount to 3 to 5 percent.

Sample 1336 was taken near the bottom of one of the slope deposits to a depth of 10 feet which was not, however, the total depth. This consisted of nearly even-sized material to this depth. In the bench deposits the last foot of material is a pumicite mud grading into black carbonaceous material. The bedrock in the area to the northwest is a granite monzonite and the northwest contacts hard lavas. Hand tests of this pumicite were favorable.

Mechanical analyses of Hidden Harbor pumicite

Plus 4-Mesh	Minus 4-Mesh Plus 10 "	Minus 10-mesh Plus 28 "	Minus 28-Mesh Plus 60 "	Minus 60-Mesh Plus 100 "
4%	15%	46.2%	33.2%	0.33%

The minus 28- to plus 60-mesh appeared to contain the greater volume of sand and cinder. The plus 4-mesh, the plus 10-mesh, and the plus 28-mesh, would make a very pure grade material. However, this mixture may require some ground fines to make the correct proportion for a good binding in pumicite block manufacture.

Area No. 2, Head of Kinack Bay, East Shore:

The northeast head of Kinack Bay is represented by a wide low valley with rolling hills and numerous draws. The hills and valleys are mantled with pumicite more or less in its original position after being deposited following the eruption. The hills range from 50 to 100 feet in height. Those back from the beach are nearly barren, while those near the beach are covered with grass and alders. There have been some later accumulations in the valleys and draws. The pumicite on the hills ranges from 3 to 4 feet in thickness. Thin black cinder seams, less than one-fourth inch in thickness, were noted distributed in the pumicite. These thin seams represent periods between pumicite eruptions. As high as eight cinder seams were noted in the 4-foot thickness of the pumicite deposit. The top 3 feet consisted of unsorted pumicite particles ranging from one-half inch in diameter down to fine dust. Below the 3 feet of coarse pumicite was a layer of fine altered pumicite mud. Considerable alteration was noted in this mud, since it resembled and had the characteristics of a very plastic clay. Under the mud stratum of one foot in thickness was the black carbonaceous mud or decayed humus. Hand tests were not favorable. Sample 1337 was taken across three feet, and an additional sample, 1337-A was taken of the pumice mud.

No screen tests were made from this sample, due to the abundance of impurities and the unfavorable hand tests. The color was brownish gray. The pumice mud may have value as a clay.

Area No. 3, Southwest Corner of Geographic Harbor:

Geographic Harbor is situated to the west of the entrance of Kinack Bay in the southern central portion of Katmai Monument. Area No. 3 consists of long slopes with intervening draws leading to the mountains inland from the southwest portion of Geographic Harbor. This harbor is ideal for medium-sized vessels, with 60 fathoms of water 200 feet off shore. There is a great abundance of pumicite below tide level on the shore lines of this harbor. The present supply of pumicite now

being used by the Pumice Building Block Company of Anchorage was taken from below tide level in this area. The benches, which rise abruptly from the shore lines 30 to 50 feet in height, are covered with pumicite. The slopes extend from the benches westward to the mountains a distance of one-half mile at about a 30° angle. The greater portion of the pumicite is covered by grass and alders. However, long barren areas exist along the steeper sided slopes.

The pumicite averages 3 feet in thickness on the tops of the slopes, with a gradual increase along the side slopes and in the gulches. Small creeks in some of the gulches have cut into the banks and removed some of the pumicite. The pumicite is underlain by 6 to 12 inches of black carbonaceous matter mixed with volcanic dust. Under the black carbonaceous stratum is the hard sedimentary bedrock. This bedrock is flat-lying and offers an even terrain. Several of the slopes offer advantages for mining. However, care would have to be exercised to not mix the black stratum with the pumicite. The 30- to 50-foot banks at the beach offer good loading sites. Sample 1338 was taken from the top of one of the long slopes and represents a depth of 3 feet.

Mechanical analyses of pumicite, SW. Geographic Harbor

Plus 4	Minus 4 Plus 10	Minus 10 Plus 28	Minus 28 Plus 60	Minus 60 Plus 100
4%	28%	50%	17%	1%

The plus 10 to plus 28, which represents 82% of the total, appears to make a very good material for pumicite blocks, as shown by hand and mechanical tests only.

The pumicite has a light brownish gray tinge to a very light gray color. The cinder content is very low--less than 1%. Sand grains amount to 2% plus, but all appear to be less than 28-mesh.

Area No. 4, Northwest Corner of Geographic Harbor:

Pumicite covers the floor of the long low valley in the northwest portion of Geographic Harbor. This is a glacial valley and contains a rolling topography of hills and valleys. The hills range from 30 to 100 feet in height and consist of bedrock. The depressions contain gravels of glacial moraine. Both hills and depressions are mantled with pumicite. There has been considerable wind action and the largest accumulations of pumicite are contained in the depressions and on the southeast or lee side of the hills. Pumicite varies from 2 and 1/2 feet in thickness on the tops of the hills to over 10 feet on the slopes and in the depressions. At the beach a 30-foot bench exists which is also covered with pumicite. Alders and grass cover the pumicite on the benches, the depressions and portions of the hills. This vegetation gradually becomes less, back from the beach. Wind action is apparently active and keeps portions barren.

The pumicite in this area contains more sand than that in the area to the southwest corner. There is also a small amount of cinder. Hand tests were favorable. The pumicite is light gray in color and shows more rounded texture than others noted. Slight stratification shows on the slopes of the hills, indicating wind deposition.

Sample 1338-B was taken to a 3-foot depth on the lee side of a hill 30 feet inland from the beach. The usual mud and black carbonaceous matter was absent here. This may be a local condition, and it probably would be found beneath the pumicite in the depressions.

Mechanical analyses of pumicite, NW. corner Geographic Harbor

<u>Plus 4</u>	<u>Minus 4</u> <u>Plus 10</u>	<u>Minus 10</u> <u>Plus 28</u>	<u>Minus 28</u> <u>Plus 60</u>	<u>Minus 60</u> <u>Plus 100</u>
4%	15%	46% plus	32% plus	3% minus

The sand and cinder was found to be mainly contained in the minus 28- and plus 60-mesh product.

Area No. 5, Takli Island:

Takli Island is located 2 miles offshore from the entrance of Geographic Harbor and southwest from the entrance of Kinack Bay. The area of the island was judged to be between 30 and 40 square miles. It is a low, flat island with the greater portion less than 50 feet above sea level. Rock benches ranging from a few feet up to 40 feet rise abruptly from the beach line. There exist innumerable small indentations into the coast line, forming small bays and lagoons. All of these contain considerable pumicite below high tide level. The northwest corner of the island contains the only notable feature of topography which consists of a hill rising abruptly from the beach to over 300 feet in elevation. The south, southeast and southwest portions of the island are directly exposed to the open sea and there appeared to be no harbors or places suitable for landing. The entire island was, following the eruption, apparently covered with pumicite. Intensive wind action has uncovered the tops of the hills and blown the greater portion of the pumicite into the depressions. The largest single deposits of pumicite are found on the east and northwest slopes of the hills, and the north-south valley depressions. The area of pumicite examined is located on the central north shore of the island inland from a small unnamed bay at the site of the Geo. Hadden cabin. This island was formerly leased as a fox island. At the present time several placer claim locations have been made in this area.

The deposit situated near the Hadden cabin consists of a depression over 300 feet in width and extending in a south-southwest direction. This depression was apparently filled with pumicite by the northerly and westerly winds blowing the material from the high portion of the island or the northwest corner. The underlying bedrock and the surrounding hills consisted of a coarse-grained lava more or less of a gabbroic composition. The feldspars of the lava weather rapidly and free numerous particles of a fine black glass. The winds that moved the pumicite also picked up some of this weathered bedrock and mixed it with the pumicite. The jointing of the lava in a general north and south direction accounts for the many long, narrow depressions.

The pumicite on the lee slopes of the hills varies in thickness from 6 feet near the bottom to a scattering near the top. The pumicite in the depressions is apparently thicker and variable in thickness. The size of the pumice particles on Takli Island appear much smaller in average size than that found on the mainland to the north. Very few pieces were noted over 3/8-inch in diameter. Due to the abundance of fine black glass particles, the pumice has a salt and pepper appearance. On the beaches and on the tops of the benches, the pumicite has been subjected to salt water spray. Near the tops of the slope deposits, the pumicite has become mixed with numerous pieces of weathered bedrock.

Sample 1339 was taken part way up on the slopes of a hill east of the Hadden cabin. The depression deposit was not sampled, since samples of this pumicite have been extensively tested by Northwest Laboratories for the Pumice Building Block Co.

A copy of the reports of these tests appears at the end of this report.

Mechanical analyses of Area 5 pumicite, Takli Island						
Plus 4	Minus 4	Minus 10	Minus 28	Minus 60	Minus 100	Minus 150
	Plus 10	Plus 28	Plus 60	Plus 100	Plus 150	
0.8%	14%	59%	24%	1.6%	2%	.5%

Hand tests were not favorable. The greater portion of the black glass was contained in the minus 28 and plus 60-mesh. It is very doubtful if the pumicite from the slopes of the hill is much better than that of the depressions, as indicated by the tests of the Northwest Laboratories.

Area No. 6, Kukak Bay:

Kukak Bay is a long east-west indentation from the Pacific Ocean, and is located in the southeastern part of Katmai Monument. The bay is very shallow at the head, due to the great amount of pumicite deposited upon the bay floor. Two large streams enter the bay at the head. The valley extends west for 18 miles and nearly to the base of Mt. Katmai. High mountains are both to the north and south, forming the valley in between, which has a width of over a mile. This valley is a large glacial valley and is only a few feet above sea level for several miles westward. Numerous small streams from hanging valleys drain from the mountain slopes. Between the valley floor and the mountains on each side, there exists a rolling topography heavily mantled with pumicite. The toes of the mountains on the north side contain numerous slopes of barren whitish gray pumicite. From the head of the bay, the distance is 2 miles back to the rolling hills and mountain slopes that appear heavily covered. Time did not allow an examination of these deposits. The pumicite as noted from a distance appears to be a whiter variety than that noted in Kinack Bay and along the south shores of the Monument. It is possible that a more recent volcano eruption than Katmai has occurred in the area to the northwest. The great abundance of pumicite particles are larger than noted elsewhere in the monument. Pieces up to 3/4-inch were noted. Further investigation of pumicite in the Kukak valley area is hereby recommended. Kukak Bay is navigable to large vessels within a mile of the head where the depth drops from a few feet to 60 fathoms.

The fresh water streams that enter at the head of the bay are largely responsible for the great accumulation of pumicite found below tide level and on the beaches. Due to this abundance of fresh water at the head of the bay, it is very probable that the pumicite beneath tide level is not contaminated with salt. Investigation of these beach deposits with auger drill is recommended. Small amounts of gravel are now deposited over the pumicite surrounding the present stream beds.

A high grade deposit of pumicite was found at driftwood level on the beach. This deposit is very noticeable, since it exists at from 2 to 3 feet above valley-floor level. The deposit extends for over one-half mile in length and ranges from 60 to 70 feet in width. It was formed by pieces of high grade floating pumice being thrown on this level during storms at high tide. About the only impurity contained in this pumicite is an occasional piece of driftwood. It rests upon the pumicite deposited by tidal action and is nearly barren with the exception of small patches of grass. The average size of the grain is 1/4-inch. The pumicite is gray in color and appears to be sorted by wave and tidal action into very uniform size. This deposit could easily be mined with mechanical shovel and is readily accessible to barge loading. There appears to be abundant material in this deposit for a small pumice block operation for several years.



COPY

NORTHWEST LABORATORIES

Report to: N. F. Shaw - pg. 2

May 14, 1947

Mix design -

Three experimental mixes were designed having variable C/W ratios (C/W equals cement/water ratio by weight). Mixes were designated "A", "B", and "C".

Mix "A"

Cement/Water.....1.13  
Calculated Compressive Strength.....2,600 lbs.

	<u>Surface Dry Weights</u>	<u>Volume Mix</u>
Cement.....	1 bag	1
Water.....	10 Gal.	10 Gal.
Aggregate.....	230 lbs.	4.3

Wt./Cu. Ft. (dry concrete) 67.5 lbs.

Mix "B"

Cement/Water.....1.41  
Calculated Compressive Strength.....3,000 lb.

	<u>Surface Dry Weights</u>	<u>Volume Mix</u>
Cement.....	1 bag	1
Water.....	8 gals.	8 gals.
Aggregate.....	165 pounds	3.1

Yield - 40 feet<sup>3</sup> per bag of cement - 6.75 bags/cu.yd.

Wt./Cu. Ft. (dry concrete) 81.0 lb.

Mix "C"

Cement/Water.....1.85  
Calculated Compressive Strength.....4,000 lbs.

	<u>Surface Dry Weights</u>	<u>Volume Mix</u>
Cement.....	1 bag	1
Water.....	6 gals.	6 gals.
Aggregate.....	116 lbs.	2.2

Wt./Cu. Ft. (dry concrete) 94.5 lbs.

Test Results of Compression Cylinders (3" X 6") and Bricks (4x8x2) made from each mix.

Cylinders, 3" x 6"

	<u>"A"</u>		<u>"B"</u>		<u>"C"</u>	
	<u>1</u>	<u>2</u>	<u>1</u>	<u>2</u>	<u>1</u>	<u>2</u>
Compressive Strength, p.s.i. (age: 7 days.)* see next page.	841	765	2020	2165	2170	2320

NORTHWEST LABORATORIES REPORT TO: N. F. Shaw  
continued.

\*High Early Cement was used. 7-day strengths represent 28-day strengths for normal Portland cement.

	Bricks, 4" x 8" x 2"					
	"A"		"B"		"C"	
	(1)	(2)	(1)	(2)	(1)	(2)
Flexure-7" span ASTM C67-44 Max. Load, Lbr.	910	900	1190		1230	
Mod. of rupture, p. s. i., (14 days)	429	563	718		760	
Compression - (ASTM C67-44) Comp. Load, Psi,	1272	1410	2950		4127	
Water Absorption - (ASTM C90)	16.3	15.9	14.0		9.9	

Specification requirements for Hollow Load Bearing Masonry Units and Concrete Building Brick are listed as follows:

Masonry Units-ASTM C90-44, Compressive Strength, Psi, gross area 1000lbs. Minimum for 1-1/4" or over.

Water Absorption, lbs. per cu. ft., 15 maximum.

Moisture Content, 40%\*

\*This value is a function of storage time and condition.

Specification requirements for Concrete Building Brick (ASTM C55-37).

Compression, psi: Grade A, 2500 lbs. minimum --Grade B, 1250 lbs. minimum.

Grade A - for use when exposed to temperatures below freezing in the presence of moisture.

Grade B - for use as back-up or interior masonry.

Modulus of Rupture, psi - Grade A, 450 lbs. -- Grade B, 300 lbs.

Mix "B" fully complies with the requirements of all specifications cited.

For vibration manufacturing of concrete units, maintain water at a minimum sufficient to just provide a dense structure. By comparing the fractured cross sections of the experimental blocks made by this laboratory with specimens manufactured by you, it should be possible to come about to proper density.

Vibration frequencies are critical and manufacturers recommendations should be followed.

When satisfactory blocks and bricks have been produced, it is recommended that ten representative units of each size be submitted for standard ASTM testing.

Grading of your aggregate is mighty important and provision should be made to check this periodically.

NORTHWEST LABORATORIES

By (sgd.) Thos. Williams

## DEPARTMENT OF MINES

JUNEAU, ALASKA

Excerpt from the Report of Investigations by J. C. Roehn,  
Associate Mining Engineer, Territorial Department of Mines, in  
the Sitka Mining Precinct, Alaska  
July 3-15, 1947, inclusive.

MT. EDGE-CUMBE PUMICITE DEPOSITS

July 11 - Leave Sitka aboard Gasboat North Star for Fred's Creek,  
Krugof Island. Arrive 4 p. m.

July 12 & 13 - Leave Fred's Creek 8 a. m. Arrive top of Mt. Edge-  
cumbe 2 p. m. The shelter cabin on the eight-mile trail is located at  
Four Mile. The base of Mt. Edgecumbe is at elevation 1550 feet. Timber-  
line is at 2000 feet. The elevation at the top read 3350'. The other  
section of the rim of the crater may have been slightly higher. Pumicite  
pieces up to one foot in diameter and down to small individual grains  
were found scattered on all the slopes of the mountain. This pumicite is  
mixed with various pieces of lava, pieces of scoria, volcanic glass and  
considerable clay with a high content of iron oxides. The pumicite  
appears to have been blown out of the crater in the last stages of  
vulcanism, and scattered along the slopes, mainly on the east side in the  
lee of probable westerly winds.

Some portions of the east slope contain a thin mantle of unconsolidated  
material which averages in thickness from a few inches to several feet. The  
tops of the sharp-out ravines that descend off the steep portions of the  
cone contain accumulations of pumicite. These deposits are recent accumu-  
lations formed from the loose material of the slopes of the cone transported  
by rain, wind and snow and the force of gravity. These deposits contain a  
mixture of pieces of pumice, pumicite and fragmental pieces of lava rock in  
a clay matrix with a high content of iron oxides. This mixture might be a  
natural mix for common brick, providing the rock pieces of lava were first  
removed. The location of these pumicite deposits are from six to eight  
miles from the beach, and due to the impurities, it is very doubtful if they  
are of economic importance.

The pumicite varies in color from dark red to pink, brown to buff and  
brownish gray. Iron oxides are contained in all the types, and its  
presence is apparently one of the factors that causes the rapid disinte-  
gration in both the pumice and lavas and forms the red clay.

No pumice flows were observed on the slopes of the cone of Mt. Edge-  
cumbe. The formations consisted of various basic lavas. In the opinion

Mt. Edgecumbe Pumicite Deposits, cont'd.

of the writer, it is very doubtful if good grade pumice exists associated with the lava flows of this extinct volcano. This opinion is based on the fact that the entire magma making up the various flows is very basic\*

Commercial types and grades of pumices are usually associated with acid or high silica magmas.

July 14 - Two outcrops of pumicite were examined along the banks of Fred's Creek.

No. 1 deposit is situated along the left limit, 500 yards inland from the beach. It has a bark exposure over 200 feet in length and is 30 feet in thickness. The pumicite is thinly bedded, either stream deposition or formed by wave action. The thin beds are inclined slightly toward the beach. The individual grains and pieces range from very fine up to one-half inch in diameter. The color is brown with considerable red and black staining. The deposit as a whole is only a remnant of apparently small size, and one of many similar occurrences along the streams and beaches.

Another deposit of similar character is to be found upstream 800 yards from the beach on the right limit of Fred's Creek.

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\*See excerpt from U. S. G. S. Bull. 504, p. 14, "The Sitka Mining District, Alaska," by Adolph Knopf, as follows:

"The youngest rocks of the region are the postglacial lavas and tuffs that make up the volcanic cone of Mount Edgecumbe on Kruzof Island. It is reported, upon somewhat questionable evidence, that Mount Edgecumbe was in eruption as late as 1796. The volcanic rocks are mainly basic andesites or basalts and display a striking diversity of color, texture, and crystallinity. They include black glasses, frothy pumices, and gray holocrystalline lavas. A lava collected at the shore east of Mount Edgecumbe consists of a gray, highly porous rock which is thickly studded with glassy tabular plagioclase feldspars, ranging in length from three-tenths to four-tenths of an inch. According to a rough estimate the feldspar phenocrysts form half the bulk of the rock. Small glassy grains of olivine are sparingly scattered throughout the rocks. Under the microscope the plagioclase phenocrysts prove to be a calcic labradorite near  $Ab_1 An_3$ ; some of the olivine forms crystals large enough to be termed phenocrysts, but most of it is found in the mesostasis between the feldspar phenocrysts. The mesostasis is holocrystalline and consists of doleritic aggregate of augite and feldspar laths, with accessory magnetite and hematite."

July 15 - The outcroppings along the military road that extends both north and west from Shoals Point were examined. Shoals Point is approximately three and one-half miles south and slightly west of Fred's Creek. The army, during the period of installations in this vicinity, had occasion to build a four-mile road along the beach. Several exposures of pumicite were found along this road. The material was used for road bed material, and mined from opencuts. The pumicite appears to make good road material, since it packs to a good hardness and appears dry and drains well during wet weather. These bank deposits appear to have been formed by wave action from pumicite and pieces of pumice which were thrown into the ocean during the period of eruption. They vary in thickness from 20 to 30 feet, and rest on sloping lava bedrock. They are found, depending upon the condition of the shorelines, ranging from a few feet to 100 or 200 feet from the present shoreline. The pumicite is unconsolidated and bedded into thin strata, which in some deposits is interbedded with thin layers of fine gravel. The top layers are stained black by decayed vegetation, and the lower layers are iron stained.

An attempt was made to reach the bay adjacent to Beaver Point on the outer west coast of Krusof Island, as large banks of pumicite were reported on the shores of this bay. Rough seas prevented an investigation.